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# NUMERICAL EVALUATION OF GRASSLANDS DOMINATED BY *SESLERIA JUNCIFOLIA* AGG. IN SERBIA

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**Abstract**

Phytosociological and numerical analyses of grasslands dominated by *Sesleria juncifolia* s.l. in Serbia were performed in order to resolve their syntaxonomy and nomenclature. Twelve relevés were sampled on Mt. Mučanj (western Serbia), which were then compared with similar relevés from other parts of the Balkan Peninsula by means of numerical analyses. The relevés were classified using cluster analysis, while the ordination was conducted using Detrended Correspondence Analysis (DCA). The results suggest the occurrence of two floristically well defined Dinaric associations in Serbia: *Seslerio juncifoliae-Edraianthetum graminifolii* ass. nova from Mt. Mokra Gora (*Oxytropidion urumovii*, *Elyno-Seslerietea*) and *Diantho petraeae-Seslerietum juncifoliae* ass. nova (*Chrysopogono-Saturejion*, *Festuco-Brometea*) from Mt. Mučanj.

**Key words**: Balkan Peninsula, classification, ordination, *Seslerietum juncifoliae* s.l., syntaxonomy, vegetation.

**Izvleček**

Naredili smo fitocenološko in numerično analizo travišč v katerih prevladuje vrsta *Sesleria juncifolia* s.l. in predstavili sintaksonomske in nomenklaturne rešitve. Dvanajst vegetacijskih popisov smo naredili na gori Mučanj (zahodna Srbija) in jih z numeričnimi metodami primerjali s podobnimi popisi z drugih delov Balkanskega polotoka. Popise smo klasificirali s klastrsko metodo, za ordinacijo smo uporabili korespondenčno analizo z odstranjenim trendom (DCA). Rezultati kažejo na obstoj dveh floristično dobro utemeljenih dinarskih endemičnih asociacij v Srbiji: *Seslerio juncifoliae-Edraianthetum graminifolii* ass. nova z Mokre Gore (*Oxytropidion urumovii*, *Elyno-Seslerietea*) in *Diantho petraeae-Seslerietum juncifoliae* ass. nova (*Chrysopogono-Saturejion*, *Festuco-Brometea*) z gore Mučanj.

**Ključne besede**: Balkanski polotok, klasifikacija, ordinacija, *Seslerietum juncifoliae* s.l., sintaksonomija, vegetacija.

## 1. INTRODUCTION

The genus *Sesleria* Scop. (*Poaceae*, *Pooideae*, *Seslerieae*) is one of the most important and interesting grass genera with its' centre of diversity and distribution on the Balkan Peninsula. The species of this genus play a very important role in the development of different types of grasslands along wide elevational and latitudinal gradients, forming syntaxa at various ranks — *Seslerietum korabiensis* Micevski 1994, *Seslerietum wettsteinii* Horvat 1937, *Seslerietum juncifoliae* Horvat 1930, *Seslerion juncifoliae* Horvat 1930, *Seslerion rigidae* Zólyómi 1939, *Seslerietalia juncifoliae* Horvat 1930,

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etc. However, their most important role is forming the grasslands on base-rich soils of alpine and subalpine belts of temperate European mountain ranges (class *Elyno-Seslerietea* Br.-Bl. 1948). The domination by *Sesleria* species of the high mountain calcareous plant communities in Europe is discussed by Petriccione (1995) in his overview of this vegetation type.

*Sesleria juncifolia* agg. represents an amphi-Adriatic group of taxa exhibiting a typical disjunct range including the western & central Balkans and the Apennine Peninsula, where neither their systematic relationships nor the syntaxonomical scheme are entirely clear. Based on relevant taxonomic papers (Deyl 1980, Strgar 1981, Alegro 2007, Di Pietro 2007), the following species are considered to belong to *S. juncifolia* agg.: *S. apennina* Ujhelyi, *S. calabrica* (Deyl) Di Pietro, *S. kalnikensis* Jávorka, *S. juncifolia* Suffren, *S. interrupta* Vis., *S. ujhelyii* Strgar and *S. albanica* Ujhelyi. Since both names, *S. juncifolia* Suffren 1802 and *S. tenuifolia* Shrader 1806, were validly published, we use the earlier legitimate name *S. juncifolia* in this paper, as it has a priority according to Art 11.4 of ICN (McNeill et al. 2012). The detailed discussion regarding the nomenclatural issues in *Sesleria juncifolia* complex is provided in Di Pietro et al. (2013).

For the territory of Serbia, Lakušić & Sabovljević (2005) proposed a classification scheme in which 31 associations and eight subassociations dominanted by different *Sesleria* species were included, belonging to five classes, seven orders and 11 alliances. However, this classification was not based on serious numerical analyses, thus an objective circumscription and classification are still missing. The most investigated grasslands dominated by *Sesleria* spp. belong to the class *Elyno-Seslerietea*, order *Seslerietalia juncifoliae* (=*tenuifoliae*) Horvat 1930, alliances *Seslerion rigidae* Zólyómi 1939 (dry grasslands on calcareous bedrock) and *Seslerion rigidae-latifoliae* D. Lakušić 1996 prov. (dry grasslands on serpentine rocks). Furthermore, seven associations belong to the order *Onobrychido-Seslerietalia* Horvat 1949, alliances *Edraiantho-Seslerion* Horvat 1949, *Onobrychido-Festucion* Horvat 1949 and *Seslerio-Festucion* R. Jovanović 1955. A significant number of communities belong to the class of alpine pastures on siliceous rocks, *Caricetea curvulae* Br.-Bl. 1948, order *Seslerietalia comosae* Simon 1957, alliance *Seslerion comosae* Horvat 1935. Only one association was recorded for the class *Asplenietea trichomanis* Br.-Bl. 1934 corr. Oberd. 1977. Finally, some communities dominated by *Sesleria* spp. belong to the *Festuco-Brometea* Br.-Bl. & Tx. ex Soó 1947. The dominant *Sesleria* species that build up these syntaxa are *S. filifolia* Hoppe in eastern Serbia and *S. serbica* (Adam.) Ujhelyi and *S. juncifolia* in western Serbia.

Our research only included the stands dominated by *Sesleria juncifolia* agg. described as associations *Seslerio-Edraianthetum jugoslavici* Petković et al. 1990 (Petković et al. 1990) from Mt. Mokra Gora, *Seslerietum tenuifoliae* S. Vukojičić & D. Lakušić 1990 prov. (Stanić 1990) from Mt. Mučanj and *Carici laevis-Helianthemetum alpestre* Horvat 1930 *seslerietosum tenuifoliae* Rajevski 1990 from Mt. Šarplanina (Rajevski 1990) in Serbia.

## MATERIALS AND METHODS

**Data sampling.** In order to describe and resolve the syntaxonomy of the Serbian grasslands dominated by *Sesleria juncifolia* agg., we processed 139 relevés belonging to 13 syntaxa dominated by *S. juncifolia* agg., distributed throughout the territory of Serbia, Bosnia and Herzegovina, Montenegro, Croatia, Slovenia and northeastern Italy. The majority of the relevés were taken from literature sources. The main criterion for the selection of the syntaxa to be included in the analyses was that *S. juncifolia* appears as both the dominant and nominal species in the name of a syntaxa, either at association or subassociation level (Table 1). In addition to the literature data, personal unpublished data previously gathered on Mt. Mučanj in Serbia, Mt. Durmitor in Montenegro and areas of Mts. Velebit (Croatia) and Snežnik (Slovenia; Table 1, Figure 1) were also included in the analyses. All the relevés were sampled according to Braun-Blanquet (1964) method. The plot size of our own relevés was 25 $m^2$, corresponding to the standard for grasslands proposed by Chytrý & Otýpková (2003). Plot sizes of relevés from the literature varied, the exact sizes for each association are given in Table 1.

**Data analysis**. After transforming Braun-Blanquet cover-abundance values into a nine-degree ordinal scale (van der Maarel 1979) the relevés were subjected to Detrended Correspondence Analysis (DCA) in order to detect the basic structure of the floristic composition. Finally, the complete set was classified using Bray-Curtis similarity and group average clustering. These

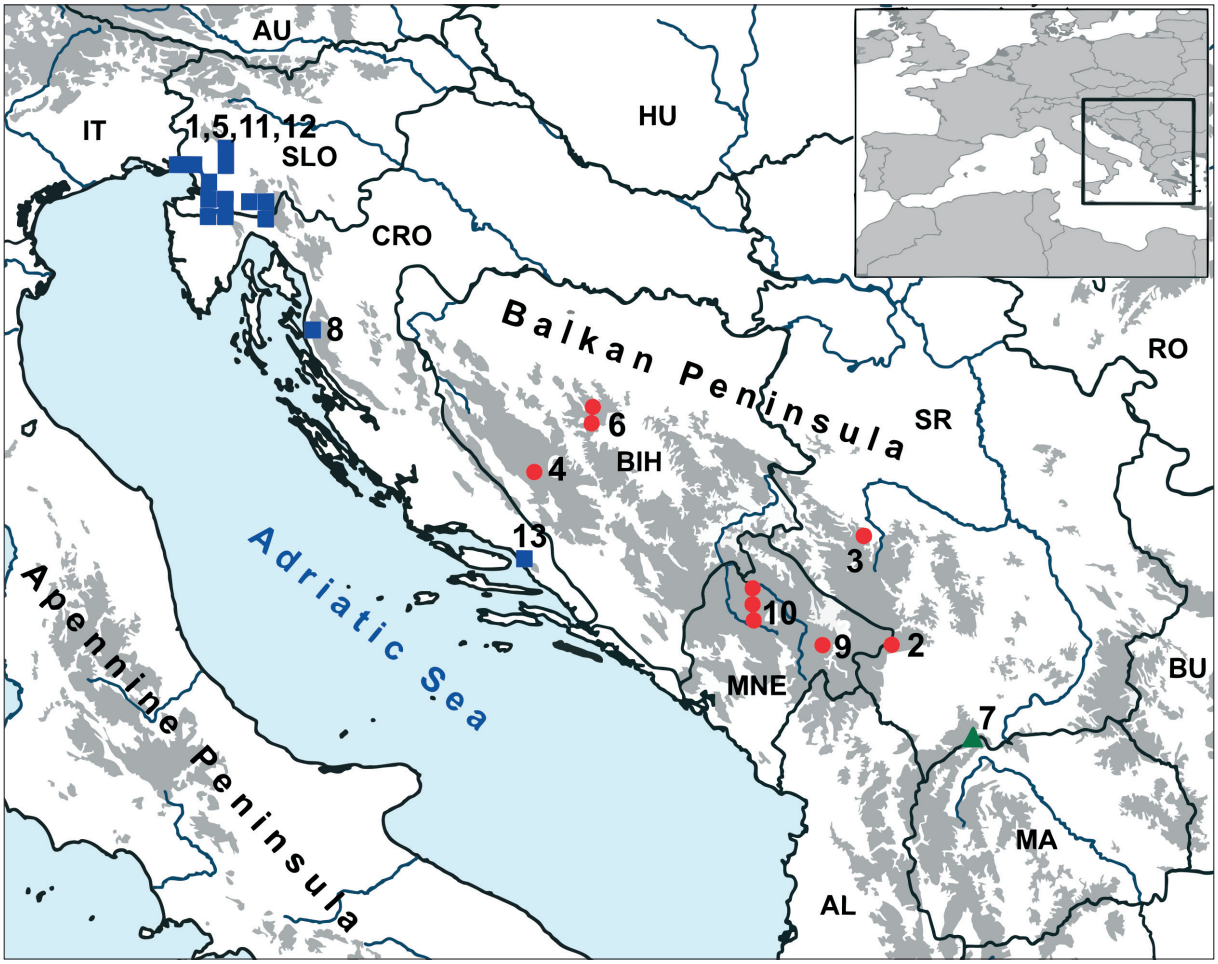



**Figure 1:** The map of the localities of analyzed syntaxa. Numbers on the map correspond to ordinal numbers in Table 1. Blue squares correspond to groups A and C, red dots and green triangle (stands from Mt. Šarplanina excluded from second step of analysis) correspond to group B from Figure 2. Both dots and squares correspond with UTM 10 x 10 squares. Area above 1000 m a.s.l. is shaded. Country abbreviation: IT – Italy, SLO – Slovenia, CRO – Croatia, HU – Hungary, BIH – Bosnia and Herzegovina, SR – Serbia, MNE – Montenegro, RO – Romania, BU – Bulgaria, MA – Macedonia, AL – Albania.

**Slika 1:** Karta lokacij proučevanih sintaksonov. Številke na karti so enake kot v Tabeli 1. Modri kvadrati ustrezajo skupinama A in C, rdeči krožci in zeleni trikotniki (sestoji s Šarplanine so izvzeti iz drugega koraka v analizi) ustrezajo skupini B na Sliki 2. Krožci in kvadrati se ujemajo z UTM 10 x 10 kvadranti. Območja nad 1000 m nad morjem so osenčena. Okrajšave držav: IT – Italija, SLO – Slovenija, CRO – Hrvaška, HU – Madžarska, BIH – Bosna in Hercegovina, SR – Srbija, MNE – Črna gora, RO – Romunija, BU – Bolgarija, MA – Makedonija, AL – Albanija.

analyses were processed using PcOrd 6.0 (McCune & Mefford 2011) and FLORA softwares (Karadžić et al. 1998).

In this paper, we used the concept of diagnostic and dominant species proposed by Chytrý et al. (2002), Chytrý & Tichý (2003) and Tichý & Chytrý (2006). Using the statistical measures of fidelity, we quantified concentrations of species occurrences in groups of classified sites in order to determine diagnostic species (Chytrý et al. 2002). The size of the site groups in the data set was standardised (virtually equalized), while the relative frequencies of species occurrence within and outside of these groups were kept constant (Tichý and Chytrý 2006) to calculate the Φ-values as a measure of fidelity independent of the number of available relevés. To assess statistical significance of concentration of species in vegetatation types, we performed the Monte Carlo significance test of observed maximum indicator value for the species with 4999 permutations. PcOrd 6.0 software (McCune & Mefford 2011) was used for the calculation of Φ-values. In order to determine the dominant species, we

calculated the coverage index (Ic) according to Lausi et al. (1982). Species with Φ-values higher than 0.50 were considered diagnostic. Species with cover ≥ 50% in a minimum of 5% of the relevés for any association were accepted as dominant. Species recorded in a minimum of 60% of the relevés for any association were considered constant. Nomenclature of plant taxa follows the Flora Europaea Database (Tutin et al. 2001), except for critical taxa with unresolved relationships, which were included as species complexes (aggregates). The names of all the syntaxa follow Rodwell et al. (2002) with a few exceptions according to Lakušić & Sabovljević (2005). All the underlying plot data used in the paper are stored in Vegetation Database of Grassland Vegetation in Serbia (Aćić et al. 2012; GIVD number: EU-RS-002; relevé numbers: 7000–7138).

## RESULTS

**Ordination** – A DCA conducted on the complete data set showed three rather discrete groups of relevés (Figure 2), well separated along first two canonical axes. The most distinct (Group I) was the one representing relevés of the *Rhododendro hirsuti-Juniperetum alpinae seslerietosum tenuifoliae* from the Liburnian karst. The remaining two groups represented the relevés from northeastern Italy, Slovenia and Croatia (Group II), and the relevés from Serbia, Bosnia and Herzegovina and Montenegro (Group III). It can also be seen that the relevés from Mt. Mučanj (western Serbia) and the ones representing the *Seslerio-Edraianthetum jugoslavici* (Mt. Mokra Gora) were well differentiated within this last group, while the relevés representing the *Carici laevis-Helianthemetum alpestre seslerietosum tenuifoliae* from Mt. Šarplanina overlapped with the rest of the relevés in this group.

**Classification** – Results of the cluster analysis performed on the complete data set were very much in accordance with the ordination results, in that they showed that two main groups of stands (clusters) could be differentiated. Cluster I (Figure 3) corresponded to the stands of the associations from northeastern Italy, Slovenia and Croatia. This cluster corresponded completely with Groups I and II in Figure 2, so the only difference is related to relevés of Liburnian heaths *Rhododendro hirsuti-Juniperetum alpinae seslerietosum tenuifoliae*, which were differentiated as a single group in DCA. On the other hand, Cluster II (Figure 3) represented the relevés from Serbia, Bosnia and Herzegovina and Montenegro (Group III in Figure 2). Within this cluster,

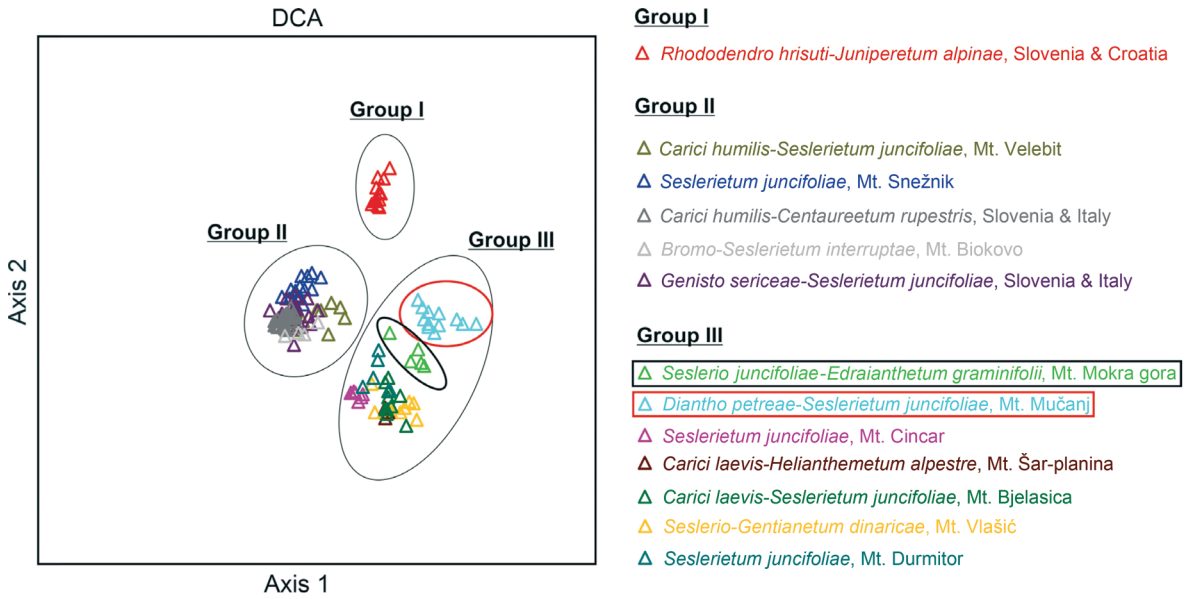
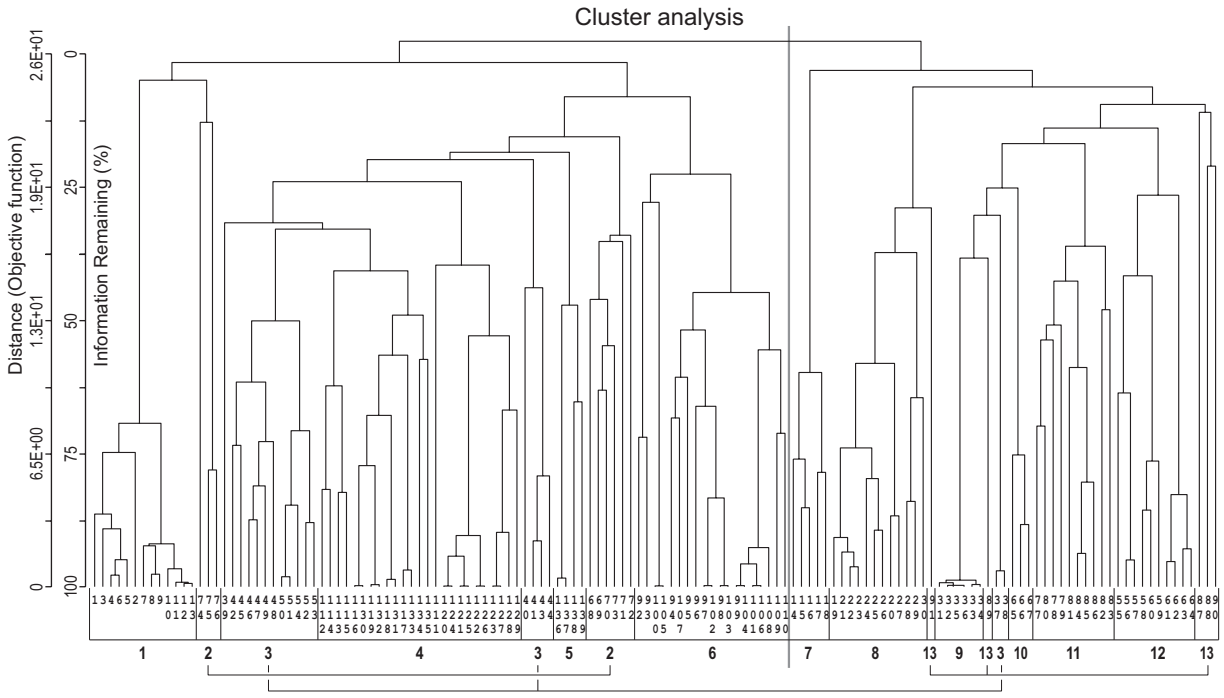



**Figure 2:** Detrended Correspondence Analysis (DCA) of stands of 13 grasslands dominated by *Sesleria juncifolia* from the Balkan Peninsula.

**Slika 2:** Korespondenčna analiza z odstranjenim trendom (DCA) sestojev 13 traviščnih združb v katerih prevladuje *Sesleria juncifolia* z Balkana.




**Cluster I**

1) 1–13 – *Rhododendro hirsuti-Juniperetum alpinae*, Slovenia and Croatia
2) 68–76 – *Carici humilis-Seslerietum juncifoliae*, Mt. Velebit
3) 39–54 – *Seslerietum juncifoliae*, Mt. Snežnik
4) 111–135 – *Carici humilis-Centaureetum rupestris*, Slovenia and Italy
5) 136–139 – *Bromo-Seslerietum interruptae*, Mt. Biokovo
6) 092–110 – *Genisto sericeae-Seslerietum juncifoliae*, Slovenia and Italy

**Cluster II**

7) 14–18 – *Edraiantho graminifoliae-Sesler. juncifoliae*, Mt. Mokra gora
8) 19–30 – *Diantho petrae-Seslerietum juncifoliae*, Mt. Mučanj
9) 31–38 – *Seslerietum juncifoliae*, Mt. Cincar
10) 65–67 – *Carici laevis-Helianthemetum alpestre*, Mt. Šar planina
11) 77–86 – *Carici laevis-Seslerietum juncifolia*, Mt. Bjelasica
12) 55–64 – *Seslerio-Gentianetum dinaricae*, Mt. Vlašić
13) 87–91 – *Seslerietum juncifoliae*, Mt. Durmitor

**Figure 3:** Cluster Analysis of stands of 13 grasslands dominated by *Sesleria juncifolia* from the Balkan Peninsula.
**Slika 3:** Klastrska analiza sestojev 13 travišč združb v katerih prevladuje *Sesleria juncifolia* z Balkana.

it was again noticeable that Serbian associations represented well separated and discrete units.

On the basis of the ordination and classification analyses, we established the existence of two well defined syntaxa with the dominance of *Sesleria juncifolia* in Serbia: ass. *Seslerio-Edraianthetum jugoslavici* from Mt. Mokra Gora, and a new association from Mt. Mučanj: *Diantho petraeae-Seslerietum juncifoliae*. Relevés of the *Carici laevis-Helianthemetum alpestre seslerietosum tenuifoliae* from Mt. Šarplanina overlapped with communities from the Cincar, Vlašić, Bjelasica and Durmitor mountains in the ordination, while in the cluster graph analysis they formed a joint cluster together with the community from Mt. Cincar and only a few relevés from the community from Mt. Durmitor. A synoptic table comparing all community types is presented in the Table 3 in order to show the differences between the individual clusters obtained by numerical classification.

## Syntaxonomical treatment

**Ass. *Diantho petraeae-Seslerietum juncifoliae* Vukojičić & D. Lakušić ass. nova hoc loco** (Holotypus Table 2, rel. 5 hoc loco)

**Original:** *Seslerietum tenuifoliae* Stanić & D. Lakušić 1990 prov., nom. ined. (Art. 1, ICPN)

**Note:** The *Seslerietum tenuifoliae* Stanić & D. Lakušić 1990 prov. was not effectively published (Def. III, Art. 1, ICPN; Weber et al. 2000), since it was only recorded and preliminarily described in a Diploma thesis (Stanić 1990). Therefore, we describe it here as a new association, in accordance with the International Code of Phytosociological Nomenclature (ICPN; Weber et al. 2000).

***Dominant species:*** *Sesleria juncifolia*

***Diagnostic species:*** *Campanula rotundifolia*, *Chamaecytisus ciliatus*, *Chamaespartium sagittale*, *Cotoneaster integerrimus*, *Dianthus petraeus* subsp. *petraeus*, *Draba lasiocarpa*, *Festuca panciciana*, *Ga-*

*lium corrudifolium*, *Helianthemum nummularium* subsp. *nummularium*, *Ornithogalum collinum*, *Pedicularis heterodonta*, *Potentilla cinerea*, *Sanguisorba minor* subsp. *minor*

***Constant species:*** *Carex kitaibeliana*, *Edraianthus graminifolius*, *Globularia cordifolia*, *Saxifraga paniculata*

***Diagnosis:*** Rocky calcareous grasslands at elevations between 1300 and 1450 m a.s.l., on the NW and W (rarely E) exposed slopes, with an inclination of about 35° on average (Table 2). The dominant species *Sesleria juncifolia* with its dense tussocks formed stands up to 40 cm high, covering 25–80% (average 65%) of the plots (Table 2). The average number of species per plot of 16 $m^2$ was 26. Some Balkan endemic and Balkan-Carpathian or Balkan-Apennine subendemic species, such as *Cerastium decalvans*, *Daphne blagayana*, *Dianthus petraeus* subsp. *petraeus*, *Draba lasiocarpa*, *Edraianthus graminifolius*, *Festuca panciciana*, *Laserpitium siler* subsp. *garganicum*, *Minuartia bosniaca*, *Pedicularis heterodonta* and *Sesleria juncifolia* were recorded in this association. Also three glacial relicts (*Arabis alpina*, *Poa alpina*, and *Saxifraga paniculata*) occuring within the stands may point to the glacial-refugial character of the association. However, the occurrence of some differential taxa from forests, such as *Daphne mezereum*, *Fagus sylvatica*, and *Poa nemoralis*, could point to the fact that the montane beech forests of *Fagetalia sylvaticae* Pawłowski 1928 prevailed in the recent past, or might even represent a natural vegetation type on sites nowadays covered by the stands of the *Diantho petraeae-Seslerietum juncifoliae*.

**Figure 4:** Summer aspect of the association *Diantho petraeae-Seslerietum juncifoliae* Vukojičić & D. Lakušić ass. nova on Mt. Mučanj (photo: N. Kuzmanović).
**Slika 4:** Poletni aspekt asociacije *Diantho petraeae-Seslerietum juncifoliae* Vukojičić & D. Lakušić ass. nova na gori Mučanj (foto: N. Kuzmanović).

**Ecology and synchorology of the association**

Stands of *Diantho petraeae-Seslerietum juncifoliae* are so far known only from the area of Mt. Mučanj in southwestern Serbia. The direction of the mountain is NW-SE, while its maximum height is 1534 m a.s.l. Mt. Mučanj is seperated from the neighboring mountains by river valleys, pointing to the fact that fluvial erosion was the factor shaping the relief, earlier formed by tectonic movements. The dominant geological substrate in this area is limestone. The soils are shallow and very skeletal. The climate type is temperate-continental, but in its modified mountain variant (Stanić 1990). The annual mean temperature is 2.9 °C, and the annual precipitation is 944 mm. January is the coldest month with a temperature of –8,5 °C, while July is the warmest with a temperature of +12.3 °C (Stanić 1990). The wettest months are May, June and August, while the driest are February and March. Mean monthly temperatures below 0 °C were noted during November, December, January, February and March, confining the growing season to between April and September. Considering the relatively low elevation and the mountain temperate climate, montane beech forests represent the potential vegetation of the investigated area. However, since the major parts of the forests were completely degraded, artificial forest stands of black pine (*Pinus nigra*), fir (*Abies alba*) and spruce (*Picea abies*) dominate the landscape (Stanić 1990).

**Ass. *Seslerio juncifoliae-Edraianthetum graminifolii*** B. Petković et al. ex Kabaš et al. ass. nov. hoc loco

**Validated name:** *Seslerio-Edraianthetum jugoslavici* Petković et al. 1990 nom. inval. (Art. 5, ICPN) Holotypus: Petković et al. (1990: Table 2, rel. 2)

**Note:** The association *Seslerio-Edraianthetum jugoslavicii* B. Petković et al. 1990 was not validly published, because the holotype relevé was not assigned (Art. 5, ICPN; Weber et al. 2000). Also,

the name *Edraianthus jugoslavicus* Lakušić was not validly published (Art. 39.1 of ICN, McNeill et al. 2012), since it was not accompanied by a Latin description or diagnosis. Accordingly, we used the accepted and validly published name *Edraianthus graminifolius* (L.) A. DC. (Euro+Med 2010) when naming the association.

**Diagnostic species:** *Acinos arvensis*, *Alchemilla plicatula*, *Alyssum montanum*, *Anthyllis vulneraria* subsp. *pulchella*, *Asplenium trichomanes-ramosum*, *Helianthemum nummularium* subsp. *grandiflorum*, *Juniperus sabina*, *Minuartia verna*, *Polygonum viviparum*, *Scabiosa ochroleuca*, *Silene pusilla*, *Polygala supina* subsp. *supina*

### Syntaxonomical scheme

*Festuco-Brometea* Br.-Bl. & Tx. ex Soó 1947
- *Scorzonero-Chrysopogonetalia* Horvat & Horvatić 1958
  - *Chrysopogono-Saturejion* Horvat & Horvatić 1934
    - *Diantho petraeae-Seslerietum juncifoliae* Vukojičić & D. Lakušić 2014

*Elyno-Seslerietea* Br.-Bl. 1948
- *Crepidetalia dinaricae* Lakušić 1966
  - *Oxytropidion urumovii* Lakušić 1964
    - *Seslerio juncifoliae-Edraianthetum graminifolii* Petković et al. ex Kabaš et al. 2014

## DISCUSSION

Our numerical analyses showed that the analyzed stands of different syntaxa dominated by *Sesleria juncifolia* agg. in the mountains of the central and western part of the Balkan Peninsula are very heterogenous and probably have different origins. Their relationships in a broader, amphi-Adriatic context are a subject of the ongoing research, preliminarily presented in Di Pietro et al. (2013).

Our results showed that the first clearly distinct group (Group I, Figure 2) represents the stands of the *Rhododendro hirsuti-Juniperetum alpinae seslerietosum tenuifoliae*. These results support the opinion of Surina (2013) that despite the domination of *S. juncifolia* in these stands, the syntaxon should actually be classified within the heath vegetation of *Erico-Pinetea* Horvat 1959, and not within the grassland communities of *Elyno-Seslerietea*. The second well differentiated group (Group II, Figure 2) corresponds to the stands from northwestern Italy, Slovenia and Croatia, representing grasslands classified mostly within the class *Festuco-Brometea*. Finally, the third well defined and separated group (Group III, Figure 2; Cluster II, Figure 3) includes Serbian, Bosnian and Herzegovinian and Montenegrian grassland stands, classified mostly within the vegetation of the high mountain rocky calcareous grasslands of the class *Elyno-Seslerietea*. Furthermore, both DCA and cluster analysis also showed that both Serbian associations are floristically well differentiated from the rest of the similar syntaxa, i.e. the association *Seslerio juncifoliae-Edraianthetum graminifolii* from Mt. Mokra Gora, along with the stands of the associations from the Bjelasica, Durmitor, Cincar and Vlašić mountains belonging to the class *Elyno-Seslerietea*. Corroboration of this statement can be seen in the floristic composition, which is determined by the position of these stands at high elevations, usually above the upper forest line.

The newly described association from Mt. Mučanj, on the other hand, significantly differs from the subalpine and alpine rocky grasslands of the class *Elyno-Seslerietea* in its floristic properties. These stands host 43 taxa (e.g., *Briza media*, *Bromus erectus*, *Euphorbia myrsinites*, *Globularia cordifolia*, *Hieracium pilosella*, *Hypericum perforatum*, *Juniperus communis*, *Leucanthemum vulgare*, *Phleum pratense*, *Plantago lanceolata*, *Plantago media*, *Poa badensis*, *Potentilla cinerea*, *Sanguisorba minor*, *Teucrium chamaedrys*, *Thymus pulegioides*, *Trifolium campestre*, *Trifolium montanum* etc.) which, within the eastern and southeastern Dinaric Alps, prefer calcareous grasslands developed within deciduous broadleaved forests. Additionally, the Φ-indices of most of these taxa are highly statistically supported, hence we find their classification within the class *Festuco-Brometea* to be fully justified. The fact that only 12 taxa typical for subalpine and alpine grasslands (*Acinos alpinus*, *Arabis alpina*, *Carex kitaibeliana*, *Daphne alpina*, *Edraianthus graminifolius*, *Helianthemum canum*, *Hieracium villosum*, *Pedicularis heterodonta*, *Poa alpina*, *Rosa pendulina*, *Sesleria juncifolia* and *Thlaspi kovatsii*) occur in stands from Mt. Mučanj further supports our classification scheme. To that end, Φ-indices of the majority of the subalpine and alpine grassland taxa from the class *Elyno-Seslerietea* do not reflect statistically significant fidelity or the diagnostic value for the association in general.

Confirmation of the opinion that the new community from Mt. Mučanj belongs to the class of *Festuco-Brometea* should also be sought in its coenotic surroundings and its origin. The potential natural vegetation of the highest part of Mt. Mučanj is deciduous broadleaved forest of the *Fagetalia sylvaticae* order (Jovanović et al. 1986). Therefore, at an altitude of 1500 m a.s.l., this isolated mountain does not provide conditions for the development of the potential vegetation of (sub)alpine grasslands of the *Elyno-Seslerietea* class.

While there is no doubt the new association from Mt. Mučanj belongs to the class *Festuco-Brometea*, and not *Elyno-Seslerietea*, as indicated in Lakušić & Sabovljević (2005), its assignment to a lower syntaxa is not completely clear. Considering their geographic position and floristic composition, these stands show transitional characteristics connecting them to calcareous karstic grasslands of the Illyric-Dinaric region with *Chrysopogono-Saturejion* Horvat & Horvatić 1934, meso-xerophytic swards in sub-oceanic regions of western Europe with *Bromion erecti* Koch 1926, and meso-xerophytic swards in sub-continental regions of central and eastern Europe with *Cirsio-Brachypodion pinnati* Hadač & Klika 1944. The most important species connecting this association with the *Chrysopogono-Saturejion* are: *Asperula cynanchica*, *Dianthus petraeus*, *Galium corrudifolium*, *Globularia cordifolia*, *Hieracium villosum*, *Laserpitium siler*, *Leontodon crispus*, *Sesleria juncifolia*, and *Teucrium chamaedrys*. The species relating it with the associations of the alliance *Bromion erecti* are the following: *Plantago media*, *Sanguisorba minor*, *Scabiosa columbaria,* considered as diagnostic for the *Bromion erecti* (Dengler 2003, Jarolímek & Šibík 2008, Chytrý 2010), while it also hosts diagnostic species of the *Cirsio-Brachypodion pinnati* (Dengler 2003, Jarolímek & Šibík 2008, Chytrý 2010) such as *Asperula cynanchica*, *Brachypodium pinnatum*, *Bromus erectus*, *Plantago media*, *Sanguisorba minor*, *Trifolium montanum*. Therefore, considering the number of common species and their diagnostic character as well as their geographic position within the continental Dinarides, the authors think the position of the new association *Diantho petraeae-Seslerietum juncifoliae* is within the alliance *Chrysopogono-Saturejion*.

The presence of 11 chasmophytic taxa in the stand of the newly described association is also significant, when the syntaxonomic position and the origin of the association are considered. Specific chasmophytic taxa are present in rocky grasslands due to the proximity of chasmophytic stands in the investigated area (Stanić & Lakušić 1993) and the fact that steep rocky grasslands share many features with rock crevices or even screes, generating ecological conditions suitable for both grassland and chasmophytic taxa, e.g. *Asplenium ceterach*, *Asplenium ruta-muraria*, *Asplenium trichomanes*, *Campanula rotundifolia*, *Erysimum sylvestris*, *Hieracium humile*, *Hieracium pannosum*, *Laserpitium siler*, *Leontopodium alpinum*, *Saxifraga tridactylites*, or *Silene saxifraga*. This circumstance was observed and recently discussed by Surina & Martinčič (2012). Nevertheless, low coverage and fidelity indices of chasmophytes in the studied stands do not justify their classification within the class *Asplenietea trichomanis*.

Finaly, the syntaxonomical position of the *Carici laevis-Helianthemetum alpestre seslerietosum tenuifoliae* from Mt. Šarplanina remains unclear, given that in the DCA analysis its stands are overlapping with the stands of associations from Bosnian and Montenegrin mountains. A possible reason for this is the fact that this subassociation was described on the basis of only three relevés, which is not representative enough for an objective understanding of its syntaxonomical position. While all of the other investigated syntaxa are found within the Dinaric floristic province, the stands of this subassociation belong to the Scardo-Pindic floristic province. Accordingly, the comparison of these three relevés with the rest of the 136 dinaric relevés would not reflect the real relationships of these syntaxa within the Balkan Peninsula.

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**Table 1:** Analysed syntaxa dominated by *Sesleria juncifola* agg. from the Balkan Peninsula used in the analysis**.**
**Tabela 1:** Proučevani sintaksoni v katerih prevladuje *Sesleria juncifola* agg. z Balkanskega polotoka uporabljeni v analizi.

| No. | Syntaxon | UTM | Locality | Reference | Plot size (m²) | Number of relevés |
|---|---|---|---|---|---|---|
| 1. | *Rhododendro hirsuti-Juniperetum alpinae* Horvat ex Horvat et al. 1974 subas. *seslerietosum tenuifoliae* Surina 2013 | 33T VL53 | Slovenia (Liburnian karst), Croatia (Liburnian karst) | Surina 2013 | 30 | 13 |
| 2. | *Seslerio-Edraianthetum jugoslavicii* Petković et al. 1990 | 34T DN44 | Serbia (Mt. Mokra Gora) | Petković et al. 1990 | 25–100 | 5 |
| 3. | *Seslerietum tenuifoliae* Stanić & D. Lakušić 1990 prov. | 34T DP22 | Serbia (Mt. Mučanj) | Vukojičić & Lakušić, D. unpubl. | 20–400 | 12 |
| 4, 5. | *Seslerietum juncifoliae* Horvat 1930 | 33T XJ66 | Bosnia and Herzegovina (Mt. Cincar) | Lakušić et al. 1984 | 20–100 | 24 |
| 6. | *Seslerio-Gentianetum dinaricae* Lakušić et al. 1982 | 33T YK00, YK01 | Bosnia and Herzegovina (Mt. Vlašić) | Lakušić et al. 1982 | 10–100 | 10 |
| 7. | *Carici laevis-Helianthemetum alpestre* Horvat 1930 subas. *seslerietosum tenuifoliae* Rajevski 1990 | 34T EM07 | Serbia (Mt. Šar-planina) | Rajevski 1990 | - | 3 |
| 8. | *Carici humilis-Seslerietum juncifoliae* | 33T VK95 | Croatia (northern part of Mt. Velebit) | Alegro & Segota 2009, 2010, manuscript | 50 | 9 |
| 9. | *Carici laevis-Seslerietum tenuifoliae* (Lakušić 1966) Redžić 2011 (=*Seslerietum juncifoliae montenegrinum* Lakušić 1964) | 34T CN94 | Montenegro (Mt. Bjelasica) | Lakušić 1966 | 100–200 | 10 |
| 10. | *Seslerietum juncifoliae* s.l. | 34T DN46, DN47, DN48 | Montenegro (Mt. Durmitor) | Lakušić, D., unpubl. | 20–100 | 5 |
| 11. | *Genisto sericeae-Seslerietum juncifoliae* Poldini 1980 | 33T UL96, VL06, VL13, VL14, VL15, VL23, VL26, VL27, VL44 | Slovenia (Liburnian karst), Italy (Karst) | Poldini 1989, Kaligarič 1997 | 70–80 | 19 |
| 12. | *Carici humilis-Centaureetum rupestris* Horvat 1931 *seslerietosum juncifoliae* Horvat 1962 | 33T VL13, VL15, VL23, VL24, VL26, VL27, VL44, VL54 | Slovenia (Liburnian karst), Italy (Karst) | Poldini 1989, Kaligarič 1997, Surina unpubl. | 100 | 25 |
| 13. | *Bromo-Seslerietum interruptae* Trinajstić 1965 | 33T XH69 | Croatia (Mt. Biokovo) | Trinajstić 1987 | - | 4 |

**Table 2:** Analytical table of the association *Diantho petraeae-Seslerietum juncifoliae* ass. nova. from Mt. Mučanj in Serbia. Species are sorted in descending order of constancy and cover values. (* = holotypus).

**Tabela 2:** Analitična tabela asociacije *Diantho petraeae-Seslerietum juncifoliae* ass. nova. z gore Mučanj v Srbiji. Vrste so razvrščene padajoče glede na stalnost in pokrovnost (* = holotip).

| Altitude (m a.s.l.) | 1450 | 1400 | 1450 | 1450 | 1450 | 1450 | 1450 | 1450 | 1450 | 1350 | 1350 | 1300 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Exposition | – | – | W | NW | NW | NW | W | NE | NW | E | E | S | | |
| Slope (°) | 0 | 0 | 10 | 10 | 10 | 30 | 70 | 70 | 70 | 50 | 65 | 70 | | |
| Total cover (%) | 60 | 60 | 80 | 80 | 80 | 50 | 80 | 70 | 60 | 60 | 80 | 25 | | |
| Plot size (m²) | 25 | 25 | 100 | 20 | 30 | 75 | 24 | 80 | 30 | 400 | 50 | 30 | | |
| Date | VII 1989 | VII 1989 | VII 1989 | VII 1989 | VII 1989 | VII 1989 | VII 1989 | VII 1989 | VII 1989 | VII 1989 | VII 1989 | VII 1989 | | |
| No. Relevé | 1 | 2 | 3 | 4 | 5* | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Constancy (%) | Cover index according to Lausi et al. (1982) (Ic,%) |
| **Dominant taxa** | | | | | | | | | | | | | | |
| *Sesleria juncifolia* agg. | 2.3 | 2.3 | 3.4 | 4.5 | 4.5 | 3.5 | 4.4 | 4.5 | 3.4 | 3.4 | 2.3 | 2.3 | 100 | 74 |
| **Constant taxa** | | | | | | | | | | | | | | |
| *Globularia cordifolia* | 3.4 | 3.3 | 1.3 | 1.3 | 1.2 | 1.3 | 1.2 | 1.1 | 3.4 | 1.3 | . | 1.2 | 92 | 33 |
| *Edraianthus graminifolius* | + | 1.1 | 1.2 | 1.2 | 1.1 | 1.1 | 1.2 | 1.2 | 1.2 | 1.3 | . | 1.1 | 92 | 42 |
| *Saxifraga paniculata* | . | . | 1.1 | 1.2 | 1.2 | 1.2 | . | 1.1 | . | 1.2 | 1.2 | 1.2 | 67 | 22 |
| *Carex kitaibeliana* | 1.2 | 1.2 | . | 1.2 | 1.2 | 1.2 | . | 1.2 | 1.2 | . | . | . | 67 | 22 |
| **Diagnostic taxa (*also constant taxa)** | | | | | | | | | | | | | | |
| *Dianthus petraeus* subsp. *petraeus** | 1.2 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 | 1.3 | 1.3 | 1.3 | 1.4 | 1.3 | 1.2 | 100 | 33 |
| *Chamaecytisus ciliatus** | 1.2 | 1.3 | 1.2 | 1.2 | 1.2 | 1.2 | 1.3 | 1.3 | 1.2 | 1.3 | 1.2 | 1.2 | 92 | 30 |
| *Festuca panciciana** | 1.1 | . | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | . | 1.2 | 2.2 | 1.2 | 92 | 30 |
| *Pedicularis heterodonta** | + | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | + | . | . | 83 | 30 |
| *Potentilla cinerea** | 1.2 | . | 1.2 | 1.3 | 1.2 | 1.2 | 1.3 | 1.3 | 1.3 | 1.2 | 1.2 | 1.2 | 83 | 26 |
| *Ornithogalum collinum** | 1.1 | . | . | 1.1 | 1.1 | 1.1 | 1.1 | + | + | 1.1 | 1.1 | . | 75 | 23 |
| *Cotoneaster integerrimus** | 1.2 | 1.2 | + | + | 1.1 | 1.2 | . | + | . | 1.3 | 1.3 | . | 75 | 22 |
| *Campanula rotundifolia** | . | . | . | . | . | . | 1.2 | 1.2 | 1.1 | 1.2 | 1.2 | 1.2 | 75 | 22 |
| *Sanguisorba minor* subsp. *minor* | + | . | 1.1 | 1.1 | + | . | 1.1 | 1.1 | . | 1.2 | 1.2 | + | 58 | 19 |
| *Helianthemum nummularium* subsp. *nummularium* | . | 1.1 | . | . | 1.1 | 1.1 | 1.1 | 1.1 | . | . | 1.2 | . | 50 | 16 |
| *Draba lasiocarpa* | + | . | . | . | . | . | 1.2 | + | . | 1.1 | 1.2 | + | 50 | 16 |
| *Chamaespartium sagittale* | 1.2 | + | 1.1 | . | . | . | . | . | + | 1.2 | 1.2 | 1.2 | 50 | 15 |
| *Galium corrudifolium* | . | . | 1.2 | . | 1.2 | 1.2 | 1.3 | . | . | 1.3 | 1.3 | . | 50 | 14 |
| **Other taxa** | | | | | | | | | | | | | | |
| *Bromus erectus* | 1.1 | . | 1.2 | 1.2 | 1.1 | 1.1 | 1.2 | . | . | | 1.1 | . | 58 | 19 |
| *Minuartia verna* | 1.1 | . | 1.2 | 1.2 | 1.2 | . | 1.2 | 1.2 | . | 1.2 | 1.2 | . | 58 | 18 |
| *Leontodon crispus* subsp. *crispus* | 1.1 | + | + | . | . | . | . | . | 1.2 | 1.3 | . | . | 50 | 17 |
| *Trifolium montanum* | 1.2 | 1.1 | 1.1 | . | 1.1 | 1.1 | . | . | . | . | . | . | 42 | 14 |
| *Arenaria serpyllifolia* subsp. *serpyllifolia* | 1.2 | . | . | 1.2 | . | . | . | . | . | 1.1 | 1.2 | . | 42 | 13 |
| *Trifolium alpestre* | 1.1 | . | + | + | . | . | . | . | . | 1.2 | 1.2 | 1.1 | 42 | 12 |
| *Euphrasia stricta* | 1.1 | . | 1.1 | 1.1 | + | . | . | . | . | 1.1 | . | . | 42 | 10 |
| *Asplenium ceterach* | . | . | . | . | . | . | . | . | . | 1.1 | 1.1 | 1.1 | 33 | 11 |
| *Juniperus communis* | . | + | . | . | . | 1.2 | . | . | . | 1.2 | . | + | 33 | 11 |
| *Poa alpina* | 1.1 | . | 1.1 | 1.2 | + | . | . | . | . | . | . | . | 33 | 10 |
| *Hieracium pilosella* subsp. *pilosella* | . | . | . | 1.2 | . | 1.2 | 1.1 | . | . | . | . | . | 33 | 9 |
| *Saxifraga tridactylites* | . | . | . | 1.1 | 1.1 | . | 1.1 | . | . | 1.1 | . | . | 33 | 9 |
| *Gymnadenia conopsea* | + | + | . | . | + | 1.1 | . | + | . | . | . | . | 25 | 8 |
| *Rhamnus saxatilis* subsp. *saxatilis* | . | . | . | . | . | . | . | . | . | 1.3 | 1.3 | 1.2 | 25 | 8 |
| *Stachys recta* | . | . | . | . | . | . | . | . | . | 1.2 | 1.2 | 1.2 | 25 | 8 |
| *Sedum acre* | . | . | . | + | . | . | . | . | . | 1.2 | 1.2 | + | 25 | 8 |
| *Euphorbia myrsinites* | . | . | . | . | . | . | . | . | . | . | 2.3 | + | 25 | 8 |
| *Rosa pendulina* | . | 1.1 | . | . | 1.1 | + | . | . | . | . | . | . | 25 | 8 |
| *Asplenium ruta-muraria* subsp. *ruta-muraria* | . | . | . | . | . | + | . | . | . | 1.1 | . | . | 25 | 8 |
| *Verbascum* sp. | . | . | . | . | . | . | . | . | . | 1.2 | 1.1 | 1.1 | 25 | 7 |

| No. Relevé | 1 | 2 | 3 | 4 | 5* | 6 | 7 | 8 | 9 | 10 | 11 | 12 | C. (%) | Cov. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Acinos alpinus* | . | . | . | . | . | . | 1.1 | . | . | 1.2 | . | 1.2 | 25 | 7 |
| *Teucrium chamaedrys* | . | . | . | . | . | . | . | . | . | 1.3 | 1.3 | 1.2 | 25 | 7 |
| *Sedum album* | . | . | . | . | + | . | . | . | . | 1.2 | 1.2 | . | 25 | 6 |
| *Erysimum sylvestre* subsp. *sylvestre* | . | . | . | . | + | + | . | . | . | . | 1.1 | . | 17 | 7 |
| *Leontopodium alpinum* subsp. *alpinum* | . | . | . | . | . | 1.2 | . | 1.1 | . | . | . | . | 17 | 6 |
| *Arabis hirsuta* | . | . | . | . | . | . | . | . | . | 1.1 | 1.2 | . | 17 | 6 |
| *Phleum pratense* subsp. *pratense* | . | . | . | . | . | . | . | . | . | 1.1 | 1.3 | . | 17 | 6 |
| *Thlaspi kovatsii* | . | . | . | . | . | . | 1.1 | 1.1 | . | . | . | . | 17 | 6 |
| *Aethionema saxatile* subsp. *saxatile* | . | . | . | . | . | . | . | . | . | 1.1 | 1.2 | . | 17 | 6 |
| *Daphne mezereum* | . | . | . | . | . | 1.1 | . | . | . | . | . | . | 17 | 6 |
| *Thymus pulegioides* | . | . | . | . | . | . | 1.1 | . | . | . | . | . | 17 | 6 |
| *Vicia incana* | . | + | . | . | . | . | . | . | . | . | 1.2 | . | 17 | 6 |
| *Cerastium decalvans* | . | . | . | . | . | . | . | . | . | 1.2 | 1.2 | . | 17 | 6 |
| *Minuartia bosniaca* | . | . | . | . | . | . | . | . | . | 1.2 | . | + | 17 | 5 |
| *Briza media* subsp. *media* | + | . | . | . | . | 1.1 | . | . | . | . | . | . | 17 | 5 |
| *Scabiosa columbaria* subsp. *columbaria* | . | . | 1.1 | . | . | . | . | . | . | 1.1 | . | . | 17 | 5 |
| *Hieracium villosum* | . | . | . | . | . | . | . | 1.2 | 1.1 | . | . | . | 17 | 5 |
| *Poa nemoralis* | . | . | . | . | . | 1.3 | 1.2 | . | . | . | . | . | 17 | 4 |
| *Rhamnus alpinus* subsp. *fallax* | . | . | . | . | . | . | . | . | . | 1.3 | . | . | 17 | 4 |
| *Epipactis atrorubens* | . | . | . | . | . | + | + | . | . | . | + | . | 8 | 3 |
| *Thymus glabrescens* | . | . | + | . | + | . | . | . | . | . | . | . | 8 | 3 |
| *Hieracium pannosum* | . | . | . | . | . | . | . | . | . | 1.4 | . | . | 8 | 3 |
| *Arabis glabra* | . | . | . | . | . | . | . | . | . | 1.2 | . | . | 8 | 3 |
| *Cerastium brachypetalum* subsp. *brachypetalum* | . | . | . | . | . | . | . | . | . | . | 1.3 | . | 8 | 3 |
| *Arabis alpina* | . | . | . | . | . | . | . | . | . | . | 1.3 | . | 8 | 3 |
| *Leucanthemum vulgare* | . | 1.1 | . | . | . | . | . | . | . | . | . | . | 8 | 3 |
| *Plantago lanceolata* | . | . | 1.1 | . | . | . | . | . | . | . | . | . | 8 | 3 |
| *Plantago media* | 1.1 | . | . | . | . | . | . | . | . | . | . | . | 8 | 3 |
| *Heracleum* sp. | . | . | . | . | . | 1.1 | . | . | . | . | . | . | 8 | 3 |
| *Fagus sylvatica* | . | . | . | . | . | + | . | . | . | . | . | . | 8 | 3 |
| *Valeriana montana* | . | . | . | . | . | . | + | . | . | . | . | . | 8 | 3 |
| *Myosotis arvensis* subsp. *arvensis* | . | . | . | . | . | . | . | + | . | . | . | . | 8 | 3 |
| *Erigeron annuus* | . | . | . | . | . | . | . | . | . | + | . | . | 8 | 3 |
| *Sorbus aria* | . | . | . | . | + | . | . | . | . | . | . | . | 8 | 3 |
| *Hypericum perforatum* | . | . | . | . | . | . | . | . | . | + | . | . | 8 | 3 |
| *Poa badensis* | . | . | . | . | . | . | . | . | . | 1.1 | . | . | 8 | 3 |
| *Asperula aristata* subsp. *scabra* | . | . | . | . | . | . | . | . | . | 1.1 | . | . | 8 | 3 |
| *Polygala supina* subsp. *supina* | . | . | . | . | . | . | . | . | . | 1.2 | . | . | 8 | 3 |
| *Brachypodium pinnatum* subsp. *pinnatum* | . | . | + | . | . | . | . | . | . | . | . | . | 8 | 3 |
| *Asplenium trichomanes* subsp. *trichomanes* | . | . | . | . | . | . | . | . | . | . | 1.1 | . | 8 | 3 |
| *Lotus corniculatus* | + | . | . | . | . | . | . | . | . | . | . | . | 8 | 3 |
| *Fragaria vesca* | . | . | . | . | . | + | + | . | . | . | . | . | 8 | 2 |
| *Allium flavum* subsp. *flavum* | . | . | . | . | . | . | . | . | . | 1.1 | . | . | 8 | 2 |
| *Laserpitium siler* subsp. *siler* | . | . | . | . | . | . | . | . | . | 1.3 | . | . | 8 | 2 |
| *Vincetoxicum hirundinaria* | . | . | . | . | . | . | . | . | . | . | 1.3 | . | 8 | 2 |
| *Daphne blagayana* | . | 1.2 | . | . | . | . | . | . | . | . | . | . | 8 | 2 |
| *Trifolium campestre* | . | . | . | . | . | . | . | . | . | + | . | . | 8 | 2 |
| *Silene saxifraga* | . | . | . | . | . | . | . | . | . | 1.3 | . | . | 8 | 2 |
| *Asperula cynanchica* | . | . | . | . | . | . | . | . | . | 1.1 | . | . | 8 | 2 |
| *Helianthemum canum* subsp. *canum* | . | . | 1.1 | . | . | . | . | . | . | . | . | . | 8 | 2 |

Relevés 1, 3–9: Serbia, Mt. Mučanj, UTM grid 34T DP22, 43.544924° N, 20.038117° E
Relevé 2: Serbia, Mt. Mučanj, UTM grid 34T DP22, 43.543552° N, 20.038329° E
Relevés 10–12: Serbia, Mt. Mučanj, UTM grid 34T DP22, 43.542562° N, 20.038277° E

**Table 3:** Synoptic table of all the analyzed communities. The percentage constancy values for each species within each of the 13 analyzed syntaxa are given in the columns. The last three columns refer to the max Φ-values of the species, the number of the syntaxa where it was observed and the overall constancy. Species are sorted in descending order of constancy and Φ-values. The companion species with less than 10% overall constancy are not shown.

**Tabela 3:** Sinoptična tabela vseh proučevanih združb. V stolpcih so podane stalnosti pojavljanj vrst v odstotkih v 13 analiziranih sintaksonih. V zadnjih treh stolpcih so predstavljene maksimalna Φ vrednost posamezne vrste, število sintaksonov v katerih se pojavlja in celotna stalnost. Vrste so razvrščene padajoče glede na stalnost in Φ vrednosti. Spremljevalne vrste s stalnostjo pod 10% niso prikazane.

| *Taxa* | ***Rhododendro hirsuti-Juniperetum alpinae*, Slovenia & Hrvatska** | ***Seslerio juncifoliae-Edraianthetum graminifolii*, Mokra gora** | ***Diantho petraeae-Seslerietum juncifoliae*, Mučanj** | ***Seslerietum juncifoliae*, Cincar** | ***Seslerietum juncifoliae*, Snežnik** | ***Seslerio-Gentianaetum dinaricae*, Vlašić** | ***Carici laevis-Helianthemetum alpestre ses. juncifoliae*, Sara** | ***Carici humilis-Seslerietum juncifoliae*, Velebit** | ***Carici laevis-Seslerietum tenuifoliae*, Bjelasica** | ***Seslerietum juncifoliae*, Durmitor** | ***Genisto sericeae-Seslerietum juncifoliae*, Slovenia & Italia** | ***Carici humilis-Centaureetum rupestris*, Slovenija & Italia** | ***Bromo-Seslerietum interruptae*, Biokovo** | **Group with Max Φ-value observed** | **Max Φ-values** | **Overall constancy** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **A** | **B** | **C** |
| | **Constancy (%)** | | | | | | | | | | | | | | | |
| **Dominant taxa** | | | | | | | | | | | | | | | | |
| *Sesleria juncifolia* agg. | 92 | 60 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 89 | 100 | 100 | 12 | 0.6 | 13 |
| **Constant taxa** | | | | | | | | | | | | | | | | |
| *Bromus erectus* agg. | . | . | 58 | . | . | 30 | . | 33 | 30 | 40 | 32 | 60 | . | 13 | 0.38 | 7 |
| *Lotus corniculatus* L. | . | 40 | 8 | . | 75 | 30 | . | 33 | . | . | 16 | 56 | . | 5 | 0.33 | 7 |
| **Diagnostic taxa** | | | | | | | | | | | | | | | | |
| *Rosa pendulina* L. | 85 | . | 25 | . | 31 | 20 | . | 11 | . | . | . | . | . | 1 | 0.57 | 5 |
| *Helianthemum canum* (L.) Baumg. ssp. *canum* | . | . | 8 | . | . | 100 | 67 | . | . | 40 | . | . | . | 6 | 0.81 | 4 |
| *Dianthus petraeus* Waldst. & Kit. ssp. *petraeus* | . | . | 100 | . | . | 40 | . | 22 | . | 20 | . | . | . | 3 | 0.75 | 4 |
| *Helianthemum oelandicum* (L.) DC. ssp. *alpestre* (Jacq.) Breistr. | . | . | . | . | . | 10 | 100 | . | 30 | 40 | . | . | . | 4 | 0.71 | 4 |
| *Helianthemum nummularium* (L.) *Miller* ssp. *grandiflorum* (Scop.) Schinz & Thell. | . | 100 | . | . | . | 70 | 67 | 22 | . | . | . | . | . | 2 | 0.68 | 4 |
| *Potentilla cinerea* Chaix ex Vill. | . | . | 83 | . | . | . | . | . | . | 20 | 26 | 20 | . | 3 | 0.62 | 4 |
| *Cerastium decalvans* Schloss. & Vuk. | . | . | 17 | . | . | 30 | 67 | . | . | 60 | . | . | . | 6 | 0.52 | 4 |
| *Minuartia verna* agg. | . | 80 | 58 | . | . | 40 | . | . | . | 40 | . | . | . | 2 | 0.51 | 4 |
| *Dorycnium pentaphyllum* Scop. ssp. *germanicum* (Gremli) Gams | . | . | . | . | . | . | . | 11 | . | 20 | 16 | 68 | . | 12 | 0.51 | 4 |
| *Globularia meridionalis* (Podp.) O. Schwarz | . | . | . | . | . | 50 | 67 | 11 | 40 | . | . | . | . | 4 | 0.5 | 4 |
| *Polygonum viviparum* L. | . | 80 | . | . | . | 30 | . | 11 | . | . | . | . | . | 2 | 0.72 | 3 |
| *Coronilla vaginalis* Lam. | . | . | . | . | 75 | . | . | 11 | . | . | . | 12 | . | 5 | 0.68 | 3 |
| *Silene pusilla* Waldst. & Kit. | . | 60 | . | . | . | 10 | . | . | 20 | . | . | . | . | 2 | 0.62 | 3 |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | A | B | C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Oxytropis dinarica* (Murb.) Wettst. | . | . | . | . | . | . | 67 | . | 20 | 60 | . | . | . | 4 | 0.6 | 3 |
| *Festuca panciciana* (Hackel) K. Richter | . | . | 92 | . | . | 80 | . | . | 20 | . | . | . | . | 3 | 0.59 | 3 |
| *Campanula rotundifolia* (Desf.) Boiss. & Reuter | . | . | 75 | . | . | . | 33 | . | . | 20 | . | . | . | 3 | 0.58 | 3 |
| *Thymus praecox* Opiz ssp. *polytrichus* (A. Kerner ex Borbás) Jalas | . | 40 | . | . | . | 60 | . | . | . | 20 | . | . | . | 4 | 0.56 | 3 |
| *Arctostaphylos uva-ursi* (L.) Sprengel | . | 40 | . | . | . | . | . | 67 | . | 40 | . | . | . | 4 | 0.54 | 3 |
| *Picea abies* (L.) Karsten ssp. *abies* | 54 | 20 | . | . | . | . | . | 33 | . | . | . | . | . | 1 | 0.53 | 3 |
| *Draba lasiocarpa* Rochel | . | 40 | 50 | . | . | . | . | . | . | 20 | . | . | . | 3 | 0.53 | 3 |
| *Cotoneaster integerrimus* Medicus | 31 | . | 75 | . | . | . | . | 33 | . | . | . | . | . | 3 | 0.53 | 3 |
| *Stipa pennata* ssp. *eriocaulis* (Borbás) Martinovsky & Skalicky | . | . | . | . | . | . | . | . | . | . | 16 | 28 | 75 | 13 | 0.53 | 3 |
| *Fumana procumbens* (Dunal) Gren. & Godron | . | . | . | . | . | . | . | . | . | . | 42 | 8 | 50 | 13 | 0.51 | 3 |
| *Daphne alpina* L. | 54 | . | . | . | 13 | . | . | . | . | . | 16 | . | . | 1 | 0.5 | 3 |
| *Asperula aristata* L. | . | . | . | . | . | . | . | 11 | . | . | . | . | 100 | 13 | 1 | 2 |
| *Salix appendiculata* Vill. | 100 | . | . | . | 6 | . | . | . | . | . | . | . | . | 1 | 0.95 | 2 |
| *Chamaecytisus ciliatus* (Wahlenb.) Rothm. | . | . | 92 | . | . | . | . | . | . | 20 | . | . | . | 3 | 0.95 | 2 |
| *Anthyllis vulneraria* L. ssp. *pulchella* (Vis.) Bornm. | . | 100 | . | . | . | . | 100 | . | . | . | . | . | . | 2 | 0.88 | 2 |
| *Draba aizoides* L. | . | . | . | . | . | . | 67 | . | 90 | . | . | . | . | 9 | 0.85 | 2 |
| *Juniperus communis* ssp. *alpina* (Suter) Celak. | 100 | . | . | . | . | . | . | 67 | . | . | . | . | . | 1 | 0.78 | 2 |
| *Jurinea mollis* (L.) Reichenb. ssp. *mollis* | . | . | . | . | . | . | . | . | . | 20 | . | 72 | . | 12 | 0.78 | 2 |
| *Onobrychis montana* DC. ssp. *scardica* (Griseb.) P. W. Ball | . | . | . | . | . | . | 100 | . | 70 | . | . | . | . | 7 | 0.77 | 2 |
| *Dryas octopetala* L. | . | . | . | . | . | . | 67 | . | . | 20 | . | . | . | 7 | 0.75 | 2 |
| *Bupleurum ranunculoides* L. | . | . | . | . | . | . | 100 | . | . | . | . | 36 | . | 7 | 0.72 | 2 |
| *Thymus praecox* Opiz ssp. *zygiformis* (H. Braun) Jalas | . | . | . | . | . | . | 67 | . | 70 | . | . | . | . | 9 | 0.72 | 2 |
| *Euphorbia nicaeensis* All. | . | . | . | . | . | . | . | . | . | . | 21 | 52 | . | 12 | 0.71 | 2 |
| *Chamaespartium sagittale* (L.) P. Gibbs | . | . | 50 | . | . | . | . | . | . | . | . | 4 | . | 3 | 0.69 | 2 |
| *Asperula purpurea* (L.) Ehrend. | . | . | . | . | . | . | . | . | . | . | 5 | . | 50 | 13 | 0.69 | 2 |
| *Cyclamen purpurascens* Miller | 85 | . | . | . | . | . | . | . | . | . | 21 | . | . | 1 | 0.68 | 2 |
| *Hypericum richeri* Vill. ssp. *grisebachii* (Boiss.) Nyman | . | . | . | . | . | 60 | . | . | . | 20 | . | . | . | 6 | 0.65 | 2 |
| *Jovibarba heuffelii* (Schott) Á. & D. Löve | . | . | . | . | . | . | . | . | 60 | 40 | . | . | . | 9 | 0.65 | 2 |
| *Galium corrudifolium* Vill. | . | . | 50 | . | . | . | . | . | . | . | . | . | 25 | 3 | 0.63 | 2 |
| *Helianthemum nummularium* (L.) Miller ssp. *nummularium* | . | . | 50 | . | . | . | . | . | . | 20 | . | . | . | 3 | 0.63 | 2 |
| *Peucedanum oreoselinum* (L.) *Moench* | . | . | . | . | 63 | . | . | . | . | . | . | 12 | . | 5 | 0.63 | 2 |
| *Verbascum chaixii* Vill. ssp. *austriacum* (Schott ex Roemer & Schultes) Hayek | . | . | . | . | . | 10 | . | . | 50 | . | . | . | . | 9 | 0.63 | 2 |
| *Plantago argentea* Chaix | . | . | . | . | . | . | . | 44 | . | . | . | 64 | . | 12 | 0.59 | 2 |
| *Plantago lanceolata* L. | . | . | 8 | . | 44 | . | . | . | . | . | . | . | . | 5 | 0.58 | 2 |
| *Festuca bosniaca* Kummer & Sendtner | . | . | . | . | . | 40 | . | . | . | 20 | . | . | . | 4 | 0.57 | 2 |
| *Athamanta cretensis* L. | 77 | . | . | . | 56 | . | . | . | . | . | . | . | . | 1 | 0.56 | 2 |
| *Polygala supina* Schreber ssp. *supina* | . | 40 | 8 | . | . | . | . | . | . | . | . | . | . | 2 | 0.55 | 2 |
| *Juniperus sabina* L. | . | 40 | . | . | . | . | . | 11 | . | . | . | . | . | 2 | 0.55 | 2 |
| *Hieracium pavichii* Heuffel | . | . | . | . | . | 10 | . | . | 40 | . | . | . | . | 9 | 0.55 | 2 |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | A | B | C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Androsace villosa* L. | . | . | . | . | . | . | . | 11 | . | 40 | . | . | . | 10 | 0.55 | 2 |
| *Achillea clavennae* L. | . | . | . | . | . | . | . | 11 | . | 40 | . | . | . | 10 | 0.55 | 2 |
| *Anthyllis vulneraria* L. ssp. *polyphylla* (DC.) Nyman | . | . | . | . | . | . | . | . | . | . | 16 | 32 | . | 12 | 0.55 | 2 |
| *Astragalus vesicarius* L. ssp. *carniolicus* (A.Kerner) Chater | . | . | . | . | . | . | . | . | . | . | 11 | 16 | . | 4 | 0.54 | 2 |
| *Echinops ritro* L. ssp. *ruthenicus* (Bieb.) Nyman | . | . | . | . | . | . | . | . | . | . | 5 | 12 | . | 13 | 0.54 | 2 |
| *Thesium linophyllon* L. | 62 | . | . | . | 38 | . | . | . | . | . | . | . | . | 1 | 0.53 | 2 |
| *Helianthemum nummularium* ssp. *obscurum* (Celak.) J. Holub | . | . | . | . | . | . | . | 22 | . | . | . | 28 | . | 5 | 0.5 | 2 |
| *Ranunculus montanus* agg. | . | 40 | . | . | . | 50 | . | . | . | . | . | . | . | 6 | 0.5 | 2 |
| *Lilium bosniacum* (Beck) Fritsch | . | . | . | . | . | . | . | 11 | . | 40 | . | . | . | 10 | 0.5 | 2 |
| *Calamagrostis varia* (Schrader) Host ssp. *varia* | 100 | . | . | . | . | . | . | . | . | . | . | . | . | 1 | 1 | 1 |
| *Erica herbacea* L. | 100 | . | . | . | . | . | . | . | . | . | . | . | . | 1 | 1 | 1 |
| *Alchemilla plicatula* Gand. | . | 100 | . | . | . | . | . | . | . | . | . | . | . | 2 | 1 | 1 |
| *Festuca duriuscula* L. | . | . | . | . | . | . | 100 | . | . | . | . | . | . | 7 | 1 | 1 |
| *Anthyllis vulneraria* L. ssp. *weldeniana* (Rchb.) Cullen | . | . | . | . | . | . | . | . | . | . | . | . | 100 | 13 | 1 | 1 |
| *Edraianthus tenuifolius* (Waldst. & Kit.) A. DC. | . | . | . | . | . | . | . | . | . | . | . | . | 100 | 13 | 1 | 1 |
| *Abies alba* Miller | 85 | . | . | . | . | . | . | . | . | . | . | . | . | 1 | 0.91 | 1 |
| *Campanula cochlearifolia* Lam. | 85 | . | . | . | . | . | . | . | . | . | . | . | . | 1 | 0.91 | 1 |
| *Pedicularis heterodonta* Pančić | . | . | 83 | . | . | . | . | . | . | . | . | . | . | 3 | 0.91 | 1 |
| *Gentiana dinarica* G. Beck | . | . | . | . | . | 80 | . | . | . | . | . | . | . | 6 | 0.89 | 1 |
| *Ornithogalum collinum* Guss. | . | . | 75 | . | . | . | . | . | . | . | . | . | . | 3 | 0.86 | 1 |
| *Sanguisorba minor* Scop. ssp. minor | . | . | 58 | . | . | . | . | . | . | . | . | . | . | 3 | 0.86 | 1 |
| *Genista januensis* Viv. | . | . | . | 75 | . | . | . | . | . | . | . | . | . | 4 | 0.86 | 1 |
| *Iberis pruitii* Tineo | . | . | . | 75 | . | . | . | . | . | . | . | . | . | 4 | 0.86 | 1 |
| *Satureja montana* L. ssp. *illyrica* Nyman | . | . | . | . | . | . | . | . | . | . | . | . | 75 | 13 | 0.86 | 1 |
| *Cerastium malyi* (Georgiev) Niketić | . | . | . | . | . | . | . | . | 70 | . | . | . | . | 9 | 0.83 | 1 |
| *Myosotis alpestris* F. W. Schmidt | . | . | . | . | . | . | . | . | 70 | . | . | . | . | 9 | 0.83 | 1 |
| *Festuca varia* Haenke | . | . | . | . | . | . | . | . | 70 | . | . | . | . | 9 | 0.83 | 1 |
| *Gymnocarpium robertianum* (Hoffm.) Newman | 69 | . | . | . | . | . | . | . | . | . | . | . | . | 1 | 0.82 | 1 |
| *Achillea ageratifolia* (Sibth. & Sm.) Boiss. | . | . | . | . | . | . | 67 | . | . | . | . | . | . | 7 | 0.81 | 1 |
| *Campanula spatulata* Sibth. & Sm. ssp. *spatulata* | . | . | . | . | . | . | 67 | . | . | . | . | . | . | 7 | 0.81 | 1 |
| *Saxifraga sempervivum* C. Koch | . | . | . | . | . | . | 67 | . | . | . | . | . | . | 7 | 0.81 | 1 |
| *Sesleria korabensis* (Kümmerle & Jáv.) Deyl | . | . | . | . | . | . | 67 | . | . | . | . | . | . | 7 | 0.81 | 1 |
| *Poa molinerii* Balbis | . | . | . | . | . | . | 67 | . | . | . | . | . | . | 7 | 0.81 | 1 |
| *Silene ciliata* Pourret | . | . | . | . | . | . | 67 | . | . | . | . | . | . | 7 | 0.81 | 1 |
| *Alyssum montanum* L. | . | 60 | . | . | . | . | . | . | . | . | . | . | . | 2 | 0.76 | 1 |
| *Asplenium trichomanes-ramosum* L. | . | 60 | . | . | . | . | . | . | . | . | . | . | . | 2 | 0.76 | 1 |
| *Pedicularis brachyodonta* Schlosser & Vuk. ssp. *brachyodonta* | . | . | . | . | . | 60 | . | . | . | . | . | . | . | 6 | 0.76 | 1 |
| *Pedicularis verticillata* L. | . | . | . | . | . | . | . | . | 60 | . | . | . | . | 9 | 0.76 | 1 |
| *Allium carinatum* L. ssp. *pulchellum* Bonnier & Layens | . | . | . | . | . | . | 67 | . | . | . | . | . | . | 7 | 0.75 | 1 |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | A | B | C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Gentiana clusii* Perr. & Song. | . | . | . | . | 56 | . | . | . | . | . | . | . | . | 5 | 0.74 | 1 |
| *Homogyne sylvestris* Cass. | 54 | . | . | . | . | . | . | . | . | . | . | . | . | 1 | 0.72 | 1 |
| *Lonicera caerulea* L. | 54 | . | . | . | . | . | . | . | . | . | . | . | . | 1 | 0.72 | 1 |
| *Genista pilosa* L. | . | . | . | . | . | 50 | . | . | . | . | . | . | . | 6 | 0.69 | 1 |
| *Saxifraga marginata* Sternb. var. *coriophylla* (Griseb.) Engler | . | . | . | . | . | 50 | . | . | . | . | . | . | . | 6 | 0.69 | 1 |
| *Alyssum scardicum* Wettst. | . | . | . | . | . | . | . | . | 50 | . | . | . | . | 9 | 0.69 | 1 |
| *Bunium alpinum* ssp. *montanum* (Koch) P.W. Ball | . | . | . | . | . | . | . | . | . | . | . | . | 50 | 13 | 0.69 | 1 |
| *Carlina corymbosa* L. | . | . | . | . | . | . | . | . | . | . | . | . | 50 | 13 | 0.69 | 1 |
| *Carex halleriana* Asso | . | . | . | . | . | . | . | . | . | . | . | . | 50 | 13 | 0.69 | 1 |
| *Centaurea spinosociliata* ssp. *cristata* (Bartl.) Dostál | . | . | . | . | . | . | . | . | . | . | . | . | 50 | 13 | 0.69 | 1 |
| *Euphrasia illyrica* Wettst. | . | . | . | . | . | . | . | . | . | . | . | . | 50 | 13 | 0.69 | 1 |
| *Ornithogalum orthophyllum* Ten. | . | . | . | . | . | . | . | . | . | . | . | . | 50 | 13 | 0.69 | 1 |
| *Festuca pseudovina* Hackel ex Wiesb. | . | . | . | . | . | . | . | . | . | . | . | . | 50 | 13 | 0.69 | 1 |
| *Aster bellidiastrum* (L.) Scop. | 46 | . | . | . | . | . | . | . | . | . | . | . | . | 1 | 0.67 | 1 |
| *Hieracium murorum* L. | 46 | . | . | . | . | . | . | . | . | . | . | . | . | 1 | 0.67 | 1 |
| *Rosa pimpinellifolia* L. | . | . | . | . | . | . | . | 44 | . | . | . | . | . | 8 | 0.65 | 1 |
| *Satureja subspicata* Bartl. ex Vis. | . | . | . | . | . | . | . | 44 | . | . | . | . | . | 8 | 0.65 | 1 |
| *Potentilla crantzii* (Crantz) Beck ex Fritsch | . | . | . | . | . | . | . | . | 60 | . | . | . | . | 9 | 0.65 | 1 |
| *Euphrasia stricta* D. Wolff ex J. F. Lehm. | . | . | 42 | . | . | . | . | . | . | . | . | . | . | 3 | 0.63 | 1 |
| *Acinos arvensis* (Lam.) Dandy | . | 40 | . | . | . | . | . | . | . | . | . | . | . | 2 | 0.62 | 1 |
| *Scabiosa ochroleuca* L. | . | 40 | . | . | . | . | . | . | . | . | . | . | . | 2 | 0.62 | 1 |
| *Minuartia baldaccii* (Halácsy) Mattf. | . | . | . | . | . | . | . | . | 40 | . | . | . | . | 9 | 0.62 | 1 |
| *Trifolium noricum* Wulfen | . | . | . | . | . | . | . | . | . | 40 | . | . | . | 10 | 0.62 | 1 |
| *Silene parnassica* Boiss. & Spruner | . | . | . | . | . | . | . | . | . | 40 | . | . | . | 10 | 0.62 | 1 |
| *Leucanthemum illyricum* (Horvatić) Vogt & Greuter | . | . | . | . | . | . | . | . | . | 40 | . | . | . | 10 | 0.62 | 1 |
| *Pedicularis brachyodonta* Schlosser & Vuk. ssp. *grisebachii* (Wettst.) Hayek | . | . | . | . | . | . | . | . | . | 40 | . | . | . | 10 | 0.62 | 1 |
| *Rubus saxatilis* L. | 38 | . | . | . | . | . | . | . | . | . | . | . | . | 1 | 0.61 | 1 |
| *Cirsium erisithales* (Jacq.) Scop. | 38 | . | . | . | . | . | . | . | . | . | . | . | . | 1 | 0.61 | 1 |
| *Chamaecytisus purpureus* (Scop.) Link | . | . | . | . | 38 | . | . | . | . | . | . | . | . | 5 | 0.6 | 1 |
| *Clematis alpina* (L.) Miller ssp. *alpina* | 69 | . | . | . | . | . | . | . | . | . | . | . | . | 1 | 0.58 | 1 |
| *Festuca adamovicii* (St-Yves) Markgr.-Dannenb. | . | . | . | . | . | . | 33 | . | . | . | . | . | . | 7 | 0.56 | 1 |
| *Alchemilla flabellata* Buser | . | . | . | . | . | . | 33 | . | . | . | . | . | . | 7 | 0.56 | 1 |
| *Cerastium alpinum* L. | . | . | . | . | . | . | 33 | . | . | . | . | . | . | 7 | 0.56 | 1 |
| *Hieracium alpicola* Schleicher ex Gaudin | . | . | . | . | . | . | 33 | . | . | . | . | . | . | 7 | 0.56 | 1 |
| *Primula veris* L. ssp. *veris* | . | . | . | . | . | . | 33 | . | . | . | . | . | . | 7 | 0.56 | 1 |
| *Pulsatilla montana* (Hoppe) Reichenb. | . | . | . | . | . | . | . | . | . | . | . | 32 | . | 12 | 0.55 | 1 |
| *Scabiosa triandra* L. | . | . | . | . | . | . | . | . | . | . | . | 32 | . | 12 | 0.55 | 1 |
| *Solidago virgaurea* L. | 31 | . | . | . | . | . | . | . | . | . | . | . | . | 1 | 0.54 | 1 |
| *Carex digitata* L. | 31 | . | . | . | . | . | . | . | . | . | . | . | . | 1 | 0.54 | 1 |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | A | B | C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Rhododendron hirsutum* L. | 100 | . | . | . | . | . | . | . | . | . | . | . | . | 1 | 0.54 | 1 |
| *Crepis praemorsa* (L.) Tausch ssp. *dinarica* (G. Beck) P. D. Sell | . | . | . | . | . | . | . | . | 30 | . | . | . | . | 4 | 0.54 | 1 |
| *Thalictrum aquilegiifolium* L. | . | . | . | . | 31 | . | . | . | . | . | . | . | . | 5 | 0.54 | 1 |
| *Dianthus giganteus* D' Urv. ssp. *croaticus* (Borbás) Tutin | . | . | . | . | . | 30 | . | . | . | . | . | . | . | 6 | 0.53 | 1 |
| *Vicia cracca* L. | . | . | . | . | . | 30 | . | . | . | . | . | . | . | 6 | 0.53 | 1 |
| *Festuca rubra* L. ssp. *rubra* | . | . | . | . | . | . | . | . | 30 | . | . | . | . | 9 | 0.53 | 1 |
| *Bellardiochloa violacea* (Bellardi) Chiov. | . | . | . | . | . | . | . | . | 30 | . | . | . | . | 9 | 0.53 | 1 |
| *Stachys germanica* L. ssp. *germanica* | . | . | . | . | . | . | . | . | 30 | . | . | . | . | 9 | 0.53 | 1 |
| *Centaurea triumfetti* All. ssp. *adscendens* (Bartl.) Dostál | . | . | . | . | . | . | . | . | . | . | . | 28 | . | 12 | 0.51 | 1 |
| **Other taxa** | | | | | | | | | | | | | | | | |
| *Globularia cordifolia* L. | . | . | 100 | . | . | . | . | 33 | . | 20 | 11 | 20 | 100 | 3 | 0.48 | 6 |
| *Teucrium montanum* L. | . | . | . | . | 56 | . | . | 33 | . | 20 | 37 | 48 | 100 | 13 | 0.45 | 6 |
| *Edraianthus graminifolius* (L.) A. DC. | . | 100 | 92 | . | . | 80 | 100 | . | 80 | 20 | . | . | . | 2 | 0.44 | 6 |
| *Carex kitaibeliana* Degen ex Becherer | . | 20 | 67 | . | . | 100 | 100 | . | 100 | 40 | . | . | . | 6 | 0.44 | 6 |
| *Dianthus sylvestris* agg. | . | . | . | . | . | 30 | 67 | . | 30 | 20 | 63 | 8 | . | 11 | 0.42 | 6 |
| *Phyteuma orbiculare* L. | 77 | 40 | . | . | 50 | 10 | . | 22 | . | . | . | 28 | . | 1 | 0.4 | 6 |
| *Galium lucidum* All. | 69 | . | . | . | 56 | . | . | 11 | . | 20 | 26 | 76 | . | 12 | 0.33 | 6 |
| *Asperula cynanchica* L. | . | . | 8 | . | . | 40 | . | 44 | . | 20 | 5 | 20 | . | 6 | 0.31 | 6 |
| *Carex humilis* Leysser | . | . | . | . | . | 20 | . | 56 | . | 20 | 74 | 88 | 100 | 13 | 0.3 | 6 |
| *Trinia glauca* agg. | . | . | . | . | . | 30 | 33 | 33 | . | . | 11 | 28 | . | 4 | 0.43 | 5 |
| *Anthyllis montana* L. ssp. *jacquinii* (A. Kerner) Hayek | . | . | . | . | . | . | . | 11 | . | 20 | 11 | 56 | 100 | 13 | 0.42 | 5 |
| *Saxifraga paniculata* Miller | . | 40 | 67 | . | . | 40 | . | . | 70 | 60 | . | . | . | 9 | 0.4 | 5 |
| *Poa alpina* L. | . | 40 | 33 | . | . | 30 | . | . | 50 | 20 | . | . | . | 9 | 0.36 | 5 |
| *Gentiana verna* agg. | . | . | . | . | . | 20 | 67 | 11 | . | . | 5 | 40 | . | 7 | 0.34 | 5 |
| *Inula ensifolia* L. | . | . | . | . | 44 | . | . | 33 | . | . | 37 | 40 | 75 | 13 | 0.33 | 5 |
| *Genista sylvestris* Scop. | . | . | . | . | 44 | . | . | 11 | . | . | 42 | 60 | 75 | 13 | 0.31 | 5 |
| *Acinos alpinus* (L.) Moench | . | . | 25 | . | . | . | . | . | 10 | 20 | 5 | . | . | 3 | 0.49 | 4 |
| *Allium ericetorum* Thore | 92 | . | . | . | 19 | . | . | . | 50 | . | 68 | . | . | 1 | 0.48 | 4 |
| *Genista sericea* Wulfen | . | . | . | . | . | . | . | 56 | . | . | 84 | 60 | 25 | 11 | 0.44 | 4 |
| *Centaurea rupestris* L. | . | . | . | . | 44 | . | . | . | . | . | 37 | 72 | 75 | 12 | 0.39 | 4 |
| *Koeleria splendens* C. Presl | . | . | . | . | . | . | . | . | 20 | 20 | . | 24 | 50 | 13 | 0.39 | 4 |
| *Plantago holosteum* Scop. | . | . | . | . | 19 | . | . | . | . | . | 11 | 44 | 25 | 12 | 0.38 | 4 |
| *Leontodon crispus* Vill. ssp. *crispus* | . | . | 50 | . | . | . | . | . | . | 20 | . | 16 | 50 | 13 | 0.37 | 4 |
| *Carlina acaulis* ssp. *simplex* (Waldst. & Kit.) Nyman | 8 | . | . | . | . | . | . | 22 | . | 20 | . | 32 | . | 5 | 0.32 | 4 |
| *Hieracium villosum* Jacq. | . | . | 17 | . | . | 30 | . | 11 | . | 20 | . | . | . | 6 | 0.32 | 4 |
| *Polygala nicaeensis* Risso ex Koch | . | . | . | . | 13 | . | . | 33 | . | . | . | 36 | 50 | 13 | 0.31 | 4 |
| *Carex caryophyllea* Latourr. | . | . | . | . | . | 30 | . | 22 | 10 | . | . | 8 | . | 6 | 0.3 | 4 |
| *Laserpitium siler* L. ssp. *siler* | 46 | . | 8 | . | 31 | . | . | . | . | . | . | 32 | . | 1 | 0.28 | 4 |
| *Teucrium chamaedrys* L. | . | . | 25 | . | 6 | . | . | 11 | . | . | . | 8 | . | 3 | 0.27 | 4 |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | A | B | C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Biscutella laevigata* L. | 38 | . | . | . | . | 40 | . | 33 | . | . | . | 4 | . | 6 | 0.27 | 4 |
| *Anthericum ramosum* L. | . | . | . | . | 6 | . | . | 33 | . | . | 42 | 40 | . | 11 | 0.27 | 4 |
| *Hippocrepis comosa* L. | . | . | . | . | 13 | 10 | . | 33 | . | . | . | 32 | . | 12 | 0.27 | 4 |
| *Gymnadenia conopsea* (L.) R. Br. | . | . | 25 | . | 25 | . | . | . | . | . | 5 | 40 | . | 12 | 0.26 | 4 |
| *Asplenium ruta-muraria* L. ssp. *ruta-muraria* | 23 | 20 | 25 | . | . | . | . | . | . | . | 5 | . | . | 1 | 0.25 | 4 |
| *Trifolium montanum* L. | . | . | 42 | . | 38 | . | . | 11 | . | . | . | 28 | . | 3 | 0.24 | 4 |
| *Sanguisorba minor* Scop. ssp. *muricata* Briq. | . | . | . | . | . | . | . | 22 | . | . | 26 | 36 | 25 | 12 | 0.23 | 4 |
| *Eryngium amethystinum* L. | . | . | . | . | . | . | . | . | . | . | 11 | 40 | 50 | 12 | 0.48 | 3 |
| *Thalictrum minus* L. ssp. *minus* | . | . | . | . | . | . | . | 33 | . | . | 5 | 52 | . | 12 | 0.47 | 3 |
| *Pinus mugo* Turra | 15 | 40 | . | . | . | . | . | 11 | . | . | . | . | . | 2 | 0.46 | 3 |
| *Anthyllis vulneraria* L. ssp. *alpestris* Ascherson & Graebner | . | . | . | . | . | 60 | . | 22 | 70 | . | . | . | . | 4 | 0.46 | 3 |
| *Inula hirta* L. | . | . | . | . | 88 | . | . | 67 | . | . | . | 56 | . | 5 | 0.46 | 3 |
| *Crepis chondrilloides* Jacq. | . | . | . | . | . | . | . | . | . | . | 11 | 28 | 50 | 13 | 0.43 | 3 |
| *Gentiana utriculosa* L. | . | . | . | . | . | 40 | . | . | 10 | . | . | 12 | . | 6 | 0.42 | 3 |
| *Gentiana lutea* L. ssp. *symphyandra* (Murb.) Hayek | 62 | . | . | . | . | . | . | 11 | . | . | . | 24 | . | 5 | 0.41 | 3 |
| *Thymus longicaulis* C. Presl | . | . | . | . | . | . | . | . | . | . | 11 | 4 | 25 | 13 | 0.41 | 3 |
| *Erysimum sylvestre* (Crantz) Scop. ssp. *sylvestre* | . | . | 17 | . | . | . | . | . | . | . | 11 | 4 | . | 3 | 0.4 | 3 |
| *Trifolium alpestre* L. | . | . | 42 | . | . | 30 | . | . | 50 | . | . | . | . | 3 | 0.39 | 3 |
| *Thesium divaricatum* Jan ex Mert. & Koch | . | . | . | . | . | . | . | . | . | . | 5 | 44 | 25 | 12 | 0.38 | 3 |
| *Pimpinella saxifraga* (L.) Loret & Barrandon | . | . | . | . | . | 30 | 33 | 33 | . | . | . | . | . | 8 | 0.36 | 3 |
| *Scorzonera austriaca* Willd. | . | . | . | . | 31 | . | . | . | . | . | 42 | 60 | . | 12 | 0.36 | 3 |
| *Senecio doronicum* (L.) L. ssp. *doronicum* | . | . | . | . | . | . | . | 22 | 50 | . | . | 44 | . | 12 | 0.35 | 3 |
| *Euphorbia cyparissias* L. | . | . | . | . | 31 | 30 | . | . | . | . | . | 8 | . | 5 | 0.3 | 3 |
| *Filipendula vulgaris* Moench | . | . | . | . | 38 | . | . | . | . | . | . | 28 | 25 | 5 | 0.29 | 3 |
| *Asplenium trichomanes* L. ssp. *trichomanes* | . | 20 | 8 | . | . | . | . | . | 20 | . | . | . | . | 9 | 0.29 | 3 |
| *Rhinanthus aristatus* Celak. | . | . | . | . | 6 | . | . | 11 | . | 20 | . | . | . | 10 | 0.29 | 3 |
| *Potentilla australis* Krasan | . | . | . | . | . | . | . | . | . | . | 11 | 36 | 25 | 5 | 0.28 | 3 |
| *Amelanchier ovalis* Medicus | 31 | . | . | . | . | . | . | 22 | . | . | 16 | . | . | 1 | 0.26 | 3 |
| *Buphthalmum salicifolium* L. | 23 | . | . | . | 6 | . | . | . | . | . | . | 12 | . | 1 | 0.25 | 3 |
| *Briza media* L. ssp. media | . | . | 17 | . | . | 20 | . | . | . | . | . | 4 | . | 6 | 0.25 | 3 |
| *Stachys recta* L. ssp. *subcrenata* (Vis.) Briq. | . | . | . | . | . | 10 | . | . | . | . | 21 | 8 | . | 11 | 0.18 | 3 |
| *Saxifraga tridactylites* L. | . | . | 33 | . | . | . | . | . | . | 20 | . | . | . | 3 | 0.49 | 2 |
| *Arenaria serpyllifolia* L. ssp. *serpyllifolia* | . | . | 42 | . | . | . | . | . | 10 | . | . | . | . | 3 | 0.49 | 2 |
| *Sedum acre* L. | . | . | 25 | . | . | . | . | . | . | 20 | . | . | . | 3 | 0.49 | 2 |
| *Juniperus communis* L. | . | . | 33 | . | . | . | . | . | . | 20 | . | . | . | 3 | 0.49 | 2 |
| *Euphrasia dinarica* (G. Beck) Murb. | . | . | . | . | . | 40 | . | . | 20 | . | . | . | . | 6 | 0.49 | 2 |
| *Silene saxifraga* L. | . | . | 8 | . | . | . | 33 | . | . | . | . | . | . | 7 | 0.49 | 2 |
| *Dianthus integer* Vis. | . | . | . | . | . | . | 33 | 11 | . | . | . | . | . | 7 | 0.49 | 2 |
| *Armeria canescens* (Host) Boiss. ssp. *canescens* | . | . | . | . | . | . | . | . | 40 | . | . | . | 25 | 9 | 0.49 | 2 |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | A | B | C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Muscari botryoides* (L.) Miller | . | . | . | . | . | . | . | . | . | . | . | 36 | 50 | 5 | 0.47 | 2 |
| *Frangula rupestris* (Scop.) Schur | . | . | . | . | . | . | . | . | . | . | 32 | 32 | . | 12 | 0.47 | 2 |
| *Campanula scheuchzeri* Vill. | 31 | . | . | . | . | 10 | . | . | . | . | . | . | . | 1 | 0.46 | 2 |
| *Senecio papposus* (Reichenb.) Less. ssp. *papposus* | . | . | . | . | . | 30 | . | . | . | 20 | . | . | . | 6 | 0.46 | 2 |
| *Luzula campestris* (L.) DC. | . | . | . | . | . | 30 | 33 | . | . | . | . | . | . | 6 | 0.46 | 2 |
| *Scabiosa columbaria* L. ssp. *portae* (A. Kerner ex Huter) Hayek | . | . | . | . | . | . | 33 | . | 30 | . | . | . | . | 9 | 0.46 | 2 |
| *Polygala alpestris* Reichenb. ssp. *croatica* (Chodat) Hayek | . | . | . | . | . | 30 | . | . | 30 | . | . | . | . | 5 | 0.44 | 2 |
| *Linum narbonense* L. | . | . | . | . | 56 | . | . | . | . | . | . | 32 | . | 5 | 0.44 | 2 |
| *Asperula aristata* L. ssp. *scabra* (J. & C. Presl) Nyman | . | . | 8 | . | . | . | 33 | . | . | . | . | . | . | 7 | 0.44 | 2 |
| *Ruta graveolens* L. | . | . | . | . | . | . | . | . | . | . | 42 | 16 | . | 11 | 0.44 | 2 |
| *Seseli elatum* ssp. *gouanii* (Koch) P.W. Ball | . | . | . | . | . | . | . | . | . | . | 53 | 24 | . | 11 | 0.43 | 2 |
| *Cytisus pseudoprocumbens* Markgraf | . | . | . | . | . | . | . | . | . | . | 11 | 20 | . | 12 | 0.43 | 2 |
| *Thymus striatus* Vahl | . | . | . | . | . | . | . | 11 | . | . | . | . | 25 | 13 | 0.41 | 2 |
| *Scabiosa columbaria* L. ssp. *columbaria* | . | . | 17 | . | . | 30 | . | . | . | . | . | . | . | 6 | 0.4 | 2 |
| *Cotoneaster nebrodensis* (Guss.) C. Koch | 15 | . | . | . | . | 30 | . | . | . | . | . | . | . | 6 | 0.4 | 2 |
| *Scorzonera villosa* Scop. | . | . | . | . | . | . | . | . | . | . | 5 | 16 | . | 12 | 0.39 | 2 |
| *Peltaria alliacea* Jacq. | 23 | . | . | . | 6 | . | . | . | . | . | . | . | . | 1 | 0.38 | 2 |
| *Valeriana montana* L. | 23 | . | 8 | . | . | . | . | . | . | . | . | . | . | 1 | 0.38 | 2 |
| *Anthyllis vulneraria* L. | . | . | . | . | . | . | . | 22 | . | 20 | . | . | . | 8 | 0.37 | 2 |
| *Satureja subspicata* ssp. *liburnica* Šilić | . | . | . | . | . | . | . | . | . | . | 21 | 64 | . | 12 | 0.37 | 2 |
| *Galium anisophyllon* Vill. | 31 | . | . | . | . | . | . | . | 30 | . | . | . | . | 1 | 0.36 | 2 |
| *Stachys recta* agg. | . | . | 25 | . | . | . | . | . | . | . | . | 8 | . | 3 | 0.35 | 2 |
| *Galium verum* L. ssp. *verum* | . | . | . | . | . | 20 | . | . | 10 | . | . | . | . | 6 | 0.35 | 2 |
| *Veronica austriaca* L. ssp. *austriaca* | . | . | . | . | . | 20 | . | . | 10 | . | . | . | . | 6 | 0.35 | 2 |
| *Gentianella crispata* (Vis.) J. Holub | . | . | . | . | . | 20 | . | . | 10 | . | . | . | . | 6 | 0.35 | 2 |
| *Brachypodium pinnatum* (L.) Beauv. ssp. *pinnatum* | . | . | 8 | . | . | 20 | . | . | . | . | . | . | . | 6 | 0.35 | 2 |
| *Primula veris* L. ssp. *columnae* (Ten.) Lüdi | . | . | . | . | . | 20 | . | 11 | . | . | . | . | . | 6 | 0.35 | 2 |
| *Arabis scopoliana* Boiss. | . | . | . | . | . | 20 | . | 11 | . | . | . | . | . | 6 | 0.35 | 2 |
| *Festuca amethystina* L. ssp. *kummeri* (G. Beck) Markgr.-Dannenb. | . | . | . | . | . | 10 | . | . | 20 | . | . | . | . | 9 | 0.35 | 2 |
| *Rhamnus alpinus* L. ssp. *fallax* (Boiss.) Maire & Petitmengin | . | . | 17 | . | . | . | . | . | . | 20 | . | . | . | 10 | 0.35 | 2 |
| *Poa badensis* Haenke ex Willd. | . | . | 8 | . | . | . | . | . | . | 20 | . | . | . | 10 | 0.35 | 2 |
| *Iris reichenbachii* Heuffel | . | . | . | . | . | . | . | . | 10 | 20 | . | . | . | 10 | 0.35 | 2 |
| *Mercurialis ovata* Sternb. & Hoppe | . | . | . | . | 25 | . | . | . | . | . | . | 8 | . | 5 | 0.34 | 2 |
| *Lilium carniolicum* Bernh. ex Koch | . | . | . | . | 25 | . | . | . | . | . | . | 8 | . | 5 | 0.34 | 2 |
| *Allium senescens* L. ssp. *montanum* (Fries) Holub | . | . | . | . | . | 10 | . | . | . | . | . | 20 | . | 12 | 0.34 | 2 |
| *Galium mollugo* L. | . | . | . | . | . | 20 | . | 22 | . | . | . | . | . | 8 | 0.32 | 2 |
| *Vicia incana* Gouan | . | . | 17 | . | . | . | . | . | . | 20 | . | . | . | 3 | 0.3 | 2 |
| *Euphorbia fragifera* Jan | . | . | . | . | . | . | . | . | . | . | 16 | 20 | . | 12 | 0.28 | 2 |
| *Viola hirta* L. | . | . | . | . | 19 | . | . | . | . | . | . | 8 | . | 5 | 0.27 | 2 |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | A | B | C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Hyssopus officinalis* L. ssp. *aristatus* (Godron) Briq. | . | . | . | . | . | . | . | . | . | . | 11 | 8 | . | 12 | 0.27 | 2 |
| *Veronica spicata* ssp. *barrelieri* (Schott ex Roemer & Schultes) Murb. | . | . | . | . | . | . | . | . | . | . | 5 | 8 | . | 12 | 0.27 | 2 |
| *Hypochoeris maculata* L. | . | . | . | . | 13 | . | . | . | . | . | . | 12 | . | 4 | 0.25 | 2 |
| *Campanula justiniana* Witasek | 8 | . | . | . | 13 | . | . | . | . | . | . | . | . | 5 | 0.24 | 2 |
| *Vincetoxicum hirundinaria* Medicus | . | . | 8 | . | . | . | . | . | . | . | . | 28 | . | 5 | 0.24 | 2 |
| *Plantago media* L. | . | . | 8 | . | . | . | . | . | . | . | . | 12 | . | 12 | 0.23 | 2 |
| *Sorbus aria* (L.) Crantz | . | . | 8 | . | . | . | . | 11 | . | . | . | . | . | 8 | 0.22 | 2 |
| *Chamaecytisus hirsutus* (L.) Link | . | . | . | . | . | . | . | 11 | . | . | . | 4 | . | 8 | 0.22 | 2 |
| *Linum catharticum* L. | . | . | . | . | 6 | 10 | . | . | . | . | . | . | . | 6 | 0.2 | 2 |
| *Iris pallida* ssp. *illyrica* (Tomm. ex Vis.) K. Richt. | . | . | . | . | . | . | . | . | . | . | 26 | 12 | . | 12 | 0.17 | 2 |
| *Anemone nemorosa* L. | 8 | . | . | . | 6 | . | . | . | . | . | . | . | . | 1 | 0.16 | 2 |
| *Artemisia alba* Turra | . | . | . | . | . | . | . | . | . | . | 32 | 8 | . | 11 | 0.16 | 2 |
| *Euphorbia verrucosa* L. | . | . | . | . | 6 | . | . | . | . | . | . | 8 | . | 12 | 0.16 | 2 |
| *Hypericum perforatum* L. | . | . | 8 | . | . | . | . | . | . | . | . | 8 | . | 12 | 0.16 | 2 |
| *Saxifraga crustata* Vest | . | . | . | . | . | . | . | . | . | . | 5 | 8 | . | 12 | 0.16 | 2 |
| *Thlaspi praecox* Wulfen | . | . | . | . | . | . | . | . | . | . | 11 | 4 | . | 11 | 0.11 | 2 |