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Chalk rocky grasslands in the arid Eastern European Plain

Kalkfelsrasen in der trockenen osteuropäischen Tiefebene

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Abstract

Chalk rocky grasslands of the arid Eastern European Plain are endangered and highly important for biodiversity protection. This study aimed to revise previous syntaxonomic concepts, compare chalk rocky grasslands with other calcareous rocky grasslands and provide a unified classification of chalk rocky grasslands. We extracted relevés from the European Vegetation Archive and added relevés from protologues and papers describing chalk rocky grasslands within the study area. We pre-selected an initial dataset of calcareous rocky grasslands, which we narrowed down to the class *Stipo pulcherrimae-Festucetalia pallentis*. These were further classified using a modified TWINSPAN algorithm. We classified them as *Anabasio cretaceae-Agropyrion desertori*, *Sileno fruticulosae-Nanophytion erinacei*, *Anthemido trotzkianae-Artemision salsoloides*, *Sileno supinae-Artemision hololeucae*, *Euphorbio cretophilae-Thymion cretacei* and transitional communities of the *Centaureo carbonatae-Koelerion talievii* alliances within two orders with validation of some syntaxa. The communities are clearly differentiated from each other along gradients of climate and edaphic properties. Differences to other European limestome communities are given. We provide the first unified European classification of continental chalk rocky grasslands, including Ukrainian, Russian and Kazakh communities.

Keywords: chalk rocky grasslands, vegetation, Eastern European Plain, Ukraine, Kazakhstan

Erweiterte deutsche Zusammenfassung am Ende des Artikels

1. Introduction

Chalk rocky grasslands dominated by specific endemic chamaephytes and hemicryptophytes with star-shaped and cobwebby pubescence occur in eastern Europe's chalk outcrops of river valleys. They occupy skeletal soils (rendzic, calcaric and calcic leptosols) and strongly depend on the high carbonate content of the chalk bedrock.

The vegetation of chalk outcrops has been studied since the late 19th century and has been the subject of numerous discussions, particularly regarding its classification, structure, and origin. Litvinov (1891, 1902) initially characterized chalk rocky grasslands. Later, Kozo-Polianskyi (1931) distinguished two components within it: the "hyssop flora" (*Hyssopus cretaceous*, *Artemisia hololeuca*, *A. salsoloides*), which has a relict character and is genetically related to the southern flora of the Central and Middle Asia, and the flora of

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“lower alpine” habitats, associated with northern Periglacial steppes (e.g. *Carex humilis*, *Androsace kozo-poljanskii*). Chalk rocky grasslands, unlike steppes dominated by hemicryptophytes with the high presence of graminoids, are characterized by a sparse cover (up to 60%) consisting mainly of chamaephytes, forming on skeletal soils without continuous dead litter. Taxonomically, many genera of *Thymus*, *Helianthemum*, *Artemisia*, *Hyssopus*, *Scrophularia*, *Pimpinella*, and *Asperula*) are subdivided into sections, subsections, series, and numerous “minor” vicarious species endemic to specific regions, indicating the uniqueness of this flora and progressive evolution of speciation (Lavrenko 1961). This distinctiveness from steppe vegetation was reflected in dominant classifications, with this vegetation being treated as thyme communities (Lavrenko 1961) or tomilliaries (Didukh 1981, 1989), analogues of Balkan phrygana.

A classification of the chalk rocky steppe vegetation of the Central Russian Upland (Ukraine and part of Russia) was first provided by Didukh (1989), who described a new order of *Thymo cretacei-Hyssopetalia cretacei* and lower syntaxa within the *Festuco-Brometea* class. Romashchenko et al. (1996) described chalk rocky vegetation within a new class of *Helianthemo-Thymetea* that was not floristically similar to pure steppe vegetation, in which the *Thymo cretacei-Hyssopetalia cretacei* order, *Artemisio hololeucae-Hyssopion cretacei*, *Euphorbio cretophilae-Thymion cretacei* and *Centaureo carbonatae-Koelerion talievii* alliances were considered. Further studies of chalk rocky vegetation in Ukraine and Russia have been analyzed in detail by Didukh et al. (2018); however, the similarity of chalk and limestone rocky grasslands led to misinterpretation in Moldova (Rushchuk et al. 2005, Pînzaru 2006).

Chalk rocky vegetation has also been described within *Anabasietea cretaceae* (Golovanov et al. 2021) east of the Volga River in the steppe region that transforms into a semi-desert and desert region in the south, which has specific desert-steppe, North Turanian steppe species (Darbaieva 2003, Riabinina & Lukianova 2005, Saksonov et al. 2019, Golovanov et al. 2021).

Generally, Mucina et al. (2016) consider these communities within the zonal steppe vegetation of the *Festuco-Brometea* class, which spreads along the temperate belt and varies from Mediterranean wet to Asian aridic conditions.

However, the absence of *Festuco-Brometea* diagnostic species causes a heated discussion about their modern syntaxonomy. The *Centaureo carbonatae-Koelerion talievii* alliance has been considered within the *Festucetalia valesiacae* or *Stipo pulcherrimae-Festucetalia pallentis* orders due to the floristic and ecological similarities of these communities with rocky grasslands (Mucina et al. 2016, Didukh et al. 2021).

Chalk rocky grasslands are currently endangered and highly important for biodiversity protection. The main threats are afforestation, terracing of the slopes and the mining of chalk and marl (Kuzemko 2022). Since the Russian aggression in 2014, new threats have arisen that influence the endangered chalk rocky grasslands: direct vanishing of the vegetation cover due to intensive military activities, abandoned agricultural lands near the slopes of chalk outcrops and proliferation of invasive species. Nevertheless, in the Bern Convention, they are of conservation importance in Europe as E1.13 Continental dry, rocky steppe grasslands and dwarf scrub on chalk outcrops (Schaminée et al. 2016).

The main goal of the current study was to revise the classification of chalk rocky vegetation within the Eastern European Plain based on a large international dataset, and to complete knowledge of its syntaxonomy, ecology and distribution. To achieve this goal, we aimed to (1) revise the syntaxonomy of chalk rocky vegetation within the Eastern European

Plain and compare it with other types of calcareous rocky grasslands; (2) analyse the distribution of chalk rocky grasslands within the study area; (3) characterise the main environmental factors that cause the differentiation of chalk rocky grasslands.

2. Study area

We considered rocky grasslands on chalk outcrops within the aridic zone of the Eastern European Plain (Fig. 1). Specifically, we focused on two distinct regions: (1) the Central Russian Upland, and (2) the Sub-Ural Upland across a climatic gradient that significantly impacts the distribution and composition of vegetation types within the study area in which chalk outcrops occur.

The Central Russian Upland occupies eastern Ukraine and southwestern Russian Federation, extending from northwest to southeast, from the right bank of the Oka to the Donets River, with an elevation of 230–250 m a.s.l. (Anon 2007). The Central Russian Upland is built of Precambrian deposits of the crystalline Voronezh Massif covered by layers of sedimentary deposits of the Devonian, Jurassic, Cretaceous and Paleogene periods (Anon 2007). The Central Russian Upland has a sub-continental (subaridic) climate, characterised by large temperature amplitudes between winter and summer. It generally has 450–500 mm annual precipitation, with an average temperature of around -4–6 °C in January and +21–24 °C in July, with essential temperature amplitudes (27–30 °C), Gorchinskyi continentality coefficient (Ig = 42–46), de Martonne coefficient of aridity-humidity (Idm = 28,5–25), with a wetter climate in the western parts of the region and a drier climate in the east (Karger et al. 2017, Didukh 2023).

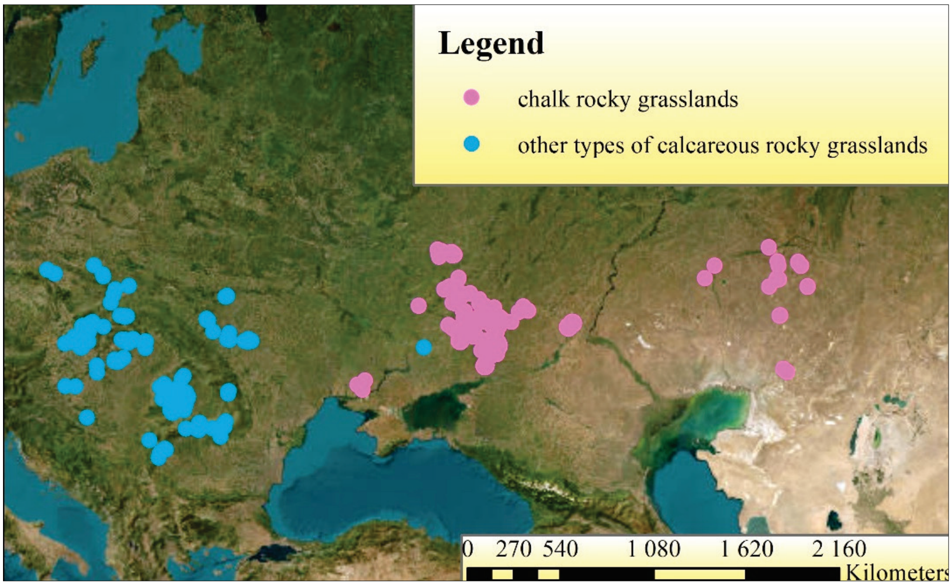

Fig. 1. Map of the chalk rocky grasslands compared with other types of calcareous rocky grasslands distribution.

Abb. 1. Karte der untersuchten Kalkfelsrasen im Vergleich zu anderen Typen von Kalkfelsrasen.

The Sub-Ural Upland is a geological and geographical region occupied by the Aktobe region in Kazakhstan, with a northwestern part in the West Kazakhstan Region and a small northern part in the Orenburg region (Russian Federation) with an elevation of 100–450 m a.s.l. (Anon. 2010). The Sub-Ural Upland predominantly comprises ancient crystalline rocks, including granite and gneiss, formed during the Precambrian period. It also contains upper layers of sedimentary bedrock, such as limestone, chalk and sandstone, deposited during later geological periods. The climate in the Sub-Ural Upland region varies depending on the location and elevation. Generally, it experiences a subcontinental climate with moderate annual precipitation, which typically ranges from 250 to 400 mm, with slightly higher amounts in the western parts of the upland, with an average temperature of around -9–13 °C in January and +22–25 °C in July, with essential temperature amplitudes (30–36 °C), Gorchinskyi continentality coefficient (Ig = 46–60), de Martonne coefficient of aridity-humidity (Idm = 25–20) (Karger et al. 2017, Didukh 2023).

3. Materials and methods

3.1 Vegetation data for broad-scale comparison

To revise the high-level syntaxonomical units of chalk rocky vegetation, we digitised data from the literature or extracted it from EVA and used it for comparison with data from the study area and adjacent territories.

We selected the data from the literature with original diagnoses of the *Anabasietea cretaceae* class Golovanov et al. 2021 (146 relevés), the "*Helianthemo-Thymetea* class Romashchenko et al. 1996" (225 relevés), the "*Thymo cretacei-Hyssopetalia cretacei* order Didukh 1989" (90 releves) and subordinate syntaxa (181 relevés) (Sereda 2008, 2009, Demina 2011, Poluyanov & Averinova 2012, Averinova 2014, Koroliuk et al. 2021).

In the EVA database (Chytrý et al. 2016), we also selected all relevés of calcareous rocky grasslands from Poland (87 relevés), Slovakia (250 relevés), Hungary (751 relevés), Romania (357 relevés), Ukraine and Moldova (580 relevés) assigned to the *Stipo pulcherrimae-Festucetalia pallentis* order Pop 1968 or subordinate syntaxa, by the initial authors or custodians of the databases. Additionally, we created a database of the Central Russian Upland (504 relevés) and added it to the general dataset.

We unified the taxonomy of vascular plants according to Euro+Med Plantbase (Euro+Med 2006+) and, in addition, Cherepanov's checklist (1995), bryophytes according to Hodgetts et al. (2020), and lichens according to the Index Fungorum (2021). We combined them into aggregates (Supplement E1), removed bryophytes and lichens because they were not recorded in some relevés, and returned them to the final synoptic table (Supplement E2).

3.2 Expert system processing

From the initial dataset of 3171 relevés, we selected relevés assigned as EUNIS habitats R1C, R15, R16 and R based on the EUNIS-ESy expert system (Chytrý et al. 2020). Afterwards, we checked these relevés by the expert system of Willner et al. (2017) aand extracted data assigned to the *Stipo pulcherrimae-Festucetalia pallentis* order. Other relevés, such as other EUNIS habitat codes and *Festuco-Brometea* orders, were removed from the analysis. After expert processing, we got a dataset of 1643 relevés of the calcareous vegetation.

3.3 TWINSPAN classification

In our analysis, we applied a modified TWINSPAN algorithm (Hill 1979, Roleček et al. 2009), utilising three pseudospecies cut levels of 0%, 5% and 25% cover. The minimum group size for the division was set at five relevés, and Whittaker's beta coefficient served as a metric for internal cluster heterogeneity. We assessed the optimal number of clusters using OptimClass 1 (Tichý et al. 2010) on the first stage of the analysis.

On reviewing the classification results, we employed non-modified TWINSPAN (Hill 1979) to classify three clusters separately, in view of their ecological and floristic heterogeneity. The same pseudospecies cut levels (0%, 5% and 25% cover) were used, with a minimum group size for division set at ten relevés and two division levels.

Diagnostic species for each cluster were identified based on the phi-coefficient of association and applied to virtually standardised cluster sizes (Chytrý et al. 2002, Tichý & Chytrý 2006). A fidelity threshold of *phi* = 0.30 was used, together with Fisher's exact test ($p < 0.05$).

3.4 Ecological indicators and distribution of the communities

We used EIVE 1.0 scales (Dengler et al. 2023) to find environmental differences between main orders of calcareous rocky grasslands in the broad-scale comparison context.

In addition, we used Didukh's scales to explore environmental differences in chalk rocky grasslands within the study area precisely. The phytoindication scales of Didukh (2011) reflect amplitude indices of the species characterised by the following dimensions: ecological indicator of soil humidity (Hd – 23 grades), ecological indicator of variability of damping (fH – 11 grades), ecological indicator of soil acidity (Rc – 15 grades), ecological indicator of total salt regime (Sl – 19 grades), ecological indicator of carbonate content (Ca – 13 grades), ecological indicator of nitrogen content (Nt –11 grades), ecological indicator of soil aeration (Ae – 15 grades), ecological indicator of thermoregime (Tm – 17 grades), ecological indicator of humidity of microclimate (Om – 23 grades), ecological indicator of continentality (Kn – 17 grades), ecological indicator of cryoregime (Cr – 15 grades) and ecological indicator of light in the community (Lc – 9 grades).

For each relevé, we calculated non-weighted means of species' values for the environmental parameters and fitted them to the Detrended Correspondence Analysis (DCA) ordination plot using *envfit* function of the *vegan* R package. DCA was also calculated using *vegan*, with default parameters. We transformed species abundance data from the seven-grade Braun-Blanquet cover-abundance scale to percentage covers as follows: r = <1%, + = <2%, 1 =< 3%, 2 = 13%, 3 = 38%, 4 = 68%, 5 = 88%. The obtained values were then log-transformed as $\log(x + 1)$ to diminish distribution skewness (Borcard et al. 2018, Tichý et al. 2020).

Depending on anatomical and morphological features, physiological and biological properties, growth processes, plant development, preservation and transmission of genetic information, three ecological strategies were distinguished: CRS, which reflects assimilation, accumulation and transfer of resources, and energy. To define the strategies of species on the phytosociological level, we constructed a Grime's triangle using Didukh's methodology (Supplement E3).

Based on the predominance of the species strategy types in the communities, we considered three types of habitats: SPE (successive ecosystems), C – concurrent strategy PSE (persistent stable ecosystems), S – stress-tolerance strategy and FLE (fluctuation labile ecosystems), R – ruderal strategy (Didukh 2023). This approach makes it possible to evaluate the ecological strategy from the standpoint of functioning, specifics of development, dynamics and stability of ecosystems, in particular conditions of existence, which assimilate, accumulate and transfer resources and energy, and preserve and ensure the spread of genetic material (Didukh 2023).

In addition, we classified all the vascular plants into one of the Raunkiaer plant life forms: therophytes, geophytes, hemicryptophytes, chamaephytes and phanerophytes (Raunkiaer 1934). The data are available in Supplements E2.

3.5 Applications and Software

The results were visualized using vegan version 2.6-4 (Oksanen 2022) and ggplot2 (Wickham 2016) packages in R (R Core Team 2021). The TWINSPAN classification was done with JUICE version 7.1 (Tichý 2002). Maps were created using ArcGIS 10.8.2. We used the following sources as the basemaps: National Geographic World Map, World Imagery, Biomes and Ecoregions 2017 (https://services.arcgis.com).

4. Results and Discussion

4.1 Cluster results of the initial vegetation dataset

We obtained 8 clusters after the suggestion of Optimclass 1 (Tichý et al. 2010) using the modified TWINSPAN algorithm (Roleček et al. 2009) in the first stage of the analysis. In the second stage of the analysis, we classified the first, second and last clusters separately due to the floristic heterogeneity of their constructions using the original TWINSPAN algorithm (Hill 1979) and obtained thirteen clusters (Fig. 2). The first six clusters (also Table 1) that contained chalk rocky grasslands (482 relevés) are described in detail below. The 7–13 clusters (1161 relevés) corresponding to the order *Stipo pulcherrimae-Festucetalia pallentis* that is not in the scope of our paper and used for comparison of life forms and ecological strategies are shown in supplementary materials (Supplement E4).

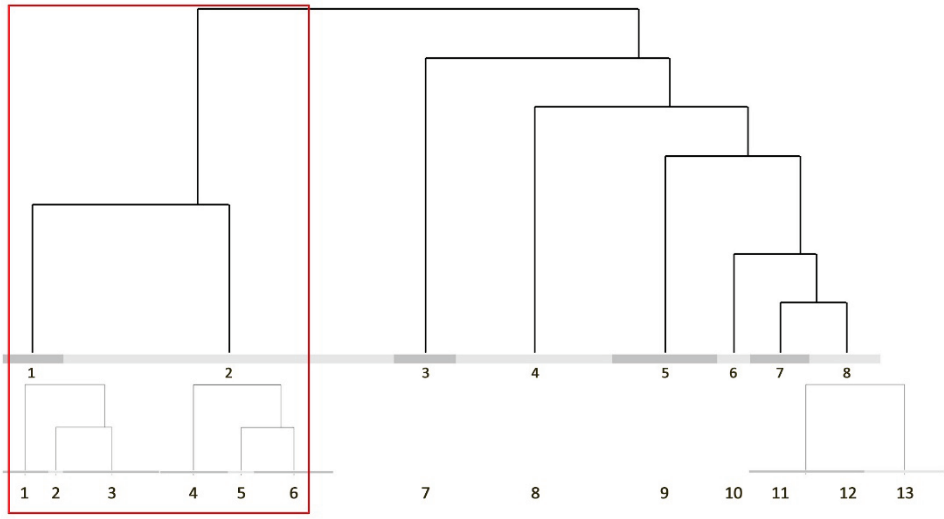

Fig. 2. Dendrogram of chalk rocky grasslands and other calcareous rocky grasslands based on the TWINSPAN algorithm. The upper dendrogram represents the first stage (eight clusters were obtained), and the lower diagrams represent the second stage (thirteen clusters were obtained). The chalk rocky grasslands are highlighted with the red frame. Non-highlighted clusters represent the other types of calcareous rocky grasslands.

Abb. 2. Dendrogramm der untersuchten und anderen Kalkfelsrasen basierend auf dem TWINSPAN-Algorithmus. Das obere Dendrogramm stellt die erste Stufe dar (es wurden acht Cluster erhalten), und die unteren Diagramme stellen die zweite Stufe dar (es wurden dreizehn Cluster erhalten). Die untersuchten Kalkfelsrasen sind mit einem roten Rahmen hervorgehoben, während die nicht hervorgehobenen Cluster die anderen Typen von Kalkfelsrasen dar stellen.

Table 1. The shortened synoptic table shows the percentage constancy of species in six clusters that represent chalk rocky grasslands. Species are ranked by decreasing fidelity measured with the *phi*-coefficient, which is not shown. Species with a *phi*-value greater than 0.30 are considered diagnostic and shaded in light grey; species with a *phi*-value greater than 0.50 are considered highly diagnostic and shaded in dark grey. Species highly diagnostic or diagnostic in one cluster are accepted as diagnostic for alliances; species highly diagnostic or diagnostic in more than one cluster are accepted as diagnostic for high-rank syntaxa. Species with a constancy of 15% or less in individual columns are not shown in the table unless they are diagnostic.

Tabelle 1. Die gekürzte synoptische Tabelle zeigt die prozentuale Stetigkeit der Arten in sechs Clustern von Kalkfelsrasen. Die Arten sind nach abnehmender Treue geordnet, gemessen mit dem nicht angegebenen *phi*-Koeffizienten. Arten mit einem *phi*-Wert größer als 0,30 gelten als diagnostisch und sind hellgrau schattiert; Arten mit einem *phi*-Wert größer als 0,50 gelten als hochdiagnostisch und sind dunkelgrau schattiert. Arten, die in einem Cluster hochdiagnostisch oder diagnostisch sind, werden als diagnostisch für Verbände akzeptiert; Arten, die in mehr als einem Cluster hochdiagnostisch oder diagnostisch sind, werden als diagnostisch für hochrangige Syntaxa akzeptiert. Arten mit einer Stetigkeit von 15 % oder weniger in einzelnen Spalten werden in der Tabelle nicht angezeigt, es sei denn, sie sind diagnostisch.

ID clusters	1	2	3	4	5	6
Number of relevés	35	11	73	243	92	28
All. *Anabasio cretaceae-Agropyrion desertori*						
Astragalus kustanaicus	63	.	.	.	.	.
Bassia prostrata	89	9	19	5	2	2
Sterigmostemum caspicum	69	9	7	.	.	.
Galatella tatarica	57	.	4	.	.	.
Agropyron cristatum aggr.	94	.	52	1	1	6
Krascheninnikovia ceratoides	63	.	7	5	3	1
Tulipa scythica	49	.	5	.	.	.
Lappula microcarpa	63	.	27	.	.	.
Allium tulipifolium	43	.	7	.	.	.
Tulipa biflora	37	.	1	.	.	.
Tulipa sylvestris	37	.	1	.	.	.
Tragopogon ruber	40	.	5	.	.	.
Poa bulbosa	40	.	4	1	.	5
Taraxacum sect. *Macrocornuta*	31	.	1	.	.	.
Isatis gymnocarpa	29	.	.	.	.	.
Asparagus inderiensis	34	.	7	.	.	.
Meniocus linifolius	37	.	1	.	.	1
Litwinowia tenuissima	23	.	.	.	.	.
Stipa sareptana	46	18	12	.	.	.
Caragana balchaschensis	23	.	1	.	.	.
Ferula caspica	23	.	3	.	.	.
Palimbia turgaica	23	.	3	.	.	.
Gagea bulbifera	17	.	.	.	.	.
Pseudosedum lievenii	17	.	.	.	.	.
Rochelia disperma subsp. *retorta*	17	.	.	.	.	.
Limonium meyeri	17	.	.	.	.	.
Allium lineare	17	.	.	.	.	.
Rindera tetraspis	31	18	.	.	.	.
Artemisia semiarida	31	18	3	.	.	.
Eriosynaphe longifolia	14	.	.	.	.	.
Astragalus temirensis	14	.	.	.	.	.
Tulipa suaveolens	14	.	.	.	.	.
Anabasis salsa	23	9	.	.	.	.
Filago arvensis	14	.	.	.	.	.
Klasea erucifolia	14	.	.	.	.	.

ID clusters	1	2	3	4	5	6
Number of relevés	35	11	73	243	92	28
Silene otites aggr.	14	.	.	.	.	1
Linaria incompleta	20	.	7	.	.	.
Artemisia lessingiana	29	.	21	.	.	.
Androsace maxima	17	.	5	.	.	.
Allium inderiense	11	.	.	.	.	.
Silene viscosa	11	.	.	.	.	.
Takhtajaniantha pusilla	11	.	.	.	.	.
Ixiolirion tataricum	11	.	.	.	.	.
Ornithogalum fischerianum	11	.	.	.	.	1
All. *Sileno fruticulosae-Nanophytion erinacei*						
Matthiola tatarica	.	100	.	.	.	.
Gypsophila diffusa	.	100	.	.	.	.
Onosma staminea	.	91	.	.	.	.
Nanophyton erinaceum	11	91	18	.	.	.
Atraphaxis spinosa	.	64	.	.	.	.
Artemisia terrae-albae	3	64	.	.	.	.
Atraphaxis replicata	3	64	.	.	.	.
Galium humifusum	.	64	.	1	.	3
Silene antri-jovis	.	55	4	.	.	.
Lepidium meyeri	.	73	25	4	.	.
Lomelosia isetensis	6	73	25	.	.	.
Anabasis cretacea	46	100	6	.	.	.
Astragalus medius	3	36	1	.	.	.
Astragalus stenoceras	.	27	.	.	.	.
Rhammatophyllum pachyrhizum	.	27	1	.	.	.
Limonium suffruticosum	3	27	.	.	.	.
Ephedra distachya	34	73	47	.	9	3
Convolvulus fruticulosus	.	18	.	.	.	.
All. *Anthemido trotzkianae-Artemision salsoloides*						
Archanthemis trotzkiana	6	.	90	.	.	.
Zygophyllum pinnatum	.	9	67	.	.	.
Atraphaxis decipiens	.	.	48	.	.	.
Matthiola fragrans	3	.	82	45	10	6
Astragalus tenuifolius	23	.	56	.	.	.
Hedysarum tscherkassovae	3	.	36	.	.	.
Jurinea kirghisorum	.	.	25	.	.	.
Gypsophila rupestris	.	.	21	.	.	.
Artemisia salsoloides	9	.	74	33	53	15
Hedysarum razoumovianum	3	.	18	.	.	.
Gypsophila altissima	.	.	12	.	.	.
Galium octonarium	9	.	27	9	1	5
Atraphaxis frutescens	.	.	14	2	.	.
All. *Sileno supinae-Artemision hololeucae*						
Hyssopus officinalis	.	.	.	81	8	10
Scrophularia cretacea	.	.	.	52	13	6
Artemisia hololeuca	.	.	.	48	4	12
Festuca cretacea	.	.	.	18	1	1
Asperula tephrocarpa	.	.	.	62	55	48
Plantago maritima subsp. *ciliata*	.	.	.	16	.	6
All. *Euphorbio cretophilae-Thymion cretacei*						
Euphorbia petrophila	.	.	.	7	84	5
Jurinea stoechadifolia	.	.	.	1	73	7
Helianthemum canum aggr.	.	.	.	2	28	2
Hedysarum grandiflorum	.	.	1	2	32	10

ID clusters	1	2	3	4	5	6
Number of relevés	35	11	73	243	92	28
Reseda lutea	.	.	1	23	55	38
Genista scythica	.	.	.	.	20	1
Linum tenuifolium	.	.	.	5	25	4
Onosma simplicissima	3	.	11	14	49	38
Leontodon crispus aggr.	.	.	.	.	16	5
Rhaponticoides taliewii	.	.	.	.	11	.
All. *Centaureo carbonatae-Koelerion talievii*						
Carex humilis	.	.	.	2	3	44
Stipa pennata	.	.	.	2	1	33
Festuca valesiaca aggr.	9	.	7	9	5	51
Viola ambigua	.	.	.	1	5	33
Polygala sibirica	.	.	.	6	1	33
Bromopsis riparia	.	.	.	2	8	35
Stipa capillata	3	.	3	4	15	44
Bupleurum falcatum	.	.	.	16	18	45
Securigera varia	.	.	.	4	9	31
Koeleria talievii	.	.	.	7	10	34
Euphorbia seguieriana	34	9	10	25	8	64
Campanula sibirica	.	.	.	5	35	44
Stachys recta	.	.	.	3	5	26
Salvia nutans	.	.	.	1	29	39
Achillea millefolium aggr.	.	.	.	.	.	16
Astragalus austriacus	.	.	1	1	1	20
Medicago falcata	3	.	1	5	7	29
Scabiosa ochroleuca	.	.	.	7	10	29
Vincetoxicum hirundinaria	.	.	.	2	21	31
Androsace villosa	.	.	.	5	.	19
Polygala cretacea	.	.	1	26	9	36
Ajuga chamaepitys	.	.	.	.	.	11
Jurinea mollis aggr.	.	.	.	5	5	20
Euphorbia nicaeensis	.	.	.	9	3	21
Helianthemum nummularium	.	.	.	.	2	13
Ord. *Anabasietalia cretaceae*						
Psathyrostachys juncea	49	.	38	1	.	.
Seseli glabratum	14	82	89	.	.	.
Ord. *Thymo cretacei-Hyssopetalia cretacei*						
Pimpinella tragium	.	.	4	86	83	58
Cephalaria uralensis	.	.	11	60	70	29
Teucrium polium	.	.	.	20	75	68
Thymus calcareus	.	.	.	70	87	83
Gypsophila oligosperma	.	.	.	57	71	66
Other taxa occurred in the communities						
Thalictrum minus	.	.	.	.	23	26
Astragalus albicaulis	.	.	.	23	13	32
Poa compressa	.	.	.	11	4	19
Salvia verticillata	.	.	.	3	11	18
Erysimum diffusum	6	.	3	3	15	23
Helichrysum arenarium	.	.	.	13	20	25
Linum flavum aggr.	.	.	.	37	47	40
Linum hirsutum	.	.	.	7	23	22
Silene supina	.	.	.	28	22	26
Psephellus marschallianus aggr.	34	.	36	5	34	34
Thesium ramosum	.	.	3	13	12	16
Stipa lessingiana	14	.	21	4	13	18

ID clusters	1	2	3	4	5	6
Number of relevés	35	11	73	243	92	28
Artemisia lerchiana	37	18	33	2	.	1
Brassica elongata	23	.	23	14	38	17
Odontarrhena tortuosa aggr.	6	.	33	2	38	9
Genista tinctoria aggr.	.	.	.	19	21	14
Odontites luteus	.	.	.	13	16	6
Echinops ritro	23	45	41	5	4	14
Crambe tataria aggr.	11	.	22	3	.	2
Camphorosma monspeliaca	11	.	15	.	.	.

Cluster 1

35 relevés (Table 1, Fig. 3, 4)

Diagnostic species: *Agropyron cristatum* aggr., *Allium inderiense*, *A. lineare*, *A. tulipifolium*, *Anabasis salsa*, *Androsace maxima*, *Artemisia lessingiana*, *A. semiarida*, *Asparagus inderiensis*, *Astragalus kustanaicus*, *A. temirensis*, *Bassia prostrata*, *Caragana balchaschensis*, *Eriosynaphe longifolia*, *Ferula caspica*, *Filago arvensis*, *Gagea bulbifera*, *Galatella tatarica*, *Isatis gymnocarpa*, *Ixiolirion tataricum*, *Klasea erucifolia*, *Krascheninnikovia ceratoides*, *Limonium meyeri*, *Linaria incompleta*, *Litwinowia tenuissima*, *Meniocus linifolius*, *Ornithogalum fischerianum*, *Palimbia turgaica*, *Poa bulbosa*, *Psathyrostachys juncea*, *Pseudosedum lievenii*, *Rindera tetraspis*, *Rochelia disperma* subsp. *retorta*, *Silene otites* aggr., *S. viscosa*, *Sterigmostemum caspicum*, *Stipa sareptana*, *Takhtajaniantha pusilla*, *Taraxacum* sect. *Macrocornuta*, *Tragopogon ruber*, *Tulipa biflora*, *T. scythica*, *T. suaveolens*, *T. sylvestris*.

Ecology and distribution: These communities occur at the feet of chalk hills, on alluvial fans of chalk bedrocks and chalk plateau peaks facing south, and south-western slopes with an inclination of 30–75º of the Sub-Ural Upland (Kazakhstan). They are apparently the latest stage of the chalk overgrowth and are transitional between *Festuco-Brometea* and *Anabasietalia cretaceae* order *nom. inv*. (Golovanov et al. 2021).

Cluster 2

11 relevés (Table 1, Fig. 3, 4)

Diagnostic species: *Anabasis cretacea*, *Artemisia terrae-albae*, *Astragalus medius*, *A. stenoceras*, *Atraphaxis replicata*, *A. spinosa*, *Convolvulus fruticulosus*, *Ephedra distachya*, *Galium humifusum*, *Gypsophila diffusa*, *Lepidium meyeri*, *Limonium suffruticosum*, *Lomelosia isetensis*, *Matthiola tatarica*, *Nanophyton erinaceum*, *Onosma staminea*, *Rhammatophyllum pachyrhizum*, *Seseli glabratum*, *Silene antri-jovis*.

Ecology and distribution: These communities occur on chalk outcrops on slopes facing south to north and northwest in northern deserts and desert steppes in the aridic conditions of the Sub-Ural Upland (Kazakhstan and partly Russian Federation). They occupy scree slopes with an inclination of 30–75° (Golovanov et al. 2021).

Cluster 3

73 relevés (Table 1, Fig. 3,4)

Diagnostic species: *Archanthemis trotzkiana*, *Artemisia salsoloides*, *Astragalus tenuifolius*, *Atraphaxis decipiens*, *A. frutescens*, *Galium octonarium*, *Gypsophila altissima*, *G. rupestris*, *Hedysarum razoumovianum*, *H. tscherkassovae*, *Jurinea kirghisorum*, *Matthiola fragrans*, *Psathyrostachys juncea*, *Seseli glabratum*, *Zygophyllum pinnatum*.

Ecology and distribution: These communities occur on chalk uplands with gravel substrates or eroded and loose chalk outcrops on slopes facing mainly to the north of the Sub-Ural and partly Obshchy Syrt Uplands (Kazakhstan). They occupy scree slopes with an inclination of 15–60° (Golovanov et al. 2021).

Cluster 4

243 relevés (Table 1, Fig. 3, 4)

Diagnostic species: *Artemisia hololeuca*, *Asperula tephrocarpa*, *Cephalaria uralensis*, *Festuca cretacea*, *Hyssopus officinalis*, *Pimpinella tragium*, *Plantago maritima* subsp. *ciliata*, *Scrophularia cretacea*.

Ecology and distribution: These communities occur on chalk outcrops at elevations of 70–140 m a.s.l. on scree slopes (15–65º) facing north to northwest on the right banks of river valleys. They occur on loose substrates caused by denudation and cover surface erosion. Relevés belonging to this cluster were recorded in the Central Russian Upland, Donetsk Ridge (Ukraine and Russian Federation). The layer of bryophytes and lichens is consisted of *Enchylium tenax*, *Geheebia fallax*, *Syntrichia ruralis*, *Weissia levieri*.

Cluster 5

92 relevés (Table 1, Fig. 3, 4)

Diagnostic species: *Cephalaria uralensis*, *Euphorbia petrophila*, *Genista scythica*, *Gypsophila oligosperma*, *Hedysarum grandiflorum*, *Helianthemum canum* aggr., *Jurinea stoechadifolia*, *Leontodon crispus* aggr., *Linum tenuifolium*, *Onosma simplicissima*, *Pimpinella tragium*, *Reseda lutea*, *Rhaponticoides taliewii*, *Teucrium polium*, *Thymus calcareus*.

Ecology and distribution: These communities occur on the lowest line of gentle chalk slopes (5-40º) facing south and southwest of river valleys. They indicate the final stage of overgrowing and transformation into pure grasslands. These communities occupy dense diluvium with carbonate and sulphate soil salinization and occur in the Central Russian Upland, Donetsk Ridge, and Eastern Don Ridge (Ukraine, Russian Federation).

Cluster 6

280 relevés (Table 1, Fig. 3, 4)

Diagnostic species: *Achillea millefolium* aggr., *Ajuga chamaepitys*, *Androsace villosa*, *Astragalus austriacus*, *Bromopsis riparia*, *Bupleurum falcatum*, *Campanula sibirica*, *Carex humilis*, *Euphorbia nicaeensis*, *E. seguieriana*, *Festuca valesiaca* aggr., *Gypsophila oligosperma*, *Helianthemum nummularium*, *Jurinea mollis* aggr., *Koeleria talievii*, *Medicago falcata*, *Polygala cretacea*, *P. sibirica*, *Salvia nutans*, *Scabiosa ochroleuca*, *Securigera varia*, *Stachys recta*, *Stipa capillata*, *S. pennata*, *Teucrium polium*, *Thymus calcareus*, *Vincetoxicum hirundinaria*, *Viola ambigua*.

Ecology and distribution: These communities occur on depths of chalk outcrops at elevations of 75–145 m a.s.l. on slopes facing north and northeast on which rendzic leptosols have accumulated. They occur in the Central Russian Upland, Donetsk Ridge (Ukraine and Russian Federation). The layer of bryophytes and lichens is consisted of *Barbula unguiculata*, *Ceratodon purpureus*, *Cladonia rei*, *Enchylium tenax*, *Homalothecium lutescens*, *Syntrichia ruralis*, *Trichostomum crispulum*, *Weissia longifolia*.

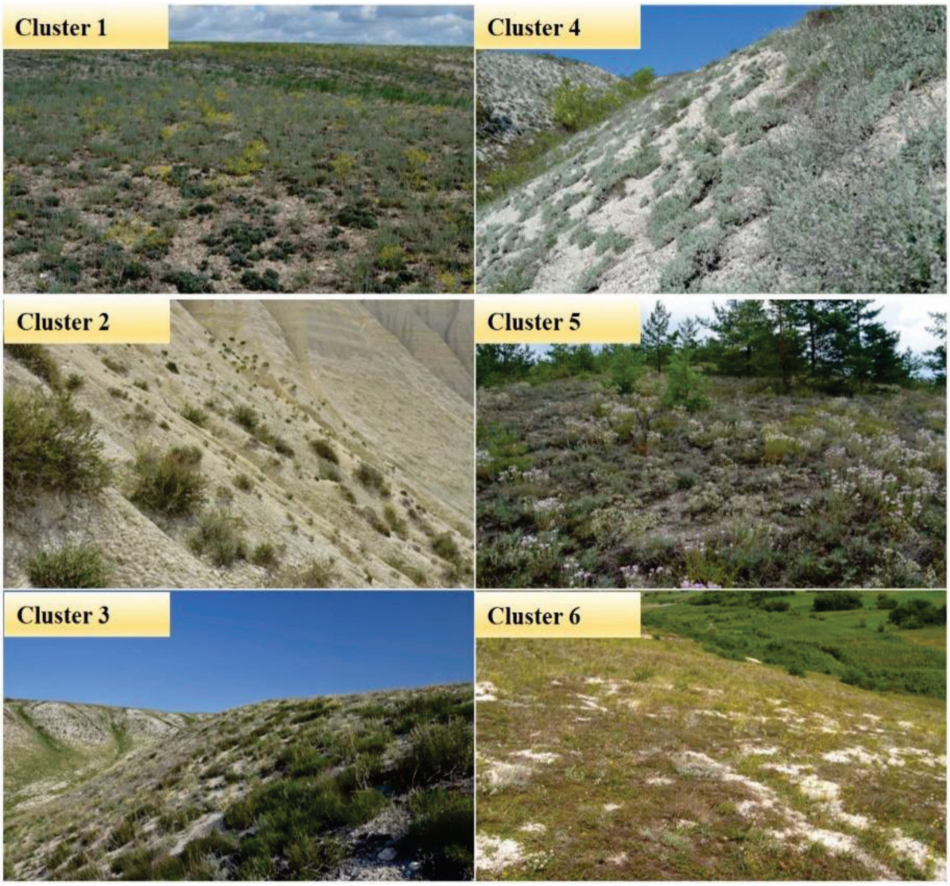

Fig. 3. Chalk rocky grasslands within the Eastern European Plain. Cluster 1 – *Anabasio cretaceae-Agropyrion desertori* (Troitsk Chalk Hills, adjacent territories of Kazakhstan, 2019); Cluster 2 – *Sileno fruticulosae-Nanophytion erinacei* (Aktolagai Ridge, Kazakhstan, 2019); Cluster 3 – *Anthemido trotzkianae-Artemision salsoloides* (Troitsk Chalk Hills, adjacent territories of Kazakhstan, 2019); Cluster 4 – *Sileno supinae-Artemision hololeucae* (Krasna valley, Svatove, Ukraine, 2014); Cluster 5 – *Euphorbio cretophilae-Thymion cretacei* ("Kreidova Flora" Nature Reserve, Ukraine, 2019); Cluster 6 – *Centaureo carbonatae-Koelerion talievii* (Krasna valley, Honcharivka, Ukraine, 2013) (Photos: cited from Golovanov et al. 2021 (1–3), O. Chusova (4–6)).

Abb. 3. Kalkfelsrasen in der osteuropäischen Tiefebene. Cluster 1 – *Anabasio cretaceae-Agropyrion desertori* (Troizker Kreidehügel, angrenzende Gebiete Kasachstans, 2019); Cluster 2 – *Sileno fruticulosae-Nanophytion erinacei* (Aktolagai-Rücken, Kasachstan, 2019); Cluster 3 – *Anthemido trotzkianae-Artemision salsoloides* (Troizker Kreidehügel, angrenzende Gebiete Kasachstans, 2019); Cluster 4 – *Sileno supinae-Artemision hololeucae* (Krasna-Tal, Svatove, Ukraine, 2014); Cluster 5 – *Euphorbio cretophilae-Thymion cretacei* (Naturschutzgebiet „Kreidova Flora", Ukraine, 2019); Cluster 6 – *Centaureo carbonatae-Koelerion talievii* (Krasna-Tal, Honcharivka, Ukraine, 2013) Fotos: zitiert nach Golovanov et al. 2021 (1–3), O. Chusova (4–6)).

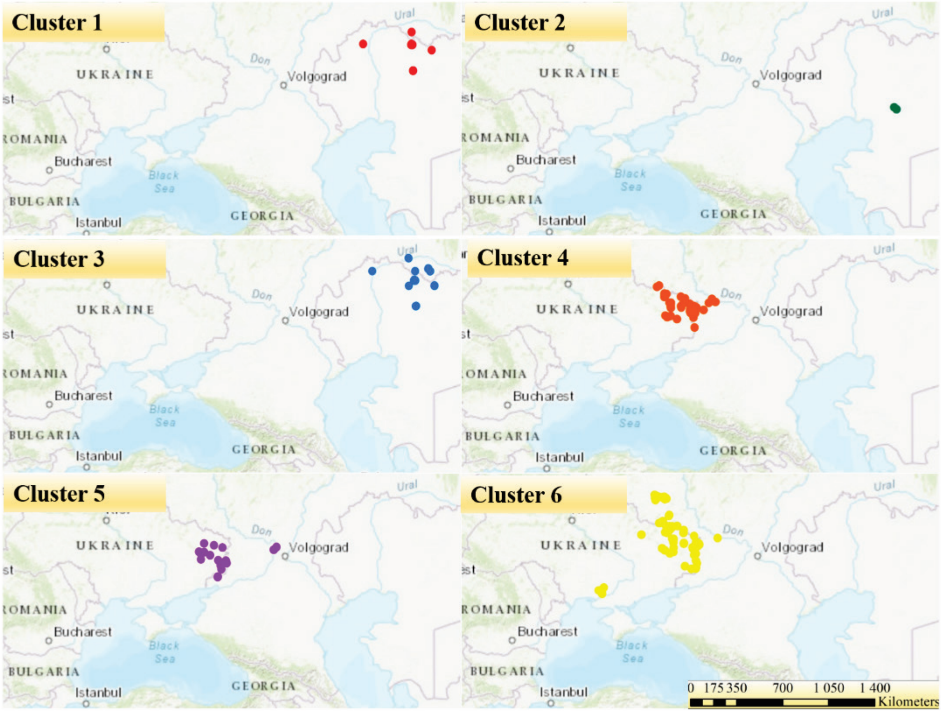

Fig. 4. Maps of the chalk rocky grasslands distribution (alliance level). Abbreviations are the same as in Figure 3.

Abb. 4. Verbeitungskarten der Kalkfelsrasen auf der Verbandsebene. Die Abkürzungen entsrepchen denen in Abbildung 3.

Proposed syntaxonomic scheme

??? Class: *Helianthemo-Thymetea* Romashchenko et al. 1996

Order: *Anabasietalia cretaceae* Golovanov et al. ex Vasheniak et al. 2024

Alliance: *Anabasio cretaceae-Agropyrion desertori* Golovanov et al. 2021

Alliance: *Sileno fruticulosae-Nanophytion erinacei* Golovanov et al. 2021

Alliance: *Anthemido trotzkianae-Artemision salsoloides* Golovanov et al. 2021

Order: *Thymo cretacei-Hyssopetalia cretaceae* Didukh ex Romashchenko et al. 1996

Alliance: *Sileno supinae-Artemision hololeucae* Didukh 1989 (*Artemisio hololeucae-Hyssopion cretacei* Romashchenko et al. 1996 nom. superfl.)

Alliance: *Euphorbio cretophilae-Thymion cretacei* Didukh ex Vasheniak et al. 2024

Transitional communities between *Helianthemo-Thymetea* and *Festuco-Brometea*

Alliance: *Centaureo carbonatae-Koelerion talievii* Romashchenko et al. 1996

4.2 Environmental differences within chalk rocky grasslands

Detrended correspondence analysis (DCA) shows the differentiation of chalk rocky grasslands (*Anabasietalia cretaceae*, *Thymo cretacei-Hyssopetalia cretaceae* orders) and other types of calcareous rocky grasslands (*Stipo pulcherrimae-Festucetalia pallentis* order) across the DCA2 axis where the vector of reaction lays within the DCA2 axis plane (Fig. 5). This differentiation is caused by variable calcareous bedrocks with high calcium ion content of chalks and lower in marls, dolomites and limestones, which affects the soil reaction.

Generally, a clear ecological distinction between chalk and other calcareous rocky grasslands can be observed; however, differentiation is also noticeable within the *Anabasietalia cretaceae and Thymo cretacei-Hyssopetalia cretaceae* group along the gradient of nitrogen, temperature and light. Therefore, we will focus more closely on the chalk rocky grasslands at the alliance level, using a broader range of ecological indicators based on Didukh's scales.

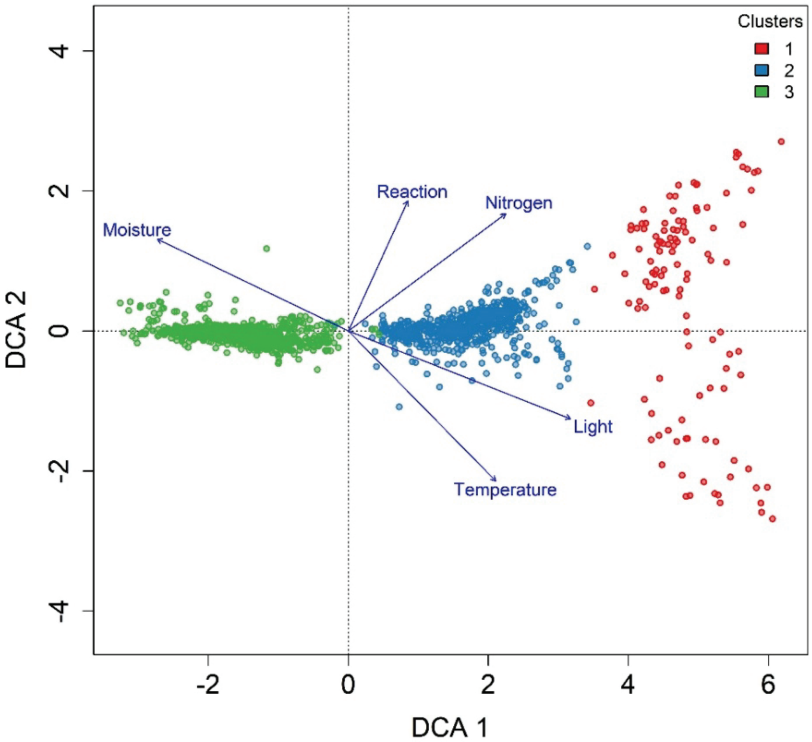

Fig. 5. DCA ordination of *Anabasietalia cretaceae* (1), *Thymo cretacei-Hyssopetalia cretaceae* (2), *Stipo pulcherrimae-Festucetalia pallentis* (3) based on EIVE 1.0 scales with passively projected mean indicator values.

Abb. 5. DCA-Ordination der *Anabasietalia cretaceae* (1), *Thymo cretacei-Hyssopetalia cretaceae* (2), *Stipo pulcherrimae-Festucetalia pallentis* (3) basierend auf EIVE 1.0-Skalen mit passiv projizierten mittleren Indikatorwerten.

According to Figure 6, chalk rocky grasslands differentiate across the DCA2 axis. The vectors of cryoregime, aeration, variation of damping and carbonate content indicators lie in the DCA1 axis plane. On the other hand, the vectors of nitrogen content and thermoregime lie in the DCA2 axis plane, where two groups (1–3 and 4–6) of chalk rocky grasslands are differentiated. Additionally, communities differ within the salt regime, continentality and light vectors, whereas communities of *Sileno fruticulosae-Nanophytion erinacei* occupy an extreme position of ecological values. This differentiation is caused by the increasing continentality, surface illumination, considerable evaporation and further salinisation of the communities in Kazakhstan compared with Ukraine and Russian Federation. All communities vary within the reaction indicator vector, where communities of *Sileno fruticulosae-Nanophytion erinacei* and *Anthemido trotzkianae-Artemision salsoloides* occupy the extreme position of the reaction indicator.

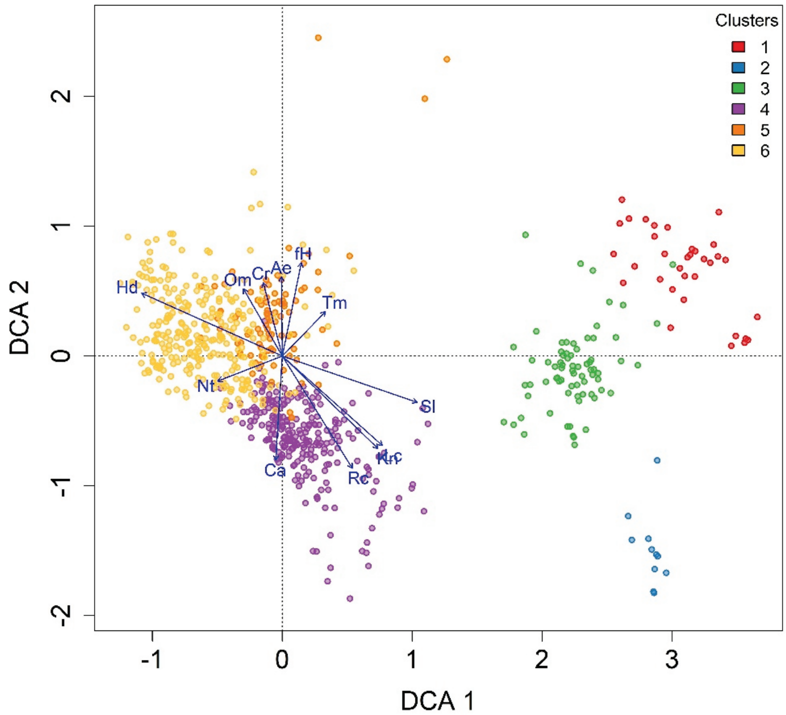

Fig. 6. DCA ordination of chalk rocky grasslands based on Didukh' scales with passively projected mean indicator values. **Abbreviations**: 1 – *Anabasio cretaceae-Agropyrion desertori*, 2 – *Sileno fruticulosae-Nanophytion erinacei*, 3 – *Anthemido trotzkianae-Artemision salsoloides*, 4 – *Sileno supinae-Artemision hololeucae*, 5 – *Euphorbio cretophilae-Thymion cretacei*, 6 – *Centaureo carbonatae-Koelerion talievii*. **Acronyms**: Hd – soil humidity, fH – variability of damping, Rc – soil acidity, Sl – total salt regime, Ca – carbonate content, Nt – nitrogen content, Ae – soil aeration, Tm – thermoregime, Om – humidity of microclimate, Kn – continentality, Cr – cryoregime, Lc – light in the community.

Abb. 6. DCA-Ordination von Kreidefelsrasen basierend auf Didukh-Skalen mit passiv projizierten mittleren Indikatorwerten. **Abkürzungen** der Verbände s.o. **Akronyme**: Hd – Bodenfeuchte, fH – Variabilität der Feuchtigkeit, Rc – Säuregehalt des Bodens, Sl – Gesamtsalzregime, Ca – Karbonatgehalt, Nt – Stickstoffgehalt, Ae – Bodenbelüftung, Tm – Thermoregime, Om – Feuchtigkeit des Mikroklimas, Kn – Kontinentalität, Cr – Kryoregime, Lc – Licht in der Gesellschaft.

To gain a better understanding of the structure and ecological characteristics of chalk rocky grasslands, which distinguish them from other types of grasslands, we carried out further analyses of life forms and ecological strategies to compare six syntaxa of chalk rocky grasslands with seven syntaxa of other types of calcareous rocky grasslands at the alliance level (see Supplement E4).

Life forms determine the structure, character of development, dynamics and resistance of coenoses to the influence of external factors; they, therefore, have significant diagnostic value. According to Figure 7, there is an apparent gap between chalk rocky grasslands and rocky grasslands of the *Stipo pulcherrimae-Festucetalia pallentis* order (Supplement E4). Communities belonging to the *Stipo pulcherrimae-Festucetalia pallentis* order have a significantly higher proportion of hemicryptophytes, the highest in the case of the *Seslerion rigidae* alliance (Fig. 7). In contrast, communities of the *Helianthemo-Thymetea* class have a much lower representation of hemicryptophytes but a much higher proportion of chamaephytes (Fig. 7), which is exceptionally high in the case of the alliances *Anthemido trotzkianae-Artemision salsoloides* and *Sileno fruticulosae-Nanophytion erinacei*. An equal proportion of hemicryptophytes and chamaephytes is characteristic of the *Anabasio cretaceae-Agropyrion desertori* and *Centaureo carbonatae-Koelerion talievii* alliances.

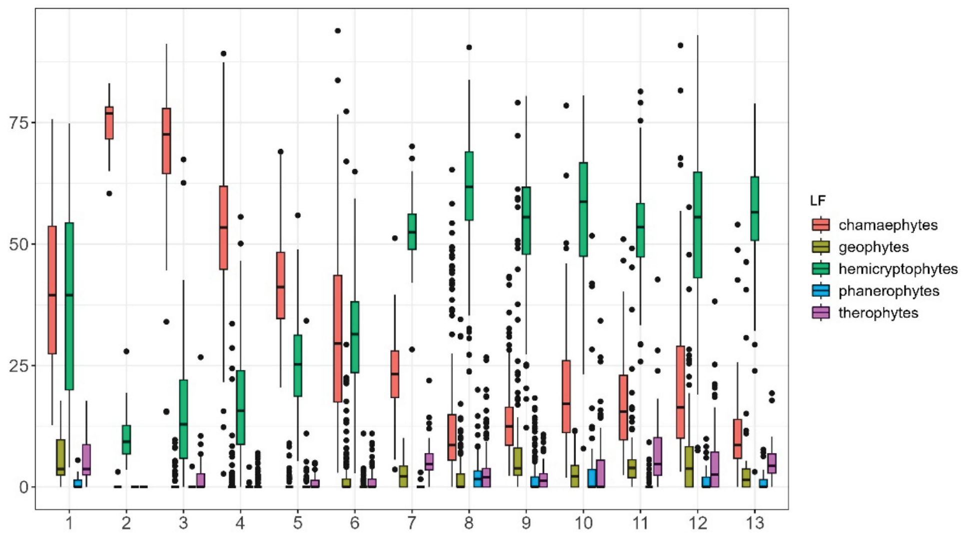

Fig. 7. Life forms of the distinguished thirteen clusters that represent chalk rocky grasslands compared with other types of calcareous grasslands (alliance level).

Abbreviations: 1 – *Anabasio cretaceae-Agropyrion desertori*; 2 – *Sileno fruticulosae-Nanophytion erinacei*; 3 – *Anthemido trotzkianae-Artemision salsoloides*; 4 – *Sileno supinae-Artemision hololeucae*; 5 – *Euphorbio cretophilae-Thymion cretacei*; 6 – *Centaureo carbonatae-Koelerion talievii*; 7 – *Seseli leucospermum-Fumana procumbens* grasslands; 8 – *Seslerion rigidae*; 9 – *Sesleria caerulea-Leontodon incanus* grasslands; 10 – *Asplenio septentrionalis-Festucion pallentis*; 11 – *Bromo pannonici-Festucion pallentis*; 12 – *Galio campanulati-Poion versicoloris*; 13 – *Linum catharticum-Galium cracoviense* grasslands.

Abb. 7. Lebensformen der dreizehn unterschiedenen Cluster, die die Kalkfelsrasen im Vergleich mit anderen Typen von Kalkmagerrasen darstellen (Verbandsebene). Abkürzungen der Syntaxa s. englische Abbildungsunterschrift.

According to the ecological strategies of Grime, chalk rocky grasslands are located in the fields (S, SC) close to S (> 50%), C < 50% and R < 75% with the dominance of stress-tolerant and stress-tolerant/competitor species. On the other hand, the calcareous rocky grasslands of *Stipo pulcherrimae-Festucetalia pallentis* are located within the CS field (Fig. 8).

SPE habitats occur at reach conditions, absorb and transform resources and energy and develop within the successional range. When the "centres of mass" approach the C peak, the mentioned parameters increase (Didukh 2023). FLE habitats are characterized by high lability, the stability of which is due to rapid reproduction after the destruction and high species flexibility caused by fluctuations characterised by resource and energy accumulation and rapid transmission (Didukh 2023). According to Figur 8, "centres of mass" do not occur in the R field, and fluctuations are not characteristic of FLE habitats.

PSE habitats occur within extreme conditions caused by maximum and minimum indices of factors that limit resource consumption. These communities are stable in relation to environmental impact, highly resistant, with limited successional changes, and exist indefinitely with weakly expressed development stages. PSE habitats develop slowly and express themselves in speciation processes due to changes in the morphological and anatomical features of organs as a specialization of adaptation mechanisms to external conditions of existence (Didukh 2023). When the "centres of mass" of chalk rocky grasslands approach the S peak, the mentioned parameters are characteristic, and chalk rocky grasslands differ from pure steppes and reflect high conservatism. Notably, the *Anabasio cretaceae-Agropyrion desertori*, *Sileno fruticulosae-Nanophytion erinacei*, and *Anthemido trotzkianae-Artemision salsoloides* communities are the closest to the PSE field and could characterized as the persistent stable ecosystems (Fig. 8). Thus, neither successions nor fluctuating processes are distinct, which is essential to consider in developing management measures for their conservation.

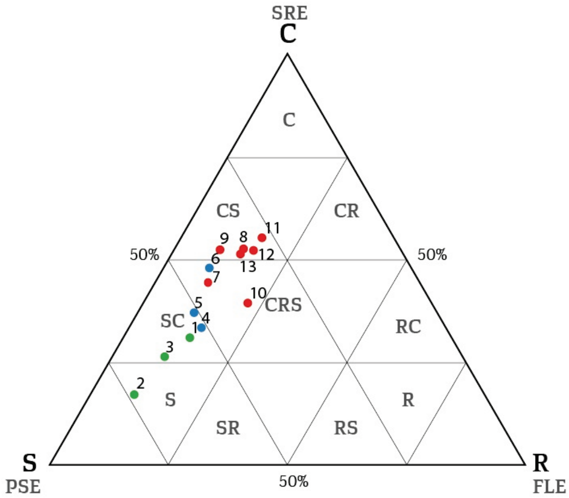

Fig. 8. The ecological strategy of the distinguished thirteen clusters that represent chalk rocky grasslands compared with other types of calcareous grasslands (alliance level). Abbreviations are the same as in the Figure 6.

Abb. 8. Die ökologische Strategie der dreizehn unterschiedenen Cluster, die Kalkfelsrasen im Vergleich zu anderen Arten von Kalkmagerrasen repräsentieren (Verbandsebene). Die Abkürzungen sind dieselben wie in Abbildung 6.

4.3 Syntaxonomical revision

Continental arid steppe zone that unifies meso-xerophytic grasslands on deep calcareous soils of Western and Central Europe that are classified within the *Festuco-Brometea* Br.-Bl. et Tx. ex Soó 1947. When conditions become more aridic, European steppes give way to the semi-desert and desert steppe vegetation within the continental arid semidesert zone that syntaxonomically classified as the *Artemisietea lerchianae* Golub 1994 (Mucina et al. 2016, 2024). However, zonal vegetation of *Festuco-Brometea* and *Artemisietea lerchianae* occur on deep soils of different genesis where the correlation of edaphic and climate environmental parameters is significant (Didukh 2023). What about the cretaceous vegetation that occurs on shallow soils on chalk outcrops if they are variations of zonal vegetation?

Chalk rocky vegetation is floristically and ecologically different from the zonal steppe vegetation of *Festuco-Brometea* and *Artemisietea lerchianae* and was considered within two classes: *Helianthemo-Thymetea* and *Anabasietea cretaceae nom. inv.* (Romashchenko et al. 1996, Didukh et al. 2018, Golovanov et al. 2021).

The *Thymo cretacei-Hyssopetalia cretacei* order, designated by Didukh (1989) as *Thymo-Hyssopetalia* in the original diagnosis, has the nomenclature type of the *Euphorbio cretophilae-Thymion* alliance. On the other hand, the *Euhorbio cretaceae-Thymion cretaceae* alliance was probably mistakenly provided in the original diagnosis (Art. 41a), rather than the *Euphorbio cretophilae-Thymion cretaceae* alliance, and it has the nomenclature type of the *Euphorbio cretaceae-Jurinetum brachycephalae* association (Didukh 1989). The name of the *Euphorbio cretophilae-Jurinetum brachycephalae* association is invalid (Art. 3f) since there is "*Euphorbia cretacea*" in the original diagnosis (Table 2, p. 19 in Didukh 1989); however, these taxa does not exist since it is not listed in Euro+Med PlantBase (https://www.emplantbase.org/). According to Art. 3f (Theurillat et al. 2021), the *Euphorbio cretophilae-Thymion* alliance and *Thymo-Hyssopetalia* order are invalidly published due to invalidly published *Euphorbio cretophilae-Jurinetum brachycephalae* association.

Romashchenko et al. (1996) later designated the illegitimate *Artemisio hololeucae-Hyssopion cretacei* Romashchenko et al. 1996 as a type of the *Thymo cretacei-Hyssopetalia cretacei* order and *de facto* validated the *Thymo-Hyssopetalia* order. The *Artemisio hololeucae-Hyssopion cretaceae* alliance is validly published, and the nomenclature type of the alliance is the *Artemisio hololeucae-Polygaletum cretaceae* association. Romashchenko et al. (1996) designated *Artemisio hololeucae-Polygaletum cretaceae* Didukh 1989 as the nomenclatural type of this alliance. However, Romashchenko et al. (1996) further indicated that this alliance is identical to *Sileno supinae-Artemision hololeucae* Didukh 1989. This means that *Artemisio hololeucae-Hyssopion cretaceae* Romashchenko et al. 1996 is "superfluous" (Art. 29c), hence the illegitimate name of *Sileno supinae-Artemision hololeucae* Didukh 1989. The *Sileno supinae-Artemision hololeucae* alliance is validly published by Didukh (1989) and designated the valid *Sileno supinae-Matthioletum fragrantis* association. The nomenclature type of the *Thymo cretacei-Hyssopetalia cretacei* order is, therefore, the *Sileno supinae-Artemision hololeucae* alliance.

Regarding the class *Anabasietea cretaceae* and order *Anabasietalia cretaceae*, the nomenclature types of high-rank syntaxa have been provided mistakenly and invalidly published (Art.8) (Theurillat et al. 2021). The nomenclature type of the order *Anabasietalia cretaceae* and class *Anabasietea cretaceae* is the *Anthemido trotzkianae–Artemisietum salsoloidis* association, despite the selected names of the alliance and order, respectively (Golovanov et al. 2021).

Regarding the *Helianthemo-Thymetea*, the nomenclature type of the class is the *Thymo cretacei-Hyssopetalia cretacei* order (Art. 8). Romashchenko et al. (1996) have validated the class in their paper, although they have not explicitly cited correct name "*Thymo cretacei-Hyssopetalia cretacei* Didukh ex Romashchenko et al. 1996" according to the Code (Theurillat et al. 2021). Mucina et al. (2016) do not consider this class in its own right and assign chalk rocky grasslands within the *Festuco-Brometea* class. However, chalk rocky grasslands sharply differentiate from the closer type of vegetation that occurs on calcareous outcrops (*Stipo pulcherrimae-Festucetalia pallentis*) (Fig. 2) and have their own diagnostic species (e.g. *Artemisia salsoloides*, *Cephalaria uralensis*, *Pimpinella tragium*). On the other hand, there are many species (e.g. *Asperula cynanchica*, *Campanula sibirica*, *Festuca vale-siaca* aggr.) with high constancy that are considered diagnostic for *Festuco-Brometea*; therefore, we have preliminarily assigned chalk rocky grasslands within *Helianthemo-Thymetea* class" (Kuzemko & Khodosovtsev 2022) with question marks "???".

4.4 Validation of the chalk rocky grasslands syntaxa

We propose to designate the nomenclature type of the *Euphorbio cretophilae-Jurinetum brachycephalae* association from Romaschenko et al. (1996) and validate the name of the association (Art. 2b):

Association *Euphorbio cretophilae-Jurinetum brachycephalae* Didukh ex Vasheniak et al. 2024
Neotypus hoc loco: Romashchenko et al. (1996), page 57, table 3, relevé 24.
Diagnostic species: according to Romaschenko et al. (1996): *Centaurea lavrenkoana*, *Cytisus ruthenicus*, *Genista tinctoria*, *Helichrysum arenarium*, *Linum austriacum*, *Minuartia setacea*, *Odontarrhena tortuosa*.
The name of the *Euphorbio cretiphilae-Jurinetum brachycephalae* association is assigned by the authors (Romashchenko et al. 1996) as the nomenclature type of the alliance *Euphorbio cretophilae-Thymion cretacei* alliance. We propose validating the alliance name according to the association's validation (Art. 2b, 8).

Alliance *Euphorbio cretophilae-Thymion cretacei* Didukh ex Vasheniak et al. 2024
Neotypus hoc loco: *Euphorbio cretophilae-Jurinetum brachycephalae* Didukh ex Vasheniak et al. 2024.
Diagnostic species: according to Romaschenko et al. (1996): *Artemisia salsoloides*, *Brassica elongata* subsp. *pinnatifida*, *Euphorbia petrophila*, *Jurinea stoechadifolia*.
In addition, we propose the designation of the validly published *Anthemido trotzkianae–Artemision salsoloidis* alliance (Golovanov et al. 2021) as the nomenclature type of the *Anabasietalia cretaceae* order (Art. 2b, 8).

Order *Anabasietalia cretaceae* Golovanov et al. ex Vasheniak et al. 2024
Lectotypus hoc loco: *Anthemido trotzkianae–Artemision salsoloidis* Golovanov et al. 2021.
Diagnostic species: according to Golovanov et al. (2021): *Anabasis cretacea*, *Anthemis trotzkiana*, *Artemisia salsoloides*, *Atraphaxis decipiens*, *Crambe aspera*, *Echinops meyeri*, *Jurinea kirghisorum*, *Hedysarum tscherkassovae*, *Lepidium meyeri*, *Limonium cretaceum*, *Linaria cretacea*, *Matthiola fragrans*, *Nanophyton erinaceum*, *Seseli glabratum*, *Zygo-phyllum pinnatum*.

4.5 Distribution of chalk rocky grasslands within the Eastern European Plain

Chalk rocky grasslands sporadically spread within the steppe zone of the aridic climate, on the other hand, occur in the south of the forest-steppe and the north of the semidesert zone and should be considered to be azonal-zonal vegetation (Lavrenko 1961) that differs from plain zonal meso-xerophytic grasslands on deep calcareous soils of the *Festuco-Brometea* and semidesert grasslands of *Artemisietea lerchianae* (Mucina et al. 2016, 2024).

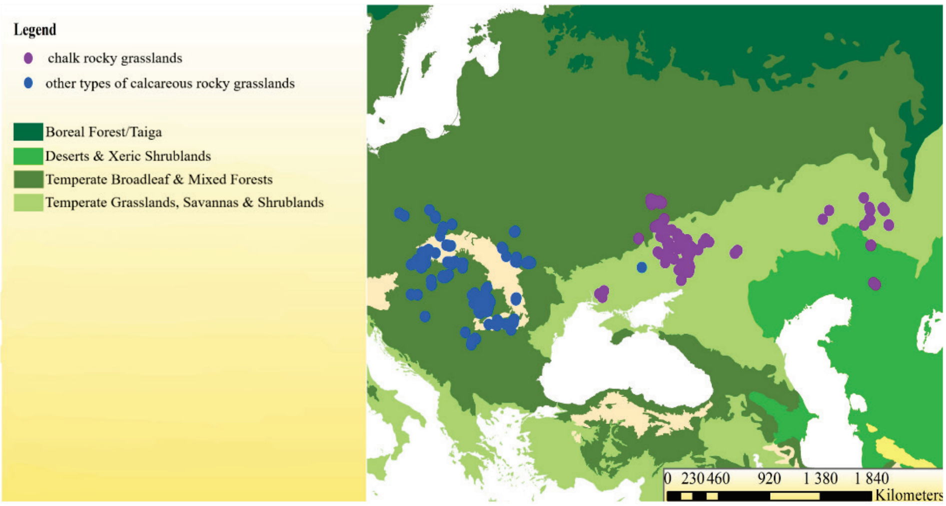

Fig. 9. Biomes and Ecoregions map of the chalk rocky grasslands compared with other types of calcareous rocky grasslands.

Abb. 9. Karte der Biome und Ökoregionen der untersuchten Kalkfelsrasen im Vergleich zu anderen Typen von Kalkfelsrasen.

On the one hand, *Centaureo carbonatae-Koelerion talievii* communities occur in steppe zone, which could be explained by the transitional nature of the alliance, which has a lot of similar features to the *Festucetalia valesiacae* order (*Festuco-Brometea* class) (Romashchenko et al. 1996, Poluyanov 2009, Poluyanov and Averinova 2012, Mucina et al. 2016, Didukh et al. 2018). Three plots of *Potentillo arenariae-Linion czernjajevii* Krasova et Smetana 1999, which were initially considered within the *Festucetalia valesiacae* order (Krasova and Smetana 1999), *Cephalario uralensis-Jurineetalia stoechadifolii* order (Vynokurov 2021) and more recently as the *Stipo pulcherrimae-Festucetalia pallentis* order (Mucina et al. 2016, Didukh et al. 2021) and have unclear syntaxonomical affiliation, are floristically very similar to *Centaureo carbonatae-Koelerion talievii* communities. Outliers of chalk rocky grasslands that occur in Right-bank Ukraine (Kherson region), according to the map (Fig. 9), cannot be considered within the *Thymo cretacei-Hyssopetalia cretaceae* order.

On the other hand, *Sileno fruticulosae-Nanophytion erinacei* and *Anthemido trotzkianae-Artemision salsoloides* communities occur in the arid semidesert zone and are deeply spread within it (Golovanov et al. 2021; Fig. 9). We presume that chalk rocky grasslands could be azonal vegetation, which strongly correlates with the edaphic parameters and is characterised by endemic races or species that are sporadically spread on chalk outcrops within the Eastern

European Plain (Klokov and Dobrochayeva 1974, Tzvelev et al. 1996, Chusova and Didukh 2014). It should be noted that the *Anabasietalia cretaceae* and *Thymo cretacei-Hyssopetalia cretaceae* orders are separated by the Volga Lowland; however, the high terraces of the Don River that occur in the Volga-Don interfluve, are habitats of *Euphorbio cretophilae-Thymion cretacei* communities (Koroliuk et al. 2021; Fig. 9). Thus, in order to fill the gap between the two orders and find transitional communities within the Volga-Don interfluve, we aim further to conduct a supraregional analysis of chalk rocky grasslands.

Edaphic and orographic parameters (uplands with chalk outcrops and undeveloped soils on the surface) vary within an aridic climate with low precipitation and high evaporation (Didukh 2023). As the continentality indices increase and the indicators of the ombroregime decrease, chalk rocky grasslands change from the transitional *Centaureo carbonatae-Koelerion talievii* alliance to typical *Thymo cretacei-Hyssopetalia cretacei*, *Anabasietalia cretaceae* communities. According to the phytoindication results, continentality and ombro-regime correlate with decreased soil humidity, nitrogen content and increased acidity and salt regimes (Fig. 5B). It should be noted that loose and disintegrated substrates of chalk rocky grasslands with a lack of soils differ from the wet, dense substrates of the *Stipo pulcherrimae-Festucetalia pallentis* communities, sub-Mediterranean and supra-oreomediterran belts of *Drypidetea spinosae*, rocky communities of *Sedo-Scleranthetea* annuals and succulents and sandy grasslands of *Koelerio-Corynephoretea* (Mucina et al. 2016).

5. Conclusions

We provided a syntaxonomy of chalk rocky grasslands in the Eastern European Plain concluding that all communities belong to the *Thymo cretacei-Hyssopetalia cretacei* and *Anabasietalia cretaceae* orders. They are distinct from other steppe communities and belong to the azonal class *Helianthemo-Thymetea* with a high proportion of chamaephytes. Chalk rocky grasslands have a high presence of stress-tolerant/competitor species (SC) characterised as PSE habitats that occur under extreme conditions. A key aspect that distinguishes *Helianthemo-Thymetea* communities from typical steppe communities is that they form on rocky substrates in the absence of soil, which means that successional processes do not occur here. We consider such communities to be “edaphic-climax”.

The main environmental factors causing the differentiation of the *Helianthemo-Thymetea* communities are the soil reaction, carbonate content, aeration, continentality, cryoregime and light. The *Helinathemo-Thymetea* communities differ from other calcareous rocky grasslands along the moisture, light and nitrogen gradients. The distribution of chalk rocky grasslands is concentrated in the continental arid steppe zone, but they may also be found in the continental arid semidesert and nemoral zone, where climate (temperature, precipitation and continentality) and edaphic conditions (carbonate content, salt regime and soil moisture) vary significantly within three biogeographical zones.

Erweiterte deutsche Zusammenfassung

Einleitung – Kalkfelsrasen, die von bestimmten endemischen Chamaephyten und Hemi-kryptophyten mit sternförmiger und spinnennetzartiger Behaarung dominiert werden, kommen auf den Kalkfelsen der Flusstäler Osteuropas vor. Sie besiedeln schwach entwickelte Kalkskelettböden (Syroseme, flachgründige Rendzinen) und sind stark vom hohen Karbonatgehalt des Kalkgrundgesteins abhängig. Kalkfelsenrasen sind derzeit gefährdet und für den Schutz der Artenvielfalt von großer

Bedeutung. Die Hauptbedrohungen sind Aufforstung, Terrassierung der Hänge und der Abbau von Kreide und Mergel (Kuzemko 2022). Seit der russischen Aggression im Jahr 2014 sind neue Bedrohungen entstanden, die die gefährdeten Kalkfelsenrasen beeinflussen: direktes Verschwinden der Vegetationsdecke aufgrund intensiver militärischer Aktivitäten, aufgegebene landwirtschaftliche Flächen in der Nähe der Hänge von Kalkfelsen und Ausbreitung invasiver Arten. Sie gelten aber gemäß der Berner Konvention als EUNIS-Habitattyp E1.13 (kontinentale trockene, felsige Steppengrasländer und Zwerggestrüpp auf Kalkfelsen) als für den Naturschutz in Europa bedeutsam (Schaminée et al. 2016). Das Hauptziel der vorliegenden Studie war es, die Klassifizierung der Kreidefelsenvegetation in der osteuropäischen Tiefebene anhand eines großen internationalen Datensatzes zu überarbeiten und das Wissen über ihre Syntaxonomie, Ökologie und Verbreitung zu vervollständigen.

Untersuchungsgebiet – Wir haben Grasland auf Kalkfelsen in der Trockenzone der osteuropäischen Tiefebene untersucht. Insbesondere haben wir uns auf zwei unterschiedliche Regionen konzentriert: (1) die Mittelrussische Platte und (2) das Sub-Urale Plateau über einen Klimagradienten hinweg, der die Verteilung und Zusammensetzung der Vegetationstypen innerhalb des Untersuchungsgebiets, in dem Kalkfelsen vorkommen, erheblich beeinflusst. Unser Untersuchungsgebiet umfasst ein breites Klimaspektrum, das von den milden kontinentalen Bedingungen der Ukraine bis zu den rein kontinentalen Bedingungen Kasachstans reicht. Dieser Klimagradient beeinflusst die Verteilung und Zusammensetzung der Vegetationstypen innerhalb des Untersuchungsgebiets erheblich.

Material und Methoden – Um eine Auswahl der Zielpflanzengesellschaften zu erhalten, die der Klasse *Helianthemo-Thymetea* entsprechen, klassifizierten wir den ursprünglichen Datensatz von 3171 Vegetationsaufnahmen mithilfe von Expertensystemen (Willner et al. 2017, Chytrý et al. 2020). Wir verwendeten den modifizierten TWINSPAN-Algorithmus (Hill 1979, Roleček et al. 2009): drei Pseudospezies-Schnittwerte – 0 %, 5 % und 25 %, Mindestgruppengröße für die Unterteilung – 10 Aufnahmen, und Whittakers Beta-Koeffizient als Maß für die interne Clusterheterogenität. Die diagnostischen Arten für einzelne Cluster wurden anhand des *phi*-Koeffizienten (Treueschwelle bei *phi* = 0,30) geschätzt, getestet mit dem exakten Test von Fisher ($p < 0{,}05$) (Chytrý et al. 2002), wobei die Größen aller Gruppen auf gleiche Größe standardisiert wurden (Tichý & Chytrý 2006). Um standörtliche Unterschiede zwischen den Clustern zu untersuchen, verwendeten wir Indikatorwerte vom Ellenberg-Typ und Didukhs Skalen (Didukh 2011, Dengler et al. 2023).

Ergebnisse und Diskussion – Wir haben den Datensatz mit 1643 Vegetationsaufnahmen mit dem modifizierten TWINSPAN-Algorithmus klassifiziert. Die TWINSPAN-Klassifizierung ergab 13 Cluster. Wir haben 7 Cluster entfernt, die als *Stipo pulcherrimae-Festucetalia pallentis* interpretiert wurden, und uns auf die verbleibenden sechs Cluster als die Verbände *Anabasio cretaceae-Agropyrion desertori*, *Sileno fruticulosae-Nanophytion erinacei*, *Anthemido trotzkianae-Artemision salsoloides*, *Sileno supinae-Artemision hololeucae*, *Euphorbio cretophilae-Thymion cretacei*, *Centaureo carbonatae-Koelerion talievii* konzentriert. Die Gesellschaften unterscheiden sich deutlich entlang der Gradienten der Klima- und Bodenparameter. Wir haben 7 Cluster zurückgegeben, die als *Stipo pulcherrimae-Festucetalia pallentis* interpretiert wurden und von der Hauptanalyse zum Vergleich von Umweltmerkmalen, Lebensformen und Verteilung der Gesellschaften ausgeschlossen wurden. Gesellschaften der Ordnung *Stipo pulcherrimae-Festucetalia pallentis* weisen einen deutlich höheren Anteil an Hemikryptophyten auf, den höchsten im Fall des Verbandes *Seslerion rigidae*. Im Gegensatz dazu sind in Gesellschaften der Klasse *Helianthemo-Thymetea* Hemikryptophyten viel weniger vertreten, aber der Anteil an Chamaephyten ist wesentlich höher. Wir haben einen aktuellen syntaxonomischen Überblick über die Gesellschaften der Grasländer auf Kalkfelsen in der osteuropäischen Tiefebene gegeben (vgl. Romashchenko et al. 1996, Didukh et al. 2018, Golovanov et al. 2021). Es wurden Übergangsgesellschaften vom *Centaureo carbonatae-Koelerion talievii* beobachtet, die Fragen zu ihrer Klassifizierung aufwerfen. Wir schlagen vor, einige von Didukh (1989), Romashchenko et al. (1996) und Golovanov et al. (2021) ungültig veröffentlichte Syntaxa zu validieren. Die Verbreitung der Kalkfels-Grasländer konzentriert sich auf die kontinentale aride Steppenzone; sie könnten jedoch auch in der kontinentalen ariden Halbwüste und der nemoralen Zone zu finden sein, wo Klima (Temperatur, Niederschlag und Kontinentalität) und edaphische Bedingungen (Karbonatgehalt, Salzregime und Bodenfeuchtigkeit) innerhalb dreier biogeografischer Zonen erheblich variieren. Wir vermuten, dass es sich bei den Kalkfelsrasen um eine azonale Vegetation handeln könnte, die stark mit den edaphischen Parametern korreliert und durch endemische Rassen oder Arten gekennzeichnet ist, die sporadisch auf Kalkaufschlüssen in der osteuropäischen Tiefebene verbreitet sind (Klokov und Dobrochayeva 1974, Tzvelev et al. 1996, Chusova und Didukh 2014).

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Authors contributions

Y.D. conceived the research project. Y.D. and O.C. provided data on chalk rocky grasslands within the study area. I.V. performed the numerical analyses and wrote the manuscript, supervised by Y.D. I.V. prepared the electronic supplements. O.C. prepared the DCA and box-and-whiskers plots. I.V. and O.C. prepared the figures for publication. All the authors revised the manuscript and agreed on the final version for publication.

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Supplements

Additional supporting information may be found in the online version of this article.

Zusätzliche unterstützende Information ist in der Online-Version dieses Artikels zu finden.

Supplement E1. List of aggregate species and definition of their combination.
Anhang E1. Liste der aggregierten Arten und Definition ihrer Kombination.

Supplement E2. Life forms, Grime's strategy for the species list used in the analysis.
Anhang E2. Lebensformen, Grime's Strategie für die Artenliste, die in der Analyse genutzt wurden.

Supplement E3. Algorithm of the Grime's triangle construction.
Anhang E3. Algorithmus zur Konstruktion des Grime-Dreiecks.

Supplement E4. Full synoptic table showing the percentage constancy and fidelity of species of the six clusters.
Anhang E4. Vollständige synoptische Tabelle mit der prozentualen Stetigkeit und Treue der Arten der sechs Cluster.

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Supplement E1. List of aggregate species and definition of their combination.

Anhang E1. Liste der aggregierten Arten und Definition ihrer Kombination.

Aggregates and valid names	Initial species data	Euro+Med	Source for aggregate definition	Synonyms
Achillea millefolium aggr.	Achillea collina	Achillea collina	Euro+Med (2024)	
Achillea millefolium aggr.	Achillea distans	Achillea distans	Euro+Med (2024)	
Achillea millefolium aggr.	Achillea millefolium	Achillea millefolium	Euro+Med (2024)	
Achillea millefolium aggr.	Achillea millefolium subsp. millefolium	Achillea millefolium subsp. millefolium	Euro+Med (2024)	
Achillea millefolium aggr.	Achillea millefolium subsp. pannonica	Achillea millefolium subsp. pannonica	Euro+Med (2024)	
Achillea millefolium aggr.	Achillea pannonica	Achillea pannonica	Euro+Med (2024)	
Achillea millefolium aggr.	Achillea setacea	Achillea setacea	Euro+Med (2024)	
Achillea millefolium aggr.	Achillea stricta	Achillea distans subsp. stricta	Euro+Med (2024)	
Agrimonia eupatoria aggr.	Agrimonia eupatoria	Agrimonia eupatoria	Ad hoc	
Agrimonia eupatoria aggr.	Agrimonia procera	Agrimonia procera	Ad hoc	Agrimonia eupatoria subsp. procera (Wallr.) Arth. ex Fr
Agropyron cristatum aggr.	Agropyron cristatum	Agropyron cristatum	Ad hoc, based on Mosyakin & Fedoronchuk (1999)	Agropyron cristatum
Agropyron cristatum aggr.	Agropyron cristatum subsp. cristatum	Agropyron cristatum	Ad hoc, based on Mosyakin & Fedoronchuk (1999)	Agropyron cristatum
Agropyron cristatum aggr.	Agropyron desertorum	Agropyron desertorum	Ad hoc, based on Mosyakin & Fedoronchuk (1999)	Agropyron cristatum subsp. desertorum
Agropyron cristatum aggr.	Agropyron pectinatum	Agropyron cristatum subsp. pectinatum	Ad hoc, based on Mosyakin & Fedoronchuk (1999)	Agropyron cristatum subsp. pectinatum
Agropyron cristatum aggr.	Agropyron ponticum	Agropyron cristatum subsp. ponticum	Ad hoc, based on Mosyakin & Fedoronchuk (1999)	Agropyron cristatum subsp. ponticum
Allium angulosum aggr.	Allium angulosum	Allium angulosum	Landolt et al. (2010)	
Allium angulosum aggr.	Allium flavescens	Allium flavescens	Landolt et al. (2010)	
Allium angulosum aggr.	Allium montanum	Allium lusitanicum	Landolt et al. (2010)	
Allium angulosum aggr.	Allium senescens	Allium senescens	Landolt et al. (2010)	
Allium angulosum aggr.	Allium senescens subsp. montanum	Allium senescens	Landolt et al. (2010)	
Allium paniculatum aggr.	Allium fuscum	Allium fuscum	Ad hoc	Allium paniculatum subsp. fuscum
Allium paniculatum aggr.	Allium paniculatum	Allium paniculatum	Ad hoc	Allium paniculatum
Allium paniculatum aggr.	Allium rupestre	Allium rupestre	Ad hoc	Allium paniculatum subsp. rupestre
Alyssum montanum aggr.	Alyssum gmelinii	Alyssum gmelinii	Landolt et al. (2010)	
Alyssum montanum aggr.	Alyssum montanum	Alyssum montanum	Landolt et al. (2010)	
Alyssum montanum aggr.	Alyssum montanum subsp. gmelinii	Alyssum montanum	Landolt et al. (2010)	
Alyssum montanum aggr.	Alyssum montanum subsp. montanum	Alyssum montanum	Landolt et al. (2010)	
Alyssum montanum aggr.	Alyssum repens	Alyssum repens	Landolt et al. (2010)	
Alyssum montanum aggr.	Alyssum rostratum	Alyssum rostratum	Landolt et al. (2010)	
Alyssum montanum aggr.	Alyssum trichostachyum	Alyssum trichostachyum	Landolt et al. (2010)	
Anthyllis vulneraria aggr.	Anthyllis biebersteiniana	Anthyllis vulneraria subsp. pulchella	Mosyakin & Fedoronchuk (1999)	
Anthyllis vulneraria aggr.	Anthyllis taurica	Anthyllis vulneraria subsp. boissieri	Mosyakin & Fedoronchuk (1999)	
Anthyllis vulneraria aggr.	Anthyllis vulneraria	Anthyllis vulneraria	Mosyakin & Fedoronchuk (1999)	
Anthyllis vulneraria aggr.	Anthyllis vulneraria subsp. alpestris	Anthyllis vulneraria subsp. alpestris	Mosyakin & Fedoronchuk (1999)	
Anthyllis vulneraria aggr.	Anthyllis vulneraria subsp. polyphylla	Anthyllis vulneraria subsp. polyphylla	Mosyakin & Fedoronchuk (1999)	
Anthyllis vulneraria aggr.	Anthyllis vulneraria subsp. vulneraria	Anthyllis vulneraria subsp. vulneraria	Mosyakin & Fedoronchuk (1999)	
Arenaria serpyllifolia aggr.	Arenaria leptoclados	Arenaria leptoclados	Ehrendorfer (1973)	
Arenaria serpyllifolia aggr.	Arenaria serpyllifolia	Arenaria serpyllifolia	Ehrendorfer (1973)	
Arenaria serpyllifolia aggr.	Arenaria serpyllifolia subsp. serpyllifolia	Arenaria serpyllifolia subsp. serpyllifolia	Ehrendorfer (1973)	
Arenaria serpyllifolia aggr.	Arenaria uralensis	Arenaria leptoclados	Ehrendorfer (1973)	
Astragalus vesicarius aggr.	Astragalus albidus	Astragalus vesicarius L. subsp. vesicarius	Ad hoc	Astragalus vesicarius L. subsp. vesicarius
Astragalus vesicarius aggr.	Astragalus cicer	Astragalus cicer	Ad hoc	Astragalus cicer
Astragalus vesicarius aggr.	Astragalus vesicarius	Astragalus vesicarius	Ad hoc	Astragalus vesicarius
Campanula rotundifolia aggr.	Campanula kladniana	Campanula kladniana	Landolt et al. (2010)	
Campanula rotundifolia aggr.	Campanula moravica	Campanula rotundifolia	Landolt et al. (2010)	
Campanula rotundifolia aggr.	Campanula moravica subsp. moravica	Campanula rotundifolia	Landolt et al. (2010)	
Campanula rotundifolia aggr.	Campanula rotundifolia	Campanula rotundifolia	Landolt et al. (2010)	
Carex muricata aggr.	Carex divulsa	Carex divulsa	Landolt et al. (2010)	
Carex muricata aggr.	Carex muricata	Carex muricata	Landolt et al. (2010)	
Carex muricata aggr.	Carex muricata subsp. lamprocarpa	Carex muricata	Landolt et al. (2010)	
Carex muricata aggr.	Carex pairaei	Carex muricata subsp. pairae	Landolt et al. (2010)	
Carex muricata aggr.	Carex spicata	Carex spicata	Landolt et al. (2010)	
Centaurea ovina aggr.	Centaurea besseriana	Centaurea besseriana	Ad hoc	Centaurea ovina subsp. besseriana
Centaurea ovina aggr.	Centaurea lavrenkoana	Centaurea lavrenkoana	Ad hoc	Centaurea ovina subsp. lavrenkoana
Cotoneaster integerrimus aggr.	Cotoneaster integerrimus	Cotoneaster integerrimus	Landolt et al. (2010)	
Cotoneaster integerrimus aggr.	Cotoneaster matrensis	Cotoneaster melanocarpus	Landolt et al. (2010)	
Cotoneaster integerrimus aggr.	Cotoneaster melanocarpus	Cotoneaster melanocarpus	Landolt et al. (2010)	
Cotoneaster integerrimus aggr.	Cotoneaster tomentosus	Cotoneaster tomentosus	Landolt et al. (2010)	
Crambe tataria aggr.	Crambe aspera	Crambe aspera	Ad hoc	Crambe tataria var. buschii
Crambe tataria aggr.	Crambe pinnatifida	Crambe tataria	Ad hoc	Crambe tataria
Crambe tataria aggr.	Crambe tataria	Crambe tataria	Ad hoc	Crambe tataria
Cuscuta epithymum aggr.	Cuscuta approximata	Cuscuta approximata	Landolt et al. (2010)	
Cuscuta epithymum aggr.	Cuscuta epithymum	Cuscuta epithymum	Landolt et al. (2010)	
Cuscuta epithymum aggr.	Cuscuta epithymum subsp. kotschyi	Cuscuta epithymum	Landolt et al. (2010)	
Cytisus hirsutus aggr.	Chamaecytisus hirsutus	Cytisus hirsutus	Landolt et al. (2010)	
Cytisus hirsutus aggr.	Chamaecytisus polytrichus	Cytisus hirsutus subsp. polytrichus	Landolt et al. (2010)	
Cytisus hirsutus aggr.	Chamaecytisus ratisbonensis	Cytisus ratisbonensis	Landolt et al. (2010)	
Cytisus hirsutus aggr.	Chamaecytisus ruthenicus	Cytisus ruthenicus	Landolt et al. (2010)	
Cytisus hirsutus aggr.	Chamaecytisus supinus	Cytisus hirsutus	Landolt et al. (2010)	
Dianthus carthusianorum aggr.	Dianthus carpaticus	Dianthus carthusianorum	Ehrendorfer (1973)	
Dianthus carthusianorum aggr.	Dianthus carthusianorum	Dianthus carthusianorum	Ehrendorfer (1973)	
Dianthus carthusianorum aggr.	Dianthus carthusianorum subsp. carthusianorum	Dianthus carthusianorum	Ehrendorfer (1973)	
Dianthus carthusianorum aggr.	Dianthus giganteiformis	Dianthus giganteiformis	Ehrendorfer (1973)	
Dianthus carthusianorum aggr.	Dianthus pontederae	Dianthus pontederae	Ehrendorfer (1973)	
Dianthus carthusianorum aggr.	Dianthus tenuifolius	Dianthus tenuifolius	Ehrendorfer (1973)	
Dianthus petraeus aggr.	Dianthus petraeus subsp. orbelicus	Dianthus petraeus subsp. orbelicus	Ad hoc	Dianthus petraeus subsp. orbelicus
Dianthus petraeus aggr.	Dianthus spiculifolius	Dianthus spiculifolius	Ad hoc	Dianthus petraeus subsp. spiculifolius
Dictamnus albus aggr.	Dictamnus albus	Dictamnus albus	Ad hoc	Dictamnus albus
Dictamnus albus aggr.	Dictamnus gymnostylis	Dictamnus gymnostylis	Ad hoc	Dictamnus albus subsp. gymnostylis
Euphrasia stricta aggr.	Euphrasia stricta	Euphrasia stricta	Ehrendorfer (1973)	
Euphrasia stricta aggr.	Euphrasia pectinata	Euphrasia pectinata	Ehrendorfer (1973)	
Festuca ovina aggr.	Festuca beckeri	Festuca beckeri	Ad hoc	Festuca ovina var. beckeri
Festuca ovina aggr.	Festuca callieri	Festuca callieri	Ad hoc	Festuca ovina var. callieri
Festuca ovina aggr.	Festuca dalmatica	Festuca dalmatica	Ehrendorfer (1973)	
Festuca ovina aggr.	Festuca ovina	Festuca ovina	Ehrendorfer (1973)	
Festuca valesiaca aggr.	Festuca pachyphylla	Festuca stricta subsp. rumelica	Mosyakin & Fedoronchuk (1999)	
Festuca valesiaca aggr.	Festuca pseudodalmatica	Festuca pseudodalmatica	Mosyakin & Fedoronchuk (1999)	
Festuca valesiaca aggr.	Festuca pseudovina	Festuca valesiaca subsp. parviflora	Mosyakin & Fedoronchuk (1999)	
Festuca valesiaca aggr.	Festuca rupicola	Festuca stricta subsp. sulcata	Mosyakin & Fedoronchuk (1999)	
Festuca valesiaca aggr.	Festuca rupicola subsp. rupicola	Festuca stricta subsp. sulcata	Mosyakin & Fedoronchuk (1999)	
Festuca valesiaca aggr.	Festuca saxatilis	Festuca stricta subsp. saxatilis	Mosyakin & Fedoronchuk (1999)	
Festuca valesiaca aggr.	Festuca stricta	Festuca stricta	Mosyakin & Fedoronchuk (1999)	
Festuca valesiaca aggr.	Festuca sulcata	Festuca stricta subsp. sulcata	Mosyakin & Fedoronchuk (1999)	
Festuca valesiaca aggr.	Festuca trachyphylla	Festuca stricta subsp. trachyphylla	Mosyakin & Fedoronchuk (1999)	
Festuca valesiaca aggr.	Festuca valesiaca	Festuca valesiaca	Mosyakin & Fedoronchuk (1999)	
Galium mollugo aggr.	Galium lucidum	Galium lucidum	Ehrendorfer (1973)	
Galium mollugo aggr.	Galium mollugo	Galium mollugo	Ehrendorfer (1973)	
Galium mollugo aggr.	Galium mollugo subsp. erectum	Galium mollugo subsp. erectum	Ehrendorfer (1973)	
Galium pusillum aggr.	Galium pumilum	Galium pumilum	Ehrendorfer (1973)	
Galium pusillum aggr.	Galium austriacum	Galium austriacum	Ehrendorfer (1973)	
Galium verum aggr.	Galium ruthenicum	Galium ruthenicum	Ad hoc	Galium verum subsp. ruthenicum
Galium verum aggr.	Galium verum	Galium verum	Ad hoc	Galium verum
Genista tinctoria aggr.	Genista tinctoria	Genista tinctoria	Ad hoc	Genista tinctoria
Genista tinctoria aggr.	Genista depressa	Genista depressa	Ad hoc	Genista tinctoria var. depressa
Genista tinctoria aggr.	Genista ovata	Genista tinctoria	Ad hoc	Genista tinctoria
Genista tinctoria aggr.	Genista tanaitica	Genista tinctoria	Ad hoc	Genista tinctoria
Goniolimon tataricum aggr.	Goniolimon besseranum	Goniolimon besseranum	Ad hoc	Goniolimon tataricum subsp. besserianum
Goniolimon tataricum aggr.	Goniolimon tataricum	Goniolimon tataricum	Ad hoc	Goniolimon tataricum
Helianthemum canum aggr.	Helianthemum canum	Helianthemum canum	Ad hoc, based on Chusova & Didukh (2014)	Helianthemum canum
Helianthemum canum aggr.	Helianthemum canum subsp. canum	Helianthemum canum	Ad hoc, based on Chusova & Didukh (2014)	Helianthemum canum
Helianthemum canum aggr.	Helianthemum stevenii	Helianthemum stevenii	Ad hoc, based on Chusova & Didukh (2014)	Helianthemum canum subsp. stevenii
Helianthemum canum aggr.	Helianthemum creticola	Helianthemum creticola	Ad hoc, based on Chusova & Didukh (2014)	Helianthemum creticola
Helianthemum canum aggr.	Helianthemum cretophilum	Helianthemum cretophilum	Ad hoc, based on Chusova & Didukh (2014)	Helianthemum cretophilum
Hieracium lachenalii aggr.	Hieracium argillaceum	Hieracium lachenalii subsp. argillaceum	FloraVeg (2024)	
Hieracium lachenalii aggr.	Hieracium diaphanum	Hieracium diaphanum	FloraVeg (2024)	
Hierochloe odorata aggr.	Hierochloe australis	Hierochloe australis	Landolt et al. (2010)	
Hierochloe odorata aggr.	Hierochloe odorata	Hierochloe odorata	Landolt et al. (2010)	
Hierochloe odorata aggr.	Hierochloe repens	Hierochloe repens	Landolt et al. (2010)	
Inula salicina aggr.	Inula aspera	Inula aspera	Landolt et al. (2010)	
Inula salicina aggr.	Inula salicina	Inula salicina	Landolt et al. (2010)	
Inula salicina aggr.	Inula salicina subsp. salicina	Inula salicina	Landolt et al. (2010)	
Iris pumila aggr.	Iris pumila	Iris pumila	Ad hoc	Iris pumila
Iris pumila aggr.	Iris scariosa	Iris scariosa	Ad hoc	Iris pumila var. scariosa
Isatis tinctoria aggr.	Isatis praecox	Isatis praecox	Landolt et al. (2010)	
Isatis tinctoria aggr.	Isatis tinctoria	Isatis tinctoria	Landolt et al. (2010)	
Isatis tinctoria aggr.	Isatis tinctoria subsp. tinctoria	Isatis tinctoria	Landolt et al. (2010)	
Jurinea mollis aggr.	Jurinea arachnoidea	Jurinea arachnoidea	Ad hoc, based on Euro+Med (2024)	Jurinea mollis subsp. arachnoidea
Jurinea mollis aggr.	Jurinea calcarea	Jurinea calcarea	Ad hoc, based on Euro+Med (2024)	Jurinea calcarea
Jurinea mollis aggr.	Jurinea glycacantha	Jurinea glycacantha	Ad hoc, based on Euro+Med (2024)	Jurinea glycacantha
Jurinea mollis aggr.	Jurinea ledebourii	Jurinea ledebourii	Ad hoc, based on Euro+Med (2024)	Jurinea ledebourii
Jurinea mollis aggr.	Jurinea mollis	Jurinea mollis	Ad hoc, based on Euro+Med (2024)	Jurinea mollis
Jurinea mollis aggr.	Jurinea mollis subsp. mollis	Jurinea mollis	Ad hoc, based on Euro+Med (2024)	Jurinea mollis
Jurinea mollis aggr.	Jurinea mollis subsp. transylvanica	Jurinea mollis	Ad hoc, based on Euro+Med (2024)	Jurinea mollis
Jurinea mollis aggr.	Jurinea mollissima	Jurinea mollissima	Ad hoc, based on Euro+Med (2024)	Jurinea mollissima
Jurinea mollis aggr.	Jurinea sordida	Jurinea roegneri	Ad hoc, based on Euro+Med (2024)	Jurinea roegneri
Jurinea mollis aggr.	Jurinea talijevii	Jurinea cretacea	Ad hoc, based on Euro+Med (2024)	Jurinea cretacea
Jurinea mollis aggr.	Jurinea transylvanica	Jurinea transylvanica	Ad hoc, based on Euro+Med (2024)	Jurinea transylvanica
Koeleria brevis aggr.	Koeleria brevis	Koeleria brevis	Ad hoc	Koeleria lobata
Koeleria brevis aggr.	Koeleria lobata	Koeleria lobata	Ad hoc	Koeleria lobata
Koeleria macrantha aggr.	Koeleria cristata	Koeleria cristata	Ad hoc	Koeleria cristata
Koeleria macrantha aggr.	Koeleria gracilis	Koeleria macrantha	Ad hoc	Koeleria macrantha
Koeleria macrantha aggr.	Koeleria macrantha	Koeleria macrantha	Ad hoc	Koeleria macrantha
Leontodon crispus aggr.	Leontodon asper	Leontodon biscutellifolius	Euro+Med (2024)	
Leontodon crispus aggr.	Leontodon biscutellifolius	Leontodon biscutellifolius	Euro+Med (2024)	
Leontodon crispus aggr.	Leontodon crispus	Leontodon crispus	Euro+Med (2024)	
Leontodon crispus aggr.	Leontodon crispus subsp. crispus	Leontodon crispus	Euro+Med (2024)	
Linum flavum aggr.	Linum czerniaevii	Linum pallasianum	Ad hoc, based on Didukh et al. (2021)	Linum pallasianum
Linum flavum aggr.	Linum flavum	Linum flavum	Ad hoc, based on Mosyakin & Fedoronchuk (1999)	Linum flavum
Linum flavum aggr.	Linum ucranicum	Linum ucranicum	Ad hoc, based on Mosyakin & Fedoronchuk (1999)	Linum ucranicum
Luzula campestris aggr.	Luzula campestris	Luzula campestris	Landolt et al. (2010)	
Luzula campestris aggr.	Luzula multiflora	Luzula multiflora	Landolt et al. (2010)	
Melica ciliata aggr.	Melica ciliata	Melica ciliata	Ehrendorfer (1973)	
Melica ciliata aggr.	Melica ciliata subsp. ciliata	Melica ciliata	Ehrendorfer (1973)	
Melica ciliata aggr.	Melica transsilvanica	Melica transsilvanica	Ehrendorfer (1973)	
Myosotis arvensis aggr.	Myosotis arvensis	Myosotis arvensis	Ad hoc	Myosotis arvensis
Myosotis arvensis aggr.	Myosotis discolor	Myosotis discolor	Ad hoc	Myosotis arvensis var. versicolor
Odontarrhena tortuosa aggr.	Alyssum obtusifolium	Odontarrhena obtusifolia	Ad hoc	Alyssum tortuosum subsp. obtusifolium
Odontarrhena tortuosa aggr.	Alyssum tortuosum	Odontarrhena tortuosa	Ad hoc	Odontarrhena tortuosa
Onobrychis viciifolia aggr.	Onobrychis arenaria	Onobrychis arenaria	Ehrendorfer (1973)	
Onobrychis viciifolia aggr.	Onobrychis miniata	Onobrychis arenaria subsp. miniata	Ehrendorfer (1973)	
Onobrychis viciifolia aggr.	Onobrychis tanaitica	Onobrychis arenaria	Ehrendorfer (1973)	
Onobrychis viciifolia aggr.	Onobrychis viciifolia	Onobrychis viciifolia	Ehrendorfer (1973)	
Onosma visianii aggr.	Onosma macrochaeta	Onosma visianii	Ad hoc	Onosma visianii
Onosma visianii aggr.	Onosma pseudarenaria	Onosma pseudoarenaria	Ad hoc	Onosma visianii subsp. transsilvanica
Onosma visianii aggr.	Onosma taurica	Onosma pseudoarenaria	Ad hoc	Onosma visianii subsp. transsilvanica
Onosma visianii aggr.	Onosma visianii	Onosma visianii	Ad hoc	Onosma visianii
Pilosella piloselloides aggr.	Hieracium bauhinii	Pilosella bauhini	Euro+Med (2024)	
Pilosella piloselloides aggr.	Hieracium cymanthum	Pilosella bauhini	Euro+Med (2024)	
Pilosella piloselloides aggr.	Hieracium pavichii	Hieracium pavichii	Euro+Med (2024)	
Pilosella piloselloides aggr.	Hieracium piloselloides	Hieracium piloselloides	Euro+Med (2024)	
Pilosella piloselloides aggr.	Hieracium praealtum subsp. bauhinii	Pilosella bauhini	Euro+Med (2024)	
Pimpinella saxifraga aggr.	Pimpinella major	Pimpinella major	Juillerat et al. (2017)	
Pimpinella saxifraga aggr.	Pimpinella nigra	Pimpinella nigra	Juillerat et al. (2017)	
Pimpinella saxifraga aggr.	Pimpinella saxifraga	Pimpinella saxifraga	Juillerat et al. (2017)	
Potentilla argentea aggr.	Potentilla argentea	Potentilla argentea	Ad hoc	Potentilla argentea
Potentilla argentea aggr.	Potentilla inclinata	Potentilla inclinata	Ad hoc	Potentilla argentea subsp. inclinata
Potentilla incana aggr.	Potentilla arenaria	Potentilla incana	Ad hoc, based on Didukh et al. (2021)	Potentilla incana
Potentilla incana aggr.	Potentilla incana	Potentilla incana	Ad hoc, based on Didukh et al. (2021)	Potentilla incana
Potentilla incana aggr.	Potentilla tabernaemontani	Potentilla tabernaemontani	Ad hoc, based on Didukh et al. (2021)	Potentilla tabernaemontani
Potentilla incana aggr.	Potentilla tommasiniana	Potentilla tommasiniana	Ad hoc, based on Didukh et al. (2021)	Potentilla cinerea subsp. tommasiniana
Prunella vulgaris aggr.	Prunella laciniata	Prunella laciniata	Ad hoc	Prunella vulgaris var. laciniata
Prunella vulgaris aggr.	Prunella vulgaris	Prunella vulgaris	Ad hoc	Prunella vulgaris
Psephellus marschallianus aggr.	Centaurea carbonata	Psephellus carbonatus	Ad hoc, based on Didukh et al. (2018)	Psephellus carbonatus
Psephellus marschallianus aggr.	Centaurea marschalliana	Psephellus marschallianus	Ad hoc, based on Didukh et al. (2018)	Psephellus marschallianus
Psephellus marschallianus aggr.	Centaurea sumensis	Psephellus sumensis	Ad hoc, based on Didukh et al. (2018)	Psephellus sumensis
Rosa canina aggr.	Rosa canina	Rosa canina	Landolt et al. (2010)	
Rosa canina aggr.	Rosa corymbifera	Rosa corymbifera	Landolt et al. (2010)	
Salvia pratensis aggr.	Salvia pratensis	Salvia pratensis	Ad hoc	Salvia pratensis
Salvia pratensis aggr.	Salvia stepposa	Salvia dumetorum	Ad hoc	Salvia pratensis var. dumetorum
Satureja montana aggr.	Satureja montana subsp. kitaibelii	Satureja kitaibelii	Ad hoc	Satureja montana subsp. kitaibelii
Satureja montana aggr.	Satureja taurica	Satureja taurica	Ad hoc	Satureja montana subsp. taurica
Senecio squalidus aggr.	Senecio rupestris	Senecio rupestris	Ad hoc	Senecio rupestris
Senecio squalidus aggr.	Senecio squalidus	Senecio squalidus	Ad hoc	Senecio squalidus
Sesleria rigida aggr.	Sesleria filifolia	Sesleria filifolia	Ad hoc	Sesleria rigida var. pancicii
Sesleria rigida aggr.	Sesleria rigida	Sesleria rigida	Ad hoc	Sesleria rigida
Sesleria rigida aggr.	Sesleria rigida subsp. rigida	Sesleria rigida	Ad hoc	Sesleria rigida
Silene italica aggr.	Silene italica	Silene italica	Ehrendorfer (1973)	
Silene italica aggr.	Silene italica subsp. italica	Silene italica	Ehrendorfer (1973)	
Silene italica aggr.	Silene italica subsp. nemoralis	Silene italica	Ehrendorfer (1973)	
Silene italica aggr.	Silene nemoralis	Silene nemoralis	Ehrendorfer (1973)	
Silene otites aggr.	Otites borysthenica	Silene borysthenica	Ehrendorfer (1973)	
Silene otites aggr.	Otites eugeniae	Silene eugeniae	Ad hoc	Silene eugeniae
Silene otites aggr.	Silene densiflora	Silene densiflora	Ehrendorfer (1973)	
Silene otites aggr.	Silene otites	Silene otites	Ehrendorfer (1973)	
Silene otites aggr.	Silene wolgensis	Silene wolgensis	Ehrendorfer (1973)	
Stipa zalesskii aggr.	Stipa pontica	Stipa zalesskii subsp. pontica	Ad hoc	Stipa zalesskii subsp. pontica
Stipa zalesskii aggr.	Stipa ucrainica	Stipa ucrainica	Ad hoc	Stipa zalesskii subsp. ucrainica
Stipa zalesskii aggr.	Stipa zalesskii	Stipa zalesskii	Ad hoc	Stipa zalesskii
Stipa zalesskii aggr.	Stipa zalesskyi	Stipa zalesskii	Ad hoc	Stipa zalesskii
Thymus pulegioides aggr.	Thymus chamaedrys	Thymus pulegioides subsp. chamaedrys	Ad hoc, based on Nachychko (2013)	Thymus pulegioides subsp. chamaedrys
Thymus pulegioides aggr.	Thymus comosus	Thymus comosus	Ad hoc, based on Nachychko (2013)	Thymus chamaedrys subsp. comosus
Thymus pulegioides aggr.	Thymus marschallianus	Thymus pulegioides subsp. pannonicus	Ad hoc, based on Nachychko (2013)	Thymus pulegioides subsp. pannonicus
Thymus pulegioides aggr.	Thymus pannonicus	Thymus pulegioides subsp. pannonicus	Ad hoc, based on Nachychko (2013)	Thymus pulegioides subsp. pannonicus
Thymus pulegioides aggr.	Thymus pulegioides	Thymus pulegioides	Ad hoc, based on Nachychko (2013)	Thymus pulegioides
Thymus serpyllum aggr.	Thymus austriacus	Thymus odoratissimus	Landolt et al. (2010)	
Thymus serpyllum aggr.	Thymus carpathicus	Thymus pulcherrimus	Landolt et al. (2010)	
Thymus serpyllum aggr.	Thymus dacicus	Thymus dacicus	Landolt et al. (2010)	
Thymus serpyllum aggr.	Thymus dimorphus	Thymus × dimorphus	Landolt et al. (2010)	
Thymus serpyllum aggr.	Thymus dzevanovskyi	Thymus kosteleckyanus	Landolt et al. (2010)	
Thymus serpyllum aggr.	Thymus glabrescens	Thymus odoratissimus	Landolt et al. (2010)	
Thymus serpyllum aggr.	Thymus kosteleckyanus	Thymus kosteleckyanus	Landolt et al. (2010)	
Thymus serpyllum aggr.	Thymus odoratissimus	Thymus odoratissimus	Landolt et al. (2010)	
Thymus serpyllum aggr.	Thymus praecox	Thymus praecox	Landolt et al. (2010)	
Thymus serpyllum aggr.	Thymus pulcherrimus	Thymus pulcherrimus	Landolt et al. (2010)	
Thymus serpyllum aggr.	Thymus roegneri	Thymus roegneri	Landolt et al. (2010)	
Thymus serpyllum aggr.	Thymus serpyllum	Thymus serpyllum	Landolt et al. (2010)	
Trisetum flavescens aggr.	Trisetum alpestre	Trisetum alpestre	Landolt et al. (2010)	
Trisetum flavescens aggr.	Trisetum flavescens	Trisetum flavescens	Landolt et al. (2010)	
Valeriana officinalis aggr.	Valeriana dubia	Valeriana rossica	Euro+Med (2024)	
Valeriana officinalis aggr.	Valeriana officinalis	Valeriana officinalis	Euro+Med (2024)	
Valerianella locusta aggr.	Valerianella coronata	Valerianella coronata	Landolt et al. (2010)	
Valerianella locusta aggr.	Valerianella dentata	Valerianella dentata	Landolt et al. (2010)	
Valerianella locusta aggr.	Valerianella locusta	Valerianella locusta	Landolt et al. (2010)	
Valerianella locusta aggr.	Valerianella mixta	Valerianella dentata	Landolt et al. (2010)	
Valerianella locusta aggr.	Valerianella rimosa	Valerianella rimosa	Landolt et al. (2010)	
Veronica austriaca aggr.	Veronica austriaca subsp. dentata	Veronica austriaca	Ehrendorfer (1973)	
Veronica austriaca aggr.	Veronica jacquinii	Veronica austriaca subsp. jacquinii	Ehrendorfer (1973)	
Veronica austriaca aggr.	Veronica austriaca	Veronica austriaca	Ehrendorfer (1973)	
Veronica austriaca aggr.	Veronica prostrata	Veronica prostrata	Ehrendorfer (1973)	
Veronica austriaca aggr.	Veronica teucrium	Veronica austriaca subsp. teucrium	Ehrendorfer (1973)	
Veronica spicata aggr.	Pseudolysimachion orchideum	Veronica orchidea	Landolt et al. (2010)	
Veronica spicata aggr.	Pseudolysimachion spicatum	Veronica spicata	Landolt et al. (2010)	
Veronica spicata aggr.	Veronica orchidea	Veronica orchidea	Landolt et al. (2010)	
Veronica spicata aggr.	Veronica spicata	Veronica spicata	Landolt et al. (2010)	
Veronica spicata aggr.	Veronica spicata subsp. spicata	Veronica spicata	Landolt et al. (2010)	
Veronica spuria aggr.	Veronica bachofenii	Veronica bachofenii	Landolt et al. (2010)	
Veronica spuria aggr.	Veronica spuria	Veronica spuria	Landolt et al. (2010)	
Veronica verna aggr.	Veronica dillenii	Veronica dillenii	Ehrendorfer (1973)	
Veronica verna aggr.	Veronica verna	Veronica verna	Ehrendorfer (1973)	
Viola tricolor aggr.	Viola arvensis	Viola arvensis	Ehrendorfer (1973)	
Viola tricolor aggr.	Viola kitaibeliana	Viola kitaibeliana	Ehrendorfer (1973)	
Viola tricolor aggr.	Viola matutina	Viola tricolor subsp. matutina	Ehrendorfer (1973)	
Viola tricolor aggr.	Viola tricolor	Viola tricolor	Ehrendorfer (1973)	
Viola tricolor aggr.	Viola tricolor subsp. saxatilis	Viola tricolor subsp. alpestris	Ehrendorfer (1973)	
Viola tricolor aggr.	Viola tricolor subsp. subalpina	Viola tricolor subsp. alpestris	Ehrendorfer (1973)	
Viola tricolor aggr.	Viola tricolor subsp. tricolor	Viola tricolor subsp. tricolor	Ehrendorfer (1973)	

Supplement E2. Life forms, Grime's strategy for the species list used in the analysis.

Anhang E2. Lebensformen, Grime's Strategie für die Artenliste, die in der Analyse genutzt wurden.

Species name	Life formes	Grime' strategy
Acanthus hungaricus	hem	C
Acer campestre	pha	C
Acer negundo	pha	CR
Acer platanoides	pha	C
Acer pseudoplatanus	pha	C
Acer tataricum	pha	C
Achillea coarctata	hem	C
Achillea crithmifolia	hem	C
Achillea millefolium aggr.	hem	C
Achillea nobilis	hem	C
Achnatherum splendens	hem	CS
Aconitum anthora	hem	C
Aconitum moldavicum	hem	C
Adonis vernalis	hem	C
Adonis volgensis	hem	C
Aegilops triuncialis	the	R
Agrimonia eupatoria aggr.	hem	C
Agrimonia repens	hem	C
Agropyron cristatum aggr.	hem	CS
Agrostis capillaris	hem	CS
Ailanthus altissima	pha	CRS
Ajuga chamaepitys	the	RS
Ajuga genevensis	hem	C
Ajuga laxmannii	hem	C
Alchemilla jailae	hem	C
Alliaria petiolata	hem	CR
Allium ascalonicum	geo	R
Allium atroviolaceum	geo	CS
Allium delicatulum	geo	S
Allium denudatum	geo	S
Allium ericetorum	geo	S
Allium flavum	geo	CS
Allium inaequale	geo	CS
Allium inderiense	geo	CS
Allium lineare	geo	CS
Allium lusitanicum aggr.	geo	CS
Allium marschalianum	geo	CS
Allium moschatum	geo	S
Allium obliquum	geo	S
Allium oleraceum	geo	RS
Allium paniculatum aggr.	geo	S
Allium podolicum	geo	S
Allium rotundum	geo	CS
Allium saxatile	geo	S
Allium schoenoprasum	geo	CS
Allium sp.	geo	CS
Allium sphaerocephalon	geo	CS
Allium tulipifolium	geo	CS
Alopecurus vaginatus	hem	CS
Alyssum alyssoides	the	RS
Alyssum lenense	cha	CS
Alyssum montanum aggr.	hem	CS
Alyssum turkestanicum	the	RS
Amaranthus retroflexus	the	R
Amelanchier ovalis	pha	R
Anabasis cretacea	cha	S
Anabasis salsa	cha	SRS
Anacamptis morio	geo	CS
Anacamptis pyramidalis	geo	C
Anagallis arvensis	the	R
Androsace elongata	the	CR
Androsace maxima	the	CR
Androsace septentrionalis	the	RS
Androsace villosa	cha	CS
Anemone nemorosa	geo	CR
Anemone ranunculoides	geo	C
Anemone sylvestris	hem	C
Anisantha rigida	the	RCS
Anisantha tectorum	the	R
Antennaria dioica	cha	CS
Anthemis arvensis	the	CR
Anthericum ramosum	geo	CS
Anthoxanthum odoratum	hem	CR
Anthyllis vulneraria aggr.	hem	CS
Aquilegia subscaposa	hem	C
Aquilegia vulgaris	hem	C
Arabidopsis arenosa	hem	RS
Arabidopsis petraea	hem	S
Arabidopsis thaliana	the	RS
Arabis auriculata	the	CR
Arabis hirsuta	hem	CR
Arabis procurrens	cha	CS
Arabis sagittata	hem	CR
Arabis sp.	hem	
Archanthemis trotzkiana	cha	S
Arenaria koriniana	hem	CS
Arenaria procera	hem	CS
Arenaria rigida	hem	CS
Arenaria serpyllifolia aggr.	the	RS
Aristolochia clematitis	geo	CS
Aristolochia pallida	geo	CS
Arrhenatherum elatius	hem	CR
Artemisia absinthium	hem	CRS
Artemisia alba	cha	CS
Artemisia alpina	cha	S
Artemisia austriaca	cha	CS
Artemisia campestris	hem	CS
Artemisia dracunculus	hem	C
Artemisia hololeuca	cha	S
Artemisia lerchiana	cha	CS
Artemisia lessingiana	cha	S
Artemisia nitrosa	cha	CS
Artemisia nutans	cha	S
Artemisia salsoloides	cha	S
Artemisia santonicum	cha	CS
Artemisia semiarida	cha	CS
Artemisia taurica	cha	CS
Artemisia terrae-albae	cha	CS
Asarum europaeum	geo	C
Asparagus inderiensis	hem	CS
Asparagus officinalis	geo	CS
Asparagus tenuifolius	geo	C
Asperula arvensis	the	S
Asperula capitata	hem	S
Asperula cretacea	cha	S
Asperula cynanchica	hem	CS
Asperula montana	cha	CS
Asperula purpurea	hem	S
Asperula supina	cha	S
Asperula taurica	hem	CS
Asperula tenella	hem	CS
Asperula tephrocarpa	cha	S
Asperula tinctoria	hem	C
Asphodeline lutea	geo	CS
Asphodeline taurica	geo	CS
Asplenium ceterach	hem	S
Asplenium ruta-muraria	hem	S
Asplenium septentrionale	hem	S
Asplenium trichomanes	hem	S
Asplenium viride	hem	S
Aster alpinus	hem	CS
Aster amellus	hem	C
Astragalus aktiubensis	cha	S
Astragalus albicaulis	cha	CS
Astragalus austriacus	hem	CS
Astragalus brachylobus	cha	CS
Astragalus buchtormensis	hem	CS
Astragalus cornutus	cha	CS
Astragalus danicus	hem	C
Astragalus glaucus	cha	CS
Astragalus glycyphyllos	hem	C
Astragalus kustanaicus	cha	S
Astragalus leontinus	hem	CS
Astragalus medius	cha	CS
Astragalus monspessulanus	hem	CS
Astragalus onobrychis	hem	CS
Astragalus ponticus	hem	CS
Astragalus pseudoglaucus	cha	CS
Astragalus roemeri	hem	CS
Astragalus rupifragus	cha	S
Astragalus stenoceras	cha	S
Astragalus storozhevae	cha	CS
Astragalus subarcuatus	cha	S
Astragalus subuliformis	cha	CS
Astragalus sulcatus	hem	CS
Astragalus temirensis	cha	CS
Astragalus tenuifolius	cha	CS
Astragalus testiculatus	hem	CS
Astragalus varius	cha	CS
Astragalus vesicarius aggr.	cha	CS
Asyneuma canescens	hem	C
Atocion armeria	the	RS
Atraphaxis decipiens	cha	S
Atraphaxis frutescens	cha	S
Atraphaxis replicata	cha	S
Atraphaxis spinosa	cha	S
Aurinia petraea	hem	S
Aurinia saxatilis	hem	S
Avenula pubescens	hem	C
Barbarea vulgaris	hem	RS
Bassia prostrata	cha	CS
Bellidiastrum michelii	hem	CS
Berberis vulgaris	pha	CR
Berteroa incana	the	CRS
Betula pendula	pha	CRS
Biscutella laevigata	hem	CS
Bothriochloa ischaemum	hem	CS
Botrychium lunaria	geo	CS
Brachypodium pinnatum	hem	C
Brassica elongata	hem	S
Briza media	hem	C
Bromopsis benekenii	hem	CS
Bromopsis cappadocica	hem	CS
Bromopsis erecta	hem	CS
Bromopsis inermis	hem	C
Bromopsis pannonica	hem	C
Bromopsis ramosa	hem	C
Bromopsis riparia	hem	CS
Bromus arvensis	the	R
Bromus commutatus	the	R
Bromus hordeaceus	the	R
Bromus japonicus	the	RS
Bromus squarrosus	the	R
Buglossoides arvensis	the	R
Bupleurum falcatum	hem	CS
Bupleurum longifolium	hem	CS
Bupleurum pachnospermum	the	RS
Calamagrostis arundinacea	hem	C
Calamagrostis epigejos	hem	CS
Calamagrostis sp.	hem	
Calamagrostis varia	hem	C
Camelina microcarpa	the	CRS
Campanula bononiensis	hem	C
Campanula carpatica	hem	CS
Campanula crassipes	hem	S
Campanula glomerata	hem	C
Campanula lingulata	hem	CS
Campanula patula	hem	C
Campanula persicifolia	hem	C
Campanula rapunculoides	hem	C
Campanula rotundifolia aggr.	hem	CS
Campanula sibirica	hem	CS
Campanula trachelium	hem	C
Camphorosma monspeliaca	cha	R
Capsella bursa-pastoris	the	CR
Caragana balchaschensis	npha	CS
Caragana frutex	npha	C
Carduus acanthoides	the	R
Carduus candicans	hem	CR
Carduus collinus	hem	CS
Carduus defloratus	hem	CS
Carduus nutans	hem	CR
Carex alba	hem	CS
Carex brevicollis	hem	C
Carex caryophyllea	hem	C
Carex cespitosa	hem	C
Carex digitata	hem	C
Carex filiformis	hem	C
Carex flacca	hem	C
Carex halleriana	hem	C
Carex humilis	hem	CS
Carex liparocarpos	hem	CS
Carex michelii	hem	C
Carex montana	hem	CS
Carex muricata aggr.	hem	C
Carex ornithopoda	hem	CS
Carex pediformis	hem	CS
Carex praecox	hem	CRS
Carex supina	hem	CS
Carlina acanthifolia subsp. utzka	hem	CS
Carlina acaulis	hem	CS
Carlina biebersteinii	hem	R
Carlina sp.	hem	
Carlina vulgaris	hem	R
Centaurea atropurpurea	hem	CS
Centaurea diffusa	hem	R
Centaurea jacea	hem	C
Centaurea orientalis	hem	CS
Centaurea ovina aggr.	hem	S
Centaurea reichenbachii	hem	CS
Centaurea scabiosa	hem	C
Centaurea sterilis	hem	CS
Centaurea stoebe aggr.	hem	CS
Centaurea trichocephala	hem	CS
Centaurea triniifolia	hem	CS
Centaurium erythraea	the	CR
Centaurium pulchellum	the	CRS
Cephalanthera rubra	geo	C
Cephalaria coriacea	hem	CS
Cephalaria radiata	hem	CS
Cephalaria uralensis	hem	CS
Cerastium arvense	hem	CR
Cerastium banaticum	hem	S
Cerastium biebersteinii	cha	CS
Cerastium brachypetalum	the	R
Cerastium fontanum	hem	CS
Cerastium glomeratum	the	CS
Cerastium pumilum	the	CRS
Cerastium semidecandrum	the	RS
Ceratocarpus arenarius	the	CRS
Ceratocephala falcata	the	R
Cerinthe minor	hem	RS
Chelidonium majus	hem	CR
Cherleria langii	cha	S
Chondrilla juncea	hem	CRS
Chrysanthemum zawadskii	hem	S
Chrysopogon gryllus	hem	C
Cicerbita muralis	hem	C
Cichorium intybus	hem	CR
Cirsium acaule	hem	CR
Cirsium erisithales	hem	CS
Cirsium pannonicum	hem	C
Clausia aprica	hem	CS
Cleistogenes serotina	hem	CS
Clematis integrifolia	hem	C
Clematis vitalba	pha	C
Clinopodium acinos	the	R
Clinopodium alpinum	cha	R
Clinopodium menthifolium	hem	S
Clinopodium suaveolens	hem	S
Clinopodium vulgare	hem	C
Consolida regalis	the	R
Convallaria majalis	geo	C
Convolvulus arvensis	geo	CR
Convolvulus calvertii subsp. calverti	cha	S
Convolvulus cantabrica	cha	CS
Convolvulus fruticulosus	cha	CS
Convolvulus lineatus	cha	CS
Convolvulus sericocephalus	cha	S
Cornus mas	pha	C
Cornus sanguinea	pha	C
Coronilla coronata	hem	CS
Coronilla scorpioides	the	CRS
Coronilla vaginalis	cha	CS
Corydalis cava	geo	C
Corydalis solida	geo	C
Corylus avellana	pha	C
Cota tinctoria	hem	CS
Cotinus coggygria	pha	CS
Cotoneaster integerrimus aggr.	pha	CS
Cotoneaster sp.	pha	
Cousinia astracanica	cha	S
Crambe tataria aggr.	cha	CS
Crataegus laevigata	pha	C
Crataegus monogyna	pha	C
Crataegus rhipidophylla	pha	C
Crepis foetida	the	R
Crepis jacquinii	hem	C
Crepis neglecta	the	RS
Cruciata glabra	hem	CS
Cruciata taurica	cha	CS
Crupina vulgaris	the	RS
Cuscuta campestris	the	R
Cuscuta epithymum aggr.	the	RCS
Cuscuta europaea	the	CR
Cuscuta sp.	the	
Cyanus pinnatifidus	hem	S
Cyanus triumfettii	hem	CS
Cynodon dactylon	geo	CRS
Cynoglottis barrelieri	hem	CS
Cynosurus cristatus	hem	C
Cystopteris fragilis	hem	CS
Cytisus albus	pha	CS
Cytisus austriacus	pha	CS
Cytisus blockianus	pha	CS
Cytisus graniticus	pha	CS
Cytisus hirsutus aggr.	cha	CS
Cytisus paczoskii	pha	C
Cytisus podolicus	pha	CS
Cytisus procumbens	cha	CS
Cytisus sp.	cha	
Dactylis glomerata	hem	C
Dactylorhiza sambucina	geo	C
Danthonia alpina	hem	CS
Daphne cneorum	cha	CS
Daucus carota	hem	CR
Deschampsia cespitosa	hem	C
Descurainia sophia	the	R
Dianthus carthusianorum aggr.	hem	C
Dianthus giganteus	hem	CS
Dianthus henteri	hem	CS
Dianthus lanceolatus	hem	C
Dianthus nitidus	hem	C
Dianthus petraeus aggr.	hem	CR
Dianthus plumarius	hem	CS
Dianthus praecox	hem	CS
Dianthus pseudarmeria	the	RS
Dianthus ramosissimus	cha	CS
Dichoropetalum carvifolia	hem	C
Dictamnus albus aggr.	hem	CS
Digitalis grandiflora	hem	C
Diplotaxis cretacea	hem	S
Diplotaxis muralis	the	CR
Diplotaxis tenuifolia	hem	CR
Doronicum columnae	hem	CS
Dorycnium pentaphyllum	cha	CS
Draba aizoides	hem	S
Draba cuspidata	cha	S
Draba lasiocarpa	hem	S
Draba nemorosa	the	CRS
Draba podolica	hem	S
Draba verna	the	RS
Dracocephalum austriacum	hem	CS
Drymocallis geoides	hem	S
Echinops bannaticus	hem	CS
Echinops ritro	hem	CS
Echinops sphaerocephalus	hem	CS
Echium vulgare	hem	CRS
Edraianthus graminifolius	hem	CS
Elymus caninus	hem	C
Elytrigia caespitosa subsp. nodosa	hem	CS
Elytrigia intermedia	geo	C
Elytrigia repens	geo	C
Elytrigia stipifolia	hem	C
Elytrigia strigosa	hem	CS
Ephedra distachya	cha	CS
Epipactis atrorubens	geo	C
Eremopyrum triticeum	the	CRS
Eremurus spectabilis	geo	CS
Erigeron acris	hem	CR
Erigeron canadensis	the	CR
Eriosynaphe longifolia	cha	CS
Erodium cicutarium	the	RS
Erucastrum nasturtiifolium	hem	R
Eryngium campestre	hem	C
Eryngium planum	hem	C
Erysimum canum	hem	CRS
Erysimum comatum	hem	CS
Erysimum cretaceum	hem	S
Erysimum cuspidatum	hem	CRS
Erysimum diffusum	hem	R
Erysimum leptostylum	hem	CS
Erysimum odoratum	hem	CS
Erysimum rhaeticum	hem	RS
Erysimum sp.	hem	
Erysimum talijevii	hem	S
Erysimum ucrainicum	hem	S
Erysimum witmannii	hem	S
Euonymus verrucosus	pha	C
Euphorbia agraria	hem	CR
Euphorbia amygdaloides	hem	C
Euphorbia angulata	hem	C
Euphorbia cyparissias	hem	C
Euphorbia epithymoides	hem	C
Euphorbia esula	hem	CR
Euphorbia myrsinites	cha	S
Euphorbia nicaeensis	hem	S
Euphorbia petrophila	hem	S
Euphorbia seguieriana	hem	CS
Euphorbia semivillosa	hem	C
Euphorbia stricta	the	CR
Euphrasia hirtella	the	CR
Euphrasia rostkoviana	the	CRS
Euphrasia salisburgensis	the	CR
Euphrasia stricta aggr.	the	CR
Euphrasia taurica	the	CRS
Fagus sylvatica	pha	C
Falcaria vulgaris	hem	CS
Fallopia convolvulus	the	RS
Fallopia dumetorum	the	RS
Ferula caspica	hem	S
Ferula tatarica	hem	CS
Ferulago campestris	hem	C
Ferulago sylvatica	hem	C
Ferulago taurica	hem	CS
Festuca cretacea	hem	CS
Festuca glauca	hem	CS
Festuca heterophylla	hem	CS
Festuca ovina aggr.	hem	C
Festuca pallens	hem	CS
Festuca rubra	hem	CS
Festuca valesiaca aggr.	hem	C
Filago arvensis	the	RS
Filago germanica	the	RS
Filipendula vulgaris	hem	C
Fragaria moschata	hem	C
Fragaria vesca	hem	C
Fragaria viridis	hem	C
Frangula alnus	pha	C
Fraxinus excelsior	pha	C
Fraxinus lanceolata	pha	
Fraxinus ornus	pha	C
Fritillaria orientalis	geo	S
Fumana procumbens	cha	CS
Fumaria officinalis	the	R
Gagea bulbifera	geo	CS
Gagea pratensis	geo	C
Gagea pusilla	geo	C
Galanthus nivalis	geo	C
Galatella angustissima	hem	CS
Galatella linosyris	hem	C
Galatella tatarica	hem	CS
Galatella villosa	hem	CS
Galeopsis angustifolia	the	R
Galeopsis ladanum	the	R
Galitzkya spathulata	hem	S
Galium album	hem	CS
Galium anisophyllon	hem	RS
Galium aparine	the	CR
Galium baillonii	hem	CS
Galium biebersteinii	hem	CS
Galium boreale	hem	C
Galium cracoviense	hem	S
Galium glaucum	hem	CS
Galium humifusum	hem	RS
Galium mollugo aggr.	hem	C
Galium octonarium	hem	CS
Galium pumilum aggr.	hem	C
Galium transcarpaticum	hem	CS
Galium verum aggr.	hem	CS
Galium volhynicum	hem	CS
Genista albida	cha	CS
Genista januensis	cha	S
Genista pilosa	cha	CS
Genista sagittalis	cha	C
Genista scythica	cha	CS
Genista tetragona	cha	S
Genista tinctoria aggr.	cha	CS
Gentiana clusii	hem	CS
Gentiana cruciata	hem	C
Gentianella lutescens	hem	CRS
Geranium columbinum	the	R
Geranium lucidum	the	CRS
Geranium pusillum	the	R
Geranium robertianum	the	CRS
Geranium rotundifolium	the	R
Geranium sanguineum	hem	C
Geranium sp.	hem	
Geranium sylvaticum	hem	C
Geum urbanum	hem	CR
Glechoma hederacea	hem	CR
Glechoma hirsuta	hem	C
Globularia bisnagarica	hem	CS
Goniolimon rubellum	hem	CS
Goniolimon speciosum	hem	CS
Goniolimon tataricum aggr.	hem	CS
Gymnadenia conopsea	geo	CS
Gymnadenia odoratissima	geo	CS
Gymnocarpium robertianum	geo	CS
Gypsophila altissima	hem	CS
Gypsophila collina	cha	CS
Gypsophila diffusa	cha	S
Gypsophila fastigiata	hem	CR
Gypsophila glomerata	hem	S
Gypsophila muralis	the	CS
Gypsophila oligosperma	hem	CS
Gypsophila pallasii	hem	S
Gypsophila paniculata	hem	CRS
Gypsophila petraea	cha	S
Gypsophila repens	cha	S
Gypsophila rupestris	cha	S
Gypsophila thyraica	cha	CS
Haplophyllum suaveolens	hem	CS
Hedysarum argyrophyllum	cha	CS
Hedysarum candidum	hem	CS
Hedysarum cretaceum	hem	CS
Hedysarum grandiflorum	hem	CS
Hedysarum polychromum	cha	CS
Hedysarum razoumovianum	cha	CS
Hedysarum tscherkassovae	cha	S
Hedysarum ucrainicum	hem	S
Helianthemum alpestre	cha	CS
Helianthemum canum aggr.	cha	CS
Helianthemum nummularium	cha	CS
Helianthemum orientale	cha	CS
Helianthemum salicifolium	the	CR
Helianthemum sp.	cha	
Helichrysum arenarium	hem	CS
Helichrysum graveolens	hem	CS
Helictochloa hookeri subsp. schellia	hem	C
Helictotrichon decorum	hem	CS
Helictotrichon desertorum	hem	CS
Helleborus odorus	hem	C
Hepatica nobilis	hem	C
Hesperis tristis	hem	CR
Hieracium bifidum	hem	C
Hieracium bupleuroides	hem	CS
Hieracium lachenalii aggr.	hem	CR
Hieracium laevigatum	hem	CS
Hieracium maculatum	hem	CR
Hieracium murorum	hem	C
Hieracium ramosum	hem	
Hieracium rotundatum	hem	
Hieracium sabaudum	hem	CS
Hieracium schmidtii	hem	CS
Hieracium sp.	hem	
Hieracium sparsum	hem	
Hieracium substellatum subsp. simo	hem	
Hieracium umbellatum	hem	CS
Hieracium villosum	hem	S
Hieracium virgicaule	hem	
Hieracium virosum	hem	CS
Hierochloe odorata aggr.	hem	CR
Hippocrepis comosa	hem	CS
Hippocrepis emerus	cha	CS
Holosteum umbellatum	the	RS
Hornungia petraea	the	RS
Humulus lupulus	hem	CRS
Hyacinthella leucophaea	geo	CS
Hylotelephium maximum	hem	CS
Hypericum elegans	hem	C
Hypericum montanum	hem	C
Hypericum perforatum	hem	CR
Hypericum tauricum	hem	CS
Hypochaeris radicata	hem	C
Hypochoeris maculata	hem	C
Hyssopus officinalis	cha	S
Iberis saxatilis	cha	CS

Species name	Life formes	Grime' strategy
Inula britannica	hem	C
Inula conyzae	hem	C
Inula ensifolia	hem	CS
Inula hirta	hem	C
Inula oculus-christi	hem	C
Inula salicina aggr.	hem	C
Inula spiraeifolia	hem	C
Ionopsidium abulense	the	S
Iris aphylla	hem	CS
Iris pontica	geo	C
Iris pumila aggr.	hem	CS
Iris reichenbachii	geo	CS
Iris ruthenica	hem	CS
Iris variegata	geo	CR
Isatis costata	hem	RS
Isatis gymnocarpa	the	R
Isatis tinctoria aggr.	hem	CS
Isolirion tataricum	geo	S
Jacobaea erucifolia	hem	C
Jacobaea vulgaris	hem	RS
Jovibarba globifera	cha	S
Jovibarba heuffelii	cha	S
Juglans regia	pha	CR
Juniperus communis	pha	CS
Juniperus sabina	pha	CS
Juniperus sp.	pha	
Jurinea kirghisorum	cha	S
Jurinea mollis aggr.	hem	CS
Jurinea mugodsharica	cha	S
Jurinea multiflora	hem	CS
Jurinea stoechadifolia	cha	CS
Kernera saxatilis	hem	S
Klasea cardunculus	hem	CS
Klasea erucifolia	hem	CS
Klasea radiata	hem	C
Knautia arvensis	hem	C
Knautia kitaibelii	hem	S
Koeleria brevis aggr.	hem	CS
Koeleria glauca	hem	C
Koeleria grandis	hem	C
Koeleria macrantha aggr.	hem	C
Koeleria pyramidata	hem	C
Koeleria sclerophylla	hem	C
Koeleria talievii	hem	CS
Krascheninnikovia ceratoides	cha	S
Lactuca perennis	hem	CR
Lactuca quercina	hem	CR
Lactuca serriola	hem	CR
Lactuca viminea	hem	CR
Lamium amplexicaule	the	R
Lamium galeobdolon	cha	C
Lamium maculatum	hem	C
Lamium purpureum	the	CR
Lappula barbata	the	R
Lappula microcarpa	the	R
Lappula patula	the	R
Lappula squarrosa	the	R
Laserpitium krapfii	hem	S
Laserpitium latifolium	hem	C
Lathyrus nissolia	the	C
Lathyrus pannonicus	hem	C
Lathyrus pratensis	hem	C
Lathyrus sphaericus	the	R
Lathyrus vernus	geo	C
Lembotropis nigricans	pha	CS
Leontodon crispus aggr.	hem	CS
Leontodon hispidus	hem	CS
Leontodon incanus	hem	CS
Leontopodium nivale subsp. alpinum	hem	S
Leonurus quinquelobatus	hem	C
Lepidium campestre	hem	CR
Lepidium coronopifolium	hem	CR
Lepidium draba	geo	CR
Lepidium meyeri	cha	S
Lepidium perfoliatum	the	RS
Leucanthemum vulgare	hem	C
Leymus akmolinensis	hem	S
Ligularia carpathica	hem	C
Ligustrum vulgare	pha	C
Lilium martagon	geo	C
Limonium cretaceum	cha	S
Limonium meyeri	cha	CS
Limonium sp.	hem	
Limonium suffruticosum	cha	CS
Linaria angustissima	hem	RS
Linaria cretacea	geo	S
Linaria genistifolia	hem	S
Linaria incompleta	hem	S
Linaria macroura	hem	CRS
Linaria vulgaris	hem	CRS
Linum austriacum	hem	CS
Linum catharticum	the	CR
Linum flavum aggr.	cha	CS
Linum hirsutum	hem	CS
Linum nervosum	hem	CS
Linum perenne	hem	CRS
Linum tauricum	cha	CS
Linum tenuifolium	hem	CRS
Linum trigynum	the	CRS
Linum ucranicum	cha	CS
Lithospermum officinale	hem	CR
Litwinowia tenuissima	the	RS
Lolium perenne	hem	CR
Lomelosia argentea	hem	CRS
Lomelosia isetensis	cha	S
Lomelosia micrantha	the	RS
Lomelosia rotata	the	RS
Lotus corniculatus	hem	C
Luzula campestris aggr.	hem	C
Malva thuringiaca	hem	CR
Marrubium peregrinum	hem	CRS
Marrubium vulgare	hem	RS
Matthiola fragrans	cha	S
Matthiola odoratissima	cha	S
Matthiola tatarica	cha	S
Medicago falcata	hem	CS
Medicago lupulina	the	CR
Medicago minima	the	CR
Medicago monspeliaca	the	RS
Medicago prostrata	hem	C
Medicago rupestris	cha	S
Medicago sativa	hem	C
Melampyrum arvense	the	R
Melampyrum barbatum	the	R
Melampyrum bihariense	the	C
Melampyrum cristatum	the	C
Melampyrum nemorosum	the	C
Melica ciliata aggr.	hem	CS
Melilotus albus	hem	RS
Melilotus officinalis	hem	R
Melilotus sp.	hem	
Melilotus sulcatus	the	R
Meniocus linifolius	the	RS
Mercurialis perennis aggr.	hem	C
Minuartia glomerata	the	CRS
Minuartia hirsuta	cha	CS
Minuartia rubra	the	RS
Minuartia setacea	cha	S
Minuartia sp.	cha	
Minuartia verna	cha	S
Misopates orontium	the	R
Moehringia muscosa	hem	CS
Muscari comosum	geo	CS
Muscari neglectum	geo	CS
Muscari tenuiflorum	geo	CS
Myosotis alpestris	hem	CS
Myosotis arvensis aggr.	the	R
Myosotis lithospermifolia	hem	C
Myosotis ramosissima	the	CRS
Myosotis sparsiflora	the	CR
Myosotis stricta	the	R
Myosotis sylvatica	hem	C
Nanophyton erinaceum	cha	S
Neotinea ustulata	geo	C
Nepeta cataria	hem	CR
Nepeta nuda	hem	CR
Nepeta ucranica	hem	CR
Noccaea kovatsii	hem	RS
Noccaea perfoliata	the	RS
Nonea pulla	hem	RS
Odontarrhena muralis	hem	CS
Odontarrhena tortuosa aggr.	hem	CS
Odontites luteus	the	CRS
Odontites vernus	the	CR
Odontites vulgaris	the	CR
Onobrychis jailae	hem	CS
Onobrychis viciifolia aggr.	hem	CS
Ononis pusilla	hem	CS
Ononis spinosa	hem	C
Onosma arenaria	hem	CS
Onosma heterophylla	hem	CS
Onosma polyphylla	cha	S
Onosma rigida	hem	CS
Onosma simplicissima	hem	CS
Onosma staminea	cha	S
Onosma tinctoria	hem	CS
Onosma visianii aggr.	hem	CS
Ophrys insectifera	geo	C
Orchis simia	geo	C
Origanum vulgare	hem	CR
Orlaya grandiflora	the	S
Ornithogalum collinum	geo	C
Ornithogalum fischerianum	geo	C
Ornithogalum pyrenaicum	geo	CS
Ornithogalum umbellatum	geo	C
Orobanche alba	geo	CS
Orobanche caryophyllacea	geo	CS
Orobanche elatior	geo	CS
Orobanche lutea	geo	CRS
Orobanche sp.	geo	C
Orobanche teucrii	geo	CS
Otites sp.	hem	CRS
Oxalis acetosella	geo	C
Oxytropis pilosa	hem	C
Paeonia tenuifolia	hem	CS
Palimbia turgaica	hem	CS
Papaver dubium	the	RS
Paronychia cephalotes	hem	CS
Pedicularis comosa	hem	S
Pedicularis interrupta	hem	S
Pedicularis kaufmannii	hem	C
Pedicularis physocalyx	cha	CS
Pedicularis sibthorpii	hem	C
Peltaria alliacea	hem	CRS
Petrorhagia prolifera	the	CRS
Petrorhagia saxifraga	the	CRS
Peucedanum austriacum	hem	CS
Peucedanum cervaria	hem	C
Peucedanum oreoselinum	hem	C
Peucedanum ruthenicum	hem	CS
Phegopteris connectilis	geo	CS
Phleum montanum	hem	C
Phleum phleoides	hem	C
Phleum pratense	hem	C
Phlomis herba-venti subsp. pungens	hem	C
Phlomis tuberosa	hem	C
Phyteuma orbiculare	hem	C
Phyteuma spicatum	hem	C
Picea abies	pha	C
Picris hieracioides	hem	RS
Pilosella cymosa	hem	CS
Pilosella echioides	hem	CS
Pilosella hoppeana	hem	C
Pilosella lactucella	hem	C
Pilosella leptophyton	hem	C
Pilosella officinarum	hem	CS
Pilosella piloselloides aggr.	hem	CS
Pilosella sp.	hem	
Pimpinella saxifraga aggr.	hem	CS
Pimpinella tragium	cha	CS
Pinguicula alpina	hem	CS
Pinus nigra	pha	C
Pinus sylvestris	pha	C
Piptatherum holciforme	hem	CS
Piptatherum virescens	hem	C
Plantago argentea	hem	CS
Plantago lanceolata	hem	C
Plantago maritima subsp. ciliata	hem	CS
Plantago media	hem	C
Plantago tenuiflora	the	CRS
Platanthera bifolia	geo	C
Poa alpina	hem	CS
Poa angustifolia	hem	C
Poa badensis	hem	CS
Poa bulbosa	hem	RS
Poa compressa	hem	RS
Poa molinerii	hem	CS
Poa nemoralis	hem	C
Poa pannonica	hem	C
Poa pratensis	hem	C
Poa sterilis	hem	CS
Poa versicolor	hem	CS
Polycnemum arvense	the	CRS
Polygala amara	hem	C
Polygala comosa	hem	C
Polygala cretacea	hem	CS
Polygala major	hem	CS
Polygala sibirica	hem	CS
Polygala supina	hem	CS
Polygala vulgaris	hem	C
Polygonatum multiflorum	geo	C
Polygonatum odoratum	geo	C
Polygonum aviculare	the	R
Polypodium vulgare	geo	CS
Potentilla alba	hem	C
Potentilla argentea aggr.	hem	CS
Potentilla astracanica	hem	CS
Potentilla aurea	hem	C
Potentilla grandiflora	hem	C
Potentilla heptaphylla	hem	CS
Potentilla humifusa	hem	CS
Potentilla incana aggr.	hem	CS
Potentilla inclinata	hem	CS
Potentilla patula	hem	C
Potentilla pusilla	hem	C
Potentilla recta	hem	C
Potentilla sp.	hem	
Potentilla thuringiaca	hem	C
Prangos ferulacea	hem	CS
Primula acaulis	hem	C
Primula auricula	hem	S
Primula elatior	hem	C
Primula sp.	hem	C
Primula veris	hem	C
Prunella grandiflora	hem	C
Prunella vulgaris aggr.	hem	C
Prunus armeniaca	pha	CR
Prunus avium	pha	CR
Prunus fruticosa	pha	CR
Prunus mahaleb	pha	CRS
Prunus spinosa	pha	CR
Prunus tenella	pha	CS
Psathyrostachys juncea	hem	S
Psathyrostachys lanuginosa	hem	S
Psephellus declinatus	hem	CS
Psephellus marschallianus aggr.	hem	CS
Psephellus trinervius	hem	CS
Pseudopodospermum hispanicum	hem	C
Pseudosedum lievenii	cha	S
Pseudoturritis turrita	hem	C
Puccinellia distans	hem	CS
Pulsatilla halleri	hem	CS
Pulsatilla montana	hem	CS
Pulsatilla patens	hem	C
Pulsatilla pratensis	hem	C
Pulsatilla sp.	hem	C
Pulsatilla vulgaris	hem	C
Pyrus communis	pha	CR
Quercus cerris	pha	CS
Quercus petraea	pha	CS
Quercus pubescens	pha	CS
Ranunculus breyninus	hem	C
Ranunculus bulbosus	geo	C
Ranunculus illyricus	geo	C
Ranunculus montanus	hem	C
Ranunculus polyanthemos	hem	C
Rapistrum perenne	hem	RS
Reseda lutea	hem	RS
Reseda phyteuma	the	RS
Rhammatophyllum pachyrhizum	hem	RS
Rhamnus cathartica	pha	CRS
Rhamnus saxatilis subsp. tinctoria	pha	CS
Rhamnus sp.	pha	
Rhaponticoides kasakorum	cha	S
Rhaponticoides ruthenica	hem	CS
Rhaponticoides talievii	hem	CS
Rhinanthus angustifolius	the	CR
Rhinanthus minor	the	R
Rhinanthus rumelicus	the	R
Rindera tetraspis	hem	CS
Rochelia disperma subsp. retorta	the	RS
Rosa canina aggr.	pha	CR
Rosa gallica	pha	C
Rosa micrantha	pha	CS
Rosa mollis	pha	C
Rosa pendulina	pha	C
Rosa rubiginosa	pha	C
Rosa sp.	pha	
Rosa spinosissima	pha	CS
Rosa tomentosa	pha	C
Rubus canescens	pha	CR
Rubus silesiacus	pha	CR
Rumex acetosa	hem	C
Rumex acetosella	hem	CRS
Salix caprea	pha	C
Salsola tamariscina	the	RS
Salsola tragus	the	RS
Salvia nemorosa	hem	C
Salvia nutans	hem	CS
Salvia pratensis aggr.	hem	C
Salvia scabiosifolia	cha	CS
Salvia verbenaca	hem	C
Salvia verticillata	hem	CRS
Sanguisorba minor	hem	CS
Sanguisorba officinalis	hem	C
Saponaria bellidifolia	hem	CS
Saponaria glutinosa	the	CS
Satureja montana aggr.	cha	S
Saxifraga adscendens	hem	S
Saxifraga marginata	cha	S
Saxifraga paniculata	hem	S
Saxifraga tridactylites	the	RS
Scabiosa canescens	hem	CS
Scabiosa columbaria	hem	C
Scabiosa lucida	hem	CS
Scabiosa ochroleuca	hem	C
Schedonorus arundinaceus	hem	CS
Schedonorus pratensis	hem	C
Scleranthus annuus	the	CRS
Scleranthus perennis	hem	CRS
Scorzonera laciniata	hem	CRS
Scorzonera mollis	hem	C
Scorzonera purpurea	hem	C
Scorzoneroides autumnalis	hem	C
Scrophularia cretacea	cha	S
Scrophularia heterophylla subsp. lac	hem	S
Scrophularia rupestris	cha	S
Scutellaria albida	hem	S
Scutellaria orientalis	cha	S
Scutellaria supina	cha	S
Securigera elegans	hem	CRS
Securigera varia	hem	C
Sedum acre	cha	CS
Sedum album	cha	CS
Sedum annuum	the	RS
Sedum hispanicum	the	S
Sedum rubens	the	S
Sedum rupestre	cha	S
Sedum sexangulare	cha	CS
Selaginella helvetica	cha	CS
Selinum silaifolium	hem	CS
Sempervivum marmoreum	cha	S
Sempervivum ruthenicum	cha	CS
Sempervivum tectorum	cha	S
Senecio glaucus subsp. coronopifolius	the	R
Senecio leucanthemifolius subsp. ve	the	RS
Senecio sp.	hem	
Senecio squalidus aggr.	hem	RS
Senecio umbrosus	hem	C
Seseli annuum	hem	CR
Seseli campestre	hem	S
Seseli dichotomum	hem	S
Seseli eriocephalum	hem	S
Seseli glabratum	cha	S
Seseli gracile	hem	CS
Seseli gummiferum	cha	S
Seseli hippomarathrum	hem	S
Seseli lehmannii	hem	S
Seseli leucospermum	hem	S
Seseli libanotis	hem	CS
Seseli osseum	hem	CS
Seseli pallasii	hem	CS
Seseli rigidum	hem	S
Seseli sp.	hem	
Seseli tortuosum	hem	CS
Sesleria caerulea	hem	CS
Sesleria heuflerana	hem	CS
Sesleria rigida aggr.	hem	C
Setaria pumila	the	R
Setaria viridis	the	R
Sherardia arvensis	the	RS
Sideritis montana	the	CS
Sideritis taurica	cha	CS
Silene antri-jovis	cha	S
Silene bupleuroides	hem	CS
Silene chlorantha	hem	C
Silene cretacea	cha	S
Silene csereii	hem	RS
Silene flavescens	hem	S
Silene italica aggr.	hem	CS
Silene latifolia	hem	CRS
Silene nutans	hem	C
Silene otites aggr.	hem	CRS
Silene procumbens	hem	CS
Silene sp.	hem	
Silene supina	cha	CS
Silene viridiflora	hem	C
Silene viscaria	hem	C
Silene viscosa	the	CS
Silene vulgaris	hem	CR
Silene zawadzkii	hem	S
Sisymbrium loeselii	the	R
Sisymbrium polymorphum	the	CS
Solanum nigrum	the	R
Solidago virgaurea	hem	CS
Sonchus asper	the	R
Sorbus aria	pha	C
Sorbus aucuparia	pha	C
Sorbus dacica	pha	C
Sorbus graeca	pha	CS
Spiraea chamaedryfolia	pha	C
Spiraea crenata	pha	CS
Spiraea hypericifolia	pha	CS
Spiraea media	pha	C
Stachys germanica	hem	C
Stachys officinalis	hem	C
Stachys recta	hem	CS
Sterigmostemum caspicum	cha	S
Stipa capillata	hem	C
Stipa eriocaulis	hem	CS
Stipa lessingiana	hem	CS
Stipa pennata	hem	CS
Stipa pulcherrima	hem	CS
Stipa sareptana	hem	CS
Stipa tirsa	hem	C
Stipa zalesskii aggr.	hem	CS
Syringa vulgaris	pha	R
Takhtajaniantha austriaca	hem	CS
Takhtajaniantha crispa	hem	CS
Takhtajaniantha pusilla	hem	S
Tanacetum achilleifolium	hem	CS
Tanacetum corymbosum	hem	C
Tanacetum kittaryanum	cha	CS
Tanacetum millefolium	hem	CS
Tanacetum santolina	hem	CS
Taraxacum sect. Dioszegia	hem	CR
Taraxacum sect. Erythrocarpa	hem	CS
Taraxacum sect. Erythrosperma	hem	CR
Taraxacum sect. Macrocornuta	hem	CR
Taraxacum sect. Piesis	hem	CR
Taraxacum sect. Scariosa	hem	CR
Taraxacum sect. Taraxacum	hem	CR
Taraxacum sp.	hem	
Taxus baccata	pha	C
Teesdalia nudicaulis	the	RS
Tephroseris integrifolia	hem	CS
Teucrium botrys	the	RS
Teucrium chamaedrys	cha	CS
Teucrium montanum	cha	CS
Teucrium polium	cha	CS
Thalictrum foetidum	hem	CS
Thalictrum minus	hem	C
Thalictrum simplex	hem	C
Thesium alpinum	hem	S
Thesium brachyphyllum	hem	CS
Thesium linophyllon	hem	C
Thesium procumbens	hem	CS
Thesium ramosum	hem	CS
Thesium sp.	hem	
Thlaspi arvense	the	CR
Thymelaea passerina	the	CR
Thymus calcareus	cha	CS
Thymus guberlinensis	cha	S
Thymus moldavicus	cha	S
Thymus pulegioides aggr.	cha	C
Thymus serpyllum aggr.	cha	CS
Thymus sp.	cha	
Thymus tauricus	cha	CS
Tilia cordata	pha	C
Tilia platyphyllos	pha	C
Tofieldia calyculata	hem	CS
Torilis japonica	the	CR
Tragopogon dasyrhynchus	hem	CRS
Tragopogon dubius	hem	CRS
Tragopogon marginifolius	hem	S
Tragopogon pratensis	hem	C
Tragopogon ruber	hem	S
Trifolium alpestre	hem	C
Trifolium ambiguum	hem	C
Trifolium arvense	the	CRS
Trifolium aureum	the	CR
Trifolium campestre	the	CR
Trifolium dubium	the	CRS
Trifolium montanum	hem	C
Trifolium pratense	hem	C
Trifolium repens	hem	C
Trifolium rubens	hem	C
Trigonella gladiata	the	RS
Trinia glauca	hem	C
Trinia multicaulis	hem	C
Trisetum flavescens aggr.	hem	C
Tulipa biflora	geo	CS
Tulipa sp.	geo	CS
Tulipa suaveolens	geo	CS
Tulipa sylvestris	geo	C
Turritis glabra	hem	CR
Tussilago farfara	geo	CRS
Tulipa scythica	geo	CS
Ulmus minor	pha	C
Ulmus sp.	pha	C
Urtica dioica	hem	CR
Vaccinium myrtillus	cha	CS
Valeriana montana	hem	S
Valeriana officinalis aggr.	hem	C
Valeriana stolonifera	hem	C
Valeriana tripteris	hem	CS
Valerianella locusta aggr.	the	R
Ventenata dubia	the	RS
Verbascum chaixii	hem	CR
Verbascum lychnitis	hem	CR
Verbascum marschallianum	hem	R
Verbascum nigrum	hem	CR
Verbascum phlomoides	hem	CR
Verbascum phoeniceum	hem	CS
Verbascum speciosum	hem	RS
Verbascum thapsus	hem	CR
Veronica arvensis	the	R
Veronica austriaca aggr.	hem	C
Veronica biloba	the	RS
Veronica chamaedrys	hem	C
Veronica fruticans	cha	CS
Veronica incana	hem	CS
Veronica multifida	hem	CS
Veronica spicata aggr.	hem	C
Veronica spuria aggr.	hem	C
Veronica taurica	hem	CS
Veronica triphyllos	the	RS
Veronica verna aggr.	the	R
Veronica vindobonensis	hem	C
Viburnum lantana	pha	C
Viburnum opulus	pha	C
Vicia cracca	hem	C
Vicia hirsuta	the	CR
Vicia sativa subsp. nigra	the	R
Vicia serratifolia	hem	R
Vicia tetrasperma	the	CR
Vinca herbacea	cha	CS
Vincetoxicum hirundinaria	hem	CS
Vincetoxicum pannonicum	hem	C
Vincetoxicum scandens	hem	C
Vincetoxicum schmalhausenii	hem	CS
Viola altaica subsp. oreades	hem	CS
Viola ambigua	hem	CS
Viola collina	hem	C
Viola hirta	hem	C
Viola jooi	hem	CS
Viola odorata	hem	C
Viola rupestris	hem	CS
Viola tricolor aggr.	hem	R
Xeranthemum annuum	the	RS
Xeranthemum cylindraceum	the	RS
Zygophyllum pinnatum	cha	S

Supplement E3. Algorithm of the Grime's triangle construction.

Anhang E3 Algorithmus zur Konstruktion des Grime-Dreiecks.

1. **Calculating the indices of CRS using the formulas**:

Ss=S + (CS/2) + (SR/2) + (CRS/3); Cc=C + (CS/2) + (CR/2) + (CRS/3); Rr=R + (CR/2) + (RS/2) + CRS/3)

S is the sum of species with expressed stress-tolerant strategies, C is the sum of species with expressed concurrent strategies, and R is the sum of species with expressed ruderal strategies. The sum values are considered in full.

CS is the sum of simultaneous competitors and stress-tolerant species, CR is the sum of simultaneous competitors and ruderal species, SR is the sum of simultaneous stress-tolerant and ruderal species, and RS is the sum of simultaneous ruderal and stress-tolerant species. The sum values are divided into two.

CRS is the sum of species more or less balanced features of all three strategy types. The sum values are divided into three.

Ss is the sum of all species exhibiting traits of the stress-tolerant strategy, Cc is the sum of all species exhibiting traits of the competitive strategy, and Rr is the sum of all species exhibiting traits of the ruderal strategy.

2. **Calculating the ratios between the indicators:** Ss: Cc, Rr: Cc, Ss: Rr, proportions of C: S: R = 1.0: X: Y, where X and Y are the proportions of S and R relative to C=1.

3. **Displaying the indicators (in percentages) of species ratios on the sides of the Grime triangle, where the vertices correspond to 100%:**

- On the C–S side, the point for Cc = 100*Cc / (Cc + Ss), and thus the position for Ss = 100-Cc.
- On the C–R side, the position for Rr = 100*Rr / (Rr + Cc), and thus the point for Cc = 100-Rr.
- On the S–R side, the position for Ss = 100*Ss/ (Ss + Rr), and thus the point for Rr = 100-Ss.

The points are plotted on the sides of the triangle and connected. Such a representation becomes an object of further analysis, which we illustrated with specific results.

4. **Determining the "centre of mass" of the triangle based on the mean values of the indicators.** The "centre" corresponds to point N (x, y), whose coordinates are located at the intersection of its medians. As is known, the point where the medians intersect divides each median in a ratio of 2:1, starting from the vertex. For this, the indicators of the vertices are projected onto the X-axis (coinciding with the lower side of the triangle) and the Y-axis, which are assigned corresponding values. Then, the position of the "centre of mass" is calculated using the formulas:

- $x=x_1+x_2+x_3 /3$
- $y=y_1+y_2+y_3 /3$

These points can be constructed graphically. The obtained positions are overlaid onto the Grime triangle, which shows nine fields and a complex transitional zone configuration (CRS). Additionally, fields are highlighted where descriptions cannot fall (horizontal hatching).

Supplement E4. Full synoptic table showing the percentage constancy and fidelity of species of the six clusters. Diagnostic species are ordered by decreasing fidelity measured with the phi-coefficient. Species with a phi-value greater than 0.3 are considered diagnostic and shaded by light grey colour; species with a phi-value greater than 0.5 are considered highly diagnostic and shaded by dark grey colour. Species that are highly diagnostic or diagnostic in one cluster are accepted as diagnostic for associations; species that are highly diagnostic or diagnostic in more than one cluster are accepted as diagnostic for high-rank syntaxa

Anhang E4. Vollständige synoptische Tabelle mit der prozentualen Stetigkeit und Treue der Arten der sechs Cluster. Diagnostische Arten sind nach abnehmender Treue, gemessen am *Phi*-Koeffizienten, sortiert. Arten mit einem Phi-Wert über 0,3 gelten als diagnostisch und sind hellgrau hinterlegt; Arten mit einem *Phi*-Wert über 0,5 gelten als hochdiagnostisch und sind dunkelgrau hinterlegt. Arten, die in einem Cluster hochdiagnostisch oder diagnostisch sind, gelten als diagnostisch für Assoziationen; Arten, die in mehr als einem Cluster hochdiagnostisch oder diagnostisch sind, gelten als diagnostisch für hochrangige Syntaxa.

ID clusters	1	2	3	4	5	6	7	8	9	10	11	12	13
Number of relevés	35	11	73	243	92	280	116	290	196	61	111	80	55
All. Anabasio cretaceae-Agropyrion desertori													
Astragalus kustanaicus	63	.	.	.	.	.	.	.	.	.	.	.	.
Bassia prostrata	89	9	19	5	2	2	.	.	.	.	.	1	.
Sterigmostemum caspicum	69	9	7	.	.	.	.	.	.	.	.	.	.
Galatella tatarica	57	.	4	.	.	.	.	.	.	.	.	.	.
Krascheninnikovia ceratoides	63	.	7	5	3	1	.	.	.	.	.	.	.
Tulipa scythica	49	.	5	.	.	.	.	.	.	.	.	.	.
Lappula microcarpa	63	.	27	.	.	.	.	.	.	.	.	.	.
Allium tulipifolium	43	.	7	.	.	.	.	.	.	.	.	.	.
Tulipa biflora	37	.	1	.	.	.	.	.	.	.	.	.	.
Tulipa sylvestris	37	.	1	.	.	.	.	.	.	.	.	.	.
Tragopogon ruber	40	.	5	.	.	.	.	.	.	.	.	.	.
Taraxacum sect. *Macrocornuta*	31	.	1	.	.	.	.	.	.	.	.	.	.
Isatis gymnocarpa	29	.	.	.	.	.	.	.	.	.	.	.	.
Meniocus linifolius	37	.	10	.	.	1	.	.	.	.	.	.	.
Asparagus inderiensis	34	.	7	.	.	.	.	.	.	.	.	.	.
Stipa sareptana	46	18	12	.	.	.	.	.	.	.	.	.	.
Litwinowia tenuissima	23	.	.	.	.	.	.	.	.	.	.	.	.
Caragana balchaschensis	23	.	1	.	.	.	.	.	.	.	.	.	.
Poa bulbosa	40	.	4	1	.	5	7	.	1	.	5	6	.
Palimbia turgaica	23	.	3	.	.	.	.	.	.	.	.	.	.
Ferula caspica	23	.	3	.	.	.	.	.	.	.	.	.	.
Rindera tetraspis	31	18	.	.	.	.	.	.	.	.	.	.	.
Artemisia semiarida	31	18	3	.	.	.	.	.	.	.	.	.	.
Gagea bulbifera	17	.	.	.	.	.	.	.	.	.	.	.	.
Allium lineare	17	.	.	.	.	.	.	.	.	.	.	.	.
Pseudosedum lievenii	17	.	.	.	.	.	.	.	.	.	.	.	.
Limonium meyeri	17	.	.	.	.	.	.	.	.	.	.	.	.
Rochelia disperma subsp. *retorta*	17	.	.	.	.	.	.	.	.	.	.	.	.
Anabasis salsa	23	9	.	.	.	.	.	.	.	.	.	.	.
Artemisia lessingiana	29	.	21	.	.	.	.	.	.	.	.	.	.
Astragalus tenuiremis	14	.	.	.	.	.	.	.	.	.	.	.	.
Tulipa suaveolens	14	.	.	.	.	.	.	.	.	.	.	.	.
Filago arvensis	14	.	.	.	.	.	.	.	.	.	.	.	.
Eriosynaphe longifolia	14	.	.	.	.	.	.	.	.	.	.	.	.
Klasea erucifolia	14	.	.	.	.	.	.	.	.	.	.	.	.
Linaria incompleta	20	.	7	.	.	.	.	.	.	.	.	.	.
Artemisia lerchiana	37	18	33	2	.	1	.	.	.	.	.	.	.
Androsace maxima	17	.	5	.	.	.	.	.	.	.	.	.	.
Takhtajaniantha pusilla	11	.	.	.	.	.	.	.	.	.	.	.	.
Allium inderiense	11	.	.	.	.	.	.	.	.	.	.	.	.
Silene viscosa	11	.	.	.	.	.	.	.	.	.	.	.	.
Isolirion tataricum	11	.	.	.	.	.	.	.	.	.	.	.	.
Ornithogalum fischerianum	11	.	.	.	.	1	.	.	.	.	.	.	.
Allium saxatile	14	.	4	.	.	.	.	.	.	.	.	.	.
Artemisia nitrosa	14	.	4	.	.	.	.	.	.	.	.	.	.
Astragalus rupifragus	11	.	1	.	.	.	.	.	.	.	.	.	.
All. Sileno fruticulosae-Nanophyton erinacei													
Matthiola tatarica	.	100	.	.	.	.	.	.	.	.	.	.	.
Gypsophila diffusa	.	100	.	.	.	.	.	.	.	.	.	.	.
Onosma staminea	.	91	.	.	.	.	.	.	.	.	.	.	.
Nanophyton erinaceum	11	91	18	.	.	.	.	.	.	.	.	.	.
Atraphaxis spinosa	.	64	.	.	.	.	.	.	.	.	.	.	.
Atraphaxis replicata	3	64	.	.	.	.	.	.	.	.	.	.	.
Artemisia terrae-albae	3	64	.	.	.	.	.	.	.	.	.	.	.
Galium humifusum	.	64	.	1	.	3	.	1	1	.	.	3	.
Lepidium meyeri	.	73	25	4	.	.	.	.	.	.	.	.	.
Silene antri-jovis	.	55	4	.	.	.	.	.	.	.	.	.	.
Lomelosia isetensis	6	73	25	.	.	.	.	.	.	.	.	.	.
Astragalus medius	3	36	1	.	.	.	.	.	.	.	.	.	.
Ephedra distachya	34	73	47	.	9	3	.	.	.	.	.	.	.
Astragalus stenoceras	.	27	.	.	.	.	.	.	.	.	.	.	.
Rhammatophyllum pachyrhizum	.	27	1	.	.	.	.	.	.	.	.	.	.
Limonium suffruticosum	3	27	.	.	.	.	.	.	.	.	.	.	.
Convolvulus fruticulosus	.	18	.	.	.	.	.	.	.	.	.	.	.
Echinops ritro	23	45	41	5	4	14	.	.	9	.	.	1	.
All. Anthemido trotzkianae-Artemision salsoloidis													
Archanthemis trotzkiana	6	.	90	.	.	.	.	.	.	.	.	.	.
Zygophyllum pinnatum	.	9	67	.	.	.	.	.	.	.	.	.	.
Atraphaxis decipiens	.	.	48	.	.	.	.	.	.	.	.	.	.
Astragalus tenuifolius	23	.	56	.	.	.	.	.	.	.	.	.	.
Hedysarum tscherkassovae	3	.	36	.	.	.	.	.	.	.	.	.	.
Jurinea kirghisorum	.	.	25	.	.	.	.	.	.	.	.	.	.
Gypsophila rupestris	.	.	21	.	.	.	.	.	.	.	.	.	.
Hedysarum razoumovianum	3	.	18	.	.	.	.	.	.	.	.	.	.
Galium octonarium	9	.	27	9	1	5	.	.	.	.	.	.	.
Gypsophila altissima	.	.	12	1	.	.	.	.	.	.	.	.	.
Atraphaxis frutescens	.	.	14	2	.	.	.	.	.	.	.	.	.
Crambe tatarica aggr.	11	.	22	3	.	2	.	.	.	.	.	.	.
Psephellus marschallianus aggr.	34	.	36	5	34	34	.	.	2	.	1	1	.
All. Sileno supinae-Artemision hololeucae													
Hyssopus officinalis	.	.	.	81	8	10	.	.	.	.	.	.	.
Scrophularia cretacea	.	.	.	52	13	6	.	.	.	.	.	.	.
Artemisia hololeuca	.	.	.	48	4	12	.	.	.	.	.	.	.
Festuca cretacea	.	.	.	18	1	1	.	.	.	.	.	.	.
Plantago maritima subsp. *ciliata*	.	.	.	16	.	6	.	.	.	.	.	.	.
All. Euphorbio cretophilae-Thymion cretacei													
Euphorbia petrophila	.	.	.	7	84	5	10	.	.	.	.	.	.
Jurinea brachycephala	.	.	1	.	73	7	1	.	3	.	.	.	.
Hedysarum grandiflorum	.	.	1	2	32	10	.	.	.	.	.	.	.
Reseda lutea	.	.	1	23	55	38	14	1	1	.	4	1	.
Genista scythica	.	.	.	.	20	1	.	.	.	.	.	.	.
Onosma simplicissima	3	.	11	14	49	38	.	.	.	.	.	.	.
Odontarrhena tortuosa aggr.	6	.	33	2	38	9	14	.	.	.	.	.	.
Rhaponticoides taliewii	.	.	.	.	11	.	.	.	.	.	.	.	.
All. Centaureo carbonatae-Koelerion talievii													
Bromopsis riparia	.	.	.	2	8	35	.	3	1	.	.	.	.
Polygala sibirica	.	.	.	6	1	33	.	.	2	.	1	1	.
Viola ambigua	.	.	.	1	5	33	3	.	1	.	1	.	.
Koeleria talievii	.	.	.	7	1	34	.	.	.	.	.	.	.
Stipa pennata	.	.	.	2	1	33	.	1	9	.	2	3	.
Salvia nutans	.	.	.	1	29	39	.	.	4	.	1	1	.
Euphorbia seguieriana	34	9	10	25	8	64	27	.	4	.	.	9	.
Polygala cretacea	.	.	.	1	26	9	36	.	.	.	.	.	.
Astragalus albicaulis	.	.	.	.	23	12	32	.	.	1	.	.	.
Astragalus austriacus	.	.	.	1	1	10	20	.	.	5	.	1	.
Euphorbia nicaeensis	.	.	.	.	9	3	21	1	.	3	.	.	1
***Seseli leucospermum-Fumana procumbens* grasslands**													
Seseli leucospermum	.	.	.	.	.	.	44	.	.	.	.	.	.
Fumana procumbens	.	.	.	.	1	.	65	.	19	.	11	.	5
Paronychia cephalotes	.	.	.	.	.	3	41	2	.	5	.	1	.
Bromopsis cappadocica	.	.	.	1	2	1	34	.	.	.	.	.	.
Allium moschatum	.	.	.	.	.	.	28	.	.	1	.	.	.
Minuartia setacea	.	.	.	.	7	.	58	5	1	.	17	20	5
Alyssum montanum aggr.	.	.	.	.	.	4	50	5	16	.	7	8	.
Thymus tauricus	.	.	.	.	.	.	28	.	.	.	.	.	.
Genista albida	.	.	.	.	.	2	26	.	1	.	2	.	.
Asperula supina	.	.	.	1	1	1	26	.	.	.	.	.	.
Helianthemum canum aggr.	.	.	.	4	38	14	73	13	22	.	11	21	5
Takhtajaniantha crispa	.	.	.	.	.	.	22	.	.	.	.	.	.
Carex liparocarpos	.	.	.	.	.	.	20	.	.	.	.	.	.
Odontites luteus	.	.	.	13	16	6	47	1	.	.	14	8	.
Sideritis taurica	.	.	.	.	.	.	19	.	.	.	.	.	.
Chrysopogon gryllus	.	.	.	.	.	.	24	2	.	.	6	.	.
Stipa eriocaulis	.	.	.	.	.	.	19	2	1	.	1	.	.
Anthyllis vulneraria aggr.	.	.	.	.	.	1	56	7	38	.	16	13	42
Stipa pulcherrima	.	.	.	.	1	8	31	2	8	2	5	1	2
Cerastium semidecandrum	.	.	.	.	.	.	16	.	.	.	1	4	.
Veronica taurica	.	.	.	.	.	.	13	.	.	.	5	.	.
Iberis saxatilis	.	.	.	.	.	.	13	.	.	.	.	1	.
Draba lasiocarpa	.	.	.	.	.	.	26	1	10	.	5	.	.
Takhtajaniantha austriaca	.	.	.	.	.	.	30	1	26	.	3	1	4
Convolvulus calvertii subsp. *calvertii*	.	.	.	.	.	.	12	.	.	.	.	.	.
Koeleria brevis aggr.	.	.	.	.	1	1	14	.	.	.	.	.	.
Cruciata taurica	.	.	.	.	1	1	13	.	.	.	.	.	.
Potentilla astracanica	.	.	.	.	.	.	13	.	.	1	.	.	.
Linum tenuifolium	.	.	.	5	25	4	44	2	38	.	7	4	2
Potentilla recta	.	.	.	.	.	2	3	22	8	.	.	.	1
All. Seslerion rigidae													
Helictotrichon decorum	.	.	.	.	.	.	.	51	.	.	1	3	.
Sesleria rigida aggr.	.	.	.	.	.	.	2	37	1	.	2	.	1
Dianthus petraeus aggr.	.	.	.	.	.	.	.	29	.	.	.	.	.
Galium album	.	.	.	1	.	1	16	55	4	.	4	5	24
Sedum hispanicum	.	.	.	.	.	.	.	32	.	10	3	1	.
Selinum silaifolium	.	.	.	.	.	.	.	19	.	.	.	.	.
Fragaria viridis	.	.	.	.	.	1	.	20	2	.	1	.	1
Cyanus pinnatifidus	.	.	.	.	.	.	.	14	.	.	.	2	.
Seseli gracile	.	.	.	.	.	.	.	19	1	.	.	6	.
Arabidopsis arenosa	.	.	.	.	.	.	.	31	7	5	1	16	13
Aconitum anthora	.	.	.	.	.	.	.	14	1	.	.	4	.
***Sesleria caerulea-Leontodon incanus* grasslands**													
Sesleria caerulea	.	.	.	.	.	.	.	2	51	.	3	.	7
Leontodon incanus	.	.	.	.	.	.	.	1	53	.	5	.	15
Anthericum ramosum	.	.	.	.	7	14	14	11	77	.	27	35	11
Inula ensifolia	.	.	.	.	1	1	19	22	62	.	3	20	6
Genista pilosa	.	.	.	.	.	.	10	1	39	25	3	.	.
Potentilla heptaphylla	.	.	.	.	.	.	.	2	26	.	1	.	7
Hippocrepis comosa	.	.	.	.	.	.	1	3	29	.	1	.	3
Gypsophila glomerata	.	.	.	.	.	.	.	.	14	.	1	.	.
Phyteuma orbiculare	.	.	.	.	.	.	.	9	19	.	2	.	1
Clinopodium alpinum	.	.	.	.	.	.	20	26	.	2	.	3	.
Biscutella laevigata	.	.	.	.	.	.	8	11	25	.	4	2	4
Pilosella piloselloides aggr.	.	.	.	.	.	.	6	4	28	3	16	6	2
All. Asplenio septentrionalis-Festucion pallentis													
Asplenium septentrionale	.	.	.	.	.	.	.	.	2	69	.	1	.
Minuartia hirsuta	.	.	.	.	.	.	.	.	2	62	.	3	1
Seseli osseum	.	.	.	.	.	.	13	37	97	41	.	15	.
Poa pannonica	.	.	.	.	.	.	.	3	4	.	.	.	.
Thymus serpyllum aggr.	.	.	.	1	1	53	9	4	8	50	8	16	.
Asplenium trichomanes	.	.	.	.	.	.	.	28	1	43	5	8	16
Spiraea media	.	.	.	.	.	.	4	1	21	.	3	.	.
Valeriana officinalis aggr.	.	.	.	.	.	.	11	4	25	.	2	.	.
Iris variegata	.	.	.	.	.	.	.	2	1	16	7	.	.
All. Bromo pannonici-Festucion pallentis													
Allium flavum	.	.	.	4	1	17	20	26	66	6	11	.	.
Artemisia alba	.	.	.	.	.	.	1	1	.	22	1	.	.
Orlaya grandiflora	.	.	.	.	.	.	1	1	.	21	.	.	.
Melica ciliata aggr.	.	.	.	2	.	1	18	42	18	18	61	16	22
Poa badensis	.	.	.	.	.	.	20	4	7	.	35	4	5
Sedum sexangulare	.	.	.	.	.	.	5	14	6	.	32	5	24
Sedum album	.	.	.	.	.	.	3	5	10	.	33	18	.
Eryngium campestre	.	.	.	1	2	4	5	1	.	.	23	3	.
Bromus squarrosus	.	.	.	.	.	.	.	.	1	.	21	.	.
Festuca ovina aggr.	.	.	.	2	1	2	3	.	.	19	2	1	.
Cladonia foliacea	.	.	.	.	.	.	.	.	1	.	19	4	.
Galium mollugo aggr.	.	.	.	.	1	12	6	.	25	3	9	.	.
Orobanche caryophyllacea	.	.	.	.	.	.	.	.	.	.	11	.	.
All. Galio campanulati-Poion versicoloris													
Syntrichia ruralis	.	.	.	.	.	1	.	.	1	.	.	29	6
Abietinella abietina	.	.	.	.	.	.	.	1	.	.	.	30	4
Cladonia pyxidata	.	.	.	.	.	.	.	.	.	.	1	26	6
Brachythecium albicans	.	.	.	.	.	.	.	.	.	.	.	20	.
Poa versicolor	.	.	.	.	.	.	.	.	.	.	.	18	.
Collema sp.	.	.	.	.	.	.	.	.	.	.	.	16	.
Thymus pulegioides aggr.	.	.	.	1	.	1	22	51	17	2	42	71	58
Buckia vaucheri	.	.	.	.	.	.	.	.	.	.	.	14	4
Artemisia campestris	.	.	.	1	3	.	7	5	5	7	2	14	8
Xanthoria elegans	.	.	.	.	.	.	.	.	.	.	.	13	.
***Linum catharticum-Galium cracoviense* grasslands**													
Linum catharticum	.	.	.	.	.	.	.	4	14	.	.	.	35
Tortella tortuosa	.	.	.	.	.	.	.	1	2	.	2	1	31
Galium cracoviense	.	.	.	.	.	.	.	.	.	.	.	.	20
Encalypta streptocarpa	.	.	.	.	.	.	.	.	.	.	.	1	18
Achillea millefolium aggr.	.	.	.	.	.	16	.	16	5	2	7	6	42
Allium lusitanicum aggr.	.	.	.	.	.	.	4	22	13	10	36	51	.
Potentilla pusilla	.	.	.	.	.	.	.	16	10	3	4	16	36
Poa compressa	.	.	.	11	4	19	.	6	1	2	13	40	.
Juniperus communis	.	.	.	.	.	.	.	2	8	.	.	.	22
Campanula rotundifolia aggr.	.	.	.	.	.	.	.	2	4	.	2	.	22
Festuca pallens	.	.	.	.	.	42	51	58	62	44	38	85	.
Pilosella officinarum	.	.	.	.	1	7	.	6	8	4	.	33	.
Arabis hirsuta	.	.	.	.	.	.	.	17	4	.	5	.	23
Scabiosa ochroleuca	.	.	.	7	10	29	3	9	28	7	29	36	62
Medicago lupulina	.	.	.	.	.	.	.	1	2	.	5	.	13
Teucrium botrys	.	.	.	.	.	.	.	.	.	.	.	.	13
Silene nutans	.	.	.	.	.	.	.	12	2	.	1	.	13
Clinopodium acinos	.	.	.	.	4	16	9	5	13	.	32	39	53
Hieracium murorum	.	.	.	.	.	.	.	.	1	.	3	.	11
Ord. *Anabasietalia cretaceae*													
Agropyron cristatum aggr.	94	.	52	1	.	.	.	.	.	6	.	.	.
Psathyrostachys juncea	49	.	38	1	.	.	.	.	.	.	.	.	.
Anabasis cretacea	46	100	6	.	.	.	.	.	.	.	.	.	.
Seseli glabratum	14	82	89	.	.	.	.	.	.	.	.	.	.
Ord. *Thymo cretacei-Hyssopetalia cretacei*													
Pimpinella titanophila	.	.	.	4	86	83	58	16	.	.	.	.	.
Asperula tephrocarpa	.	.	.	.	62	55	48	25	.	.	.	.	.
Teucrium polium	.	.	.	.	2	75	68	28	2	.	.	.	.
Linum flavum aggr.	.	.	.	.	44	48	48	4	4	1	.	2	.
Thymus calcareus	.	.	.	.	70	87	83	5	.	.	8	2	.
Gypsophila oligosperma	.	.	.	.	57	71	66	.	.	.	.	.	.
??? Cl. *Helianthemo-Thymetea*													
Matthiola fragrans	3	.	82	45	10	6	.	.	.	.	.	.	.
Artemisia salsoloides	9	.	74	33	53	15	.	.	.	.	.	.	.
Cephalaria uralensis	9	.	60	60	70	29	.	.	2	.	8	.	.
Brassica elongata	23	.	23	14	38	17	.	.	.	.	.	.	.
Silene supina	.	2	.	28	22	20	25	.	.	.	.	.	.
Linaria cretacea	3	9	8	10	5	1	.	.	.	.	.	.	.
Rhaponticoides ruthenica	.	.	.	1	8	47	6	.	.	.	.	.	.
Erysimum diffusum	6	.	3	3	15	23	2	1	.	.	.	.	.
Convolvulus lineatus	3	.	.	5	12	8	1	.	.	.	.	.	.
Ord. *Stipo pulcherrimae-Festucetalia pallentis*													
Globularia bisnagarica	.	.	.	.	.	.	52	.	46	5	1	.	.
Teucrium montanum	.	.	.	.	.	.	82	40	91	.	25	.	.
Carex humilis	.	.	.	2	3	44	78	21	91	.	44	35	16
Asplenium ruta-muraria	.	.	.	.	.	.	.	50	6	.	34	29	69
Helianthemum nummularium	.	.	.	1	2	3	29	60	2	57	13	34	.
Jovibarba globifera	.	.	.	.	.	.	2	1	31	85	51	1	67
Potentilla incana aggr.	.	.	.	.	1	8	22	27	33	89	80	53	35
Cl. *Festuco-Brometea*													
Euphorbia cyparissias	.	.	.	.	1	9	47	67	31	82	63	80	.
Asperula cynanchica	.	.	.	7	14	13	28	10	30	16	41	16	35
Vincetoxicum hirundinaria	.	.	.	2	21	31	6	45	41	13	8	5	.
Jurinea mollis aggr.	.	.	.	7	1	4	1	6	.	.	.	.	.
Teucrium chamaedrys	.	.	.	.	3	30	46	51	26	46	.	.	.
Thalictrum minus	.	.	.	.	.	23	26	7	3	.	13	5	.
Campanula sibirica	.	.	.	5	35	44	14	38	27	9	29	.	.
Festuca valesiaca aggr.	9	.	7	9	5	51	41	16	12	23	46	43	5
Stachys recta	.	.	.	3	5	26	22	38	14	8	52	39	27
Bupleurum falcatum	.	.	.	16	18	45	15	9	36	2	25	44	4
Arenaria serpyllifolia aggr.	.	.	.	.	.	.	6	4	8	.	38	20	16
Centaurea stoebe aggr.	.	.	.	.	.	8	2	17	.	18	9	4	.
Medicago falcata	3	.	1	5	7	29	6	3	9	.	33	11	7
Bothriochloa ischaemum	.	.	.	.	.	1	22	3	16	7	9	.	5
Stipa capillata	3	.	3	4	15	44	30	.	2	.	7	2	.
Linaria genistifolia	.	.	.	4	1	9	.	10	4	8	.	10	21
Koeleria macrantha aggr.	9	.	1	4	11	14	30	14	10	21	46	29	2
Silene otites aggr.	14	.	.	.	.	1	.	.	.	6	1	.	.
Stipa lessingiana	14	.	21	4	4	13	18	1	.	.	.	.	.

ID clusters	1	2	3	4	5	6	7	8	9	1	11	12	13
Number of relevés	35	11	73	243	92	280	116	290	196	61	111	80	55
Other taxa occurred in the communities													
Acanthus hungaricus	.	.	.	.	.	.	.	1	.	.	.	.	.
Acer campestre	.	.	.	.	.	.	.	1	.	.	.	.	.
Acer negundo	.	.	.	1	.	1	.	.	.	.	.	.	.
Acer platanoides	.	.	.	.	.	.	.	.	.	.	1	.	.
Acer pseudoplatanus	.	.	.	.	.	.	.	1	.	.	.	.	.
Acer tataricum	.	.	.	.	.	1	.	.	.	.	.	.	.
Achillea coarctata	.	.	.	.	.	.	.	3	.	.	1	.	.
Achillea crithmifolia	.	.	.	.	.	.	.	2	.	.	.	.	.
Achillea nobilis	.	.	1	1	1	2	1	.	1	8	5	.	2
Achnatherum splendens	3	.	.	.	.	.	.	.	.	.	.	.	.
Aconitum moldavicum	.	.	.	.	.	.	.	2	.	.	.	.	.
Adonis vernalis	.	.	.	.	1	7	3	.	2	.	2	3	.
Adonis volgensis	6	.	3	.	1	3	.	.	.	.	.	.	.
Aegilops triuncialis	.	.	.	.	.	.	1	.	.	.	.	.	.
Agonimia opuntiella	.	.	.	.	.	.	.	.	.	.	1	.	.
Agrimonia eupatoria aggr.	.	.	.	1	.	6	.	.	2	.	1	.	.
Agrimonia repens	.	.	.	.	.	.	.	.	.	.	.	3	.
Agrostis capillaris	.	.	.	1	.	.	.	.	.	.	.	1	2
Ailanthus altissima	.	.	.	.	.	.	.	.	2	.	2	.	.
Ajuga chamaepitys	.	.	.	.	.	11	1	.	.	.	.	4	.
Ajuga genevensis	.	.	.	.	.	.	.	4	1	2	4	.	11
Ajuga laxmannii	.	.	.	.	.	2	.	.	.	.	.	.	.
Alchemilla jailae	.	.	.	.	.	.	1	.	.	.	.	.	.
Alliaria petiolata	.	.	.	.	.	.	.	.	.	.	1	.	.
Allium ascalonicum	.	.	.	.	4	2	.	.	.	.	.	.	.
Allium atroviolaceum	.	.	.	.	.	.	1	.	.	.	.	.	.
Allium delicatulum	9	.	.	.	.	.	.	.	.	.	.	.	.
Allium denudatum	.	.	.	.	.	.	.	1	.	.	1	3	.
Allium ericetorum	.	.	.	.	.	.	.	.	5	.	.	.	.
Allium inaequale	.	.	.	.	.	4	.	.	.	.	.	.	.
Allium marschalianum	.	.	.	.	.	.	3	.	.	.	.	.	.
Allium obliquum	.	.	.	.	.	.	.	1	.	.	.	.	.
Allium oleraceum	.	.	.	.	.	.	.	1	.	.	2	.	2
Allium paniculatum aggr.	.	.	.	.	.	1	3	.	.	.	.	.	.
Allium podolicum	.	.	.	.	.	.	.	.	.	.	.	8	.
Allium rotundum	.	.	.	.	1	.	.	1	.	.	.	1	.
Allium schoenoprasum	.	.	.	.	.	.	.	2	.	.	2	1	.
Allium sp.	.	.	.	.	.	.	.	1	.	.	.	.	.
Allium sphaerocephalon	.	.	.	.	.	1	.	.	2	.	3	1	.
Aloina rigida	.	.	.	.	.	.	.	.	.	.	.	1	.
Alopecurus vaginatus	.	.	.	.	.	.	8	.	.	.	.	.	.
Alyssum alyssoides	.	.	.	.	.	.	16	7	1	7	23	13	4
Alyssum lenense	.	.	.	.	.	1	.	.	.	.	.	.	.
Alyssum turkestanicum	.	.	.	.	.	1	.	1	.	.	2	.	.
Amaranthus retroflexus	.	.	.	.	.	.	.	.	.	.	1	.	.
Amelanchier ovalis	.	.	.	.	.	.	.	.	6	.	.	.	.
Anacamptis morio	.	.	.	.	.	.	.	.	.	.	.	1	.
Anacamptis pyramidalis	.	.	.	.	.	.	.	.	3	.	.	.	.
Anagallis arvensis	.	.	.	.	.	.	.	.	.	2	.	.	.
Androsace elongata	.	.	.	.	.	.	.	.	.	5	.	.	.
Androsace septentrionalis	.	.	.	.	.	.	.	.	.	.	.	.	4
Androsace villosa	.	.	.	5	.	19	20	1	1	.	.	.	.
Anemone nemorosa	.	.	.	.	.	.	.	1	.	.	.	.	.
Anemone ranunculoides	.	.	.	.	.	1	.	.	.	.	.	.	.
Anemone sylvestris	.	.	.	.	.	1	.	.	1	.	.	.	.
Anisantha rigida	.	.	.	.	.	.	.	.	.	.	2	.	.
Anisantha tectorum	.	.	.	.	1	1	.	.	.	.	.	.	.
Anomodon viticulosus	.	.	.	.	.	.	.	1	.	.	.	.	.
Antennaria dioica	.	.	.	.	.	.	3	.	.	.	.	.	.
Anthemis arvensis	.	.	.	.	.	.	.	.	.	2	.	.	.
Anthoxanthum odoratum	.	.	.	.	.	.	.	.	.	.	.	.	2
Aongstroemia schreberiana	.	.	.	.	.	.	.	.	.	.	.	.	4
Aquilegia subscaposa	.	.	.	.	.	.	.	1	.	.	.	.	.
Aquilegia vulgaris	.	.	.	.	.	.	.	1	1	.	.	.	2
Arabidopsis petraea	.	.	.	.	.	.	.	.	.	.	.	.	4
Arabidopsis thaliana	.	.	.	.	.	.	.	.	.	2	1	3	4
Arabis auriculata	.	.	.	.	.	.	.	1	2	.	5	.	4
Arabis procurrens	.	.	.	.	.	.	.	1	.	.	.	.	.
Arabis sagittata	.	.	.	.	.	.	.	.	.	.	.	1	.
Arabis sp.	.	.	.	.	.	.	.	.	.	.	.	.	2
Arenaria koriniana	9	.	1	.	.	.	.	.	.	.	.	.	.
Arenaria procera	.	.	.	.	.	1	.	.	.	.	.	.	.
Arenaria rigida	.	.	.	.	.	1	.	.	.	.	.	.	.
Aristolochia clematitis	.	.	.	.	.	.	.	1	.	.	.	.	.
Aristolochia pallida	.	.	.	.	.	.	.	1	.	.	.	.	.
Arrhenatherum elatius	.	.	.	.	.	.	.	1	.	.	3	1	5
Artemisia absinthium	.	.	.	3	.	1	.	.	.	.	.	.	.
Artemisia alpina	.	.	.	1	.	.	.	.	.	.	.	.	.
Artemisia austriaca	.	.	5	2	1	4	.	.	1	.	6	4	.
Artemisia dracunculus	.	.	.	1	.	.	.	.	.	.	.	.	.
Artemisia nutans	.	.	.	7	1	3	.	.	.	.	.	.	.
Artemisia santonicum	.	.	.	1	.	.	.	.	.	.	.	1	.
Artemisia taurica	.	.	.	.	1	.	.	.	.	.	.	.	.
Asarum europaeum	.	.	.	.	1	.	.	.	.	.	.	.	.
Asparagus officinalis	3	.	.	.	3	3	1	.	1	.	.	.	.
Asparagus tenuifolius	.	.	.	.	.	.	.	1	.	.	.	.	.
Asperula arvensis	.	.	.	.	.	1	.	.	.	.	.	.	.
Asperula capitata	.	.	.	.	.	.	.	7	.	.	.	.	.
Asperula cretacea	.	.	.	1	2	1	.	.	.	.	.	.	.
Asperula montana	.	.	.	.	1	1	.	.	.	.	.	.	.
Asperula purpurea	.	.	.	.	.	.	.	3	.	.	.	.	.
Asperula taurica	.	.	.	1	.	.	.	.	.	.	.	.	.
Asperula tenella	.	.	.	.	3	.	4	1	.	.	.	.	.
Asperula tinctoria	.	.	.	1	.	9	.	1	15	.	2	3	2
Asphodeline lutea	.	.	.	.	.	.	2	.	.	.	.	.	.
Asphodeline taurica	.	.	.	.	1	.	2	.	.	.	.	.	.
Asplenium ceterach	.	.	.	.	.	.	.	4	.	.	4	.	.
Asplenium viride	.	.	.	.	.	.	.	2	.	.	.	.	.
Aster alpinus	.	.	.	.	.	.	.	10	4	.	2	.	4
Aster amellus	.	.	.	.	.	4	2	14	12	.	.	6	.
Astragalus aktiubensis	.	.	3	.	.	.	.	.	.	.	.	.	.
Astragalus brachylobus	6	9	.	.	.	.	.	.	.	.	.	.	.
Astragalus buchtormensis	.	.	.	.	1	.	.	.	.	.	.	.	.
Astragalus cornutus	.	.	.	.	.	2	.	.	.	.	.	.	.
Astragalus danicus	.	.	.	.	.	.	.	.	.	.	.	3	.
Astragalus glaucus	.	.	.	1	.	1	.	.	.	.	.	.	.
Astragalus glycyphyllos	.	.	.	.	.	.	.	4	.	.	.	.	.
Astragalus leontinus	.	.	.	.	1	.	.	.	.	.	.	.	.
Astragalus monspessulanus	.	.	.	1	.	.	.	1	9	.	.	5	.
Astragalus onobrychis	.	.	.	2	1	6	.	.	5	.	1	5	.
Astragalus ponticus	.	.	.	.	.	.	1	.	.	.	.	.	.
Astragalus pseudoglaucus	.	.	.	.	.	1	.	.	4	.	.	.	.
Astragalus roemeri	.	.	.	.	.	.	.	1	.	.	.	.	.
Astragalus storozhevae	.	.	1	.	.	.	.	.	.	.	.	.	.
Astragalus subarcuatus	6	.	5	.	.	.	.	.	.	.	.	.	.
Astragalus subuliformis	.	.	.	5	4	12	.	.	.	.	.	.	.
Astragalus sulcatus	.	.	.	.	.	1	.	.	.	.	.	.	.
Astragalus testiculatus	9	.	.	.	.	.	.	.	.	.	.	.	.
Astragalus varius	.	.	.	2	1	.	.	.	.	.	.	.	.
Astragalus vesicarius aggr.	.	.	.	.	1	1	6	.	.	.	2	.	.
Asyneuma canescens	.	.	.	.	1	2	.	1	3	.	.	4	.
Athallia pyracea	.	.	.	.	.	.	.	.	.	.	.	1	.
Atocion armeria	.	.	.	.	.	.	.	1	.	.	.	.	.
Aurinia petraea	.	.	.	.	.	.	.	2	.	.	.	.	.
Aurinia saxatilis	.	.	.	.	.	.	.	4	1	10	2	18	2
Avenula pubescens	.	.	.	.	.	.	1	1	1	.	.	.	2
Barbarea vulgaris	.	.	.	.	.	.	.	1	.	.	.	.	.
Barbula unguiculata	.	.	.	.	.	1	.	.	1	.	.	5	.
Bellidiastrum michelii	.	.	.	.	.	.	.	.	3	.	.	.	.
Berberis vulgaris	.	.	.	.	.	.	.	2	6	.	2	1	.
Berteroa incana	.	.	.	.	.	1	.	1	.	.	.	6	.
Betula pendula	.	.	.	.	.	.	.	1	1	.	.	.	.
Blastenia hungarica	.	.	.	.	.	.	.	1	.	.	.	.	.
Botrychium lunaria	.	.	.	.	.	.	.	1	.	.	.	.	9
Brachypodium pinnatum	.	.	.	.	.	.	2	2	14	.	1	1	2
Briza media	.	.	.	.	.	.	.	.	6	.	.	.	.
Bromopsis benekenii	.	.	.	.	.	.	.	.	1	.	.	.	.
Bromopsis erecta	.	.	.	.	.	.	.	1	1	.	2	.	.
Bromopsis inermis	.	.	.	.	.	3	.	.	.	.	1	.	.
Bromopsis pannonica	.	.	.	.	.	.	3	.	10	.	15	.	.
Bromopsis ramosa	.	.	.	.	.	.	.	.	.	.	2	.	.
Bromus arvensis	.	.	.	.	.	.	.	1	.	.	.	.	.
Bromus commutatus	.	.	.	.	.	.	.	1	.	.	.	.	.
Bromus hordeaceus	.	.	.	.	.	.	.	.	.	.	.	.	2
Bromus japonicus	.	.	.	.	.	.	.	.	.	2	.	.	.
Bryum argenteum	.	.	.	.	.	.	.	.	.	.	.	11	7
Bryum sp.	.	.	.	.	.	1	.	.	.	.	2	3	.
Buglossoides arvensis	.	.	.	.	.	1	.	.	.	.	.	.	.
Bupleurum longifolium	.	.	.	.	.	.	.	.	1	.	.	.	.
Bupleurum pachnospermum	.	.	.	.	.	.	.	.	.	2	.	.	.
Calamagrostis arundinacea	.	.	.	.	.	.	.	1	.	.	.	.	.
Calamagrostis epigejos	.	.	.	.	1	5	.	.	.	.	.	1	.
Calamagrostis sp.	.	.	.	.	.	.	.	.	1	.	.	.	2
Calamagrostis varia	.	.	.	.	.	.	.	3	2	.	.	.	.
Camelina microcarpa	.	.	.	.	.	1	.	.	.	.	.	.	.
Campanula bononiensis	.	.	.	.	.	.	.	.	1	.	.	.	.
Campanula carpatica	.	.	.	.	.	.	.	4	.	.	.	.	.
Campanula crassipes	.	.	.	.	.	.	.	1	.	.	.	.	.
Campanula glomerata	.	.	.	.	.	2	.	1	4	.	1	.	.
Campanula lingulata	.	.	.	.	.	.	.	1	.	.	.	.	.
Campanula patula	.	.	.	.	.	.	.	1	.	.	.	.	.
Campanula persicifolia	.	.	.	.	.	.	.	4	1	.	5	.	.
Campanula rapunculoides	.	.	.	.	.	.	.	1	3	.	.	3	15
Campanula trachelium	.	.	.	.	.	.	.	1	.	.	.	.	2
Camphorosma monspeliaca	11	.	15	.	.	.	.	.	.	.	.	.	.
Camptothecium lutescens	.	.	.	.	.	.	.	1	.	.	.	3	11
Campylium chrysophyllum	.	.	.	.	.	.	.	1	1	.	.	.	.
Candelariella vitellina	.	.	.	.	.	.	.	.	.	.	.	5	.
Capsella bursa-pastoris	.	.	.	.	.	.	.	.	.	.	.	.	2
Caragana frutex	.	.	.	.	7	8	.	.	1	.	.	.	.
Carduus acanthoides	.	.	.	.	.	2	.	1	.	.	.	.	2
Carduus candicans	.	.	.	.	.	.	.	4	.	.	1	.	4
Carduus collinus	.	.	.	.	.	.	.	1	1	5	4	.	.
Carduus defloratus	.	.	.	.	.	.	.	7	7	.	.	.	.
Carduus nutans	.	.	.	.	.	.	.	1	.	.	.	.	.
Carex alba	.	.	.	.	.	.	.	1	1	.	.	.	.
Carex brevicollis	.	.	.	.	.	.	.	1	.	.	.	.	.
Carex caryophyllea	.	.	.	.	1	.	3	1	1	.	5	.	5
Carex cespitosa	.	.	.	.	.	1	.	.	.	.	.	.	.
Carex digitata	.	.	.	.	.	.	.	4	2	.	1	.	9
Carex filiformis	.	.	.	.	.	.	.	.	1	.	1	.	.
Carex flacca	.	.	.	.	.	.	.	.	1	.	.	.	.
Carex halleriana	.	.	.	.	.	.	.	.	1	.	.	.	.
Carex michelii	.	.	.	.	.	.	1	.	1	.	1	.	.
Carex montana	.	.	.	.	.	1	.	1	.	.	2	1	.
Carex muricata aggr.	.	.	.	.	.	3	.	2	.	.	.	.	2
Carex ornithopoda	.	.	.	.	.	.	.	1	.	.	.	.	4
Carex pediformis	.	.	.	.	4	2	.	.	1	.	.	.	.
Carex praecox	.	.	.	.	.	.	.	.	.	.	1	.	.
Carex supina	.	.	.	.	1	1	.	.	.	.	.	.	.
Carlina acanthifolia subsp. *utzka*	.	.	.	.	.	.	.	.	1	.	.	.	.
Carlina acaulis	.	.	.	.	.	.	.	1	11	.	2	.	7
Carlina biebersteinii	.	.	.	.	.	.	.	.	1	.	.	.	.
Carlina sp.	.	.	.	.	.	.	.	.	2	.	.	.	.
Carlina vulgaris	.	.	.	.	.	.	.	1	9	.	.	4	4
Catapyrenium daedaleum	.	.	.	.	.	.	.	.	.	.	.	3	.
Catapyrenium lachneum	.	.	.	.	.	.	.	.	.	.	.	8	.
Centaurea atropurpurea	.	.	.	.	.	.	.	9	.	.	1	.	.
Centaurea diffusa	.	.	.	.	.	1	.	.	.	.	.	.	.
Centaurea jacea	.	.	.	.	.	1	.	1	1	.	.	.	.
Centaurea orientalis	.	.	.	.	1	7	.	.	.	.	.	1	.
Centaurea ovina aggr.	.	.	.	1	9	1	.	.	.	.	.	1	.
Centaurea reichenbachii	.	.	.	.	.	.	.	2	.	.	2	.	.
Centaurea scabiosa	.	.	.	.	.	3	8	.	11	.	2	5	16
Centaurea sterilis	.	.	.	.	.	.	2	.	.	.	.	.	.
Centaurea trichocephala	.	.	.	.	.	1	.	.	.	.	.	.	.
Centaurea triniifolia	.	.	.	.	.	.	.	2	.	.	.	.	.
Centaurium erythraea	.	.	.	.	.	.	.	.	1	.	1	.	.
Centaurium pulchellum	.	.	.	.	.	1	.	.	.	.	.	.	.
Cephalanthera rubra	.	.	.	.	.	.	.	.	3	.	.	.	.
Cephalaria coriacea	.	.	.	.	.	.	5	.	.	.	.	.	.
Cephalaria radiata	.	.	.	.	.	.	.	10	4	.	.	.	.
Cephaloziella divaricata	.	.	.	.	.	.	.	.	.	.	.	.	2
Cerastium arvense	.	.	.	.	.	.	.	4	.	.	.	.	11
Cerastium banaticum	.	.	.	.	.	.	.	2	.	.	2	.	.
Cerastium biebersteinii	.	.	.	.	.	.	9	.	.	.	.	.	.
Cerastium brachypetalum	.	.	.	.	.	.	.	1	3	.	9	.	4
Cerastium fontanum	.	.	.	.	.	1	.	.	.	.	.	.	5
Cerastium glomeratum	.	.	.	.	.	.	.	.	.	.	2	.	.
Cerastium pumilum	.	.	.	.	.	.	3	.	2	.	3	.	.
Ceratocarpus arenarius	.	.	1	.	.	.	.	.	.	.	.	.	.
Ceratocephala falcata	9	.	.	.	.	.	.	.	.	.	.	.	.
Ceratodon purpureus	.	.	.	.	.	1	.	.	.	.	4	18	20
Cerinthe minor	.	.	.	.	1	1	.	.	1	.	.	.	.
Cetraria islandica	.	.	.	.	.	.	.	.	.	.	.	4	.
Chelidonium majus	.	.	.	.	.	.	.	1	.	.	.	.	2
Cherleria langii	.	.	.	.	.	.	.	1	4	.	.	.	.
Chondrilla juncea	.	.	.	.	.	.	.	1	.	.	4	.	.
Chrysanthemum zawadskii	.	.	.	.	.	.	.	2	1	.	.	.	2
Cicerbita muralis	.	.	.	.	.	.	.	.	.	.	.	.	2
Cichorium intybus	.	.	.	1	.	3	.	.	1	.	1	.	.
Cirsium acaule	.	.	.	.	.	.	.	.	.	.	.	.	2
Cirsium erisithales	.	.	.	.	.	.	.	2	.	.	.	.	.
Cirsium pannonicum	.	.	.	.	.	.	.	.	8	.	.	.	.
Cladonia chlorophaea	.	.	.	.	.	.	.	.	.	.	1	.	.
Cladonia coniocraea	.	.	.	.	.	.	.	.	.	.	.	.	2
Cladonia cornuta	.	.	.	.	.	.	.	.	.	.	.	1	.
Cladonia fimbriata	.	.	.	.	.	.	.	.	.	.	1	.	.
Cladonia furcata	.	.	.	.	.	.	.	.	.	.	.	6	.
Cladonia furcata	.	.	.	.	.	.	.	.	.	.	.	.	2
Cladonia magyarica	.	.	.	.	.	.	.	.	.	.	3	1	.
Cladonia pocillum	.	.	.	.	.	.	.	1	1	.	6	6	15
Cladonia rangiferina	.	.	.	.	.	.	.	.	.	.	7	.	.
Cladonia rangiformis	.	.	.	.	.	.	.	.	.	.	.	6	2
Cladonia rei	.	.	.	.	.	1	.	.	.	.	.	1	.
Cladonia sp.	.	.	.	1	.	.	.	.	.	.	6	8	.
Cladonia subulata	.	.	.	.	.	.	.	.	.	.	.	3	.
Cladonia symphycarpa	.	.	.	.	.	.	.	.	.	.	5	.	.
Clausia aprica	.	.	.	.	.	1	.	.	.	.	.	.	.
Cleistogenes serotina	.	.	.	.	.	1	1	2	1	.	7	11	.
Clematis integrifolia	.	.	.	.	.	1	1	.	.	.	.	.	.
Clematis vitalba	.	.	.	.	.	.	.	1	.	.	.	.	.
Clinopodium menthifolium	.	.	.	.	.	.	.	1	.	.	.	.	.
Clinopodium suaveolens	.	.	.	.	.	.	.	.	.	.	.	1	.
Clinopodium vulgare	.	.	.	.	.	.	.	1	1	.	.	.	4
Consolida regalis	.	.	.	.	.	1	.	.	.	.	.	1	.
Convallaria majalis	.	.	.	.	.	.	.	.	1	.	.	.	.
Convolvulus arvensis	.	.	.	1	2	5	.	1	2	.	4	1	.
Convolvulus cantabrica	.	.	.	1	.	.	2	2	.	.	9	.	.
Convolvulus sericocephalus	.	.	.	.	1	.	.	.	.	.	.	.	.
Cornicularia aculeata	.	.	.	.	.	.	.	.	.	.	.	3	.
Cornus mas	.	.	.	.	.	.	.	2	1	3	2	.	2
Cornus sanguinea	.	.	.	.	.	1	.	1	1	.	2	.	5
Coronilla coronata	.	.	.	.	.	.	.	.	2	.	.	.	.
Coronilla scorpioides	.	.	.	.	.	.	1	.	.	.	.	.	.
Coronilla vaginalis	.	.	.	.	.	.	.	.	3	.	.	.	.
Corydalis cava	.	.	.	.	.	.	.	.	.	.	1	.	.
Corydalis solida	.	.	.	.	.	.	.	.	.	.	2	.	.

ID clusters	1	2	3	4	5	6	7	8	9	1	11	12	13
Number of relevés	35	11	73	243	92	280	116	290	196	61	111	80	55
Other taxa occurred in the communities (continued)													
Corylus avellana	.	.	.	.	.	.	.	1	1	.	.	.	4
Cota tinctoria	.	.	.	2	7	2	1	4	.	3	1	1	2
Cotinus coggygria	.	.	.	.	2	.	.	3	2	3	1	1	.
Cotoneaster integerrimus aggr.	.	.	.	.	.	.	5	8	8	13	.	5	9
Cotoneaster sp.	.	.	.	.	.	.	.	.	.	.	.	.	2
Cousinia astracanica	.	.	1	.	.	.	.	.	.	.	.	.	.
Crataegus laevigata	.	.	.	.	.	.	.	.	1	.	.	.	.
Crataegus monogyna	.	.	.	.	.	.	3	1	1	.	4	4	2
Crataegus rhipidophylla	.	.	.	.	.	1	.	.	.	.	.	.	.
Crepis foetida	.	.	.	.	.	1	.	1	.	.	.	1	.
Crepis jacquinii	.	.	.	.	.	.	.	.	1	.	.	.	.
Crepis neglecta	.	.	.	.	.	.	.	.	.	.	.	1	.
Cruciata glabra	.	.	.	.	.	.	.	3	1	.	.	.	2
Crupina vulgaris	.	.	.	.	.	.	1	.	.	.	4	.	.
Ctenidium molluscum	.	.	.	.	.	.	.	1	.	.	.	.	.
Cuscuta campestris	.	.	.	.	.	.	.	.	1	.	.	.	.
Cuscuta epithymum aggr.	.	.	1	.	.	.	2	.	1	3	3	4	.
Cuscuta europaea	.	.	.	.	.	.	.	.	.	.	.	1	.
Cuscuta sp.	.	.	.	1	.	1	.	.	1	.	.	.	.
Cyanus triumfettii	.	.	.	.	.	.	.	13	15	.	8	.	4
Cynodon dactylon	.	.	.	.	.	.	3	.	.	.	.	.	.
Cynoglottis barrelieri	.	.	.	.	.	.	.	3	.	.	.	1	.
Cynosurus cristatus	.	.	.	.	.	.	.	1	.	.	.	.	.
Cystopteris fragilis	.	.	.	.	.	.	.	6	.	15	.	1	2
Cytisus albus	.	.	.	.	.	.	.	6	2	.	2	8	.
Cytisus austriacus	.	.	.	.	.	1	.	1	2	.	2	.	.
Cytisus blockianus	.	.	.	.	.	.	.	.	.	.	.	3	.
Cytisus graniticus	.	.	.	.	.	1	.	.	.	.	.	.	.
Cytisus hirsutus aggr.	.	.	.	1	5	8	13	10	6	3	5	4	2
Cytisus paczoskii	.	.	.	.	.	.	.	.	2	.	.	3	.
Cytisus podolicus	.	.	.	.	.	.	.	.	.	.	.	1	.
Cytisus procumbens	.	.	.	.	.	.	.	.	2	.	1	.	.
Cytisus sp.	.	.	.	.	.	.	.	.	.	.	.	1	.
Dactylis glomerata	.	.	.	.	.	.	.	.	1	.	.	.	2
Dactylorhiza sambucina	.	.	.	.	.	.	.	1	.	.	.	.	.
Danthonia alpina	.	.	.	.	.	.	.	.	.	2	1	.	.
Daphne cneorum	.	.	.	.	.	.	.	.	6	.	.	.	.
Daucus carota	.	.	.	2	.	1	.	.	1	.	.	3	4
Deschampsia cespitosa	.	.	.	.	.	.	.	1	.	.	.	.	.
Descurainia sophia	3	.	1	.	.	.	.	.	.	.	.	.	.
Dianthus carthusianorum aggr.	.	.	.	.	.	.	12	22	11	5	21	4	13
Dianthus giganteus	.	.	.	.	.	.	.	2	1	.	.	6	.
Dianthus henteri	.	.	.	.	.	.	.	1	.	.	.	.	.
Dianthus lanceolatus	.	.	.	.	.	.	1	.	.	.	.	.	.
Dianthus nitidus	.	.	.	.	.	.	.	.	1	.	.	.	.
Dianthus plumarius	.	.	.	.	.	.	7	1	3	.	.	.	.
Dianthus praecox	.	.	.	.	.	.	.	.	14	.	5	.	9
Dianthus pseudarmeria	.	.	.	.	4	1	.	.	.	.	.	.	.
Dianthus ramosissimus	3	.	.	.	.	.	.	.	.	.	.	.	.
Dichoropetalum carvifolia	.	.	.	.	.	.	.	.	1	.	.	.	.
Dicranella heteromalla	.	.	.	.	.	.	.	.	.	.	.	.	2
Dicranum bonjeanii	.	.	.	.	.	.	.	.	.	.	.	3	.
Dicranum scoparium	.	.	.	.	.	.	.	1	.	.	.	.	.
Dictamnus albus aggr.	.	.	.	.	1	.	.	4	1	5	6	1	.
Didymodon acutus	.	.	.	.	.	.	.	.	.	.	.	1	.
Didymodon sp.	.	.	.	.	.	.	.	.	.	.	.	1	.
Digitalis grandiflora	.	.	.	.	.	.	.	13	2	.	3	.	2
Diploschistes muscorum	.	.	.	.	.	.	.	.	.	.	.	5	.
Diplotaxis cretacea	.	.	.	5	11	4	.	.	.	.	.	.	.
Diplotaxis muralis	.	.	.	.	.	1	.	.	1	.	.	1	.
Diplotaxis tenuifolia	.	.	.	.	.	.	1	.	.	.	.	.	.
Doronicum columnae	.	.	.	.	.	.	.	1	.	.	.	.	.
Dorycnium pentaphyllum	.	.	.	.	.	.	10	1	19	.	.	8	.
Draba aizoides	.	.	.	.	.	.	.	.	1	.	.	.	4
Draba cuspidata	.	.	.	.	.	.	6	.	.	.	.	.	.
Draba nemorosa	.	.	.	.	.	.	.	.	.	2	.	.	.
Draba podolica	.	.	.	.	1	.	.	.	1	.	.	3	.
Draba verna	.	.	.	.	.	1	.	.	2	5	8	.	2
Dracocephalum austriacum	.	.	.	.	.	.	.	1	.	.	.	.	.
Drymocallis geoides	.	.	.	.	.	.	3	.	.	.	.	.	.
Echinops bannaticus	.	.	.	.	.	.	.	1	.	.	.	.	.
Echinops sphaerocephalus	.	.	.	.	.	.	.	1	.	.	.	3	.
Echium vulgare	.	.	.	.	.	8	2	7	8	3	23	18	18
Edraianthus graminifolius	.	.	.	.	.	.	.	.	.	.	.	.	2
Elymus caninus	.	.	.	.	.	.	.	1	.	.	.	.	.
Elytrigia caespitosa subsp. *nodosa*	.	.	.	.	.	.	2	.	.	.	.	.	.
Elytrigia intermedia	.	.	.	.	1	10	.	4	4	.	11	18	.
Elytrigia repens	.	.	1	1	.	9	3	1	.	2	1	1	.
Elytrigia stipifolia	.	.	.	2	2	3	.	.	.	.	.	.	.
Elytrigia strigosa	.	.	.	.	.	.	9	.	.	.	.	.	.
Encalypta vulgaris	.	.	.	.	.	.	.	.	1	.	3	8	9
Enchylium bachmanianum	.	.	.	.	.	.	.	.	.	.	1	.	.
Enchylium tenax	.	.	.	2	.	3	.	.	.	.	.	9	.
Epipactis atrorubens	.	.	.	.	.	.	.	1	9	.	.	1	.
Eremopyrum triticeum	3	.	.	.	.	.	.	.	.	.	.	.	.
Eremurus spectabilis	.	.	.	.	1	.	.	.	.	.	.	.	.
Erigeron acris	.	.	.	.	.	1	.	.	.	.	.	.	.
Erigeron canadensis	.	.	.	.	1	.	.	.	.	.	.	.	.
Erodium cicutarium	.	.	.	.	.	.	.	.	.	.	5	1	.
Erucastrum nasturtiifolium	.	.	.	.	.	.	.	.	.	.	.	1	.
Eryngium planum	.	.	.	.	2	1	.	.	.	.	.	1	.
Erysimum canum	.	.	.	1	1	.	.	.	.	.	.	.	.
Erysimum comatum	.	.	.	.	.	.	.	1	.	.	1	.	.
Erysimum cretaceum	.	.	.	1	.	.	.	.	.	.	.	.	.
Erysimum cuspidatum	.	.	.	.	.	.	6	.	.	.	.	.	.
Erysimum leptostylum	.	.	.	1	3	1	.	.	.	.	.	.	.
Erysimum odoratum	.	.	.	.	.	.	9	30	14	3	30	13	24
Erysimum rhaeticum	.	.	.	.	.	.	.	1	.	.	.	.	.
Erysimum sp.	.	.	.	.	.	.	.	1	.	.	.	.	.
Erysimum talijevii	.	.	.	1	.	1	.	.	.	.	.	.	.
Erysimum ucrainicum	.	.	.	8	.	.	.	.	.	.	.	.	.
Erysimum witmannii	.	.	.	.	.	.	.	8	10	.	.	.	13
Euonymus verrucosus	.	.	.	.	.	.	.	1	.	.	.	.	.
Euphorbia agraria	.	.	.	.	.	1	10	.	2	.	1	.	.
Euphorbia amygdaloides	.	.	.	.	.	.	.	1	1	.	2	.	2
Euphorbia angulata	.	.	.	.	.	.	.	1	.	.	.	.	.
Euphorbia epithymoides	.	.	.	.	.	.	.	2	5	2	4	.	.
Euphorbia esula	3	.	.	.	.	1	.	.	2	.	.	.	.
Euphorbia myrsinites	.	.	.	.	.	.	1	.	.	.	.	.	.
Euphorbia semivillosa	.	.	.	1	.	1	.	.	.	.	.	.	.
Euphorbia stricta	.	.	.	.	.	.	.	.	.	.	.	9	4
Euphrasia hirtella	.	.	.	1	.	3	.	.	.	.	.	.	.
Euphrasia rostkoviana	.	.	.	.	.	.	.	1	4	.	.	.	4
Euphrasia salisburgensis	.	.	.	.	.	.	.	3	4	.	.	1	2
Euphrasia stricta aggr.	.	.	.	1	.	8	.	1	4	3	1	.	5
Euphrasia taurica	.	.	.	.	.	.	2	.	.	.	.	.	.
Evernia mesomorpha	.	.	.	.	.	.	.	.	.	.	.	3	.
Fagus sylvatica	.	.	.	.	.	.	.	1	1	.	.	.	.
Falcaria vulgaris	.	.	.	.	.	1	.	.	.	.	.	.	.
Fallopia convolvulus	.	.	.	.	.	.	.	1	.	2	3	.	4
Fallopia dumetorum	.	.	.	.	.	.	.	1	.	2	1	.	.
Ferula tatarica	11	.	3	.	.	.	.	.	.	.	.	.	.
Ferulago campestris	.	.	.	.	.	1	.	.	.	.	.	.	.
Ferulago sylvatica	.	.	.	.	.	.	.	1	.	.	.	.	.
Ferulago taurica	.	.	.	.	.	.	5	.	.	.	.	.	.
Festuca glauca	.	.	.	.	.	.	.	6	.	.	.	.	.
Festuca heterophylla	.	.	.	.	.	.	.	.	1	.	.	.	.
Festuca rubra	.	.	.	.	.	1	.	1	1	.	.	.	4
Filago germanica	.	.	.	.	.	.	2	.	.	.	.	.	.
Filipendula vulgaris	.	.	.	.	.	4	17	1	.	13	5	1	5
Fissidens taxifolius	.	.	.	.	.	.	.	.	1	.	.	.	.
Flexitrichum flexicaule	.	.	.	.	.	.	.	1	2	.	1	8	7
Fragaria moschata	.	.	.	.	.	.	.	.	.	.	2	.	.
Fragaria vesca	.	.	.	.	.	.	.	7	.	10	.	.	15
Frangula alnus	.	.	.	.	.	.	.	1	.	.	.	1	.
Fraxinus excelsior	.	.	.	.	.	.	.	3	.	.	.	.	.
Fraxinus lanceolata	.	.	.	.	.	1	.	.	.	.	.	.	.
Fraxinus ornus	.	.	.	.	.	.	.	8	.	.	4	.	.
Fritillaria orientalis	.	.	.	.	.	.	.	1	.	.	.	.	.
Fumaria officinalis	.	.	.	.	.	.	.	.	.	.	2	.	.
Gagea pratensis	.	.	.	.	.	.	.	.	.	.	.	1	.
Gagea pusilla	3	.	.	.	.	.	.	.	.	.	1	.	.
Galanthus nivalis	.	.	.	.	.	.	.	.	.	.	1	.	.
Galatella angustissima	.	.	1	.	.	.	.	.	.	.	.	.	.
Galatella linosyris	.	.	.	.	.	1	7	.	1	.	3	.	.
Galatella villosa	14	.	3	.	1	4	.	.	.	.	.	.	.
Galeopsis angustifolia	.	.	.	.	.	.	.	1	.	.	.	.	2
Galeopsis ladanum	.	.	.	.	.	.	.	.	.	2	.	.	.
Galitzkya spathulata	.	.	8	.	.	.	.	.	.	.	.	.	.
Galium anisophyllon	.	.	.	.	.	.	.	1	1	.	.	.	.
Galium aparine	.	.	.	.	.	.	.	.	.	2	.	.	.
Galium baillonii	.	.	.	.	.	.	.	1	.	.	.	.	.
Galium biebersteinii	.	.	.	.	.	3	5	.	.	.	.	.	.
Galium boreale	.	.	.	.	.	1	.	.	1	.	.	5	.
Galium glaucum	.	.	.	.	.	1	13	1	10	5	5	23	9
Galium pumilum aggr.	.	.	.	.	.	.	.	.	12	.	2	.	5
Galium transcarpaticum	.	.	.	.	.	.	.	1	.	.	.	.	.
Galium verum aggr.	.	.	5	3	12	13	7	3	2	.	4	9	5
Galium volhynicum	.	.	.	.	.	.	.	.	1	.	1	1	.
Geheebia fallax	.	.	.	1	.	.	.	.	1	.	.	3	5
Gemmabryum caespiticium	.	.	.	1	.	1	.	1	.	.	.	15	7
Gemmabryum kunzei	.	.	.	.	.	.	.	.	1	.	.	4	.
Genista januensis	.	.	.	.	.	.	.	1	1	.	1	5	.
Genista sagittalis	.	.	.	.	.	.	.	1	.	.	.	.	.
Genista tetragona	.	.	.	.	.	1	.	.	3	.	.	.	.
Genista tinctoria aggr.	.	.	.	19	21	14	2	1	1	2	4	1	.
Gentiana clusii	.	.	.	.	.	.	.	.	2	.	.	.	.
Gentiana cruciata	.	.	.	.	.	1	2	1	.	.	.	.	.
Gentianella lutescens	.	.	.	.	.	.	.	1	.	.	.	.	.
Geranium columbinum	.	.	.	.	.	.	.	2	.	.	4	.	2
Geranium lucidum	.	.	.	.	.	.	.	.	.	5	.	.	.
Geranium pusillum	.	.	.	.	.	.	.	1	.	.	1	.	.
Geranium robertianum	.	.	.	.	.	.	.	7	2	2	1	3	13
Geranium rotundifolium	.	.	.	.	.	.	.	1	.	.	.	.	.
Geranium sanguineum	.	.	.	.	.	.	.	10	14	3	8	6	5
Geranium sp.	.	.	.	.	.	.	.	.	1	.	.	.	.
Geranium sylvaticum	.	.	.	.	.	.	.	1	.	.	.	.	.
Geum urbanum	.	.	.	.	.	.	.	1	.	.	.	.	.
Glechoma hederacea	.	.	.	.	.	.	.	.	1	.	.	.	.
Glechoma hirsuta	.	.	.	.	.	.	.	1	1	.	1	.	.
Goniolimon rubellum	3	.	.	.	.	.	.	.	.	.	.	.	.
Goniolimon speciosum	3	.	.	.	.	.	.	.	.	.	.	.	.
Goniolimon tataricum aggr.	.	.	.	.	.	1	.	.	.	.	.	.	.
Grimmia pulvinata	.	.	.	.	.	.	.	.	.	.	11	4	7
Grimmia sp.	.	.	.	.	.	.	.	.	.	.	.	.	2
Gyalolechia bracteata	.	.	.	.	.	.	.	.	.	.	.	8	.
Gyalolechia fulgens	.	.	.	.	.	.	.	.	.	.	4	.	.
Gymnadenia conopsea	.	.	.	.	.	.	.	1	5	.	.	.	.
Gymnadenia odoratissima	.	.	.	.	.	.	.	.	2	.	.	.	.
Gymnocarpium robertianum	.	.	.	.	.	.	.	1	1	.	.	.	2
Gypsophila fastigiata	.	.	.	3	1	5	.	.	.	.	.	8	.
Gypsophila glomerata	.	.	.	.	1	.	3	.	.	.	.	.	.
Gypsophila muralis	.	.	.	.	.	.	.	1	.	2	.	.	.
Gypsophila pallasii	.	.	.	.	.	1	.	.	.	.	.	.	.
Gypsophila paniculata	.	.	.	1	.	2	.	.	.	.	.	.	.
Gypsophila petraea	.	.	.	.	.	.	.	2	.	.	.	.	.
Gypsophila repens	.	.	.	.	.	.	.	.	1	.	.	.	.
Gypsophila thyraica	.	.	.	1	.	1	.	.	1	.	.	10	.
Haplophyllum suaveolens	.	.	.	.	1	1	1	.	.	.	.	.	.
Hedwigia ciliata	.	.	.	.	.	.	.	.	.	.	.	3	4
Hedysarum argyrophyllum	.	.	1	.	.	.	.	.	.	.	.	.	.
Hedysarum candidum	.	.	.	.	.	.	1	.	.	.	.	.	.
Hedysarum cretaceum	.	.	.	7	.	3	.	.	.	.	.	.	.
Hedysarum polychromum	.	.	3	.	.	.	.	.	.	.	.	.	.
Hedysarum ucrainicum	.	.	.	7	.	.	.	.	.	.	.	.	.
Helianthemum alpestre	.	.	.	.	.	.	.	.	1	.	.	.	.
Helianthemum orientale	.	.	.	.	.	.	1	.	.	.	.	.	.
Helianthemum salicifolium	.	.	.	.	.	.	1	.	.	.	.	.	.
Helianthemum sp.	.	.	.	.	.	.	.	1	3	.	.	.	.
Helichrysum arenarium	.	.	.	13	20	25	.	.	1	.	1	9	2
Helichrysum graveolens	.	.	.	.	.	.	2	.	.	.	.	.	.
Helictochloa hookeri subsp. *schelliana*	.	.	.	.	.	1	.	.	.	.	.	.	.
Helictotrichon desertorum	.	.	.	.	.	1	.	.	.	.	.	.	.
Helleborus odorus	.	.	.	.	.	.	.	.	.	.	2	.	.
Hepatica nobilis	.	.	.	.	.	.	.	1	.	.	.	.	.
Hesperis tristis	.	.	.	.	.	.	.	.	.	.	5	.	.
Hieracium bifidum	.	.	.	.	.	.	.	1	4	.	.	.	5
Hieracium bupleuroides	.	.	.	.	.	.	.	1	7	.	.	.	7
Hieracium lachenalii aggr.	.	.	.	.	.	.	.	.	1	.	.	.	.
Hieracium laevigatum	.	.	.	.	.	.	.	.	.	.	.	.	5
Hieracium maculatum	.	.	.	.	.	.	.	.	.	.	.	.	4
Hieracium ramosum	.	.	.	.	.	.	.	.	.	2	.	.	.
Hieracium rotundatum	.	.	.	.	.	.	.	1	.	.	.	.	.
Hieracium sabaudum	.	.	.	.	.	.	.	.	.	3	.	.	.
Hieracium schmidtii	.	.	.	.	.	.	.	.	.	.	.	.	2
Hieracium sp.	.	.	.	1	.	.	.	1	1	.	.	.	.
Hieracium sparsum	.	.	.	.	.	.	.	2	.	.	.	.	.
Hieracium substellatum subsp. *simonkaianum*	.	.	.	.	.	.	.	1	.	.	.	.	.
Hieracium umbellatum	.	.	.	.	.	7	.	1	2	15	.	5	2
Hieracium villosum	.	.	.	.	.	.	.	1	.	.	.	.	.
Hieracium virgicaule	.	.	.	.	.	.	.	.	1	.	.	.	.
Hieracium virosum	.	.	.	1	2	11	1	.	4	.	.	9	.
Hierochloe odorata aggr.	.	.	.	.	.	4	.	1	.	.	.	1	.
Hippocrepis emerus	.	.	.	.	.	.	.	1	.	.	.	.	.
Holosteum umbellatum	.	.	.	.	.	1	.	.	1	2	.	1	.
Homalothecium lutescens	.	.	.	.	.	1	.	1	.	.	.	6	.
Homalothecium philippeanum	.	.	.	.	.	.	.	1	.	.	.	.	7
Homalothecium sericeum	.	.	.	.	.	.	.	.	.	.	.	.	2
Homalothecium sericeum	.	.	.	.	.	.	.	1	1	.	1	1	2
Hornungia petraea	.	.	.	.	.	.	.	.	1	.	.	.	2
Humulus lupulus	.	.	.	.	.	.	.	1	.	.	.	.	.
Hyacinthella leucophaea	.	.	.	.	.	1	.	.	.	.	1	.	.
Hylocomium splendens	.	.	.	.	.	.	.	1	.	.	.	.	.
Hylotelephium maximum	.	.	.	.	.	.	.	16	.	25	12	15	16
Hypericum elegans	.	.	.	.	2	7	.	1	2	.	.	1	.
Hypericum montanum	.	.	.	.	.	.	.	.	.	.	.	.	4
Hypericum perforatum	.	.	.	1	.	4	1	15	6	7	26	9	20
Hypericum tauricum	.	.	.	.	.	.	6	.	.	.	.	.	.
Hypnum cupressiforme	.	.	.	.	.	.	.	.	.	.	2	6	5
Hypochaeris radicata	.	.	.	.	.	.	.	.	.	.	.	.	2
Hypochoeris maculata	.	.	.	1	.	4	.	.	.	.	.	.	.
Inula britannica	.	.	.	.	.	1	.	.	.	.	.	.	.
Inula conyzae	.	.	.	.	.	.	.	1	1	.	.	.	2
Inula hirta	.	.	.	.	.	1	.	.	2	7	2	.	.
Inula oculus-christi	.	.	.	.	.	.	3	.	.	.	.	.	.
Inula salicina aggr.	.	.	.	.	.	7	2	.	5	.	.	.	.
Inula spiraeifolia	.	.	.	.	.	.	.	.	.	.	5	.	.
Ionopsidium abulense	.	.	.	.	.	.	.	.	3	.	.	.	.
Iris aphylla	.	.	.	.	.	.	.	1	1	2	.	1	.
Iris pontica	.	.	.	.	.	.	.	.	1	.	.	.	.
Iris pumila aggr.	.	.	1	.	2	1	6	1	1	3	5	.	.
Iris reichenbachii	.	.	.	.	.	.	.	1	.	.	.	.	.
Iris ruthenica	.	.	.	.	.	.	.	1	.	.	.	.	.
Isatis costata	.	.	.	1	.	.	.	.	.	.	.	.	.
Isatis tinctoria aggr.	.	.	.	.	.	.	.	12	.	2	2	1	.
Jacobaea erucifolia	.	.	.	.	.	2	.	.	.	.	.	.	.
Jacobaea vulgaris	.	.	.	.	.	3	.	.	2	.	2	.	.
Jovibarba heuffelii	.	.	.	.	.	.	.	2	.	.	.	.	.
Juglans regia	.	.	.	.	.	.	.	1	.	.	.	.	.
Juniperus sabina	.	.	.	.	.	.	1	2	.	.	.	.	.
Juniperus sp.	.	.	.	.	.	.	2	.	.	.	.	.	.
Jurinea mugodsharica	.	.	1	.	.	.	.	.	.	.	.	.	.
Jurinea multiflora	3	.	1	.	4	2	.	.	.	.	.	.	.
Kernera saxatilis	.	.	.	.	.	.	.	9	5	.	.	.	.
Klasea cardunculus	11	.	3	.	.	.	.	.	.	.	.	.	.
Klasea radiata	.	.	.	.	.	1	3	.	.	.	3	.	.
Knautia arvensis	.	.	.	.	.	2	.	3	.	.	.	.	5
Knautia kitaibelii	.	.	.	.	.	.	.	.	8	.	.	.	2
Koeleria glauca	.	.	.	.	.	1	.	.	1	.	.	.	.
Koeleria grandis	.	.	.	.	.	5	.	.	.	.	.	1	.

ID clusters	1	2	3	4	5	6	7	8	9	1	11	12	13
Number of relevés	35	11	73	243	92	280	116	290	196	61	111	80	55
Other taxa occurred in the communities (continued)													
Koeleria pyramidata	.	.	.	.	.	.	.	.	1	.	.	.	.
Koeleria sclerophylla	.	.	4	.	.	.	.	.	.	.	.	.	.
Lactuca perennis	.	.	.	.	.	.	.	1	2	13	5	.	.
Lactuca quercina	.	.	.	.	.	.	.	1	.	.	.	.	.
Lactuca serriola	.	.	.	.	.	.	.	.	.	.	1	4	.
Lactuca viminea	.	.	.	.	.	.	.	.	.	.	1	.	.
Lamium amplexicaule	.	.	.	.	.	.	.	.	.	2	.	1	.
Lamium galeobdolon	.	.	.	.	.	.	.	.	.	.	.	.	2
Lamium maculatum	.	.	.	.	.	.	.	1	.	.	.	.	.
Lamium purpureum	.	.	.	.	.	.	.	.	.	.	2	.	.
Lappula barbata	.	.	.	.	2	.	.	.	.	.	.	.	.
Lappula patula	.	.	.	.	.	.	.	.	.	.	.	5	.
Lappula squarrosa	.	.	.	1	4	3	.	.	.	.	2	6	.
Laserpitium krapfii	.	.	.	.	.	.	.	1	.	.	.	.	.
Laserpitium latifolium	.	.	.	.	.	.	.	6	3	.	.	.	.
Lathyrus nissolia	.	.	.	.	.	.	.	.	.	.	1	.	.
Lathyrus pannonicus	.	.	.	.	.	.	3	.	.	.	.	.	.
Lathyrus pratensis	.	.	.	.	.	.	1	.	.	.	.	.	.
Lathyrus sphaericus	.	.	.	.	.	.	.	.	.	.	1	.	.
Lathyrus vernus	.	.	.	.	.	.	.	.	.	2	.	.	.
Lecanora frustulosa	.	.	.	.	.	.	.	.	.	.	.	1	.
Lecidea lurida	.	.	.	.	.	.	.	.	.	.	2	.	.
Lecidea sp.	.	.	.	.	.	.	.	.	.	.	1	.	.
Lembotropis nigricans	.	.	.	.	.	.	.	11	14	.	.	8	.
Lempholemma chalazanum	.	.	.	.	.	.	.	.	.	.	1	.	.
Leontodon crispus aggr.	.	.	.	.	16	5	4	7	15	.	5	20	.
Leontodon hispidus	.	.	.	.	.	.	.	.	3	.	1	5	5
Leontopodium nivale subsp. *alpinum*	.	.	.	.	.	.	.	1	.	.	.	.	.
Leonurus quinquelobatus	.	.	.	.	.	1	.	.	.	.	.	.	.
Lepidium campestre	.	.	.	.	.	.	.	1	.	.	.	.	.
Lepidium coronopifolium	3	9	.	.	.	.	.	.	.	.	.	.	.
Lepidium draba	.	.	.	.	.	1	.	.	.	.	.	.	.
Lepidium perfoliatum	.	.	.	.	.	1	.	.	.	.	.	.	.
Lepraria incana	.	.	.	.	.	.	.	1	.	.	.	.	.
Leskea polycarpa	.	.	.	.	.	.	.	.	.	.	.	1	.
Leucanthemum vulgare	.	.	.	.	.	.	.	5	10	.	.	.	5
Leucodon sciuroides	.	.	.	.	.	.	.	.	.	.	.	.	2
Leymus akmolinensis	3	.	.	.	.	.	.	.	.	.	.	.	.
Ligularia carpathica	.	.	.	.	.	.	.	1	.	.	.	.	.
Ligustrum vulgare	.	.	.	.	.	.	.	.	6	.	2	.	.
Lilium martagon	.	.	.	.	.	.	.	1	1	.	.	.	.
Limonium cretaceum	.	.	8	.	.	.	.	.	.	.	.	.	.
Limonium sp.	.	.	.	.	.	1	.	.	.	.	.	.	.
Linaria angustissima	.	.	.	.	.	.	.	1	.	8	5	.	.
Linaria macroura	3	.	.	.	.	.	.	.	.	.	.	.	.
Linaria vulgaris	.	.	.	2	4	1	.	.	1	.	2	.	4
Linum austriacum	.	.	.	2	7	8	5	.	1	.	1	.	.
Linum hirsutum	.	.	.	7	23	22	1	.	2	.	.	.	.
Linum nervosum	.	.	.	1	1	1	1	.	.	.	.	.	.
Linum perenne	.	.	7	.	.	5	.	.	4	.	.	1	.
Linum tauricum	.	.	.	.	1	.	1	.	1	.	.	.	.
Linum trigynum	.	.	.	.	.	.	1	.	.	.	.	.	.
Lithospermum officinale	.	.	.	.	.	1	.	1	.	.	.	.	.
Lolium perenne	.	.	.	.	.	.	.	.	.	.	.	.	2
Lomelosia argentea	.	.	.	.	.	2	.	.	.	.	.	.	.
Lomelosia micrantha	.	.	.	.	.	.	2	.	.	.	.	.	.
Lomelosia rotata	.	.	.	.	.	.	1	.	.	.	.	.	.
Lophocolea minor	.	.	.	.	.	.	.	.	.	.	.	.	2
Lotus corniculatus	.	.	.	1	1	1	.	1	9	.	3	.	9
Luzula campestris aggr.	.	.	.	.	.	.	2	.	.	5	1	.	.
Malva thuringiaca	.	.	.	.	.	1	.	.	.	.	.	.	.
Mannia fragrans	.	.	.	.	.	.	.	.	.	.	5	.	.
Marrubium peregrinum	.	.	.	1	4	6	.	.	.	.	1	.	.
Marrubium vulgare	.	.	.	.	.	.	.	.	.	.	1	.	.
Matthiola odoratissima	.	.	.	1	.	1	.	.	.	.	.	.	.
Medicago minima	.	.	.	.	.	1	1	1	1	.	5	3	.
Medicago monspeliaca	.	.	.	1	.	.	.	.	.	.	.	.	.
Medicago prostrata	.	.	.	.	.	.	1	1	.	11	11	.	4
Medicago rupestris	.	.	.	.	.	.	4	.	.	.	.	.	.
Medicago sativa	.	.	.	.	.	1	.	.	.	.	.	.	2
Melampyrum arvense	.	.	.	6	3	7	1	.	6	.	2	6	.
Melampyrum barbatum	.	.	.	.	.	.	.	1	1	.	4	.	.
Melampyrum bihariense	.	.	.	.	.	.	.	1	.	.	.	.	.
Melampyrum cristatum	.	.	.	1	.	1	.	.	3	2	.	.	.
Melampyrum nemorosum	.	.	.	.	.	1	.	.	.	.	.	.	2
Melilotus albus	.	.	.	1	.	1	.	.	.	.	.	.	.
Melilotus officinalis	.	.	.	14	1	7	.	.	1	.	1	6	.
Melilotus sp.	.	.	.	.	.	1	.	.	.	.	.	.	.
Melilotus sulcatus	.	.	.	.	.	.	.	1	.	.	.	.	.
Mercurialis perennis aggr.	.	.	.	.	.	.	.	1	1	.	.	.	.
Minuartia glomerata	.	.	.	.	.	.	1	.	.	.	.	.	.
Minuartia rubra	.	.	.	.	.	.	.	.	3	.	9	.	.
Minuartia sp.	.	.	.	.	.	.	.	1	.	.	.	.	.
Minuartia verna	.	.	.	.	.	.	8	16	.	.	9	5	.
Misopates orontium	.	.	.	.	.	.	.	.	.	2	.	.	.
Moehringia muscosa	.	.	.	.	.	.	.	5	.	.	.	.	.
Muscari comosum	.	.	.	.	.	.	.	2	1	.	.	1	.
Muscari neglectum	.	.	.	.	.	.	7	.	1	.	6	.	.
Muscari tenuiflorum	.	.	.	.	.	.	.	.	1	.	.	.	.
Myosotis alpestris	.	.	.	.	.	.	.	1	.	.	.	.	.
Myosotis arvensis aggr.	.	.	.	.	.	.	.	.	1	5	1	.	2
Myosotis lithospermifolia	.	.	.	.	.	.	1	.	.	.	.	.	.
Myosotis ramosissima	.	.	.	.	.	.	3	.	.	7	.	.	.
Myosotis sparsiflora	.	.	.	.	.	.	.	1	.	.	.	.	.
Myosotis stricta	3	.	.	.	.	.	.	.	.	.	3	.	.
Myosotis sylvatica	.	.	.	.	.	.	.	1	.	.	.	.	.
Myriolecis crenulata	.	.	.	.	.	.	.	.	.	.	.	1	.
Neckera pumila	.	.	.	.	.	.	.	.	.	.	.	.	2
Neotinea ustulata	.	.	.	.	.	.	.	.	2	.	.	.	.
Nepeta cataria	.	.	.	.	2	.	.	.	.	.	.	.	.
Nepeta nuda	.	.	.	.	.	.	.	1	.	.	.	.	.
Nepeta ucranica	.	.	1	.	.	.	.	.	.	.	.	.	.
Niphotrichum canescens	.	.	.	.	.	.	.	.	.	.	.	.	4
Noccaea kovatsii	.	.	.	.	.	.	.	.	1	.	.	.	.
Noccaea perfoliata	.	.	.	.	.	1	.	1	3	.	6	5	4
Nonea pulla	.	.	.	.	2	10	.	.	1	.	.	.	.
Odontarrhena muralis	.	.	.	.	.	.	.	4	2	.	.	.	.
Odontites vernus	.	.	.	.	.	.	.	1	.	.	.	.	.
Odontites vulgaris	.	.	.	2	.	4	.	1	6	.	.	1	4
Onobrychis jailae	.	.	.	.	.	.	9	.	.	.	.	.	.
Onobrychis viciifolia aggr.	.	.	.	1	3	8	5	.	9	.	1	6	.
Ononis pusilla	.	.	.	.	.	.	1	.	.	.	.	.	.
Ononis spinosa	.	.	.	.	.	.	.	1	1	.	.	.	.
Onosma arenaria	.	.	.	.	.	.	3	.	.	.	.	.	.
Onosma heterophylla	.	.	.	.	.	.	.	1	.	.	1	5	.
Onosma polyphylla	.	.	.	1	.	.	.	.	.	.	.	.	.
Onosma rigida	.	.	.	.	1	.	3	.	.	.	.	.	.
Onosma tinctoria	3	.	.	.	.	.	.	.	.	.	.	.	.
Onosma visianii aggr.	.	.	.	.	.	1	4	.	6	.	4	1	.
Ophrys insectifera	.	.	.	.	.	.	.	.	4	.	.	.	.
Orchis simia	.	.	.	.	.	.	.	.	1	.	.	.	.
Origanum vulgare	.	.	.	1	1	3	.	10	5	.	1	3	9
Ornithogalum collinum	.	.	.	.	.	.	.	.	.	.	.	1	.
Ornithogalum pyrenaicum	.	.	.	.	.	.	2	.	.	.	.	.	.
Ornithogalum umbellatum	.	.	.	.	.	.	.	1	.	.	1	.	.
Orobanche alba	.	.	.	.	1	.	.	.	.	.	3	.	.
Orobanche elatior	.	.	.	.	.	.	.	.	.	.	2	.	.
Orobanche lutea	.	.	.	.	.	.	.	.	.	.	1	.	.
Orobanche sp.	.	.	.	.	.	.	.	.	7	.	1	.	.
Orobanche teucrii	.	.	.	.	.	.	.	1	.	.	.	.	.
Orthotrichum anomalum	.	.	.	.	.	.	.	.	.	.	5	.	4
Orthotrichum cupulatum	.	.	.	.	.	.	.	.	1	.	.	1	.
Orthotrichum sp.	.	.	.	.	.	.	.	.	.	.	.	1	2
Otites sp.	.	.	.	.	.	1	.	.	.	.	.	.	.
Oxalis acetosella	.	.	.	.	.	.	.	1	.	.	.	.	.
Oxytropis pilosa	.	.	.	.	2	4	1	.	1	.	.	3	.
Paeonia tenuifolia	.	.	.	1	1	1	1	.	.	.	.	.	.
Papaver dubium	.	.	.	.	.	.	.	1	.	.	1	.	.
Parmelia sp.	.	.	.	.	.	.	.	.	.	.	5	.	.
Pedicularis comosa	.	.	.	.	.	.	.	6	.	.	1	.	.
Pedicularis interrupta	3	.	4	.	.	.	.	.	.	.	.	.	.
Pedicularis kaufmannii	.	.	.	.	1	.	.	.	.	.	.	.	.
Pedicularis physocalyx	6	.	8	.	.	.	.	.	.	.	.	.	.
Pedicularis sibthorpii	.	.	.	.	.	.	4	.	.	.	.	.	.
Peltaria alliacea	.	.	.	.	.	.	.	1	.	.	.	.	.
Peltigera didactyla	.	.	.	.	.	.	.	.	.	.	.	3	.
Peltigera malacea	.	.	.	.	.	.	.	.	.	.	.	1	.
Peltigera rufescens	.	.	.	.	.	.	.	.	.	.	1	.	9
Petrorhagia prolifera	.	.	.	.	.	.	.	1	.	8	5	.	4
Petrorhagia saxifraga	.	.	.	.	.	.	.	2	.	.	3	.	2
Peucedanum austriacum	.	.	.	.	.	.	.	3	.	.	.	.	.
Peucedanum cervaria	.	.	.	.	.	.	.	.	5	.	.	6	.
Peucedanum oreoselinum	.	.	.	.	.	.	.	4	7	.	2	3	.
Peucedanum ruthenicum	.	.	.	.	.	1	1	.	.	.	1	.	.
Phegopteris connectilis	.	.	.	.	.	.	.	1	.	.	.	.	.
Phleum montanum	.	.	.	.	.	.	.	17	2	.	.	6	2
Phleum phleoides	.	.	.	.	.	1	1	3	2	2	13	1	18
Phleum pratense	.	.	.	.	.	.	.	.	.	.	.	.	2
Phlomis herba-venti subsp. *pungens*	11	.	1	.	1	1	7	.	.	.	.	.	.
Phlomis tuberosa	.	.	.	.	.	1	2	.	.	.	.	.	.
Physcia tenella	.	.	.	.	.	.	.	.	.	.	.	9	.
Phyteuma spicatum	.	.	.	.	.	.	.	.	1	.	.	.	.
Picea abies	.	.	.	.	.	.	.	1	1	.	.	.	.
Picris hieracioides	.	.	.	.	2	.	.	.	.	.	2	.	.
Pilosella cymosa	.	.	.	.	.	.	.	1	1	.	.	.	.
Pilosella echioides	.	.	.	.	.	4	.	1	3	.	2	4	.
Pilosella hoppeana	.	.	.	.	.	.	.	1	1	.	.	.	.
Pilosella lactucella	.	.	.	.	.	.	.	.	.	.	.	.	2
Pilosella leptophyton	.	.	.	.	.	1	.	.	.	.	.	.	.
Pilosella sp.	.	.	.	.	.	.	4	.	.	.	.	.	.
Pimpinella saxifraga aggr.	.	.	.	.	.	3	.	6	7	.	1	11	13
Pinguicula alpina	.	.	.	.	.	.	.	.	1	.	.	.	.
Pinus nigra	.	.	.	1	.	.	.	1	2	.	.	1	.
Pinus sylvestris	.	.	.	.	3	1	.	1	13	.	.	.	2
Piptatherum holciforme	.	.	.	.	.	.	.	1	.	.	.	.	.
Piptatherum virescens	.	.	.	.	.	.	.	1	1	.	1	.	.
Plagiochila asplenioides	.	.	.	.	.	.	.	.	.	.	.	.	2
Plantago argentea	.	.	.	.	.	.	.	1	2	.	6	.	.
Plantago lanceolata	.	.	.	1	.	6	1	2	4	.	5	6	9
Plantago media	.	.	.	.	.	5	2	3	12	.	4	1	9
Plantago tenuiflora	.	.	.	1	.	.	.	.	.	.	.	.	.
Platanthera bifolia	.	.	.	.	.	.	.	.	8	.	.	.	.
Pleurochaete squarrosa	.	.	.	.	.	.	.	.	.	.	2	.	.
Poa alpina	.	.	.	.	.	.	.	1	.	.	.	.	.
Poa angustifolia	.	.	.	2	1	6	.	1	1	.	2	.	.
Poa molinerii	.	.	.	.	.	.	.	1	.	.	.	.	.
Poa nemoralis	.	.	.	.	.	.	.	10	.	11	.	.	.
Poa pratensis	.	.	.	.	.	.	.	1	.	.	1	.	4
Poa sterilis	.	.	.	1	3	.	6	.	.	.	.	.	.
Pohlia cruda	.	.	.	.	.	.	.	.	.	.	.	.	2
Pohlia nutans	.	.	.	.	.	.	.	.	.	.	.	.	2
Polycnemum arvense	.	.	.	.	.	.	.	.	.	5	.	.	.
Polygala amara	.	.	.	.	.	.	.	11	13	.	.	.	2
Polygala comosa	.	.	.	.	4	5	.	2	1	.	.	4	4
Polygala major	.	.	.	.	.	.	2	1	6	.	.	.	.
Polygala supina	.	.	.	.	.	.	1	.	.	.	.	.	.
Polygala vulgaris	.	.	.	.	.	.	1	1	1	.	.	3	4
Polygonatum multiflorum	.	.	.	.	.	.	.	1	1	.	.	3	.
Polygonatum odoratum	.	.	.	.	1	2	3	12	10	2	5	1	4
Polygonum aviculare	.	.	.	.	.	1	.	.	.	2	.	.	.
Polypodium vulgare	.	.	.	.	.	.	.	3	.	13	.	.	2
Polytrichum piliferum	.	.	.	.	.	.	.	.	.	.	.	.	7
Potentilla alba	.	.	.	.	.	.	.	.	.	.	.	.	2
Potentilla argentea aggr.	.	.	.	.	.	.	.	6	5	3	4	1	20
Potentilla aurea	.	.	.	.	.	.	.	.	1	.	.	.	.
Potentilla grandiflora	.	.	.	.	.	.	.	.	.	.	.	.	2
Potentilla humifusa	.	.	1	.	.	11	2	.	1	.	.	.	.
Potentilla inclinata	.	.	.	.	.	1	.	.	.	.	.	.	.
Potentilla patula	.	.	.	.	.	6	.	.	.	.	.	.	.
Potentilla sp.	.	.	.	.	.	.	.	.	.	.	.	.	2
Potentilla thuringiaca	.	.	.	.	.	.	.	8	.	.	.	.	.
Prangos ferulacea	.	.	.	.	.	.	.	1	.	.	.	.	.
Primula acaulis	.	.	.	.	.	.	.	.	1	.	.	.	.
Primula auricula	.	.	.	.	.	.	.	.	3	.	.	.	.
Primula elatior	.	.	.	.	.	.	.	3	1	.	.	.	.
Primula sp.	.	.	.	.	.	.	1	.	.	.	.	.	.
Primula veris	.	.	.	.	.	.	.	12	1	2	1	.	.
Protoparmeliopsis muralis	.	.	.	.	.	.	.	.	.	.	.	4	.
Prunella grandiflora	.	.	.	.	.	.	.	.	3	.	.	.	.
Prunella vulgaris aggr.	.	.	.	.	.	.	.	.	1	.	.	.	.
Prunus armeniaca	.	.	.	.	1	1	.	.	.	.	.	.	.
Prunus avium	.	.	.	.	.	.	.	.	.	.	.	1	.
Prunus fruticosa	.	.	.	.	1	.	.	.	1	.	.	.	.
Prunus mahaleb	.	.	.	.	.	1	.	1	.	.	3	.	.
Prunus spinosa	.	.	.	.	.	1	.	1	1	.	.	5	.
Prunus tenella	.	.	.	.	1	.	.	.	.	.	.	.	.
Psathyrostachys lanuginosa	.	9	.	.	.	.	.	.	.	.	.	.	.
Psephellus declinatus	.	.	.	.	.	.	4	.	.	.	.	.	.
Psephellus trinervius	.	.	.	.	.	.	1	.	.	.	.	.	.
Pseudoleskeella catenulata	.	.	.	.	.	.	.	.	.	.	.	.	2
Pseudopodospermum hispanicum	11	.	3	.	.	.	.	.	.	.	.	.	.
Pseudopodospermum hispanicum	.	.	.	.	.	1	.	.	.	.	.	.	.
Pseudoturritis turrita	.	.	.	.	.	.	.	2	.	.	.	.	.
Psora decipiens	.	.	.	.	.	.	.	.	.	.	1	.	.
Puccinellia distans	.	.	1	1	.	.	.	.	.	.	.	.	.
Pulsatilla halleri	.	.	.	.	.	.	11	.	7	.	2	.	.
Pulsatilla montana	.	.	.	.	.	.	.	3	1	.	1	5	.
Pulsatilla patens	.	.	.	.	.	.	.	.	1	.	.	.	.
Pulsatilla pratensis	.	.	.	.	.	.	.	.	3	3	.	.	.
Pulsatilla sp.	.	.	.	.	.	.	.	.	6	.	.	.	.
Pulsatilla vulgaris	.	.	.	.	.	.	4	3	18	3	5	1	.
Pyrus communis	.	.	.	.	.	1	.	.	2	2	.	1	.
Quercus cerris	.	.	.	.	.	.	.	.	.	.	2	.	.
Quercus petraea	.	.	.	.	.	.	.	1	.	.	.	.	.
Quercus pubescens	.	.	.	.	.	.	.	1	2	.	1	.	.
Ramalina lacera	.	.	.	.	.	.	.	.	.	.	.	5	.
Ramalina siliquosa	.	.	.	.	.	.	.	.	.	.	.	5	.
Ranunculus breyninus	.	.	.	.	.	.	4	6	1	.	.	.	.
Ranunculus bulbosus	.	.	.	.	.	.	.	1	.	.	3	.	.
Ranunculus illyricus	.	.	.	.	.	.	.	.	.	.	2	.	.
Ranunculus montanus	.	.	.	.	.	.	.	1	.	.	.	.	.
Ranunculus polyanthemos	.	.	.	.	.	1	.	1	1	.	.	.	.
Rapistrum perenne	.	.	.	.	.	.	.	.	1	.	.	.	.
Reseda phyteuma	.	.	.	.	.	.	6	.	.	.	.	.	.
Rhamnus cathartica	.	.	.	.	.	1	.	3	.	.	.	1	4
Rhamnus saxatilis subsp. *tinctoria*	.	.	.	.	.	.	.	7	.	.	1	6	.
Rhamnus sp.	.	.	.	.	.	.	.	.	.	.	.	.	4
Rhaponticoides kasakorum	6	18	14	.	.	.	.	.	.	.	.	.	.
Rhinanthus angustifolius	.	.	.	.	.	.	.	.	3	.	.	.	7
Rhinanthus minor	.	.	.	.	.	.	.	1	1	.	.	1	.
Rhinanthus rumelicus	.	.	.	.	.	.	.	1	.	.	.	.	.
Rhytidiadelphus triquetrus	.	.	.	.	.	.	.	1	.	.	.	.	.
Rhytidium rugosum	.	.	.	.	.	.	.	.	.	.	.	5	2
Riccia sorocarpa	.	.	.	.	.	.	.	.	.	.	.	.	2
Rosa canina aggr.	.	.	.	.	2	4	.	1	2	5	.	6	7
Rosa gallica	.	.	.	.	.	1	.	.	.	.	.	.	.
Rosa micrantha	.	.	.	.	.	.	.	.	.	.	.	.	2
Rosa mollis	.	.	.	.	.	.	.	.	.	.	.	.	2
Rosa pendulina	.	.	.	.	.	.	.	1	.	.	.	.	.
Rosa rubiginosa	.	.	.	.	.	.	.	.	.	.	.	1	.
Rosa sp.	.	.	.	.	.	1	.	1	4	11	1	1	.
Rosa spinosissima	.	.	.	.	.	.	2	5	.	.	.	.	.
Rosa tomentosa	.	.	.	.	.	.	.	.	.	.	.	.	2
Rosulabryum capillare	.	.	.	.	.	.	.	.	.	.	.	3	2
Rubus canescens	.	.	.	.	.	.	.	1	.	.	.	.	.
Rubus silesiacus	.	.	.	.	.	.	.	1	.	.	.	.	.
Rumex acetosa	.	.	.	.	.	.	.	.	.	.	2	.	.
Rumex acetosella	.	.	.	.	.	.	.	1	.	8	.	.	2
Salix caprea	.	.	.	.	.	.	.	1	.	.	.	.	.
Salsola tamariscina	6	.	.	.	.	.	.	.	.	.	.	.	.

ID clusters	1	2	3	4	5	6	7	8	9	1	11	12	13
Number of relevés	35	11	73	243	92	280	116	290	196	61	111	80	55
Other taxa occurred in the communities (continued)													
Salsola tragus	.	.	.	.	.	1	.	.	.	.	.	.	.
Salvia nemorosa	.	.	.	.	.	3	.	.	.	.	.	4	.
Salvia pratensis aggr.	.	.	.	.	.	1	3	2	14	.	10	8	4
Salvia scabiosifolia	.	.	.	.	.	.	1	.	.	.	.	.	.
Salvia verbenaca	.	.	.	.	.	1	.	.	.	.	.	.	.
Salvia verticillata	.	.	.	3	11	18	.	13	11	.	2	8	25
Sanguisorba minor	.	.	.	.	.	4	51	12	49	.	50	3	35
Sanguisorba officinalis	.	.	.	.	.	.	.	.	.	.	.	.	4
Saponaria bellidifolia	.	.	.	.	.	.	.	6	1	.	.	4	.
Saponaria glutinosa	.	.	.	.	.	.	.	1	.	.	.	.	.
Satureja montana aggr.	.	.	.	.	2	.	4	1	.	.	.	.	.
Saxifraga adscendens	.	.	.	.	.	.	.	2	.	.	.	.	.
Saxifraga marginata	.	.	.	.	.	.	.	1	.	.	.	.	.
Saxifraga paniculata	.	.	.	.	.	.	.	22	2	20	1	.	16
Saxifraga tridactylites	.	.	.	.	.	.	.	2	3	7	5	.	9
Scabiosa canescens	.	.	.	.	.	.	16	.	7	.	2	.	.
Scabiosa columbaria	.	.	.	.	1	.	3	8	3	.	1	5	.
Scabiosa lucida	.	.	.	.	.	.	.	4	2	.	.	.	.
Schedonorus arundinaceus	.	.	.	1	.	3	.	.	.	.	.	.	.
Schedonorus pratensis	.	.	.	.	.	1	.	.	.	.	1	.	2
Schistidium apocarpum	.	.	.	.	.	.	.	.	.	.	.	5	.
Schistidium brunnescens	.	.	.	.	.	.	.	.	.	.	.	1	.
Schistidium sp.	.	.	.	.	.	.	.	.	.	.	.	1	.
Scleranthus annuus	.	.	.	.	.	.	.	1	.	3	.	.	.
Scleranthus perennis	.	.	.	.	.	.	.	.	.	.	.	.	2
Scorzonera laciniata	.	.	.	.	.	1	.	.	.	.	.	.	.
Scorzonera mollis	.	.	.	.	.	.	1	.	.	.	.	.	.
Scorzonera purpurea	.	.	.	.	.	.	.	1	2	.	1	3	.
Scorzoneroides autumnalis	.	.	.	.	.	.	.	1	3	.	.	.	5
Scrophularia heterophylla subsp. *laciniata*	.	.	.	.	.	.	.	1	.	.	.	.	.
Scrophularia rupestris	.	.	.	.	1	.	1	3	.	.	.	.	.
Scutellaria albida	.	.	.	1	1	.	.	.	.	.	.	.	.
Scutellaria orientalis	.	.	.	.	1	1	.	.	.	.	.	.	.
Scutellaria supina	.	.	.	.	5	4	.	.	.	.	.	.	.
Scytinium lichenoides	.	.	.	.	.	.	.	.	.	.	.	.	4
Securigera elegans	.	.	.	.	.	.	.	1	.	.	.	.	.
Securigera varia	.	.	.	4	9	31	1	18	5	.	8	11	16
Sedum acre	.	.	.	.	.	.	1	11	5	38	32	44	44
Sedum annuum	.	.	.	.	.	.	.	1	.	.	.	.	.
Sedum rubens	.	.	.	.	.	.	.	.	.	.	1	.	.
Sedum rupestre	.	.	.	.	.	.	.	.	.	.	3	.	.
Selaginella helvetica	.	.	.	.	.	.	.	6	.	.	.	.	.
Sempervivum marmoreum	.	.	.	.	.	.	.	20	1	16	7	1	.
Sempervivum ruthenicum	.	.	.	.	.	.	.	.	.	.	.	6	.
Sempervivum tectorum	.	.	.	.	.	.	.	1	.	.	1	.	.
Senecio glaucus subsp. *coronopifolius*	.	.	1	.	.	.	.	.	.	.	.	.	.
Senecio leucanthemifolius subsp. *vernalis*	.	.	.	.	.	1	.	.	.	.	.	1	2
Senecio sp.	.	.	.	.	.	.	9	.	.	.	.	.	.
Senecio squalidus aggr.	.	.	.	.	.	.	.	3	.	.	.	1	.
Senecio umbrosus	.	.	.	.	.	.	.	.	3	.	.	.	.
Seseli annuum	.	.	.	.	.	1	.	1	.	.	.	3	4
Seseli campestre	.	.	.	.	.	1	.	.	.	.	.	.	.
Seseli dichotomum	.	.	.	.	.	.	1	.	.	.	.	.	.
Seseli eriocephalum	3	9	.	.	.	.	.	.	.	.	.	.	.
Seseli gummiferum	.	.	.	.	1	.	.	.	.	.	.	.	.
Seseli hippomarathrum	.	.	.	.	.	.	9	1	2	.	1	14	.
Seseli lehmannii	.	.	.	.	.	.	7	.	.	.	.	.	.
Seseli libanotis	.	.	1	1	.	1	.	8	3	.	.	9	20
Seseli pallasii	.	.	.	.	.	.	.	6	11	.	2	4	4
Seseli rigidum	.	.	.	.	.	1	.	10	3	.	.	.	.
Seseli sp.	.	.	.	.	.	.	.	.	1	.	.	.	.
Seseli tortuosum	.	.	.	1	.	.	.	.	.	.	.	.	.
Sesleria heuflerana	.	.	.	.	.	.	.	13	2	8	1	9	.
Setaria pumila	.	.	.	1	.	1	.	.	.	.	.	.	.
Setaria viridis	.	.	.	.	.	.	.	.	.	3	.	.	.
Sherardia arvensis	.	.	.	.	.	.	1	.	.	.	.	.	.
Sideritis montana	.	.	.	.	1	1	8	.	.	.	18	5	.
Silene bupleuroides	.	.	.	.	.	1	.	1	1	.	1	3	.
Silene chlorantha	.	.	.	.	1	1	.	.	.	.	.	.	.
Silene cretacea	.	.	.	7	1	4	.	.	.	.	.	.	.
Silene csereii	.	.	.	.	.	.	.	.	.	.	.	1	.
Silene flavescens	.	.	.	.	.	.	.	1	.	.	.	.	.
Silene italica	.	.	.	.	.	.	.	8	.	.	2	.	2
Silene latifolia	.	.	.	.	.	.	.	1	.	.	1	.	.
Silene procumbens	.	.	.	1	.	.	.	.	.	.	.	.	.
Silene sp.	.	.	.	.	.	.	.	.	.	.	1	5	.
Silene viridiflora	.	.	.	.	.	.	.	1	.	.	.	.	.
Silene viscaria	.	.	.	.	.	.	.	.	.	.	.	.	2
Silene vulgaris	.	.	.	.	.	.	.	3	2	.	4	3	7
Silene zawadzkii	.	.	.	.	.	.	.	1	.	.	.	.	.
Sisymbrium loeselii	.	.	.	.	.	.	.	1	.	.	.	.	.
Sisymbrium polymorphum	3	.	1	.	.	2	.	.	.	.	.	.	.
Solanum nigrum	.	.	.	.	.	.	.	.	.	2	.	.	.
Solidago virgaurea	.	.	.	.	.	.	.	1	1	.	.	.	.
Sonchus asper	.	.	.	.	1	.	.	.	.	.	.	.	.
Sorbus aria	.	.	.	.	.	.	.	2	3	3	.	.	.
Sorbus aucuparia	.	.	.	.	.	.	.	2	1	.	.	.	.
Sorbus dacica	.	.	.	.	.	.	.	4	.	.	.	.	.
Sorbus graeca	.	.	.	.	.	.	.	1	.	.	.	.	.
Spiraea chamaedryfolia	.	.	.	.	.	.	.	1	.	.	.	.	.
Spiraea crenata	.	.	.	.	.	.	.	1	.	.	.	.	.
Spiraea hypericifolia	6	.	.	.	.	.	.	.	.	.	.	.	.
Squamarina cartilaginea	.	.	.	.	.	.	.	.	.	.	1	.	.
Squamarina lentigera	.	.	.	.	.	.	.	.	.	.	.	6	.
Stachys germanica	.	.	.	.	.	1	.	.	.	.	.	.	.
Stachys officinalis	.	.	.	.	.	.	.	.	3	.	2	.	.
Stipa tirsa	.	.	.	.	.	1	.	.	.	.	.	.	.
Stipa zalesskii aggr.	3	.	1	1	1	5	2	.	.	.	.	1	.
Streblotrichum convolutum	.	.	.	.	.	.	.	.	.	.	.	.	2
Syntrichia calcicola	.	.	.	.	.	.	.	.	.	.	.	1	.
Syntrichia montana	.	.	.	.	.	.	.	.	.	.	.	1	.
Syntrichia ruralis	.	.	.	1	.	3	.	1	.	.	.	.	11
Syntrichia ruralis var. ruraliformis	.	.	.	.	.	.	.	.	.	.	.	1	.
Syringa vulgaris	.	.	.	.	.	.	.	1	.	.	.	.	.
Tanacetum achilleifolium	.	.	1	.	.	.	.	.	.	.	.	.	.
Tanacetum corymbosum	.	.	.	.	.	1	1	2	3	.	.	.	.
Tanacetum kittaryanum	.	.	3	.	.	.	.	.	.	.	.	.	.
Tanacetum millefolium	.	.	.	.	.	2	.	.	.	.	.	.	.
Tanacetum santolina	.	9	.	.	.	.	.	.	.	.	.	.	.
Taraxacum sect. *Dioszegia*	.	.	1	4	3	8	.	.	2	.	1	.	.
Taraxacum sect. *Erythrocarpa*	.	.	.	.	.	.	.	9	.	.	.	.	.
Taraxacum sect. *Erythrosperma*	.	.	1	.	1	1	.	2	.	.	3	1	11
Taraxacum sect. *Piesis*	6	.	.	.	.	.	.	.	.	.	.	.	.
Taraxacum sect. *Scariosa*	.	.	.	1	.	1	.	.	.	.	.	.	.
Taraxacum sect. *Taraxacum*	.	.	.	.	.	1	3	1	.	.	.	.	9
Taraxacum sp.	.	.	.	.	.	.	.	.	2	.	1	.	2
Taxus baccata	.	.	.	.	.	.	.	.	1	.	.	.	.
Teesdalia nudicaulis	.	.	.	.	.	.	.	.	.	.	.	.	2
Tephroseris integrifolia	.	.	.	.	.	.	.	1	6	.	.	.	.
Thalictrum foetidum	.	.	.	.	.	.	.	8	1	3	.	.	.
Thalictrum simplex	.	.	.	.	.	1	.	.	.	.	.	.	.
Thalloidima sedifolium	.	.	.	.	.	.	.	.	.	.	.	.	5
Thesium alpinum	.	.	.	.	.	.	.	.	6	.	.	.	2
Thesium brachyphyllum	.	.	.	.	.	.	1	.	.	.	.	.	.
Thesium linophyllon	.	.	.	.	1	.	5	7	17	.	2	1	2
Thesium procumbens	.	.	.	1	.	7	.	.	.	.	.	.	.
Thesium ramosum	.	.	3	13	12	16	3	.	.	.	.	.	.
Thesium sp.	.	.	.	.	.	1	.	.	.	.	.	.	.
Thlaspi arvense	.	.	.	1	.	.	.	.	.	.	.	.	.
Thymelaea passerina	.	.	.	.	.	3	.	.	.	.	.	.	.
Thymus guberlinensis	.	.	3	.	.	.	.	.	.	.	.	.	.
Thymus moldavicus	.	.	.	.	.	.	.	.	2	.	.	4	.
Thymus sp.	.	.	.	.	.	.	.	.	8	.	5	.	.
Tilia cordata	.	.	.	.	.	.	.	2	1	.	1	.	.
Tilia platyphyllos	.	.	.	.	.	.	.	1	.	.	.	.	.
Tofieldia calyculata	.	.	.	.	.	.	.	.	1	.	.	.	.
Toninia coeruleonigricans	.	.	.	.	.	.	.	.	.	.	.	6	.
Toninia sp.	.	.	.	.	.	.	.	.	.	.	8	.	.
Torilis japonica	.	.	.	.	.	.	.	.	.	.	.	.	2
Tortella inclinata	.	.	.	.	.	.	.	.	1	.	3	8	2
Tortula caucasica	.	.	.	.	.	.	.	.	.	.	.	1	.
Tortula muralis	.	.	.	.	.	.	.	1	.	.	1	1	4
Tortula sp.	.	.	.	.	.	1	.	.	.	.	2	.	.
Tragopogon dasyrhynchus	.	.	.	.	.	.	1	.	.	.	.	.	.
Tragopogon dubius	.	.	1	1	.	1	.	.	1	2	5	.	.
Tragopogon marginifolius	.	.	1	.	.	.	.	.	.	.	.	.	.
Tragopogon pratensis	.	.	.	.	.	.	.	.	.	.	1	.	.
Trichostomum crispulum	.	.	.	.	.	1	.	.	.	.	.	1	.
Trifolium alpestre	.	.	.	.	.	.	2	2	4	7	2	1	4
Trifolium ambiguum	.	.	.	.	.	.	2	.	.	.	.	.	.
Trifolium arvense	.	.	.	.	.	.	.	1	.	11	10	.	.
Trifolium aureum	.	.	.	.	.	.	.	.	.	.	7	.	.
Trifolium campestre	.	.	.	.	.	.	.	1	1	5	5	.	.
Trifolium dubium	.	.	.	.	.	.	.	.	.	.	1	.	.
Trifolium montanum	.	.	.	.	.	1	.	3	1	2	.	.	.
Trifolium pratense	.	.	.	.	.	.	.	.	1	.	.	.	.
Trifolium repens	.	.	.	.	.	.	.	.	.	.	.	.	2
Trifolium rubens	.	.	.	.	.	.	.	.	.	2	1	.	.
Trigonella gladiata	.	.	.	.	.	.	1	.	.	.	3	.	.
Trinia glauca	.	.	.	.	.	.	8	1	1	.	5	.	.
Trinia multicaulis	6	.	.	.	.	1	.	.	1	.	.	.	.
Trisetum flavescens aggr.	.	.	.	.	.	.	.	1	.	.	.	.	2
Turritis glabra	.	.	.	.	.	.	.	.	.	.	2	.	.
Tussilago farfara	.	.	.	3	.	.	.	.	.	.	.	.	.
Ulmus minor	.	.	.	.	.	1	.	.	.	2	1	.	.
Ulmus sp.	.	.	.	.	.	1	.	.	.	.	.	.	.
Urtica dioica	.	.	.	.	.	.	.	1	.	.	.	1	.
Vaccinium myrtillus	.	.	.	.	.	.	.	1	.	.	.	.	.
Valeriana montana	.	.	.	.	.	.	.	1	.	.	.	.	.
Valeriana stolonifera	.	.	.	.	.	.	.	.	.	.	1	.	.
Valeriana tripteris	.	.	.	.	.	.	.	.	1	.	.	.	2
Valerianella locusta aggr.	.	.	.	.	.	.	.	2	.	.	4	.	.
Ventenata dubia	.	.	.	.	.	.	.	.	.	3	.	.	.
Verbascum chaixii	.	.	.	1	.	1	.	4	1	11	5	.	2
Verbascum lychnitis	.	.	.	1	1	6	.	18	.	2	14	3	11
Verbascum marschallianum	.	.	.	.	.	1	.	.	.	.	.	.	.
Verbascum nigrum	.	.	.	.	.	1	.	1	1	.	1	3	4
Verbascum phlomoides	.	.	.	.	.	.	.	1	.	.	1	4	4
Verbascum phoeniceum	6	.	1	1	.	1	.	.	.	.	1	3	.
Verbascum speciosum	.	.	.	.	.	.	.	1	.	.	.	.	.
Verbascum thapsus	.	.	.	.	.	.	.	.	.	.	.	.	5
Veronica arvensis	.	.	.	.	.	.	.	1	.	.	4	.	4
Veronica austriaca aggr.	.	.	.	1	.	4	16	9	6	.	15	.	16
Veronica biloba	9	.	.	.	.	.	.	.	.	.	.	.	.
Veronica chamaedrys	.	.	.	.	.	.	.	1	.	.	3	.	.
Veronica fruticans	.	.	.	.	.	.	.	.	.	.	.	.	5
Veronica incana	.	.	1	.	.	1	3	1	.	.	.	8	.
Veronica multifida	.	.	.	.	.	.	4	.	.	.	.	.	.
Veronica spicata aggr.	.	.	.	1	2	6	5	2	7	16	32	19	13
Veronica spuria aggr.	.	.	.	.	.	.	.	1	.	.	.	.	.
Veronica triphyllos	.	.	.	.	.	.	.	.	.	.	1	.	.
Veronica verna aggr.	.	.	.	.	.	.	.	.	.	7	1	.	2
Veronica vindobonensis	.	.	.	.	.	.	.	.	.	.	1	.	.
Viburnum lantana	.	.	.	.	.	.	.	1	1	.	.	.	.
Viburnum opulus	.	.	.	.	.	.	.	.	1	.	.	.	.
Vicia cracca	.	.	.	.	.	.	.	1	.	.	1	.	.
Vicia hirsuta	.	.	.	.	.	.	.	.	.	2	1	.	.
Vicia sativa subsp. *nigra*	.	.	.	.	.	.	.	.	.	.	2	.	.
Vicia serratifolia	.	.	.	.	.	.	.	.	.	.	1	.	.
Vicia tetrasperma	.	.	.	.	.	1	.	.	.	.	1	.	.
Vinca herbacea	.	.	.	.	.	2	8	1	.	.	1	1	.
Vincetoxicum pannonicum	.	.	.	.	.	.	1	.	.	.	.	.	.
Vincetoxicum scandens	.	.	.	.	.	1	.	.	.	.	.	.	.
Vincetoxicum schmalhausenii	.	.	.	.	.	.	2	.	.	.	.	.	.
Vinealobryum vineale	.	.	.	.	.	.	.	.	.	.	.	3	.
Viola altaica subsp. *oreades*	.	.	.	.	.	.	3	.	.	.	.	.	.
Viola collina	.	.	.	.	.	.	.	1	5	.	.	1	9
Viola hirta	.	.	.	.	.	.	.	2	16	2	2	.	15
Viola odorata	.	.	.	.	.	1	.	.	.	.	1	.	.
Viola rupestris	.	.	.	.	.	7	.	1	.	.	.	.	11
Viola tricolor aggr.	.	.	.	.	.	.	2	12	.	10	9	.	13
Weissia condensa	.	.	.	.	.	.	.	.	1	.	3	1	.
Weissia levieri	.	.	.	1	.	.	.	.	.	.	.	.	.
Weissia longifolia	.	.	.	.	.	1	.	.	.	.	.	5	.
Weissia sp.	.	.	.	.	.	2	.	.	1	.	.	.	.
Xeranthemum annuum	.	.	.	.	.	1	.	.	.	.	5	.	.
Xeranthemum cylindraceum	.	.	.	.	.	.	.	1	.	.	.	.	.