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DRY GRASSLAND COMMUNITIES OF *ERYSIMO-TRIFOLIETUM* IN THE NORTH-EASTERN PART OF THE REPUBLIC OF MACEDONIA

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Abstract

The study deals with the distribution and classification of the association *Erysimo-Trifolietum* Micevski 1977 (alliance *Trifolion cherleri* Micevski 1971, order *Astragalo-Potentilletalia* Micevski 1971, class *Festuco-Brometea* Br. Bl. et Tx. 1943). The association develops on siliceous bedrock of the northern and northeastern parts of the Republic of Macedonia. After the research of dry grasslands in the region of Kratovo, enough information was available to prepare a synthetic overview of the association *Erysimo-Trifolietum*. Within the frame of this association, two new subassoaciations are described – subass. *scleranthetosum* subass. nova and subass. *brachypodietosum* subass. nova. Analysis of geoelements showed that sub-Mediterranean species are the most numerous and analysis of life forms provided evidence of their therophyto-hemicryptophytic physiognomy. The paper also presents the localities of occurrence, their floristic composition, synecological characteristics, life forms incidence and areal types.
Key words: *Erysimo-Trifolietum*, geoelements, life forms, syntaxonomy, vegetation, Republic of Macedonia.

Izvleček

Raziskava se ukvarja z razširjenostjo in klasifikacijo asociacije *Erysimo-Trifolietum* Micevski 1977 (zveza *Trifolion cherleri* Micevski 1971, red *Astragalo-Potentilletalia* Micevski 1971, razred *Festuco-Brometea* Br. Bl. et Tx. 1943). Asociacija se pojavlja na silikatni podlagi v severnem in severovzhodnem delu Republike Makedonije. Po zaključenih raziskavah v okolici Kratova, smo razpolagali z zadostno količino podatkov, da smo lahko pripravili sintetični pregled asociacije *Erysimo-Trifolietum*. V okviru asociacije smo opisali dve novi subasociaciji – subasociacijo *sclerathetosum* subass. nova in *brachypodietosum* subass. nova. Analiza horološkega spektra je pokazala, da so v združbah najbolj pogoste submediteranske vrste, analiza življenjskih oblik pa kaže na terofitsko-hemikriptofitski značaj te asociacije. Delo prikazuje lokalitete, kjer se združbe pojavljajo, floristično zgradbo, sinekološke značilnosti, spekter življenjskih oblik in horološki spekter.
Ključne besede: *Erysimo-Trifolietum*, geoelementi, življenjske oblike, sintaksonomija vegetacija, Republika Makedonija.

1. INTRODUCTION

Dry grasslands have existed in the landscape of Europe since the Pleistocene and they are western outposts of the vast steppes of Russia and the Ukraine (Kuneš et al. 2008, Werger 2009), and can be primary and secondary. On the territory of the Republic of Macedonia they are maintained by human activities. With the abandonment of traditional agriculture, they have become overgrown, mainly by thermophilous deciduous forest of *Quercetalia pubescentis*. During the 20th century, they therefore became fragmented and are among endangered habitats. Various activities

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for the preservation of dry grasslands are taking place throughout Europe. (Dzwonko & Loster 2007, Kiehl & Pfadenauer 2007, Dostalek & Frantik 2008, Čarni & al. 2009, Kavgaci & al. 2010)

In continental parts of Europe, dry grasslands of lower altitudes are mainly classified within the class of *Festuco-Brometea*. In Atlantic and sub-Atlantic parts of Europe, appearing also in the western part of the Balkan Peninsula, there appear lowland dry grasslands over acidic substrate, dominated by *Nardus stricta,* but in the southern Balkans, such vegetation appears at higher altitudes and can be classified within *Calluno-Ulicetea* or *Juncetea trifidi*. (Micevski 1994, Redžić 2007, Velev & Apostolova 2009)

Dry grasslands in the southern part of the Balkan Peninsula are classified in the endemic order *Astragalo-Potentilletalia* within the class *Festuco-Brometea*. (Micevski 1971, Rodwell et al. 2002, Bergmeier & al. 2009).

The dry grasslands on siliceous geological bedrock on the territory of the Republic of Macedonia are assigned to the class *Festuco-Brometea*, order *Astragalo-Potentilletalia* and alliance *Trifolion cherleri*.

The order *Astragalo-Potentilletalia* (Micevski 1971) and alliance *Trifolion cherleri* (Micevski 1972) that comprises the vegetation of dry grassland on siliceous, have been described on the territory of Macedonia. Many elaboration of this vegetation exist over the wider area of the southern Balkans (Micevski 1970, 1972, 1973, 1977, 1978, 1994, Horvatić & Randjelović 1973, Randjelović 1975, Rexhepi 1979, Randjelović & Ružić 1982, 1986, Ružić 1983, Micevski & Matevski 1984, Konstantinou 1992, Matevski & Kostadinovski 1998, Matevski et al. 2007, Sopotlieva & Apostolova 2007, Bergmeier 2009, Čarni et al. 2010).

Five associations have been described in Macedonia so far, *Tunico-Trisetetum myrianthi* Micevski 1972 (in the region of Gevgelija and Bitola), *Helianthemo-Euphorbietum thessalae* Micevski 1973 (in the region of Kočani, Prilep, Veles and Makedonska Kamenica), *Erysimo-Trifolietum* Micevski 1977 (in the region of Skopje, Radoviš, Štip, Probištip, Kratovo and Veles), *Diantho-Cistetum incani* Micevski et Matevski 1984 (in the region of Gevgelija) and *Biserrulo-Scleranthetum dichotomae* Matevski et Kostadinovski 1998 (in the Mariovo region).

Here we deal with the dry grassland communities of *Erysimo-Trifolietum,* which develops on siliceous bedrock up to 900 m. It is widespread in the central, northern and northeastern part of the Republic of Macedonia (Micevski 1977).

The aim of the article is to identify the position of newly acquired data of dry grassland vegetation in the eastern part of the Republic of Macedonia. After syntaxonomic classification of data within the association *Erysimo-Trifolietum*, we investigated its floristic, phytogeographical and structural diversity, as well as its detailed distribution pattern. Finally, we describe new syntaxa and discuss the classification of dry grasslands in the southern Balkans.

2. MATERIALS AND METHODS

During 2004 and 2005, field studies were conducted on many dry grassland localities in the region of Kratovo, on both sides of the River Kriva. We collected 81 vegetation samples (relevés) with plot size 100 m^2, inhomogeneous relevés are expelled, where mixture of silicate and carbonate plant appears, other are shown in Table 1. The average annual temperature for this region is 11.4 °C, and the average annual rainfall is 728.4 mm (Lazarevski 1993).

Vegetation research was carried out according to the Braun-Blanquet approach (Braun-Blanquet 1964; Westhoff & van der Maarel 1973). The nomenclature of plant species is according to *Flora Europaea* (Tutin et al. 1964–1993); *Prodromus florae peninsulae Balcanicae* (Hayek 1927–1933), *Flora of the Republic of Macedonia* (Micevski 1985, 1993, 1995, 1998, 2001, 2005), *Flora of Bulgaria* (Jordanov 1963–1979; Velchev 1982, Kozuharov 1992, 1995), *Flora of the SR Serbia* (Josifović 1970–1977), as well as many other monographs and floristic and taxonomic articles. The syntaxonomy and nomenclature of the new plant communities are in accordance with the International Code of Phytosociological Nomenclature (Weber al. 2000).

Vegetation relevés made in the field and from literature sources were entered in the Turboveg database (Hennekens et al. 2001). The combined values for the cover-abundance scale was transformed according to Van der Maarel (1979) for the purpose of numerical analysis. Classifications of relevés were made by the program PC-ORD 4 (McCune & Mefford 1999) where Ward's, Flexible beta methods and the relative Euclidean distance were applied. Vegetation relevés were also analyzed by the computer program JUICE 6.4

(Tichy 2006), whereby diagnostic species were determined using fidelity measure coefficients (Barkman 1979, Chytrý et al. 2002).

Life forms according to Raunkiaer (1934) were used for defining the biological spectrum. Geoelements were established according to Gajić (1980) and Pignatti (2005). The proportion of therophytes and hemicryptophytes was visualised by a Mean plot diagram in the computer program Statistica 7.0. (StatSoft, 2007).

The results of numerical analysis were used to elaborate an analytic table (Table 1). All plant taxa appearing in the relevés were classified into the corresponding syntaxa. The basis for this classification was a synthetic table (not shown in the article), including the calculation of fidelity measurements, and expert knowledge.

The basic soil properties (soil type, pH and $CaCO_3$ concentration) were analyzed and determined. The pH value of the soil solution was electrometrically determined with a glass electrode in water suspension and 1 M KCl, while the carbonate concentration in the soil was determined by Scheibler's volumetric method (Mitrićeski et al. 2001).

3. RESULTS

We first made a cluster analysis with the formed database, which consists of 257 vegetation relevés. The results are presented as a dendrogram (Figure 1). It can be seen that vegetation relevés made during of our investigations in the northern parts of the Republic of Macedonia (around in Kratovo region) are divided into two clusters (numbers 1 and 2) and they are mostly related to vegetation relevés of the ass. *Erysimo-Trifolietum* (cluster with ordinal number 3).

Our relevés show a floristic affinity to *Erysimo-Trifolietum* and all nine diagnostic taxa proposed by Micevski (1977) appear; it was decided to classify the relevés under consideration into *Erysimo-Trifolietum*.

The relevés classified within *Erysimo-Trifolietum* were elaborated separatly. The results are presented as a dendrogram (Figure 2), in which it can be seen that the vegetation relevés are grouped in four clusters. It was decided that these four groups represent independent syntaxa, i.e., subassociations of the association *Erysimo-Trifolietum*, as *typicum, onobrychidetosum, scleranthetosum* and *brachypodietosum*.

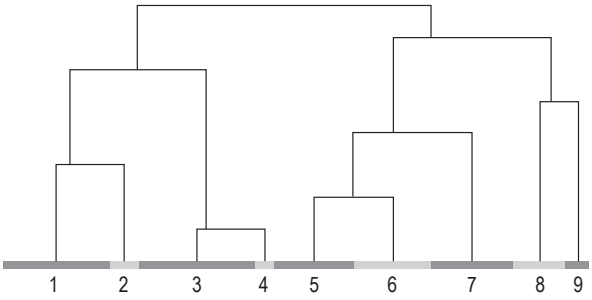

Figure 1: Dendrogram of hierarchical clustering of the vegetation relevés of the alliance *Trifolion cherleri* from the territory of the Republic of Macedonia in 9 clusters (flexible beta method, relative Euclidean distance). Legend: cluster 1 and cluster 2 – *Erysimo-Trifolietum* (Tab. I/1-25; II/26-53; III/1-32; Micevski, 1977); cluster 3 – Tab. 1/1–62 (own relevés) cluster 4– Tab. 1/63–72 (own relevés); cluster 5 and cluster 7 – *Helianthemo-Euphorbietum thessalae* (literature data); cluster 6 –*Tunico-Trisetetum myrianthi* (literature data); cluster 8 – *Biserrulo-Scleranthetum dichotomae* (literature data); and cluster 9 – *Diantho-Cistetum incani* (literature data);

Slika 1: Dendrogram hierarhičnega kopičenja vegetacijskih popisov zveze *Trifolion cherleri* z ozemlja Republike Makedonije: 7 snopov (Wardova metoda, relativna evklidska razdalje). Legenda: snop 1 – Tabela 1/63–72 (lastni popisi); snop 2 – Tabela 1/1–62 (lastni popisi); snop 3 – *Erysimo-Trifolietum* (literaturni podatki); snop 4 – *Tunico-Trisetetum myrianthi* (literaturni podatki); snop 5 – *Helianthemo-Euphorbietum thessalae* (literaturni podatki); snop 6 – *Biserrulo-Scleranthetum dichotomae* (literaturni podatki); in snop 7 – *Diantho-Cistetum incani* (literaturni podatki).

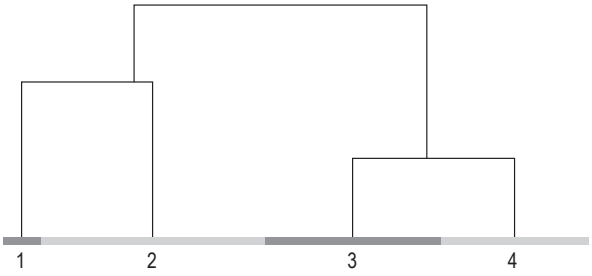

Figure 2: Dendrogram of hierarchical clustering of the vegetation *relevés* of the ass. *Erysimo-Trifolietum* Micevski 1977 on the territory of the Republic of Macedonia in four clusters (Ward's method, relative Euclidean distance); cluster 1 – Table 1/63–72 – *Erysimo-Trifolietum brachypodietosum*, cluster 2 – Table 1/1–62 – *Erysimo-Trifolietum scleranthetosum*, cluster 3 – *Erysimo-Trifolietum typicum*, cluster 4 – *Erysimo-Trifolietum onobrychidietosum*.

Slika 2: Dendrogram hierarhičnega kopičenja vegetacijskih popisov asociacije *Erysimo-Trifolietum* Micevski 1977 z ozemlja Republike Makedonije: 4 snopi (Wardova metoda, relative Evklidska razdalja); snop 1 – Tabela 1/63–72 – *Erysimo-Trifolietum brachypodietosum*, snop 2 – Tabela 1/1–62 – *Erysimo-Trifolietum scleranthetosum*, snop 3 – *Erysimo-Trifolietum typicum*, snop 4 – *Erysimo-Trifolietum onobrychidietosum*.

The individuality of the four groups was also confirmed by calculation of differences in the biological spectrum (life forms) and phytogeographical structure (geoelements) (Table 3, 4). The difference in the presence of therophytes and hemicryptophytes in the four groups of relevés (subassociations) is statistically significant (Figure 3, 4). The spread of the relevés from the first to the fourth group is generally from north to south, by which the impact of continental climate is reduced and the impact of the sub-Mediterranean climate is increased. Therophytes, as the plants most adapted to arid conditions, appear in a dry and hot climate in which the vegetation period is shorter. It seems that the main difference between the subassociations is the proportion of therophytes and hemicryptopytes, which correlates to the geographical position and this is shown in the map of the distribution of the four subassociations (Figure 5).

Their biological and chorological spectra are presented in Tables 2 and 3.

Table 2: Biological spectrum of the subassociations of the ass. *Erysimo diffusi-Trifolietum angustifolii* Micevski 1977.
Tabela 2: Biološki spekter subasociacij asociacije *Erysimo diffusi-Trifolietum angustifolii* Micevski 1977.

life form (%)	T	Ch	G	H	Ph
subass. *brachypodietosum*	53	40	2	4	1
subass. *scleranthetosum*	54	39	5	2	0
subass. *typicum*	56	38	3	3	0
subass. *onobrychietosum*	64	29	5	2	0

Table 3: Chorological spectrum of the subassociations of the ass. *Erysimo diffusi-Trifolietum angustifolii* Micevski 1977.
Tabela 3: Horološki spekter subasociacij asociacije *Erysimo diffusi-Trifolietum angustifolii* Micevski 1977.

Areal types (%)	subass. *brachypodietosum*	subass. *scleranthetosum*	subass. *typicum*	subass. *onobrychietosum*
Eurasian	37	34	30	32
Euromediterranean	36	32	36	36
Stenomediterranean	10	7	10	17
Mediterranean-mountain	2	3	5	3
Balkanic and sub-Balkanic	5	11	7	5
Boreal	2	3	3	0
Cosmopolitan	8	10	8	7

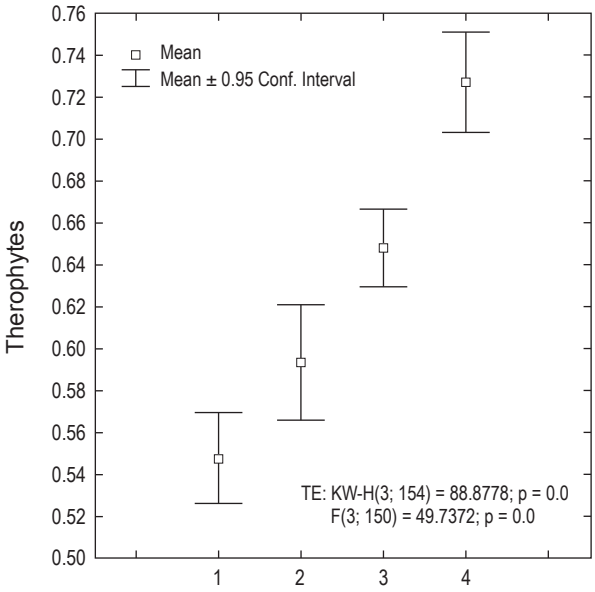

Figure 3: Mean plot diagram. Proportion of therophytes in groups of relevés (subassociations): 1 – subass. *brachypodietosum*, 2 – subass. *scleranthetosum*, 3 – subass. *typicum* and 4 – subass. *onobrychietosum*.
Slika 3: Diagram srednjih vrednosti. Delež terofitov v skupinah popisov (subasociacijah): 1 – subass. *brachypodietosum*, 2 – subass. *scleranthetosum*, 3 – subass. *typicum* in 4 – subass. *onobrychietosum.*

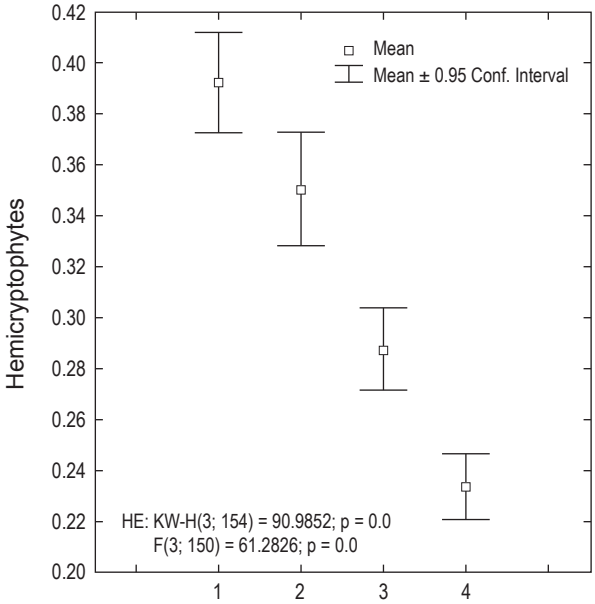

Figure 4: Mean plot diagram. Proportion of hemicryptophytes in groups of *relevés* (subassociations): 1 – subass *brachypodietosum*, 2 – subass. *scleranthetosum*, 3 – subass. *typicum* and 4 – subass. *onobrychidietosum*.
Slika 4: Diagram srednjih vrednosti. Delež hemikriptofitov v skupinah popisov (subasociacijah): 1 – subass. *brachypodietosum*, 2 – subass. *scleranthetosum*, 3 – subass. *typicum* in 4 – subass. *onobrychietosum.*

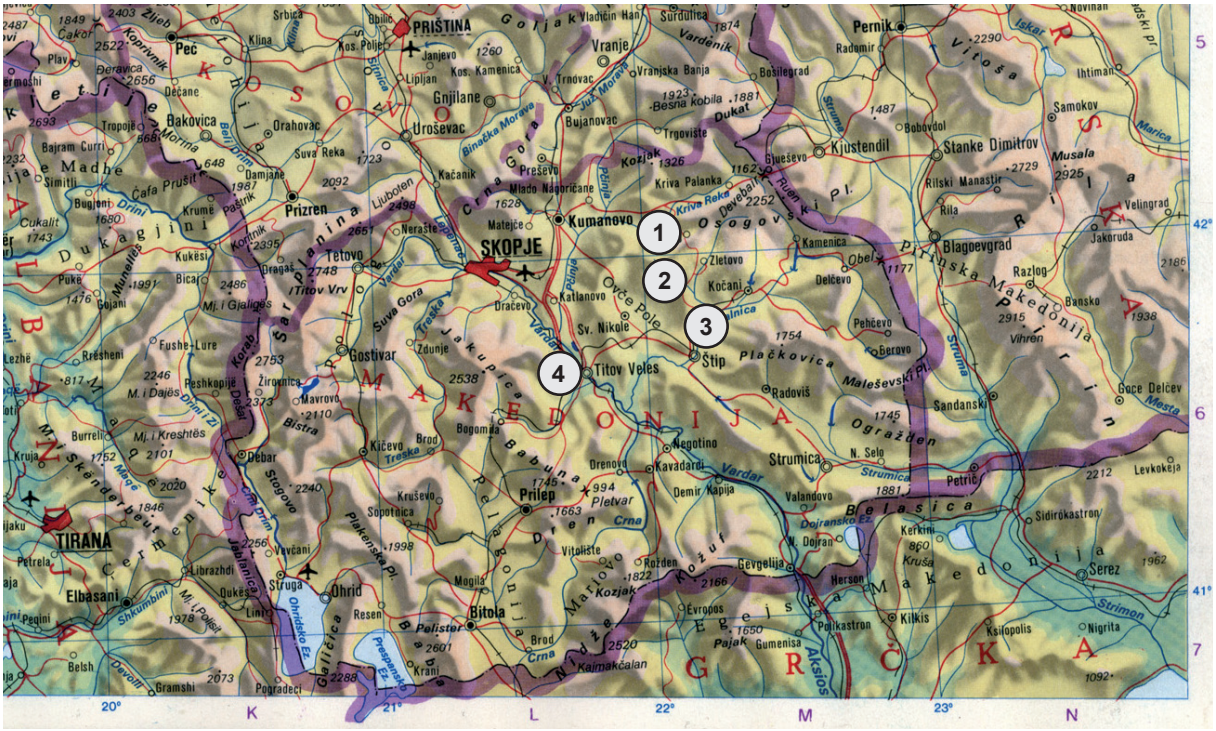

Figure 5: Distribution of the subassociations of the association *Erysimo-Trifolietum*, 1 – subass. *brachypodietosum*, 2 – subass. *scleranthetosum*, 3 – subass. *typicum* and 4 – subass. *Onobrychietosum.*
Slika 5: Razporeditev subasociacij associacije *Erysimo-Trifolietum*, 1 – subass. *brachypodietosum*, 2 – subass. *scleranthetosum*, 3 – subass. *typicum* in 4 – subass. *onobrychietosum.*

4. DISCUSSION

The results show that the vegetation of dry grasslands in the research area around Kratovo should be classified into the association *Erysimo-Trifolietum* Micevski 1977. Under the original syntaxonomic concept, it is part of the alliance *Trifolion cherleri*, which includes the community on rock and highland pastures on siliceous bedrock, in the order *Astragalo-Potentiletallia* and the class *Festuco-Brometea* (Micevski 1977).

The position of the alliance *Trifolion cherleri* in modern syntaxonomic systems is often defined differently from its original conception. Thus, according to Rodwell et al. (2002), which provides a review of phytocenological alliances and their correlation with EUNIS habitats, the alliance *Trifolion cherleri* is not part of the order *Astragalo-Potentilletalia* and the class *Festuco-Brometea* but within the order *Helianthemetalia guttati* Br.-Bl. in Br.-Bl. et al. 1940, from the class *Helianthemetea guttati* (Br.-Bl. in Br.-Bl. et al. 1952) Rivas Goday et Rivas-Mart. 1963.

This new syntaxonomic solution is accepted by Sopotlieva & Apostolova (2007) and the first time they register the ass. *Erysimo-Trifolietum* on the territory of the Republic of Bulgaria, they place it in the class *Helianthemetea guttati*.

The problem of the syntaxonomic position of the alliance *Trifolion cherleri* described on the territory of the Republic of Macedonia (represented by five associations also described from its territory) is still an open question. A definitive solution requires extensive research into its broader areal, based on the most recent findings presented in the works of Royer (1991), Mucina (1997), Rodwell et al. (2002) and others. In this paper, we adhere to the syntaxonomy within the frame of the class *Festuco-Brometea,* in which have been subordinated community from the belt of mountain pastures in the territory of the Republic of Macedonia.

According to the results of analysis within the frame of the ass. *Erysimo-Trifolietum* from northeastern parts of the Republic of Macedonia, two new well- separated subassociations can be distinguished, we propose the following syntaxonomic scheme of the association:

Class: ***Festuco-Brometea*** Br. Bl. et Tx. 1943
Order: ***Astragalo – Potentilletalia*** Micevski 1971
Alliance: ***Trifolion cherleri*** Micevski 1971
ass. ***Erysimo diffusi-Trifolietum angustifolii*** Micevski 1977
(Table 1 (Micevski 1977), lectotypus hoc loco: relevé no. 9)
– subass. *typicum* Micevski 1977
– subass. *onobrychietosum* Micevski 1977
(Table 3 (Micevski 1977), lectotypus hoc loco: relevé no. 14)
– subass. scleranthetosum subass. nova
– subass. *brachypodietosum* subass. nova

***Erysimo diffusi-Trifolietum angustifolii scleranthetosum* subass. nova**

(Table 1, relevés 1–62, holotypus hoc loco: relevé no. 11)

Registered at several locations around Kratovo, at 453–735 m height, inclination up to 10°, in fields with different aspects (mostly with a southern aspect) (Figure 6).

The differential species of the subassociation *scleranthetosum* are *Logfia arvensis*, *Scleranthus perennis* subsp. *dichotomus*, *Sedum hispanicum*, *Verbascum lesnovoensis*, *Trifolium retusum*, *Valerianella turgida* and *Elymus hispidus* subsp. *hispidus*.

The results of chemical analysis of soil samples taken from the soil profile on a representative vegetation relevé are shown in Table 4.

Table 4: Soil type results and pH.
Tabela 4: Tipi tal in pH.

Serial No.	Soil type	Horizon and depth (cm)	Locality	$CaSO_3$ (%)	pH H_2O	pH nKCl
1	leptosol	(A) 0–5	v. Kuklica - Vidim	0	7.5	6.4
2	leptosol	(A) 0–10	v. Filipovci	0	6.9	5.4
3	leptosol	(A) 0–8	v. Konju	0	7.1	5.8

In the researched leptosols, because of the shallow solum, supplying the plants with water and nutrients is obstructed and the habitats must therefore be considered extremely xerothermic. The profile with serial number 1 is particularly xerothermic.

Stands of the subass. *scleranthetosum* were registered on very eroded habitats, so they contain many xerothermic species that are specific to that type of habitat (*Scleranthus perennis* subsp. *dichotomus*, *Sedum annuum*, *Sedum hispanicum*, *Sedum sartorianum*, *Sedum rubens*, *Valerianella turgida*, *Minuartia hirsuta* subsp. *falcata*, *Psilurus incurvus*, *Poa bulbosa*, *Eragrostis minor*, *Vulpia ciliata*, *Logfia arvensis* and others), which determine the physiognomy of the plant cover.

Figure 6: Location of the investigated area (village Pendać).
Slika 6: Lokaliteta na raziskovanem območju (vas Pendać).

The communities representing the subass. *scleranthetosum* contain 250 plant species. Their biological and chorological spectra are presented in Table 2 and 3.

From the analysis of the floristic composition and percentage incidence of the life forms, it is obvious that this is a typical sub-Mediterranean community. The large percentage incidence of therophytes (54%) is in direct correlation with the influence of the modified sub-Mediterranean climate. The chorological spectrum in the studied areas shows great phytogeographic diversity.

***Erysimo diffusi-Trifolietum angustifolii brachypodietosum* subass. nova**

(Table 1, relevés. 63–72, Holotypus hoc loco: relevé no. 66)

The floristic composition of the community in the area is very rich and is shown in Table 1.

The subassoaciation is clearly differentiated and is characterized by the following species – *Minuartia hamata*, *Brachypodium distachyon*, *Echinaria capitata*, *Ziziphora capitata*, *Linum corymbulosum*, *Coronilla scorpioides*, *Buffonia tenuifolia* and *Dianthus pallens*.

According to the chemical analysis of soil samples taken from representative relevés of the researched areas, the soil reaction in H_2O is pH – 6.6, and in nKCl is 5.4.

Based on the American classification of soil reaction in water specified by Filipovski (1984), the soil of this locality has a neutral reaction.

The alliance *Trifolion cherleri* is poorly char-

acterized and is represented with several taxa – *Taeniatherum caput-medusae, Galium macedonicum* and *Aphanes arvensis*. This is probably the result of the large number of calcifilic species that have found favourable conditions for development within the subassociation and they have probably outcompeted most of the characteristic species of the alliance *Trifolion cherleri*.

The presence of many calcifilic species is specific for the researched stands of this subassociation around Kratovo, although there is a lack of limestone as a geological substrate. This could be explained by the influence of limestone from the deeper soil layers or the presence of limestone as a geology substrate in the surroundings.

The communities representing the subass. *brachypodietosum* contain 162 plant species. Their biological and chorological spectra are presented in Table 2 and 3.

From analysis of the floristic composition and percentage incidence of life forms, this is obviously a typical sub-Mediterranean community. The group of Mediterranean areal types (Steno-Mediterranean, Euromediterranean, and Mediterranean-mountain) is dominant and provides a strong sub-Mediterranean imprint to the vegetation of the researched area. This group is represented by 48 percent and usually inhabits theroxerophylous habitats.

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7. APPENDIX

Localities of the reléves and cover of the layers in Table 1. Running number, locality aspect, altitude (m), cover, inclination (%), latitude, longitude, and sampling date are presented, respectively.'"

1: Ketenovo, E, 431, 79, 24, 42° 6' 32.31" N, 22° 5' 4.05" E, 28. 05. 2004; **2**: Ketenovo, E, 459, 82, 30, 42° 6' 36.65" N, 22° 5' 4.07" E, 28. 05. 2004; **3**: Ketenovo, NE, 478, 83, 17, 42° 6' 36.51" N, 22° 5' 2.79" E, 28. 05. 2004; **4**: Pendać, SW, 590, 87, 6, 42° 6' 50.42" N, 22° 0' 58.86" E, 05. 06. 2004; **5**: Pendać, SE, 593, 78, 8, 42° 6' 55.98" N, 22° 0' 50.57" E, 05. 06. 2004; **6**: Pendać, SW, 665, 91, 4, 42° 7' 11.30" N, 22° 0' 57.03" E, 06. 06. 2004; **7**: Pendać, SW, 652, 97, 3, 42° 7' 6.95" N; 22° 0' 47.04" E, 06. 06. 2004; **8**: Pendać, SW, 635, 83, 3, 42° 7' 7.99" N, 22° 0' 29.22" E, 06. 06. 2004; **9**: Filipovci, E, 544, 98, 6, 42° 3' 16.00" N, 22° 4' 45.01" E, 09. 06. 2004; **10**: Filipovci, S, 548, 89, 3, 42° 3' 16.49" N, 22° 4' 46.14" E, 09. 06. 2004; **11**: Filipovci, SW, 569, 78, 4, 42° 3' 16.05" N; 22° 4' 51.46" E, 10. 06. 2004; **12**: Filipovci, W, 575, 98, 42° 3' 15.18" N, 22° 4' 53.67" E, 09. 06. 2004; **13**: Filipovci, N, 578, 100, 2, 42° 3' 17.31" N, 22° 4' 55.65" E, 10. 06. 2004; **14**: Filipovci, W, 561, 100, 1, 42° 3' 21.08" N, 22° 4' 52.91" E, 10. 06. 2004; **15**: Š. Rudare, SW, 417, 100, 3, 42° 4' 47.56" N, 21° 59' 18.90" E, 07. 06. 2004; **16**: Š. Rudare, S, 423, 100, 10, 42° 4' 46.55" N, 21° 59' 20.93" E, 10. 06. 2004; **17**: Š. Rudare, SE, 445, 100, 9, 42° 4' 41.93" N, 21° 59' 30.47" E, 10. 06. 2004; **18**: Š. Rudare, SE, 440, 100, 3, 42° 4' 39.92" N, 21° 59' 32.24" E, 13. 06. 2004; **19**: Š. Rudare, SE, 433, 98, 8, 42° 4' 38.46" N; 21° 59' 34.17" E, 13. 06. 2004; **20**: Š. Rudare, W, 421, 92, 12, 42° 4' 53.82" N, 21° 59' 18.77" E, 13. 06. 2004; **21**: Š. Rudare, SW, 441, 100, 10, 42° 4' 52.62" N, 21° 59' 22.94" E, 13. 06. 2004; **22**: Ketenovo, N, 454, 84, 13, 42° 6' 51.75" N; 22° 5' 1.21" E, 29. 05. 2004; **23**: Ketenovo, NW, 427, 96, 17, 42° 6' 50.34" N, 22° 5' 7.30" E, 29. 05. 2004; **24**: Kuklica, W, 678, 100, 11, 42° 6' 2.97" N, 22° 1' 5.12" E, 31. 05. 2005; **25**: Kuklica, N, 413, 100, 15, 42° 5' 3.75" N, 22° 1' 6.56" E, 31. 05. 2005; **26**: Kuklica, N, 427, 100, 3, 42° 5' 4.58" N, 22° 1' 18.57" E, 31. 05. 2005; **27**: Kuklica, S, 395, 100, 1, 42° 4' 59.40" N, 22° 1' 24.93" EE, 03. 06. 2005; **28**: Kuklica, NE, 401, 100, 1, 42° 5' 2.27" N, 22° 1' 24.85" E, 03. 06. 2005; **29**: Kuklica, E, 404, 100, 5, 42° 5' 1.31" N, 22° 1' 23.20" E, 03. 06. 2005; **30**: Kuklica, S, 598, 97, 3, 42° 5' 40.08" N, 22° 1' 34.89" E, 28. 05. 2005; **31**: Kuklica, SE, 678, 98, 15, 42° 5' 43.80" N, 22° 1' 48.88" E, 28. 05. 2005; **32**: Kuklica, S, 765, 100, 17, 42° 6' 22.25" N, 22° 1' 32.11" E, 29. 05. 2005; **33**: Kuklica, SW, 705, 72, 5, 42° 5' 49.71" N, 22° 1' 39.49" E, 28. 05. 2005; **34**: Kuklica, NE, 698, 75, 8, 42° 6' 6.78" N, 22° 1' 39.76" E, 28. 05. 2005; **35**: Kuklica, S, 660, 68, 4, 42° 5' 57.40" N, 22° 1' 12.54" E, 29. 05. 2005; **36**: Kuklica, S, 650, 74, 3, 42° 5' 55.95" N, 22° 1' 12.29" E, 29. 05. 2005; **37**: Kuklica, S, 719, 78, 5, 42° 6' 5.52" N, 22° 1' 10.10" E, 29. 05. 2005; **38**: Kuklica, E, 727, 80, 8, 42° 6' 9.29" N, 22° 1' 13.23" E, 01. 06. 2005; **39**: Kuklica, SE, 745, 80, 4, 42° 6' 20.84" N, 22° 1' 17.13" E, 01. 06. 2005; **40**: Kuklica, E, 741, 100, 25, 42° 6' 35.53" N, 22° 1' 39.11" E, 29. 05. 2009; **41**: Kuklica, E, 535, 95,12, 42° 5' 34.38" N, 22° 1' 31.14" E, 05. 06. 2005; **42**: Kuklica, N, 541, 98, 7, 42° 5' 37.42" N, 22° 1' 12.30" E, 05. 06. 2005; **43**: Kuklica, S, 390, 68, 5, 42° 4' 56.03" N, 22° 1' 17.31" E, 01. 06. 2005; **44**: Kuklica, SE, 387, 72, 10, 42° 4' 56.00" N, 22° 1' 23.00" E, 01. 06. 2005; **45**: Kuklica, E, 396, 96, 9, 42° 5' 0.46" N, 22° 1' 25.30" E, 01. 06. 2005; **46**: Kuklica, S, 387, 67, 5, 42° 4' 56.00" N, 22° 1' 5.00" E, 31. 05. 2005; **47**: Kuklica, S, 400, 69, 7, 42° 4' 59.00" N, 22° 1' 6.00" E, 31. 05. 2005; **48**: Kuklica, S, 406, 72, 9, 42° 5' 2.00" N, 22° 1' 5.00" E, 31. 05. 2005, 04. 06. 2005; **49**: Kuklica, S, 472, 62, 15, 42° 5' 26.00" N, 22° 1' 17.00" E, 01. 06. 2005; **50**: Kuklica, SW, 476, 78, 9, 42° 5' 28.23" N, 22° 1' 10.35" E, 04. 06. 2005; **51**: Kuklica, S, 480, 86, 9, 42° 5' 27.19" N, 22° 1' 15.26" E, 04. 06. 2005; **52**: Kuklica, SW, 487, 80, 5, 42° 5' 28.09" N, 22° 1' 20.79" E, 04. 06. 2005; **53**: Kuklica, S, 502, 90, 10, 42° 5' 30.00" N, 22° 1' 29.00" E, 04. 06. 2005; **54**: Kuklica, W, 403, 88, 14, 42° 5' 7.16" N, 22° 0' 34.46" E, 05. 06. 2005; **55**: Kuklica, S, 398, 86, 15, 42° 5' 7.02" N, 22° 0' 42.77" E, 05. 06. 2005; **56**: Kuklica, SW, 499, 89, 16, 42° 5' 10.00" N, 22° 0' 45.00" E, 05. 06. 2005; **57**: Ljoljak, S, 461, 94, 5, 42° 5' 5.89" N, 21° 57' 48.12" E, 04. 06. 2005; **58**: Ljoljak, S, 467, 99, 4, 42° 5' 7.26" N, 21° 57' 46.64" E, 04. 06. 2004; **59**: Konju, NE, 455, 98, 4, 42° 5' 5.90" N, 21° 57' 50.79" E, 04. 06. 2004; **60**: Konju, S, 470, 98, 6, 42° 5' 8.15" N, 21° 57' 44.43" E, 07. 06. 2004; **61**: Konju, S, 464, 88, 3, 42° 5' 10.22" N, 21° 57' 36.31" E, 07. 06. 2004; **62**: Pendać, SE, 592, 79, 4, 42° 6' 50.90" N, 22° 0' 58.88" E, 05. 06. 2004; **63**: Trnovac, SE, 550, 98, 4, 42° 7' 19.26" N, 22° 4' 43.17" E, 02. 06. 2004; **64**: Trnovac, S, 559, 99, 5, 42° 7' 17.91" N, 22° 4' 40.99" E, 02. 06. 2004; **65**: Trnovac, S, 550, 94, 8, 42° 7' 16.97" N, 22° 4' 41.36" E, 03. 06. 2004; **66**: Trnovac, E, 503, 90, 7, 42° 7' 17.35" N, 22° 4' 52.55" E, 03. 06. 2004; **67**: Trnovac, NE, 512, 97, 9, 42° 7' 18.35" N, 22° 4'

51.06" E, 03. 06. 2004; **68**: Trnovac, E, 495, 100, 5, 42° 7' 16.45" N, 22° 4' 53.52" E, 25. 05. 2004; **69**: Trnovac, NE, 513, 97, 14, 42° 7' 17.75" N, 22° 4' 50.33" E, 25. 05. 2004; **70**: Trnovac, S, 526, 93, 17, 42° 7' 15.36" N, 22° 4' 45.20" E, 26. 05. 2004; **71**: Trnovac, S, 521, 86, 12, 42° 7' 15.88" N, 22° 4' 46.62" E, 27. 05. 2004; **72**: Trnovac, S, 540, 98, 7, 42° 7' 16.30" N, 22° 4' 43.08" E, 26. 05. 2004;

Заедници од *Erysimo-Trifolietum* на брдските пасишта во северо-источниот дел на Република Македонија

Брдските пасишта на територијата на Република Македонија се секундарни вегетациски формации, формирани со сукцесивна и долготрајна деградација или со потполно уништување на шуми, пред се од редот *Quercetalia pubescentis*, класа *Querco-Fagetea*, во низинскиот појас до 1200 (1400m). Денес тие завземаат околу 521.000 ha од територијата на Република Македонија. Припаѓаат кон сојузите *Trifolion cherleri* Мицевски 1971, *Saturejo-Thymion* Мицевски 1970 и *Armerio-Potentillion* Мицевски 1978 од редот *Astragalo-Potentilletalia* Мицевски 1971 и класата *Festuco-Brometea* Br. Bl. 1943.

Теренските истражувања во текот на 2004 и 2005 година, опфатија голем број на локалитети во околината на Кратово, каде во оптималниот вегетациски период (мај и јуни) направени се 72 вегетациски снимки, за да се регистрира вкупниот флористчки состав на истражуваната вегетација.

На истражуваното подрачје доминира умерено континентална, а во неколку делови и планинска клима, со топли и суви лета и ладни зими. Средна годишна температура е 11,4 ˚C

Вегетациските истражувања се направени со класичниот европски метод (Braun Blanquet 1964; Westhoff & Van der Maarel, 1973).

Вегетациските снимки (сопствени и од литература), внесени се во базата со податоци Turboveg (Hennekens, 2001). Комбинираната проценка за бројност и покровност трансформирана е по Van der Maarel (1979). За таа цел користени се различни мултиваријантни анализи од компјутерските програми PC-ORD 4 (Mc Cune & Mefford 1999), JUICE 6.4 (Tichý, 2006) и STATISTICA 7.0 (Stat Soft, Inc., www.statsoft.com).

По сеопфатните анализи и по споделувањето со претходно опишаните асоцијации на територијата на Република Македонија и соседните подрачја, дојдовме до заклучок дека на истражуваното подрачје се развиваат следните растителни заедници.

Ass. *Erysimo-Trifolietum* Мицевски 1977 (сојуз *Trifolion cherleri*, ред *Astragalo-Potentilletalia*, класа *Festuco-Brometea*).

Во асоцијацијата се издиференцирани две нови субасоцијации – *scleranthetosum* subass. nova и *brachypodietosum* subass. nova.

Subass. *brachypodietosum* subass. nova – е регистрирана во близина на селото Трновац. Диференцијални видови на оваа субасоцијација се следните: *Minuartia hamata*, *Brachypodium distachyon*, *Echinaria capitata*, *Ziziphora capitata*, *Linum corymbulosum*, *Coronilla scorpioides*, *Buffonia tenuifolia* и *Dianthus pallens*.

Subass. *scleranthetosum* subass. nova – е регистрирана на повеќе локалитети во околината на Кратово. Диференцијални видови на субасоцијацијата *scleranthetosum* по кои се одвојува од субасоцијацијата *brachypodietosum* се *Logfia arvensis*, *Scleranthus perennis* subsp. *dichotomus*, *Sedum hispanicum*, *Verbascum lesnovoensis*, *Trifolium retusum*, *Valerianella turgida* и *Elymus hispidus* subsp. *hispidus*.

Table 1: Analytical table of ass. *Erysimo diffusi-Trifolietum angustifolii* Micevski 1977.
Tabela 1: Analitična tabela asociacije *Erysimo diffusi-Trifolietum angustifolii* Micevski 1977.

Number of relevé	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Erysimo-Trifolietum																												
Erysimum diffusum	+	+	+	+	.	.	+	+	+	.	+	+	+	+	+	+	+	+	+	+	.	+	+	1	1	+	+	+
Trifolium sylvaticum	+	.	.	1	.	2	2	1	1	1	1	1	1	1	2	2	3	1	1	1	1	.	+	1	1	+	.	.
Trifolium angustifolium	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	+	+	+	+	+	+	.	.	.	+	2	+	+
Trifolium leucanthum	.	.	.	1	.	1	+	+	+	+	.	+	1	+	.	.	.	.	.	.	.	.	.	.	+	+	.	.
Vulpia myuros	.	.	.	.	.	+	.	.	.	.	1	1	+	2	.	1	+	.	.	1	.	.	.	.	.	.	.	.
Trifolium echinatum	1	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium striatum subsp. *striatum*	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Trifolium physodes	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ventenata dubia	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
***scleranthetosum* subass. nova**																												
Logfia arvensis	2	3	2	3	3	1	1	1	2	2	2	2	+	1	3	1	1	3	2	2	2	.	.	.	.	.	+	+
Scleranthus perennis subsp. *dichotomus*	.	.	3	1	.	1	.	1	1	3	2	+	.	+	1	.	+	.	+	.	+	.	.	.	.	.	.	.
Sedum hispanicum	1	+	.	1	2	1	.	+	2	2	2	1	1	.	.	.	.	+	.	.	.	.	.	1	+	.	.	.
Verbascum lesnovoensis	1	+	+	+	.	.	.	.	+	.	+	+	+	.	+	+	.	.	.	+	+	.	.	.	.	.	.	.
Trifolium retusum	.	.	.	+	.	.	.	.	+	+	.	+	+	.	+	.	.	.	.	.	.	.	+	.	.	.	+	1
Valerianella turgida	.	.	.	2	.	2	1	3	.	.	+	.	.	.	.	.	.	+	+	+	+	+	.	.	.	.	.	.
Elymus hispidus	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
***brachypodietosum* subass. nova**																												
Minuartia hamata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Brachypodium distachyon	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Echinaria capitata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ziziphora capitata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linum corymbulosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Coronilla scorpioides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Buffonia tenuifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dianthus pallens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trifolion cherleri																												
Taeniatherum caput-medusae	1	1	2	.	1	1	1	2	+	1	1	1	1	1	2	3	2	2	1	1	2	1	.	+	+	1	1	1
Petrorhagia prolifera	+	+	+	+	.	.	1	1	+	1	1	1	1	+	+	1	1	.	+	+	1	+	+	+	+	+	+	+
Galium macedonicum	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	+	.	1	+	.	+	.
Vulpia ciliata	.	.	.	.	.	1	.	2	+	+	1	2	2	.	+	.	.	.	.	.	.	.	.	.	.	.	+	+
Silene frivaldskyana	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.
Allium guttatum subsp. *sardoum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Aphanes arvensis	.	.	.	.	.	+	.	.	.	+	.	.	.	1	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Astragalo-Potentilletalia																												
Astragalus onobrychis var. *chlorocarpus* f. *chlorocarpus*	+	2	1	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	1	1	1	+	1	1	+	1	+	1
Bromus squarrosus	1	2	1	2	2	2	1	2	3	2	2	2	+	3	1	2	2	2	1	2	2	+	+	1	1	+	2	2
Centaurea grisebachii	+	+	.	2	1	1	1	1	1	1	1	1	+	+	+	1	+	+	+	+	1	1	+	+	+	+	.	.
Potentilla laciniosa	.	.	+	1	2	1	1	.	+	1	1	+	1	1	+	2	1	3	2	1	2	+	+	1	+	+	.	.
Thymus pseudo-atticus var. *vardarensis*	2	2	2	3	3	2	1	2	1	2	2	2	3	3	+	2	2	1	1	1	1	.	.	2	2	+	+	+
Dasypyrum villosum	1	2	1	1	2	1	+	1	1	1	+	+	+	1	+	+	.	.	.	.	.	+	.	+	1	1	1	.
Medicago rigidula	3	2	3	+	+	1	1	2	1	1	+	1	1	1	1	+	+	1	+	+	1	+	+	+	1	+	+	+
Aegilops neglecta	2	+	+	1	1	+	+	+	+	+	1	+	1	+	.	.	.	.	.	.	.	+	+	.	+	+	1	1
Xeranthemum annuum	+	1	1	1	1	+	+	1	+	+	1	+	+	+	+	+	1	1	2	1	1	+	+	+	+	+	+	+
Ornithogalum comosum	.	.	+	+	+	1	1	1	+	.	.	+	1	1	+	+	1	1	1	1	+	.	+	1	1	1	+	+
Sedum sartorianum	.	.	1	1	1	.	1	1	+	+	+	+	+	1	.	1	.	.	.	.	+	+	1	+	+	.	.	.
Hypericum rumeliacum var. *rumeliacum*	+	+	+	1	.	1	1	+	.	+	+	+	.	1	.	+	+	.	.	.	1	+	+	+	+	.	.
Petrorhagia illyrica subsp. *haynaldiana*	+	+	+	+	+	+	+	+	.	.	.	+	.	.	.	.	.	.	.	.	+	+	.	.	.	+	+
Dianthus gracilis subsp. *gracilis*	.	+	+	.	.	+	+	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	1	1	.	+	+
Galium tenuissimum	.	.	.	2	1	1	1	1	.	1	+	+	1	2	1	1	2	2	3	1	2	.	.	.	.	.	+	+

29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	constancy
+	1	1	1	1	1	1	1	1	1	1	1	1	1	1	+	1	+	+	+	1	1	1	1	1	+	1	+	.	.	.	+	+	+	+	+	1	1	+	1	+	+	+	+	+	V
.	1	+	1	1	+	1	1	1	1	+	1	+	+	+	+	+	+	+	+	+	+	1	+	1	1	1	+	2	2	2	1	2	2	.	.	.	.	.	.	+	1	2	1	V
+	+	+	.	+	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	+	+	+	+	.	+	.	.	.	.	.	.	.	.	+	+	+	.	+	.	.	+	.	.	II
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+	+	+	1	+	1	1	+	2	1	1	+	+	3	1	2	2	1	2	2	2	2	1	2	+	2	2	2	2	1	1	2	1	2	1	1	2	1	2	1	2	2	2	1	V
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+	1	.	1	1	1	1	2	1	1	1	1	+	+	+	+	+	1	+	1	1	1	2	2	1	2	1	1	+	+	1	+	1	2	+	+	1	+	+	+	.	+	.	+	V
+	2	2	+	1	1	1	2	2	1	1	.	2	+	1	1	2	1	2	2	2	1	1	1	2	1	2	2	2	2	1	1	1	2	1	1	.	.	.	1	1	+	1	+	1	1	V
.	+	1	2	+	+	1	+	1	+	+	+	1	1	.	.	+	+	+	+	+	+	.	+	+	+	+	+	+	+	1	1	+	1	+	1	1	+	+	+	+	1	.	2	IV
+	1	1	1	1	1	.	1	1	.	+	.	1	1	.	.	.	+	1	2	+	.	.	.	.	.	.	+	+	1	2	1	+	.	.	.	.	.	.	.	.	+	+	+	IV
1	1	1	2	+	+	.	.	.	.	.	.	1	+	+	+	+	.	1	1	+	1	.	.	1	+	1	1	.	+	+	+	+	+	1	+	2	1	1	1	2	2	2	2	IV
+	.	.	.	.	.	.	.	.	+	.	.	.	.	+	+	+	+	+	+	+	.	+	.	.	.	.	.	1	1	1	1	+	1	4	3	2	+	+	+	+	1	+	1	IV
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+	.	.	.	.	.	.	+	+	+	+	+	.	.	.	+	+	+	.	.	.	+	+	+	+	+	+	+	+	.	.	.	.	.	+	+	+	+	+	+	+	+	.	+	.	III
+	+	+	+	+	+	+	.	.	.	.	.	.	.	.	+	+	+	.	+	+	1	+	1	+	+	.	+	+	+	.	+	+	+	+	.	.	.	.	1	.	+	.	.	.	III
+	.	.	.	.	.	.	.	+	.	.	.	+	.	+	.	1	.	.	.	.	.	1	.	.	.	.	2	1	.	1	1	1	1	.	+	+	.	.	.	+	+	.	III

Number of relevé	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Crepis sancta	2	1	.	1	1	1	+	+	+	1	1	1	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.
Minuartia hirsuta subsp. *falcata*	.	.	.	2	1	1	.	1	+	.	1	+	1	1	.	+	.	+	.	.	1	.	.	+	.	.	.	.
Torilis leptophylla	1	+	.	+	1	+	+	+	.	.	.	+	.	.	.	.	.	.	.	1	+	.	.	.	+	.	.	.
Scabiosa triniifolia	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	+	+	+	+	.	.	.
Petrorhagia illyrica subsp. *illyrica*	.	.	.	.	+	.	+	.	.	+	.	+	.	+	.	.	.	.	.	.	.	.	.	+	+	+	.	.
Acinos hungaricus	+	1	+	.	.	.	.	.	.	+	+	+	+	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.
Anthemis ruthenica	.	.	.	.	.	.	.	.	+	+	.	+	.	+	3	1	+	+	+	1	2	.	.	.	.	.	.	.
Viola kitaibeliana	+	1	+	.	.	.	+	.	.	.	.	+	.	.	.	+	.	.	.	1	+	.	.	.	.	.	.	.
Onobrychis alba subsp. *calcarea* var. *echinata*	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	+	.	.	.
Crepis foetida subsp. *rhoeadifolia*	+	.	.	.	+	+	.	.	+	+	.	.	.	.	+	.	.	+	1	+	+	.	.	.	.	.	+	+
Crucianella graeca	1	+	.	+	.	+	+	.	.	.	.	.	.	.	.	1	2	+	+	+	+	.	.	.	.	.	.	.
Sideritis montana	.	.	2	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Leontodon crispus subsp. *crispus*	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.
Rumex acetosella var. *multifidus*	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	+	+	.	.	.	.	.
Festuca thracica subsp. *violaceo-sordida*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bupleurum apiculatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Thymus tosevii subsp. *tosevii* var. *tosevii*	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	2	1	.	.	.	.	.
Allium meteoricum	.	.	.	+	+	+	+	.	1	+	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Petrorhagia saxifraga	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Linaria simplex	.	.	.	1	2	1	+	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Thymelaea passerina f. *passerina*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Echinops microcephalus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tragopogon balcanicus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Potentilla argentea	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Plantago subulata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.
Onobrychis alba subsp. *calcarea*	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Scabiosa argentea subsp. *ucranica*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.
Allium stamineum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Medicago prostrata subsp. *pseudorupestris* var. *pseudorupestris* f. *pseudorupestris*	.	.	.	.	.	1	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia seguieriana subsp. *niciciana*	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Onobrychis alba subsp. *calcarea* var. *striatula*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuco-Brometea																												
Eryngium campestre	1	.	+	2	1	1	1	1	+	1	1	1	+	1	1	+	1	1	1	+	1	1	1	+	+	1	+	+
Trifolium scabrum f. *scabrum*	1	1	.	1	1	2	2	1	1	+	1	1	1	1	2	1	1	1	1	1	+	.	+	+	1	+	+
Poa bulbosa	.	.	.	2	2	2	1	2	2	2	2	1	2	2	2	2	.	+	1	1	.	1	2	+	+	+	.	+
Herniaria incana var. *incana*	+	+	.	+	+	+	+	+	+	1	+	1	+	+	.	+	1	+	+	+	.	+	.	.	.	.	+	+
Dichanthium ischaemum	2	2	1	+	2	1	.	+	.	1	.	1	.	1	1	+	.	.	.	+	+	1	2	+	+	+	+	+
Holosteum umbellatum	+	+	+	.	.	+	+	.	+	+	+	+	+	+	.	+	+	+	+	+	+	+	+	+	.	.	.	.
Trifolium incarnatum subsp. *molinerii*	.	.	.	+	+	.	+	.	+	.	+	+	+	+	+	.	.	.	.	.	.	.	.	+	1	1	+	+
Convolvulus cantabrica	+	+	1	2	1	1	1	1	+	1	+	.	+	+	+	1	1	+	1	+	1	.	.	.	+	.	.	.
Trigonella monspeliaca	+	+	+	+	+	1	1	+	1	1	+	+	+	+	+	+	+	1	+	.	+	+	+	+	.	.	.	.
Asperula cynanchica	.	+	.	+	.	+	+	.	+	+	+	+	+	.	.	+	+	+	+	.	+	2	+	.	.	.	+	+
Melica ciliata	+	+	+	+	+	+	+	+	.	.	.	+	.	.	.	+	+	.	+	1	+	+	1	+	1	1	.	.
Teucrium polium	1	1	2	.	.	.	.	+	.	1	+	.	.	+	+	+	+	+	+	+	.	+	+	.	.	.	.	+
Bombycilaena erecta	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.
Chondrilla juncea	.	.	.	+	+	+	.	.	+	.	.	+	+	+	+	.	.	+	+	+	.	.	.	+	+	+	+	+
Euphorbia cyparissias	.	.	.	+	.	.	.	.	.	.	.	+	+	+	.	+	+	.	.	+	.	1	+	.	.	+	+	+
Koeleria splendens	.	.	.	2	+	1	1	1	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	2	1	2	.	.
Carthamus lanatus	.	.	.	+	+	1	+	+	.	+	.	+	+	+	+	.	1	+	+	1	.	.	.	.	.	.	+	.
Chrysopogon gryllus	.	.	+	+	+	+	+	+	.	+	+	.	.	.	.	+	2	+	+	+	+	.	.	.	.	1	+	2
Achillea setacea	.	.	.	+	.	2	1	1	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	+	.	1	+
Sanguisorba minor subsp. *muricata*	.	.	.	.	+	.	.	.	1	+	+	1	1	.	+	.	.	.	.	.	1	1	.	.	.	.	.	.
Phleum phleoides	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	1	1	1	1

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1	1	1	1	1	1	1	1	1	1	2	1	1	1	.	1	+	.	.	+	+	+	+	+	2	+	+	1	1	2	2	1	1	1	.	+	+	+	.	.	+	+	1	1	V
+	1	.	.	2	3	2	2	1	1	3	+	2	1	1	1	2	1	+	+	+	+	+	+	+	.	.	.	2	3	3	2	2	2	.	.	1	+	+	2	1	+	1	1	V
+	+	+	+	1	1	1	1	+	1	1	1	1	1	.	+	.	+	.	+	+	.	+	.	+	+	+	+	.	.	+	.	+	+	.	+	+	.	+	.	1	+	+	+	IV
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.	.	+	.	+	.	.	.	+	.	.	.	+	1	1	+	+	+	+	+	2	2	+	+	+	1	1	1	.	.	.	+	+	+	.	.	.	.	.	.	.	.	+	+	.	III
+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	.	1	+	1	1	+	2	+	.	.	+	+	+	+	+	1	.	1	+	+	+	+	+	+	+	III
.	1	+	+	+	+	1	1	1	+	1	.	1	+	+	+	+	1	+	+	1	1	1	1	1	1	1	+	.	.	.	.	.	.	2	2	1	2	2	1	1	1	1	1	III
+	+	+	+	+	+	.	.	.	.	.	.	+	.	+	+	+	+	+	+	.	.	.	.	.	+	.	.	+	+	.	+	+	+	.	+	.	.	.	.	.	.	.	.	III
+	+	+	.	+	+	.	.	.	.	.	+	.	.	.	+	+	+	+	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	+	+	+	1	+	.	+	+	+	III
1	1	.	1	.	.	1	2	1	1	.	1	+	.	1	2	+	3	3	2	2	3	2	2	.	2	2	1	.	.	.	+	1	3	.	.	.	.	.	.	.	.	.	.	III
.	.	+	+	.	.	.	+	+	+	+	.	+	+	.	.	.	.	.	.	.	+	.	+	.	+	+	.	.	+	1	.	1	+	.	.	.	.	.	.	.	.	+	+	+	III
1	.	+	.	.	.	.	+	.	.	.	.	.	.	2	.	+	.	.	.	+	.	.	.	+	1	+	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	+	.	III
+	1	1	+	+	+	+	+	1	1	+	.	1	1	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	II
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Number of relevé	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Echinops sphaerocephalus subsp. *sphaerocephalus*	+	+	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	+	+	.	+	+	.	.	.	.	.
Hieracium praealtum subsp. *bauhinii*	.	.	.	.	.	.	+	.	.	.	.	.	.	1	.	.	.	.	.	.	.	+	+	+	+	1	.	.
Koeleria nitidula	1	2	2	.	.	.	.	.	+	.	+	1	+	+	.	2	.	+	.	1	1	2	3	.	.	.	.	.
Festuca valesiaca	.	.	.	.	.	.	.	.	.	.	.	+	1	1	.	.	.	.	.	.	.	3	3	3	1	3	3	2
Neatostema apulum	.	.	.	.	.	.	.	.	.	+	+	.	.	.	+	+	1	+	1	.	.	.	.	.	.	.	+	.
Alyssum alyssoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Allium sphaerocephalon subsp. *arvense*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	1	1	+	+	.	.	.	.	.	.	.	.
Carlina vulgaris	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.
Medicago falcata subsp. *tenderiensis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.
Phleum phleoides var. *blepharodes*	.	.	.	.	.	.	.	+	.	.	.	.	+	+	.	+	.	.	.	.	.	+	+	.	.	.	.	.
Astragalus hamosus	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.
Scilla autumnalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linum austriacum	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Filago vulgaris	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium verum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Teucrium chamaedrys	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Silene otites	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.
Sedum annuum	.	.	.	.	.	1	.	.	+	+	1	+	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Minuartia viscosa f. *viscosa*	.	.	.	.	.	.	.	.	3	1	.	1	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valerianella eriocarpa	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Herniaria glabra	.	.	.	.	.	.	.	.	.	+	1	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lens nigricans f. *ciriferum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bupleurum affine var. *quadridentatum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.
Linaria genistifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.	.	.
Ononis spinosa subsp. *spinosa*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thesium arvense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Inula oculus-christi	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	2	.	.	.	.	.
Vinca herbacea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arabidopsis thaliana	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Achillea pannonica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Phlomis herba-venti subsp. *pungens*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Allium moschatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.
Helianthemetea guttati; Helianthemetalia guttati																												
Medicago minima var. *minima*	1	.	+	1	2	2	2	.	2	2	2	2	2	1	1	1	1	1	1	1	+	1	+	+	+	+	1
Trifolium campestre var. *campestre*	2	2	1	1	+	1	1	1	.	.	.	+	+	+	+	2	1	+	1	1	1	1	1	1	2	1	1	1
Trifolium arvense var. *arvense*	+	1	2	1	.	1	1	1	1	1	+	1	1	1	1	2	2	2	2	3	2	+	+	1	1	1	1	1
Helianthemum salicifolium	+	+	.	.	.	+	.	.	2	2	2	2	1	1	1	2	2	2	2	1	2	.	.	2	1	1	1	1
Arenaria serpyllifolia var. *viscida*	1	1	2	.	.	1	+	.	+	1	.	+	.	+	1	1	.	.	.	.	.	+	+	.	.	.	.	.
Silene conica subsp. *conica*	+	+	.	1	.	+	.	.	+	.	+	+	+	.	+	2	1	1	1	.	.	1	+	.	+	.	.	.
Veronica verna	2	+	1	+	+	+	1	1	1	1	1	1	1	1	+	.	.	+	.	.	.	.	+	+	.	.	.	.
Myosotis stricta	+	+	.	1	+	1	1	1	+	1	1	+	+	+	+	+	+	1	+	+	+	+	+	.	.	.	.	.
Psilurus incurvus	+	.	.	2	2	+	2	+	2	+	2	2	+	2	1	2	.	.	1	1	+	.	.	.	.	.	.	.
Vicia lathyroides	+	2	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	+	1
Crupina vulgaris	+	.	1	+	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	1	1	.	.	.	1	+	.	.
Erophila verna	.	.	.	.	.	.	.	.	+	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sedum rubens	.	+	.	+	.	.	1	.	+	+	+	+	+	+	.	2	2	.	2	1	2	.	.	.	.	.	.	.
Hypochoeris glabra	.	.	.	.	.	.	.	.	+	+	+	+	.	.	+	+	1	.	+	+	.	.	.	.	.	.	+	+
Sedum caespitosum	.	.	.	.	.	.	.	.	+	+	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Helianthemum ledifolium	.	1	1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Others																												
Achillea coarctata	+	+	+	1	1	3	4	3	1	1	1	2	2	1	1	1	+	1	1	+	1	1	+	1	1	+	1	1
Erodium cicutarium	1	+	.	1	+	.	+	+	1	+	1	+	1	1	1	1	1	1	+	1	+	.	+	.	.	.	.	.
Cruciata pedemontana	+	+	.	1	+	2	1	+	.	.	+	+	+	.	.	+	.	.	+	+	.	.	+	.	+	+	+	+
Carduus thoermeri	+	.	1	+	+	.	+	+	.	.	.	.	.	.	+	+	.	+	+	.	.	.	.	+	+	.	.	+

29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	const.
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1	1	1	1	1	1	.	+	1	.	1	.	.	+	.	+	1	.	.	.	1	+	+	+	1	+	+	+	1	.	.	+	+	+	+	1	+	1	2	1	1	1	2	2	V
1	1	1	.	1	1	+	1	1	+	1	1	1	1	1	1	1	1	2	2	1	1	1	2	1	.	1	+	1	1	1	1	+	1	.	.	.	.	.	.	.	.	.	.	V
1	1	.	1	1	+	.	2	2	1	.	.	1	+	.	.	2	+	.	.	+	+	+	1	1	+	1	1	+	2	2	1	1	1	.	.	.	1	2	1	2	1	2	.	IV
.	.	+	.	+	+	+	2	1	1	1	.	1	.	+	+	1	1	+	+	.	+	+	+	.	1	+	1	1	1	.	2	1	.	1	+	2	1	1	1	2	1	2	1	IV
.	+	.	+	.	+	.	.	.	.	+	.	+	+	1	+	.	+	1	1	+	+	+	.	+	+	1	1	1	+	+	+	+	+	3	.	.	+	+	.	.	.	+	.	.	III
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+	+	+	.	+	+	+	+	1	+	.	.	1	+	.	+	.	1	+	+	.	+	.	.	+	+	.	.	.	+	+	+	+	+	+	.	.	.	.	.	.	.	+	.	III

Number of relevé	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Valerianella coronata	2	1	1	1	1	.	.	.	.	.	.	1	.	.	.	1	+	+	+	+	.	+	+	+	1	1	+	+
Nigella arvensis f. *tuberculata*	+	+	+	.	.	1	1	1	+	+	+	+	.	+	+	+	1	1	1	1	1	.	.	+	+	+	.	.
Trifolium hirtum	1	2	1	1	+	+	+	+	.	.	.	+	.	.	.	.	.	+	.	.	+	+	.	.	+	.	+	.
Stipa capillata	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	1	+	.	.	.	.	2	3	.	+	+
Plantago lanceolata	.	.	.	.	.	.	+	+	.	+	.	+	+	+	.	.	.	.	.	.	.	.	+	.	.	+	+	+
Tribulus terrestris var. *terrestris*	.	.	.	+	+	.	.	.	+	+	+	+	+	+	+	+	+	+	+	+	+	.	.	.	.	.	.	.
Crepis setosa	+	.	.	+	+	+	+	1	+	.	+	.	1	.	+	+	.	.	+	+	+	.	.	+	.	.	2	2
Taraxacum officinale	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tragopogon dubius	.	.	.	.	+	.	.	.	.	+	+	.	.	.	+	+	+	.	.	+	.	.	.	+	+	.	.	.
Paliurus spina-christi	+	+	1	.	+	+	+	+	.	+	.	+	.	+	.	.	+	.	.	+	.	+	+	.	.	.	.	.
Cerastium brachypetalum subsp. *roeseri*	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	2	2	1	1	1	.	.
Sherardia arvensis	.	.	.	.	.	+	.	+	.	+	.	1	+	+	.	.	.	.	.	.	.	.	.	.	+	+	1	1
Cynosurus echinatus	.	.	.	.	.	+	+	.	.	+	.	.	.	+	.	+	+	+	.	1	.	.	.	.	+	+	+	+
Polygonum aviculare	.	.	.	+	+	+	+	+	.	.	.	+	.	.	.	+	+	+	+	+	.	.	.	+	+	+	.	.
Conyza canadensis	+	+	.	.	.	.	.	.	.	+	.	+	.	.	+	+	+	+	+	+	+	.	.	.	.	.	.	.
Calepina irregularis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea solstitialis subsp. *solstitialis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Eragrostis minor	.	.	.	1	1	.	.	.	1	1	+	1	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia helioscopia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Portulaca oleracea	.	.	.	.	.	.	.	.	+	+	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Alyssum desertorum	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bromus tectorum	.	+	.	+	.	.	.	.	+	+	.	2	1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Setaria viridis	.	.	.	+	.	+	.	+	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.
Anthemis austriaca	.	.	.	+	+	+	+	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Orlaya grandiflora	.	+	.	+	+	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Scleranthus annuus subsp. *polycarpos*	.	.	.	.	.	.	.	.	2	.	.	+	+	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
Vicia hirsuta	+	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	+	.
Carthamus dentatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tragus racemosus	.	.	.	1	1	.	.	.	+	+	.	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Gagea arvensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculus ficaria subsp. *calthifolis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Digitalis lanata	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.
Marrubium peregrinum	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.
Heliotropium europeum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.
Hieracium hoppeanum subsp. *troicum*	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Papaver rhoeas subsp. *rhoeas*	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	+	1	1	+	.	.	.	.	.	.	.	.	.
Convolvulus arvensis	.	.	.	+	.	.	.	+	+	.	.	.	+	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.
Alyssum strigosum	1	1	.	.	.	.	.	.	+	1	+	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carduus acanthoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lactuca serriola	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.	.	.	.	.	.	.
Lathyrus cicera	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arrhenatherum elatius	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Picnomon acarna	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stachys plumosa	+	+	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Buglossoides arvensis	.	+	.	+	+	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Herniaria hirsuta f. *hirsuta*	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	.	+	+	.	.	.	.	.	.	.	.
Anthemis arvensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga tridactylites	.	.	.	.	.	.	.	.	+	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lathyrus nissolia var. *nissolia*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Geranium columbinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypecoum pendulum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Myosotis arvensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cichorium intybus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lotus corniculatus var. *tenuis*	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.

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Number of relevé	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Colchicum hungaricum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Medicago orbicularis	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lamium amplexicaule	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Triticum baeoticum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Muscari racemosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Geranium rotundifolium	+	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Torilis arvensis subsp. *arvensis*	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium nigrescens	.	.	.	.	.	.	.	.	+	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stachys germanica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia taurinensis	+	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asperugo procumbens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tordylium maximum	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.
Anchusa officinalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.
Polycnemum arvense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Delphinium balcanicum	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex praecox	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carduus hamulosus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fumaria thuretii	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Crepis pulchra	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Scabiosa sicula	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bromus hordeaceus subsp. *hordeaceus*	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Other species with low frequency: *Androsace elongata* 6: +; *Medicago minim*a var. *brevispina* f. *pulchella* 8: +; *Campanula phrygia* 11: +; *Potentilla inclinata* var. *incisoserrata* f. *lanuginosa* 15: +; *Lathyrus inconspicuus* var. *inconspicuus* 23: +; *Parentucelia latifolia* 29: +; *Thesium macedonicum* 54: +; *Potentilla suskalovicii* 65: +; *Euphorbia falcata* 70: +; *Trigonella gladiata* 70: +; *Campanula scutellata* 1: 1, 2: 1; *Picris pauciflora* 1: +, 2: +; *Trifolium trichopterum* 43: +, 44: +; *Velezia rigida* 1: +, 2: +; *Allium sphaerocephalon* subsp. *sphaerocephalon* 19: +, 22: +; *Orobanche purpurea* 63: +, 65: +; *Lactuca viminea* subsp. *viminea* 16: +, 17: +; *Camelina rumelica* 15: +, 61: +; *Sisymbrium orientale* var. *orientale* 57: +, 58: +; *Caucalys platycarpos* 1: +, 2: +; *Bifora radians* 13: +; *Ranunculus psilostachys* 22:+, 23: +; *Alyssum stribrnyi* var. *macedonicum* 22: 1, 23: 1; *Geranium dissectum* 11: +, 14: +; *Cynodon dactylon* 1: +, 2: +; *Alyssum saxatile* subsp. *orientale* 3: +, 56: +; *Echium italicum* 6: +, 62: +; *Orobanche* sp. 55: +, 56: +; *Papaver dubium* 5: +, 65: +; *Senecio vulgaris* 18: 1, 69: +; *Ajuga chamaepitys* subsp. chia 64: +, 68: +; *Dorycnium herbaceum* subsp. *macedonicum* 63: +. 64: +; *Poa angustifolia* 65: +, 68: +; *Goniolimon tataricum* 57: +, 58: +; *Scorzonera laciniata* 65: +, 68: +; *Stipa joannis* subsp. *joannis* 57: +, 59: 1.

29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	const.
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