MASARYKOVA

UNIVERZITA

PŘÍRODEOVĚDECKÁ FAKULTA

ÚSTAV BOTANIKY A ZOOLOGIE

Alpínská vegetace pohoří Smolikas v Řecku a Nemërçkë v Albánii

Diplomová práca

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Vedoucí práce: prof. RNDr. Milan Chytrý, Ph.D. **Brno 2018**

MASARYK UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF BOTANY AND ZOOLOGY

Alpine vegetation of Mount Smolikas (Greece) and Mount Nemërçkë (Albania)

Master's thesis

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Supervisor: prof. RNDr. Milan Chytrý, Ph.D. **Brno 2018**

Bibliografický záznam

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Název práce: Alpínská vegetace pohoří Smolikas v Řecku a Nemërçkë v Albánii

Studijní program: Ekologická e evoluční biologie

Studijní obor: Botanika, směr Ekologie rostlin

Vedoucí práce: prof. RNDr. Milan Chytrý, Ph.D.

Akademický rok: 2017/2018

Počet stran: 96+32

Klíčová slova: Albánie, alpínská vegetace, diverzita, endemizmus, fytocenologie, Pindos, Řecko

Bibliographic entry

Author:	Bc. Mário Duchoň Faculty of Science, Masaryk University Department of Botany and Zoology
Title of Thesis:	Alpine vegetation of Mount Smolikas (Greece) and Mount Nemërçkë (Albania)
Degree programme:	Ecological and Evolutionary Biology
Field of Study:	Botany, specialization Plant ecology
Supervisor:	prof. RNDr. Milan Chytrý, Ph.D
Academic Year:	2017/2018
Number of Pages:	96+32
Keywords:	Albania, alpine vegetation, endemism, Greece, phytosociology, Pindus Mts., species richness

Abstrakt

Vegetace jižní části Balkánskeho polostrova je vzhledem ke své diverzitě fytocenologicky ještě málo prozkoumaná. V téhle práci přináším nové informace ke klasifikaci, druhovému složení, ekologii, vztahům mezi faktory prostředí, druhovému bohatství a endemismu pohoří Smolikas a Nemërçkë, která leží blízko sebe v albánsko-řeckém pohraničí. Obě mají podobnou nadmořskou výšku, ale rozdílné geologické podloží. Smolikas je budován ultrabazickými ofiolity, zatímco Nemërçkë je vápencové pohoří.

Terénní průzkum proběhl v letech 2012 a 2013. V pohoří Nemërçkë bylo zapsáno 105 fytocenologických snímků v pohoří Smolikas 110 snímků. Tyto snímky byly pomocí numerických metod klasifikovány na základě prezence, absence a abundance jednotlivých druhů. Detrendovaná korespondenční analýza zobrazila podobnosti vegetačních typů obou pohoří. Vztahy mezi faktory prostředí a druhovou bohatosti byly vyhodnoceny pomocí lineárních modelů.

Celkem 17 rostlinných společenstev zařazených do 6 fytocenologických tříd (*Asplenietea trichomanis, Daphno-Festucetea, Elyno-Seslerietea, Mulgedio-Aconitetea, Thlaspietea rotundifolii* a *Trifolio anatolici-Polygonetea arenastri*) bylo popsáno z pohoří Nemërçkë a 21 společenstvev v 10 třídách z pohoří Smolikas, kde se navíc vyskytují třídy *Juncetea trifidi, Littorelletea uniflorae, Montio-Cardaminetea* a *Scheuchzerio palustris-Caricetea fuscae*.

Analýzy ukazují, že druhové bohatství společenstev klesá s rostoucí nadmořskou výškou. Pokryvnost skal a z toho vyplývajíci další faktory, například stres ze sucha, jsou důležitější než pH půdy, které nemá významný vliv na druhovou diverzitu. Společenstva jsou druhově bohatší na hlubších, méně kamenitých půdách v rámci téměř všech biotopů. Poměr počtu endemitů k počtu druhů v snímku je v obou pohořích relativně podobný, ovšem ofiolitický Smolikas má větší počet stenoendemitů. Vegetace skal a sutí na vápencích pohoří Nemërçkë je rozmanitější, s větším počtem rostlinných spoločenstev jakož i druhů. Pohoří Smolikas však má vegetaci celkově rozmanitější, jelikož se zde vyskytují vodní, prameništní a rašeliništní společenstva, přesto se zde vyskytuje méně druhů.

Abstract

Mountain vegetation of the southern Balkans is phytosociologically still poorly explored in spite of its high diversity. Here I bring new information on alpine plant communities, their species composition, ecology, species richness and occurence of endemics in two mountain ranges situated near the Greek-Albanian border: Mt. Nemërçkë and Mt. Smolikas. Both are of similar altitude and occur close to each other, although they have different bedrock: limestone on Mt. Nemërçkë and ultramafic ophiolites on Mt. Smolikas.

In the growing seasons of year 2012 and 2013, I recorded 105 relevés on Mt. Nemërçkë and 110 relevés on Mt. Smolikas. These relevés were classified using numerical methods based on presence, absence and abundance of vascular plants. Detrended correspondence analysis visualised the similarities among the vegetation types. Relationship of environmental factors and species richness was visualised using linear models.

In total, 17 plant communities belonging to 6 phytosociological classes (*Asplenietea trichomanis, Daphno-Festucetea, Elyno-Seslerietea, Mulgedio-Aconitetea, Thlaspietea rotundifolii* and *Trifolio anatolici-Polygonetea arenastri*) were described from Mt. Nemërçkë and 21 communities belonging to 10 classes were described from Mt. Smolikas where the classes *Juncetea trifidi, Littorelletea uniflorae, Montio-Cardaminetea* and *Scheuchzerio palustris-Caricetea fuscae* occur in addition. Further analyses show that fine-scale species richness is decreasing towards higher altitudes. Cover of bare rock and associated factors, such as drough stress, are more important than soil pH, which does not show relation to species richness. Plant communities on deeper, less rocky soils have higher fine-scale species richness within almost all the habitats. Endemism ratio in both mountain ranges is relatively similar, although ophiolitic Mt. Smolikas has more stenoendemic species. Scree and rock vegetation on limestone of Mt. Nemërçkë is more diverse with higher number of plant communities and higher species richness comparing to ophiolites of Mt. Smolikas. In general, however, vegetation of Mt. Smolikas is more diverse as it supports the occurrence of aquatic, spring and fen habitats, although it harbours lower total number of species.

Masarykova univerzita

Přírodovědecká fakulta

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Studijní program: **Biologie**

Studijní obor: **Ekologická a evoluční biologie – Botanika**

Ředitel Ústavu botaniky a zoologie PřF MU Vám ve smyslu Studijního a zkušebního řádu MU určuje diplomovou práci s tématem:

Alpínská vegetace pohoří Smolikas v Řecku a Nemërçkë v Albánii

Alpine vegetation of Mount Smolikas (Greece) and Mount Nemërçkë (Albania)

Oficiální zadání:

Úkolem práce je fytocenologická dokumentace alpínské vegetace hadcového pohoří Smolikas v severozápadním Řecku a blízkého vápencového pohoří Nemërçkë v jižní Albánii. Obě pohoří budou navštívena ve vegetačním období a fytocenologickými snímky budou dokumentovány všechny vizuálně rozlišitelné typy vegetace v oblasti nad horní hranicí lesa. Z každého snímku bude odebrán půdní vzorek. Současně bude pořízen dokladový herbář.

Fytocenologické snímky budou klasifikovány subjektivně podle různých biotopů a v případě potřeby také vhodnými numerickými metodami. Rozlišené vegetační typy, odpovídající přibližně úrovni asociací, budou interpretovány na základě srovnání s regionální fytocenologickou literaturou a zařazeny do fytocenologických syntaxonů, případně popsány jako nové syntaxony. Tyto syntaxony budou dokumentovány ve srovnávacích fytocenologických tabulkách druhového složení a fotografiemi reprezentativních porostů. Budou popsány z hlediska vztahu k zaznamenaným faktorům prostředí včetně měřených vlastností půdy.

Dále bude zpracován obecný popis alpínské vegetace obou pohoří zaměřený na srovnání alfa a beta diverzity na hadcích a vápencích, v různých nadmořských výškách a na různých typech reliéfu. Pozornost bude věnována také zastoupení endemických druhů rostlin v různých biotopech.

Diplomová práce bude psána anglicky nebo slovensky.

Orientační osnova práce: I. Úvod (vymezení problému v kontextu dosavadního výzkumu, stanovení cílů práce). II. Charakteristika přírodních poměrů. II. Metodika. IV. Výsledky (včetně grafů a tabulek s výsledky analýz, mapami a fotografiemi z terénu). VI. Diskuse (interpretace výsledků a jejich zasazení do širšího kontextu). VII. Seznam literatury. VIII.

Přílohy (rozsáhlejší materiály, hlavně tabulky primárních dat, které není vzhledem k jejich rozsahu vhodné vložit do hlavního textu).

Rozsah: přibližně 80 stran včetně tabulek, obrázků a grafů, podle potřeby může být více, nebo méně.

Základní odborná literatura

Horvat, I., Glavač, V. & Ellenberg, H. 1974. Vegetation Südosteuropas. G. Fischer Verlag, Jena.

Jazyk závěrečné práce: slovenština nebo angličtina
Vedoucí diplomové práce: prof. RNDr. Milan Chytrý, Ph.D.
Podpis vedoucího práce:

Konzultant: -
Datum zadání diplomové práce: listopad 2015

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Acknowledgment

I would like to express my gratitude to my supervisor prof. Milan Chytrý for all the help, useful comments and remarks on previous versions of this thesis. I am very grateful to Tomáš Figura who accompanied me in the field and it was really fun sometimes. For help with the specimen identification I would like to thank to Jindřich Chrtek (*Hieracium*), Jiří Danihelka (*Achillea*, *Stipa*, *Viola*), Svatava Kubešová (bryophytes), Nevena Kuzmanović (*Sesleria*), Petr Šmarda (*Festuca*) and Milan Štech (*Agrostis*). For help with the data analysis in R I would like to thank to Kryštof Chytrý, for preparation of maps to Martin Večeřa. I would also like to thank to Kristína Morgošová for her help with transliteration of some words in cyrillic. To all my friends I thank for the support during the preparation of the thesis. In particular I am very thankful to my family and parents who always supported me in whatever I wanted to do and liked to do.

Declaration

I agree with storing of this thesis in the library of the Department of Botany and Zoology at the Faculty of Science of the Masaryk university in Brno, or in other library of the Masaryk university. I agree with its usage for scientific, educational and other beneficial public purposes, provided that the information form this thesis will be accurately cited and not used commercially.

Brno, 2 January 2018 Mário Duchoň

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1. Introduction

Phytosociology of vegetation of the mountains of Albania and northern Greece still remains poorly explored (Dimopoulos et Georgiadis 1995, Dring et al. 2002). For this reason and my very close relationship to this part of the Balkans, I could not refuse the opportunity to do my master's thesis in this area. The choice fell on Mount Smolikas and Mount Nemërçkë. Mt. Smolikas was partially studied by Quézel (1967). Nemërçkë, as almost all the Albanian mountains, has not been studied by any phytosociologist yet. These two mountain ranges were selected also because of their proximity to each other, similar altitude and contrasting bedrock. Mt Nemërçkë is built of limestones, Mt. Smolikas is an ophiolitic mountain range with very specific flora and the highest number of serpentinite endemics in the Balkans (Stevanović et al. 2003). This offers an opportunity to compare the differences in vegetation between limestones and ophiolites.

The main goal of this study is to describe all the vegetation types above the timberline in both mountain ranges and widen the knowledge about mountain vegetation of the southern Balkans. Secondary goal is to compare vegetation on limestones and ophiolites.

2. Background

2.1 Location and physiography

Both Mt. Smolikas and Mt. Nemërçkë are situated near the Greek-Albanian border at distance of about 40 km from each other and belong to the Pindus mountain system which is a part of the Hellenides (Salmon 2006). Mt. Nemërçkë is an oblong-shaped mountain range, 8–10 km wide and about 28 km long. In the northwest, the ridge continues as the Dhembelli mountain range (Mali Dhëmbellit). In Greece it is known as Dhouskon. The highest peak of the range is Maja e Papingut (2482 m a. s. l.). Nemërçkë (Nemercka) means "sleeping women" according to locals (pers. comm.). It is a common name for a mountain of this shape in this geografical area. Also one peak with a flat ridge on Mt. Smolikas is called Nemërçkë. Mt. Smolikas is about 13 km wide and 18 km long. The highest peak is Smolikas (2637 m a. s. l.) and an altitude above 2600 m is also reached by Moasa (2610 m a. s. l.).

Mt. Smolikas is made of Mesozoic intrusive ophiolites (serpentinites, rarely diabases). The ophiolites of the same age and origin occur in an intact belt from northern Albania to Thessalia in Greece (Meco et Aliaj 2000, Higgins et Higgins 1996). The surroundigs and even higher elevated areas in the western part of Mt. Smolikas are built of flysch. The landscape of Smolikas was shaped by glaciers which covered its highest elevated parts during the past glaciation periods. Southern slopes were not covered by larger glaciers and therefore the relief is mostly smooth with gentle slopes. Northern and eastern slopes were strongly glaciated and the longest glacier in the Vadulakkos valley ended at nearly 1000 m a. s. l. during its maximal extent (Hughes et al. 2006). The results of glaciation are rock cliffs in source areas of former glaciers, glacier cirques, glacial lakes, moraines and hanging valleys.

Mt. Nemërçkë consists of cretaceous limestones, marls and dolomites (Meco et Aliaj 2000). Its layers are inclined to the southwest and it is one of the reasons why the southwestern slopes are more or less gentle, without bigger rock walls. The northeastern slopes of the Mt. Nemërçkë are spectacular because of high rock cliffs and large screes beneath them. The highest parts of the mountain range were also shaped by glaciers in some places: typical glacial cirques, moraines and other relief types are present.

The climate of the area has a mediterranean character (Fig. 1) with dry summers. According to Fotiadi et al. (1999), the both mountain ranges lay in a zone of mean annual precipitation of about 1300 mm. In the village of Fourka (1350 m a.s.l) on the slopes of the Smolikas it is 1391 mm per year. However, precipitation in the highest areas is likely to be considerably higher, although no records exist. At the highest altitudes of the Pindus above 2000 m a. s. l., Furlan (1977) estimated that mean temperatures of minus 5 and plus 15 °C occur during the winter and summer months, respectively. During the winter, snow falls are very heavy with drifts of several meter thickness persisting until summer.

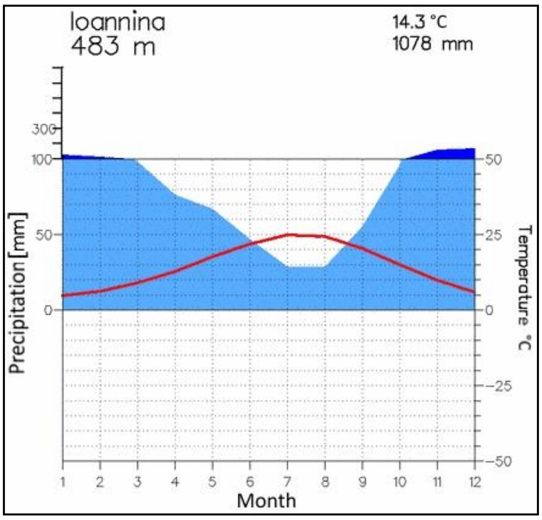


Fig. 1; A climate graph for Ioannina (www1)

2.2 History of botanical research

Although botanical exploration of Greece started in the late 18th century, the first botanist to visited Mt. Smolikas and Mt. Nemërçkë was the Italian Antonio Baldacci in 1892 (Baldacci 1894, 1900). Later, Albania was a region of the investigation of Friedrich Markgraf (Markgraf 1932). In 1935, Constantine Andreas von Regel collected plants in the Pindus including Smolikas (Regel 1941 1942). His work was followed by Dimitrios Phitos (Phitos 1962) and a research group of Arne Strid and Kit Tan who were mostly interested in the northern Pindus during their field research which led to publication of Mountain Flora of Greece (Strid 1986, Strid et Kit 1991). Afterwards, other botanists probably also visited the area, although there are no published data. Albania was very isolated during the communist era, but after its end in 1990 it became to be an interesting (unexplored) area for botanists again. Some of them, in this case Albanian, published their findings also from Mt. Nemërçkë (cf. Shuka et al. 2011, Mahmutaj et al. 2015). However, not many botanists visited the mountains of southern Albania and northern Greece to study the flora, and even less of them came to study vegetation and its ecology. The only phytosociologist who studied the alpine vegetation of Greek mountains, including Mt. Smolikas and the surroundings, was Pierre Quézel (Quézel 1964, 1967). He also published studies dealing with other mountain ranges in Greece (Quézel 1969, 1973). Few others also studied the vegetation above the timberline (Raus 1987, Zaffran 1990, Dimopoulos 1993, Georgiadis et Dimopoulos 1993, Karagiannakidou 1994, Papademetriou et al. 1998). In southern Albania, although not on Mt. Nemërçkë, alpine vegetation was studied by Buzo (1990).

2.3 Phytogeography

According to Takhtajan (1986), the study area of the northern Pindus belongs to the Illyrian Province of the Circumboreal Region of the Holarctic Realm. Frey et Lösh (1998) include this area into the wider Submediterranean floristic region. Comparing to other parts of Europe, this territory is characteristic by the occurrence of many relict and endemic species and generally high biodiversity (Griffiths et al. 2004).

Mt. Smolikas is characterized by occurrence of a high number of widespread species of northern hemisphere, arctic-alpine and central Europaen species, a feature that is typical for siliceous mountains in northern Greece. Together they make about 45% of the flora of Smolikas and 39% of the flora of the Timfi Mts. (Strid 1995). Data for Mt. Nemërçkë (Dhouskon) does not exist, but the Timfi Mts. should be the most similar to Mt. Nemërçkë. The Timfi has also some flysch parts, whereas Nemërçkë is purely calcareous, therefore it has probably less species of these three northern geoelements. Of these species, only on Mt. Smolikas and most probably not on Mt. Nemërçkë, for example *Carex nigra*, *Cerastium cerastoides*, *Euphrasia minima*, *Geum reptans*, *Gnaphalium supinum*, *Nardus stricta*, *Oxyria digyna*, *Sedum alpestre*, *Vaccinium myrtillus* and *Veratrum album* occur above the timberline, and *Polygonatum verticillatum* and *Pyrola minor* in its mountain forests (Strid 1986, Strid et Kit Tan 1991). Species such as *Acinos alpinus*, *Asplenium viride*, *Dactylorhiza sambucina*, *Euphrasia salisburgensis*, *Galium anisophyllon*, *Phleum alpinum*, *Saxifraga paniculata*, *Luzula spicata*, *Trisetum flavescens* and *Veronica aphylla* can be found also on Mt. Nemërçkë (most of them in both mountain ranges). A smaller group of species of the Balcanic-Anatolian element includes for example *Astragalus angustifolius*, *Lactuca intricata*, *Ornitogalum oligophyllum*, *Potentilla speciosa*, *Thymus praecox* subsp.

jankae. Some species such as *Drypis spinosa*, *Festuca spectabilis* subsp. *affinis*, *Ranunculus brevifolius* and *Stipa rechingeri* occur both on the Balkans and the Italian Peninsula. These two species groups occur in a similar ratio in both mountain ranges. Species such as *Armeria canescens*, *Carex macrolepis*, *Geranium subcaulescens*, *Sedum magellense* are widespread on the Balkans, the Italian Peninsula and in Anatolia. These belong into the widespread Mediterannean element together with the species which have even wider distribution range such as *Koeleria lobata* or *Heracleum sphondylium* subsp. *pyrenaicum*. A group of the Balkan endemics and local endemics includes 25.8% (128 species) on Mt. Smolikas and 30% (108 species) in the Timfi Mts (Strid 1995). Mt. Smolikas has a higher rate of stenoendemic species, while in the limestone mountain ranges such as the Timfi or Mt. Nemërçkë their number is lower. Of the species recorded in relevés used for this study, *Alyssum smolikanum*, *Aubrieta gracilis* subsp. *glabrescens*, *Centaurea ptarmicifolia*, *Galium ophioliticum* and *Thlaspi epirotum* are restricted to Mt. Smolikas according to the recent knowlege (Strid 1986, Strid et Kit Tan 1991). Other have wider ranges across the Balkans or only its ophiolite mountain groups. For example, *Cerastium smolikanum*, which was considered to be an endemic of Mt. Smolikas, was recently found also in southern Albania on Mt. Valamara (Shuka et Kit Tan 2009), *Solenanthus albanicus* is endemic for Mt. Nemërçkë, and *Minuartia pseudosaxifraga* is only known from the Timfi and Mt. Nemërçkë (Strid 1986, Strid et Kit Tan 1991, Shuka et al. 2011). Other species from Mt. Nemërçkë with endemic status are more widespread in limestone mountain ranges of Greece and Albania or even further. Of the species considered as Tertiary relicts, *Ramonda serbica* occurs on shaded rocks in the forest zone of Mt. Nemërçkë and *Pinus heldreichii* on slopes of Mt. Smolikas (Strid 1986, Strid et Kit Tan 1991).

Table 6, Phytogeographical elements by Strid (1995). Values are in percentages. **1.** cosmopolitan, widespread in the northem hemisphere, arctic-alpine, or Euro-Siberian; **2.** Central & S. European (sometimes extending to the Caucasus and N Iran); **3.** Balkanic and Anatolian; **4.** widespread Mediterranean; **5.** Balkans & Italy; **6.** Balkan endemics; **7.** Greek endemics; **8.** Single area endemics; **9.** Single mountain endemics.

	1	2	3	4	5	6	7	8	9	∑
Smolikas	24.2	21.0	8.4	11.2	6.8	19.6	3.8	1.4	1	499
Timfi	18.3	20.5	7.5	13.3	7.5	23.0	5.8	0.6	0.6	361

2.4 Plants and bedrock

Both limestones and ultramafic rocks (ophiolites) have features supporting evolution of specific, species-rich flora with high rate of endemism. These patterns were studied in many parts of the globe. In the tropics (Polak 2000), subtropical fynbos vegetation (Willis et al. 1996) and also in the temperate zone on the Balkans (Redžić 2011a) the authors consider limestone (karst) areas as very species-rich and unique comparing to other types of bedrock (and landscape) in surroundings. The biodiversity in karst areas is related to high variability of geomorphology, hydrology and therefore higher environmental heterogenity (Redžić 2011a). Shallow limestone soils have high pH, which is usually also connected with higher plant biodiversity (Ewald 2003), but it may not be too high if combined with drought stress (Chytrý et al. 2007, Palpurina et al. 2017).

Ultramafic soils are considered to be a model system for the study of plant adaptation, speciation, and species interactions (Harrison et Rajakaruna 2011). These soils are stressful for plant growth, due to nutrient deficiencies, especially Ca, low water-holding capacity, and high levels of heavy metals and Mg (Kruckeberg 1985). Species growing on ultramafic soils have evolved morphological as well as physiological adaptations (Constantinidis et al. 2002; Brady et al. 2005). Plant communities found on ultramafic soils are usually significantly distinct from adjacent communities on “normal” soils (Brooks 1987; Robinson et al. 1996). Strong selection by ultramafic soil leads to local adaptation and the formation of soil ecotypes which may be a stage in the progression toward species endemism. These endemics are restricted from more fertile soils by competition (Anacker 2014, Kruckeberg 1951). Ophiolite soils host a spectacular level of plant endemism in many regions; for example, California has 215, Cuba 854, New Caledonia 1150 (Anacker, 2011), the Balkans more than 300, and Mt. Smolikas with surroundigs 42 taxa found growing only on serpentinite (Stevanović et al. 2003). As seen, despite the fact that different types of ultramafic rocks represent only a negligible fraction (less than 1%) of the Earth’s surface (Brooks 1987), they are big hotspots of endemism and biodiversity.

3. Methodology

3.1 Data collection, fieldwork

I conducted field survey of Mt Smolikas at the end of July 2012. One year later at the end of June and beginning of July, I went to Mt. Nemërçkë. I focused only on vegetation above the timberline. On Mt. Nemërçkë, where forests have been reduced by human impact (field observation), only the vegetation of the alpine zone defined by the occurrence of snowbeds and *Festuca varia* grasslands was sampled. Relevés were made following the Braun-Blanquet approach (Braun-Blanquet 1964) using the nine-degree cover-abundance scale (Barkman et al. 1964). Each relevé (n = 110 from Mt. Smolikas and 105 from Mt. Nemërçkë) had a uniform area of 16 m^2. Percentage cover of each vegetation layer was estimated. Cryptogams were identified only for the fen and spring vegetation. Basic environmental variables (aspect and inclination of slope, percentage of rocks, soil depth) were recorded for all relevés, as well as coordinates (WGS-84) taken using a GPS receiver. I also took a mixed soil sample from each relevé if possible. Subsequently, pH of dried soil samples was measured in a water suspension (2:5) using portable instruments (GMH Greisinger pH-meter).

3.2 Plant identification and nomenclature

Specimens of all unknown or questionable plants were collected in the field for later identification. I used mostly identification keys from the Mountain Flora of Greece (Strid 1986, Strid et Kit Tan 1991). Numerous specialized identification keys, papers and online sources of pictures of herbarium specimens were also used. For final comfirmation of the identification, I also compared some of my specimens with those in the Herbarium of the Department of Botany and Zology of the Masaryk University (BRNU). If necessary, I asked for help specialists in selected plant genera. All the collected specimens will be deposited in the herbarium BRNU. Bryophytes were identified only for the vegetation of fens and springs.

The nomenclature of the vascular plants follows the Euro+Med PlantBase (www2). Species that are not covered yet by this database follow The Plant List (www3). For the genera *Alyssum*, *Thlaspi* and *Betonica*, traditional taxonomical concept from the

Mountain Flora of Greece (Strid 1986, Strid et Kit Tan 1991) was used. Taxa which still need more study and could not be identified certainly are listed as “sensu lato“ or only identified at the genus level (*Taraxacum*). Nomenclature of mosses is unified according to Sabovljević et al. (2008).

3.3 Classification

After storing the data in TURBOVEG (Hennekens et Schaminée 2001), I used JUICE 7.0 (Tichý 2002) for further analysis. Vegetation of both mountain ranges was classified separately, using modified TWINSPAN (Roleček et al. 2009). I tried several approaches and different intersample distance measures. All methods used produced similar results. Finally I decided for pseudospecies cut levels set at 0, 1, 5, 15, 25% cover and total inertia as heterogeneity measure. Subsequently, I selected final clusters that were homogeneous from the ecological point of view. Species composition of clusters was compared with literature and classified within known syntaxa if possible. Classification on the level of classes was verified by EuroVegChecklist Expert system (Mucina et al. 2016b). The interpretation of the species composition and structure of clusters was based on diagnostic, constant and dominant species. The *phi* coefficient (Sokal et Rohlf 1995) was calculated for the identification of diagnostic species. Species with a *phi* coefficient higher than 0.7 were accepted as being highly diagnostic (underlined in text) and species with *phi* coefficient higher than 0.4 were considered diagnostic. Fisher's exact test (alpha = 0.001) was calculated to exclude species with non-significant affinity to relevé groups from the list of diagnostic species in the synoptic tables. For the information given in the text, Fisher's exact test was not calculated to show even less frequent species with diagnostic value. As the identification of diagnostic species depends on the size of clusters, the sizes of all clusters were virtually equalized (Tichý et Chytrý 2006). Species with relative occurrence frequency higher than 70% were considered as very frequent (underlined in the text) and species with frequency higher than 50% as constant. Species with cover values higher than 15% were accepted as dominant for rock and scree vegetation, whereas for other communities with higher cover of herb layer, cut level at 25% was set. For subassociations, only constant and dominant species are listed in the text.

Diagnostic species in synoptic tables are sorted by fidelity, other species are listed below them and sorted by relative frequency.

3.4 Other analyses

For further analyses, the heat load index and the radiation index were calculated for each relevé according to McCune et Keon (2002). Endemic species were counted for each relevé according to most recent information about their distribution range from various literature sources, mostly according to Strid (1986) and Strid et Kit Tan (1991), also verified by GBIF (www4) and Euro+Med PlantBase (www2). The genus *Festuca* was excluded from the count. For Tab. 7 total numbers of species per plot and total numbers of species per class were calculated in JUICE 7.0. Rarefaction curves (Colwell et al. 2004) were also calculated in JUICE 7.0 (Tichý 2002) for comparable vegetation classes.

Detrended Correspondence Analysis (DCA) and linear analyses for correlations between vegetation (species richness, endemism) and factors of the environment were performed in R. Boxplots for chosen atributes vere also made in R. The library *ggplot2* from the file *tidyverse* was used. Logaritmic transformation of the data was made for DCA analysis using the *vegan* library (Oksanen et al. 2017). Particularly DCA analyses for grasslands (*Elyno-Seslerietea*, *Daphno-Festucetea*) was made by CANOCO 5 (Šmilauer et Lepš 2014).

3.5 List of abbreviations

Abbreviations used in the text and graphs are as follows:

ASP – *Asplenietea trichomanis*
DAP – *Daphno-Festucetea*
ET – endangerment
SM – synmorfology
MUL – *Mulgedio-Aconitetea*
N – Mt. Nemërçkë
SC – synchorology
SE – synecology
SES – *Elyno-Seslerietea*
SM – synmorfology
ST – syntaxonomy
TPO – *Trifolio anatolici-Polygonetea arenastri*
THL – *Thlaspietea rotundifolii*
TS – transitions and syndynamics

4 Results and discussion

4.1 Vegetation of Mt. Nemërçkë

4.1.1 Syntaxonomical overview

ASPLENIETEA TRICHOMANIS (Br.-Bl. in Meier et Br.-Bl. 1934) Oberd. 1977

Potentilletalia speciosae Quézel 1964

- ***Galion degenii* Quézel 1967**
  - *Trifolio norici-Valerianetum epiroticae* Quézel 1967
    - subass. *saxifragetosum marginatae* subass. nova hoc loco
    - subass. *thymetosum boissieri* subass. nova hoc loco
  - *Saxifrago taygetei-Doronicetum columnae* ass. nova hoc loco

***THLASPIETEA ROTUNDIFOLII* Br.-Bl. 1948**

Drypidetalia spinosae Quézel 1964

- ***Silenion caesiae* Quézel 1964**
  - *Cardamine carnosa* community
  - *Ranunculus brevifolius* community
  - *Drypis spinosa* community
  - *Geranium macrorrhizum* community
  - *Arrhenathero elatioris-Heracleetum pyrenaici* ass. nova hoc loco
  - *Betonico alopecuri-Geranietum subcaulescentis* ass. nova hoc loco

***ELYNO-SESLERIETEA* Br.-Bl. 1948**

Onobrychido-Seslerietalia Horvat 1960

  - *Pediculari graecae-Seslerietum tenerrimae* ass. nova hoc loco

***DAPHNO-FESTUCETEA* Quézel 1964**

Daphno oleoidis-Festucetalia variae Quézel 1964

- ***Astragalo angustifolii-Seslerion coerulantis* Quézel 1964**
  - *Edraiantho australis-Koelerietum lobatae* ass. nova
    - subass. *typicum* subass. nova hoc loco
    - subass. *astragaletosum angustifolii* subass. nova hoc loco
    - subass. *trifolietosum norici* subass. nova hoc loco
  - *Cyano epirotae-Festucetum variae* ass. nova hoc loco
    - subass. *typicum* subass. nova hoc loco

subass. *seslerietosum vaginalis* subass. nova hoc loco

TRIFOLIO ANATOLICI-POLYGONETEA ARENASTRI **Quézel 1973**

Trifolietalia parnassi Quézel 1964

- ***Trifolion parnassi*** **Quézel 1964**
  - *Anthemido carpaticae-Alopecuretum gerardi* ass. nova hoc loco

MULGEDIO-ACONITETEA **Hadač et Klika in Klika et Hadač 1944**

Adenostyletalia alliariae Br.-Bl. 1930

- ***Rumicion alpini*** **Scharfetter 1938**
  - *Alopecuro gerardi-Chenopodietum boni-henrici* ass. nova hoc loco

4.1.2 Asplenietea trichomanis

Trifolio norici-Valerianetum epiroticae **Quézel 1967**

Trifolium noricum-Valeriana epirota-Ass. Quézel 1967 nom. orig.

Table 1, cluster 1

Number of relevés: 11

Diagnostic species: *Aubrieta deltoidea*, <u>*Galium degenii*</u>, *Hieracium pannosum*, *Minuartia pseudosaxifraga* <u>*Potentilla speciosa*</u>, *Saxifraga federici-augusti* subsp. *grisebachii*, <u>*Saxifraga marginata*</u>, *Sedum dasyphyllum*

Constant species: <u>*Aubrieta deltoidea*,</u> *Poa thessala*, <u>*Saxifraga marginata*</u>, <u>*Sesleria tenerrima*</u>

Dominant species: *Saxifraga marginata*

SM: Species-poor or moderately rich plant communities of rock chasmophytes accompanied by herbs from surrounding grasslands. *Saxifraga marginata*, *Aubrieta deltoidea* and *Potentilla speciosa* occur with higher cover values.

SE: Crevices and small terraces of dry rock walls.

SD: In less inclined habitats with more developed soils it transits to grasslands of the *Pediculari graecae-Seslerietum tenerrimae* and also to the communities belonging to the class *Daphno-Festucetea*. On wet rocks it is replaced by stands of the *Saxifrago taygetei-Doronicetum columnae*.

ST: The association *Trifolio norici-Valerianetum epiroticae* was described from the Timfi Mts. (Quézel 1967). Comparing to the Timfi, my relevés do not contain *Achillea* *holosericea*, *Alkanna scardica*, *Arabis alpina* subsp. *caucasica*, *Cardamine plumieri*, *Valeriana crinii* subsp. *epirotica*. These most probably do not occur on Mt. Nemërçkë. On the other hand, the flora of rock crevices of Mt. Nemërçkë is very similar and it does not include a single endemic or local species which wouldn not occcur in the Timfi. Therefore, I suggest to classify the communities from Mt. Nemërçkë only as new subassociations of the *Trifolio norici-Valerianetum epiroticae*. *Trifolium noricum* as main diagnostic species of the association is common on Mt. Nemërçkë. Both mountain ranges also share *Achillea frasii*. Other diagnostic species of the association indicated by Quézel (1967), *Alchemilla plicatula* and *Asplenium viride*, also occur on Mt. Nemërçkë, but were recorded only in stands of the *Pediculari graecae-Seslerietum tenerrimae*.

Fig. 1;

A) Northeast-facing slopes of Mt. Nemërçkë with spectacular cliffs. Under peak of Maja e Papingut cliffs reach a height of 1000 m.

B) *Galium degenii*

C) *Aubrieta deltoidea*, a widespread species of all rock vegetation types on Mt. Nemërçkë.

Subassociations:

T. n.-V. e. subass. *saxifragetosum marginatae* subass. nova hoc loco

(Holotypus: Table 1, rel. 3)

Relevés: First 6 relevés in Table 1, cluster 1

Constant species: *Aubrieta deltoidea, Poa thessala, Saxifraga marginata, Saxifraga paniculata, Sesleria tenerrima*

Dominant species: *Saxifraga marginata*

Alt.: 2065–2400	Asp.: E–N–W	Slope: 60–90°	C_{E1}: 7–25 %	Sp.: 5–20 (10)

This subassociation is characterized by *Saxifraga marginata* occurring with high cover values and stable presence of *Sesleria tenerrima* and *Trifolium noricum*. It is bound to higher altitudes and usually occurs on north-facing, vertical rock faces.

Fig. 2; Cushions of *Saxifraga marginata*, the dominant species of the subass. *saxifragetosum marginatae*. It is able to grow even under small overhangs and on the most extreme, steepest rock faces.

T. n.-V. e. **subass.** ***thymetosum boissieri*** **subass. nova hoc loco**

(Holotypus: Table 1, rel. 9)

Relevés: Last 5 relevés in Table 1, cluster 1

Constant species: *Achillea frasii, Aubrieta deltoidea, Campanula rotundifolia* s. l., *Edraianthus australis, Galium degenii, Minuartia pseudosaxifraga, Minuartia verna* s. l., *Poa thessala, Potentilla speciosa, Silene parnassica* subsp. *parnassica, Thymus boissieri*

Dominant species: –

Alt.: 1965–2360 Asp.: NEE–SE, SW Slope: 60–85° C_{E1}: 10–25 % Sp.: 13–21 (17)

In addition to *Potentilla speciosa*, which usually prevails in this vegetation type, this subassociation is typical by the occurrence of more termophilous elements and species of the *Daphno-Festucetea*, for example *Thymus boissieri*. It inhabits warmer, sunny and usually less inclined rock walls comparig to subass. *saxifragetosum marginatae*. Presence of *Silene pseudosaxifraga* and *Saxifraga federici-augusti* subsp. *grisebachii*, less frequent diagnostic species of the *Gnaphalio roeseri-Asplenietum fissae* Quézel 1967, shows partial similarity of this subassociation to the rock communities in lower altitudes of the Timfi Mts. (cf. Quézel 1967).

Fig. 3; Stands of *Potentilla speciosa* on southern slopes of Mt. Nemërçkë.

Saxifrago taygetei-Doronicetum columnae ass. nova hoc loco

(Holotypus: Table 1, rel. 17)

Table 1, cluster 2

Number of relevés: 9

Diagnostic species: *Aubrieta deltoidea*, *Cystopteris fragilis*, *Doronicum columnae*, *Myosotis suaveolens*, *Saxifraga taygetea*, *Sedum magellense*

Constant species: *Aubrieta deltoidea*, *Cystopteris fragilis*, *Doronicum columnae*, *Myosotis suaveolens*, *Saxifraga taygetea*, *Sedum magellense*

Dominant species: *Aubrieta deltoidea*, *Doronicum columnae*, *Saxifraga taygetea*

Alt.: 2005–2440 Asp.: E–N–NW. Slope: 20–80° C_{E1}: 8–70 % Sp.: 5–18 (13)

SM: Herb layer is usually well developed, formed by moisture demanding species. Moss layer covers up to 40 % in some places.

SE: It occurs on wet, often shaded rocks in karstic dolines, rocks close to snowbeds and at other similar places. It can very rarely grow in stabilized screes composed of large boulders or on gravel in narrow, humid glens.

SD: Above the wet and shady basal parts of bigger rock walls it transits to the *Trifolio norici-Valerianetum epiroticae.*

Fig. 4; Stands of *Cystopteris fragilis*, *Doronicum columnae* and *Saxifraga taygetea* in a karstic doline.

4.1.3 Thlaspietea rotundifolii

Cardamine carnosa community

Table 1, cluster 3

Number of relevés: 4

Diagnostic species: <u>*Cardamine carnosa*</u>, *Stachys tymphaea*

Constant species: <u>*Cardamine carnosa*</u>, <u>*Stachys tymphaea*</u>

Dominant species: –

Alt.: 1920–2180	Asp.: <u>N</u>–NW–W	Slope: <u>20</u>–45°	C_{E1}: 5–10 %	Sp.: 2–9 (5)

SM: Species-poor community, often consisting only of sparsely growing *Cardamine carnosa*.

SE: This is the most chionophilous scree community of all recorded in the area. It grows in the basal parts of scree cones often made only of larger stones and missing gravelly particles.

TS: *Cardamine carnosa* can rarely occur also in the other types of scree communities in its surroundigs.

ST: In the other parts of the Balkans, *Cardamine carnosa* is a component of chionophilous communities included in the order *Thlaspietalia rotundifolii* Br.-Bl. in Br.-Bl. et Jenny 1926. It is an important species for example in the *Drypidetum spinosae* Horvat 1931 in the Velebit Mts. and in the mountains of the Republic of Macedonia (Horvat et al. 1974). In Greece the communities with this species can be found on Mt. Olympos, where it is one of the diagnostic species (together with *Linaria alpina* for example) for the *Alysso handelii-Achilletum ambrosiacae* Quézel 1967. It also occurs in the Timfi Mts., where it grows in the *Achilleo abrotanoides-Arenarietum confertae* Quézel 1967 (cf. Quézel 1967). Except the occurrence of few local and endemic species, these communities are very similar to those from the other parts of the Balkans. Although these most chionophilous scree communities of the highest peaks of Greece are also ecologically very similar to the more northern ones, they are traditionally classified in the order *Drypidetalia spinosae* rather than in *Thlaspietalia rotundifolii*.

Fig. 5; *Cardamine carnosa* flowering between stones in a basal part of a scree cone.

Ranunculus brevifolius community

Table 1, cluster 4

Number of relevés: 3

Diagnostic species: <u>*Ranunculus brevifolius*</u>, *Senecio squalidus*

Constant species: *Carduus tmoleus, Drypis spinosa, Myosotis suaveolens,* <u>*Ranunculus brevifolius*</u>*, Ranunculus sartorianus, Scrophularia heterophylla* subsp. *laciniata, Sedum album, Senecio squalidus*

Dominant species: –

Alt.: 1950–2260	Asp.: <u>N</u>–NWW	Slope: 20–30°	C_{E1}: 15–20 %	Sp.: 4–11 (9)

SM: The prevailing *Ranunculus brevifolius* is accompanied by herbs such as *Myosotis suaveolens* and *Doronicum columnae*, which are typical of relatively wet habitats. Widespread scree species (*Drypis spinosa*, *Scrophularia heterophylla* subsp. *laciniata*) are also present.

SE: This community is typical of stabilized or almost stabilized gravely screes mixed with particles of soil which are often visible even on the surface of scree. Snow cover usually remains quite long time in these habitats.

TS: In less inclined and well stabilized screes it transits to the snowbeds and grasslands, in less stabilized screes to other scree communities.

ST: *Ranunculus brevifolius* is a diagnostic species of the alliance *Silenion caesiae* (Horvat et al. 1974). It occurs in wide range of scree communities described by Quézel (1964, 1967) together with species of different types of screes. Ecologically, *Ranunculus brevifolius* is bound quite strictly to the habitats of well stabilized screes, not only on Mt. Nemërçkë, but also in different mountain ranges where I could observe it. For this reason, it is questionable if Quézel used to choose really homogeneous stands for his relevés and if he used to care about details of scree ecology – its type, level of stabilization, duration of snow cover and other factors (check also chapter 4.3).

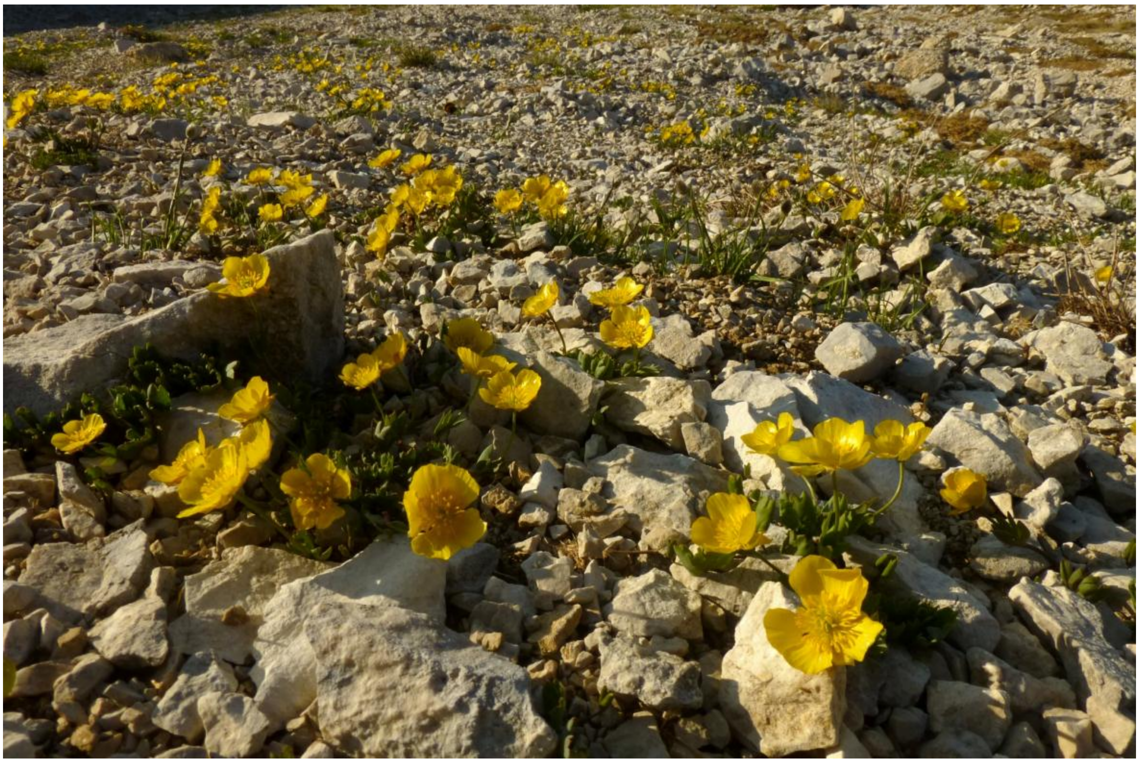


Fig. 6; (up) Community with flowering *Ranunculus brevifolius*.

Fig 7; (down left) The rhizomes of *Ranunculus brevifolius*, not very long, but dense and firm, play significant role in scree stabilization and soil development.

Drypis spinosa community

Table 1, cluster 5

Number of relevés: 4

Diagnostic species: *Drypis spinosa*, *Scrophularia heterophylla* subsp. *laciniata*, *Silene caesia*

Constant species: *Drypis spinosa*, *Scrophularia heterophylla* subsp.*laciniata*

Dominant species: *Drypis spinosa*

Alt.: 1805–2190	Asp.: –	Slope: 25–30°	C_{E1}: 5–30 %	Sp.: 3–8 (5)

SM: Scree communities formed by rounded tufts of *Drypis spinosa.*

SE: It occurs on dry, gravely or stony screes, often on convex type of relief and more frequently on sunny places or at lower altitudes. Soil is not developed in the upper layer of these screes.

TS: In more stabilized screes it transits to the grasslands with *Festuca varia. Festuca spectabilis* subsp. *affinis* often occurs in lower parts of scree cones. In glens and screes under bigger rock walls at higher altitudes it is usually replaced by the *Arrhenathero elatioris-Heracleetum pyrenaici*.

Fig. 8; Scree with *Drypis spinosa*.

Geranium macrorrhizum community

Table 1, cluster 6

Number of relevés: 3

Diagnostic species: *Geranium macrorrhizum*

Constant species: *Drypis spinosa, Festuca varia, Geranium macrorrhizum*

Dominant species: *Geranium macrorrhizum*

Alt.: 1615–1750 Asp.: N–NE Slope: 30° C_{E1}: 40–60 % Sp.: 3–4 (3)

SM: Species-poor scree community with *Geranium macrorrhizum* which covers the ground by its wide leaves.

SE: A community of stable stony edges and basal parts of scree cones formed by bigger stones and boulders. It occurs in lower altitudes, close to the timberline. Its habitats are quite mesic and facing to the north. Soil is not developed on the surface of scree.

TS: It transits to *Festuca varia* grasslands and other types of scree communities.

ST: *Geranium macrorrhizum* is a species widespread in southern France, Italy and the Balkans (Strid 1986). It often grows in scree forests and shaded screes in a forest zone (pers. obs.). In the southern part of the Balkans it is present in more communities described by Quézel (1964, 1967), for example in the *Geranietum macrorrhizae-Rumicetum scutatae* Quézel 1964 (Giona and Parnassos) or in the *Geranio aristatae-Polystichetum lonchitis* Quézel 1967 from the Timfi. Due to lack of other species than *Geranium macrorrhizum* in the stands recorded on Mt. Nemërçkë, it is hard to classify this vegetation. Nevertheless, *Geranium aristatum, Rosa heckeliana* and other species of the *Geranio aristatae-Polystichetum lonchitis* occur in this area and maybe at some places they grow together with *G. macrorrhizum* as well.

Fig. 9; *Geranium macrorrhizum* in bloom.

Fig. 10; Community with *Geranium macrorrhizum*.

Arrhenathero elatioris-Heracleetum pyrenaici **ass. nova hoc loco**

(Holotypus: Table 1, rel. 39)

Table 1, cluster 7

Number of relevés: 8

Diagnostic species: *Arrhenatherum elatius*, *Heracleum sphondylium* subsp. *pyrenaicum*, *Festuca spectabilis* subsp. *affinis*, *Poa cenisia*

Constant species: *Arrhenatherum elatius*, *Heracleum sphondylium* subsp. *pyrenaicum*

Dominant species: *Festuca spectabilis* subsp. *affinis*, *Heracleum sphondylium* subsp. *pyrenaicum*

Alt.: 1680–2300	Asp.: SEE—N–W	Slope: 30–35°	C_{E1}: 20–45 %	Sp.: 4–16 (9)

SM: Scree community of tall herbs – *Heracleum sphondylium* subsp. *pyrenaicum* and *Festuca spectabilis* subsp. *affinis*.

SE: It usually occurs in glens and on larger scree cones under high rock walls. The screes in glens are characteristic by more humid conditions comparing to those on other types of relief. Ecologically similar to glens are the central (axial) parts of the scree cones. These are made of gravel and stones, but also finer material which remains here and does not fall to the edges of the scree cone as bigger rocks. Also, these parts of the scree are often supplied by water from the gullies above them and finer scree material can retain the moisture better then rough gravel and stones. That is possible reason why *Heracleum sphondylium* susbsp. *pyrenaicum* with lush green leaves survives in this habitat and finds enough water, at least deeper in the scree. Soil is not developed and visible on the surface of these screes but when digging deeper it is possible to find soil particles at some localities.

ST: Variability of this community depends on altitude and position on the scree cone. A variant with prevailing or subdominant *Festuca spectabilis* subsp. *affinis* occurs in lower and relatively drier parts of scree cones. In the upper parts of the scree cones or at higher altitudes, *Poa cenisia* becomes more frequent. Mesophilous communities with *Heracleum sphobdylium* subsp. *pyrenaicum* from wet gorges of mountain creeks are described from Mt. Giona and Mt. Parnassos as the *Heracleo oetaeum-Betonicetum jacquinii* Quézel 1964 within the alliance *Cirsion appendiculati* (Quézel 1964).

Fig. 11;. Stands of the *Arrhenathero elatioris-Heracleetum pyrenaici* in a wide glen on the northern slopes of Mt. Nemërçkë.

Betonico alopecuri-Geranietum subcaulescentis **ass. nova hoc loco**

(Holotypus: Table 8, rel. 45)

Table 1, cluster 8

Number of relevés: 3

Diagnostic species: *Achillea* abrotanoides, *Betonica alopecuros*, *Erysimum pusillum* subsp. *cephalonicum, Galium oreophilum, Geranium subcaulescens, Laserpitium siler, Linaria peloponnesiaca*, *Rumex nebroides, Sedum ochroleucum*

Constant species: *Acinos alpinus, Achillea abrotanoides, Betonica alopecuros, Carum rupestre, Erysimum pusillum* subsp. *cephalonicum, Festuca varia, Galium oreophilum, Geranium subcaulescens, Heracleum sphondylium* subsp. *pyrenaicum, Linaria peloponesiaca, Lotus corniculatus* s. l., *Ranunculus sartorianus, Rumex nebroides, Sedum album*

Dominant species: *Athamantha densa, Betonica alopecuros, Geranium subcaulescens, Lotus corniculatus* s. l., *Phyllolepidum cyclocarpum* subsp. *pindicum, Ranunculus sartorianus*

Alt.: 2020–2220	Asp.: SEE–NE	Slope: 30–45°	C_{E1}: 65–75 %	Sp.: 12–21(18)

SM: Community with prevalence of *Betonica alopecuros* and *Geranium subcaulescens*. Few other species can also occur with higher cover values.

Fig. 12; Stands of the *Betonico alopecuri-Geranietum subcaulescentis* with pink flowering *Geranium subcaulescens, Betonica alopecuros* up in right corner of the picture and white flowering *Phyllolepidum cyclocarpum* subsp. *pindicum* down in left corner of the picture.

SE: It inhabits relatively dry, steep gullies and slopes with partially stabilized screes where often also solid bedrock outcrops occur. Soil is rarely developed under the plant cushions. It is dark brown, humic and very gravely.

TS: At wet and more shady places this vegetation is locally replaced by the *Saxifrago taygetei-Doronicetum columnae.* In more extensive glens it often borders the stands of the *Arrhenathero elatioris-Heracleetum pyrenaici*.

4.1.4 Daphno-Festucetea

Edraiantho australis-Koelerietum lobatae **ass. nova hoc loco**

(Holotypus: Table 2, rel. 3)

Table 2, cluster 1

Number of relevés: 16

Diagnostic species: *Anthyllis vulneraria, Astragalus angustifolius, Asyneuma limonifolium, Draba lasiocarpa, Edraianthus australis, Koeleria lobata, Paronychia albanica, Podospermum canum, Taraxacum* sp.*, Thymus boissieri, Trinia glauca* subsp. *pindica*

Constant species: *Asyneuma limonifolium, Cerastium decalvans, Draba lasiocarpa, Edraianthus australis, Koeleria lobata, Minuartia verna* s. l.*, Poa thessala, Taraxacum* sp.*, Thymus boissieri, Trinia glauca* subsp. *pindica*

Dominant species: *Astragalus angustifolius, Festuca duriuscula* s. l.*, Stipa eriocaulis, Trifolium noricum*

SM: Usually open communities of low-growing herbs appressed to the rock surface.

SE: Pioneer stands of flat or convex ridges and inclined rocky ledges. Soil is usually developed only under plant cushions; it is dark-brown, humic and very gravelly, 5–10 cm deep.

TS: This community represents primary, blocked successional stages of grasslands from the class *Daphno-Festucetea*. In the highest parts of main ridge of Mt. Nemërçkë, it is strongly influenced by the species which are dispersing to it from communities of the *Pediculari graecae-Seslerietum tenerrimae* which grow on the north-facing slopes. *Trifolium noricum* may occur with a high cover. *Sedum atratum* and *Sesleria tenerrima* are also present, but in general the community consists of many species characteristic for the class *Daphno-Festucetea.* Still the subass. *trifolietosum norici* has a transitional character to the *Elyno-Seslerietea*.

Subassociations:

E. a-K. l. **subass.** ***typicum*** **subass. nova hoc loco**

(Holotypus: Table 2, rel. 3)

Relevés: First 3 in Table 2 cluster 1

Constant species: *Anthyllis montana* subsp. *jacquinii*, *A. vulneraria*, *Astragalus lacteus*, *Asyneuma limonifolium*, *Bromus cappadocicus* subsp. *lacmonicus*, *Cerastium decalvans*, *Draba lasiocarpa*, *Edraianthus australis*, *Koeleria lobata*, *Minuartia verna* s.l., *Paronychia albanica*, *Poa thessala*, *Taraxacum* sp., *Thymus boissieri*, *Trinia glauca* subsp. *pindica*

Dominant species: -

Alt.: 1990–2125 Asp.: S–SSE Slope: 5–10° C_{E1}: 15–30 % Sp.: 14–19 (17)

Plant communities of wind-exposed rocky ridges in lower altitudes with prevalence of *Edraianthus australis*, *Thymus boissieri*, stable occurrence of *Anthyllis montana* subsp. *jacquinii* and more xero- and thermophilous species which occur also in the stands of subass. *astragaletosum angustifoliae*.

Fig. 13; Stands of the *Edraiantho australis-Koelerietum lobatae typicum* with flowering *Edraianthus australis* and locally also with *Stipa eriocaulis*.

E. a-K. l. subass. *astragaletosum angustifolii* subass. nova hoc loco

(Holotypus: Table 2, rel. 8)

Relevés: From 4 to 11 in Table 2, cluster 1

Constant species: *Astragalus angustifolius, Asyneuma limonifolium, Cyanus epirotus, Draba lasiocarpa, Edraianthus australis, Festuca duriuscula* s. l., *Koeleria lobata, Minuartia verna* s.l., *Poa thessala, Podospermum canum, Taraxacum* sp., *Thymus boissieri, Trinia glauca* subsp. *pindica*

Dominant species: *Astragalus angustifolius, Festuca duriuscula* s. l., *Stipa eriocaulis*

Alt.: 1950–2270 Asp.: E–S–W Slope: 5–25° C_{E1}: 55–85 % Sp.: 12–24 (18)

Cushions of *Astragalus angustifolius* and *Festuca duriuscula* s. l. determine physiognomy of this subassociation. It also differs from the other subassociations by the occurrence of *Podospermum canum*. As the previous subassociation, it inhabits rocky ridges with shallow soils. The only difference is that it usually occurs at leeward sites.

Fig. 14; Stands of the subass. *astragaletosum angustifolii* with white flowering tufts of *Astragalus angustifolius.*

***E. a-K. l.* subass. *trifolietosum norici* subass. nova hoc loco**

(Holotypus: Table 2, rel. 13)

Relevés: Last 5 in Table 2, cluster 1

Constant species: *Cerastium decalvans*, *Draba lasiocarpa*, *Edraianthus australis*, *Festuca duriuscula* s. l., *Minuartia verna* s. l., *Myosotis suaveolens*, *Poa thessala*, *Sedum atratum*, *Sesleria tenerrima*, *S. vaginalis*, *Taraxacum* sp., *Thymus boissieri*, *Trifolium noricum*, *Trinia glauca* subsp. *pindica*

Dominant species: *Trifolium noricum*

Alt.: 2300–2475 Asp.: W–SW Slope: 2–20° C_{E1}: 15–80 % Sp.: 12–19 (15)

The composition of these stands is transitional to the *Pediculari graecae-Seslerietum tenerrimae*. *Trifolium noricum* grows appressed closely to the surface, while other species of cooler north-facing slopes also occur sparsely. Several species characteristic of the *Daphno-Festucetea* are still present in this habitat.

Fig. 15; Stands of the subass. *trifolietosum norici* with pink floweing *Thymus boissieri* and white *Trifolium noricum* in the bottom right part of the picture.

***Cyano epirotae-Festucetum variae* ass. nova hoc loco**

(Holotypus: Table 2, rel. 28)

Table 2, cluster 2

Number of relevés: 20

Diagnostic species: *Astragalus lacteus, Bromus cappadocicus* subsp. *lacmonicus, Cyanus epirotus, Euphorbia myrsinites, Pilosella cymosa* subsp. *sabina, Sedum acre*

Constant species: *Anthemis cretica* subsp. *carpatica, Cerastium decalvans, Cyanus epirotus,* *Festuca varia*, *Minuartia verna* s.l., *Myosotis suaveolens,* *Pilosella cymosa* subsp. *sabina*, *Poa thessala*, *Thymus boissieri*

Dominant species: *Festuca varia, Sesleria vaginalis, Thymus boissieri*

SM: Grasslands with dominance of *Festuca varia*, *Sesleria vaginalis* and *Thymus boissieri*.

SE: Widespread on the slopes exposed to the south but also to the north at lower altitudes. Soils are usually 15–25 cm deep, stony, gravely, with a brown, rarely dark-brown and humic loam. Being the most widespread community of Mt. Nemërçkë alpine belt, it may transit into all possible types of vegetation on Mt. Nemërçkë.

ST: The nearest described grassland association of this type (*Festuco variae–Marubietum velutini* Quézel 1967) occurs in the Timfi Mts., but its species composition differs in many species (cf. Quézel 1967).

Fig. 16; Stands of the *Cyano epirotae-Festucetum variae typicum*.

Subassociations:

C. e-F. v. subass. *typicum* subass. nova hoc loco

(Holotypus: Table 2, rel. 28)

Relevés: First 16 relevés in Table. 2, cluster 2

Constant species: *Acinos alpinus, Anthemis cretica* subsp. *carpatica, Armeria canescens, Astragalus lacteus, Asyneuma limonifolium, Bromus cappadocicus* subsp. *lacmonicus, Campanula rotundifolia, Cyanus epirotus, Cerastium decalvans, Dianthus integer* subsp. *minutiflorus, Festuca varia, Geranium subcaulescens, Minuartia verna, Myosotis suaveolens, Pilosella cymosa* subsp. *sabina, Poa thessala, Sedum acre, Thymus boissieri, Trinia glauca* subsp. *pindica*

Dominant species: *Festuca varia, Thymus boissieri*

Alt.: 1760–2355 Asp.: – Slope: 5–45° C_{E1}: 25–90 % Sp.: 16–36 (24)

Species-rich communities of lower altitudes. They differ from the next subassociation by a frequent occurrence of thermophilous and xerophilous species such as *Astragalus lacteus*, *Bromus cappadocicus* subsp. *lacmonicus, Cyanus epirotus, Euphorbia myrsinites*, *Geranium subcaulescens*, *Sedum acre* and others. Presence of *Geocaryum pindicola* in some relevés indicates stabilized screes and very gravelly sites.

C. e-F. v. subass. *seslerietosum vaginalis* subass. nova hoc loco

(Holotypus: Table 2, rel. 36)

Relevés: Last 16 relevés in Table. 2, cluster 2

Constant species: *Festuca varia, Minuartia verna, Myosotis suaveolens, Pilosella cymosa* subsp. *sabina, Poa thessala, Sesleria vaginalis, Thymus boissieri*

Dominant species: *Sesleria vaginalis*

Alt.: 2220–2350 Asp.: – Slope: 15–30° C_{E1}: 50–65 % Sp.: 10–16 (13)

Grasslands with prevalence of *Sesleria vaginalis*. This association is also differentiated by the absence, or very rare occurrence, of the species of lower altitudes which are common in the subass. *typicum*.

Fig. 17 Stands of the *Cyano epirotae-Festucetum variae seslerietosum vaginalis*.

4.1.5 Elyno-Seslerietea

Pediculari graecae-Seslerietum tenerrimae ass. nova hoc loco

(Holotypus: Table 2, rel. 40)

Table 2, cluster 3

Number of relevés: 7

Diagnostic species: *Alchemilla plicatula, Botrychium lunaria, Carex kitaibeliana, Dactylorhiza viridis, Festuca alpina* s. l., *Galium anisophyllon, Pedicularis graeca, Saxifraga adscendens* subsp. *parnassica, S. marginata, S. paniculata, Sedum atratum, Sesleria tenerrima, Trifolium noricum*

Constant species: *Alchemilla plicatula, Armeria canescens, Campanula rotundifolia* s. l., *Carex kitaibeliana, Carum rupestre, Cerastium decalvans, Festuca alpina* s. l., *F. duriuscula* s. l., *Minuartia verna* s. l., *Myosotis suaveolens, Pedicularis graeca, Pilosella cymosa* subsp. *sabina, Poa thessala, Saxifraga adscendens* subsp. *parnassica, S. marginata, S. paniculata, Sedum atratum, Sesleria tenerrima, Thymus boissieri, Trifolium noricum*

Dominant species: *Sesleria tenerrima, Trifolium noricum*

Alt.: 2180–2580	Asp.: –	Slope: 30–45°	C_{E1}: 5–25 %	Sp.: 15–27 (24)

SM: Grasslands formed by tussocks of *Sesleria tenerrima* and locally also with high abundance of *Trifolium noricum*. Moss and lichen layer is also very well developed and its cover in the recorded relevés ranges between 10 and 50 %. *Cetraria islandica* is often a prevailing species.

Fig. 18; Stands of the *Pediculari graecae-Seslerietum tenerrimae* with *Trifolium noricum*.

Fig. 19; Steep north-facing slopes, a habitat of the *Pediculari graecae-Seslerietum tenerrimae*.

SE: It occurs on steep, wind exposed slopes under the main ridge of Mt. Nemërçkë. The soil is dark-brown, humus-rich, almost without gravel and usually about 20–30 cm deep. Habitat is microclimatically cool and even during the summer it does not suffer the drought as do communities of the class *Daphno-Festucetea* on sunny slopes.

TS: It successionally follows pioneer communities of the *Trifolio norici-Valerianetum epiroticae*. Similar habitats at lower altitudes support transitional vegetation types to the *Daphno-Festucetea*.

ST: Typical stands are lacking most of the species of the *Daphno-Festucetea*, whereas species of the *Elyno-Seslerietea* (cf. Mucina et al. 2016b) such as *Alchemilla plicatula, Galium anisophyllon, Saxifraga adscendens* subsp. *parnassica, S. paniculata*, *Sedum atratum, Trifolium noricum, Veronica aphylla* and others, occur frequently.

4.1.6 Trifolio anatolici-Polygonetea arenastri

Anthemido carpaticae-Alopecuretum gerardi ass. nova hoc loco

(Holotypus: Table 2, rel. 48)

Table 2, cluster 4

Number of relevés: 12

Diagnostic species: *Alopecurus gerardi, Carduus tmoleus, Herniaria parnassica, Phleum alpinum, Plantago atrata* subsp. *graeca, Scilla bifolia* s. l., *Scleranthus perennis* subsp. *marginatus, Trifolium parnassi*

Constant species: *Alopecurus gerardi*, *Anthemis cretica* subsp. *carpatica*, *Armeria canescens, Carduus tmoleus, Herniaria parnassica*, *Myosotis suaveolens*, *Phleum alpinum*, *Pilosella cymosa* subsp. *sabina, Plantago atrata* subsp. *graeca, Poa timoleontis, Ranunculus sartorianus,* *Scilla bifolia* s. l., *Taraxacum* sp., *Trifolium parnassi*, *Trinia glauca* subsp. *pindica*

Dominant species: *Alopecurus gerardi, Anthemis cretica* subsp. *carpatica, Armeria canescens, Plantago atrata* subsp. *graeca, Poa timoleontis, Ranunculus sartorianus, Viola epirota*

Alt.: 1900–2340	Asp.: –	Slope: 0–25°	C_{E1}: 25–95 %	Sp.: 15–28 (20)

SM: Plant communities formed of various colourfully flowering plants. After the snow melt, geophytes such as *Ornithogalum oligophyllum* and *Scilla bifolia* s. l., or often prevailing *Plantago atrata* subsp. *graeca*, bloom as first. Later, the other dominant species such as *Anthemis cretica* subsp. *carpatica, Armeria canescens, Poa timoleontis,* *Ranunculus sartorianus* and *Viola epirota* dominate the physiognomy of this habitat.

SE: Snowbed communities of karstic dolines, gentle slopes of wind-sheltered parts of ridges and various types of depressions, where snow remains until the summer months. Soils are usually deeper than 30 cm, loamy and often slightly leached.

TS: Transitional stands to grasslands with *Festuca varia* and scree vegetation may occur. Stands of the association *Saxifrago taygetei-Doronicetum columnae* are also related to snowbeds and occur usually very close to them.

Fig. 20; Colourful stands of the *Anthemido carpaticae-Alopecuretum gerardi* with flowering *Anthemis cretica* subsp. *carpatica* and *Armeria canescens*.

Fig. 21; Flowering *Scilla bifolia* s. l. and the first green leaves of *Alopecurus gerardi*.

ST: Various species may be dominant in this community, *Poa timoleontis* on rocky ground with shallow soil, *Plantago atrata* subsp. *graeca* in places with the longest duration of snow cover and *Viola epirota* in the meadow like communities where the snow melts relatively early. In general, however, the species composition remains the same.

From the already described snowbed communities, the *Alopecuro gerardi-Crocetum veluchensis* Quézel 1967 is the most similar, but *Crocus veluchensis* and other diagnostic species do not occur on Mt. Nemërçkë. Conversely, some species, e.g. *Anthemis cretica* subsp. *carpatica*, do not occur in relevés of the *Alopecuro gerardi-Crocetum veluchensis* (cf. Quézel 1967).

4.1.7 Mulgedio-Aconitetea

Alopecuro gerardi-Chenopodietum boni-henrici ass. nova hoc loco

(Holotypus: Table 5, rel. 6)

Table 5, cluster 1

Relevés from Mt. Nemërçkë: First 5 in Table 5, cluster 1

Diagnostic species: *Capsella bursa-pastoris*, *Chenopodium bonus-henricus*, *Soleanthus albanicus*, *Urtica dioica*

Constant species: *Capsella bursa-pastoris*, *Chenopodium bonus-henricus*, *Phleum alpinum*, *Ranunculus sartorianus*, *Scilla bifolia* s. l., *Soleanthus albanicus*, *Trifolium parnassi*, *Urtica dioica*

Dominant species: *Chenopodium bonus-henricus*, *Soleanthus albanicus*

Alt.: 1570–2110 Asp.: – Slope: 0–20° C_{E1}: 80–99 % Sp.: 9–17 (14)

SM: A two-layer community characterized by the occurrence of *Chenopodium bonus-henricus* and rarely also of *Rumex alpinus*. On Mt. Nemërçkë it is typical by the presence of endemic *Soleanthus albanicus*, which is often prevailing species in these stands. Interesting is an occurrence of *Rumex nepalensis* which grows here at the western margin of its distribution range (Strid 1986). Species of snowbed communities grow in lower herb layer.

SE: This community inhabits eutrophicated habitats of sheepfolds, watering places and areas under rock overhangs. Soils are variably deep, gravely and rich in nutrients.

ST, SC: Species composition of this community is locally different, but in general it is very similar in both mountain ranges. It is the only association which occurs on Mt. Nemërçkë and also on Mt. Smolikas.

Fig. 22; Stand of the *Alopecuro gerardi-Chenopodietum boni-henrici* with *Soleanthus albanicus*.

Fig. 23; Karstic doline with a watering pond, including a vegetation of snowbeds, ruderal vegetation at the pond, and grasslands in the surroundings.

4.2 Vegetation of Mt. Smolikas

4.2.1 Syntaxonomical overview

***ASPLENIETEA TRICHOMANIS* (Br.-Bl. in Meier et Br.-Bl. 1934) Oberd. 1977**

Potentilletalia speciosae Quézel 1964

- ***Galion degenii* Quézel 1967**
    - *Sileno pindicolae-Cardaminetum plumieri* Quézel 1967

***THLASPIETEA ROTUNDIFOLII* Br.-Bl. 1948**

Drypidetalia spinosae Quézel 1964

- ***Campanulion hawkinsianae* Quézel 1967**
    - *Violo albanicae-Alyssetum smolikani* Quézel 1967 nom. corr. hoc loco

Thlaspietalia rotundifolii Br.-Bl. in Br.-Bl. et Jenny 1926

Myosotido suaveoleontis-Saxifragetum taygetei ass. nova hoc loco

***DAPHNO-FESTUCETEA* Quézel 1964**

Daphno oleoidis-Festucetalia variae Quézel 1964

- ***Eryngio multifidi-Bromion fibrosi* Quézel 1964**
    - *Seslerio robustae-Bornmuelleretum baldacci* Quézel 1967 nom. corr. hoc loco
        - subass. *typicum* subass. nova hoc loco
        - subass. *arenarietosum serpentini* subass. nova hoc loco
        - subass. *daphnetosum oleoidis* subass. nova hoc loco
    - *Saturejo montanae-Stipetum rechingeri* ass. nova hoc loco
    - *Centaureo ptarmicifoliae-Festucetum duriusculae* ass. nova hoc loco

***ELYNO-SESLERIETEA* Br.-Bl. 1948**

Onobrychido-Seslerietalia Horvat 1960

Pediculari petiolaris-Caricetum macrolepis ass. nova hoc loco

***JUNCETEA TRIFIDI* Hadač in Klika et Hadač 1944**

Festucetalia spadiceae Barbero 1970

- ***Potentillo ternatae-Nardion* Simon 1958**
    - *Minuartio recurvae-Poetum violaceae* Quézel 1967
    - *Nardus stricta* community

***TRIFOLIO ANATOLICI-POLYGONETEA ARENASTRI* Quézel 1973**

Trifolietalia parnassi Quézel 1964

- ***Trifolion parnassi* Quézel 1964**
  - *Alopecuro gerardi-Gnaphalietum hoppeani* Quézel 1967
  - *Cerastio cerastoidis-Trifolietum parnassi* ass. nova hoc loco
  - *Ranunculo sartoriani-Caricetum kitaibelianae* ass. nova hoc loco

***MULGEDIO-ACONITETEA* Hadač et Klika in Klika et Hadač 1944**

Adenostyletalia alliariae Br.-Bl. 1930

- ***Cirsion appendiculati* Horvat et al. 1937**
  - *Rumex alpinus* community
- ***Rumicion alpini* Scharfetter 1938**
  - *Alopecuro gerardi-Chenopodietum boni-henrici* ass. nova hoc loco

***LITTORELLETEA UNIFLORAE* Br.-Bl. et Tx. ex Westhoff et al. 1946**

Littorelletalia uniflorae Koch ex Tx. 1937

- ***Littorellion uniflorae* Koch ex Klika 1935**
  - *Sparganium angustifolium* community

***MONTIO-CARDAMINETEA* Br.-Bl. et Tx. ex Klika et Hadač 1944**

Montio-Cardaminetalia Pawłowski et al. 1928

- ***Pinguiculo balcanicae-Cardaminion acris* Čarni et Matevski 2010**
  - *Sileno pusillae-Pinguiculetum hirtiflorae* ass. nova hoc loco
  - *Allium schoenoprasum* subsp. *alpinum* community

***SCHEUCHZERIO PALUSTRIS-CARICETEA FUSCAE* Tx. 1937**

Caricetalia fuscae Koch 1926

- ***Narthecion scardici* Horvat ex Lakušić 1968**
  - *Narthecio scardici-Caricetum kitaibelianae* ass. nova hoc loco
  - *Pinguiculo hirtiflorae-Soldanelletum pindicolae* Quézel 1967

4.2.2 Asplenietea trichomanis

Sileno pindicolae-Cardaminetum plumieri Quézel 1967

Silene pindicola-Cardamine plumieri-Ass. Quézel 1967 nom. orig.

Table 3, cluster 1

Number of relevés: 7

Diagnostic species: *Artemisia eriantha*, *Aubrieta gracilis* subsp. *glabrescens*, *Cardamine plumieri*, *Festuca alpina* s. l., *Potentilla speciosa*, *Saxifraga exarata*, *Saxifraga paniculata*, *Silene parnassica* subsp. *pindicola*

Constant species: *Artemisia eriantha*, *Aubrieta gracilis* subsp. *glabrescens*, *Cardamine plumieri*, *Festuca alpina* s. l., *Galium anisophyllon*, *Potentilla speciosa*, *Saxifraga exarata*, *Saxifraga paniculata*, *Silene parnassica* subsp. *pindicola*

Dominant species: –

Alt.: 2450–2635	Asp.: –	Slope: 55–80°	C_{E1}: 4–6 %	Sp.: 4–12 (10)

SM: Species-poor communities of rock chasmophytes of which *Artemisia eriantha* and *Potentilla speciosa* are the most abundant.

Fig. 24; Stands of the *Sileno pindicolae-Cardaminetum plumieri* with *Artemisia eriantha* and *Saxifraga exarata*.

SE: This vegetation occurs in rock crevices and on small terraces of rock faces, both north and south-facing, but it was recorded only at the highest altitudes of study area. Soil is developed only in rock fissures.

TS: Clearly differentiated community, with transitional stands to other vegetation types being very rare. In places species typical of rock walls are growing also on screes below them.

ST, SC: This association was described from Mt. Zygos and Mt. Smolikas. On Mt. Smolikas it is represented by the subass. *saxifragetosum exaratae* Quézel 1967. Except *Silene parnassica* subsp. *pindicola* and *Cardamine plumieri*, the subassociation *seselietosum pindici* Quézel 1967 from Mt. Zygos lacks all the species occurring in the Smolikas. The communities from Mt. Zygos grow at lower altitudes (1750–1950 m asl.). Therefore we can find more termophilous species there, for example *Asplenium trichomanes* and *Sedum dasyphyllum* (Quézel 1967).

ET: It is a typical habitat of *Aubrieta gracilis* subsp. *glabrescens*, which is endemic for Mt. Smolikas (Gustavson 1986).

4.2.3 Thlaspietea rotundifolii

***Violo albanicae-Alyssetum smolikani* Quézel 1967** nom. corr. hoc. loco.
Viola albanica-Alyssum scardicum-Ass. Quézel 1967 nom. orig.

Table 3, cluster 2

Number of relevés: 13

Diagnostic species: *Campanula hawkinsiana, Euphorbia herniariifolia, Poa cenisia, Rumex scutatus, Sedum album, Senecio doronicum, Valantia aprica, Viola albanica*

Constant species: *Alyssum smolikanum, Campanula hawkinsiana, Poa cenisia, Rumex scutatus, Sedum album*

Dominant species: *Senecio doronicum*

Alt.: 2180–2580	Asp.: –	Slope: 30–45°	C_{E1}:5–25 %	Sp.: 5–13 (9)

SM: Open vegetation of screes with prevalence of *Poa cenisia*, *Rumex scutatus* and *Campanula hawkinsiana*. At few localities also *Senecio doronicum* occurs, forming conspicuous clumps visible from a distance.

SE: This association inhabits dry, unstable or only partially stabilized screes composed of fine gravel, stones and even small boulders.

TS: On the north-facing slopes this vegetation often borders with the *Myosotido suaveoleontis-Saxifragetum taygetei*. On the stabilized screes of sunny slopes it transits to the *Seslerio robustae-Bornmuelleretum baldacci arenarietosum serpentini*.

ST: In the original description, Quézel (1967) mentions *Alyssum scardicum* as a diagnostic species, but *Alyssum smolikanum* is certainly the only species of this genus in the area which grows very frequently in this habitat. Therefore, I propose the name correction. We can distinguish two variants within this association: the more termophilous variant with *Euphorbia herniariifolia* and the variant with *Senecio doronicum* at higher altitudes on north-facing slopes.

Fig. 25; Stands of the *Violo albanicae-Alyssetum smolikani* with *Rumex scutatus* and *Poa cenisia*.

Fig. 26; *Campanula hawkinsiana*

Fig. 27; *Viola albanica*

Myosotido suaveoleontis-Saxifragetum taygetei ass. nova

(Holotypus: Table 3, rel. 22)

Table 3, cluster 3

Number of relevés: 7

Diagnostic species: *Doronicum columnae, Festuca varia, Galium anisophyllon, Myosotis suaveolens, Saxifraga taygetea, Sedum alpestre*

Constant species: *Alopecurus gerardi, Carduus tmoleus, Doronicum columnae, Galium anisophyllon, Myosotis suaveolens, Poa cenisia, Saxifraga taygetea, Sedum alpestre, Taraxacum* sp.

Dominant species: *Saxifraga taygetea*

Alt.: 2190–2480 Asp: NE–N–NW Slope: 10–30° C_{E1}:7–25 (–70) % Sp.: 9–17 (12)

SM: *Saxifraga taygetea* and other chionophilous, moisture demanding species of rocky habitats are the main components of this plant community.

Fig. 28; A stand of the *Myosotido suaveoleontis-Saxifragetum taygetei* with the name-giving species.

SE: The community at the sites of most durable snow beds that melt in the second half of July or even at the beginning of August. It occurs on fine gravely screes, but also partially stabilized screes consisting of bigger rocks and boulders. Soil is not developed or very shallow and gravely, occurring only under plant cushions.

TS: On stabilized screes with more developed soil this community transits to the snowbed communities of the alliance *Trifolion parnassi*, which follow in a succession series. On screes with a shorter period of snow cover it is replaced by stands of the association *Violo albanicae-Alyssetum smolikani*.

ST: Due to its chionophilous character, this distinctive community is missing almost all diagnostic species of the *Drypidetalia spinosae* and the *Campanulion hawkinsianae* (Horvat et al. 1974). Ecologically it is identical with the chionophilous communities belonging to the order *Thlaspietalia rotundifolii*.

The arctic-alpine *Oxyria digyna* and high-alpine *Geum reptans* are considered as relict species in this geographical area (Strid 1986). Their occurrence in this area also highlights the connection and ecological similarity with plant communities of the Central European mountains and the Arctic. These two species are most frequent on siliceous screes of the order *Androsacetalia vandelii* Br.-Bl. in Meier et Br.-Bl. 1934 corr. Bl.-Bl. 1948, but may occur also on calcareous screes in the Balkans (Horvat et al. 1974). Also, in the study area, they are rare and accompanied by species which grow also on limestones. For this reason, I suggest to classify this community within the order *Thlaspietalia rotundifolii*, but there is actually no suitable alliance for it.

SC: Rare but due to its habitat preferences easily traceable community. Similar stands could occur also in the highest mountains in southern Albania and northern Greece, for example in the Gramos and the Timfi ranges.

ET: For *Geum reptans*, the Smolikas is only the second known and new locality for Greece, the first already known one being in the Timfi Mts. (Strid 1986).

Fig. 29; *Oxyria digyna* and *Saxifraga taygetea* in the background.

Fig. 30; *Geum reptans*

***Seslerio robustae-Bornmuelleretum baldacci* Quézel 1967** nom. corr. hoc loco

Sesleria nitida-Bornmullera baldacci-Ass. Quézel 1967 nom. orig.

Table 4, cluster 4

Number of relevés: 22

Diagnostic species: *Festuca varia*, *Hieracium hoppeanum*

Constant species: *Alyssum smolikanum*, <u>*Bornmuellera baldaccii*</u>, <u>*Campanula rotundifolia* s. l.</u>, <u>*Daphne oleoides*</u>, <u>*Festuca varia*</u>, *Minuartia verna.* s. l., *Sesleria robusta*, <u>*Thymus praecox* subsp. *jankae*</u>

Dominant species: *Daphne oleoides*, *Festuca amethystina*, *Festuca varia*, *Juniperus communis* subsp. *nana*, *Sesleria robusta*

SM: Grasslands dominated by *Festuca varia*, *Sesleria robusta* and small cushion shrubs – *Daphne oleoides* and very rarely *Juniperus communis* subsp. *nana*.

SE: This is the most common vegetation type of Mt. Smolikas occurring in various habitats.

Fig. 31; Stands of the *Seslerio robustae-Bornmuelleretum baldacci typicum* on southern slopes of Mt. Smolikas. with its highest peak Smolikas on the top right.

ST: The subassociations listed below are clearly differentiated by their physiognomy, habitat preferences and dominant species in the field, however, they are very similar in species composition. Their diagnostic species, if any, have rather low fidelity to these subassociations. In general, this association is a basal community differentiated from the other grasslands on the basis of absence of diagnostic species that occur in other, more specific habitats. Only the communities above the timberline were studied both by me and Quézel (1967). However, *Festuca varia* dominated grasslands also occur in clearings in the zone of *Pinus heldreichii* forests, where they are enriched in more thermophilous species. Name was corrected because *Sesleria nitida* does not occur in the area.

Subassociations:

S. r.-B. b. subass. *typicum* subass. nova hoc loco

(Holotypus: Table 4, rel. 31)

Relevés: First 10 in Table 4, cluster 4

Constant species: *Bornmuellera baldaccii*, *Botrychium lunaria*, *Campanula rotundifolia* s. l., *Carex kitaibeliana, Cerastium banaticum, Daphne oleoides, Festuca amethystina*, *Festuca varia*, *Gentiana verna* subsp. *balcanica, Sesleria robusta, Silene vulgaris, Thymus praecox* subsp. *jankae*

Dominant species: *Festuca amethystina, Festuca varia, Sesleria robusta*

Alt.: 2065–2470 Asp: – Slope: 10–30° C_{E1}: 45–80 % Sp.: 12–31 (19)

This is the most widespread subassociation dominated by *Festuca varia*, and less frequently by *Sesleria robusta*. It occurs on various gentle or steeper slopes. Soils are gravely, stony, shallow or deeper than 30 cm. At cooler north-facing slopes and on deeper soils in higher altitudes, it is possible to find transitional types to the association *Pediculari petiolaris-Caricetum macrolepis.* At overgrazed localities, the herb layer often becomes sparse and these areas are threatened by erosion.

S. r.-B. b. subass. *arenarietosum serpentini* subass. nova hoc. loco

(Holotypus: Table 4, rel. 39)

Relevés: From 11 to 14 in Table 4, cluster 4

Constant species: <u>*Alyssum smolikanum*</u>, *Arenaria conferta* subsp. *serpentini, Campanula rotundifolia* s. l., *Cerastium banaticum*, <u>*Festuca varia*</u>, <u>*Sesleria robusta*</u>, *Thymus praecox* subsp. *jankae*

Dominant species: *Sesleria robusta*

Alt.: 2505–2610 Asp: S	Slope: 25–35°	C_{E1}: 35–55 %	Sp.: 8–16 (14)

Communities with dominance of *Sesleria robusta* accompanied by *Arenaria conferta* subsp. *serpentini* and *Viola albanica* which show the connection of this subassociation to the scree vegetation. The community is stabilizing gravely screes on convex slopes. It was only found in small areas at higher altitudes under the tops of Smolikas, Moasa and Nemercka peaks.

Fig. 32; Stands of the subass. *arenarietosum serpentini* with *Sesleria robusta* and open patches occupied by species of screes such as *Arenaria conferta* susbp. *serpentini* and *Viola albanica*.

***S. r.-B. b.* subass. *daphnetosum oleoidis* subass. nova hoc. loco**

(Holotypus: Table 4, rel. 45)

Relevés: Last 8 in Table 4, cluster 4

Constant species: *Alyssum smolikanum*, *Bornmuellera baldaccii*, *Campanula rotundifolia* s. l., *Daphne oleoides*, *Festuca varia*, *Hieracium hoppeanum*, *Jasione orbiculata*, *Juniperus communis* subsp. *nana*, *Lotus corniculatus*, *Minuartia verna*, *Poa thessala*, *Thymus praecox* subsp. *jankae*

Dominant species: *Daphne oleoides*, *Juniperus communis* subsp. *nana*

Alt.: 2190–2480 Asp: SE–S–SW Slope: 0–20 (–30)° C_{E1}: 30–90 (–70) % Sp.: 9–24(17)

Easily recognizable communities dominated by shrubs, especially by *Daphne oleoides* and rarely by *Juniperus communis* subsp. *nana*. Of the other species, only *Hieracium hoppeanum* shows slight affinity to these stands. This vegetation type most frequently occurs on small ridges of glacial moraines (consisting of stones and boulders) in glacial cirques or at any similar, but wind sheltered rocky convex landforms. Soils are rocky and shallow, 5–20 cm deep. As it often occurs in a contact with snowbed communities, the species as *Alopecurus gerardi*, *Jasione orbiculata* might be present occasionally.

Fig. 33; Stands of the subass. *daphnetosum oleoidis* with typical cushions of *Daphne oleoides*.

Saturejo montanae-Stipetum rechingeri **ass. nova hoc loco**

(Holotypus: Table 4, rel. 25)

Table 4, cluster 3

Number of relevés: 6

Diagnostic species: *Cytisus decumbens, Galium ophioliticum, Helianthemum nitidum, Koeleria lobata, Satureja montana, Sedum album, Stipa rechingeri, Teucrium montanum, Thymus teucrioides*

Constant species: *Alyssum smolikanum, Bornmuellera baldaccii, Campanula rotundifolia, Carex kitaibeliana, Daphne oleoides, Festuca varia, Sedum album, Sesleria robusta, Silene parnassica subsp. pindicola, Stipa rechingeri, Thymus praecox* subsp. *jankae, Thymus teucrioides*

Dominant species: *Stipa rechingeri*

Alt.: 2100–2335	Asp: SE–S–SW	Slope: 15–45°	C_{E1}: 25–40 %	Sp.: 12–23 (19)

SM: Open and during the bloom of dominant *Stipa rechingeri* easily identifiable community. It is also characteristic by the occurrence of *Sedum album* and xerophilous chamaephytes *Helianthemum nitidum, Satureja montana* and *Teucrium montanum*.

Fig. 34; Stands of the *Saturejo montanae-Stipetum rechingeri* on a steep rocky slope.

SE: Usually small-scale community of sunny and often also very rocky habitats – steep slopes, sharp ridges, rocks on the edge of glacial cirques and similar places. Soils are gravely, rocky and very shallow, usually only 5–10 cm deep.

ST: The most xerophilous grassland community of the alpine zone of Mt. Smolikas where it occurs at the upper limit of its altitudinal range. It might be more species-rich at lower altitudes in the zone of *Pinus heldreichii* forests.

Centaureo ptarmicifoliae-Festucetum duriusculae ass. nova hoc loco

(Holotypus: Table 4, rel. 14)

Table 4, cluster 2

Number of relevés: 9

Diagnostic species: *Alyssum scardicum*, *Arenaria conferta* subsp. *serpentini*, *Centaurea ptarmicifolia*, *Daphne oleoides*, *Dianthus haematocalyx* subsp. *pindicola*, *Festuca duriuscula* s. l., *Iberis aurosica*, *Paronychia albanica*, *Scorzonera austriaca*

Constant species: *Alyssum scardicum*, *Alyssum smolikanum*, *Arenaria conferta* subsp. *serpentini*, *Centaurea ptarmicifolia*, *Festuca duriuscula* s. l., *Iberis aurosica*, *Taraxacum* sp., *Thymus praecox* subsp. *jankae*

Dominant species: *Festuca duriuscula* s. l.

Alt.: 2230–2637 Asp: – Slope: 0–15° C_{E1}: 5–25 % Sp.: 8–14 (11)

SM: Communities formed of scattered firm tufts of *Festuca duriuscula* s. l., *Dianthus haematocalyx* subsp. *pindicola* and low herbs appressed closely to the surface such as *Centaurea ptarmicifolia* and *Alyssum scardicum*.

SE: It occurs on wind-exposed, convex or wide flat ridges. The most important factor forming the habitat is a strong wind and associated absence of or very thin snow cover during the winter. Soil is very specific, containing a 5–10 thick layer of gravel on the top and 5–15 cm thick loamy layer below it, which is either gravely or almost gravel-free. Beneath the loamy layer it is again very gravely and stony and soils are usually up to 20–30 cm deep in total.

TS: Pioneer community of gravely ridges. Presence of species such as *Arenaria conferta* subsp. *serpentini* and *Viola albanica* is a sign of close connection to the scree vegetation, although in this vegetation the gravelly substrate is stable. Lower under the ridge it transits to grasslands with *Festuca varia*, or occasionaly to other vegetation types.

ST: The association is homogeneous in its species composition, but in the most extreme places *Festuca duriuscula* s. l. is less abundant or even absent while *Centaurea ptarmicifolia* prevails. On the less extreme ridges the abundances of these two species are reversed.

Fig. 35; A flat ridge under the peak of Nemercka covered by the *Centaureo ptarmicifoliae-Festucetum duriusculae* s. l.

Fig. 36; A stand of *Festuca duriuscula* s. l.

Fig. 37; A stand of *Centaurea ptarmicifolia*.

4.2.5 Elyno-Seslerietea

Pediculari petiolaris-Caricetum macrolepis **ass. nova hoc loco**

(Holotypus: Table 4, rel. 2)

Table 4, cluster 1

Number of relevés: 10

Diagnostic species: *Anthyllis vulneraria, Armeria canesces, Botrychium lunaria, Carex macrolepis, Carum rupestre, Festuca amethystina, Galium anisophyllon, Gentiana verna* subsp. *balcanica, Gentianella bulgarica, Linum capitatum* subsp. *serrulatum*, *Pedicularis petiolaris, Podospermum roseum*, *Vaccinium myrtillus*

Constant species: *Armeria canescens*, *Botrychium lunaria*, *Campanula rotundifolia* s. l., *Carex kitaibeliana*, *Carex macrolepis*, *Carum rupestre*, *Cerastium banaticum*, *Euphrasia minima*, *Festuca amethystina,* *Galium anisophyllon*, *Gentiana verna* subsp. *balcanica*, *Juniperus communis* subsp. *nana*, *Linum capitatum* subsp. *serrulatum*, *Luzula spicata* subsp. *italica*, *Minuartia verna*, *Pedicularis petiolaris, Plantago media* subsp. *pindica*, *Silene vulgaris, Taraxacum* sp., *Thymus praecox* subsp. *jankae*

Dominant species: *Carex kitaibeliana*, *Carex macrolepis*, *Festuca amethystina*, *Vaccinium myrtillus*

Alt.: 2297–2600 Asp: NE–N–NW Slope: 10–40° C_{E1}: 60–90 % Sp.: 16–29 (21)

Fig. 38; Stands of the *Pediculari petiolaris-Caricetum macrolepis*.

SM: Grasslands with prevalence of low sedges and ocassionally also of *Vaccinium myrtillus*. In the flowering period, their physiognomy is characterized by colourful

Gentiana verna subsp. *balcanica*, *Linum capitatum* subsp. *serrulatum*, *Pedicularis petiolaris* and *Podospermum roseum*.

SE: This association inhabits gentle slopes of wide, inclined rock terraces, most frequently exposed to the north. The bedrock is solid, consequntly soils are not much gravely but loamy and humic, usually 15–50 cm deep.

TS: In similar habitats at lower altitudes or on more sunny slopes, transitional stands to the *Seslerio robustae-Bornmuelleretum baldacci* can be rarely found.

SC: Community with many high mountain (central European) species, now confined to the highest and coldest areas of the mountain range, occurring mostly on the northern side from the main ridge of Mt. Smolikas.

4.2.6 Juncetea trifidi

Minuartio recurvae-Poetum violaceae **Quézel 1967 nom. mut. prop. hoc loco.**

Poa violacea-Minuartia recurva-Ass. Quézel 1967 nom. orig.

Table 3, cluster 7

Number of relevés: 3

Diagnostic species: *Bellardiochloa violacea, Plantago holosteum*

Constant species: *Taraxacum* sp., *Bellardiochloa violacea*, *Plantago holosteum*, *Scleranthus perennis* subsp. *marginatus*, *Poa thessala*, *Nardus stricta*, *Minuartia verna* s. l., *Herniaria parnassica*, *Gentiana verna* subsp. *balcanica*, *Euphrasia minima*, *Dianthus deltoides* subsp. *degenii*, *Alopecurus gerardi*

Dominant species: *Plantago holosteum, Bellardiochloa violacea, Nardus stricta*

Alt.: 2140–2210 Asp: – Slope: 0° C_{E1}: 85–90 % Sp.: 5–17 (12)

SM: Grasslands with *Bellardiochloa violacea*, *Nardus stricta* and at very grazed sites also *Plantago holosteum*.

SE: These communities are strongly influenced and probably also partially conditioned by grazing. They inhabit flat saddles and ridges with deep (> 30 cm), loamy soil.

ST: My relevés do not contain some species, for example *Minuartia recurva*. The reason is that I only have relevés from the eastern part of the mountain range, whereas Quézel (1967) sampled the western (flysh) part. Nevertheless, ecology and main species of this community do not differ considerably between these two areas.

ET: Erosion caused by overgrazing is reducing the area of this community.

Fig. 39; Eroded stands of the *Minuartio recurvae-Poetum violaceae*.

Nardus stricta community

Table 3, cluster 8

Number of relevés: 4

Diagnostic species: *Festuca rubra* s. l., *Nardus stricta*

Constant species: *Nardus stricta*, *Trifolium parnassi*, *Taraxacum* sp., *Plantago media* subsp. *pindica*, *Festuca rubra* s. l.

Dominant species: *Nardus stricta*, *Trifolium parnassi*

Alt.: 2130–2440	Asp: –	Slope: 0–5°	C_{E1}: 85–100 %	Sp.: 9–12 (10)

SM: Usually monodominant stands of *Nardus stricta* accompanied by species of fens.

SE: This community occurs at terestrializing edges of mountain lakes and edges of springs. Soils are deeper than 30 cm, loamy.

TS: These stands occur in contact with fen communities of the alliance *Narthecion scardici* and snowbeds of the alliance *Trifolium parnassi*.

ST: Similar communities from the former Yugoslavia were classified within *Scheuchzeriopalustris-Caricetea fuscae* (Randelović et al. 1998). In Bulgaria, similar stands of the *Carici-Nardetum strictae* (Resm. 1984) Resm. et Pop 1986 were classified within *Potentillo ternatae-Nardion* by Velev et Apostolova (2009).

Fig. 40; Communities with *Nardus stricta* at the edge of a lake grazed by horses.

4.2.7 Trifolio anatolici-Polygonetea arenastri

Alopecuro gerardi-Gnaphalietum hoppeani Quézel 1967

Alopecurus gerardi-Gnaphalium hoppeanum-Ass. Quézel 1967 nom. orig.

Table 3, cluster 4

Number of relevés: 8

Diagnostic species: *Alopecurus gerardi, Armeria canescens, Bornmuellera baldaccii, Gentiana verna* subsp. *balcanica, Jasione orbiculata, Lotus corniculatus, Minuartia verna* s. l., *Plantago media* subsp. *pindica, Potentilla aurea* subsp. *chrysocraspeda, Ranunculus sartorianus, Scleranthus perennis* subsp. *marginatus, Thesium parnassi, Thlaspi epirotum, Trifolium parnassi, Trinia glauca* subsp. *pindica, Viola dukadjinica*

Constant species: *Alopecurus gerardi, Armeria canescens, Bornmuellera baldaccii, Campanula rotundifolia* s. l., *Jasione orbiculata, Lotus corniculatus, Minuartia verna* s. l., *Plantago media* subsp. *pindica, Poa thessala, Ranunculus sartorianus, Taraxacum* sp., *Trifolium parnassi, Trinia glauca* subsp. *pindica*

Dominant species: *Alopecurus gerardi, Bornmuellera baldaccii, Jasione orbiculata, Poa alpina, Ranunculus sartorianus, Trifolium parnassi*

Alt.: 2190–2455 Asp: – Slope: 5–25° C_{E1}: 15–80 % Sp.: 13–22 (18)

SM: Stands with open or very well developed herb layer. Dominant species is usually *Alopecurus gerardi*, less frequently *Bornmuellera baldaccii*, *Jasione orbiculata*, *Lotus corniculatus*, *Ranunculus sartorianus* and *Trifolium parnassi*. These species together with other richly flowering species make this habitat probably the most colourful on Mt. Smolikas.

SE: These communities occur on flat bottoms in glacial cirques, gentle slopes in depressions and similar habitats with long-lasting snow cover. Soils are well developed, often deeper than 30 cm, loamy, but also shallower, gravely and rocky in some places.

Fig. 41; Stands of the *Alopecuro gerardi-Gnaphalietum hoppeani* with flowering *Bornmuellera baldaccii* (white) and *Ranunculus sartorianus* (yellow).

TS: According to local conditions, there are transitions to other vegetation types including grasslands, screes, other two associations of snowbed communities and also to ruderal communities, which were originally snowbeds before eutrophication.

ST: Quézel (1967) described this association from Mt. Olympos and Mt.Smolikas Stands from Mt. Smolikas should belong to the subassociation *typicum* Quézel 1967. Both *Gnaphalium hoppeanum* and *G. supinum* are present in older relevés of Quézel (cf. Quézel 1967). I recorded and collected only *G. supinum* during my fieldwork, but the occurrence of *G. hoppeanum* is possible.

ET: This is a habitat of the rare plant species *Thlaspi epirotum* and *Viola dukadjinica*.

Cerastio cerastoidis-Trifolietum parnassi ass. nova hoc loco

(Holotypus: Table 3, rel. 37)

Table 3, cluster 5

Number of relevés: 2

Diagnostic species: *Cerastium cerastoides*, *Cerastium smolikanum*, *Poa macedonica*, *Trifolium parnassi*

Constant species: *Cerastium cerastoides*, *Poa alpina*, *Taraxacum* sp., *Trifolium parnassi*

Dominant species: *Bornmuellera baldaccii*, *Poa macedonica*

Alt.: 2380–2495	Asp: N	Slope: 0–5°	C_{E1}: 70–80 %	Sp.: 9

SM: Species-poor community of *Poa macedonica, Bornmuellera baldaccii, Cerastium cerastoides* and few other herbs of the alliance *Trifolion parnassi.*

SE: Most chionophilous snowbed community with snow melting at the end of July and later. Melt water supplies the habitat during the summer seasson. It also occurs at the rocky shores of the glacial lake Drakólimni tis Mósias east of Moasa (Mósia) peak. Soils are gravely, shallow and more humic comparing to the communities of the common *Alopecuro gerardi-Gnaphalietum hoppeani*.

SD: It borders with, and transits to communities of the *Alopecuro gerardi-Gnaphalietum hoppeani* or *Carex nigra* dominated fens of the *Pinguiculo hirtiflorae-Soldanelletum pindicolae.*

Fig. 42; *Cerastium cerastoides* and *Poa macedonica.*

Fig. 43; *Cerastium smolikanum*

Fig. 44; Stands of the *Cerastio cerastoidis-Trifolietum parnassi*.

Ranunculo sartoriani-Caricetum kitaibelianae **ass. nova hoc loco**

(Holotypus: Table 3, rel. 39)

Table 3, cluster 6

Number of relevés: 5

Diagnostic species: *Euphrasia minima, Jasione orbiculata, Leontodon hispidus, Plantago media* subsp. *pindica, Poa thessala, Ranunculus sartorianus, Rumex acetosa*

Constant species: *Alopecurus gerardi*, *Bornmuellera baldaccii*, *Carex kitaibeliana*, *Euphrasia minima*, *Jasione orbiculata*, *Leontodon hispidus*, *Lotus corniculatus*, *Luzula spicata* subsp. *italica*, *Minuartia verna*, *Plantago media* subsp. *pindica*, *Poa thessala*, *Ranunculus sartorianus*, *Taraxacum* sp., *Thymus praecox* subsp. *jankae*

Dominant species: *Carex kitaibeliana*

Alt.: 2180–2450 Asp: NE–N–NW Slope: 0–25° C_{E1}: 50–90 % Sp.: 10–21 (16)

SM: These are grasslands with prevalence of *Carex kitaibeliana*, usually with closed herb layer. *Plantago media* subsp. *pindica* and *Ranunculus sartorianus* also occur with higher cover values.

SE: This is the least chionophilous snowbed community occurring on flat bottoms and gentle slopes in glacial cirques. In addition to the shorter snow cover duration, the soil properties are also very important for the developement of this community. Soils are loamy, more humus-rich than in the other snowbed communities, and in the upper layer almost without gravel, in general 25–30 cm deep or deeper.

SD: It occurs in contact with communities of the *Alopecuro gerardi-Gnaphalietum hoppeani, Nardus stricta* comm. and *Seslerio robustae-Bornmuelleretum baldacci*.

ST: Presence of *Dianthus deltoides* subsp. *degenii*, *Euphrasia minima*, *Luzula spicata* subsp. *italica*, *Nardus stricta* and *Rumex acetosella* shows its close relation with communities of the class *Juncetea trifidi*. Species of the snowbeds are also present and occur with higher abundance than those of the *Juncetea trifidi*.

Fig. 45; Stands of the *Ranunculo sartoriani-Caricetum kitaibelianae*.

4.2.8 Mulgedio-Aconitetea

Rumex alpinus community

Relevé Sm94, full header data in Table 5B

E_1: *Rumex alpinus* 4, *Lamium garganicum* subsp. *pictum* 2b, *Cirsium appendiculatum* 2a, *Doronicum columnae* 2a, *Silene pusilla* 2a, *Agrostis gigantea* 2a, *Saxifraga taygetea* 1, *Campanula patula* +, *Soldanella pindicola* +, *Poa cenisia* +, *Senecio squalidus* subsp. *rupestris* +¸ *Silene vulgaris* +, *Veratrum* *album* +, *Artemisia eriantha* r, *Saxifraga paniculata* r

Alt.: 2235	Asp: W	Slope: 45°	C_{E1}: 90 %	Sp.: 14

SM: Tall-herb community characteristic by the occurrence of *Rumex alpinus, Cirsium appendiculatum* and *Veratrum album*. These species are accompanied by plants of wet screes and those fallen from the nearby rocks (*Artemisia eriantha*, *Saxifraga paniculata*).

SE: The only stand of this community was found under the rock overhang at permanently wet place with dropping water from above. Animals, such as a chamois observed during the visit of this locality, use the overhang as a shelter and cause local eutrophication.

Fig. 46; Stand of *Rumex alpinus* and *Cirsium appendiculatum*.

ST: Ecologically similar stands of the *Cirsio tymphei-Veratretum flavi* have been recorded by Quézel (1967) at water streams on Mt. Smolikas and other mountain ranges of the Pindos. I found *Cirsium tymphaeum* near Samarina village, where it grows both in wet places and drier habitats.

***Alopecuro gerardi-Chenopodietum boni-henrici* ass. nova hoc loco**

(Holotypus Table 5, rel. 6)

Table 5, cluster 1

Relevés from Mt. Smolikas: Last 2 in Table 5, cluster 1

Diagnostic species: *Arenaria serpyllifolia, Bornmuellera emarginata, Bromus riparius, Capsella bursa-pastoris, Herniaria parnassica, Chenopodium bonus-henricus, Phleum alpinum, Poa annua, Silene vulgaris, Trifolium parnassi, Trisetum flavescens, Urtica dioica*

Constant species: *Alopecurus gerardi, Alyssum smolikanum, Arenaria serpyllifolia, Capsella bursa-pastoris, Carduus tmoleus, Herniaria parnassica, Chenopodium bonus-henricus, Phleum alpinum, Silene vulgaris, Trifolium parnassi, Trisetum flavescens, Urtica dioica*

Dominant species: *Alopecurus gerardi, Carduus tmoleus, Chenopodium bonus-henricus, Phleum alpinum*

Alt.: 2070–2150	Asp: –	Slope: 5°	C_{E1}: 80–95 %	Sp.: 9–17 (12)

Fig. 47; A stand of the *Alopecuro gerardi-Chenopodietum boni-henrici*.

SM: Two-layer community with higher weeds such as *Carduus tmoleus and Chenopodium bonus-henricus* in the upper layer, *Alopecurus gerardi* and all the other species in the lower herb layer.

SE: Community of sheepfolds in valleys and depressions. It evolved from stands of the *Alopecuro gerardi-Gnaphalietum hoppeani* after their eutrophication.

ST: This is the only association which occurs in the both mountain ranges, Mt. Smolikas and Mt. Nemërçkë. Stands from Mt. Smolikas only differ by the absence of *Soleanthus albanicus* and presence of serpentinite species, *Alyssum smolikanum, Bornmuellera baldacii* and *B. emarginata*.

4.2.9 Littorelletea uniflorae

Sparganium angustifolium community

Relevé Sm 64, full header data in Table 5B

E_1: *Sparganium angustifolium* 5

Alt.: 2215	Asp: –	Slope: 0°	C_{E1}:90 %	Sp.: 1

Fig. 48; A dry lake with *Sparganium angustifolium*.

SM, SE: Monodominant community of a shallow lake in the glacial cirque east from the saddle between the peaks Moasa and Nemercka. The bottom of the lake is muddy, with water usually 25–30 cm deep, but during my visit the lake was already dry and grazed by the sheep and goats.

ET: In the mountains of northern Greece, *Sparganium angustifolium* reaches the southern border of its distribution range. Rare species classified as vulnerable (VU) in the Greek Red List (Phitos et al. 2009).

4.2.10 Montio-Cardaminetea

Sileno pusillae-Pinguiculetum hirtiflorae ass. nova hoc loco

(Holotypus: Table 5, rel. 16)

Table 5, cluster 4

Number of relevés: 2

Diagnostic species: *Soldanella pindicola, Silene pusilla, Pinguicula hirtiflora*

Constant species: *Soldanella pindicola, Silene pusilla, Pinguicula hirtiflora, Carex kitaibeliana*

Dominant species: -

Alt.: 2190–2455	Asp: N–E, –	Slope: 40–80°	C_{E1}:5–20 %	Sp.: 4–7

Fig. 49; Wet rock with a stand of the *Sileno pusillae-Pinguiculetum hirtiflorae*.

SM: Open spring communities with prevalence of *Pinguicula crystallina* subsp. *hirtiflora* or *Silene pusilla*. Moss layer may be missing but in some places it is well developed.

SE: Wet rocks at springs and streams.

SD: In some places this community may transit into the *Narthecio scardici-Caricetum kitaibelianae*, which also occurs on steep slopes and follows in successional series.

***Allium schoenoprasum* subsp. *alpinum* community**

Relevé Sm 30, full header data in Table 5B

E_1: *Allium schoenoprasum* subsp. *alpinum* 4, *Deschampsia cespitosa* 1, *Carex kitaibeliana* 1, *Ranunculus sartorianus* +

Alt.: 2200	Asp: NE, –	Slope: 17°	C_{E1}: 70 %	Sp.: 4

SM: Plant community with domince of *Allium schoenoprasum* subsp. *alpinum* and absence of fen species of the *Narthecion scardici*.

SE, ST: The relevé was recorded in a gravelly (stony) area of spring with barely developed soil. In the study area *Allium schoenoprasum* subsp. *alpinum* occurs also in communities with *Carex nigra* of the *Pinguiculo hirtiflorae-Soldanelletum pindicolae*.

Fig. 50; Spring with *Allium schoenoprasum* subsp. *alpinum*.

4.2.11 Scheuchzerio palustris-Caricetea fuscae

Narthecio scardici-Caricetum kitaibelianae ass. nova hoc loco

(Holotypus: Table 5, rel. 14)

Table 5, cluster 3

Number of relevés: 2

Constant species: *Plantago media* subsp. *pindica*, *Pinguicula hirtiflora*, *Narthecium scardicum*, *Carex lepidocarpa*, *Carex kitaibeliana*

Dominant species: *Carex kitaibeliana*

Alt.: 2280–2290	Asp: SE–E, –	Slope: 20–40°	C_{E1}: 65–70 %	Sp.: 7–12

SM: Communities characteristic by the occurrence of *Carex kitaibeliana* and *Narthecium scardicum. Carex nigra* is missing. Mosses cover up to 1 % of the plot area.

SE: This type of vegetation can be found on steep slopes near streams and springs. Soil is humic, organic, mixed with a significant amount of gravel and stones, but up to 30–45 cm deep.

ET: *Narthecium scardicum* is a rare species of Greece, occurring there on the southern edge of its range, growing only on Mt. Smolikas and the Mavrovouni Mts. (Strid et Kit Tan 1991).

Fig. 51; Spring vegetation of the *Narthecio scardici-Caricetum kitaibelianae* with *Narthecium scardicum* and *Carex lepidocarpa*.

Pinguiculo hirtiflorae-Soldanelletum pindicolae **Quézel 1967**

Pinguicula hirtiflora-Soldanella pindicola-Ass. Quézel 1967 nom. orig.

Table 5, cluster 2

Number of relevés: 5

Diagnostic species: *Carex nigra*, *Deschampsia cespitosa*, *Juncus alpinoarticulatus*

Constant species: *Carex nigra*, *Deschampsia cespitosa*, *Juncus alpinoarticulatus*

Dominant species: *Carex nigra*, *Allium schoenoprasum*

Alt.: 2130–2445	Asp: –	Slope: 0–10°	C_{E1}: 75–100 %	Sp.: 3–16 (9)

SM: Fens with prevalence of *Carex nigra* and *Bryum schleicherii*. Other species usually occur with low cover values.

SE: This community grows at springs and terrestrialized lakes. Soil is usually deeper than 30 cm, organic.

SD: After the change of water regime this vegetation changes to communities with *Nardus stricta*. At higher altitudes of glacial ciques its species composition is often also influenced by species dispersing from the snowbeds.

ST: Most of my relevés come from the terrestrialized edges of mountain lakes. Compared to the spring fens on gentle slopes, from where it was described by Quézel (1967), these stands are often very species-poor. Still they should be classified within this association because dianostic species usually occur in the surroundings.

Fig. 52; Stands of the *Pinguiculo hirtiflorae-Soldanelletum pindicolae* at mountain lake.

4.3 Notes on the classification and some high-rank syntaxa

The classification of the community types distinguised on Mt. Nemërçkë and Mt. Smolikas is based on a comparison of my field data with older studies and already described communities from the other parts of the Balkans (mostly Greece). I faced to several questions and problems which are discussed here.

All the studies from the nearby mountain ranges were led by Pierre Quézel and done about 50 years ago (Quézel 1964, 1967). His approach to vegetation study was partly different from current standards. His plots were usually larger, often about 200 m^2 and it seems in many cases they were not made in an ecologically homogeneous area, but in an area with as many species as possible. Larger plot area, even if homogeneous, can harbour more species in general. For this reason, many described communities seem to be a mix of species with different ecological requirements.

This is most striking in the scree communities. I recognized different types of scree vegetation according to the degree of its stabilization, presence of soil particles, humidity, duration of snow cover and size of the stone particles. Relevés of Quézel (1967) from the Timfi, the nearest limestone mountain range, comprise almost the same species, but occurring together in one relevé. Some of the scree communities such as the *Arrhenathero elatioris-Heracleetum pyrenaici* are very specific and clearly distinct, for the other I only use the rank of “community“ as further reasearch is needed. Better is the situation on Mt. Smolikas, where all the screes are very homogeneous, except chionophilous stands of the *Myosotido suaveoleontis-Saxifragetum taygetei*, which were not studied by Quézel (1967).

From the syntaxonomical point of view, all the high mountain scree communities of the southern Balkans, characterized by predominace of the Balkan chorotypes are traditionally classified within the order *Drypidetalia spinosae* (Dimopoulos et al. 1997). For the *Myosotido suaveoleontis-Saxifragetum taygetei* and the *Cardamine carnosa* comm. (chapters 4.1.3, 4.2.3), it would be more suitable to classify the most chionophilous scree vegetation types within the order *Thlaspietalia rotundifolii* because of their ecology and species composition. I still keep the *Cardamine carnosa* comm. within the *Drypidetalia spinosae* in my syntaxonomical synopsis because of the need of obtaining more data about this community. But the *Myosotido suaveolentis-*

Saxifragetum taygetei from Mt. Smolikas should for sure belong to the *Thlaspietalia rotundifolii* and I classify it within this class, although without classification into alliance for the time being. Chionophilous scree communities still need more research to understand their diversity in this geographical area.

Also in the vegetation of rock walls, the relevés recorded by Quézel (1967) contain a heterogenous misture of the species of wet shaded rocks and dry rocks. But it is not that meaningful as by the screes and the data are comparable. Also the stands of grasslands, snowbeds and other vegetation types are comparable with existing associations or specific enough to describe it as new.

Of the grasslands, the most interesting by its species composition are the stands of cooler habitats. The stands of the *Pediculari graecae-Seslerietum tenerrimae* from Mt. Nemërçkë are classified to the *Elyno-Seslerietea* according to their ecology and occurrence of many diagnostic species of the class. Besides my a priori subjective assignment to this class, it was supported also by the EuroVegChecklist Expert system (Mucina et al. 2016b). The communities of this class were not studied in Greece and southern Albania. The class *Elyno-Seslerietea* is not included in the most recent Greek vegetation lists (Dimopoulos et Georgiadis 1995, Papastergiadou et al. 1997). Redžić (2003) suggests that stands of this class occur in northern Greece and its highest mountains. According to older studies of Horvat (1960) and Micevski (1994), it should reach its southern limits in northern Greece and Macedonia. I suggest similar stands can occur on the north-facing slopes of the highest limestone mountains in Greece, however there is no suitable alliance described for this vegetation.

The same, and from the phytogeographical point of view also very interesting, is the *Pediculari petiolaris-Caricetum macrolepis* from Mt. Smolikas. According to EuroVegChecklist Expert system (Mucina et al. 2016b) it also belongs to the *Elyno-Seslerietea* as many species of this class, including the prevailing *Carex macrolepis,* occur in these stands. Species of the *Juncetea trifidi* are also present and this association has a transitional character between these two classes. Compared to the stands of the *Elyno-Seslerietea* from Mt. Nemërçkë it has very different species composition and should be probably classified into separate alliance in the future.

The class *Juncetea trifidi* also reaches the southern limit of its range in the mountains of Greece. Quézel (1969) described three associations of the *Poion violaceae* Horvat et al. 1937 from the Bela Voda Mts. at the border with the Republic of Macedonia and that is all from Greece for now (Dimopoulos et Georgiadis 1995). Also communities of the alliance *Potentillo ternatae-Nardion* belong to the same class, but are more widespread in Greece and occur also on Mt. Smolikas. It used to be classified within snowbed communities of the alliance *Trifolion parnassi* (Quézel 1967, Dimopoulos et Georgiadis 1995), but it was inappropriate, because it is not a snowbed vegetation. These communities are very similar to those occurring in Bulgaria classified within the *Potentillo ternatae-Nardion* (cf. Velev et Apostolova 2009).

Vegetation of the *Daphno-Festucetea* is developed across large areas in both mountain ranges and its most common types are also well explored comparing to the other vegetation types (cf. Dimopoulos 1993, Karagiannakidou et al. 2001, Maroulis 2003, Quézel 1964, 1967, Zafran 1990). Vegetation of the wind exposed ridges, for example the *Centaureo ptarmicifoliae-Festucetum duriusculae* could be interesting for further study. With its specific species composition and ecology it could belong to a new alliance.

Aquatic and wetland vegetation of the *Cirsion appendiculati* and the classes *Littorelletea uniflorae*, *Montio-Cardaminetea* and *Scheuchzerio palustris-Caricetea fuscae* also occurs on Mt. Smolikas. These communities are studied only partially and occur more frequently in lower altitudes below the timberline. All of these vegetation types are relatively species-poor, because they also occur at the southern limit of their range (cf. Čarni et Matevski 2010, Lakušić et al. 2015, Peterka et al. 2017).

Vegetation of ruderalized sites of the *Rumicion alpini* is very similar in both mountain ranges. Until now it was not studied in this geographical area. Similar communities were described from the Dinarides (cf. Redžić et al. 2011b), originally within the alliance *Chenopodion subalpinum* Br.-Bl., which is now synonymized with *Rumicion alpini* (Mucina et al. 2016a).

4.4 General differences between vegetation of Mt. Nemërçkë and Mt. Smolikas

Geological bedrock is importat factor influencing the vegetation and its species composition in many ways (Kruckeberg 2002). As shown in the previous chapters of this study, the vegetation on limestones of Mt. Nemërçkë and ophiolites of Mt.

Smolikas differs in its species composition on the level of associations and usually also on the level of alliances. Only the tall-forb vegetation of the class *Mulgedio-Aconitetea* is almost the same in both mountain ranges. This is also confirmed by DCA analysis of species composition (Fig. 53). The samples from Mt. Nemërçkë and Mt. Smolikas are divided into two separate groups except the *Mulgedio-Aconitetea* and scree vegetation of the *Thlaspietea rotundifolii*. Screes are often very species-poor and therefore they appear as outliers in the analyses, forming special and very variable group on their own.

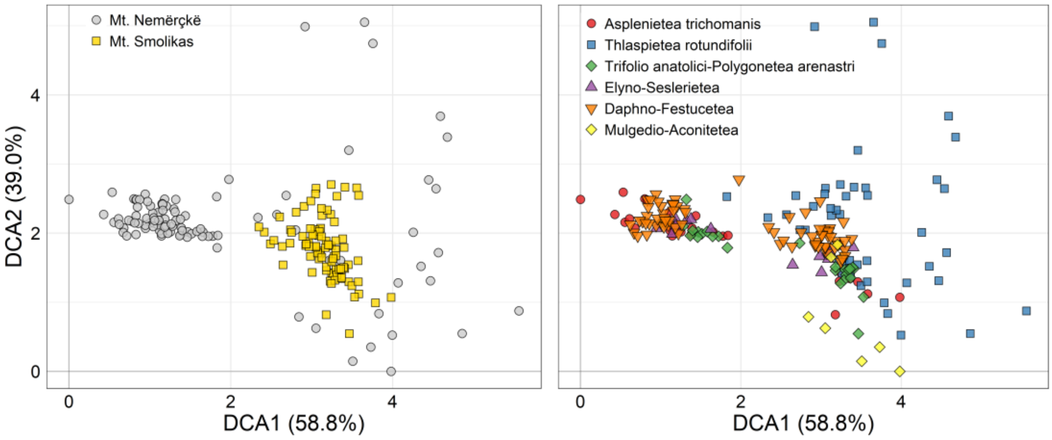


Fig. 53; DCA graphs showing differences between both mountain ranges and their plant community types.

4.5 Vegetation variability and the environment

Vegetation of the both mountain ranges varies in relation to landforms, slope orientation, substrate (soil) features, humidity of habitat, altitude and other factors. Landscape relief is usually the most determinant factor in both mountain ranges while other factors, some of them depending on landforms, influence the vegetation on finer scale. Rock vegetation is bound to rock walls, scree vegetation to screes beneath them, and grasslands to gentle or steeper slopes suitable for development of deeper soils. Special types of grasslands occur on wind-exposed convex ridges with shallow soils. Snowbeds occur in depressions and similar relief types where snow accumulates during the winter. Tall-forb and ruderal habitats, fen and spring communities are partially predicted by relief, but high accumulation of nutrients and water is essential for their development.

Internal variability of all these habitats in the studied mountain ranges is driven by other factors that are hidden at first sight and harder to understand. I describe them separately for every plant community in information about their ecology in previous chapters, giving a brief general summary here. Vegetation of rock walls varies mostly with altitude, slope aspect, steepness and habitat humidity. Variability of screes is also driven by altitude, slope orientation and habitat humidity, but also by snow cover duration and features of scree (stabilized vs. moving, fine vs. stony). Snowbed vegetation varies mostly according to snow cover duration (which is partially influenced by altitude), but also according to humidity and soil depth. For grasslands, as for a group with the most representative data (highest number of relevés), a separate DCA analysis with projected environmental gradients was performed. For Mt. Nemërçkë (Fig.54) it shows that the *Elyno-Seslerietea* is bound to steeper, less sunny slopes at higher altitudes and with deeper soils, it is also typical by higher cover of moss layer. In contrast, the *Daphno-Festucetea* occurs on sunny slopes and more stony soils with higher pH. Its pioneer types are linked to higher cover of bare rock and shallow soils. On Mt. Smolikas (Fig. 55) the main ecological gradients are the same as on Mt. Nemërçkë, although the *Elyno-Seslerietea* is not that clearly divided from some types of the *Daphno-Festucetea*. The *Centaureo ptarmicifoliae-Festucetum duriusculae* (DAP) shows its strong affinity to stony and sunny places with high pH.

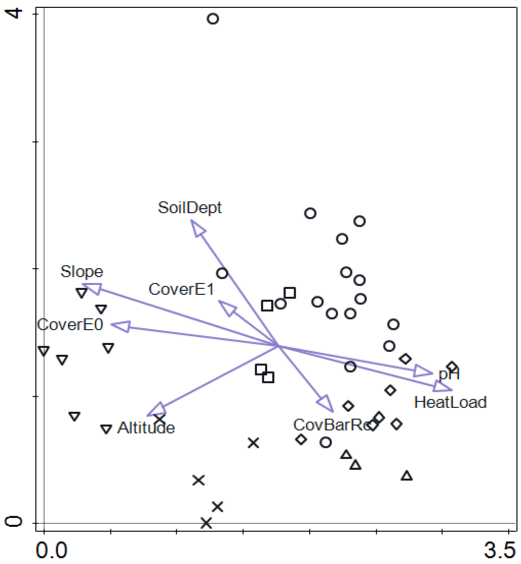


Fig. 54; Grasslands of Mt. Nemërçkë.

▽ – *Pediculari graecae-Seslerietum tenerrimae* (SES)
○ – *Cyano epirotae-Festucetum variae typicum* (DAP)
□ – *Cyano epirotae-Festucetum variae seslerietosum vaginalis* (DAP)
△ – *Edraiantho australis-Koelerietum lobatae typicum* (DAP)
◇ – *Edraiantho australis-Koelerietum lobatae astragaletosum angustifolii* (DAP)
× – *Edraiantho australis-Koelerietum lobatae trifolietosum norici* (DAP)

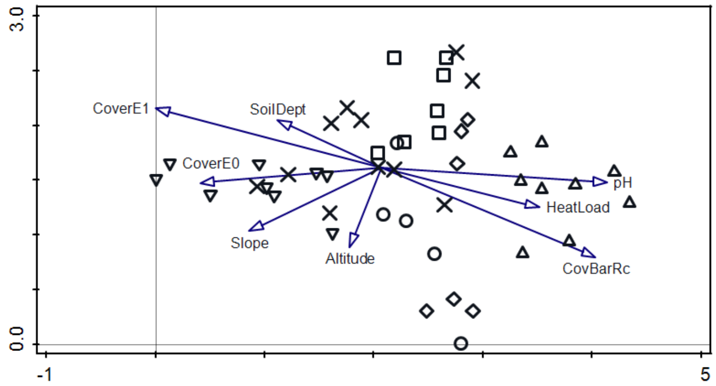


Fig. 55; Grasslands of Mt. Smolikas.
∇ – *Pediculari petiolaris-Caricetum macrolepis* (SES), ✕ – *Seslerio robustae-Bornmuelleretum baldacci typicum* (DAP), □ – *Seslerio robustae-Bornmuelleretum baldacci daphnetosum oleoidis* (DAP), ◯ –*Seslerio robustae-Bornmuelleretum baldacci arenarietosum serpentini* (DAP),◇ – *Saturejo montanae-Stipetum rechingeri* (DAP), Δ – *Centaureo ptarmicifoliae-Festucetum duriusculae* (DAP)

4.6 Species richness and the environment

Although bedrock is different in the two mountain ranges, species richness shows similar responses to the environment.

Influence of altitude: In the vegetation of rock crevices, grasslands and snowbeds, fine-scale species richness is negatively correlated with altitude (Fig. 56). In general, mountain ranges tend to be most species-rich at their medium altitudes (Vetaas et Grytnes 2002). The fact that species richness is higher in lower (medium) altitudes of both mountain ranges is in accordance with it.

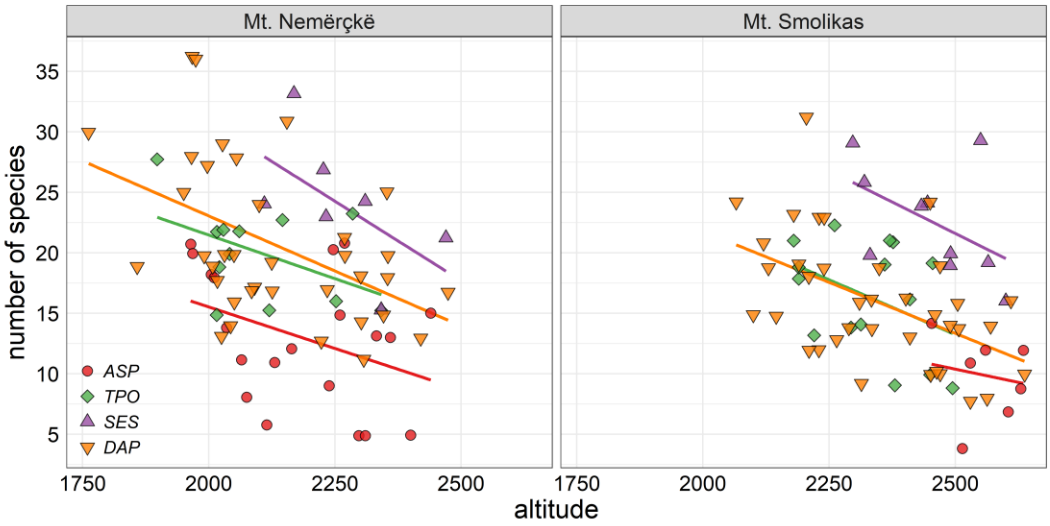


Fig. 56; Relation of altitude and fine-scale species richness.

Influence of pH: In temperate Europe, especially in forests, pH is usually positively correlated with species richness (Ewald 2003). The same pattern does not appear in the vegetation of Mt. Nemërçkë and Mt. Smolikas. Vegetation of Mt. Nemërçkë does not show any significant and reliable relation to pH (Fig. 57). On Mt. Nemërçkë, pH gradient is short and really acidic soils are not present. Minimum measured pH in samples from this mountain range was 5.86. In this type of habitats, species richness peak usually lies at pH 5.5–7.5 (Schuster et Diekmann 2003, Tyler 2003, Chytrý et al. 2007), so all the plots are in this peak zone. On Mt. Smolikas, pH goes below 5 (Fig. 58) and pH gradient is wider. However, also here pH does not have positive relationship with species richness. Actually, it is possible to see even negative relationship of pH and species richness, however the data are not really reliable. The reason is that the soils with higher pH are usually shallow and stony. Highest pH was recorded in scree and rock vegetation which is generally poor due to different reasons and cannot be directly compared with other vegetation types. Anyway, we can see negative relation of pH and species richness even within grasslands of the *Daphno-Festucetea* which are represented by highest number of samples. One of the reasons could be that vegetation of grasslands occurring in more stony places with shallower soils suffers stronger drought stress during the dry summer. Drought has negative influence on species richness and supresses influence of pH (Chytrý et al. 2007, Palpurina et al. 2017).

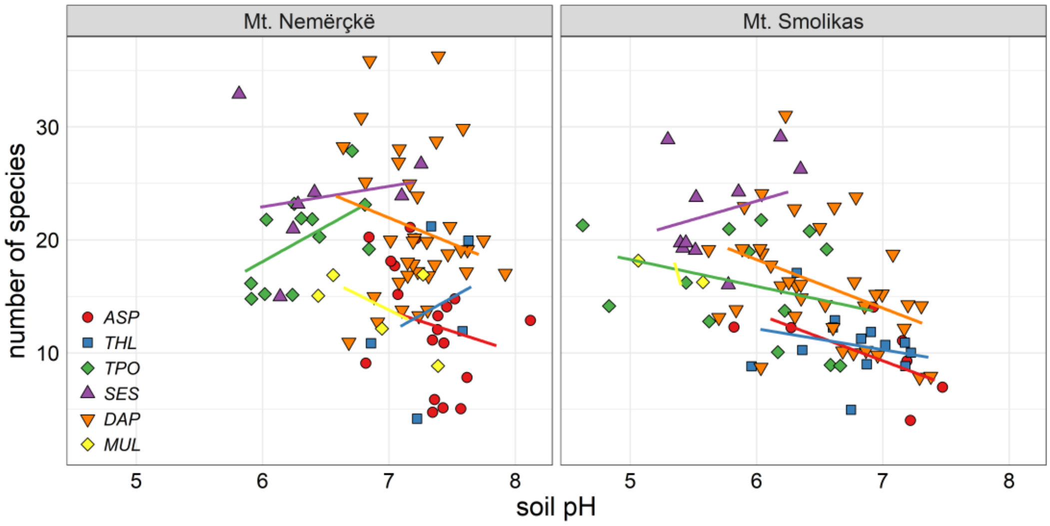


Fig. 57; Relation of pH and fine scale species richness within vegetation classes.

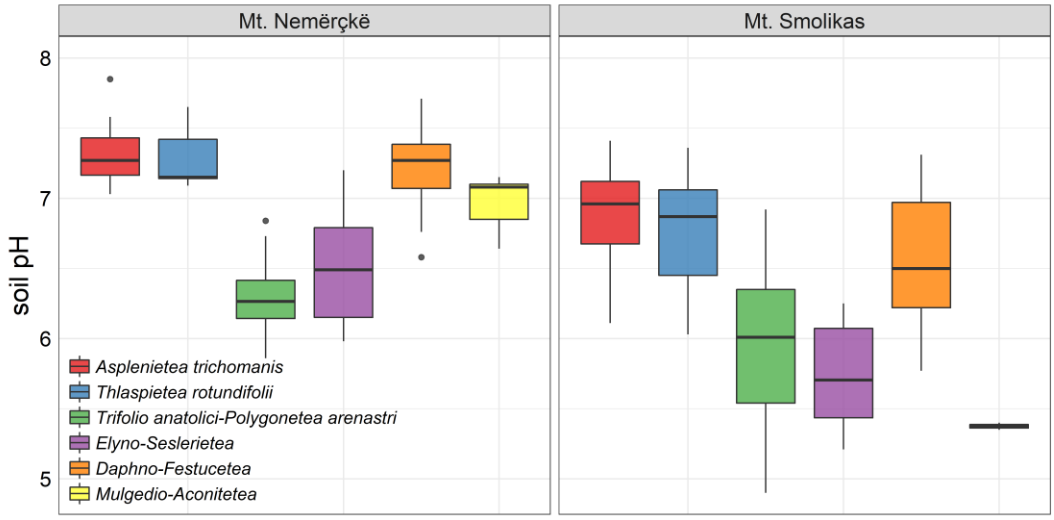


Fig. 58; Boxplots for soil pH in each vegetation class.

Influence of bare rock cover: Another factor partially influencing fine-scale species richness is cover of bare rock, or its complement variable, cover of herb layer. Fig. 59 shows that scree vegetation becames more species-rich if it has lower cover of bare rock. Consequently it has a higher cover of herb layer, more individuals and more species withing the plot. It is known that species richness of mountain scree vegetation grows with cover of herb layer until some point (Rejmánek et al. 2004). Negative relationship between species richness and cover of bare rock can be seen also in the *Daphno-Festucetea*. In other vegetation types, influence of bare rock cover is less significant and shown correlations (Tab. 9) might be the reason of low number of relevés within groups. It is possible to see the tendency that snowbeds in rocky places on Mt. Nemërçkë can be less species-rich comparing to those on less rocky places. In contrast snowbeds on Mt. Smolikas with higher cover of bare rock can be more species-rich, probably because of higher heterogeneity within plot area comparing to the plots without stones.

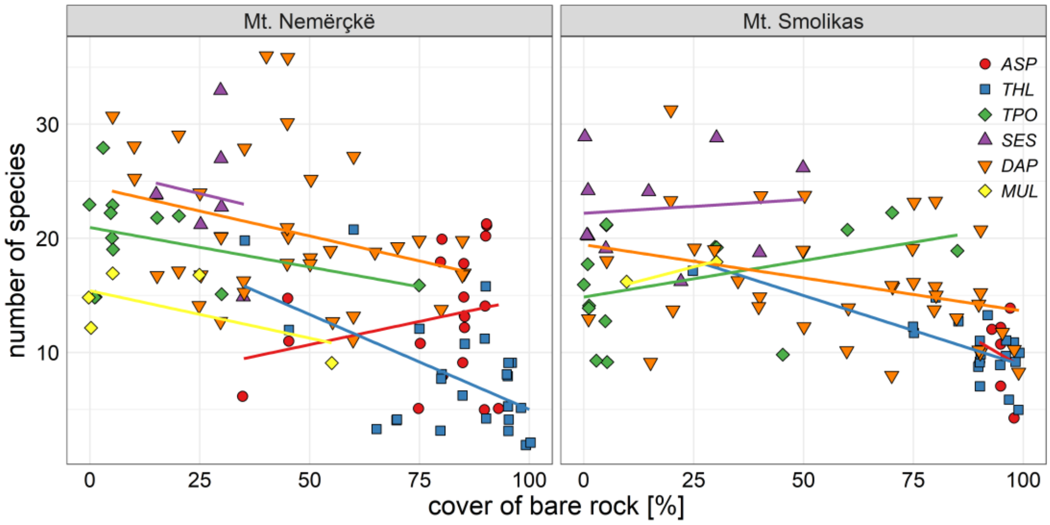


Fig. 59; Relation of bare rock cover and fine-scale species richness within classes.

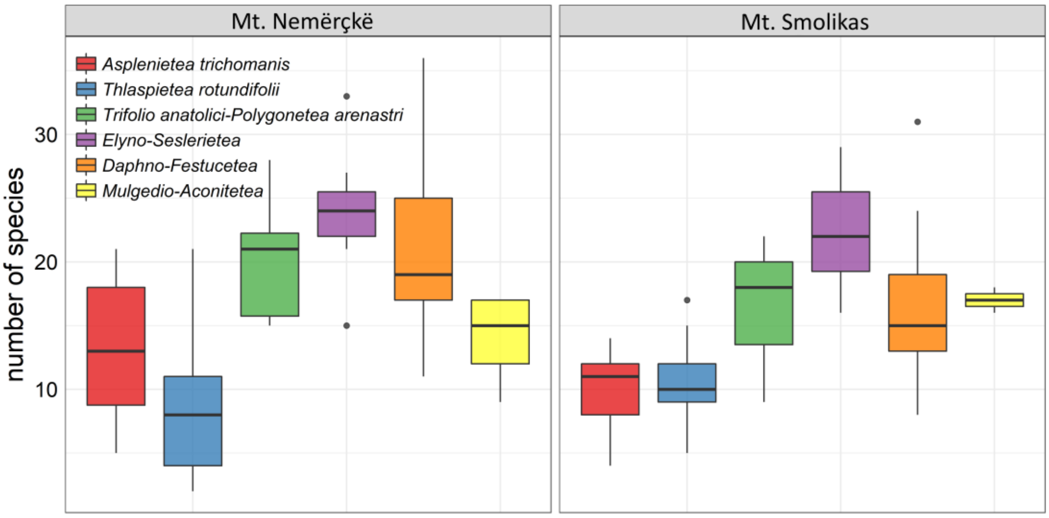


Fig. 60; Fine-scale species richness per classes.

Comparison of habitats and their fine scale species richness in general: The most species-poor communies (*Asplenietea trichomanis*, *Thlaspietea rotundifolii*) occur in rocky (stony) habitats with shallow soils, high cover of bare rock and resulting ecological stress, low productivity, low cover values of herb layer and lower number of individuals per plot which belong to factors influencing species richness negatively (Tilman et Pacala 1993, Grace 1999). Grassland habitats (*Elyno-Seslerietea*, *Daphno-Festucetea*) and snowbeds (*Trifolio anatolici-Polygonetea arenastri*) have higher fine-scale species richness (Fig. 60). On average, the class *Elyno-Seslerietea* is the most species-rich of all. However, these communities usually occur in the highest elevated and coolest habitats, hosting a wide spectrum of species. They occur on north-facing slopes which are not so much affected by summer drought as the habitats of the *Daphno-Festucetea*. Soils are relatively deep and humus-rich, their average pH is 5.7 on Mt. Smolikas and 6.5 on Mt. Nemërçkë (Fig. 58). These values are lower than in samples of the *Daphno-Festucetea*, but the soil is still not very acidic. Also, grasslands of the *Elyno-Seslerietea* occur on steep slopes with rock outcrops and pH is most probably more variable within the plot area. For all these reasons, habitats of the *Elyno-Seslerietea* offer suitable place for relatively mesophilous high-mountain species (often occurring also in mountain ranges of central Europe), species of rock outcrops, acidophillous species and basiphilous species, all of them occcurring together in the same plot, which leads to their high species richness. The *Daphno-Festucetea*, the most widespread plant communities in both mountain ranges are the best model vegetation type of altitude and species richness. The most species-rich relevés (of the dataset in total) with 36 and 37 species were recorded at altitudes below 2000 m a. s. l. on Mt. Nemërçkë, while the species-poor (subass. *seslerietosum vaginalis*) with only 13 species on average occurs at the highest altitudes of this mountain range. The class *Daphno-Festucetea* includes also pioneer vegetation types (*Edraiantho australis-Koelerietum lobatae*, *Saturejo montanae-Stipetum rechingeri* and *Centaureo ptarmicifoliae-Festucetum duriusculae*), which are less species-rich and with lower cover values of herb layer. After their exclusion, average species richness for this class slightly increases, but it still remains lower than in the *Elyno-Seslerietea* (Tab. 8).

Table 8, Average fine-scale species richness within the *Daphno-Festucetea* with and without its pioneer vegetation types.

	Without pioneer types	With pioneer types
Mt. Nemërçkë	23	20.8
Mt. Smolikas	17.4	16

4.7 Species richness and habitat diversity

Rarefaction curves (Fig. 61) for the *Daphno-Festucetea* and *Elyno-Seslerietea* are very similar in both mountain ranges, the only difference being that communities on Mt. Nemërçkë are slightly more species-rich in general. These classes also have the same number of lower syntaxonomical units (associations, subassociations) in both mountain ranges. The class *Trifolio anatolici-Polygonetea arenastri* is represented by three associations on Mt. Smolikas and one on Mt. Nemërçkë (Tab. 7), however it seems to be more species-rich on Mt. Nemërçkë. Number of syntaxonomical units within the class is, to some extent, a measure of its internal variability. Communities of the classes *Asplenietea trichomanis* and *Thlaspietea rotundifolii* differ considerably between Mt. Nemërçkë and Mt. Smolikas. Rock vegetation of the *Asplenietea trichomanis* is rare on Mt. Smolikas. Suitable rock walls with fissures and terraces are not very frequent and they are a habitat of only one association with homogeneous species composition (Tab. 3). In contrast the limestone rock walls offer much better conditions for development of rock fissure vegetation. On Mt. Nemërçkë, the vegetation of rock crevices has higher fine-scale species richness, higher number of syntaxonomical units and also higher total number of species occurring in this habitat. According to my field observations, this should be true, but the number of relevés from both mountain ranges is not the same. From this point of view, vegetation of the class *Thlaspietea rotundifolii* looks also very similar. It is represented by higher number of syntaxonomical units and it has higher total species richness on Mt. Nemërçkë than on Mt. Smolikas. However, relevés from Mt. Smolikas have higher average fine-scale species richness. Number of relevés from both mountain ranges is similar and I think they catch most of the variability of scree vegetation in both mountain ranges. If going to lower altitudes, variability would be even much higher on Mt. Nemërçkë, but only slightly higher on Mt. Smolikas. According to these facts, we can say that limestones have more variable scree and rock vegetation and most probably also higher number of scree and rock species comparing to ultramafic rocks. Of course, to confirm it for sure, further research is necessary.

In the sum, the dataset from Mt. Nemërçkë contains 105 plots, 17 communities from 6 classes with 189 species (taxa) of vascular plants in total. The dataset of Mt. Smolikas contains 21 communities from 10 classes with 176 species (taxa) of vascular plants. Although Mt. Smolikas has higher number of different communities and aquatic, spring and fen habitats in addition, it has lower number of recorded species in total.

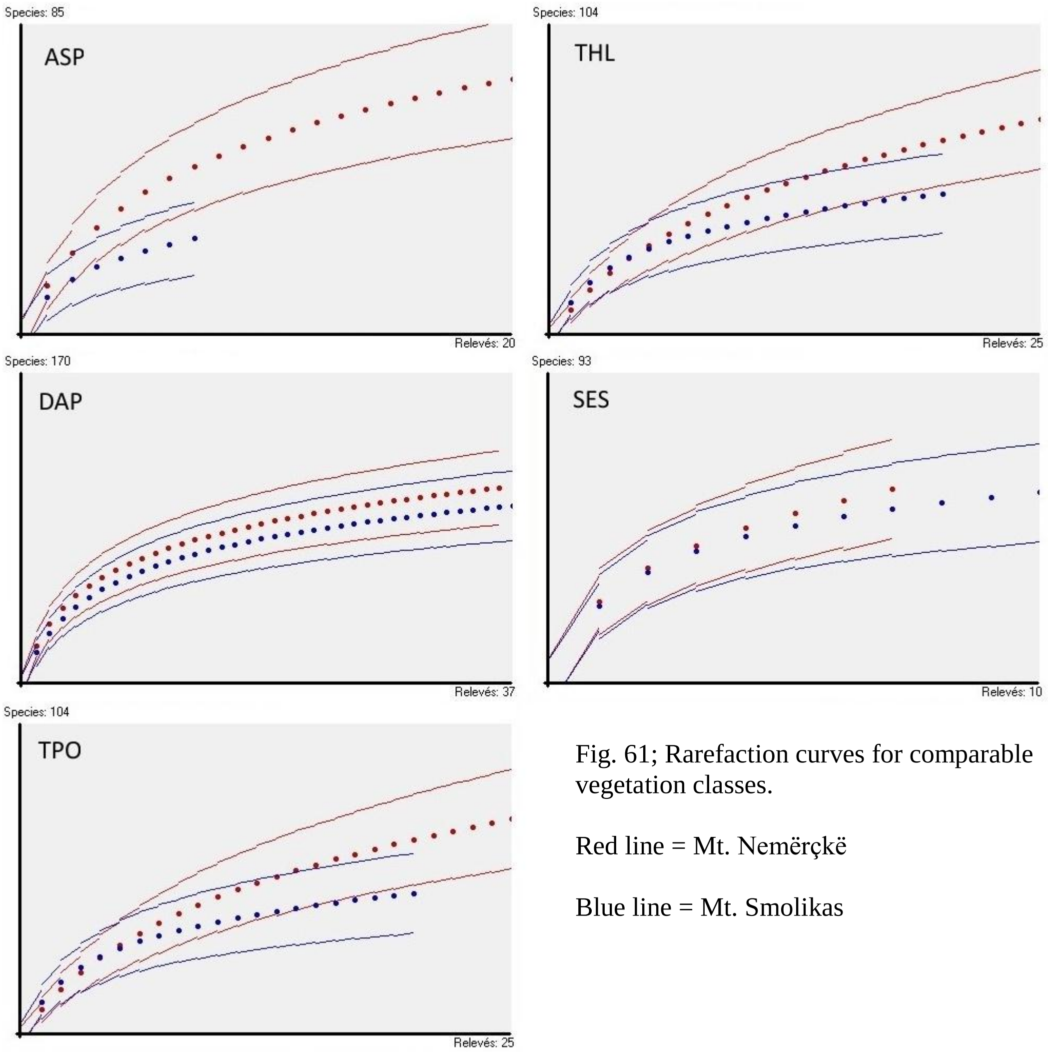


Fig. 61; Rarefaction curves for comparable vegetation classes.

Red line = Mt. Nemërçkë

Blue line = Mt. Smolikas

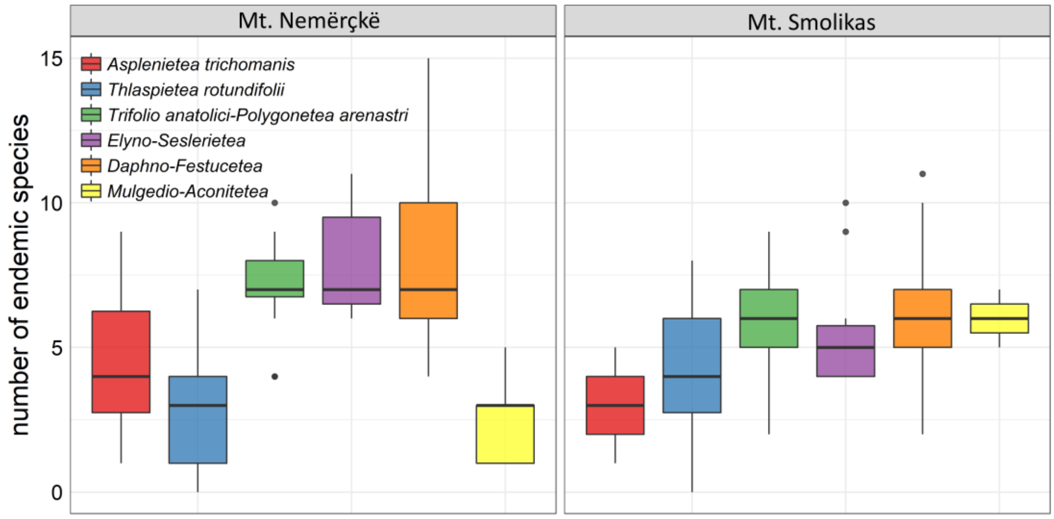


Fig. 62, Number of endemics per plot per vegetation classes.

4.8 Endemism

Endemism ratio is very similar in both mountain ranges (Tab. 7). Although ultramafic ranges are famous of their high endemism (Stevanović et al. 2003), limestone mountain ranges of the Balkans also have many endemic species, although with different distribution ranges. Endemism and its richness was studied by many scientists (cf. Hobohm 2014). The most important and generally applicable factors influencing endemism are isolation and altitude. Total number of endemic species grows with altitude until the vegetation is not getting poor in the alpine belt due to ecological stress and other factors (mid-domain effect). For this reason, highest total number of endemic species occurs at the medium altitudes of high mountains (with developed alpine zone or its equivalent). Endemism ratio (number of endemics divided by the number of all species) grows up to the highest altitudes of mountains (Vetaas et Grytnes 2002). My data does not cover the whole altitudinal gradient of the selected mountian ranges, but only their vegetation above the timberline. For this reason, number of endemic species grows with growing species diversity down to the medium altitudes. Endemism ratio does not show correlation with altitude and is approximately constant across the altitudinal gradient. Also, number of endemic species per plot does not show strong correlation with any of measured environmental data (Tab. 9), only with altitude (species richness).

There are small differences of endemism ratio between the vegetation classes. The class *Elyno-Seslerietea* has quite low average endemism ratio comparing to other classes because of the occurrence of many species with wider distributional ranges covering also areas out of the Balkans. Anyway, number of endemic species per plot is still high as these communities are on average the most species-rich (Fig. 62). The class *Daphno-Festucetea* as a typical vegetation unit of the southern Balkans has a higher endemism ratio, one of the highest of all the classes (Tab. 7). Number of endemic species per plot in this class is the highest of all the classes (Fig. 62, Tab. 7). The vegetation of the class *Thlaspietea rotundifolii* has also high endemism ratio, mostly on Mt. Smolikas (Tab. 7). Rock vegetation of the *Asplenietea trichomanis*, which has high endemic ratio on Mt. Nemërçkë, is relatively poor in endemic species on Mt. Smolikas. As in case of the *Elyno-Seslerietea*, many of its species occur also in the mountains outside the Balkans.

Comparing to Mt. Nemërçkë, more stenoendemic species are present per plot on Mt. Smolikas (Tab. 7). It is caused by higher number of stenoendemic species on ultramafic rocks in general (Stevanović et al. 2003).

Table 7

	Avg. No. Sp. per plot per group		Total No. Sp. per group		Avg. No. endemics per plot per group		Avg. No. stenoendemics per plot per group		Avg. endemism ration per plot per group in percents		No. syntax. units per group		Number of relevés per group	
	Sm	N	Sm	N	Sm	N	Sm	N	Sm	N	Sm	N	Sm	N
ASP	9.86	**13.5**	26	**72**	3	4.75	1	0.2	29	**37**	1	**3**	7	20
THL	**10.4**	7.92	47	**72**	4.2	2.7	0.85	0	**42**	**36**	2	**6**	20	25
TPO	16.3	**20.1**	57	63	5.65	7.1	1.2	0.08	35	35	**3**	1	15	12
SES	22.6	25.3	57	60	5.6	8	1	0	25	33	1	1	10	7
DAP	16	**20.8**	97	111	6.4	7.95	1.6	0	**42**	**39**	5	5	37	36
MUL	17	14.2	22	37	6	2.6	1.5	0.8	**35**	18	1	1	2	5

5 Conclusions

The main part of this study is focused on classification and description of plant community types in both mountain ranges. Information about already known plant communities was completed and several new syntaxa were described. This information enriched the poor knowledge about the mountain plant communities in the area and can be used for further study. Besides describing new associations, I consider information about the occurrence of communities of the class *Elyno-Seslerietea* in the highest mountain ranges of northern Greece and southern Albania as the most interesting result of this study. In my opinion, also the chionophilous communities of the class *Thlaspietea rotundifolii* need further study in this geographical area and I assume that it should be probably partially classified within the order the *Thlaspietalia rotundifolii* rather than *Drypidetalia spinosae*.

Analysis of the data also brought information about the patterns of vegetation and environment.

1) Fine-scale species richness of alpine vegetation in both mountain ranges is higher at lower altitudes what is in accordance with the fact that medium altitudes of mountains are usually the most species-rich (Vetaas et Grytnes 2002).
2) Fine-scale species richness does not increase with pH in selected vegetation

types. On Mt. Nemërçkë, pH seems to be almost irrelevant factor for species richness. On Mt. Smolikas, negative influence of cover of bare rock (stoniness) on species richness is much stronger than pH, which increases with stoniness.

3) Number of endemics increases with species richness. This is in accordance with Vetaas et Grytnes (2002). Endemism ratio does not show relation to species richness or altitudinal gradient, most probably because the gradient is not wide enough and the data include only relevés of non-forest alpine vegetation above the timberline.
4) Number of endemics and endemism ratio is similar on limestones of Mt. Nemërçkë and ophiolites of Mt. Smolikas. The only difference is that Mt. Smolikas has a higher number of stenoendemic species.
5) Vegetation of screes and rock crevices is more diverse on limestones of Mt. Nemërçkë comparing to ophiolites of Mt. Smolikas, both in number of different plant communities and species.
6) Higher number of different habitats occurs on the ophiolites of Mt. Smolikas because of the presence of aquatic, fen and spring plant communities. Occurrence of this wetland habitats is not supported by limestone bedrock in this geograpical area (cf. Peterka et al. 2017).

6. References

Anacker, B. L. 2011. Phylogenetic patterns of endemism and diversity. In: Harrison, S. P. et Rajakaruna, N. (eds). Serpentine: The evolution and ecology of a model system. University of California Press, Berkeley, California, USA. 49–70 pp.

Anacker, B. L. 2014. The nature of serpentine endemism. American Journal of Botany 101:219–224.

Baldacci, A. 1894. Rivistacritica della collezionebotanica fatta nel 1892 in Albania. Malphigia.

Baldacci, A. 1900. Itinerari Albanesi. Boll. Soc. Geogr. It. Seria IV/1: 378-409.

Barkman, J. J., Doing, H. et Segal, S. 1964. Kritische Bemerkungen und Vorschläge zur quantitativen Vegetationsanalyse. Acta Bot. Neerl. 13: 394–419.

Brady, K. U., Kruckeberg, A. R. et Bradshaw, H. D. 2005. Evolutionary ecology of plant adaptation to serpentine soils. Annu. Rev. Ecol. Evol. Syst. 36: 243–266.

Braun-Blanquet, J. 1964. Pflanzensoziologie. Grundzüge der Vegetationskunde. 3. Aufl. Springer Verlag, Wien. 866 pp.

Brooks, R. R. 1987. Serpentine and its vegetation: a multidisciplinary approach. Dioscorides Press, Portland, Oregon, USA. 462 pp.

Buzo, K. 1990. Bimesia e livadheve dhe kullotave natyrore te Shqiperise. Sh.B.L.U., Tirana. 176 pp.

Čarni, A. et Matevski, V. 2010. Vegetation along mountain streams in the southern part of the Republic of Macedonia. Braun-Blanquetia 46: 157–170.

Chytrý, M., Danihelka, J., Ermakov, N. et al. 2007. Plant species richness in continental southern Siberia: effects of pH and climate in the context of the species pool hypothesis. Global Ecology and Biogeography 16: 668–678.

Colwell, R. K., Mao, C. X. et Chang, J. 2004. Interpolating, extrapolating, and comparing incidence-based species accumulation curves. Ecology 85: 2717–2727.

Constantinidis, T., Bareka, E, P., Kamari, G. 2002. Karyotaxonomy of Greek serpentine angiosperms. Bot. J. Linn. Soc. 139: 109–124.

Dimopoulos, P. 1993. Chloristiki ke fitokoinoniologiki erevna tou orous Killini. Ikologiki prosengisi (Floristic and phytosociological research of Mount Killini - an ecological approach). Ph.D. Thesis, Depon. in University of Patras, Patras. 141 pp.

Dimopoulos, P., et Georgiadis, T. 1995. Present state of the phytosociological research on the Greek mountains, syntaxonomy and future perspectives. Ann. Bot. 53: 119–133.

Dimopoulos, P., Sýkora, K., Mucina, L. et Georgiadis, T. 1997. The high-rank syntaxa of the rock-cliff and scree vegetation of the Mainland Greece and Crete. Folia Geobot. 32: 313–334.

Dring, J., Hoda, P., Mersinllari, M., et al. 2002. Vegetation of Albania – Preliminary overview. Annali di Botanica II: 7-30.

Ewald, J. 2003. The calcareous riddle: Why are there so many calciphilous species in the Central European flora? – Folia Geobot. 38: 357–366.

Fotiadi, A. K., Metaxas, D. A. et Bartzokas, A. 1999. A statistical study of precipitation in northwest Greece. International Journal of Climatology 19: 1221–1232.

Frey, W. et Lösh, R. 1998. Lehrbuch der Geobotanik. Pflanze und vegetation in Raum und Zeit. Gustav Fisher Verlag, Stuttgart. 436 pp.

Furlan, D. 1977. The Climate of Southeast Europe. In Wallen, C. C. (ed.). Climates of Central and Southeastern Europe. Elsevier, Amsterdam. 185–223 pp.

Georgiadis, T. et Dimopoulos, P. 1993. Etude de la vegetation supraforestierre du Mont Killini (NE Peloponnisos, Greece). Bot. Helv. 103: 149–175.

Grace, J. B. 1999. The factors controlling species density in herbaceous plant communities: an assessment. Perspect. Plant Ecol. Evol. Syst. 2: 1–28.

Griffith, H. I., Kryštufek, B. et Reed, J. M. 2004. Balkan biodiversity: pattern and process in the European hotspot. Kluwer Academic Publishers, Dordrecht. 358 pp.

Harrison, S. et Rajakaruna, N. 2011. Serpentine: The evolution and ecology of a model system. University of California Press, Berkeley, California, USA. 464 pp.

Hennekens, S. M. et Schaminée, J. H. J. 2001. TURBOVEG, a comprehensive data base management system for vegetation data. J. Veg. Sci. 12: 589–591.

Higgins, M. D.,et Higgins, R. 1996. A Geological companion to Greece and the Aegean. Cornell University Press. Duckworth Publishers, NY / London. 240 pp.

Hobohm, C. (ed.). 2014. Endemism in vascular plants. Springer, Berlin, Germany. 348 pp.

Horvat, I. 1960. Planinska vegetacija Makedonije u svijetlu suvremenih istraživanja. Acta Musei macedonici scientarum naturalium 6(8): 1–34.

Horvat, I., Glavač, V., Ellenberg, H. 1974. Vegetation Südosteuropas. Gustav

Fisher Verlag, Stuttgart, Germany. 768 pp.

Hughes, P. D., Woodward, J. C. et Gibbard, P. L. 2006. The last glaciers of Greece. Zeitschrift für Geomorphologie 50: 37–61.

Karagiannakidou, V. 1994. Contribution to the study of mountain-subalpine grassland vegetation of Mount Menikion, north eastern Greece. Ecol. Medit. 20(3–4): 73–84.

Karagiannakidou, V., Dimopoulos, P. et Papademetriou, K. 2001. Phytosociological researches on the montane and high-altitude grasslands of North Eastern Greece: Mount Pangeon. Fitosociologia 38(1): 25–54.

Kruckeberg, A. R. 1951. Intraspecific variability in the response of certain native plant species to serpentine soil. American Journal of Botany 38: 408–419.

Kruckeberg, A. R. 1985. California serpentines: flora, vegetation, geology, soils, and management problems. University of California Press, Berkeley, California, USA. 196 pp.

Kruckeberg, A. R. 2002. Geology and plant life: the effects of land forms and rock types on plants. University of Washington Press, Seattle, USA. 304 pp.

Lakušić, D., Randjelović, V. et Di Pietro, R. 2015. Nomenclature adjustments to neglected syntaxa of the tall-herb hygrophilous communities of the SE-Europe. Periodicum Biologorum 117(3): 383–397.

Mahmutaj, E., Shuka, L., Xhulaj, M. et al. 2015. Rare and endemic plants in the southern mountain ecosystems of Albania, their threats and diversity. Albanian J. Agric. Sci. 14(1): 1–10.

Markgraf, F. 1932. Pflanzengeographie von Albanien. Bibliotheca Botanica. 26 (105): 1–132.

McCune, B. T. et. Keon, D. 2002. Equations for potential annual direct incident radiation and heat load. – J. Veg. Sci. 13. 603–606.

Maroulis, G. 2003. Flora and vegetation of the ecosystems of Mt. Erimanthos (NW Peloponnisos), PhD Thesis (in Greek, with English summary). Depon in. University of Patras, Patras.

Meco, S., et Aliaj, S. 2000. Geology of Albania. Beiträge zur regionalen Geologie der Erde, 28. Borntraeger, Berlin. 246 pp.

Micevski, K. 1994. Visokoplaninska vegetacija na planinata Bistra. Makedonska akademija na naukite i umetnostite, Bistra 3, Skopje. 91 pp.

Mucina, L., Bültmann, H., Dierßen, K. et al. 2016a. Vegetation of Europe: Hierarchical floristic classification system of vascular plant, bryophyte, lichen, and algal communities. Appl. Veg. Sci. 19. 3–264.

Mucina, L., Bültmann, H., Dierßen, K. et al. 2016b. Vegetation of Europe: Hierarchical floristic classification system of vascular plant, bryophyte, lichen, and algal communities. Appl. Veg. Sci. Appendix S6: ESL1: List of diagnostic species of classes of the plant communities dominated by vascular plants (EVC1).

Oksanen, J, Guillaume, B.F., Kindt, R, et al. 2017. vegan: Community Ecology Package. R package version 2.4-5. http://CRAN.R-project.org/package=vegan

Palpurina, S., Wagner, V., von Wehrden, H. et al. 2017. The relationship between plant species richness and soil pH vanishes with increasing aridity across Eurasian dry grasslands. Global Ecology and Biogeography 26: 425–434.

Papademetriou, K., Karagiannakidou, V., Konstantinou, M. et Dimopoulos, P. 1998. Phytosociological Research of the Above the Timberline Grasslands of Mount Pangeon (NE Greece). In: Tsekos, I., Moustakas, M. (eds). Progress in Botanical Research. Springer, Dordrecht, 117–120 pp.

Papastergiadou, E., Dafis, S., Dimopoulos, P. et al. 1997. Syntaxonomic typology of Greek habitats. Folia Geobot. 32: 335–341.

Peterka, T., Hájek, M., Jiroušek, M. et al. 2017. Formalized classification of European fen vegetation at the alliance level. – Applied Vegetation Science 20. 124–142.

Phitos, D. 1962. Beitrag zur Kenntnis der Flora von Nord-Pindos. Mitt. Bot. Staatssamml. München 4(3): 285–293.

Phitos, D., Constantinidis, T. et Kamari, G. 2009. The Red Data Book of Rare and Threatened Plants of Greece, vol. 1 (A-D) & vol.2 (E-Z), (in Greek). Hellenic Botanical Society, Patras. 406 & 413 pp.

Polak, M. 2000. The botanical diversity in the Ayawasi area, Irian Jaya, Indonesia. Biodiversity and Conservation 9: 1345–1375.

Quézel, P. 1964. Végétation des hautes montagnes de la Grece meridionale. Vegetatio 12(5–6): 289–386.

Quézel, P. 1967. La végétation des hautes sommets du Pinde et de l'Olympe de

Thessalie. Vegetatio 14(1–4): 127–228.

Quézel, P. 1969. La végétation du massif de Bela Voda (Macédonia Nord-Occidentale). Biol. Gallo-Hellenica 2(2): 93–112.

Quézel, P. 1973. Contribution a l'etude de la vegetation du Vardoussia. Biol. Gallo-Hellenica 5: 139-166.

Randelović, V., Zlatković, B. et Amidžić, L. 1998. Flora i vegetacija visokoplaninskih tresava Šar planine. Zaštita prirode 50: 377–387.

Raus, T. 1987. Gipfelvegetation des Ossa-Gebirges im Vergleich zum Olymp (Thessalien, Griechenland). Münsterische Geogr. Arbeiten 27: 199–206.

Redžić, S. 2003. The syntaxonomy and syngenesis of the *Elyno-Seslerietea* Br.-Bl. 1948 in the Balkan peninsula. Annali di Botanica (nuova serie) 3: 53–74.

Redžić, S., Barudanović, S., Trakić, S. et Kulijer, D. 2011a. Vascular plant biodiversity richness and endemo-relictness of the karst mountains Prenj, Čvrsniva and Čabulja in Bosnia and Herzegovina (W. Balkan). Acta Carsologica 40: 527–555.

Redžić, S., Bulić, Z., Hadžiablahović, S. 2011b. High mountain vegetation of Dinarides (W Balkan). Glasnik Republičkog zavoda za zaštitu prirode u Podgorici 31/32. 7–46 pp.

Rejmánek, M., Rejmánková, E. et Holzner, W. 2004. Species diversity of plant communities on calcareous screes: the role of intermediate disturbance. Preslia 76: 207–222.

Regel, C. 1941. Florae graecae notulae I. Candollea 8: 222–242.

Regel, C. 1942. Florae graecae notulae I. Candollea 9: 104–137.

Robinson, B. H., Brooks, R. R., Kirkman, J. H. et al 1996. Plant-available elements in soils and their influence on the vegetation over ultramafic (" Serpentine ") rocks in New Zealand. Journal of the Royal Society of New Zealand 26: 457–468.

Roleček, J., Tichý, L., Zelený, D. et Chytrý, M. 2009. Modified TWINSPAN classification in which the hierarchy respects cluster heterogeneity. – J. Veg. Sci. 20: 596–602.

Sabovljević, M., Natcheva, R., Dihoru, G. et al. 2008. Check-list of the mosses of SE Europe. – Phytol. Balcan. 14: 207–244.

Salmon, T. 2006. The Mountains of Greece: The Pindos Mountains. Cicerone Press, London. 368 pp.

Shuka, L. et Tan, K. 2009. On the distribution of *Cerastium smolikanum* (Caryophyllaceae) and *Centaurea vlachorum* (Asteraceae) in the Balkan Peninsula. Phytologia Balcanica. 15(3): 347–350.

Shuka, L., Malo, S. et Tan, K.2011. New chorological dataand floristic notes for Albania. Botanica Serbica 35(2): 157–162.

Sokal, R. R. et Rohlf, F.J. 1995. Biometry. Ed. 3. – W.H. Freeman and Company, New York. 887 pp.

Stevanović, V., Tan, K., Iatrou, G. 2003. Distribution of the endemic Balkan flora on serpentine I. – obligate serpentine endemics. Plant Syst. Evol. 242: 149–170.

Strid, A. (ed.). 1986. Mountain flora of Greece 1. Cambridge Univ. Press, Cambridge. 822 pp.

Strid, A. et Tan, K. (eds.). 1991. Mountain flora of Greece 2. Edinburgh Univ. Press, Edinburgh. 974 pp

Strid, A. 1995. The Greek mountain flora, with special reference to the Central European element. – Bocconea 5: 99–112.

Takhtajan, A. 1986. Floristic regions of the world. University of California Press, Berkeley, California, USA. 522 pp.

Tichý, L. 2002. JUICE, software for vegetation classification. J. Veg. Sci. 13: 451–453.

Tichý, L. et Chytrý, M. 2006. Statistical determination of diagnostic species for site groups of unequal size. J. Veg. Sci. 17. 809–818.

Schuster, B. et Diekmann. M. 2003. Changes in species density along the soil pH gradient – evidence from German plant communities. Folia Geobot. 38: 367–379.

Šmilauer, P. et Lepš, J. Š. 2014. Multivariate analysis of ecological data using CANOCO 5. – Cambridge University Press, Cambridge. 284 pp.

Tilman, D. et Pacala, S. 1993. "The maintenance of species richness inplant communities," In Ricklefs, R. E. et Schluter, D. (eds.). Species Diversity in Ecological Communities. University of Chicago Press, Chicago. 13–25 pp.

Tyler, G. 2003. Some ecophysiological and historical approaches to species richness and calcicole/calcifuge behaviour – contribution to a debate. Folia Geobotanica 38: 419–428.

Velev N. et Apostolova, I. 2009. A review of *Potentillo ternatae-Nardion strictae* alliance. – Hacquetia. 8(1): 49–66.

Vetaas, O. R. et Grytnes, J. A. 2002. Species richness and altitude: a comparison between null models and interpolated plant species richness along the Himalayan altitudinal gradient, Nepal. Am. Nat. 159: 294–304.

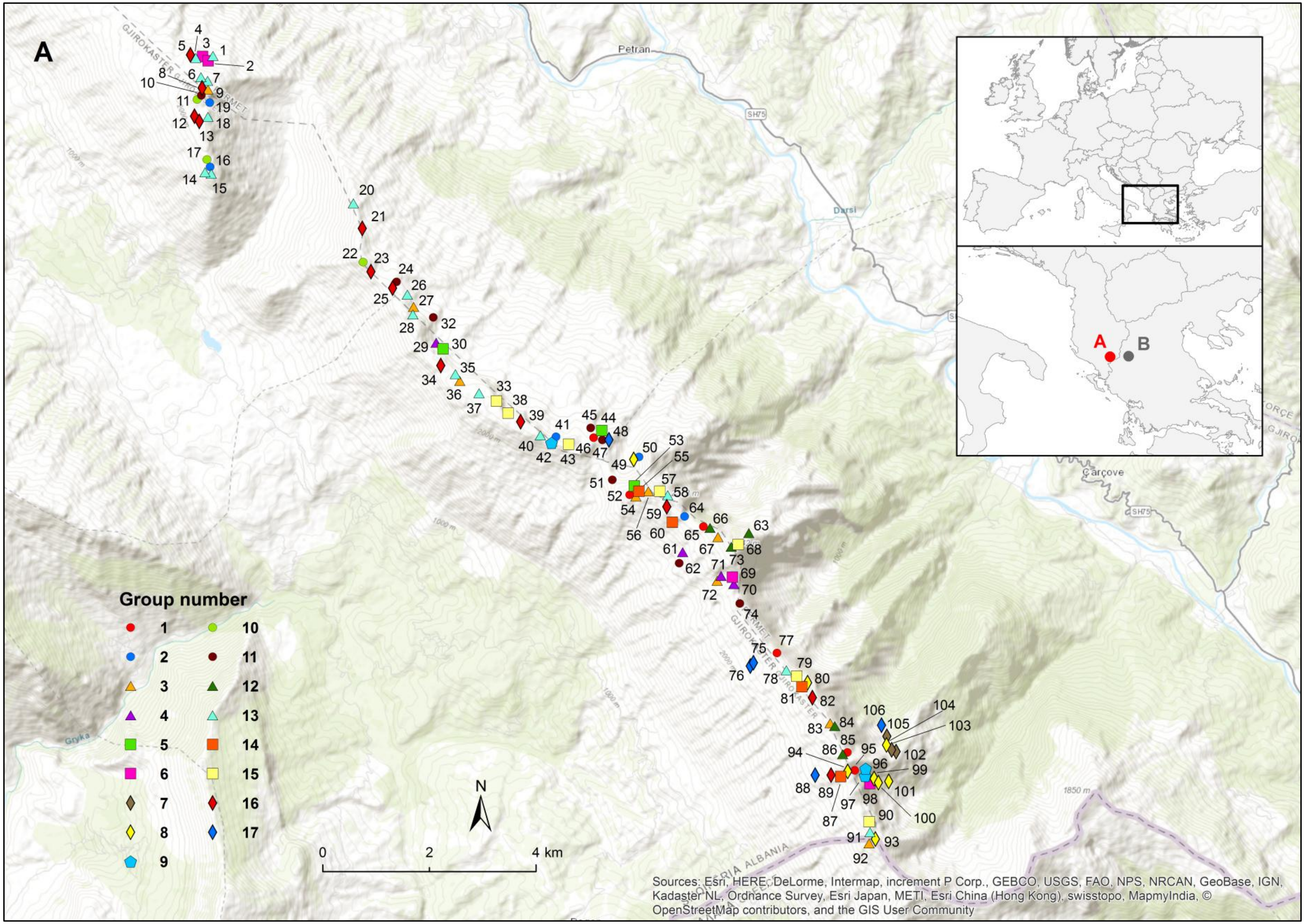
Willis, C. K., Lombard, A. T., Cowling, R. M. et al. 1996. Reserve systems for limestone endemic flora of the Cape lowland fynbos: Iterative versus linear programming. Biological Conservation. 77: 53–62.

Zaffran, J. 1990. Contributions à la flore et à la végétation de la Crète. Universite de Provence, Aix-en-Provence. 615 pp.

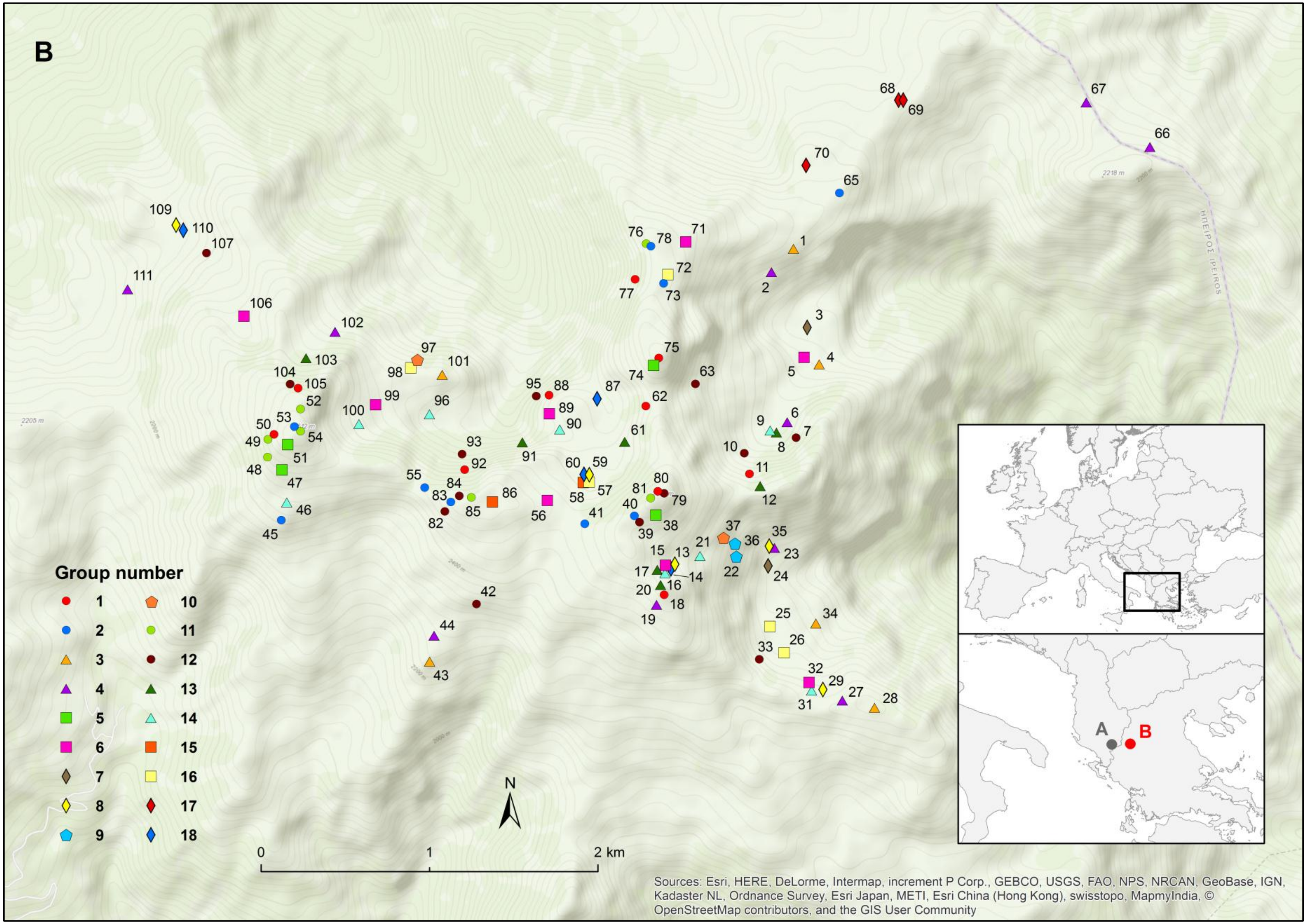
Web sources:

www1: http://www.klimadiagramme.de
www2: www.bgbm.org/EuroPlusMed/; accessed 2017–12–29
www3: http://www.theplantlist.org/; accesed 2017–12–29
www4: https://www.gbif.org/; accessed 2017–12–01

7. Appendices



Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community



Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Map A – Mt. Nemërçkë

1 *Trifolio norici-Valerianetum epiroticae saxifragetosum marginatae*
2 *Trifolio norici-Valerianetum epiroticae thymetosum boissieri*
3 *Saxifrago taygetei-Doronicetum columnae*
4 *Cardamine carnosa* community
5 *Ranunculus brevifolius* community
6 *Drypis spinosa* community
7 *Geranium macrorrhizum* community
8 *Arrhenathero elatioris-Heracleetum pyrenaici*
9 *Betonico alopecuri-Geranietum subcaulescentis*
10 *Edraiantho australis-Koelerietum lobatae typicum*
11 *Edraiantho australis-Koelerietum lobatae astragaletosum angustifolii*
12 *Edraiantho australis-Koelerietum lobatae trifolietosum norici*
13 *Cyano epirotae-Festucetum variae typicum*
14 *Cyano epirotae-Festucetum variae seslerietosum vaginalis*
15 *Pediculari graecae-Seslerietum tenerrimae*
16 *Anthemido carpaticae-Alopecuretum gerardi*
17 *Alopecuro gerardi-Chenopodietum boni-henrici*

Map B – Mt. Smolikas

1 *Pediculari petiolaris-Caricetum macrolepis*
2 *Centaureo ptarmicifoliae-Festucetum duriusculae*
3 *Saturejo montanae-Stipetum rechingeri*
4 *Seslerio robustae-Bornmuelleretum baldacci typicum*
5 *Seslerio robustae-Bornmuelleretum baldacci arenarietosum serpentini*
6 *Seslerio robustae-Bornmuelleretum baldacci daphnetosum oleoidis*
7 *Alopecuro gerardi-Chenopodietum boni-henrici*
8 *Pinguiculo hirtiflorae-Soldanelletum pindicolae*
9 *Narthecio scardici-Caricetum kitaibelianae*
10 *Sileno pusillae-Pinguiculetum hirtiflorae*
11 *Sileno pindicolae-Cardaminetum plumieri*
12 *Violo albanicae-Alyssetum smolikani*
13 *Myosotido suaveolentis-Saxifragetum taygetei*
14 *Alopecuro gerardi-Gnaphalietum hoppeani*
15 *Cerastio cerastoidis-Trifolietum parnassi*
16 *Ranunculo sartoriani-Caricetum kitaibelianae*
17 *Minuartio recurvae-Poetum violaceae*
18 *Nardus stricta* community

Spearman's correlations

Mt. Smolikas

Table 9	Group No.	Radiation	Heatload	Altitude	Slope	Bare rock	Species No.	Stenoend. No.	Balcans end. No.	Total No. end.	Endem. ratio	Soil depth
Radiation	0.710737											
Heatload	0.647217	0.905786										
Altitude	0.10466	0.189585	0.226855									
Slope	-0.7084	-0.81623	-0.8223	-0.09211								
Bare rock	-0.38024	-0.26168	-0.29036	0.022113	0.446415							
Species No.	0.375704	0.26281	0.168973	-0.21257	-0.28253	-0.4249						
Stenoend. No.	0.573917	0.551715	0.506013	0.165485	-0.46097	0.001123	0.21085					
Balcans end. No.	0.207253	0.225025	0.109579	-0.28361	-0.20571	-0.1528	0.687326	0.122156				
Total No. end.	0.396366	0.390802	0.269785	-0.18573	-0.34091	-0.14222	0.681912	0.461271	0.931984			
Endemism ratio	0.148012	0.194635	0.177771	0.043079	-0.18081	0.221102	-0.1653	0.389194	0.437606	0.540833		
Soil depth	0.602951	0.472027	0.454955	0.117136	-0.56404	-0.69346	0.456918	0.240175	0.297717	0.351885	-0.00986	
pH	-0.52327	-0.44285	-0.42597	-0.09977	0.516683	0.661714	-0.49059	-0.16903	-0.14772	-0.18617	0.253589	-0.62254

Spearman's correlations

Mt. Mt. Nemërçkë

Radiation	0.630003											
Heatload	0.625585	0.908486										
Altitude	-0.3437	-0.22762	-0.15934									
Slope	-0.75467	-0.86008	-0.84713	0.370054								
Bare rock	-0.55912	-0.36595	-0.38573	0.335723	0.553508							
Species No.	0.461597	0.347639	0.20353	-0.38594	-0.33656	-0.4831						
Stenoend. No.	-0.23982	-0.1233	-0.10715	0.341596	0.26557	0.218594	-0.2812					
Balcans end. No.	0.41792	0.374087	0.265324	-0.30242	-0.37312	-0.33707	0.825751	-0.41974				
Total No. end.	0.405493	0.375773	0.263758	-0.26987	-0.35481	-0.32352	0.828207	-0.30082	0.991871			
Endemism ratio	0.040647	0.108681	0.105523	0.111951	-0.10152	0.0945	0.058272	-0.13754	0.561934	0.571151		
Soil depth	0.604681	0.397427	0.413547	-0.31531	-0.52875	-0.75748	0.453718	-0.12671	0.31364	0.311783	-0.11195	
pH	-0.00964	0.003526	-0.00782	-0.11713	0.059753	0.412034	-0.18505	-0.14631	-0.02534	-0.04714	0.166764	-0.5077

Table 1

Field number	52	65	95	85	77	46	19	16	64	41	50	92	72	83	54	27	36	56	67	09	70	71	61	29	30	44	53	69	.3	98	2	102	105	103	101	99	104	49	94	100	80	93	97	96	42
Cluster	1											2									3				4			5				6			7								8		
Number in table	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Trifolio norici-Valerianetum epiroticae																																													
Sesleria tenerrima	+	+	+	r	+	1	.	.	.	r	1	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga marginata	a	a	b	1	1	a	.	.	.	+	+	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium degenii	+	.	+	.	1	.	.	.	a	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Potentilla speciosa	.	.	.	.	1	.	a	1	+	a	a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Edraianthus australis	.	.	.	.	1	+	r	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifrago taygetei-Doronicetum columnae																																													
Saxifraga taygetea	.	.	.	.	.	.	+	.	.	.	.	1	a	.	+	1	3	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cystopteris fragilis	+	.	+	.	.	.	.	+	.	.	.	+	1	.	.	1	1	+	+	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sedum magellense	.	.	.	.	.	.	+	+	.	.	.	+	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Doronicum columnae	.	.	+	.	.	+	.	+	.	.	.	1	a	a	4	1	a	3	a	+	.	+	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	a	.	.	.	.
Myosotis suaveolens	.	.	.	r	.	r	.	.	.	.	.	1	r	.	+	+	1	+	1	+	.	.	.	.	a	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
***Cardamine carnosa* community**																																													
Cardamine carnosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1	a	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
***Ranunculus brevifolius* community**																																													
Ranunculus brevifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	a	a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
***Drypis spinosa* community**																																													
Drypis spinosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	a	.	+	1	.	1	3	a	b	1	.	1	.	.	.	.	.	.	.	.	.	.	.
***Geranium macrorrhizum* community**																																													
Geranium macrorrhizum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	4	3	.	.	.	.	.	.	.	.	.	.	.
Arrhenathero elatioris-Heracleetum pyrenaici																																													
Heracleum sphondylium subsp. pyrenaicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	r	a	3	b	3	a	3	1	1	.

Arrhenatherum elatius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	+	1	+	.	+	+	.	.	.	.	.
Betonico alopecuri-Geranietum subcaulescentis																																													
Betonica alopecuros	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	a	a	b
Diagnostic species with lower *phi* value																																													
Poa thessala	+	.	+	.	+	+	.	+	1	+	.	.	.	.	+	.	1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Saxifraga paniculata	1	1	.	1	.	1	.	.	.	1	+	+	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca duriuscula s. l.	.	+	.	.	1	+	.	.	1	a	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thymus boissieri	.	.	.	.	.	.	1	1	1	1	+	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Campanula rotundifolia s. l.	.	.	+	.	+	.	.	.	+	+	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium banaticum subsp. speciosum	+	.	.	.	1	.	.	.	1	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Minuartia pseudosaxifraga	.	+	.	.	.	.	.	.	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poa timoleontis	.	.	.	.	.	.	1	+	.	.	.	r	.	.	+	+	.	.	.	a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stachys tymphaea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	r	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.
Senecio squalidus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	r	.	.	.	.	.	.	.	.	r	.	.	.	.	.	+	.	.	.
Carduus tmoleus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	r	.	.	1
Festuca spectabilis subsp. affinis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	b	b	b	a	.	.	.	.	.	.	.
Poa cenisia	.	.	.	.	.	.	.	.	.	.	.	+	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	1	.	.	.
Geranium subcaulescens	.	.	.	.	.	.	.	1	.	.	.	.	.	a	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	a	3	b
Erysimum pusillum subsp. cephalonicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	.
Rumex nebroides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1	.	1
Acinos alpinus	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1
Linaria peloponnesiaca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1
Carum rupestre	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	1
Achillea abrotanoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1	1	1	.
Lotus corniculatus agg.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	b
Other species with higher frequency																																													
Aubrieta deltoidea	+	.	r	.	+	1	1	1	+	1	+	1	+	a	+	a	.	1	+	b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Minuartia verna s. l.	.	.	.	.	+	.	.	+	+	+	+	.	.	+	.	.	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r
Silene parnassica subsp. parnassica	.	.	.	.	+	.	1	1	1	.	.	.	.	.	+	1	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Silene caesia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	+	a	a	.	.	.	.	.	.
Festuca varia	.	.	.	.	.	.	+	1	.	.	.	.	.	.	1	1	+	.	.	.	r	.	.	.	.	1	.	.	.	.	1	.	a	+	.	.	.	.	.	.	.	.	1	1	1
Galium oreophilum	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	+	.	.	.	.	.	+	1	a
Sedum album	.	.	.	.	+	.	+	1	.	.	.	.	.	1	.	+	+	.	.	1	.	.	.	.	+	+	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	+	.	+
Ranunculus sartorianus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	1	+	.	.	.	.	.	.	.	.	.	+	.	.	r	.	.	r	1	b	r
Scrophularia heterophylla subsp. laciniata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	1	.	.	+	1	1	+	+	+	.	.	.	.	.	1	.	+	.	.	1	.	.	.
Other species																																													
Asperula aristata subsp. condensata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Sempervivum marmoreum	.	.	.	.	+	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Astragalus depressus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Phyllolepidum cyclocarpum subsp. pindicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	b
Verbascum longifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.
Anthemis cretica subsp. carpatica	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Arenaria serpyllifolia	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Laserpitium siler	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Cyanus epirotus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Rhinanthus mediterraneus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	+
Phleum alpinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Potentilla pedata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Trisetum flavescens	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.
Aurinia saxatilis s. l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	a	.	.
Sedum ochroleucum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Athamanta densa	.	.	1	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	a	1	.	.	.	.	.	.	3	.	.
Armeria canescens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Draba lasiocarpa	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pedicularis graeca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Cerastium decalvans	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium anisophyllon	.	.	.	.	.	.	.	.	.	.	.	+	.	1	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dryopteris villarii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Urtica dioica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Alchemilla plicatula	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga federici-augusti subsp. grisebachii	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Erigeron glabratus	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Koeleria lobata	.	.	.	.	.	.	.	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rosa heckeliana	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Alopecurus gerardi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	+	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium parnassi	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bromus cappadocicus subsp. lacmonicus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca alpina s. l.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga adscendens subsp. parnassica	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trinia glauca subsp. pindica	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sesleria vaginalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	r	.	+	.	.	+	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.
Euphorbia herniariifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Centranthus longiflorus subsp. junceus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Teucrium chamaedrys	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.
Pilosella cymosa subsp. sabina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Cynoglossum pustulatum subsp. parviflorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Valantia aprica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Malcolmia orsiniana subsp. angulifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Arenaria conferta subsp. serpentini	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.
Hypericum rumeliacum subsp. apollinis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Geocaryum pindicola	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.
Leontodon incanus s. l.	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	r	.	.	.	.
Thalictrum minus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.

Prangos ferulacea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Matthiola fruticulosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Leontodon crispus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Tragopogon samaritanii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Hieracium pannosum	.	.	.	.	+	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Taraxacum sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Achillea chrysocoma	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asplenium ceterach	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sedum dasyphyllum	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Astragalus angustifolius	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asplenium ruta-muraria	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Iberis sempervirens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cotoneaster integerrimus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dianthus integer subsp. minutiflorus	.	.	.	.	+	.	+	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Achillea fraasii	.	.	.	.	.	.	r	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Trifolium noricum	.	r	+	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Chenopodium bonus-henricus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lamium garganicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sedum atratum	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sedum acre	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 2

Field number	11	17	22	51	24	62	10	47	74	32	45	66	86	84	73	63	4	91	58	37	78	18	26	15	20	28	40	14	1	35	7	6	81	60	87	55	33	68	38	79	43	57	90	5	21	23	12	25	59	13	89	82	39	34	8
Cluster	1																2																				3							4											
Number in table	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	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
Edraiantho australis-Koelerietum lobatae																																																							
Edraianthus australis	1	a	b	r	.	.	+	+	r	+	+	1	1	1	1	a	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	.	.	.	+	.	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Koeleria lobata	1	.	+	1	1	1	1	.	1	a	.	.	a	a	.	.	.	.	.	.	.	.	+	.	+	.	.	+	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca duriuscula s. l.	.	1	a	b	a	b	+	b	1	a	.	1	+	1	+	1	.	1	.	1	.	+	.	.	.	.	.	a	1	a	a	+	.	.	.	.	a	b	a	1	.	a	a	.	.	.	.	.	.	.	.	.	.	.	.
Cyano epirotae-Festucetum variae																																																							
Festuca varia	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	b	4	b	3	3	3	b	b	b	3	3	3	b	r	1	.	.	1	a	+	.	.	.	+	.	.	.	b	.	.	.	.	.	.	.	.	.	.	+
Pediculari graecae-Seslerietum tenerrimae																																																							
Saxifraga marginata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	1	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga paniculata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	a	1	a	1	a	b	1	.	.	.	.	.	.	.	.	.	.	.	.
Alchemilla plicatula	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	+	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Sesleria tenerrima	.	.	.	.	.	.	.	.	+	.	.	+	1	+	+	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	r	4	b	3	4	3	3	3	.	.	.	.	.	.	.	.	.	.	.	.
Festuca alpina s. l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.
Pedicularis graeca	.	.	r	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	.	.	.	.	1	.	+	.	.	.	.	.	.	.	.	1	1	.	1	+	1	1	.	.	.	.	.	.	.	.	.	r	.	.
Saxifraga adscendens subsp. parnassica	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	+	+	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Anthemido carpaticae-Alopecuretum gerardi																																																							
Alopecurus gerardi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	3	3	3	1	+	b	1	3	3
Carduus tmoleus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	r	+	+	a	+	r	.	1
Trifolium parnassi	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	1	1	a	b	1	b	a
Herniaria parnassica	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	1	+	1	1	+	a	1
Phleum alpinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	1	.	+	1	b	1	1	1	.	.	a	a
Scilla bifolia s. l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	+	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	+	+	.	1	a	1	1	+	+	+	.	.
Scleranthus perennis subsp. marginatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	+	+	.	.	+	.
Plantago atrata subsp. graeca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	1	1	+	.	3	.	3	1	3	.	.	.

Poa timoleontis	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	b	.	.	1	.	.	+	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	a	4	4	.	1	+	b	.	.	.	+	1
Other frequent species																																																							
Draba lasiocarpa	.	+	+	1	.	.	+	.	+	+	+	+	+	.	+	+	.	.	.	.	.	+	+	+	+	.	+	.	+	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anthyllis vulneraria	+	r	1	a	.	.	+	+	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	.	.	1	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Astragalus angustifolius	.	.	.	3	4	3	3	4	3	1	b	.	.	.	.	.	.	.	r	r	.	a	.	+	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Paronychia albanica	+	+	1	.	.	.	+	+	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	a	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Podospermum canum	+	.	.	+	.	1	+	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	r	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Sesleria vaginalis	.	.	.	+	.	.	.	.	.	.	.	+	.	+	+	.	.	.	b	.	.	.	1	.	.	+	.	a	.	+	.	b	4	3	3	3	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Acinos alpinus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	+	.	.	1	+	a	+	.	1	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	.	.	1	r	+	.	.	.	.
Astragalus lacteus	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	a	a	+	.	.	1	1	+	r	+	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	+	.	.	.	.	.	.	.
Dianthus integer subsp. minutiflorus	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	.	1	.	.	.	1	+	a	1	+	.	1	+	.	.	+	.	.	.	.	.	.	.	.	.	.	1	1	+	.	.	.	.	.	.	.	.	.	.
Sedum acre	.	.	.	1	.	a	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	1	+	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca dalmatica	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	a	.	1	.	.	.	.	1	a	.	.	1	.	.	1	1	.	a	.	.	.	.	.	.	.	a	.	.	.	.	.	.	.	.	.	.	.
Carex kitaibeliana	.	.	.	.	.	.	.	1	.	+	.	.	+	.	1	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	a	.	1	.	a	.	+	+	1	1	1	a	.	.	.	.	.	.	.	.	.	+	.	.
Sedum atratum	.	.	.	.	.	.	.	.	+	.	.	.	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.
Botrychium lunaria	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Sedum album	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium banaticum subsp. speciosum	.	.	.	.	.	.	.	.	+	.	.	1	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.
Galium anisophyllon	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Dactylorhiza viridis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Cystopteris fragilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculus sartorianus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1	1	b	+	a	3	.	+	.
Trisetum flavescens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1	.	+	.	.	a	+	.	b	.	1	.
Arenaria serpyllifolia	.	r	.	.	r	+	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	+	.	+	.	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	.	.	+	.	.	.	+
Asyneuma limonifolium	+	+	+	.	1	.	+	1	.	1	1	.	.	+	.	1	.	.	.	.	+	.	1	+	1	+	.	1	+	+	1	+	.	.	+	.	.	.	.	.	r	.	.	.	r	.	+	.	.	.	.	.	.	.	.
Cyanus epirotus	.	+	.	.	1	1	+	+	.	+	+	.	.	.	.	.	.	1	1	+	+	+	a	+	1	.	+	+	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	a	.	.	.	.	.	.	.	.	.
Bromus cappadocicus subsp. lacmonicus	+	.	r	.	+	.	+	+	.	.	+	.	.	.	.	.	+	1	.	.	.	+	.	.	1	+	1	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Trifolium noricum	. . . . + . . 3 3 3 + r . . . . 1 . . . . 3 . b . 3 1 . . . .
Anthemis cretica subsp. carpatica	. + . + . . + ... + ... 1 . + r . + 1 1 + 1 + ... + r . + + ... + b b 1 1 . + 3 1 + 1 .
Campanula rotundifolia s. l.	. . . + ... + ... + + + + . . + + + . + + . . . + + . . + + + . + + + + . + . . . + . . . a .
Geranium subcaulescens	. . . . + ... a 1 . . . 1 1 + 1 b 1 . + 1 . . . . . . + . 1 . + ...
Carum rupestre	. . . . + + 1 . . 1 + . . + + . + ... + . . . 1 1 . 1 + 1 1 . . + ...
Other very frequent species of all the grassland types	
Thymus boissieri	1 a a b a + a 1 a b 1 a 1 1 + b . a 1 + . a a b 3 b a a 1 a b a 1 a 1 a 1 + + . + + . + . + ...
Trinia glauca subsp. pindica	+ + + 1 1 1 + + 1 + . + 1 + . + . . . 1 + . + 1 + . + + + . + + + ... + ... 1 1 1 r 1 . 1 . . 1 1 a
Taraxacum sp.	+ + + + . + + 1 + + + 1 1 + . . . + + + + . . . + . + . + . + + + ... + . 1 . 1 + + 1 1 b + +
Cerastium decalvans	. 1 + . . + . . 1 1 1 . 1 1 + . . + . . + 1 + 1 a a . 1 + + . + + . 1 . 1 1 1 + + . + . . . + . . r . . . . .
Pilosella cymosa subsp. sabina	. . . 1 . . . . + + 1 . . . . . + a a 1 1 1 1 1 a 1 . 1 b . + . + 1 1 . + . 1 + + . + 1 . 1 1 + b 1 a 1 . 1 +
Myosotis suaveolens	. . . . . + ... + . + . r 1 + 1 . + + + . + + . + + . + . + 1 + . 1 1 . 1 + + . 1 + + 1 1 1 + + + 1 . .
Armeria canescens	. . . . r . . + 1 . . + . 1 + + + + + . + . . r . . + + + + + + + a 1 . b 1 1 b a + + 3 3
Minuartia verna s. l.	+ 1 1 1 1 . 1 + 1 1 1 1 . + 1 1 . . + 1 + . . 1 + 1 1 + 1 + 1 1 1 1 + + 1 1 1 1 + 1 . + 1 1 . . + . . + 1 . .
Poa thessala	1 1 + 1 1 . 1 + 1 a + . 1 . + 1 . 1 + a 1 1 + 1 + . 1 + . 1 a + . 1 1 + 1 + 1 . 1 + + . . + . . + . + + 1 1 .
Other species	
Cerastium brachypetalum subsp. roeseri	. . . . 1 + . . 1 . + . . . + ... + . . + . . + . . . +
Viola epirota	. . . . r . . . . a . . 1 . 1 . 3 . . . .
Tulipa sylvestris subsp. australis	. . . . + r . . . . . . r . . . . + + + + ...
Ornithogalum oligophyllum	. . . . 1 . . . . r + ... 1 . 1 1 . . . .
Erophila verna s. l.	. . . . + ... + ... + ... +
Centaurea deustiformis	. . . . + ... + . + ...
Stachys tymphaea	. . . . 1 . r . . . . . .
Verbascum longifolium	. . . . r . . . . r r . . . .
Lotus corniculatus agg.	. . . r . . . . + . . . + . + ... 1 . . a . . . . . 1 . . . . .
Astragalus depressus	. . . . . + ... 1 . . + + ... r . . . . 1 . r . . . .
Carum graecum subsp. graecum	. . . . a . . . . + . . 1 + ...
Leontodon crispus	. . . . a . . . . . + ... + ... + . . + 1 . . . . r . . . . . .

Artemisia absinthium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Thymus longicaulis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	a	.	.	.	.	.	.	.	.	.	.	.
Achillea chrysocoma	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Sagina procumbens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Rumex acetosella	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Gagea liotardii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Solenanthus albanicus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Hypericum barbatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Luzula spicata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Dactylorhiza sambucina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Corydalis solida subsp. incisa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Phyllolepidum cyclocarpum subsp. pindicum	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Allium sp.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.
Rumex nebroides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Erigeron glabratus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	.	.	.	.	.	.	.	.	.	+	.	.
Thlaspi pseudorivulare	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Hypericum rumeliacum subsp. apollinis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Erysimum pusillum subsp. cephalonicum	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stipa eriocaulis	.	+	.	.	.	.	.	.	.	b	3	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium oreophilum	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia myrsinites	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	+	+	r	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Achillea fraasii	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Orobanche alba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Onosma visianii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Teucrium chamaedrys	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Astracantha rumelica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia herniariifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculus psilostachys	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Poa cenisia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Nepeta spruneri	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca cf. callieri	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Geocaryum pindicola	+	.	.	+	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	a	.	.	.	.	.	.	.	.	.	b	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca circummediterranea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anthyllis montana subsp. jacquinii	1	1	a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Drypis spinosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Muscari neglectum	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Daphne oleoides	.	.	+	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	1	+	a	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga taygetea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asplenium viride	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
Senecio squalidus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thesium parnassi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aubrieta deltoidea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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Asplenium ruta-muraria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Cotoneaster integerrimus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Pimpinella tragium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	r	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Juniperus communis subsp. nana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	b	.	.	.	.	.	.	.	.	.	.	.	.
Doronicum columnae	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	r	.	.	.	.	.	.	.	.	.	.	.	.
Veronica aphylla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tephroseris integrifolia subsp. aucheri	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhinanthus mediterraneus	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	+	+	.	.	.	.	1	.	.	+	r	.	.	.	.	.	.	.	.	.	.	.	1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Euphrasia salisburgensis	.	a	.	+	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Sempervivum marmoreum	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asperula aristata subsp. condensata	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Medicago lupulina	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linaria peloponnesiaca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Antennaria dioica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valeriana tuberosa	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Silene parnassica subsp. parnassica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Astragalus vesicarius	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arabidopsis thaliana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Scutellaria alpina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Achillea holosericea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dianthus haematocalyx subsp. pindicola	.	.	1	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium degenii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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Potentilla pedata	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 3

Field number	49	85	48	81	52	76	54	10	79	93	95	84	33	104	42	82	63	7	39	107	91	17	8	20	21	103	61	100	16	96	21	46	9	90	31	86	58	26	57	25	98	72	70	69	68	14	60	87	110
Cluster	1							2													3							4								5		6					7			8			
Number in table	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
Sileno pindicolae-Cardaminetum plumieri																																																	
Artemisia eriantha	1	1	1	+	1	+	+	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga paniculata	+	+	1	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aubrieta gracilis subsp. glabrescens	+	1	+	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Potentilla speciosa	+	.	1	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca alpina s. l.	.	.	.	+	+	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga exarata	+	.	.	+	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cardamine plumieri	+	.	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Silene parnassica ssp. pindicola	.	.	1	.	+	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.

Violo albanicae-Alyssetum smolikani																																																	
Campanula hawkinsiana	.	.	.	.	.	.	.	.	.	1	1	.	+	+	+	+	1	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumex scutatus	.	.	.	.	.	.	.	1	.	a	1	+	+	1	+	.	1	1	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Alyssum smolikanum	1	.	.	.	.	.	.	.	a	.	1	.	1	.	1	1	1	1	1	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arenaria conferta subsp. serpentini	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	+	a	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia herniariifolia	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	+	r	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poa cenisia	.	.	+	r	.	.	.	+	+	a	a	a	1	a	1	+	+	a	r	a	+	r	+	r	+	+	.	.	.	.	.	.	.	1	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.
Viola albanica	.	.	.	.	.	.	.	.	.	1	.	+	.	+	+	1	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Myosotido suaveoleontis-Saxifragetum taygetei																																																	
Saxifraga taygetea	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	3	a	a	1	b	1	b	r	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Doronicum columnae	.	.	.	+	.	.	.	+	1	+	.	+	.	+	.	.	.	.	.	.	1	1	+	+	1	1	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Myosotis suaveolens	.	.	.	.	.	.	.	.	.	+	.	+	r	+	.	.	.	.	.	.	a	1	1	.	+	1	+	1	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Galium anisophyllon	+	.	.	.	+	1	+	.	.	.	.	1	.	.	.	.	.	.	.	+	1	1	+	+	1	+	1	1	+	.	.	.	a	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Alopecuro gerardi-Gnaphalietum hoppeani																																																	
Armeria canescens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	a	+	.	1	+	.	.	.	.	1	+	.	.	.	.	.	.	.	.
Jasione laevis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	a	a	b	+	.	a	1	+	.	.	1	+	1	1	.	.	.	.	.	.	.	.
Lotus corniculatus agg.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	a	a	a	1	1	+	1	.	.	.	a	.	1	1	.	.	+	.	+	.	.	a
Ranunculus sartorianus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	b	a	b	1	+	1	3	.	1	1	1	a	a	1	.	.	.	.	.	1	a
Alopecurus gerardi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	b	.	.	1	.	+	+	b	3	b	b	3	1	3	a	+	.	1	+	a	.	.	.	1	+	.	.	+	.
Trifolium parnassi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	+	1	1	b	1	a	1	.	+	.	.	.	.	.	a	.	a	3	b
Cerastio cerastoidis-Trifolietum parnassi																																																	
Cerastium cerastoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculo sartoriani-Caricetum kitaibeliana																																																	
Carex kitaibeliana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	4	4	3	5	3	.	.	.	+	.	.	.
Euphrasia minima	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	+	.	+	+	.	.	.	.
Minuartia verna s. l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	1	+	a	1	.	.	.	.	+	+	+	+	+	.	+	1	.	.	.	.
Minuartio recurvae-Poetum violaceae																																																	

Bellardiochloa violacea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	a	4	5	.	.	.	.
Plantago holosteum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	b	3	1	+	.	.	.	.
***Nardus stricta* community**																																																	
Festuca rubra s. l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	b	.	+
Nardus stricta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	4	a	.	5	4	3	4
Other frequent species																																																	
Cardamine glauca	.	.	.	.	.	+	.	+	+	.	+	+	+	.	.	.	.	r	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thlaspi epirotum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Potentilla aurea subsp. chrysocraspeda	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	1	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	.
Sagina saginoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.
Gnaphalium supinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	+	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium smolikanum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Thymus praecox subsp. jankae	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	+	1	+	.	.	.	.	.	.	.	.
Rumex acetosella	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	.	+	.	.	.	.	.
Gentiana verna subsp. balcanica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	+	.	.	+	+	.	.	.	.
Dianthus deltoides subsp. degenii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	1	.	.	.	.	+
Scleranthus perennis subsp. marginatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	+	+	.	.	+	.
Deschampsia cespitosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	b	.	1
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Campanula rotundifolia s. l.	+	.	+	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	1	1	1	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Sedum album	+	.	+	.	.	1	.	.	+	1	1	+	+	1	+	+	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carduus tmoleus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	r	.	.	r	.	+	r	.	.	+	.	1	+	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Sedum alpestre	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	+	+	+	.	.	.	.	.	.	1	+	.	1	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Sedum atratum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	+	+	.	+	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Festuca varia	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	+	.	.	.	.	r	.	.	+	.	+	r	.	.	.	.	.	.	.	.	.	.	r	r	.	.	.	1	.	.	.	.	.
Trinia glauca subsp. pindica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	1	+	.	.	.	.	.	.	+	+	.	.	.	.	+	.	.	.	.
Herniaria parnassica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1	.	+	+	.	.	.	.	.	.	.	.	+	1	.	.	.	.
Luzula spicata subsp. italica	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	1	+	+	.	+	+	.	+	.	.	.	.	.

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Poa thessala	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	+	+	1	b	.	1	b	.	.	.	+	1	1	.	1	.	a	+	.	.	.	.
Leontodon hispidus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	a	.	a	+	+	.	.	.	.	.	.	+	+	.
Bornmuellera baldaccii	.	.	.	.	.	.	.	.	.	.	.	.	1	+	1	1	1	+	.	+	.	.	.	.	.	.	1	a	1	1	b	b	1	b	a	.	3	+	1	1	1	1	.	.	.	.	.	+	.
Plantago media subsp. pindica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	+	a	1	.	+	b	1	b	b	.	.	.	r	+	1	.	+
Taraxacum sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	+	1	+	1	+	a	1	1	+	1	a	+	1	a	1	a	+	1	1	.	.	1	1	+	.	a	1	+
Other species																																																	
Carex ovalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Veratrum album	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Trifolium pratense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Euphrasia rostkoviana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Juncus alpinoarticulatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Agrostis gigantea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Narcissus poeticus subsp. radiiflorus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Rorippa pyrenaica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Soldanella pindicola	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Sesleria robusta	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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Thesium parnassi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Scrophularia heterophylla subsp. laciniata	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carum rupestre	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Cystopteris fragilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Senecio doronicum	.	.	.	.	.	.	.	.	b	.	1	a	.	b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aconogonon alpinum	.	.	.	.	.	.	.	.	.	.	a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Erigeron glabratus	.	+	.	.	.	+	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anthyllis vulneraria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca amethystina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.

Iberis aurosica	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thymus teucrioides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asplenium viride	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Silene pusilla	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Polystichum lonchitis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea ptarmicifolia	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca duriuscula s. l.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Potentilla heptaphylla subsp. australis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Draba lasiocarpa	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Potentilla geoides s. l.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Juniperus communis subsp. nana	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Campanula tymphaea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Carum graecum subsp. serpentinicum	.	.	.	.	.	+	.	.	.	.	+	.	.	+	.	r	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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Viola dukadjinica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Hieracium hoppeanum s. l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Oxyria digyna	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium banaticum subsp. speciosum	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valantia aprica	.	.	.	.	.	.	.	.	.	+	.	.	.	+	1	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Acinos alpinus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 4

Field number	75	62	105	50	18	80	88	77	92	11	65	40	83	41	73	45	55	53	78	28	4	43	1	101	34	6	67	102	66	23	111	19	27	44	2	74	51	47	38	15	71	56	32	5	99	106	89
Cluster	1										2									3						4																					
Number in table	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
Pediculari petiolaris-Caricetum macrolepis																																															
Carex macrolepis	a	3	3	1	.	4	3	1	3	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca amethystina	a	a	a	b	b	b	1	b	b	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	a	.	3	+	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.
Armeria canescens	.	+	+	+	.	+	1	+	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linum capitatum subsp. serrulatum	.	+	+	.	.	.	1	a	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pedicularis petiolaris	1	1	a	1	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carum rupestre	+	+	+	.	.	+	1	+	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	+	+	.	.	.	+	.	1	.	.	.	.	.	.	.	.
Euphrasia minima	+	+	.	.	+	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Plantago media subsp. pindica	+	.	1	.	.	.	+	+	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex kitaibeliana	b	3	a	5	3	1	b	3	3	+	.	.	.	.	.	.	.	.	.	1	+	.	+	+	1	1	.	1	1	.	.	.	.	1	+	.	+	+	.	.	.	.	.	.	.	+	+
Centaureo ptarmicifoliae-Festucetum duriusculae																																															
Centaurea ptarmicifolia	.	.	.	.	.	.	.	.	.	.	1	a	+	1	1	.	a	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Alyssum scardicum	.	.	.	.	.	.	.	.	.	.	+	1	1	1	+	.	+	a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Arenaria conferta subsp. serpentini	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	1	+	+	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	+	+	+	.	+	.	.	.	.	.	.
Festuca duriuscula s. l.	1	r	.	.	.	.	.	.	.	.	1	r	b	a	.	b	1	b	a	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.
Iberis aurosica	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	+	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Saturejo montanae-Stipetum rechingeri																																															
Stipa rechingeri	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	b	b	3	1	1	b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r
Sedum album	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	+	+	+	.	.	.	.	+	.	.	.	.	.	+	.	.	.	+	.	.	.	+	.	.	.
Seslerio robustae-Bornmuelleretum baldacci																																															
Festuca varia	.	.	.	1	1	.	.	+	.	3	+	.	.	.	.	.	.	.	.	1	1	1	b	b	a	3	1	3	3	3	3	4	3	3	3	1	1	1	a	b	b	1	1	a	b	1	a
Other frequent species																																															

Luzula spicata subsp. italica	1	+	+	+	+	.	+	.	+	+	.	.	+	.	.	+	.	+	.	.	.	.	.	.	.	.	.	+	+	.	.	.	+	.	.	.	+	.	.	.	.	1	.	.	.	.	.
Gentiana verna subsp. balcanica	+	+	.	+	+	+	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	1	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.
Galium anisophyllon	+	+	.	.	+	.	+	+	.	1	.	+	.	1	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.
Botrychium lunaria	.	.	.	+	.	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Silene vulgaris	.	+	1	.	.	.	a	a	1	a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1	.	1	+	.	+	.	.	.	.	1	.	.	.	.	+	.	.
Juniperus communis subsp. nana	.	.	r	.	.	r	+	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	1	.	+	.	1	b	5	4
Carum graecum subsp. serpentinicum	1	+	.	+	1	.	.	.	.	+	.	+	.	1	.	.	.	.	+	+	+	.	.	.	.	1	.	.	1	+	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	.
Soldanella pindicola	.	.	1	.	.	.	a	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vaccinium myrtillus	.	.	3	.	.	.	b	.	1	a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thymus teucrioides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	a	.	+	.	1	.	.	a	a	.	.	.	1	.	.	.	.	a	.	.	.	.	.	.	.
Cytisus decumbens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trinia glauca subsp. pindica	.	.	.	.	+	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	+	.	.	+	.	+	.	.	.	.	+	.	.	.	.	.	.	.	+	.	+	.	+	.	.	.
Satureja montana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	a	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Koeleria lobata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Potentilla heptaphylla subsp. australis	+	+	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	+	.	.	.	.	.	+	.	1	.	.	+	+	.	.	.	.	+	.	.	+	+	.	.	.
Silene parnassica ssp. pindicola	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1	.	.	.	1	+	+	+	.	.	.	.	+	.	.	.	+	.	.	.	+	.	+	+	.	.	.	.
Hieracium hoppeanum s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	+	+	+	.	.	+	.	.	.	.	.	+	+	.	+	+	+	.	1
Lotus corniculatus agg.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	1	1	1	1	1	.	.	.	.	.	.	1	.	+	+	+	+	.	.
Jasione orbiculata	1	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	1	+	.	.	.	1	.	.	.	.	.	.	1	+	+	+	+	1	.	.
Cerastium banaticum subsp. speciosum	+	1	.	.	+	.	.	1	+	1	.	.	.	+	.	.	.	.	.	.	.	.	.	1	.	1	.	.	+	.	.	.	+	.	+	.	1	1	a	.	.	.	.	.	.	.	+
Taraxacum sp.	+	+	.	+	+	+	.	.	.	.	+	1	.	1	+	1	+	1	.	.	.	+	.	.	.	.	+	+	+	.	.	+	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Daphne oleoides	+	r	.	.	.	.	.	.	r	.	r	.	+	.	.	+	.	.	.	+	+	+	1	+	+	.	+	.	+	+	+	.	a	1	1	.	+	.	.	3	4	4	3	b	3	+	+
Campanula rotundifolia s. l.	1	1	+	1	+	+	+	1	+	+	.	.	.	.	.	.	.	+	.	1	+	+	.	+	.	+	.	+	+	+	.	+	+	.	+	.	+	+	1	+	+	.	+	+	+	.	+
Minuartia verna s. l.	+	+	+	+	.	+	.	+	+	+	.	.	+	+	.	+	.	1	.	.	.	+	.	.	.	+	+	.	+	.	.	.	+	.	.	.	+	1	.	+	+	+	+	+	+	.	+
Bornmuellera baldaccii	+	1	.	+	1	.	.	.	.	+	.	.	+	.	+	+	.	.	.	.	+	+	+	.	+	+	1	.	+	1	+	.	1	1	+	.	1	.	.	+	1	+	1	1	1	.	+
Sesleria robusta	.	.	.	.	.	1	1	1	1	a	.	.	.	.	.	.	r	.	.	+	+	.	1	+	.	1	.	.	+	+	b	1	.	.	a	3	3	3	3	+	.	.	.	.	.	1	+
Thymus praecox subsp. jankae	b	a	.	1	b	1	.	+	.	+	+	.	+	.	+	+	.	+	.	.	+	+	+	.	1	1	1	+	1	.	a	1	1	1	.	.	1	+	.	1	+	+	1	1	1	1	1
Alyssum smolikanum	1	.	.	1	+	1	.	.	.	.	1	+	+	+	1	1	1	.	+	+	+	+	.	1	.	1	+	.	.	a	+	1	.	.	1	1	+	1	a	.	.	a	+	1	.	1	+

Other species																																															
Acinos alpinus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	+	.	1	.	+	.	.	.	.	+	.	+	.	+	.	+	.	.
Poa thessala	+	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	1	+	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	+	1	+	+	+	.	.
Carduus tmoleus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	+	.	+	.	+	.	.	+	a	.	.	.	.	+	+	.	.	.	.	.	.
Draba lasiocarpa	+	.	.	+	+	.	.	.	.	.	+	.	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	.	.	.	.	.	.	1	+	+	.	.	.
Myosotis suaveolens	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	+	.	+	+	.	r	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.
Viola dukadjinica	.	.	+	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	+	1	.	.	.	.	.	1	1	.	.	.	.	.	.	.
Alopecurus gerardi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	1	+	.	+	.	.
Ranunculus sartorianus	.	.	+	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Iberis sempervirens	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	.	.	.	.	.	+	.	+
Scabiosa columbaria	.	.	.	.	.	.	.	a	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	1	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
Cardamine glauca	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.
Doronicum columnae	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Euphorbia herniariifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.
Poa cenisia	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	+	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.
Thesium parnassi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Crepis guioliana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.
Viola albanica	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.
Leontodon hispidus	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Leucanthemum praecox	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Dianthus integer subsp. minutiflorus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Muscari tenuiflorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Euphorbia myrsinites	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Scorzonera austriaca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Bellardiochloa violacea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asyneuma limonifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Silene radicosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Herniaria parnassica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.

Asperula aristata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cuscuta europaea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bromus riparius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypericum barbatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Astragalus depressus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium parnassi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pinus heldreichii	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poa macedonica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Scleranthus perennis subsp. marginatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linum punctatum subsp. pycnophyllum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stachys recta subsp. baldaccii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Potentilla micrantha	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Campanula tymphaea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Podospermum roseum	+	+	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Scrophularia heterophylla subsp. laciniata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Hippocrepis comosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Paronychia albanica	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphrasia salisburgensis	.	.	.	.	a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dianthus haematocalyx subsp. pindicola	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Veratrum album	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Betonica alopecuros	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Erigeron glabratus	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Plantago holosteum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lactuca intricata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Silene parnassica subsp. parnassica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Teucrium montanum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium ophioliticum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Helianthemum nitidum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Narcissus poeticus subsp. radiiflorus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga paniculata	.	.	.	.	.	.	+	.	1	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga taygetea	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anthoxanthum odoratum	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thlaspi epirotum	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aethionema saxatile	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dactylorhiza viridis	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gentianella bulgarica	+	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Helictotrichon aetolicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumex acetosella	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anthyllis vulneraria	.	+	1	.	.	.	a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Alchemilla sp.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 5

Field No. (First 5 rel. from Nemërçkë, other Sm)	76	48	75	88	106	24	3	35	59	29	109	13	22	36	97	37
Cluster	1							2					3		4	
Number in table.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Alopecuro gerardi-Chenopodietum boni-henrici																
Urtica dioica	+	a	1	1	a	1	a	.	.	.	.	.	.	.	.	.
Chenopodium bonus-henricus	1	4	3	4	5	4	a	.	.	.	.	.	.	.	.	.
Phleum alpinum	1	+	b	a	.	b	+	.	.	.	.	.	.	.	.	.
Capsella bursa-pastoris	a	.	a	+	.	+	+	.	.	.	.	.	.	.	.	.
Trifolium parnassi	.	+	+	1	.	+	+	.	.	.	.	+	.	.	.	.
Solenanthus albanicus	5	a	4	1	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculus sartorianus	r	.	+	.	+	+	.	.	.	+	.	+	.	.	.	.
Carduus tmoleus	.	.	a	1	.	a	4	+	.	.	.	+	+	.	.	.
Arenaria serpyllifolia	+	.	1	.	.	+	1	.	.	.	.	.	.	.	.	.
Alopecurus gerardi	+	+	1	.	.	a	b	.	.	.	.	.	.	.	.	.
Pinguiculo hirtiflorae-Soldanelletum pindicolae																
Carex nigra	.	.	.	.	.	.	.	4	4	5	5	5	.	.	.	.
Juncus alpinoarticulatus	.	.	.	.	.	.	.	a	+	.	+	+	b	.	.	.
Deschampsia cespitosa	.	.	.	.	.	.	.	.	.	1	1	+	.	.	.	.
Species of the *Narthecio scardici-Caricetum kitaibelianae*																
Plantago media subsp. pindica	.	.	.	.	.	.	.	.	.	.	.	1	1	1	.	.
Narthecium scardicum	.	.	.	.	.	.	.	.	.	.	.	.	a	b	.	.
Carex lepidocarpa	.	.	.	.	.	.	.	+	.	.	+	.	a	1	.	.
Narthecio scardici-Caricetum kitaibelianae* and *Sileno pusillae-Pinguiculetum hirtiflorae																
Soldanella pindicola	.	.	.	.	.	.	.	1	.	.	.	.	1	.	+	+
Silene pusilla	.	.	.	.	.	.	.	1	.	.	.	+	+	.	1	+
Pinguicula hirtiflora	.	.	.	.	.	.	.	.	.	.	+	1	b	b	+	b
Carex kitaibeliana	.	.	.	.	.	.	.	1	.	.	.	.	b	3	+	+
Bryophytes																
Bryum pseudotriquetrum	.	.	.	.	.	.	.	1	a	.	.	.	+	.	.	
Bryum schleicherii	.	.	.	.	.	.	.	a	4	5	a	5	.	.	a	.
Campylium stellatum	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Cratoneuron falcatum	.	.	.	.	.		.	3	.	.	.	1	+	.	a	.
Phillonotis calcarea	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.
Other species																
Allium schoenoprasum subsp. alpinum	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	r
Cardamine glauca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Molinia caerulea	.	.	.	.	.	.	.	.	.	.	.	.	.	a	.	r
Eleocharis palustris	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Carex echinata	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Blysmus compressus	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Veronica serpyllifolia subsp. humifusa	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Festuca rubra s. l.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.
Cerastium cerastoides	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.

Doronicum columnae	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asperugo procumbens	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gentianella bulgarica	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Veratrum album	.	.	.	.	.	.	.	b	.	.	.	.	.	.	.	.
Agrostis gigantea	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Poa macedonica	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Dactylis glomerata	.	.	.	b	.	.	.	.	.	.	.	.	.	.	.	.
Campanula rotundifolia s. l.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Senecio squalidus	.	a	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arrhenatherum elatius	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Poa pratensis	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.
Scandix pecten-veneris	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Alyssum smolikanum	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.
Poa annua	.	.	.	+	.	.	1	.	.	.	.	.	.	.	.	.
Eleocharis quinqueflora	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Cerastium brachypetalum subsp. pindigenum	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Silene vulgaris	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.
Secale strictum	+	a	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Scilla bifolia s. l.	1	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.
Gagea liotardii	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Poa thessala	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Poa timoleontis	+	.	a	.	.	.	.	.	.	.	.	.	.	.	.	.
Herniaria parnassica	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.
Rumex nepalensis	+	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
Silene parnassica subsp. pindicola	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Taraxacum sp.	.	.	.	.	.	+	.	.	1	.	.	1	+	.	.	.
Lotus corniculatus agg.	.	+	.	.	.	.	1	.	.	.	.	+	+	.	.	.
Nardus stricta	.	.	.	.	.	.	.	.	.	.	.	r	+	.	.	.
Poa bulbosa subsp. pseudoconcinna	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Artemisia absinthium	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Parnassia palustris	.	.	.	.	.	.	.	1	.	.	.	+	.	+	.	.
Heracleum sphondylium subsp. pyrenaicum	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Bornmuellera baldaccii	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Bornmuellera emarginata	.	.	.	.	.	.	a	.	.	.	.	.	.	.	.	.
Myosotis suaveolens	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumex alpinus	.	b	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Buglossoides incrassata	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hesperis dinarica	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Bromus riparius	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Trisetum flavescens	+	.	.	.	.	a	1	.	.	.	.	.	.	.	.	.
Verbascum longifolium	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Cynosurus echinatus	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Astragalus depressus	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Stachys tymphaea	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.

Table 1B

No.	Field. No.	Lat.	Long.	Alt.	Asp.	Slope	Ct	E1	E0	Rock	Date
1	N52	400758.8	202435.4	2239	270	90	15	12	4	85	20130702
2	N65	400739.8	202531.1	2400	338	90	10	8	2	90	20130703
3	N95	400511.8	202732.3	2065	360	90	30	25	5	75	20130705
4	N85	400523	202725.3	2297	360	85	7	7	1	93	20130704
5	N77	400623	202630.2	2269	90	70	15	15	2	90	20130704
6	N46	400833.6	202405	2075	360	60	20	15	5	80	20130701
7	N19	401156	201857.1	1964	113	85	15	15	1	90	20130629
8	N16	401116.8	201857.7	1968	68	80	10	10	1	90	20130629
9	N64	400745.9	202516.2	2360	135	70	17	17	1	85	20130703
10	N41	400831.9	202331.9	2247	90	70	25	25	1	80	20130701
11	N50	400821.7	202438.1	2035	248	60	15	15	2	90	20130702
12	N92	400429.1	202745.8	2164	10	80	15	8	12	85	20130705
13	N72	400706.8	202542.4	2115	360	80	70	65	20	35	20130703
14	N83	400540.4	202712.7	2332	45	65	20	20	2	85	20130704
15	N54	400759.7	202436.6	2260	338	20	70	70	5	45	20130702
16	N27	400952.1	202139.6	2005	45	55	20	15	5	85	20130630
17	N36	400907.6	202217.3	2131	360	65	55	30	40	45	20130701
18	N56	400801	202447.3	2310	338	50	35	35	5	75	20130702
19	N67	400733.4	202542.8	2440	360	55	30	20	10	85	20130703
20	N09	401204.9	201852	2011	90	50	25	25	1	80	20130628
21	N70	400704.9	202555.6	2177	338	30	5	5	0	99	20130703
22	N71	400709.7	202545.5	2143	225	20	10	10	0	96	20130703
23	N61	400724.1	202514.8	2070	270	30	10	10	0	95	20130702
24	N29	400930.8	202158.3	1920	15	45	10	10	0	100	20130630
25	N30	400927.8	202202	1951	360	23	20	20	0	85	20130630
26	N44	400836.6	202409.1	1996	360	30	15	15	0	90	20130701
27	N53	400802.4	202437	2260	293	25	15	15	0	90	20130702
28	N69	400709	202554.5	2189	225	30	5	5	0	98	20130703
29	N03	401223	201852.2	1806	23	25	30	30	0	70	20130626
30	N98	400505.9	202746.3	1835	135	30	10	10	0	95	20130705
31	N02	401222.7	201853.6	1805	45	25	25	25	0	80	20130626
32	N102	400524.2	202804	1750	360	30	45	45	5	70	20130706
33	N105	400532.7	202757.7	1616	23	30	60	60	0	65	20130706
34	N103	400524.4	202801.6	1725	360	30	40	40	2	80	20130706
35	N101	400505.2	202759.3	1700	113	30	35	35	0	80	20130705
36	N99	400506.1	202747.5	1803	113	30	30	30	0	90	20130705
37	N104	400527.4	202757.4	1680	45	30	40	40	0	75	20130706
38	N49	400821	202437.2	2003	248	30	40	40	0	85	20130702
39	N94	400510.4	202725.4	2103	90	33	25	25	0	95	20130705
40	N100	400504.3	202751.1	1760	113	30	45	45	0	95	20130705
41	N80	400605.2	202652.3	2300	90	30	20	20	0	95	20130704
42	N93	400430.2	202746.2	2139	68	30	30	30	0	95	20130705
43	N97	400508.5	202740.6	2019	113	38	75	75	0	60	20130705
44	N96	400512.2	202739.4	2025	68	30	65	65	0	45	20130705
45	N42	400832	202332.5	2220	85	45	75	75	0	35	20130701

Table 2B

No.	Field No.	Lat.	Long.	Alt.	Asp.	Slope	Ct	E1	E0	Rock	Date
1	N11	401157.9	201847	2043	158	5	15	15	0	80	20130628
2	N17	401121.3	201855.2	1991	180	10	15	15	0	85	20130629
3	N22	401019.6	202059.8	2125	158	7	30	30	0	70	20130630
4	N51	400808	202418.8	2100	225	20	75	75	3	25	20130702
5	N24	401006.8	202125	2025	135	5	70	70	0	30	20130630
6	N62	400717.4	202512.1	2051	180	5	70	70	1	35	20130702
7	N10	401200.4	201850.4	2050	135	5	70	70	1	30	20130628
8	N47	400831.7	202410.9	2091	135	15	85	85	0	15	20130701
9	N74	400653.1	202600.5	2270	270	15	60	60	2	45	20130704
10	N32	400946.2	202155.8	1950	100	20	55	55	1	50	20130701
11	N45	400839.5	202401.3	2031	90	25	70	70	1	30	20130701
12	N66	400739	202536.4	2420	270	20	60	60	1	55	20130703
13	N86	400523	202724.2	2302	225	2	80	80	2	25	20130705
14	N84	400539.6	202715.2	2354	270	15	60	60	1	50	20130704
15	N73	400728	202556.2	2474	270	10	15	15	1	85	20130704
16	N63	400736	202607.3	2355	225	8	30	30	0	75	20130703
17	N04	401224.2	201844.5	1858	23	30	40	40	0	65	20130626
18	N91	400434.3	202744.8	2155	270	20	90	90	1	5	20130705
19	N58	400759.1	202500.9	2353	225	20	80	80	1	10	20130702
20	N37	400900.2	202232.5	2085	315	5	60	60	1	25	20130701
21	N78	400612.6	202637.7	2301	225	20	45	45	1	50	20130704
22	N18	401147.4	201855.9	2027	90	35	75	75	0	20	20130629
23	N26	400959.9	202135.2	1997	45	20	40	40	0	60	20130630
24	N15	401113.4	201857.4	1967	113	20	60	60	0	45	20130629
25	N20	401055.3	202051.7	1966	293	20	65	65	1	35	20130630
26	N28	400949.4	202139.6	2055	45	45	90	80	15	10	20130630
27	N40	400834.8	202321.5	2269	158	25	45	45	1	45	20130701
28	N14	401113.6	201855.9	1974	225	15	65	65	0	40	20130629
29	N01	401224.5	201859.4	1762	68	20	45	45	5	45	20130626
30	N35	400911.7	202213.8	2126	180	10	25	25	0	85	20130701
31	N07	401208.4	201853.1	2017	270	10	40	40	0	45	20130628
32	N06	401211.2	201851.8	2008	23	5	50	50	1	55	20130628
33	N81	400601.8	202652.7	2346	270	20	65	65	0	35	20130704
34	N60	400742.2	202506.5	2235	225	15	65	65	1	20	20130702
35	N87	400510.4	202724.1	2223	180	30	50	50	1	60	20130705
36	N55	400801	202440	2307	338	20	50	50	1	60	20130702
37	N33	400855.5	202246.4	2110	315	50	85	70	50	15	20130701
38	N68	400728.9	202555.7	2470	45	45	80	75	10	25	20130703
39	N38	400848.1	202255.7	2232	23	60	75	70	30	30	20130701
40	N79	400608.9	202646	2310	338	60	90	85	15	15	20130704
41	N43	400829.4	202344	2227	23	60	70	65	25	30	20130701
42	N57	400801.1	202456.3	2342	360	55	70	65	10	35	20130702
43	N90	400440.6	202744	2169	68	65	75	70	15	30	20130705
44	N05	401225	201841.5	1898	338	5	95	95	10	3	20130626
45	N21	401040	202059	2041	315	10	90	80	20	5	20130630
46	N23	401013.7	202106.1	2060	90	15	75	75	1	20	20130630
47	N12	401147.6	201845.1	2016	0	0	90	90		15	20130628

48	N25	401005.1	202125.2	2021	90	10	90	85	10	5	20130630
49	N59	400751.7	202502	2285	248	10	80	80		5	20130702
50	N13	401144.5	201848.9	2029	338	5	90	80	25	5	20130628
51	N89	400508.8	202713.8	2146	203	20	95	95	5	0	20130705
52	N82	400555.9	202658.6	2342	68	25	90	90		30	20130704
53	N39	400843	202305.7	2252	270	2	25	25	1	75	20130701
54	N34	400916.8	202202.1	2120	0	0	95	70		1	20130701
55	N08	401204.9	201851	2016	315	50	90	90	1	1	20130628

Table 3B

No.	Field No.	Lat.	Long.	Alt.	Asp.	Slope	Ct	E1	E0	Rock	Date
1	Sm49	400519.1	205524.1	2560	270	65	5	5	1	95	20120726
2	Sm85	400507.4	205614.5	2514	225	80	4	4	1	98	20120729
3	Sm48	400515.2	205523.4	2530	270	75	5	5	0	95	20120726
4	Sm81	400507.3	205659.5	2605	225	55	7	5	2	95	20120729
5	Sm52	400524.5	205531.6	2630	45	80	10	5	5	90	20120726
6	Sm76	400556.5	205658.4	2453	113	70	6	6	0	97	20120729
7	Sm54	400520.5	205531.24	2635	90	80	7	6	1	93	20120726
8	Sm10	400516	205723	2230	90	30	5	5	0	99	20120723
9	Sm79	400508.2	205702.9	2581	23	45	25	25	1	75	20120729
10	Sm93	400515.8	205612.2	2350	20	30	15	15	0	90	20120730
11	Sm95	400527	205630.8	2210	248	33	25	25	0	90	20120730
12	Sm84	400507.7	205611.5	2495	255	35	20	20	0	90	20120729
13	Sm33	400436.15	205726.8	2235	68	30	7	7	0	98	20120725
14	Sm104	400529.3	205529	2443	23	30	20	20	0	85	20120731
15	Sm42	400446.8	205615.8	2320	180	30	8	8	0	95	20120726
16	Sm82	400504.7	205607.9	2483	225	30	5	5	0	98	20120729
17	Sm63	400529.4	205710.7	2340	90	35	10	10	0	90	20120727
18	Sm7	400519	205736	2245	270	30	10	10	0	99	20120723
19	Sm39	400503.2	205656.5	2570	180	30	5	5	0	97	20120725
20	Sm107	400554.6	205508	2184	45	30	7	7	0	96	20120731
21	Sm91	400518.1	205627.3	2276	338	30	70	70	5	25	20120730
22	Sm17	400452.9	205702.3	2470	23	30	12	10	2	90	20120724
23	Sm8	400520	205731.1	2190	355	15	10	10	2	90	20120723
24	Sm20	400450.5	205702	2480	45	10	8	7	1	92	20120724
25	Sm12	400509.6	205727	2370	23	25	20	20	1	80	20120723
26	Sm103	400534.3	205533	2357	360	20	7	7	1	96	20120731
27	Sm61	400518.2	205653	2390	270	20	25	25	2	75	20120727
28	Sm100	400521.6	205546.3	2377	338	10	30	25	5	60	20120730
29	Sm16	400453.4	205702.8	2455	45	20	50	50	1	30	20120724
30	Sm96	400523.5	202604	2261	185	5	35	35	1	70	20120730
31	Sm21	400456.1	205711.9	2370	90	5	80	80	1	5	20120724
32	Sm46	400506.4	205528.2	2410	203	10	70	70	1	0	20120726
33	Sm9	400520.4	205729.5	2190	90	25	15	15	1	85	20120723

34	Sm90	400520.6	205636.7	2313	293	3	80	80	0	1	20120730
35	Sm31	400430.5	205739.7	2220	23	5	80	75	5	5	20120725
36	Sm86	400506.5	205619.8	2495	0	0	75	70	5	5	20120729
37	Sm58	400510.3	205642.6	2380	360	5	90	70	0	3	20120727
38	Sm26	400437.4	205733	2190	270	3	90	90	2	1	20120725
39	Sm57	400510.4	205644.1	2360	315	5	65	65	0	30	20120727
40	Sm25	400442.5	205729.5	2180	0	0	75	75	1	5	20120724
41	Sm98	400532.6	205559.7	2293	23	25	90	90	1	1	20120730
42	Sm72	400550.5	205703.8	2450	113	90	50	50	1	45	20120729
43	Sm70	400611.6	205738.5	2209	0	0	90	85	10	0	20120728
44	Sm69	400624.2	205802.1	2142	0	0	90	85	5	0	20120728
45	Sm68	400624.2	205802.2	2139	0	0	90	90	1	0	20120728
46	Sm14	400454	205704.1	2440	90	5	85	85	0	0	20120723
47	Sm60	400511.9	205642.8	2380	90	1	100	100	1	0	20120727
48	Sm87	400526.5	205646.1	2309	0	0	90	90	1	2	20120730
49	Sm110	400559	205502.2	2129	0	0	90	90	1	0	20120731

Table 4B

No.	Field No.	Lat.	Long.	Alt.	Asp.	Slope	Ct	E1	E0	Rock	Date
1	Sm75	400534.1	205701	2550	13	25	60	60	2	30	20120729
2	Sm62	400525.1	205658.3	2445	270	15	75	75	2	15	20120727
3	Sm105	400528.5	205531	2491	355	30	85	75	20	1	20120731
4	Sm50	400519.2	205524.5	2565	225	15	5	90	1	5	20120726
5	Sm18	400448.6	205702.9	2490	248	10	65	60	5	40	20120724
6	Sm80	400508.6	205701.3	2600	68	20	75	75	3	22	20120729
7	Sm88	400527.2	205634	2297	360	40	90	90	5	0	20120730
8	Sm77	400549.6	205655.6	2433	293	25	85	85	1	1	20120729
9	Sm92	400512.8	205612.8	2331	338	35	95	90	10	1	20120730
10	Sm11	400512	205724.3	2320	360	30	90	85	5	50	20120723
11	Sm65	400606.3	205746.8	2230	0	0	10	10	0	95	20120727
12	Sm40	400503.2	205656.5	2530	293	5	8	8	0	99	20120725
13	Sm83	400506.5	205609.4	2507	210	15	20	20	0	80	20120729
14	Sm41	400502.3	205643	2490	293	15	20	20	0	90	20120725
15	Sm73	400548.8	205702.7	2451	135	5	5	5	0	98	20120729
16	Sm45	400503	205526.8	2410	180	5	20	20	0	85	20120726
17	Sm55	400509.3	205602.8	2470	225	10	15	15	0	90	20120727
18	Sm53	400520.8	205530.6	2637	90	15	25	25	1	60	20120725
19	Sm78	400556	205659.5	2463	225	10	15	15	0	90	20120729
20	Sm28	400426.8	205755.7	2310	203	40	25	25	1	80	20120725
21	Sm4	400533.2	205741.8	2120	90	15	25	25	1	90	20120722
22	Sm43	400435.7	205604.1	2230	135	15	40	40	0	75	20120726
23	Sm1	400555.51	202735.35	2240	158	30	30	30	0	80	20120722
24	Sm101	400531.1	205607.2	2334	158	20	30	30	1	75	20120731
25	Sm34	400443.1	205741	2100	135	45	25	25	1	80	20120725
26	Sm6	400522	205733.8	2190	270	30	60	60	1	50	20120723

27	Sm67	400623.8	205848.8	2145	90	15	20	20	0	90	20120728
28	Sm102	400539.4	205540.3	2289	355	25	65	60	5	40	20120731
29	Sm66	400615.2	205904.8	2205	45	25	75	75	1	20	20120728
30	Sm23	400457.7	205730.6	2180	158	30	55	55	1	20	20120724
31	Sm111	400547.6	205448.2	2066	293	15	65	65	0	40	20120731
32	Sm19	400446.7	205701	2470	203	20	80	80	1	25	20120724
33	Sm27	400428.2	205747.6	2240	338	20	55	55	1	30	20120725
34	Sm44	400440.7	205605.2	2265	113	10	80	80	0	1	20120726
35	Sm2	400551	205729.8	2210	160	30	45	45	0	50	20120722
36	Sm74	400533.5	205700.7	2563	180	30	40	40	1	70	20120729
37	Sm51	400517.6	205528.4	2610	180	25	40	40	0	70	20120726
38	Sm47	400512.7	205527	2505	180	30	35	35	0	70	20120726
39	Sm38	400504	205700.8	2570	158	35	55	55	1	60	20120725
40	Sm15	400454.3	205703.2	2450	135	20	60	60	1	50	20120724
41	Sm71	400556.8	205708.3	2402	90	20	70	70	1	35	20120729
42	Sm56	400506.8	205633.6	2460	90	15	70	70	0	40	20120727
43	Sm32	400431.2	205739.4	2210	203	5	40	40	1	5	20120725
44	Sm5	400534.5	205738	2130	0	0	30	30	1	75	20120723
45	Sm99	400525.3	205550.5	2349	90	30	60	60	1	50	20120730
46	Sm106	400542.4	205517.4	2314	180	5	90	90	1	15	20120731
47	Sm89	400523.6	205634.1	2335	165	20	80	80	0	20	20120730

Table 5B

No.	Field No.	Lat.	Long.	Alt.	Asp.	Slope	Ct	E1	E0	Rock
1	N76	400614.9	202609.1	2012	45	15	85	85	25	20130704
2	N48	400833	202412.7	2085	360	5	95	95	0	20130702
3	N75	400617.3	202611	2111	225	10	95	95	5	20130704
4	N88	400508.7	202701.1	2069	0	0	99	99	0	20130705
5	N106	400539.4	202753.4	1570	23	20	80	80	55	20130706
6	Sm24	400454.2	205729	2150	90	5	95	95	10	20120724
7	Sm3	400540.3	205738.8	2070	90	5	80	80	30	20120722
8	Sm35	400458	205729.3	2270	45	45	100	100	0	20120725
9	Sm59	400511.7	205643.7	2380	0	0	99	75	0	20120727
10	Sm29	400430.3	205742.8	2210	0	0	90	90	0	20120725
11	Sm109	400600	205500.4	2128	0	0	90	75	0	20120731
12	Sm13	400454.1	205704.4	2440	90	10	97	90	3	20120723
13	Sm22	400456	205721	2280	158	20	65	65	30	20120724
14	Sm36	400458.5	205720.7	2280	90	40	70	70	10	20120725
15	Sm97	400533.8	205600.1	2272	23	40	20	5	80	20120730
16	Sm37	400459.6	205717.8	2330	90	80	20	20	80	20120725
Rumex alpinus comm., *Sparganium angustifolium* comm., *Allium schoenoprasum* subsp. *alpinum* comm.										
	Sm96	400524.8	205632	2236	248	45	90	90	2	20120730
	Sm64	400431.2	205742.6	2215	0	0	90	90	0	20120727
	Sm30	400431.2	205742.6	2200	45	17	70	70	0	20120725