Tuexenia 44: xxx–xxx. Göttingen 2024.
doi: 10.14471/2024.44.005, available online at www.tuexenia.de

Habitat preference for the populations of the endangered species *Pontechium maculatum* (*Boraginaceae*) in Romania

Lebensraumpräferenz für die Populationen der gefährdeten Art *Pontechium maculatum* (*Boraginaceae*) in Rumänien

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Abstract

Pontechium maculatum (L.) Böhle & Hilger (*Boraginaceae* Juss.) is a biennial herb native to the dry grasslands from Central Europe to West Asia. It is considered a steppe relict with a pontic distribution. In Romania, the size and number of *P. maculatum* populations have decreased significantly due to overgrazing. This study aimed to identify the main plant communities containing *P. maculatum* and to analyze the relationships between floristic composition and environmental variables. For the syntaxonomic assignment, 218 phytocoenological relevés were used, and the vegetation classification was conducted using Agglomerative Hierarchical Clustering (ß-flexible method, β = -0.25, Bray-Curtis dissimilarity). The relationship between floristic composition and environmental variables was assessed using Detrended Correspondence Analysis (DCA) and Canonical Correlation Analysis (CCA). The results showed that dry grassland (*Festuco-Brometea* class) is the most frequent habitat in which the species *P. maculatum* occurs. Vegetation analysis indicated that *P. maculatum* grows in plant communities of the *Festucion valesiacae* alliance, in particular. The species also occurs in plant communities of the *Stipion lessingianae* alliance. Based on the moisture index of the floristic composition of the analyzed grasslands, *P. maculatum* is classified as a mesoxerophilic species. The most important variable influencing the floristic composition was BIO12 – annual precipitation.

Keywords: *Pontechium maculatum*, floristic composition, ecology of rare plants, habitat preference, annual precipitation (BIO12)

Erweiterte deutsche Zusammenfassung am Ende des Artikels

1. Introduction

One of the major global challenges is the loss of plant diversity (Wolf et al. 2017). For example, of the 424.335 plant species described by the IUCN in 2022 (IUCN Red List, vers. 2022-2; https://www.iucnredlist.org/species/162105/5538499#assessment-information), 24.914 are threatened. Pimm and Joppa (2015) mention that one third of the world's 450.000 angiosperms are threatened by extinction. The main threats to plant diversity include habitat loss and fragmentation, overexploitation, invasive exotic species, and the effects of

Manuscript received 07 October 2023, accepted 22 May 2024
Published online 22 October 2024
Co-ordinating Editor: Péter Török

anthropogenic climate change. The conservation of plant species is important scientifically, ethically, and aesthetically. Moreover, plant species can be conserved through the following strategies (Corlett 2016): assessment of conservation status, improvement of the system of protected areas, control of overexploitation, and *ex-situ* conservation. It has also been observed that plants are as threatened as mammals, less threatened than amphibians, and more threatened than birds (Corlett 2016). One of the threatened grassland species is *Pontechium maculatum* (L.) Böhle & Hilger (syn. *Echium russicum* J.F. Gmel.; Hilger & Böhle 2000), a thermophilic steppe relict (Jakovljević et al. 2011) with ornamental, bee-keeping, sanitary, and medicinal value (Nowak et al. 2020).

The species *P. maculatum* is a medicinal plant of the family *Boraginaceae* Juss. (Olennikov et al. 2017), which grows in a limited diversity of habitats. Representative habitats for the species are the dry narrow-leaved grasslands (*Festucion valesiacae* order) and broad-leaved grasslands (*Bromion erecti* order) of Eastern Europe (Böhle et al. 1996). The species also grows in grasslands (Makowski et al. 2023), sunny forest steppes (Dresler et al. 2017), thickets (Anastasiu & Negrean 2008), orchards, hayfields, bushes (Grințescu 1960), vineyards (Bernhardt et al. 2011), roadsides, edges of thermophilic forests, and in areas contaminated by heavy-metals (Jakovljević et al. 2019). *Pontechium maculatum* is a steppe and forest steppe species grasslands (Popescu 2013, Sârbu et al. 2013), with a limited and fragmented distribution (Valdés 2011, Bernhardt et al. 2011, Nowak et al. 2020) in Central Europe (Austria, Czech Republic, Hungary, Poland, Romania, and Slovakia), from the East (Ukraine and the Republic of Moldova) to the South-East (Albania, Bulgaria, Bosnia-Herzegovina, Croatia and Serbia), Central and Eastern European Russia, the Northern Caucasus and Southwest Asia (Azerbaijan, Armenia, and Turkey). In Romania, the analyzed species was reported from Banat, Bucovina, Crișana, Dobrogea, Oltenia, Maramureș, Moldova, Muntenia, and Transylvania (Oprea 2005).

At a global level, the species is not assessed (EEA 2023), and at the European and European Union level, the species is classified as "Least Concern" (Bernhardt et al. 2011, EEA 2023). In Romania, the species is considered vulnerable (Oprea 2005). In some countries of Central Europe (Austria, Czech Republic, Poland, and Slovakia) and South-Eastern Europe (Bulgaria), *P. maculatum* is threatened by the abandonment of grazing activities, the subsequent succession of vegetation, the expansion of agricultural fields and vineyards, spring fires, and improper grassland management (Niklfeld & Schratt-Ehrendorfer 1999, Holub & Procházka 2000, Petrova & Vladimirov 2009, Bernhardt et al. 2011, Mereďa & Hodálová 2011, Eliáš et al. 2015, Nowak et al. 2020). Only in some countries (Russia, Serbia and Hungary), are *P. maculatum* populations considered stable. As such, the species is legally included in Annex I, as revised by Resolution 6 (1998) of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1979), Annexes IIb and IVb of Council Directive 92/43 /CEE (EU Habitats Directive 1992) and is protected by GEO 57/2007 (Law 49/2011).

Currently, its distribution area in Romania has been reduced due to anthropogenic activities (Bernhardt et al. 2011, Mereďa & Hodálová 2011, Sava et al. 2019, Vladimirov et al. 2023): overgrazing, conversion of grasslands into arable land, fires of spring, the natural expansion of shrubs and trees, etc. Other pressures and threats include competition with other species. In this context, it is necessary to develop conservation measures for the species. Of the approximately 200 populations of *P. maculatum* recorded in Romania, approximately 60% have not been confirmed in the last two decades. This underscores the importance of obtaining accurate information on the preferred habitat, number and dynamics

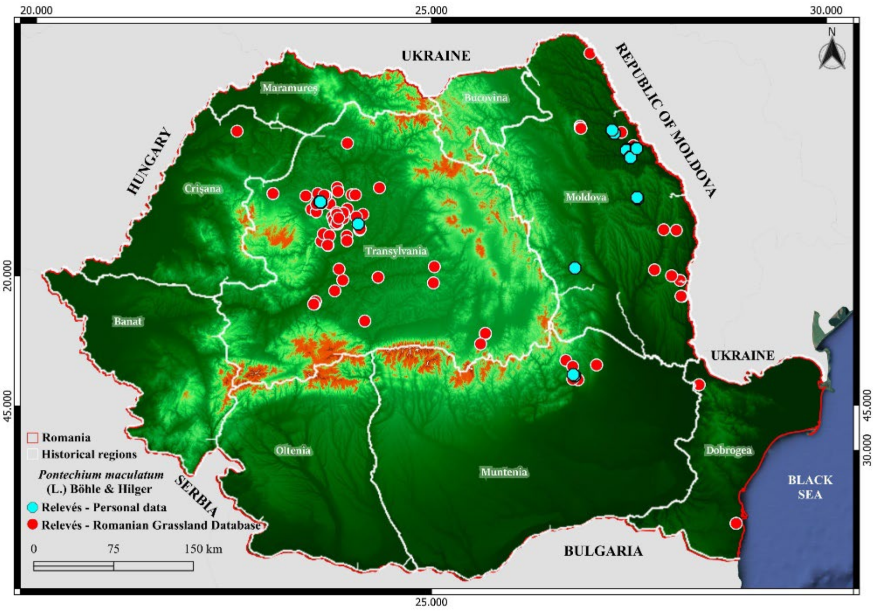

Fig. 1. Area of the study (Map: S.D. Chirilă; Raster: SRTM data, 2023).

Abb. 1. Das Untersuchungsgebiet.

of *P. maculatum* populations. Moreover, analyzing the habitat preferences of *P. maculatum* is important for identifying the probability of its survival under current habitat conditions, and for developing conservation measures for the species.

The purpose of the study is to investigate the habitat preferences of *P. maculatum* in Romania, as there is insufficient data from the entire distribution area regarding the appropriate habitat of the species.

2. Study area

The study areas were represented by five historical regions of Romania: Crișana, Dobrogea, Moldova, Muntenia, and Transylvania (Fig. 1). The elevation of the studied areas varied from 19 m to 776 m. The climate is temperate continental, with an annual mean temperature ranging from 6.2 °C to 11.8 °C, and annual precipitation ranging from 432 mm to 731 mm (Fick & Hijmans 2017). The soil types identified in these areas are chernozems, clay-iluvial browns, and acid browns (Florea & Munteanu 2003).

3. Material and methods

3.1 Study species

Pontechium maculatum (Fig. 2) is a Pontic-Pannonian hemicryptophyte, considered a biennial (Grințescu 1960) or perennial (Vladimirov et al. 2023) species with a pivot root (Grințescu 1960). The stem is erect (Grințescu 1960), and the basal leaves are linear-lanceolate (Anastasiu 2015). The height of the species ranges from 20 to 90–100 cm (Brînzan et al. 2013, Anastasiu 2015). The fruit is an obliquely ovoidal nucule (Anastasiu & Negrean 2008).

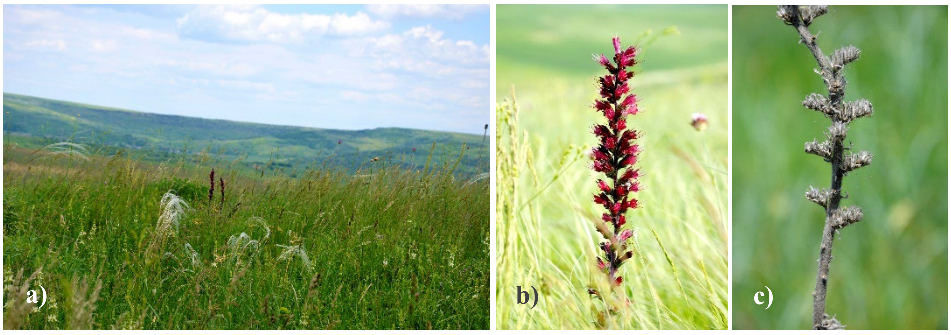

Fig. 2. *Pontechium maculatum* **a)** the habitat of the species, **b)** the flowering stage, and **c)** the maturity stage (Photos: S.D. Chirilă, a) and b) May 2022, c) August 2022).

Abb. 2. *Pontechium maculatum* **a)** Lebensraum der Art, **b)** Blühstadium und **c)** Reifephase (Fotos: S.D. Chirilă, a) und b) Mai 2022, c) August 2022).

3.2 Vegetation sampling and classification

For the vegetation analysis, 218 relevés (including 771 taxa) were used: 181 relevés were obtained from the Romanian Grasslands Database (RGD; Vassilev et al. 2018) collected during the period 1938–2021; and 37 relevés were conducted between May and June 2020–2021 (personal data). The size of the personal plots was 100 m^2, while the size of the plots obtained from the Romanian Grasslands Database varied from 25 m^2 to 100 m^2.

For further data analysis, the relevés were imported into the JUICE 7.1 program (Tichý 2002), and then the dataset was standardized (Dengler et al. 2012, Mucina et al. 2016, Willner et al. 2019): (i) taxonomy and nomenclature were unified; (ii) removal of taxa identified only at the genus level; (iii) exclusion of lichens and bryophytes from the analysis, as they were only recorded in some relevés; (iv) downweighting of rare plant species present in a single relevé; (v) the unified of taxa (subspecies) at the species level. The final dataset included 218 relevés and 503 taxa.

Agglomerative Hierarchical Clustering methods (ß-flexible method, $\beta = -0.25$, and Bray-Curtis dissimilarity) were used to classify vegetation based on data transformed to square roots. The data were presented as mean percentage values corresponding to the Braun-Blanquet scale of cover-abundance (Braun-Blanquet 1964, Borza & Boșcaiu 1965, Cristea et al. 2004). The mean AD ranges corresponding to the classes are: r (0.01% – 0.1%); + (0.1% – 1%); 1 (1% – 10%); 2 (10% – 25%); 3 (25% – 50%); 4 (50% – 75%); and 5 (75% – 100%). The dendrogram was generated using GINKGO software (Bouxin 2005). The optimal number of clusters was determined based on the mean Silhouette index (Rousseeuw 1987). After identifying the optimal number of clusters, the synoptic table of plant communities was created using the JUICE program version 7.1 (Tichý 2002).

For each cluster, diagnostic species were identified based on their indicator value (IndVal; Dufrêne & Legendre 1997) and validated by a permutation test (de Cáceres & Legendre 2009) using GINKGO. For each diagnostic species, two values were presented: the first value represents the statistical value, and the second value represents the p-value. For example, in our results, the species *Carex humilis* has a statistical value of 0.834, suggesting a strong association with Cluster 1. The p-value for *C. humilis* is 0.001, which is less than the significance level (alpha) of 0.05 (denoted as ***), indicating a significant association between *C. humilis* and Cluster 1.

The cenotaxonomic affiliation of the plant associations followed Coldea et al. (2012). The nomenclature of plant species followed EURO+MED (2023), and the nomenclature of plant associations followed Coldea et al. (2012). The nomenclature of higher syntaxa followed Mucina et al. (2016). Habitat types were classified using the EUNIS expert habitat classification system (Chytrý et al. 2020).

3.3 Environmental variables

In the multivariate analysis, topographic variables (elevation, aspect, slope), climatic variables (annual mean temperature, annual precipitation), and edaphic variables (pH, phosphorus – P, and potassium – K) were used. Elevation, aspect, and slope were recorded in the field, while annual mean temperature and annual precipitation were extracted from the WorldClim database (Fick & Hijmans 2017).

– For personal data, soil samples were collected from each relevé. The chemical composition of the following elements was then determined: determination of elemental composition by X-ray fluorescence; phosphorus and available potassium – Egner-Riehm Domingo method according to ISO 11263:1994 (https://www.iso.org/standard/19241.html; Soil quality – Determination of phosphorus – Spectrometric determination of phosphorus soluble in sodium hydrogen carbonate solution) and soil pH according to SR EN ISO 10390:2005 (https://www.iso.org/standard/40879.html; Soil quality – Determination of pH).
– For the data obtained from the Romanian Grassland Database (RGD), values for chemical elements P, K, and soil pH (Ballabio et al. 2019) were extracted from the European Soil Database & soil properties (ESDAC; https://esdac.jrc.ec.europa.eu/resource-type/european-soil-database-soil-properties).
– The moisture index (U) was used to classify plants according to the moisture level of their environment. Depending on the value of the index, there are different ecological categories (Păcurar & Rotar 2014): 1–2 (xerophilic), 3–4 (meso-xerophilic), 5–6 (mesophilic), 7–8 (meso-hygrophilic), 9 (hydrophilic), 10 (ultrahydrophilic), X (euriphilic).

3.4 Vegetation-environment relationship

Relationships between vegetation and environmental variables were analyzed using Detrended Correspondence Analysis (DCA). Data were transformed using square root transformation, with detrending by segments and reducing the weight of rare species. Canonical Correspondence Analysis (CCA) was then applied to quantify the effect of each environmental variable on the floristic composition, using the Monte Carlo permutation test (999 permutations). Ordination analysis was performed in CANOCO version 5.1 (ter Braak & Šmilauer 2018). Collinearity between independent variables was assessed using the Variance Inflation Factor (VIF), in CANOCO. Variables with VIF value > 5 were considered multicollinear (Hair et al. 2010) and excluded from the model. Variables with a VIF value < 5 were retained (Table 1). The data distribution map (relevés) was created using QGIS version 3.28.3 (https://qgis.org).

Table 1. VIF (Variance Inflation Factor) analysis between environmental variables.

Tabelle 1. VIF-Analyse zwischen Umgebungsvariablen.

Variables	VIF
Aspect	1.073
Slope (°)	1.100
BIO12 – annual precipitation (mm)	1.571
Elevation (m)	1.760
pH	1.959
P – phosphorus (mg kg^{-1})	1.305
K – potassium (mg kg^{-1})	1.520

4. Results

4.1 Syntaxonomical scheme

Pontechium maculatum populations were identified to inhabit four main syntaxonomical classes: *Festuco-Brometea*, *Trifolio-Geranietea sanguinei*, *Molinio-Arrhenatheretea* and *Festuco-Puccinellietea*. In this context, the vegetation was grouped into seven orders, ten alliances, and 20 plant associations.

Syntaxonomic overview of relevés

Class: *Festuco-Brometea* Br.-Bl. et Tx. ex Soó 1947
- Order: *Brachypodietalia pinnati* Korneck 1974
  - All.: *Chrysopogono-Danthonion calycinae* Kojic 1959
    - Ass.: *Thymio pannonici-Chrysopogonetum grylli* Doniţă et al. 1992
    - Ass.: *Festuco rupicolae-Danthonietum alpinae* Csürös et al. 1961
  - All.: *Cirsio-Brachypodion pinnati* Hadač et Klika in Klika et Hadač 1944
    - Ass.: *Danthonio alpinae-Brachypodietum pinnati* Soó ex Pop et al. 2002
    - Ass.: *Carici humilis-Brachypodietum pinnati* Soó (1942) 1947
- Order: *Festucetalia valesiacae* Soó 1947
  - All.: *Stipion lessingianae* Soó 1947
    - Ass.: *Taraxaco serotinae-Festucetum valesiacae* (Burduja et al. 1956, Răvăruţ et al. 1956) Sârbu et al. 1999
    - Ass.: *Jurineo arachnoideae-Stipetum lessingianae* (Dobrescu 1974) Chifu et al. 2006
  - All.: *Festucion valesiacae* Klika 1931
    - Ass.: *Festuco rupicolae-Brachypodietum pinnati* (Soó 1927) Schneider-Binder 1971
    - Ass.: *Cleistogeni-Festucetum sulcatae* Zólyomi 1958
    - Ass.: *Jurineo transylvanicae-Stipetum pulcherrimae* (Soó 1942)
    - Ass.: *Salvio transsilvanicae-Festucetum rupicolae* (Soó 1947)
    - Ass.: *Allio albidi-Stipetum lessingianae* (Soó 1947)
    - Ass.: *Medicagini minimae-Festucetum valesiacae* Wagner 1941
    - Ass.: *Danthonio alpinae-Stipetum stenophyllae* Ghişa 1941
    - Ass.: *Cynodonto-Poëtum angustifoliae* (Rapaics 1926) Soó 1957
- Order: *Stipo pulcherrimae-Festucetalia pallentis* Pop 1968
  - All.: *Bromo pannonici-Festucion csikhegyensis* Zólyomi 1966 corr. Mucina in Di Pietro et al. 2015
    - Ass.: *Thymio comosi-Festucetum rupicolae* (Csűrös 1959) Pop et Hodişan 1985
  - All.: *Artemisio-Kochion* Soó 1964
    - Ass. *Agropyro-Kochietum prostratae* Zólyomi 1958

Class: *Trifolio-Geranietea sanguinei* T. Müller 1962
- Order: *Origanetalia vulgaris* T. Müller 1962
  - All.: *Geranion sanguinei* Tx. in T. Müller 1962
    - Ass.: *Inulo ensifoliae-Peucedanetum cervariae* (Kozlowska 1925) Gils et Kovács 1977

Class: *Molinio-Arrhenatheretea* Tx. 1937
Order: *Arrhenatheretalia elatioris* Tx. 1931
All.: *Arrhenatherion elatioris* Koch 1926
Ass.: *Pastinaco-Arrhenatheretum* Passarge 1964
Order: *Potentillo-Polygonetalia avicularis* Tx. 1947
All.: *Potentillion anserinae* Tx. 1947
Ass.: *Rumici crispi-Agrostietum stoloniferae* Moor 1958
Class: *Festuco-Puccinellietea* Soó ex Vicherek 1973
Order: *Puccinellietalia* Soó 1947
All.: *Festucion pseudovinae* Soó 1933
Ass.: *Artemisio santonici-Festucetum pseudovinae* Soó in Máthé corr. Borhidi 1966

The species *P. maculatum* is a mesoxerophilic species, characteristic of steppe (25%) and forest-steppe (75%) grasslands, growing on phaeozem and chernozem soils. Initially, the ecological optimum of the species was in the steppe grasslands of the Pannonian region, but it was gradually shifted to the forest-steppe grasslands (Mereďa & Hodálová 2011). Most populations of *P. maculatum* are in Transylvania (66%). *Pontechium maculatum* prefers slopes with sunny aspects (58%): southwest, south, and west. It can also be found in eastern, east-southeastern, and north-northeastern aspects (42%). In general, the species was identified on gentle slopes – from 3° to 10° (43%), followed by moderate slopes – from 11° to 20° (27%) and steep slopes – from 21° to 35° (16%). The species was very rare on very gentle slopes – from 0° to 3° (5%) and on very steep slopes – from 36° to 50° (8%). In the analyzed grasslands with *P. maculatum*, the difference in elevation ranges from 38 m to 776 m, with an average of 330 m. The annual mean temperature ranges from 6.3 °C to 12 °C, and the annual precipitation from 434 mm to 731 mm. The type of grassland management is represented by the following categories: non-grazed, grazed, overgrazed, and mowed grassland. Perennial plants dominate the analyzed plant communities (85%). Overall vegetation cover ranges from 40% to 100%, with an average of 90%.

4.2 Cluster analysis

The results of the cluster analysis are presented in the form of a dendrogram and a synoptic table (Supplement E1). The vegetation, classified into 17 clusters (Fig. 3), can be assigned to different syntaxa or groups of syntaxa described in the literature (Coldea et al. 2012).

Cluster 1: *Carici humilis-Brachypodietum pinnati*

The diagnostic species is *Carex humilis* (0.834, 0.001).

It is distributed in the counties of Alba, Brașov, Cluj, and Sibiu, with communities used as pastures. The association occurs at medium elevation, on moderate slopes with a south-southwest aspect. The soil is moderately acidic, and K-rich. The climate is temperate, with moderate precipitation. The species diversity is moderate, with cover ranging from 50% to 100% (Table 2). *Carex humilis* is the dominant species. Several species such as *Festuca valesiaca* and *Brachypodium pinnatum* show variability in their cover abundance. Species such as *Thymus pulegioides* and *Teucrium chamaedrys* have variable values but are generally lower, suggesting that although they are part of the community, they are not as influential in terms of vegetation cover. The species *P. maculatum* had moderate cover, ranging from 0.01% to 5%.

Fig. 3. Dendrogram of relevés with *Pontechium maculatum* in Romania.

Abb. **3**. Dendrogramm von Vegetationsaufnahmen mit *Pontechium maculatum* in Rumänien.

Cluster 2: *Brachypodium pinnatum-Festuca valesiaca community*

The diagnostic species is *Brachypodium pinnatum* (0.866, 0.001).

It is distributed in the counties of Mureș and Cluj, where the grassland is used for mowing and grazing. The soil is moderately acidic, with medium levels of phosphorus and very high levels of potassium. Communities with *Brachypodium pinnatum* occur at medium elevation, on moderate slopes with a southeast aspect. The climate is temperate. The diversity of species and vegetation cover are high (Table 2). *Brachypodium pinnatum* is the dominant species in most relevés. Several species such as *Festuca valesiaca*, *F. stricta* subsp. *sulcata* and *Lotus corniculatus* have variable cover abundance, indicating their subdominant role in the ecosystem structure. Species like *Thymus pulegioides* and *Convolvulus arvensis* occur with low cover, meaning that they are less dominant and may represent opportunistic species taking advantage of gaps in the vegetation. The presence and abundance of specific species may indicate certain environmental conditions. For example, *Euphorbia cyparissias* often indicate well-drained, dry soils, whereas *Filipendula vulgaris* may indicate slightly wetter conditions. The species *P. maculatum* had a low cover of 0.5%.

Cluster 3: *Thymio comosi-Festucetum rupicolae*, *Cleistogeni-Festucetum sulcatae*, and *Festuca stricta* subsp. *sulcata-Brachypodium pinnatum-Carex humilis* community

The diagnostic species is *Festuca stricta* subsp. *sulcata* (0.689, 0.001).

It is distributed in the counties of Alba, Bistrița-Năsăud, Cluj, Mureș, and Sibiu. The communities are used as pastures. The soil is moderately acidic, with moderate levels of nutrients. The climatic conditions are moderate, and the elevation is medium. The aspect is south-eastern, and the slope is moderate. Diversity of species and vegetation cover are high (Table 2). *Festuca stricta* subsp. *sulcata* is consistently the most abundant species in almost all relevés, with abundance values ranging from 30% to 50%. *Brachypodium pinnatum* shows variability in abundance, suggesting it may be dominant in some areas (with values up to 15%) and less so in others. *Carex humilis* is moderately abundant in several relevés, but there are relevés where it is slightly abundant (values of 10% and 15%) and others where it is less abundant or not present. This could indicate a preference for certain environmental conditions or stages of ecological succession.

Cluster 4: *Festuca stricta* subsp. *sulcata-Vicia cracca* community

The diagnostic species are *Vicia cracca* (0.978, 0.001), *Pilosella caespitosa* (0.765, 0.002), *Lathyrus pallescens* (0.620, 0.013), *Rumex acetosa* (0.605, 0.012), *Potentilla patula* (0.600, 0.015), *Rhinanthus angustifolia* (0.572, 0.016), *Phleum montanum* (0.530, 0.033), *Helictochloa pratensis* (0.528, 0.031), *Tragopogon pratensis* (0.506, 0.038).

The community is distributed in the counties of Alba and Cluj, at medium elevations, on moderate slopes, with a northwest aspect. The soils are moderately acidic, with high nutrient levels. The climatic conditions are moderate. Species diversity and vegetation cover are high (Table 2). The species *P. maculatum* had a low cover, at 0.1%.

Cluster 5: *Danthonio alpinae-Stipetum stenophyllae*, *Festuco rupicolae-Danthonietum alpinae*, and *Danthonio-Brachypodietum pinnati*

The diagnostic species is *Danthonia alpina* (0.949, 0.001).

It is distributed in the counties of Alba and Cluj, at medium elevations. The soils are moderately acidic, with high nutrient levels. The climate conditions are moderate. The communities occur on moderate slopes, with a southern aspect. The diversity of species and vegetation cover is high (Table 2). Species such as *Danthonia alpina*, *Festuca stricta* subsp. *sulcata*, and *Carex humilis* have a high cover in most relevés. The species *P. maculatum* had a low cover, at 0.5%.

Cluster 6: *Stipa tirsa-Festuca stricta* subsp. *sulcata* community

The diagnostic species is *Stipa tirsa* (0.956, 0.001).

It is distributed in Cluj and Satu-Mare counties, at moderate elevations. The soil is moderately acidic and rich in potassium and phosphorus. The climate conditions are moderate. The communities occur on slight slopes, with southern and eastern aspects. *Stipa tirsa* is the dominant species, with high cover in almost all relevés (Table 2). *Festuca stricta* subsp. *sulcata* and *Carex humilis* also show significant cover in certain relevés, indicating that they are important but not as dominant as *Stipa tirsa.* Their presence in varying degrees of relevés suggests they might prefer different environmental conditions or could be predominant in different stages of succession. Species such as *Briza media*, *Clematis integrifolia*, and *Salvia pratensis* are present in moderate to low abundance. The species *P. maculatum* had a low cover, at 1%.

Cluster 7: *Rumici crispi-Agrostietum stoloniferae* and *Pastinaco-Arrhenatheretum*

The diagnostic species are *Taraxacum* sect. *Taraxacum* (0.664, 0.003), *Leontodon hispidus* (0.615, 0.002), *Agrostis stolonifera* (0.577, 0.02), *Linum austriacum* (0.575, 0.014), *Festuca valesiaca* (0.562, 0.044), *Cerastium fontanum* (0.553, 0.022), *Cirsium furiens* (0.551, 0.04), *Leucanthemum vulgare* (0.536, 0.011), *Galium boreale* (0.505, 0.03).

It is distributed in Cluj County, at medium elevations. The soil is moderately acidic, with moderate levels of nutrients. The climatic conditions are moderate. The aspect is easterly, with slight slopes. The diversity of species is very low, and the vegetation cover is high (Table 2). The data analyzed presents a plant community with a significant variety of species, each represented by single occurrences, except for *Agrostis stolonifera* and *Arrhenatherum elatius*, which are predominant. The floristic composition, with species such as *Clematis integrifolia* and *Filipendula vulgaris*, often indicates a temperate meadow, possibly with varying soil conditions from dry to moderately moist. The species *P. maculatum* had a low cover, ranging from 0.5% to 1%.

Cluster 8: ***Artemisio santonici-Festucetum pseudovinae***

The diagnostic species are *Festuca valesiaca* subs. *parviflora* (0.993, 0.013), *Cirsium furiens* (0.988, 0.01), *Ficaria verna* (0.972, 0.018), *Linum tenuifolium* (0.969, 0.014), *Ornithogalum pyramidalis* (0.927, 0.028), *Orobanche alba* (0.867, 0.045), *Potentilla heptaphylla* (0.845, 0.021), and *Nonea pulla* (0.500, 0.037).

The communities are distributed in Cluj County, at moderate elevations, on slight slopes with a south-western aspect. These communities are characterized by the highest annual precipitation and the lowest annual mean temperatures compared to the other associations. The soil is moderately acidic, with moderate levels of phosphorus and very high levels of potassium. Species diversity is low, and the vegetation cover is high (Table 2). The dominant species in this area is *Festuca valesiaca* subsp. *parviflora*, indicating that this species might be the predominant feature of the vegetation in this area, potentially shaping the ecosystem's characteristics. The presence of species such as *Salvia nemorosa* and *S. transsylvanica* may indicate a grassland or steppe-like habitat, commonly found in temperate areas. *Pulsatilla montana* and *Primula veris* are typical in grasslands, and their presence could indicate well drained soils, possibly with calcareous characteristics. The species *P. maculatum* had a low cover of 0.5%.

Cluster 9: ***Cynodonto-Poëtum angustifoliae***

The diagnostic species are *Allium paniculatum* (1.000, 0.001), *Silene coronaria* (1.000, 0.001), *Poa angustifolia* (0.979, 0.001), *Orlaya grandiflora* (0.913, 0.001), *Galium humifusum* (0.795, 0.004), *Cynodon dactylon* (0.770, 0.002), *Hypericum elegans* (0.764, 0.003), *Galium mollugo* (0.704, 0.003), *Digitalis lanata* (0.692, 0.014), *Melica ciliata* (0.689, 0.004), *Rumex acetosella* (0.685, 0.006), *Bromus hordeaceus* (0.661, 0.008), *Iris variegata* (0.636, 0.008), *Rosa corymbifera* (0.620, 0.039), *Rhamnus cathartica* (0.608, 0.036), *Clinopodium acinos* (0.603, 0.014).

It is distributed in Tulcea County, at low elevations. The soil is moderately acidic and poor in nutrients. The climate is warm and dry. The species diversity is low, and the vegetation cover is moderate (Table 2). *Poa angustifolia* is the dominant species. The species *P. maculatum* had a low cover of 1%.

Cluster 10: ***Inulo ensifoliae-Peucedanetum cervariae***

The diagnostic species are *Origanum vulgare* (0.991, 0.001), *Brachypodium rupestre* (0.989, 0.001), *Inula ensifolia* (0.979, 0.001), *Campanula rapunculoides* (0.972, 0.002), *Peucedanum cervaria* (0.970, 0.001), *Asyneuma canescens* (0.872, 0.001), *Peucedanum officinale* (0.852, 0.002), *Artemisia pontica* (0.777, 0.004), *Bromopsis erecta* (0.775, 0.004), *Anthericum ramosum* (0.648, 0.004), *Bupleurum falcatum* (0.641, 0.011), *Cleistogenes serotina* (0.599, 0.019), *Galatella linosyris* (0.579, 0.021), *Eryngium planum* (0.573, 0.041), *Astragalus monspessula* (0.565, 0.009), *Clinopodium vulgare* (0.528, 0.047).

It is distributed in the counties of Harghita and Mureș. The soil is moderately acidic, with moderate levels of phosphorus and potassium. The climatic variations are moderate, and the elevation is medium. The aspect is south-southwest. There is a high diversity of species, and the vegetation cover is high (Table 2). *Inula ensifolia* is the dominant species, and *Peucedanum cervaria* is the co-dominant species. The slight difference in cover values between the two relevés for *Pontechium maculatum* could be due to differences in microhabitat preferences or the influence of interspecific interactions, such as competition. The species *P. maculatum* had a low cover, ranging from 0.1% to 1%.

Cluster 11: ***Medicagini minimae-Festucetum valesiacae***

The diagnostic species are *Bothriochloa ischaemum* (0.947, 0.001), *Crepis setosa* (0.857, 0.001), *Melilotus officinalis* (0.840, 0.001), *Trifolium arvense* (0.796, 0.003), *Stachys annua* (0.751, 0.002), *Jurinea arachnoidea* (0.732, 0.001), *Linum hirsutum* (0.717, 0.006), *Leopoldia comosa* (0.701, 0.004), *Malva thuringiaca* (0.693, 0.004), *Cytisus austriacus* (0.677, 0.003), *Reseda lutea* (0.672, 0.007), *Centaurea solstitialis* (0.667, 0.006), *Taraxacum serotinum* (0.658, 0.008), *Astragalus onobrychis* (0.656, 0.013), *Euphorbia nicaeensis* (0.656, 0.008), *Cota tinctoria* (0.638, 0.009), *Silene densiflora* (0.635, 0.01), *Phlomis herba-venti* (0.618, 0.007), *Bromopsis inermis* (0.605, 0.015), *Centaurea orientalis* (0.601, 0.013), *Marrubium peregrinum* (0.600, 0.02), *Agrimonia eupatoria* (0.584, 0.028), *Daucus carota* (0.580, 0.019), *Clematis integrifolia* (0.544, 0.03), *Veronica austriaca* (0.523, 0.029), *Linum flavum* (0.521, 0.025).

It is distributed in Alba County. The soils are slightly acidic, with moderate levels of potassium and phosphorus. The climate is cooler and more humid. These communities occur at lower elevations, on moderate slopes with a south-west aspect. There is a high species diversity and a very high vegetation cover (Table 2). The dominant species is *Bothriochloa ischaemum*. Some plant species, such as *Achillea setacea* and *Veronica austriaca*, recorded different cover in relevés from this cluster. The species *P. maculatum* had a low cover, at 0.5%.

Cluster 12: ***Agropyro-Kochietum prostratae***

The diagnostic species are *Limonium bellidifolium* (1.000, 0.001), *Agropyron cristatum* (0.988, 0.001), *Poa bulbosa* (0.914, 0.001), *Anisantha tectorum* (0.894, 0.02), *Echinops ritro* (0.894, 0.02), *Bassia prostrata* (0.855, 0.002), *Xeranthemum annuum* (0.800, 0.005), *Limonium gmelinii* (0.775, 0.02), *Potentilla hirta* (0.775, 0.01), *Consolida regalis* (0.732, 0.003), *Bromus squarrosus* (0.714, 0.001), *Artemisia austriaca* (0.644, 0.013), *Androsace maxima* (0.632, 0.036), *Centaurea diffusa* (0.632, 0.037), *C. stereophylla* (0.632, 0.037), *Dianthus leptopetalus* (0.632, 0.036), *Tanacetum millefolium* (0.632, 0.035), *Allium sphaerocephalon* (0.529, 0.045).

It is distributed in Constanța County. The soil is neutral, with low to medium nutrient fertility. The climate is the warmest among all, with low precipitation and low elevations. The aspect is southern with a moderate slope. The species diversity is low, but the vegetation cover is moderate (Table 2). *Agropyron cristatum* is the dominant species. *Festuca valesiaca* has a low cover in the relevés, indicating it has a subdominant presence in this community. The species *P. maculatum* had a low cover, at 0.5%.

Cluster 13: ***Salvio transsilvanicae-Festucetum rupicolae***

The diagnostic species are *Paeonia tenuifolia* (0.999, 0.001), *Achillea ochroleuca* (0.845, 0.001), *Potentilla pedata* (0.845, 0.002), *Astragalus dasyanthus* (0.818, 0.001), *Nepeta ucranica* (0.811, 0.001), *Lathyrus pratensis* (0.800, 0.003), *Sideritis montana* (0.799, 0.002), *Linum nervosum* (0.771, 0.001), *Allium denudatum* (0.747, 0.004), *Peucedanum ruthenicum* (0.682, 0.002), *Thymus odoratissimus* (0.679, 0.003), *Salvia transsylvanica* (0.657, 0.003), *Hesperis tristis* (0.655, 0.015), *Psephellus trinervius* (0.638, 0.004), *Potentilla argentea* (0.631, 0.001), *Stipa pennata* (0.622, 0.031), *Aster amellus* (0.612, 0.01), *Oxytropis pilosa* (0.607, 0.004), *Artemisia campestris* (0.607, 0.014), *Pilosella officinarum* (0.603, 0.005), *Dianthus membranaceus* (0.583, 0.011), *Centaurea scabiosa* (0.564, 0.001), *Teucrium polium* (0.558, 0.016), *Linaria genistifolia* (0.520, 0.012), and *Achillea setacea* (0.503, 0.041).

It is distributed in Mureș County. The soil is moderately acidic and rich in nutrients. The climate is moderate, with a medium elevation. The aspect is easterly, and the slope is moderate. The diversity of species and vegetation cover is very high (Table 2). *Paeonia tenuifolia* is the dominant species. Most of the other species have low cover, indicating their presence within the community, but not as a dominant species. These include a variety of species from different genera, such as *Achillea* spp., *Campanula* spp., *Centaurea* spp., *Plantago* spp., etc. which contribute to the diversity of the plant community. The species *P. maculatum* had a low cover, ranging from 0.1% to 1%.

Cluster 14: *Thymio pannonici-Chrysopogonetum*

The diagnostic species are *Chrysopogon gryllus* (0.989, 0.001), *Achillea nobilis* (0.655, 0.016), *Linaria angustissima* (0.655, 0.015), *Galium octonarium* (0.607, 0.021), *Malabaila graveolens* (0.581, 0.015), *Torilis japonica* (0.535, 0.041), and *Potentilla recta* (0.510, 0.02).

It is distributed in the Buzău County. The soil is neutral, with moderate nutrient levels. The association occurs at medium elevations on moderate slopes with a south-west aspect. The climate is moderate. There is high species diversity and vegetation cover (Table 2). *Chrysopogon gryllus* is the dominant species. Certain species such as *Galium verum* and *Jacobaea vulgaris*, are consistently present in almost all the relevés. The species *P. maculatum* had a low cover, of 1%.

Cluster 15: *Jurineo transylvanicae-Stipetum pulcherrimae*

The diagnostic species are *Stipa pulcherrima* (0.990, 0.001), *Vinca herbacea* (0.568, 0.019), *Iris pumila* (0.535, 0.023).

It is distributed in the counties of Cluj, Mureș, Sălaj, and Sibiu. The soil is moderately acidic with moderate levels of phosphorus and potassium. The climate is temperate with moderate precipitation. Communities with *Stipa pulcherrima* occur at medium elevations on very steep slopes with a southern aspect. There is a moderate species diversity with high vegetation cover (Table 2). *Stipa pulcherrima* is the dominant species. There is a diverse presence of species with cover values of 1%, such as *Achillea millefolium*, *Galium glaucum*, *Medicago falcata*, etc., indicating a complex plant community. The species *P. maculatum* had a low cover, ranging from 0.1% to 1%.

Cluster 16: *Taraxaco serotinae-Festucetum valesiacae*

The diagnostic species are *Festuca valesiaca* (0.908, 0.001), *Carex praecox* (0.529, 0.02).

It is distributed in the counties of Bacău, Botoșani, Buzău, Cluj, Galați, Iași, and Vaslui. The grasslands are grazed. The soil is neutral, with high nutrient levels. The climatic conditions are moderate. Communities with *Festuca valesiaca* occur at low elevations on moderate slopes with a southern aspect. Species diversity and vegetation cover are high (Table 2). *Festuca valesiaca* is the dominant species. *P. maculatum* had a low cover, ranging from 0.1% to 1%.

Table 2. Measured values of chemical and bioclimatic parameters analyzed. Values are means ± standard deviations (SD). VEGC – vegetation cover; BIO12 = annual precipitation; BIO1 - annual mean temperature; ELV – elevation; Asp - Aspect: S-south, SSW-south-southwest, SE-southeast, SW-southwest, E-east, W-west.

Tabelle 2. Messwerte für die analysierten chemischen und bioklimatischen Parameter. Werte sind Mittelwerte ± Standardabweichungen (SD).

Cluster	No. of relevés	No. of species	VEGC (%)	pH	P (mg kg^{-1})	K (mg kg^{-1})	BIO1 (°C)	BIO12 (mm)	ELV (m)	Asp	Slope (°)
Cluster 1	20	52±20	85±11	5.7±1	23±7	272±60	8.1±1	606±35	495±110	SSW	19±10
Cluster 2	8	60±20	90±9	5.5±2.1	22±10	270±112	8.4±0.4	603±16	424±86	SE	11±6.4
Cluster 3	31	50±15	91±8	5.9±0.6	27±16	300±39	8.6±0.5	602±14	393±78	SE	16±13.6
Cluster 4	11	60±13	93±4	5.9±0.3	28±4	314±54	9.2±1	593±16	337±115	W	9.3±3.4
Cluster 5	21	47±17	93±6	5.8±0.5	27±7	300±61	8.5±1	605±23	418±119	S	12.2±9.2
Cluster 6	9	39±14	89±11	6±0.5	28±5	269±58	8.9±0.7	603±25	427±143	S	7.2±4.9
Cluster 7	2	49±18	95±3	6.2±0.1	26±6	314±65	8.7±0.3	586±4	413±32	E	5
Cluster 8	1	34	94	6	27	328	8.1	622	450	SW	10
Cluster 9	2	27±8	76±9	5.8	24	136	9.9	485	266	SW	4.4
Cluster 10	2	41±13	95±4	6.2±0.3	38±1	296±68	8.2±1	595±4	535±78	SSW	10
Cluster 11	5	55±15	95±12	5.9±1	28±8	223±89	8.7±1	565±8	343±107	SSW	6.5±5
Cluster 12	5	30±12	72±12	7.2	15	299	11.8	434	38	SSW	5
Cluster 13	7	72±8	98±2	6.4	35	370	8.8	601	430	E	12
Cluster 14	7	43±9	85±19	6.6±0.5	26±18	276±36	9.7±0.6	544±15	428±121	SW	13±5
Cluster 15	18	43±13	85±9	5.8±0.4	25±8	294±29	8.5±0.2	614±20	441±37	SSW	29±17
Cluster 16	28	46±17	86±12	6.5±0.5	33±21	323±55	9.5±0.5	554±24	212±123	S	12±9
Cluster 17	41	39±11	73±13	7±0.8	38±26	301±56	9.1±0.6	574±20	272±153	S	16±14

Cluster 17: ***Allio albidi-Stipetum lessingianae*** **and** ***Jurineo arachnoideae-Stipetum lessingianae***

The diagnostic species are *Stipa lessingiana* (0.708, 0.001), *Carex distans* (0.638, 0.006), *Dianthus capitatus* (0.600, 0.024), *Schedonorus pratensis* (0.597, 0.028), *Crambe tataria* (0.589, 0.023).

It is distributed in the counties of Alba, Buzău, Cluj, and Iași. The grasslands are used as pastures. The soil is neutral, and rich in potassium and phosphorus. *Stipa lessingiana* communities occur at lower elevations on moderate slopes with a southern aspect. Slightly warmer climatic conditions prevail. There is moderate species diversity with high vegetation cover (Table 2). The dominant species is *Stipa lessingiana*. Other species present include *Teucrium chamaedrys*, *Schedonorus pratensis*, *Crambe tataria*, *Festuca valesiaca* etc. The species *P. maculatum* had a low cover, ranging from 0.1% to 1%.

4.3 Relationship between floristic composition and environmental variables

In the DCA analysis, the length of the floristic similarity gradients was 4.43 along the first axis. This value indicates the choice of an unimodal variation model in the floristic composition, such as CCA. Canonical Correspondence Analysis (CCA) was used to estimate the effect of environmental variables on the floristic composition (Table 3, Fig. 4).

The DCA diagram (Fig. 4) illustrates the distribution of vegetation types along the first and second ordination axes. The first DCA axis was correlated with elevation and annual precipitation (BIO12). The main gradient in vegetation composition along the second axis can be explained by positive correlations with variables such as pH, phosphorus, and potassium.

The main gradient extends from xerophilic grassland communities of the *Festuco-Brometea* class, mesophilic grasslands of the *Molinio-Arrhenatheretea* class, forest edge communities of the *Trifolio-Geranietea sanguinei* class, up to saline grasslands of the *Festuco-Puccinellietea* class. The left side of the scatterplot is occupied by relevés of the *Festuca stricta* subsp. *sulcata-Vicia cracca* community (cluster 4), *Stipa tirsa-Festuca stricta* subsp. *sulcata* community (cluster 6), *Rumici crispi-Agrostietum stoloniferae* and *Pastinaca-Arrhenatheretum* associations (cluster 7) found on moderately acidic soils, at an elevation of 380 m. The communities of *Carici humilis-Brachypodietum pinnati* (cluster 1), *Artemisio santonici-Festucetum pseudovinae* (cluster 8), *Inulo ensifoliae-Peucedanetum cervariae* (cluster 10) dominate the lower left part of the ordination space, being quite well differentiated from the other vegetation units, occurs on nutrient-rich, slightly acidic soils. The *Agropyro-Kochietum prostratae* (cluster 12) occupies the opposite side of the DCA diagram. This community is develop on rather deep and nutrient-rich soils, with a better

Table 3. Summary of the DCA analysis.

Tabelle 3. Zusammenfassung der DCA-Analyse.

	Axis 1	Axis 2	Axis 3	Axis 4
Eigenvalues	0.5195	0.3588	0.2557	0.2101
Explained variation (cumulative)	4.58	7.74	9.99	11.84
Gradient length	4.43	2.98	3.89	3.16
Pseudo-canonical correlation (suppl.)	0.7299	0.4036	0.4336	0.3905

water retention capacity, which also depends on the vegetation cover. The central part of the scatter diagram is occupied by the *Jurineo transylvanicae-Stipetum pulcherrimae* (cluster 15). This community is found at elevations between 360 m and 492 m, on very steep slopes and on moderately acidic, nutrient-rich soils. According to the Canonical Correspondence Analysis (CCA), the variation of the floristic composition of *P. maculatum* phytocoenoses is influenced by annual precipitation – BIO12 (Table 4).

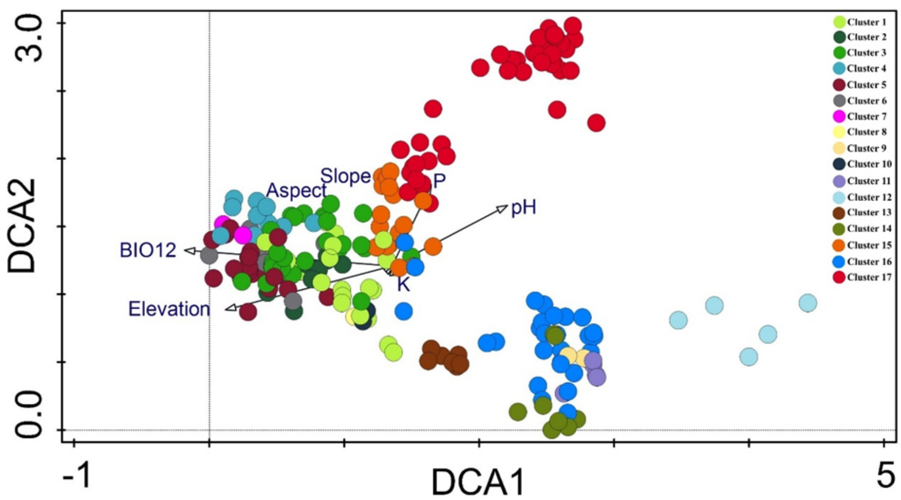

Fig. 4. DCA ordination diagrams of the 218 vegetation plots.

Abb. 4. DCA-Ordnungsdiagramme der 218 Aufnahmeflächen.

Table 4. Results of the CCA ordination.

Tabelle 4. Ergebnisse CCA-Ordination.

Variables	Explains (%)	Contribution (%)	pseudo-F	*P*	*P(adj)*
BIO12 – the annual precipitation	3.08	36.33	6.9	0.001	0.007
Slope	1.27	15.02	2.9	0.001	0.007
Elevation	1.09	12.85	2.5	0.001	0.007
Potassium (K)	0.76	8.95	1.7	0.001	0.007
pH	1	11.76	2.3	0.001	0.007
Aspect	0.78	9.15	1.8	0.001	0.007
Phosphorus (P)	0.5	5.94	1.2	0.243	1

5. Discussion

5.1 General aspects

The species *Pontechium maculatum* occurs in the hills, plateaus, mountains, and plains of Romania, but it is more predominant in the plateau area (89%). The relief units with the most favorable environmental conditions for *P. maculatum* are the Transylvanian Depression

(62.84%) and the Moldavian Plateau (23.85%). The distribution area of the species in Romania is 900 km^2 (European Topic Centre on Biological Diversity 2013–2018). The results of the study show that dry grasslands (*Festuco-Brometea* class) are the habitat where the species *P. maculatum* appeared most frequently. This can be explained by the fact that the species is drought tolerant, but also by the fact that the soils are poorer in nutrients, and competition is reduced compared to mesophilic grasslands. In this habitat type, the highest number of relevés was found compared to the other habitat types. The presence of the species in dry grasslands was also reported by other studies (Soó 1942, Csűrös-Káptalan et al. 1964, Rațiu et al. 1969, Schneider-Binder 1975, Tauber & Weber 1976, Pop 1996, Bădărău et al. 2001, Vladimirov et al. 2015, 2023). The presence of the species in the *Trifolio-Geranietea sanguinei, Molinio-Arrhenatheretea* and *Festuco-Puccinellietea* classes was low. These results coincide with the data mentioned by some studies in the literature (Hargitai 1942, Schneider-Binder 1972, Coldea & Pop 1991, Pop 1996). The plant associations in the *Festuco-Brometea* class in which *P. maculatum* was identified have also been reported by other studies (Soó 1942, Schneider-Binder 1975, Bădărău et al. 1999, Bernhardt et al. 2011). Based on field observations, it was found that *P. maculatum*, like the species *Crambe tataria* (Chirilă 2022, Chirilă et al. 2022), prefers open microhabitats, with low vegetation, to survive. However, the size and number of populations in this type of habitat have decreased significantly in the last three decades. Most of the grasslands in this habitat are in various stages of degradation due to human activities, mainly in Transylvania, and Moldova. The main threats to the species are overgrazing (the main threat), agriculture, burning of grasslands, succession, competition with other species, land-use change, etc. (Bernhardt et al. 2011).

5.2 Syntaxonomical scheme and cluster analysis

Within our study, we observed that *P. maculatum* has a significant affinity for the *Festuco-Brometea* class, with 98% (213 out of 218 relevés) of the analyzed samples falling within this class. This distribution pattern is consistent with similar findings reported in the literature, both at the Romanian (Sămărghițan & Oroian 1997, Oroian et al. 2017) and European levels (Pavlović 1951, 1955, 1974, Ganchev 1952, Cincović & Kojić 1955, 1956, Tatić 1969, Rexhepi 1978, 1979, Jovanović et al. 1992, Krasniqi 2006, Krasniqi & Millaku 2007, Marković 2007, Millaku et al. 2011, Vassilev 2013, Matevski et al. 2015). Furthermore, our results extend the ecological spectrum of the species, highlighting its presence in other vegetation classes such as *Festuco-Puccinellietea*, *Molinio-Arrhenatheretea*, and *Trifolio-Geranietea sanguinei*, thus diversifying our understanding of its preferred habitats. Contrary to these findings, the literature (Cincović & Kojić 1955, 1956, Tatić 1969, Pavlović 1974, Marković 2007) documented a higher frequency of the species in the order *Halacsyetalia sendtneri* Ritter-Studnička 1970, followed by *Brachypodietalia pinnati*, and to a lesser extent in *Festucetalia valesiacae*. Regarding alliances, *P. maculatum* was reported in a wider spectrum of alliances than those identified in our study, such as *Centaureo-Bromion fibrosi* Blečić et al. 1969, *Saturejion montanae* Horvat in Horvat et al. 1974, *Saturejo-Thymion* Micevski 1971, and *Scabioso-Trifolion dalmatici* Horvatić et N. Ranđelović in N. Ranđelović 1977, reflecting a wide and complex ecological distribution. Despite the diversity of habitats and plant associations, the common alliances identified include *Chrysopogono-Danthonion calycinae*, *Festucion valesiacae*, and *Cirsio-Brachypodion pinnati*, emphasizing the central role of these alliances in supporting the biodiversity specific to the *Festuco-Brometea* class.

Regarding the phytocoenological distribution of *P. maculatum*, our analysis revealed a pronounced affinity of the species for the dominant communities of *Festuca stricta* subsp. *sulcata*, with a significant presence in various communities: *Festuca stricta* subsp. *sulcata – Brachypodium pinnatum*, *Festuca stricta* subsp. *sulcata – Carex humilis*, *Festuca stricta* subsp. *sulcata – Danthonia alpina*, *Festuca stricta* subsp. *sulcata – Vicia cracca*, *Festuca stricta* subsp. *sulcata – Thymus comosus*, recording 51 relevés, representing 23% of the total observations. The species was also found in the associations *Taraxaco serotinae-Festucetum valesiacae* (28 relevés – 13%), *Jurineo arachnoideae-Stipetum lessingianae* (27 relevés – 12%), *Carici humilis-Brachypodietum pinnati* (20 relevés – 9%), *Jurineo transylvanicae-Stipetum pulcherrimae* (18 relevés – 8%), *Allio albidi-Stipetum lessingianae* (14 relevés – 6%). In Romania, according to studies by Oroian et al. (2017), *P. maculatum* was identified in the associations *Carici humilis-Brachypodietum pinnati* and *Jurineo transylvanicae-Stipetum pulcherrimae*.

In the European context, the species presents various associations, different from those observed in this study. In Kosovo, according to sources (Rexhepi 1979, Millaku et al. 2011), the species was associated with *Potentillo tommasinianae-Fumanetum bonapartei* Rexhepi ex Aćić et al. 2014, and *Stipeto-Convolvuletum compactis*.

In Serbia, some studies (Pavlović 1951, 1955, 1974, Kojić & Ivanović 1954, Cincović & Kojić 1955, 1956, Tatić 1969, Rexhepi 1978, Blaženčić & Vučković 1983, Jovanović et al. 1992, Krasniqi 2006, Krasniqi & Millaku 2007, Marković 2007) have reported the presence of *P. maculatum* in the associations *Agrostideto-Chrysopogonetum grylli* Kojic 1959, *Alysso-Chrysopogonetum grylli* Marković 2007, *Artemisio-Teucrietum montani* Blaženčić et Vučković 1986, *Bromus fibrosus-Chrysopogon gryllus* community, *Festuco duriusculae-Euphorbietum glabriflorae* S. Jov. et R. Jov., *Festuco sulcatae-Potentilletum zlatiborensis* Z. Pavlovic 1951, *Hyperico-Euphorbietum glabriflorae* Rexhepi 1978, *Koelerietum montanae* Pavlović 1951, *Koelerio-Danthonietum alpinae* Pavlović 1974, and *Poo molinieri-Plantaginetum holostei* Z. Pavlovic 1951. In Macedonia, Matevski et al. (2015) identified the species in the *Astragalo-Stachyetum macedonicae* association, while in Bulgaria, Ganchev (1952) reported its presence in the *Amygdaleto-Brometum squarrosum* association. These findings underscore the remarkable ecological diversity of *P. maculatum* and its adaptability to a diverse range of plant communities.

5.3 EUNIS habitat classification

Based on the syntaxa analyzed in this study, *P. maculatum* corresponds to the following EUNIS habitats (Chytrý et al. 2020): Grassland – R1 Dry grasslands: R1A Semi-dry perennial calcareous grassland (meadow steppe), R1B Continental dry grassland (true steppe), R16 Perennial rocky grassland of Central and South-Eastern Europe; R2 Mesic grasslands: R22 Low and medium altitude hay meadow; R3 Seasonally wet and wet grasslands: R36 Moist or wet mesotrophic to eutrophic pasture; R5 Woodland fringes and clearings and tall forb stands: R51 Thermophilous forest fringe of base-rich soils; R6 Inland salt steppes: R62 Continental inland salt steppe. The common habitats analyzed in this study with those at the European level are R1A Semi-dry perennial calcareous grassland (meadow steppe) and R1B Continental dry grassland (true steppe). The habitats different from ours recorded at the European level are R12 Cryptogam- and annual-dominated vegetation on siliceous rock outcrops, R16 Perennial rocky grassland of Central and South-Eastern Europe, and R17 Heavy-metal dry grassland of the Balkans.

In a concise, comparative analysis, the presence and adaptation of *P. maculatum* across various EUNIS habitats highlights its ecological versatility and specific habitat preferences. In semi-dry perennial calcareous grasslands (EUNIS R1A), *P. maculatum* has a moderate cover, thrives on calcium-rich soils is tolerant of semi-arid, alkaline conditions. This contrasts with its significant presence in continental dry grasslands (EUNIS R1B), where adaptations such as deep root systems and water retention mechanisms allow it to cope with drier environments, indicating ecological dominance in such habitats. In the perennial rocky grasslands of Central and South-Eastern Europe (EUNIS R16) the species has a lower cover, exploiting niches in shallow soils and rock crevices, which suggests an ability to grow in nutrient-poor, challenging terrains. Similarly, in low and medium elevations hay meadows (EUNIS R22), traditional haymaking practices create favorable conditions for *P. maculatum*, although it maintains a low cover, reflecting a preference for open habitats with balanced moisture. Moist or wet mesotrophic to eutrophic pastures (EUNIS R36) and thermophilous forest fringes of base-rich soils (EUNIS R51) both support *P. maculatum* at low cover, with adaptations to periodic water stress and an ability to benefit from edge effects in transitional zones, respectively. Finally, its establishment in continental inland salt steppes (EUNIS R62) is poorly represented. Our analysis is based on a single relevé of *Puccinellietalia*, and the co-occurring species are typical of dry and semi-arid grasslands (such as *Stipa capillata*, *S. tirsa*, *Salvia transsylvanica*, *Pulsatilla montana*, etc.). Only *Festuca valesiaca* subsp. *parviflora* is present in the relevé as a salt-tolerant plant. Overall, *P. maculatum* exhibits limited ecological plasticity, with adaptability to both dry and semi-moist conditions, ranging from calcium-rich grasslands to salt-affected steppes, highlighting its importance in diverse habitat types across the EUNIS classification system (Schaminée et al. 2019, Chytrý et al. 2020).

5.4 The relationship between floristic composition and environmental variables

Among the seven environmental variables studied, annual precipitation (BIO12) emerges as the most influential factor shaping the floristic composition of *P. maculatum* phytocoenoses. The optimal annual precipitation for *P. maculatum* growth appears to be moderate, as supported by our study. Given its role in water availability, annual precipitation serves as an important determinant in many ecosystems. *P. maculatum* may exhibit specific preferences for precipitation regimes, influencing key processes such as germination, growth, and reproduction. Regions with adequate precipitation levels maintain optimal soil moisture, essential for the species' well-being (Peñuelas et al. 2013). Beyond the studied environmental variables, anthropogenic impacts, notably overgrazing, also significantly affect the habitat of plant species (Duan et al. 2010). Elevation, which affects temperature, humidity, and atmospheric pressure, exerts a notable influence on vegetation. *P. maculatum* is often correlated with specific elevation ranges that provide favorable climatic conditions. These elevational gradients contribute to the biodiversity and the structural composition of plant communities, with species adapting to the unique conditions found at each elevation level (Körner 2000).

Potassium is essential for plants, including *P. maculatum*, as it contributes to the regulation of physiological processes such as photosynthesis, water transport, and nutrient assimilation. In addition, potassium increases plant tolerance to both biotic and abiotic stressors, such as drought and diseases. While specific studies on *P. maculatum* are limited, research on similar species suggests that an adequate level of potassium in the soil is essential for optimal plant development and resistance to adverse conditions (Marschner 2012).

Phosphorus is important for plant growth and plays a key role in metabolic processes. It is an essential component of DNA and contributes to root development and flowering. Studies focusing on grassland species suggest that phosphorus can have a positive effect on biodiversity and productivity (Ceulemans et al. 2014). For *P. maculatum*, an ample supply of phosphorus can help maintain vitality in environments with limited resources. Soil pH significantly affects nutrient availability and can affect the composition of plant species within a habitat. *Pontechium maculatum* is often found in soils with a neutral to slightly alkaline pH, indicating a preference for conditions that allow optimal availability of essential nutrients such as K and P (Rengel 1992).

6. Conservation implications

Grasslands play an important role in carbon sequestration and mitigating the impacts of climate change (Chang et al. 2021). Over the past century, global grassland loss has been driven mainly by urbanization, industrialization, commercial agriculture, and afforestation (MacDougall et al. 2013). Currently, anthropogenic pressures on grasslands have increased significantly (Lark 2020, Scholtz & Twidwell 2022). In this context, grassland areas are decreasing, and land use change continues to threaten their expansion (Schils et al. 2022).

The majority of *Pontechium maculatum* populations are located in Transylvania. Current populations in this region have declined due to human impact (Bădărău et al. 1999). This has also been observed for other grassland species, such as *Crambe tataria*, *Salvia nutans*, *Astragalus exscapus* subsp. *transsilvanicus*, etc. (Szabo et al. 2021). Thus, the current state of *P. maculatum* populations is a consequence of the latest reforms in Romania (Bădărău et al. 1999, Szabo et al. 2021). Like the species *Crambe tataria* (Chirilă 2021), or *Iris brandzae* Prodán (Chirilă et al. 2024), *P. maculatum* was much more widespread in the past. Overgrazing and the conversion of grasslands into agricultural land have been the main causes of the destruction of steppe grassland habitats in Romania. In this context, conservation strategies should be based on the restoration of habitats and the reestablishment of population in restored areas. Additionally, to prevent the further decline of *P. maculatum* populations, adequate conservation and protection measures are necessary, especially in the northeastern and central parts of Romania. The studied populations of *P. maculatum* prefer moderately acidic to neutral soils, rich in potassium, and poor in phosphorus.

Based on the moisture index of the floristic composition in the analyzed grasslands, it has been observed that *P. maculatum* is a mesoxerophilic species. *P. maculatum* was most abundant in the habitat of dry grasslands. In contrast, its presence was markedly low in the habitats of mesic grasslands (*Molinio-Arrhenatheretea*), woodland fringes and clearings, tall forb stands (*Trifolio-Geranietea sanguinei*), and inland salt steppes (*Festuco-Puccinellietea*). This differential distribution highlights the importance of habitat specificity for *P. maculatum* and underscores the need for targeted conservation efforts in its preferred dry grassland ecosystems to support its ecological niche.

In the investigated areas, the following limiting factors on the species were identified: overgrazing causes drastic changes in the specific composition of the vegetation, resulting in the complete disappearance of sensitive and rare species. It also leads to soil subsidence and erosion. Other factors include the of grasslands to agricultural land, the use of biocidal products, and chemicals in marginal areas of grasslands, roads and paths leading to soil subsidence, favoring the development of ruderal species and reducing populations of *P. maculatum*, invasive species that profoundly transform the flora of grasslands, fires that can lead to the disappearance of *P. maculatum* populations if carried out in early spring, and the collection plants, which is another threat to this species. In this context, the following management measures are necessary: monitoring the size of the species' habitat in Romania, moderate traditional grazing practiced in rotation schemes, rationalization of sheep grazing, maintaining the existing network of dirt roads rationally by setting up a slope formed by natural vegetation, control of invasive species, prohibition of burning grasslands during sensitive seasons (spring).

In order to develop *in situ* conservation measures for the species, it is necessary to carry out a study on the influence of grazing on the species, as in the case of the *Crambe tataria* species (Chirilă 2023). Additionally, other conservation strategies for the species may include its translocation.

Erweiterte deutsche Zusammenfassung

Einleitung – *Pontechium maculatum* ist eine Art, die aufgrund von Überweidung und Landnutzungsänderungen vom Aussterben bedroht ist. In Rumänien wächst die analysierte Art in Dickichten, Obstgärten, Heufeldern, Gebüschen, Weinbergen, Straßenrändern, und am Rand wärmeliebender Wälder. Ziel der Studie war es, die Lebensraumpräferenzen von *P. maculatum* in Rumänien zu ermitteln. Das Verständnis der Habitatpräferenzen seltener Pflanzenarten ist für deren Erhaltung und Management von Bedeutung. Diese Präferenzen können von einer Vielzahl von Faktoren wie Boden, Klima, Ressourcenverfügbarkeit und Interaktionen mit anderen Organismen im Ökosystem bestimmt werden. Durch die Identifizierung und das Verständnis dieser Präferenzen können wir effizientere Strategien zur Erhaltung der Habitate seltener Arten entwickeln und die Biodiversität im Allgemeinen schützen.

Untersuchungsgebiet – Die Untersuchungsgebiete werden durch fünf historische Regionen Rumäniens repräsentiert: Crisana, Dobrogea, Moldawien, Muntenia und Siebenbürgen. Die Höhenlage der untersuchten Gebiete variiert zwischen von 19 m bis 776 m. Das Klima ist gemäßigt-kontinental. Die durchschnittliche Jahrestemperatur liegt zwischen von 6,2 °C und 11,8 °C und der durchschnittliche jährliche Niederschlag liegt zwischen 432 mm und 731 mm (Fick & Hijmans 2017). Die in diesen Gebieten identifizierten Bodentypen sind Tschernoseme, ton-iluvische Braunerden und saure Braunerden (Florea & Munteanu 2003).

Methoden – Die floristische Zusammensetzung der Phytozönosen von *Pontechium maculatum* wurde auf der Grundlage von 181 pflanzensoziologischen Aufnahmen aus der Rumänischen Wiesendatenbank (RGD, Vassilev et al. 2018) und unseren eigenen Daten (37 Probeflächen) analysiert. Die Größe der eigenen Aufnahmen betrug 100 m^2, die Größe der aus der rumänischen Vegetationsdatenbank erhaltenen Aufnahmen variierte zwischen 25 bis 100 m^2. Für die 37 gesammelten Bodenproben (eigene Daten) wurden der Boden-pH-Wert sowie die Phosphor- und Kaliumgehalte gemessen. Für die 181 Aufnahmen in der RGD-Datenbank wurden Werte für P, K und den pH-Wert des Bodens (Ballabio et al. 2019) aus der European Soil Database (ESDAC) extrahiert. Die Werte für die durchschnittliche Jahrestemperatur wurden der WorldClim-Datenbank entnommen (Fick & Hijmans 2017). Die Vegetation wurde mittels agglomerativer hierarchischer Clusterbildung unter Verwendung des flexiblen β-Algorithmus ($\beta = -0{,}25$) und der Bray-Curtis-Distanz klassifiziert. Beziehungen zwischen Artenzusammensetzung und Umweltvariablen wurden mithilfe von DCA und CCA analysiert. Die Daten wurden anhand von mittleren Prozentwerten dargestellt, die der von Braun-Blanquet entwickelten Artmächtigkeitsskala (Braun-Blanquet 1964, Borza & Boşcaiu 1965, Cristea et al. 2004) – entsprechen. Um die Kollinearität zwischen den unabhängigen Variablen zu bestimmen, wurde in CANOCO der variable Inflationsfaktor (VIF) verwendet. Die Datenverteilungskarte (relevés) wurde in QGIS Version 3.28.3 (https://qgis.org) erstellt.

Ergebnisse – Die Vegetation mit *Pontechium maculatum* wurde in 17 Cluster (Gruppen) eingeteilt. Diese Gruppen spiegeln die von Coldea et al. (2012) beschriebene Syntaxonomie wider. Die erste Vegetationsachse nach DCA korrelierte am stärksten mit dem Jahresniederschlag (BIO12).

Cluster	Pflanzengruppen
Cluster 1	*Carici humilis-Brachypodietum pinnati*
Cluster 2	*Brachypodium pinnatum–Festuca valesiaca*
Cluster 3	*Thymio comosi-Festucetum rupicolae, Cleistogeni-Festucetum sulcatae* und der *Festuco stricta* subsp. *sulcata-Brachypodium pinnatum-Carex humilis*
Cluster 4	*Festuca stricta* subsp. *sulcata-Vicia cracca*
Cluster 5	*Danthonio alpinae-Stipetum stenophyllae*, *Festuco rupicolae-Danthonietum alpinae* und *Danthonio-Brachypodietum pinnati*
Cluster 6	*Stipa tirsa-Festuca stricta* subsp. *sulcata*
Cluster 7	*Rumici crispi-Agrostietum stoloniferae* und *Pastinaco-Arrhenatheretum*
Cluster 8	*Artemisio santonici-Festucetum pseudovinae*
Cluster 9	*Cynodonto-Poëtum angustifoliae*
Cluster 10	*Inulo ensifoliae-Peucedanetum cervariae*
Cluster 11	*Medicagini minimae-Festucetum valesiacae*
Cluster 12	*Agropyro-Kochietum prostratae*
Cluster 13	*Salvio transsilvanicae-Festucetum rupicolae*
Cluster 14	*Thymio pannonici-Chrysopogonetum*
Cluster 15	*Jurineo transylvanicae-Stipetum pulcherrimae*
Cluster 16	*Taraxaco serotinae-Festucetum valesiacae*
Cluster 17	*Allio albidi-Stipetum lessingianae* und *Jurineo arachnoideae-Stipetum lessingianae*

Diskussion – *Pontechium maculatum* wächst, genau wie die Art *Crambe tataria*, in einer begrenzten Anzahl von Pflanzengesellschaften. Die Ergebnisse der Studie bestätigen die Häufigkeit von *P. maculatum*-Populationen in den Gesellschaften mesoxerophiler Wiesen.

Gemäß den Lebensraumtypen EUNIS (Chytrý et al. 2020) entspricht *P. maculatum* den folgenden Lebensraumtypen: Grünland – R1 Trockenrasen: R1A Halbtrockener mehrjähriger Kalkrasen (Wiesensteppe), R1B Kontinentaler Trockenrasen (echte Steppe), R16 Mehrjähriges felsiges Grasland Mittel- und Südosteuropas; R2 Mesophiles Grasland: R22 Mähwiesen in niedriger und mittlerer Höhe; R3 Saisonal feuchte und feuchte Wiesen: R36 Feuchte oder nasse mesotrophe bis eutrophe Weiden; R5 Waldränder und Lichtungen sowie Hochstaudenbestände: R51 Thermophiler Waldrand basenreicher Böden; R6 Binnensalzsteppe: R62 Kontinentale Binnensalzsteppe.

Schlussfolgerung – Die Studie zeigte, dass der Jahresniederschlag (BIO12) der wichtigste Faktor ist, der die floristische Zusammensetzung der Phytozönosen von *Pontechium maculatum* beeinflusst. Die analysierten Populationen von *P. maculatum* bevorzugen mäßig saure bis neutrale Böden, reich an Kalium, arm an Phosphor. Trockenrasen der Klasse *Festuco-Brometea* sind der häufigste Lebensraum, in dem die Art vorkommt. Die Vegetationsanalyse ergab, dass *P. maculatum* insbesondere in Pflanzengesellschaften des Verbandes *Festucion valesiacae* wächst. Die Art kommt auch in Pflanzengesellschaften des Verbandes *Stipion lessingianae* vor. Basierend auf dem Feuchtigkeitsindex der floristischen Zusammensetzung in den analysierten Graslandschaften wurde beobachtet, dass es sich bei *P. maculatum* um eine mesoxerophile Art handelt.

Authors contributions

S.D. Chirilă contributed to manuscript conceptualization, methodology (vegetation sampling and classification, environmental variables and other statistical analyses), data collection (took soil samples and identified plant species in the field - relevés personal) software use during data analysis, data curation, writing (original draft preparation; visualization, investigation, supervision, validation, w – releves personariting), reviewing and editing of the manuscript. K. Vassilev contributed to data collection and standartization, writing (visualization, supervision and validation), reviewing and editing of the manuscript.

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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. Synoptic table with the percentage frequencies of plant species in the communities with *Pontechium maculatum* in Romania.

Anhang E1. Übersichtstabelle mit den prozentualen Häufigkeiten der Pflanzenarten in den Gesellschaften mit *Pontechium maculatum* in Rumänien.

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Supplement E1. Synoptic table with the percentage frequencies of plant species in the communities with *Pontechium maculatum* in Romania. Clusters are: cluster 1 consists of the *Carici humilis-Brachypodietum pinnati* association; cluster 2 consists of the *Brachypodium pinnatum-Festuca valesiaca* community; cluster 3 consists of the *Thymio comosi-Festucetum rupicolae*, *Cleistogeni-Festucetum sulcatae* associations, and *Festuco stricta* subsp. *sulcata-Brachypodium pinnatum-Carex humilis* community; cluster 4 includes the *Festuca stricta* subsp. *sulcata-Vicia cracca* community; cluster 5 includes the *Danthonio alpinae-Stipetum stenophyllae*, *Festuco rupicolae-Danthonietum alpinae*, and *Danthonio-Brachypodietum pinnati* associations; cluster 6 includes the *Stipa tirsa-Festuca stricta* subsp. *sulcata* community; cluster 7 includes the *Rumici crispi-Agrostietum stoloniferae* and *Pastinaco-Arrhenatheretum* associations; cluster 8 includes the *Artemisio santonici-Festucetum pseudovinae* association; cluster 9 includes the *Cynodonti-Poetum angustifoliae* association; cluster 10 includes the *Inulo ensifoliae-Peucedanetum cervariae* association; cluster 11 consists of the *Medicagini minimae-Festucetum valesiacae* association; cluster 12 consists of the *Agropyro-Kochietum prostratae* association; cluster 13 consists of the *Salvio transsilvanicae-Festucetum rupicolae* association; cluster 14 consists of the *Thymio pannonici-Chrysopogonetum* association; cluster 15 consists of the *Jurineo transylvanicae-Stipetum pulcherrimae* association; cluster 16 consists of the *Taraxaco serotinae-Festucetum valesiacae* association; cluster 17 consists of the *Allio albidi-Stipetum lessingianae* and *Jurineo arachnoideae-Stipetum lessingianae* associations.

Anhang E1. Übersichtstabelle mit den prozentualen Häufigkeiten der Pflanzenarten in den Gesellschaften mit *Pontechium maculatum* aus Rumänien.

Group (cluster)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
No. of relevés	20	8	31	11	21	9	2	1	2	2	5	5	7	7	18	28	41
Achillea collina	15	25	10	.	19	.	.	.	.	.	40	20	.	.	17	21	7
Achillea millefolium	40	63	42	91	33	11	100	100	.	.	.	.	57	.	22	14	7
Achillea nobilis	.	.	.	.	.	.	.	.	.	.	.	.	.	43	.	.	.
Achillea ochroleuca	.	.	.	.	.	.	.	.	.	.	.	.	71	.	.	.	.
Achillea pannonica	10	13	23	.	5	33	.	.	.	.	.	.	57	.	.	.	12
Achillea setacea	.	.	3	.	14	.	50	.	100	.	20	60	100	71	.	43	46
Adonis vernalis	70	50	32	55	52	56	.	.	.	.	80	.	86	71	67	57	76
Adonis volgensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.
Agrimonia eupatoria	25	.	16	9	.	11	.	.	.	50	80	.	.	29	17	11	15
Agropyron cristatum	.	.	.	.	.	.	.	.	.	.	80	100	.	.	.	25	12
Agrostis canina	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.
Agrostis capillaris	15	.	16	27	52	11	50	.	.	.	.	.	.	.	.	7	.
Agrostis stolonifera	.	.	3	.	.	.	50	.	.	.	.	.	.	.	.	.	.
Ajuga chamaepitys	.	.	.	.	.	.	.	.	.	.	.	.	29	.	6	4	.
Ajuga genevensis	15	25	16	45	10	11	50	.	.	.	.	.	.	.	.	7	.
Ajuga laxmannii	20	38	29	.	.	22	.	100	.	.	80	.	71	14	33	21	29
Allium denudatum	20	.	.	.	.	.	.	.	.	.	.	.	71	.	.	.	.
Allium flavum	5	.	.	.	5	.	.	.	.	.	40	.	14	.	6	7	2
Allium paniculatum	.	.	.	.	.	.	.	.	100	.	.	.	.	.	.	.	.
Allium rotundum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.
Allium sphaerocephalon	15	.	.	.	.	.	.	.	50	.	.	60	.	.	.	4	.
Alyssum alyssoides	25	13	6	27	5	.	.	.	.	.	.	.	57	.	22	4	2
Alyssum turkestanicum	.	.	.	.	.	.	.	.	.	.	.	40	.	.	.	7	.
Anacamptis coriophora	.	.	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anacamptis morio	.	13	.	18	.	.	.	.	.	.	.	.	.	.	.	.	.
Anchusa ochroleuca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18	.
Anchusa officinalis	.	.	6	.	.	.	.	.	.	.	.	.	.	.	.	18	.
Androsace maxima	.	.	.	.	.	.	.	.	.	.	.	40	.	.	.	.	.
Anemone sylvestris	.	.	.	9	.	11	.	.	.	.	.	.	.	.	.	.	.
Anisantha tectorum	.	.	.	.	.	.	.	.	.	.	.	80	.	.	.	.	.
Anthericum ramosum	40	13	13	.	43	.	.	.	.	100	.	.	57	.	6	11	.
Anthoxanthum odoratum	15	13	23	55	67	11	50	100	.	.	.	.	.	14	.	7	2
Anthyllis vulneraria	15	13	16	64	52	11	.	.	.	.	.	.	71	.	.	7	.
Arabis hirsuta	15	25	3	36	10	.	.	.	.	.	.	.	.	.	.	4	2
Arenaria procera	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.
Arenaria serpyllifolia	20	.	6	36	24	11	.	.	.	.	20	.	57	.	11	18	2
Aristolochia clematitis	.	.	.	.	.	.	.	.	.	.	.	.	.	14	.	.	2
Arrhenatherum elatius	10	.	6	18	24	11	50	.	.	.	.	.	.	.	.	11	.
Artemisia austriaca	.	.	.	.	.	.	.	.	.	.	100	100	.	.	.	43	7
Artemisia campestris	15	.	3	.	.	.	.	.	.	.	.	.	71	.	17	4	7
Artemisia pontica	.	.	6	.	.	11	.	100	.	100	.	.	.	.	17	.	7
Asparagus officinalis	5	.	16	.	10	.	.	.	.	.	.	.	.	14	33	29	37
Asperula cynanchica	70	88	42	45	57	67	50	.	50	100	20	40	100	57	78	43	34
Asperula tenella	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18	.
Asperula tinctoria	10	.	6	.	.	.	.	.	.	.	.	.	.	.	.	4	.
Aster amellus	10	25	.	.	5	22	.	.	.	.	.	.	71	.	6	.	2
Astragalus asper	.	13	6	.	.	.	.	.	.	.	.	.	29	.	6	7	.
Astragalus austriacus	.	.	3	.	5	.	.	.	.	50	.	.	43	.	.	14	.
Astragalus cicer	.	.	.	9	5	.	.	.	.	.	.	.	.	.	.	.	.
Astragalus dasyanthus	.	.	3	.	.	.	.	.	.	.	.	.	100	.	22	4	10
Astragalus exscapus	.	.	3	.	.	.	.	.	.	.	.	.	.	.	28	.	10
Astragalus monspessulanus	15	.	23	9	5	11	.	.	.	100	.	40	29	.	72	.	24
Astragalus onobrychis	5	.	10	.	.	.	.	.	.	.	80	.	.	29	.	50	7
Asyneuma canescens	25	.	13	.	5	.	.	.	.	100	.	.	.	.	.	4	.
Avenula pubescens	15	25	26	.	19	11	.	.	.	.	.	.	.	.	.	4	.
Bassia prostrata	.	.	.	.	.	.	.	.	.	.	.	80	.	.	.	7	2
Berteroa incana	20	.	.	.	.	.	.	.	.	.	20	.	.	14	.	18	2
Bothriochloa ischaemum	35	25	23	.	10	.	.	.	100	100	100	20	71	71	56	43	12
Brachypodium pinnatum	70	100	68	36	29	22	50	.	.	.	.	.	.	.	.	11	7
Brachypodium rupestre	.	.	.	.	.	.	.	.	.	100	.	.	.	.	.	.	15
Brassica elongata	15	.	10	.	5	.	.	.	.	.	.	.	29	14	22	4	15
Briza media	15	75	39	36	76	44	50	.	.	.	.	.	.	.	.	4	.
Bromopsis erecta	10	.	.	9	.	.	.	.	.	100	.	.	.	.	.	.	.
Bromopsis inermis	10	.	.	.	5	11	.	.	50	.	80	.	.	.	.	18	5
Bromus commutatus	.	.	.	18	.	.	.	.	.	.	20	.	.	.	.	4	2
Bromus hordeaceus	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	7	.
Bromus japonicus	.	.	.	.	.	.	.	.	.	.	.	40	.	14	.	.	.
Bromus squarrosus	.	.	.	.	.	.	.	.	.	.	.	60	.	.	.	11	.
Buglossoides arvensis	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	7	.
Bupleurum falcatum	25	38	16	.	14	.	.	.	.	100	20	.	71	.	6	7	2
Calamagrostis epigejos	.	.	3	.	5	22	.	.	.	.	40	.	.	29	.	7	.
Camelina microcarpa	.	.	.	9	.	.	.	.	.	.	.	.	.	.	.	18	.
Campanula bononiensis	5	.	13	.	.	11	.	.	.	.	.	.	.	29	.	7	.
Campanula glomerata	25	63	23	18	29	22	100	.	.	.	20	.	57	.	.	4	2
Campanula patula.	.	.	.	27	14	.	.	.	.	.	.	.	.	.	.	.	.
Campanula persicifolia	.	.	13	9	19	11	.	.	.	.	.	.	.	.	.	.	.
Campanula rapunculoides	5	.	.	.	10	.	.	.	.	100	.	.	.	.	.	.	.
Campanula sibirica	25	38	26	36	24	22	.	.	.	100	60	.	100	.	22	29	12
Carduus acanthoides	10	.	16	18	.	.	.	.	.	.	.	.	.	14	.	25	.
Carduus hamulosus	10	50	10	.	5	22	.	.	.	.	.	40	71	71	44	21	27
Carduus nutans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18	.
Carex caryophyllea	15	13	10	36	.	.	.	.	.	.	.	.	.	14	.	18	.
Carex distans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	27
Carex filiformis	20	38	29	18	5	.	.	.	.	.	.	.	.	.	.	11	.
Carex humilis	100	63	52	27	43	44	.	.	.	100	.	.	71	43	72	7	34
Carex liparocarpos	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.
Carex michelii	20	38	26	.	5	.	.	.	.	.	.	.	.	.	.	29	.
Carex montana	15	50	10	45	10	11	.	.	.	.	.	.	.	.	.	4	.
Carex praecox	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	32	.
Carlina acaulis	10	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.
Carlina vulgaris	10	.	3	.	.	.	.	.	.	.	.	.	.	.	6	.	.
Carum carvi	.	.	.	18	.	11	.	.	.	.	.	.	.	.	.	.	.
Caucalis platycarpos	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
Centaurea calocephala	.	.	.	.	.	.	.	.	.	.	.	.	.	.	17	.	.
Centaurea diffusa	.	.	.	.	.	.	.	.	.	.	.	40	.	.	.	.	.
Centaurea jacea	15	38	29	.	10	11	.	.	.	50	.	.	.	.	6	7	.
Centaurea neiceffii	.	.	.	.	.	.	.	.	.	.	.	.	.	29	.	.	.
Centaurea orientalis	.	.	.	.	.	.	.	.	.	.	80	20	.	57	.	46	59
Centaurea phrygia	5	25	13	.	19	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea scabiosa	60	63	45	.	10	22	.	.	.	.	.	.	100	.	11	21	2
Centaurea solstitialis	.	.	.	.	.	.	.	.	.	.	80	60	.	.	.	7	.
Centaurea stereophylla	.	.	.	.	.	.	.	.	.	.	.	40	.	.	.	.	.
Centaurea stoebe	35	.	19	.	14	.	.	.	.	100	100	40	86	71	39	43	34
Cephalaria radiata	.	.	.	.	.	.	.	.	.	.	.	.	14	.	.	.	2
Cephalaria uralensis	10	.	.	.	.	.	.	.	.	.	.	.	.	.	44	4	22
Cerastium fontanum	10	25	16	18	33	11	100	.	.	.	.	.	.	.	.	11	.
Ceratocarpus arenarius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.
Cerinthe minor	.	25	3	45	10	.	50	.	.	.	40	.	29	.	.	25	17
Chondrilla juncea	.	.	.	.	.	.	.	.	.	.	.	20	.	.	6	7	.
Chrysopogon gryllus	5	.	10	.	10	.	.	.	100	.	.	.	.	100	.	7	.
Cichorium intybus	10	.	13	9	19	.	.	.	50	.	.	.	.	14	.	18	.
Cirsium arvense	.	.	3	.	.	.	.	.	.	.	20	.	.	.	.	.	2
Cirsium eriophorum	.	.	16	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cirsium furiens	.	.	3	.	.	.	.	100	.	.	.	.	.	.	.	.	.
Cirsium pannonicum	15	13	19	18	24	.	.	.	.	.	.	.	.	.	.	.	.
Cirsium vulgare	.	.	3	.	.	.	.	.	.	.	20	.	.	.	.	7	5
Cleistogenes serotina	.	.	.	.	.	.	.	.	.	100	80	.	71	.	11	7	5
Clematis integrifolia	10	.	13	9	38	44	50	.	.	.	80	.	.	.	.	14	10
Clematis recta	10	.	6	36	29	.	50	.	.	.	.	.	.	.	.	.	.
Clinopodium acinos	20	.	3	.	5	.	.	.	100	.	80	.	29	29	.	14	2
Clinopodium vulgare	10	25	19	.	.	.	.	.	.	50	.	.	.	29	6	.	.
Colchicum autumnale	5	.	.	9	5	.	50	.	.	.	.	.	.	.	.	.	.
Consolida regalis	.	.	.	.	.	.	.	.	.	.	.	60	.	.	.	7	.
Convolvulus arvensis	20	38	42	45	19	11	50	.	.	.	.	40	.	29	17	18	51
Cornus sanguinea	15	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Cota tinctoria	5	.	.	.	.	.	.	.	.	.	80	40	29	.	.	4	.
Crambe tataria	15	25	6	.	10	.	.	.	.	.	80	.	57	43	28	32	78
Crataegus monogyna	25	38	35	.	5	11	.	.	50	.	.	.	.	43	17	.	7
Crepis biennis	5	.	.	18	.	.	50	.	.	.	.	.	.	.	.	.	.
Crepis foetida	.	.	.	.	.	.	.	.	.	.	20	.	.	29	.	4	.
Crepis nicaeensis	.	13	19	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Crepis setosa	.	.	.	.	.	.	.	.	.	.	80	.	.	.	.	7	.
Cruciata glabra	25	50	23	27	10	.	50	.	.	50	.	.	.	.	.	.	.
Crupina vulgaris	.	.	.	.	.	.	50	.	.	.	.	.	29	.	.	11	.
Cyanus triumfettii	10	.	19	18	24	11	50	.	.	.	.	.	.	.	.	.	.
Cynodon dactylon	5	.	.	.	.	.	.	.	100	.	.	60	.	.	.	4	.
Cynoglossum officinale	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6	.	5
Cynoglottis barrelieri	10	.	10	.	10	22	.	.	.	.	.	.	57	.	11	11	12
Cynosurus cristatus	.	.	3	.	5	.	.	.	.	.	.	.	.	.	.	.	.
Cytisus albus	15	38	16	18	38	44	50	.	.	.	.	.	.	.	17	.	15
Cytisus austriacus	5	.	.	.	.	.	.	.	.	.	80	.	.	57	.	36	44

Continued on next page

Fortsetzung auf nächsten Seite

Group (cluster)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
No. of relevés	20	8	31	11	21	9	2	1	2	2	5	5	7	7	18	28	41
Cytisus hirsutus	5	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cytisus procumbens	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cytisus ratisbonensis	.	.	6	.	.	.	.	.	.	.	.	.	.	.	6	.	.
Dactylis glomerata	40	88	55	91	48	.	50	.	.	.	.	.	.	43	.	18	54
Danthonia alpina	.	25	16	9	100	44	50	.	.	.	.	.	.	.	.	.	.
Daucus carota	20	38	3	9	5	.	.	.	50	.	80	20	.	.	6	7	.
Dianthus capitatus	.	.	.	.	.	.	.	.	.	.	.	.	.	43	.	4	49
Dianthus carthusianorum	35	88	48	73	71	78	100	.	.	.	.	.	100	.	17	11	.
Dianthus giganteus	5	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.
Dianthus leptopetalus	.	.	.	.	.	.	.	.	.	.	.	40	.	.	.	.	.
Dianthus membranaceus	.	.	.	.	.	.	.	.	.	.	100	.	100	43	.	57	2
Dictamnus albus	20	25	35	9	14	.	.	.	.	.	.	.	.	.	44	.	29
Digitalis grandiflora	5	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Digitalis lanata	10	13	.	.	.	.	.	.	50	.	.	.	.	.	.	.	.
Diplotaxis muralis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6	.	2
Dorycnium pentaphyllum	20	25	26	.	10	22	.	100	.	50	80	.	100	86	72	39	10
Draba nemorosa	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.
Draba verna	.	13	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.
Echinops ritro	.	.	.	.	.	.	.	.	.	.	.	80	.	.	.	.	.
Echium vulgare	40	25	10	.	5	11	.	.	.	.	20	20	57	.	17	25	5
Elytrigia intermedia	55	75	48	.	24	11	.	.	50	100	80	80	57	14	44	50	22
Elytrigia repens	10	.	6	18	14	.	.	.	50	.	.	.	.	.	.	18	.
Equisetum arvense	10	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.
Erigeron acris	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	4	.
Erodium cicutarium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	.
Eryngium campestre	25	38	39	9	29	33	.	100	100	.	100	60	71	57	72	64	54
Eryngium planum	.	13	6	.	.	.	.	.	.	50	.	.	.	.	.	.	2
Erysimum diffusum	.	.	.	.	.	.	.	.	.	.	.	.	.	29	.	36	.
Erysimum hieracifolium	.	.	.	.	.	.	.	.	.	.	.	.	29	.	.	7	.
Erysimum odoratum	.	13	10	45	14	22	.	.	.	.	.	.	.	.	6	7	12
Euphorbia angulata	.	25	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia cyparissias	50	50	55	36	43	11	.	100	.	.	.	.	71	.	72	32	15
Euphorbia epithymoides	25	13	6	.	10	11	50	.	.	.	.	.	.	.	.	.	.
Euphorbia esula	15	.	23	36	5	22	.	.	.	.	.	.	29	.	.	14	.
Euphorbia illirica	5	13	.	.	5	.	.	.	.	.	.	.	.	.	.	4	.
Euphorbia nicaeensis	5	.	.	.	.	.	.	.	.	.	80	40	.	43	.	54	34
Euphorbia seguieriana	.	.	3	.	.	.	.	.	.	.	.	20	.	.	11	4	15
Falcaria vulgaris	25	63	16	18	14	44	.	.	50	.	.	60	14	14	67	32	46
Ferulago campestris	5	.	.	.	.	.	.	.	.	.	.	.	.	29	.	14	.
Ferulago sylvatica	.	.	3	45	38	22	.	.	.	.	.	.	.	.	.	.	.
Festuca rubra	.	.	.	.	14	.	50	.	.	.	.	.	.	.	.	.	.
Festuca stricta	45	38	100	100	67	67	.	.	.	100	.	.	100	.	72	14	24
Festuca valesiaca	50	38	35	.	5	11	.	.	.	.	100	60	57	57	28	100	71
Festuca valesiaca subsp. *parviflora*	.	50	.	.	10	.	.	100	.	.	.	.	.	.	.	7	.
Ficaria verna	.	25	.	9	.	.	.	100	.	.	.	.	.	.	.	.	.
Filago arvensis	.	13	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.
Filipendula vulgaris	70	75	90	100	90	67	100	.	50	50	80	.	.	100	50	43	63
Fragaria viridis	40	25	65	64	33	44	50	.	.	50	.	.	57	57	61	39	49
Galatella linosyris	20	13	6	.	14	11	.	.	.	100	.	.	71	.	50	7	12
Galatella villosa	.	.	.	.	.	.	.	.	.	.	.	20	.	.	.	25	.
Galium album	10	.	6	.	.	.	.	.	.	.	.	.	.	.	6	.	.
Galium glaucum	40	38	23	27	14	22	.	.	.	100	80	.	100	.	78	7	29
Galium humifusum	.	.	.	.	.	.	.	.	100	.	20	20	.	.	.	18	2
Galium mollugo	20	50	16	9	10	.	50	.	100	.	.	.	.	.	6	7	.
Galium octonarium	.	.	.	.	.	.	.	.	.	.	.	.	.	71	.	54	10
Galium verum	45	25	77	91	76	78	100	.	.	.	80	60	71	86	6	43	49
Gallium boreale	30	.	29	55	10	22	100	.	.	.	.	.	.	.	.	.	.
Genista sagittalis	.	.	6	36	33	.	.	.	.	.	.	.	.	.	.	.	.
Genista tinctoria	25	13	23	27	10	11	.	.	.	.	.	.	.	.	6	4	.
Gentiana cruciata	5	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Geranium pratense	.	13	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.
Geranium sanguineum	35	13	13	18	48	11	50	.	.	50	.	.	.	.	.	.	2
Glechoma hederacea	.	.	3	9	.	11	.	.	.	.	.	.	.	.	.	.	.
Glechoma hirsuta	10	13	3	.	5	.	.	.	.	.	.	.	.	.	.	.	.
Helianthemum canum	5	13	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Helianthemum nummularium	20	13	3	9	10	.	.	.	.	.	.	.	.	.	.	.	.
Helichrysum arenarium	.	.	.	.	.	.	.	.	.	.	40	.	.	.	.	11	.
Helictochloa pratensis	10	.	6	45	.	11	.	.	.	.	.	.	.	.	.	.	.
Helleborus purpurascens	.	25	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Herniaria incana	.	.	.	.	.	.	.	.	.	.	.	20	.	.	.	7	.
Hesperis tristis	.	.	.	.	.	.	.	.	.	.	.	.	43	.	.	.	.
Hieracium umbellatum	5	.	10	9	.	.	.	.	.	.	.	.	.	.	.	.	.
Hierochloë repens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.
Holcus lanatus	.	13	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hordeum murinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
Hypericum elegans	5	13	3	.	.	.	.	.	100	.	.	.	57	29	11	4	.
Hypericum perforatum	25	.	19	.	14	11	.	.	.	.	.	.	.	14	28	18	2
Hypochaeris maculata	10	13	16	55	48	33	50	.	.	.	.	20	.	14	.	.	.
Inula britannica	.	.	.	.	.	.	.	.	.	.	.	.	.	14	.	4	.
Inula ensifolia	20	13	3	.	10	22	.	.	.	100	.	.	71	.	56	11	17
Inula germanica	5	25	.	18	.	11	.	.	.	.	80	20	71	.	6	29	27
Inula hirta	20	13	3	55	38	44	.	.	.	100	.	20	100	.	6	11	49
Inula oculus-christi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	.
Inula salicina	5	13	23	.	.	22	.	.	.	.	.	.	.	.	11	11	.
Iris aphylla	35	50	16	.	5	22	.	.	.	.	.	.	71	14	22	46	46
Iris graminea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14	15
Iris pontica	5	.	.	.	5	.	.	.	.	.	.	.	.	.	6	.	5
Iris pumila	20	.	3	.	.	.	.	.	.	.	.	.	.	.	61	.	17
Iris sintenisii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18	.
Iris variegata	5	.	3	.	.	.	.	.	50	.	.	.	.	.	.	4	.
Jacobaea erucifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	14	.	11	.
Jacobaea vulgaris	30	38	.	.	48	11	.	100	.	.	80	.	.	57	33	21	15
Jurinea arachnoidea	.	.	.	.	.	.	.	.	.	.	100	.	.	29	.	61	2
Jurinea ledebourii	10	.	19	9	5	.	.	.	.	.	.	.	.	.	.	.	7
Jurinea mollis	40	50	16	9	10	22	.	.	.	100	.	.	100	.	67	.	27
Jurinea transylvanica	10	.	6	.	14	.	.	.	.	.	.	.	.	.	.	.	2
Kickxia spuria	.	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Klasea lycopifolia	10	.	.	.	10	11	.	.	.	.	.	.	.	.	.	.	.
Klasea radiata	25	38	19	.	.	22	.	.	.	.	.	.	57	14	50	.	24
Knautia arvensis	35	38	45	91	52	33	100	.	.	.	100	.	100	57	.	36	56
Koeleria macrantha	60	25	58	91	57	56	50	.	.	.	.	20	100	29	44	61	15
Koeleria pyramidata	5	.	10	.	5	.	.	.	.	.	.	.	.	.	.	.	44
Lappula squarrosa	15	.	.	.	5	.	.	.	.	.	20	.	.	.	.	18	2
Lapsana communis	.	25	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lathyrus latifolius	.	.	.	.	5	11	.	.	.	.	.	.	.	.	.	.	.
Lathyrus pallescens	.	13	3	64	5	22	.	.	.	.	.	.	.	.	6	4	.
Lathyrus pannonicus	5	.	.	.	5	11	.	.	.	.	.	.	.	.	6	18	.
Lathyrus pratensis	.	13	3	9	.	.	.	.	.	.	.	.	86	.	.	.	.
Lathyrus tuberosus	5	13	.	.	.	.	.	.	.	.	.	.	.	14	.	.	.
Lembotropis nigricans	20	13	6	.	5	.	.	.	.	.	.	.	.	.	.	.	.
Leontodon crispus	20	.	10	.	.	.	.	.	.	.	.	.	.	29	44	7	15
Leontodon hispidus	35	38	45	55	38	11	100	100	.	.	.	.	.	.	.	4	.
Leopoldia comosa	.	.	13	.	.	.	.	.	.	.	80	.	.	14	11	25	54
Leopoldia tenuiflora	5	13	23	9	19	33	.	100	.	.	.	.	29	14	61	7	22
Lepidium campestre	.	.	19	27	.	.	.	.	.	.	.	.	.	.	.	.	.
Lepidium draba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	17	14	2
Leucanthemum vulgare	40	63	42	82	67	33	100	100	.	.	.	.	.	.	.	.	.
Ligustrum vulgare	10	13	.	.	.	.	.	.	.	.	.	.	.	.	11	.	.
Limonium bellidifolium	.	.	.	.	.	.	.	.	.	.	.	100	.	.	.	.	.
Limonium gmelinii	.	.	.	.	.	.	.	.	.	.	.	60	.	.	.	.	.
Linaria angustissima	.	.	.	.	.	.	.	.	.	.	.	.	.	43	.	.	.
Linaria genistifolia	5	.	.	.	.	.	.	.	.	.	.	40	57	.	.	18	5
Linum austriacum	10	25	.	9	.	22	50	100	.	.	.	.	.	.	17	.	5
Linum catharticum	35	38	6	9	52	.	50	.	.	.	.	.	.	.	17	4	.
Linum flavum	15	25	13	.	5	.	.	100	.	50	80	.	.	29	6	14	2
Linum hirsutum	5	13	.	.	.	.	.	.	.	.	80	.	.	.	6	14	2
Linum nervosum	5	25	10	9	5	11	.	.	.	.	.	.	100	.	6	.	5
Linum perenne	.	13	6	9	.	.	.	.	.	.	.	40	.	.	.	11	.
Linum tenuifolium	.	.	.	.	5	.	.	100	.	.	.	.	.	.	.	4	2
Lithospermum officinale	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15
Lolium perenne	.	.	6	.	.	.	.	.	.	.	20	.	.	.	.	14	2
Lotus corniculatus	35	50	48	55	57	56	100	100	.	.	20	.	71	43	.	46	2
Luzula campestris	.	.	6	18	5	.	.	.	.	.	.	.	.	.	.	4	.
Lysimachia vulgaris	.	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Malabaila graveolens	.	.	.	.	.	.	.	.	.	.	.	.	.	57	.	25	.
Malva sylvestris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10
Malva thuringiaca	.	13	.	.	.	.	.	.	.	.	80	.	43	14	.	7	2
Marrubium peregrinum	.	.	.	.	.	.	.	.	.	.	80	60	.	14	.	18	37
Marrubium vulgare	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	7
Medicago falcata	60	63	45	73	29	22	.	100	.	100	80	20	100	86	61	75	54
Medicago lupulina	15	25	29	45	19	.	.	.	.	.	20	.	.	.	.	50	5
Medicago minima	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25	.
Melampyrum arvense	10	.	.	.	.	11	.	.	.	.	.	.	.	29	6	32	54
Melampyrum bihariense	.	.	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Melampyrum cristatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.
Melica ciliata	10	.	.	.	.	.	.	.	100	.	80	.	.	.	11	14	.
Melica transsilvanica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.
Melilotus officinalis	.	.	.	.	.	.	.	.	.	.	80	.	.	.	.	4	2
Mercurialis ovata	10	.	6	.	10	.	50	.	.	.	.	.	.	.	.	.	5
Minuartia setacea	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Muscari botryoides	10	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Muscari neglectum	.	13	.	.	.	.	.	.	.	.	.	.	.	.	.	14	.
Myosotis sylvatica	.	.	.	18	.	.	.	.	.	.	.	.	.	.	.	.	.
Neotinea tridentata	.	.	3	.	5	.	.	.	.	.	.	.	.	.	.	.	.
Nepeta nuda	10	50	16	64	14	22	50	.	50	.	.	.	.	29	.	7	2
Nepeta ucranica	.	.	6	.	.	.	.	.	.	.	.	.	100	.	17	.	10
Nigella arvensis	.	.	3	.	5	.	.	.	.	.	40	40	.	.	.	.	.
Noccaea perfoliata	.	.	.	36	.	.	.	.	.	.	.	.	.	.	17	.	.
Nonea pulla	10	13	29	91	19	22	.	100	.	.	80	20	71	14	39	39	32
Odontites luteus	5	.	3	.	.	11	.	.	.	.	.	.	.	.	.	.	.

Continued on next page

Fortsetzung auf nächsten Seite

Group (cluster)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
No. of relevés	20	8	31	11	21	9	2	1	2	2	5	5	7	7	18	28	41
Onobrychis arenaria	10	.	3	9	24	33	.	.	.	.	.	.	29	14	17	4	2
Onobrychis viciifolia	25	63	52	73	57	22	50	.	.	50	80	.	.	57	.	50	44
Ononis spinosa	5	.	3	.	5	.	.	.	.	.	.	.	.	.	.	7	.
Onopordum acanthium	.	13	.	.	.	.	.	.	.	.	20	.	.	.	.	.	2
Origanum vulgare	.	.	6	.	.	.	.	.	.	100	.	.	.	.	.	.	.
Orlaya grandiflora	.	.	.	.	.	.	.	.	100	.	.	20	.	.	.	.	.
Ornithogalum pyramidale	.	.	3	.	.	11	.	100	.	.	.	.	.	.	.	.	2
Ornithogalum umbellatum	.	13	16	.	.	.	.	.	.	.	.	.	.	.	6	.	.
Orobanche alba	5	.	3	.	5	11	.	100	.	.	.	.	.	29	11	.	5
Orobanche lutea	.	.	3	.	.	.	.	.	.	.	.	.	29	.	.	4	.
Oxytropis pilosa	.	.	.	.	.	.	.	.	.	.	.	.	71	.	17	11	12
Paeonia tenuifolia	.	13	19	.	.	.	.	.	.	.	.	.	100	.	.	.	.
Pastinaca sativa	.	.	.	9	.	.	50	.	.	.	.	.	.	.	.	.	.
Pedicularis comosa	.	25	3	18	14	11	100	.	.	.	.	.	.	.	.	.	.
Peucedanum cervaria	.	38	.	.	19	11	.	.	.	100	.	.	.	.	6	.	.
Peucedanum officinale	.	.	10	.	.	11	.	.	.	100	.	.	.	.	.	.	.
Peucedanum oreoselinum	.	.	6	9	24	.	.	.	.	.	.	.	.	.	6	.	.
Peucedanum ruthenicum	5	25	10	.	5	.	.	.	.	.	.	.	100	.	50	.	17
Phleum hirsutum	.	.	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Phleum montanum	15	13	6	73	29	44	.	.	.	.	.	.	.	.	11	.	2
Phleum phleoides	30	75	10	.	19	.	50	.	50	50	.	.	43	29	6	18	.
Phlomis herba-venti	.	.	.	.	.	.	.	.	.	.	80	.	.	57	.	61	56
Phlomis tuberosa	.	38	6	9	5	22	.	.	.	50	.	.	71	43	.	25	17
Phragmites australis	.	.	.	.	.	.	.	.	.	.	.	.	.	43	.	.	22
Picris hieracioides	40	38	6	.	5	.	.	.	.	.	.	.	.	.	17	7	5
Pilosella bauhini	5	.	6	.	14	.	.	.	.	50	.	.	.	29	.	32	.
Pilosella caespitosa	.	.	6	73	.	11	.	.	.	.	.	.	.	.	.	.	.
Pilosella cymosa	.	.	.	9	.	.	.	.	.	.	.	.	.	.	17	.	.
Pilosella officinarum	10	.	10	18	14	11	.	.	.	.	.	.	71	.	.	11	.
Pilosella piloselloides	10	.	23	9	14	22	50	.	.	.	.	.	.	.	33	7	2
Pimpinella saxifraga	45	50	42	55	33	33	.	.	.	.	40	.	.	14	.	.	.
Plantago argentea	35	13	6	18	19	22	.	.	.	.	.	.	71	.	39	.	29
Plantago cornuti	.	.	.	.	.	.	.	.	.	.	.	.	.	29	.	.	.
Plantago lanceolata	40	38	71	64	52	22	50	.	.	.	80	40	100	57	6	50	27
Plantago major	.	.	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Plantago media	60	38	71	91	62	44	100	.	.	.	.	.	.	29	56	43	32
Poa angustifolia	20	38	16	9	.	.	.	.	100	.	.	.	57	.	33	18	15
Poa badensis	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poa bulbosa	.	13	.	.	.	.	.	.	.	.	.	100	.	.	.	7	.
Poa compressa	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	4	.
Poa pratensis	.	.	13	27	.	.	50	.	.	.	.	.	.	14	.	7	29
Podospermum canum	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	7	5
Podospermum purpureum	10	.	10	9	19	33	.	.	.	.	.	.	.	.	.	.	.
Podospermum roseum	5	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.
Polygala comosa	10	.	10	9	10	11	50	.	.	.	.	.	.	.	.	7	.
Polygala major	50	63	23	55	57	56	.	.	.	.	.	.	57	86	.	14	20
Polygala vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	.
Polygonatum odoratum	10	.	.	.	5	.	.	.	.	50	.	.	.	.	.	.	.
Polygonum aviculare	.	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pontechium maculatum	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Potentilla alba	10	.	.	.	38	.	.	.	.	50	.	.	.	.	.	4	.
Potentilla argentea	.	.	19	18	5	.	.	.	50	.	.	.	100	43	6	50	32
Potentilla cinerea	40	13	26	27	19	44	.	100	.	.	40	.	100	.	83	29	24
Potentilla heptaphylla	5	.	23	.	10	.	.	100	.	.	.	20	.	.	.	11	.
Potentilla hirta	.	.	.	.	.	.	.	.	.	.	.	60	.	.	.	.	.
Potentilla patula	.	.	3	55	10	11	.	.	.	.	.	.	.	.	.	.	.
Potentilla pedata	.	.	.	.	.	.	.	.	.	.	.	.	71	.	.	.	.
Potentilla recta	5	.	6	.	5	.	.	.	.	.	.	.	57	57	.	25	.
Potentilla reptans	.	.	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Primula veris	15	50	23	36	24	.	.	100	.	.	.	.	.	.	.	4	.
Prunella grandiflora	15	.	16	.	29	22	.	.	.	.	40	.	57	.	.	11	.
Prunella laciniata	20	38	13	.	.	22	.	.	.	.	.	.	.	.	.	21	.
Prunella vulgaris	15	50	10	36	10	.	50	.	.	.	20	.	.	.	.	18	2
Prunus fruticosa	.	13	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.
Prunus spinosa	20	25	16	9	5	.	.	.	.	.	.	.	.	29	6	.	12
Prunus tenella	15	25	6	.	5	22	.	.	.	.	.	.	.	.	44	4	17
Psephellus trinervius	.	.	3	.	.	.	.	.	.	.	.	.	71	.	11	.	2
Pulmonaria mollis	5	13	16	.	5	11	.	.	.	.	.	.	.	.	.	.	.
Pulmonaria montana	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pulsatilla montana	30	63	35	73	24	22	.	100	.	50	.	.	.	.	28	29	15
Pulsatilla patens	.	.	.	18	5	.	.	.	.	.	.	.	.	.	.	.	.
Pyrus communis	10	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculus acris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	.
Ranunculus illyricus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18	.
Ranunculus polyanthemos	35	50	52	64	38	11	100	.	.	.	.	.	.	14	.	7	12
Rapistrum perenne	.	.	.	.	.	.	.	.	.	.	.	.	14	.	6	21	7
Reseda inodora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.
Reseda lutea	.	.	.	.	.	.	.	.	.	.	80	.	.	14	.	39	29
Rhamnus cathartica	.	13	.	.	5	.	.	.	50	.	.	.	.	.	.	.	2
Rhinanthus angustifolius	10	.	19	73	19	11	50	.	.	.	.	.	.	.	.	.	.
Rhinanthus minor	.	13	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhinanthus rumelicus	20	25	23	.	33	56	100	.	.	.	.	.	.	.	6	7	.
Robinia pseudoacacia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	.	.
Rorippa pyrenaica	.	.	.	18	5	.	.	.	.	.	.	.	.	.	.	.	.
Rosa canina	5	.	16	.	.	.	.	.	.	.	.	.	.	29	6	7	5
Rosa corymbifera	.	25	.	.	.	.	.	.	50	.	.	.	.	.	.	.	.
Rosa gallica	5	13	3	18	14	22	.	.	.	.	.	.	29	14	17	14	7
Rubus caesius	5	13	3	.	.	.	.	.	.	.	.	.	.	.	6	.	.
Rumex acetosa	5	.	19	64	14	11	50	.	.	.	.	.	.	.	.	.	2
Rumex acetosella	.	.	3	.	.	.	.	.	50	.	.	.	.	.	.	.	.
Rumex tuberosus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	.
Salvia aethiopis	.	.	.	.	.	.	.	.	.	.	.	20	.	.	.	4	.
Salvia austriaca	35	.	29	73	29	.	50	.	.	.	.	.	100	.	44	36	39
Salvia nemorosa	40	25	10	9	14	11	.	100	.	.	80	40	100	100	39	46	66
Salvia nutans	45	25	35	.	10	44	.	.	.	100	.	.	100	.	83	4	27
Salvia pratensis	55	50	58	100	62	67	100	.	.	.	.	.	71	.	6	32	29
Salvia transsylvanica	15	.	19	.	14	11	.	100	.	.	.	.	100	.	11	.	10
Salvia verticillata	35	50	26	18	10	11	50	.	.	50	80	.	43	29	17	32	.
Salvia x betonicifolia	.	.	.	.	.	22	.	.	.	.	.	.	.	.	6	.	.
Sanguisorba minor	.	.	10	9	5	.	.	.	.	.	.	.	.	.	.	4	.
Scabiosa ochroleuca	50	50	32	55	62	33	100	.	.	50	80	20	71	86	22	29	5
Schedonorus pratensis	5	25	26	45	10	.	100	.	.	.	.	.	.	.	.	11	44
Scleranthus annuus	5	.	.	.	.	.	.	.	.	.	40	.	.	29	.	7	.
Scorzonera austriaca	15	25	3	.	.	11	.	.	.	.	.	.	.	.	.	.	.
Scorzonera hispanica	15	13	23	45	19	11	.	.	.	.	.	.	.	.	39	.	32
Scorzoneroides autumnalis	.	.	.	18	.	.	.	.	.	.	.	.	.	.	.	4	.
Securigera varia	45	50	42	27	29	22	50	.	.	50	80	.	.	29	28	25	15
Sedum album	.	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sedum hispanicum	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sedum sexangulare	.	.	3	.	5	.	.	.	.	.	.	.	.	.	.	7	.
Senecio doria	15	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Senecio leucanthemifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.
Senecio ovatus	.	.	.	.	14	.	.	.	.	.	.	.	.	.	.	.	.
Serratula tinctoria	5	.	6	.	.	11	.	.	.	.	.	.	.	.	6	.	.
Seseli annuum	35	63	23	45	10	22	.	.	.	.	.	.	.	.	.	.	.
Seseli gracile	5	13	.	.	.	.	.	.	.	.	.	.	14	.	.	.	.
Seseli osseum	5	.	3	9	.	.	.	.	.	.	.	.	.	.	6	.	2
Seseli pallasii	35	.	3	.	5	.	.	.	.	.	.	.	14	.	22	.	5
Seseli peucedanoides	.	13	13	.	.	.	.	.	.	.	.	20	14	.	.	.	.
Sideritis montana	.	.	.	.	.	.	.	.	.	.	.	.	71	.	.	7	.
Silene bupleuroides	.	.	.	.	.	.	.	.	.	50	.	.	.	.	6	.	.
Silene coronaria	.	.	.	.	.	.	.	.	100	.	.	.	.	.	.	.	.
Silene densiflora	.	.	.	.	.	.	.	.	.	.	80	.	71	.	.	7	.
Silene nemoralis	.	13	.	9	5	.	50	.	.	.	.	.	.	.	.	.	.
Silene nutans	.	.	16	.	5	.	.	.	.	.	.	.	.	.	.	.	.
Silene otites	10	.	3	.	14	33	.	.	.	.	.	20	.	57	.	46	2
Sisymbrium loeselii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14	.
Solidago virgaurea	5	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.
Stachys annua	.	.	.	.	.	.	.	100	.	.	80	.	.	.	.	.	.
Stachys germanica	.	13	3	9	.	11	.	.	50	100	.	.	.	.	.	.	.
Stachys officinalis	20	38	35	55	57	11	50	.	.	.	.	.	.	43	.	4	.
Stachys recta	80	88	39	55	52	44	50	.	50	50	.	20	100	57	72	57	88
Stellaria graminea	.	.	3	.	10	.	50	.	.	.	.	.	.	.	.	4	5
Stellaria holostea	.	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stipa capillata	15	13	10	.	5	11	.	100	50	100	.	60	29	29	28	14	10
Stipa lessingiana	5	.	3	.	.	.	.	.	.	.	.	.	29	29	28	4	100
Stipa pennata	.	.	3	.	.	.	.	.	.	.	.	.	43	.	.	.	.
Stipa pulcherrima	25	25	10	.	.	.	.	.	.	.	.	.	.	.	100	14	17
Stipa tirsa	20	13	3	.	43	100	.	100	.	.	.	.	.	.	6	.	.
Tanacetum corymbosum	10	38	19	36	5	22	.	.	.	.	.	.	.	.	.	.	2
Tanacetum millefolium	.	.	.	.	.	.	.	.	.	.	.	40	.	.	.	.	.
Taraxacum erythrospermum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	.
Taraxacum sect.	.	.	6	18	.	.	50	100	.	.	.	.	.	.	.	.	.
Taraxacum serotinum	.	.	.	.	.	.	.	.	.	.	80	20	.	14	.	46	20
Tephroseris integrifolia	.	.	3	18	.	11	.	.	.	.	.	.	.	.	.	4	.
Teucrium capitatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.
Teucrium chamaedrys	60	50	61	45	33	33	.	.	.	.	.	.	.	43	94	7	85
Teucrium montanum	15	.	3	.	10	22	.	.	.	.	.	.	.	.	6	.	7
Teucrium polium	.	.	.	.	.	.	.	.	.	.	.	20	71	.	.	29	2
Thalictrum aquilegiifolium	5	13	.	18	5	.	.	.	.	.	.	.	.	.	.	.	.
Thalictrum minus	10	25	35	36	19	22	.	.	.	.	.	.	.	29	39	.	66
Thesium dollineri	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.
Thesium linophyllon	40	75	39	55	43	33	50	.	.	.	.	.	.	.	50	7	10
Thlaspi arvense	.	13	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thymus comosus	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thymus odoratissimus	.	.	6	.	.	.	.	.	.	.	.	.	71	.	.	.	.
Thymus pulegioides	30	25	26	.	5	.	.	.	.	.	.	.	.	14	56	7	7
Thymus x porcii	.	.	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Torilis japonica	.	.	.	.	.	.	.	.	.	.	.	.	.	29	.	.	.
Tragopogon dubius	5	13	3	9	10	11	.	.	.	.	.	.	.	.	44	.	15

Continued on next page

Fortsetzung auf nächsten Seite

Group (cluster)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
No. of relevés	20	8	31	11	21	9	2	1	2	2	5	5	7	7	18	28	41
Tragopogon pratensis	15	38	42	64	14	11	50	.	.	.	.	.	.	14	.	4	.
Trifolium alpestre	5	.	13	55	33	44	.	.	.	.	.	.	.	14	6	.	22
Trifolium arvense	.	.	.	.	.	.	.	.	.	.	80	.	.	43	.	7	.
Trifolium campestre	.	.	.	9	.	.	.	.	.	.	.	.	.	.	.	4	.
Trifolium fragiferum	5	.	.	.	.	.	.	.	.	.	20	.	.	.	.	.	2
Trifolium medium	.	.	3	.	10	.	.	.	.	.	.	.	.	.	.	11	.
Trifolium montanum	40	88	52	91	67	56	100	.	.	.	.	.	.	29	6	4	44
Trifolium ochroleucon	15	13	.	.	14	11	.	.	.	.	.	.	.	.	.	.	.
Trifolium pannonicum	5	.	.	9	24	11	.	.	.	.	.	.	.	.	.	.	.
Trifolium pratense	5	.	16	55	43	22	50	.	.	.	.	.	.	.	.	7	.
Trifolium repens	5	25	3	27	5	.	50	.	.	.	.	.	.	.	.	7	2
Trinia glauca	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Trinia kitaibelii	.	.	.	.	.	.	.	.	.	.	.	.	.	43	.	32	.
Trisetum flavescens	.	.	3	.	5	.	.	.	.	.	.	.	.	.	.	.	.
Urtica dioica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	10
Valeriana officinalis	.	.	19	27	.	.	50	.	.	.	.	.	.	.	.	.	.
Valerianella dentata	.	.	.	18	.	.	.	.	.	.	.	.	.	.	6	.	.
Veratrum nigrum	10	.	.	.	14	11	.	.	.	.	.	.	.	.	.	.	.
Verbascum chaixii	.	13	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Verbascum lychnitis	.	.	3	.	.	11	.	.	.	.	.	.	.	.	.	.	2
Verbascum nigrum	.	.	.	.	.	.	.	.	.	.	20	.	.	14	.	.	.
Verbascum phlomoides	.	.	.	18	.	.	.	.	.	.	.	.	.	.	.	.	15
Verbascum phoeniceum	20	.	35	45	10	11	50	.	.	.	.	.	.	.	56	7	7
Verbascum speciosum	.	.	.	.	.	.	.	.	.	.	40	.	.	.	.	4	.
Verbena officinalis	.	13	.	.	.	.	.	.	.	.	.	.	.	.	6	.	.
Veronica austriaca	50	50	39	55	19	33	.	.	50	.	100	.	.	14	28	21	56
Veronica chamaedrys	.	13	26	45	14	.	.	.	.	.	.	.	.	.	.	.	.
Veronica officinalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
Veronica orchidea	20	38	6	.	14	.	.	100	.	.	.	.	.	.	44	.	7
Veronica prostrata	15	13	29	.	5	.	.	.	.	.	.	.	.	.	.	7	.
Veronica spicata	.	25	3	9	.	22	.	.	.	.	.	.	.	.	.	.	.
Vicia cracca	5	.	3	100	29	22	50	.	.	.	.	.	.	.	.	.	39
Vicia sativa	.	.	3	9	.	.	.	.	.	.	.	.	.	.	.	.	2
Vicia tenuifolia	.	13	19	.	5	11	.	.	.	.	.	.	.	.	.	.	.
Vicia villosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6	.	12
Vinca herbacea	25	25	10	.	.	.	.	.	.	.	.	.	.	.	67	.	37
Vincetoxicum hirundinaria	20	25	13	.	14	.	.	.	.	.	.	.	.	.	6	.	15
Viola ambigua	5	.	6	9	5	22	.	.	.	.	.	.	.	.	6	.	5
Viola arvensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14	.
Viola canina	.	.	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Viola hirta	50	50	39	45	19	.	50	.	.	.	.	.	.	14	39	4	5
Xeranthemum annuum	.	.	.	.	.	.	.	.	.	.	.	80	.	29	.	11	.