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# FLORA, VEGETATION AND IMPORTANT HABITAT TYPES OF ARID KARST FIELDS IN PIPERI (MONTENEGRO)

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The Kopilje, Radovče, and Gostilje Martinićko are arid karst fields located in the Piperi region of central Montenegro, at altitudes ranging from 600 to 950 meters above sea level. These fields are found within zones of thermophilous hornbeam and oak forests, as well as mesophilous beech forests. Despite covering a relatively small area of approximately 7.4 km², these three fields are home to a rich diversity of plant life, with 480 species and subspecies of vascular plants recorded, belonging to 284 genera and 63 families. The most species-rich families are Asteraceae, Fabaceae, and Poaceae, while the genera *Trifolium*, *Medicago*, *Veronica*, and *Geranium* are among the most diverse. Hemicryptophytes dominate the life forms, with significant participation from therophytes and geophytes. In terms of chorology, Eurimediterranean species predominate. Eighteen species found in the area are of conservation importance, with three species — *Galatella linosyris*, *Crocus weldenii* f. *lutescens*, and *Succisella petteri* — being particularly notable as they occur only in one or a few localities in Montenegro. The semi-natural grassland vegetation of these karst fields is unique, represented by nine plant communities. Three of these communities are exclusive to the karst fields in Piperi: *Armerio canescenti-Festucetum illyricae chrysopogonetosum grylli*, *Ornithogalo comosi-Koelerietum pyramidatae artemisietosum albae*, and *Stipo eriocauli-Caricetum humilis*. With the exception of the ruderalized annual grasslands, the other grassland communities are vegetation equivalents of two NATURA 2000 habitat types: 62A0 and 6510, both of which are of significant ecological value.

**Key words:** dry grasslands; *Festuco-Brometea; Scorzoneretalia villosae*; *Saturejion subspicatae*; *Scorzonerion villosae; Arrhenatheretum*

## INTRODUCTION

Karst fields are considered one of the most fascinating landscape features of the Dinaric Karst [1], as well as habitats where a unique flora has developed due to the specific geological-biological history and later zooanthropogenic activities [2–5]. In Montenegro, karst fields are found in the southern, western, and central regions. Settlements have mainly developed on their plains (Podgorica on Ćemovsko polje, Cetinje on Cetinjsko polje, and Nikšić on Nikšić polje), and due to the fertility of the soil, parts of these areas are cultivated (vineyards and orchards on Ćemovsko polje, arable land on Grahovsko polje, and immortelle plantations on Kopilje) or used for pasture (Dragalj, Lukovo, Radovče). The landscape of these karst fields has been altered due to open-cast mining and the extraction of fluvioglacial sediments (Kopilje, Dragalj). The type of sediments that filled the slopes and formed the plains of the fields (morainic and/or fluvioglacial) links their formation to glaciation [1].

The geological history is reflected in the flora [6], which largely explains the composition of

the current flora and vegetation, as well as the presence of endemic and relict elements, all of which are of great significance for nature conservation [7, 8]. Of particular botanical value to Grahovsko polje are *Haplophyllum patavinum* (L.) G. Don, *Thymus bracteosus* Vis. ex Benth, *Dianthus knappii* (Pant.) Borbás, and from Kopilje, Radovče, Grahovsko polje, and Dragalj, *Hyacinthella dalmatica* Chouard, along with plant communities of East Submediterranean grasslands (*Scorzoneretalia villosae*) – NATURA 2000 habitat type 62A0 [5, 7, 8].

Regarding hydrology, three types of karst fields can be distinguished: dry, periodically flooded, and permanently flooded. Apart from Nikšićko polje, all other Montenegrin karst fields are dry and lack permanent watercourses. However, during autumn and spring, ephemeral watercourses may appear, causing localized and short-term flooding. Generally, the southern, western, and central regions of Montenegro, including Piperi, are characterized by dry and extremely hot summers [9], which promote the development of dry, semi-arid to temperate grassland vegetation. Dry grasslands are considered the most floristically rich yet least studied, particularly in southeastern Europe [10, 11]. To address this gap, this paper presents the characteristics of the flora, vegetation, and habitat types of karst arid grasslands in Piperi, specifically Kopilje, Radovče, and Gostilje Martinićko, and lists the associated threats, along with suggestions for management and sustainable use.

## MATERIALS AND METHODS

### Study area

In the central part of Montenegro, a typical karst area was formed, bordered by the Prekornica mountain to the north, the Ostroške Grede to the northwest, and the Morača valley to the southeast, as well as the flat karst fields of Kopilje and Radovče and the hilly surface of Gostilje Martinićko (Fig. 1). During the Neogene period, this area was covered by the waters of ancient lakes, which, through post-Neogene drainage, created the plains of today's fields.

Kopilje Polje is situated at its lowest point at 604 m above sea level. It spans an area of 3.42 km² and stretches in a north-south direction. It is bordered by Krivac to the east, Kopiljske Strane to the north, Obruč to the northwest, Kozica to the west, Košutica to the southwest, and Mikulica to the southeast. Through Branjevina, it is connected to the Bjelopavlićka Ravnica, through which the Mediterranean climate influence is transmitted [12]. The geological substrate is of glaciofluvial origin, primarily consisting of a gravelly-pulverized fraction with interlayers of earthy components, occasionally silt, and conglomerate [13].

In the northwest, at an altitude of 800–850 m, lies Gostilje Martinićko. It covers an area of 0.73 km² and, unlike the flat Kopilje Polje, features a hilly terrain with prominent moraines and fluvioglacial drifts. It stretches from east to west. To the southwest, it borders Kopiljske Strane; to the northeast, it is bounded by Pantelijev Vrh; to the southeast, it opens towards Bjelopavlićka Ravnica; and to the northwest, it is separated from Brajovićko Gostilje by moraine ridges.

To the northeast lies the highest (850–900 m) and largest (3.48 km²) field – Radovče. It borders Kopiljske Strane, Radojev Brijeg to the north, Bijela Glava to the southeast, Živa, Jehova Glava, and Lazareva Struna to the east, Crnac Strane to the northeast, the foothills of Konjica to the north, Bradvi to the northwest, Medna Glava to the west, and Pantelijev Vrh to the southwest. The surface is gently undulating and consists of glaciofluvial and moraine deposits [14].

As previously mentioned, the fields were once covered by a lake, and the subsequent drift of glacial rivers contributed to the formation of their plains. Traces of the ancient Kopiljska Rijeka are still visible in the central part of the field. Currently, no surface water, even temporarily, forms on the fields. Due to the higher permeability of the substrate, atmospheric water quickly sinks into the ground and flows through underground channels into the Bjelopavlićka Ravnica. However, a small portion remains above the less permeable marl deposits, where wells have been dug. The soil in the fields is of the rendzine type [15].

The climate of Piperi is classified as perhumid sub-Mediterranean, characterized by slightly cooler winters and long, hot, dry summers. The average annual rainfall is 2349 l/m², with the highest amounts (40 %) occurring between November and January. The driest months are June, July, and August, when only 12 % of the annual rainfall is received. The high relative annual fluctuation index of 12 % indicates the uneven distribution of precipitation, with highly contrasting rainy and dry seasons. The amount of precipitation in the rainy quarter exceeds that in the dry quarter by 70 %. The warmest months are July and August, while the coldest are January and February. The average annual temperature is 20 °C, with fluctuations of up to ± 110 %. The prevailing winds come from the north (22 %) and south (14 %), while about a third of the days are windless (Micevski, pers. comm., 2001).

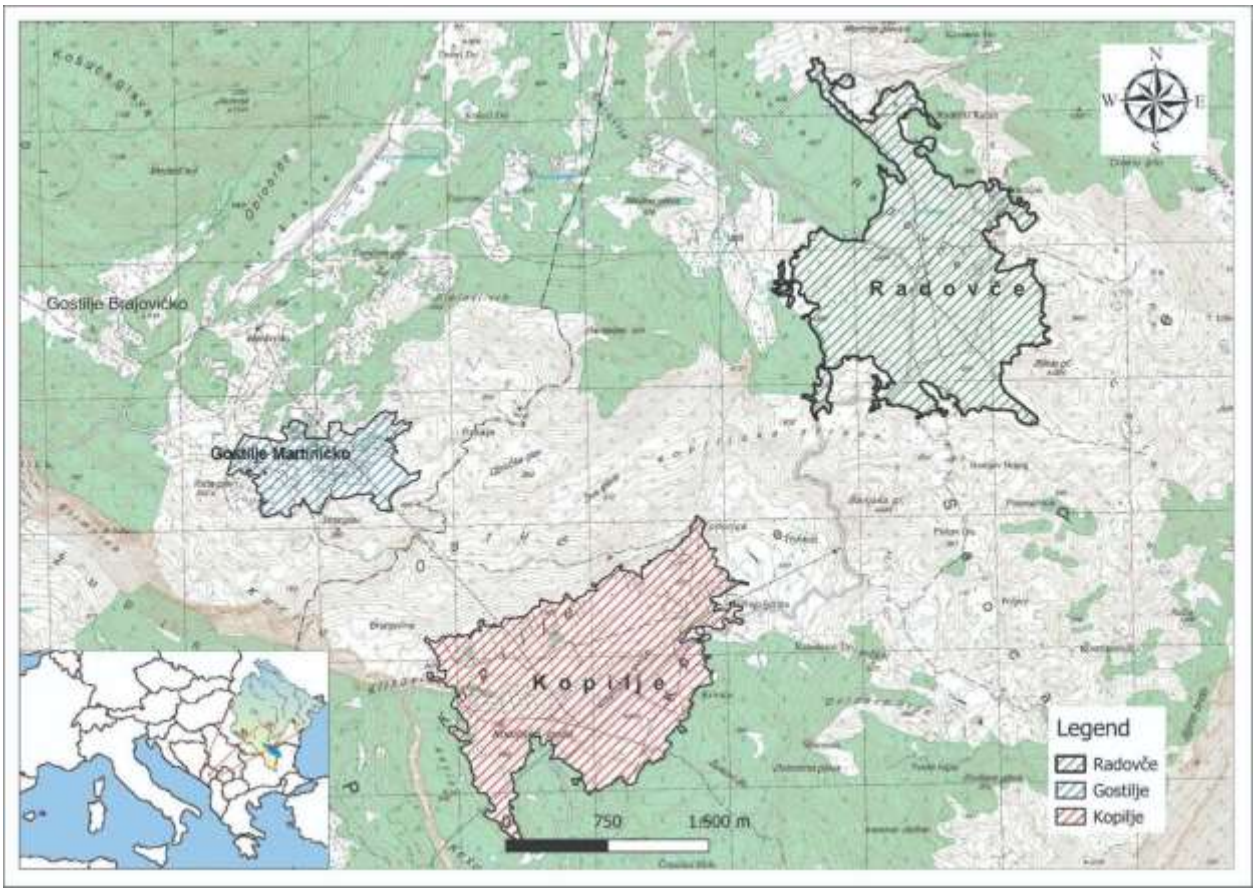


**Figure 1.** Geographic location of the investigated karst fields: Kopilje, Radovče, and Gostilje Martinićko in Montenegro.

## Fieldwork

Research on the flora, vegetation, and habitats of the arid karst fields in Piperi was conducted between 2018 and 2024. Data on flora were collected during the spring, summer, and autumn periods. To define the NATURA 2000 habitat types, a phytocenological survey was carried out from June to early July, during the peak of the growing season. A total of 68 phytocenological relevés were made using the Braun-Blanquet method [16], with plots of uniform size (25 m²).

## Data analysis

The collected plant material was herbarized and deposited in the herbarium collection of the University of Montenegro (TGU!). The taxa were identified to species or subspecies using the following identification keys [17–19]. The nomenclature is harmonized with EURO+MED (2006–) [20].

Life forms and chorotypes follow Pignatti [21], while the conservation status is based on the Official Gazette of the Republic of Montenegro [22], Stevanović et al. [6], the Council Directive [23], and CITES [24]. The invasive status of alien species in Montenegro follows Stešević and Petrović [25] and Stešević and Caković [26].

The similarity index of the flora in the karst fields was calculated using Sørensen's formula [27]: Cs = 2ab / (a + b), where 'a' represents the number of taxa found in karst field A, 'b' is the number of taxa in karst field B, and 'ab' is the number of taxa shared by both fields.

The relevés were stored in TURBOVEG [28] and included in Montenegro's national vegetation database (GIVD EU-ME-001) [29].

Habitat mapping was conducted using QGIS [30] in the WGS 84 / UTM zone 34N coordinate system. The following habitat types were mapped: 62A0 – Eastern sub-Mediterranean dry grasslands (*Scorzoneratalia villosae*), 6510 – Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*), and Annual grasslands.

Syntaxonomical concepts and nomenclature treatment of plant communities follow Stanišić-Vujačić [31].

Abbreviations used in the check list: Life forms: T – therophytes, H – hemicroptophytes, Ch – chamaephytes, G – geophytes, P – phanero-

phytes; Chorological element: ADV – alien plant, AS – Asian, ATL – Atlantic, BALK – Balkan, CAUCAS – Caucasian, CIRCUMBOR – Circumboreal, COSM – Cosmopolitan, END – Endemic plant of the Balkan Peninsula, EURO – European, EURIMED – Eurimediterranean, MED – Mediterranean, MONT – Montane, OR – Oriental, OROF – Orophyte, PALEOTEMP – Paleotemperate, PONT – Pontic, SIB – Sibiarian, STENOMED – Stenomediterranean, SUBCOSM – Subcosmopolitan, SUBEND – Subendemic plant, SUBMED – Submediterranean, TUR – Turanian; Sites: G – Gostilje, K – Kopilje, R – Radovče; Habitat: 62A0 – Eastern submediteranean dry grasslands (*Scorzoneratalia villosae*), 6510 – Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*), ANGRAS – Annual grasslands, FOR – Forest, FOREDG – Forest edge, GRAEX – Gravel excavation, RUD – Ruderal; association: AA-FI-TYP – *Armerio canescenti-Festucetum illyricae-typicum*, AA-FI-CG – *Armerio canescenti-Festucetum illyricae-chrysopogonetosum grylii*, GP-AC – *Gladiolo palustri-Agrostietum castellana*, OC-KP-AA – *Ornithogalo comosi-Koelerietum pyramidatae artemisietosum albae*, OC-KP-TYP – *Ornithogalo comosi-Koelerietum pyramidatae typicum*, RB-AE – *Ranunculo bulbosi-Arrhenatheretum elatioris*, SS-ET – *Saturejo subspicatae-Edraianthetum tenuifolii*, SE-CH – *Stipo eriocauli-Caricetum humilis*; Conservation status: *National legislation, **International legislation: a-Habitat Directiva, b- CITES); [i] Invasive species.

## RESULTS

The checklist of vascular plants of the karst fields in Piperi (Montenegro) includes 480 species and subspecies, 284 genera and 63 families. The taxa are arranged alphabetically and grouped by families, which are also arranged alphabetically. The following information is listed for each species: life form, chorotype, occurrence in karst fields, literature source, habitat type, association, conservation status and invasiveness. Not all parameters are available for each species.

**Amaranthaceae**

[i]*Amaranthus retroflexus* L.; T; ADV; K; R; G; RUD

**Amaryllidaceae**

*Allium flavum* L.; G; EURIMED; K; R; G; 62A0 GP-AC, SS-ET, SE-CH

*Allium guttatum* subsp. *dalmaticum* (A. Kern. ex Janch.) Stearn; G; END; K; R; G; 62A0 AC-FI-CG, GP-AC, OC-KP, SS-ET, SE-CH

*Allium lusitanicum* Lam.; G; SE-S.SIB; R; 62A0 SS-ET, SE-CH

*Allium sphaerocephalon* L.; G; PALEOTEMP; K; R; G; 62A0 AC-FI-TYP, OC-KP-AA, SS-ET, SE-CH

**[b]*Galanthus reginae-olgae* subsp. *vernalis* Kamari; G; END; K; R; G; FOREDG; FOR

*,**[a]*Gladiolus palustris* Gaudin; G; C.EURO; K; R; G; 62A0 AC-FI-CG, GP-AC, SE-CH

**Narcissus poeticus* subsp. *Radiiflorus* (Salisb.) BakeR; G; OROF-S.EURO; K; R; G; 62A0 GP-AC, SE-CH

**Apiaceae**

*Bunium alpinum* subsp. *montanum* (W. D. J. Koch) P. W. Ball; G; END; K; R; G; 62A0 AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SE-CH, SS-ET

*Bupleurum veronense* Turra; T; EURIMED; K; R; G; 62A0 GP-AC, OC-KP-AA, SS-ET, SE-CH

*,***Chaerophyllum coloratum* L.; H; END; K; R; G; ANGRAS; 62A0 AC-FI-CG, OC-KP-AA

*Chaerophyllum nodosum* (L.) Crantz; H; STENOMED; K; G; FOREDG

*Daucus carota* L.; H; COSM; K; R; G; RUD; 6510 RB-AE

*Eryngium amethystinum* L.; H; N.E.MED; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH; 6510 RB-AE

*Malabaila aurea* (Sm.) Boiss.; H; END; K; ANGRAS

*Orlaya grandiflora* (L.) Hoffm.; H; END; K; R; G; ANGRAS; 62A0 AC-FI-CG, OC-KP-AA

*Peucedanum cervaria* (L.) Lapeyr.; H; EUROSIB; R; FOREDG

*Pimpinella major* (L.) Huds.; H; EURO-CAUCAS; K; FOREDG

*Pimpinella saxifraga* L.; H; EURO-CAUCAS; K; R; G; FOREDG

*Scandix pecten-veneris* L.; T; EURIMED; K; R; G; RUD; FOREDG

*Seseli montanum* subsp. *tommasinii* (Rchb. f.) Arcang.; H; END; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH; 6510 RB-AE

*Smyrnium perfoliatum* L.; H; EURIMED; K; G; FOREDG

*Torilis arvensis* (Huds.) Link; T; SUBCOSM; K; G; RUD; FOREDG

**Apocynaceae**

**Vincetoxicum huteri* Vis. & Asch.; H; END; K; R; G; FOREDG; 62A0 SE-CH

**Araceae**

*Arum italicum* Mill.; G; STENOMED; K; G; FOREDG

**Aristolochiaceae**

*Aristolochia pallida* Willd.; G; EURIMED; K; G; 62A0 AC-FI-TYP

**Asparagaceae**

*Anthericum ramosum* L.; G; SUBATL; R; FOREDG

*Asparagus acutifolius* L.; G; STENOMED; K; FOREDG
*Convallaria majalis* L.; G; CIRKUMBOR; K; R; G; FOREDG
**Hyacinthella dalmatica* Chouard; G; END; K; R; 62A0 GP-AC, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH
*Muscari botryoides* (L.) Mill.; G; EURIMED; K; R; G; 62A0 OC-KP-AA
*Muscari comosum* (L.) Mill.; G; EURIMED; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-AA, SS-ET, SE-CH
*Muscari neglectum* Guss. ex Ten.; G; EURIMED; K; 62A0 SS-ET, SE-CH
*Ornithogalum comosum* L.; G; MED-MONT; K; R; G; ANGRAS; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP, SS-ET, SE-CH
*Ornithogalum exscapum* Ten.; G; N.EURIMED; K; 62A0 OC-KP-AA
*Ornithogalum sphaerocarpum* A.Kern.; G; SE-EURO; K; FOREDG
*Prospero autumnale* (L.) Speta; G; EURIMED; K; R; G; ANGRAS; 62A0 AC-FI-TYP, AC-FI-CG, OC-KP-AA, SS-ET, SE-CH
*Ruscus aculeatus* L.; G; EURIMED; K; R; G; FOR
*Scilla bifolia* L.; G; EURO-CAUCAS; K; G; FOREDG

**Asteraceae**

*Achillea millefolium* L.; H; EUROSIB; K; R; G; ANGRAS; 62A0 AC-FI-TYP, AC-FI-CG; 6510 RB-AE
*Achillea nobilis* L.; H; SE-S.SIB; K; 62A0 AC-FI-CG, GP-AC
*Anthemis arvensis* L.; T; COSM; K; 62A0 AC-FI-CG, OC-KP-AA
*Artemisia alba* Turra; CH; EURIMED; K; R; G; 2A0 AC-FI-CG, OC-KP-AA, SS-ET, SE-CH
*Artemisia vulgaris* L.; H; CIRKUMBOR; K; R; G; RUD
*Bellis perennis* L.; H; EURO-CAUCAS; G; RUD
*Bombycilaena erecta* (L.) Smoljan.; T; SE-S.SIB; K; 62A0 OC-KP-AA,
*Carduus acanthoides* L.; H; EURO-CAUCAS; K; R; G; RUD
*Carduus collinus* Waldst. & Kit.; H; S.EURO; K; 62A0 AC-FI-CG, OC-KP-AA
*Carduus nutans* subsp. *micropterus* (Borbás) Hayek; H; N.MED-MONT; K; ANGRAS; RUD
*Carlina corymbosa* L.; H; STENOMED; K; R; G; ANGRAS; RUD
*Centaurea calcitrapa* L.; H; SUBCOSM; K; RUD
*Centaurea deusta* Ten.; H; SUBEND; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-AA, SS-ET, SE-CH
*Centaurea jacea* subsp. *angustifolia* (DC.) Gremli; H; SE-S.SIB; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, SE-CH; 6510 RB-AE
*Centaurea nicolai* Bald.; H; END; K; R; G; 62A0 AC-FI-CG, SE-CH
*Centaurea scabiosa* L.; H; EURAS; K; G; 62A0 SE-CH
*Centaurea solstitialis* L.; H; COSM; K; G; RUD
*Chondrilla juncea* L.; H; SE-S.SIB; K; R; G; RUD; 62A0 OC-KP-AA; 6510 RB-AE
*Cichorium intybus* L.; H; COSM; K; R; G; RUD
*Cirsium acaulon* (L.) Scop.; H; EURO-CAUCAS; R; 62A0 GP-AC
*Cirsium arvense* (L.) Scop.; H; EURAS; K; R; G; RUD; 62A0 OC-KP-AA; 6510 RB-AE
*Cirsium candelabrum* Griseb.; H; END; K; G; RUD
*Cirsium eriophorum* (L.) Scop.; H; C.EURO; R; 62A0 OC-KP-AA
*Cirsium vulgare* (Savi) Ten.; H; PALEOTEMP; R; G; RUD
*Cota segetalis* (Ten.) Holub; H; S.EURO; K [32], *Anthemis brachycentros* Asch.); RUD
*Crepis foetida* L.; T; EURIMED; K; R; G; 62A0 OC-KP-AA
*Crepis neglecta* L.; T; NE.EURIMED; K; R; G; ANGRAS; 62A0 AC-FI-CG, OC-KP-AA, SS-ET, SE-CH; 510 RB-AE
*Crepis sancta* (L.) Bornm.; T; EURIMED-TURAN; K; ANGRAS; RUD
*Echinops ritro subsp*. *ruthenicus* (M. Bieb.) Nyman; H; STENOMED; K; G; 62A0 OC-KP-AA
[i]*Erigeron annuus* subsp. *septentrionalis* (Fernald & Wiegand) Wagenitz; T; ADV; K; R; G; RUD; 62A0 AC-FI-CG, OC-KP-AA
[i]*Erigeron canadensis* L.; T; ADV; K; G; RUD
[i]*Erigeron sumatrensis* Retz.; T; ADV; K; RUD
*Eupatorium cannabinum* L.; H; PALEOTEMP; R; G; RUD
*Filago germanica* (L.) Huds.; T; PALEOTEMP; K; G; 62A0 AC-FI-CG, OC-KP-AA, SE-CH
*Galatella linosyris* (L.) Rchb. f.; H; SE-S.SIB; R; 62A0 SE-CH
[i]*Galinsoga parviflora* Cav.; T; ADV; K; G; RUD
*Gelasia villosa* (Scop.) Cass.; H; NE.EURIMED; K; 62A0 GP-AC, SE-CH
*Hieracium heterogynum* (Froel.) Gutermann; H; END; K; R; G; FOREDG
*Hieracium tommasinianum* K. Malý; H; END; K; 62A0 OC-KP-AA
*Hieracium umbellatum* L.; H; CIRKUMBOR; R; FOREDG, 62A0 GP-AC
*Hypochaeris radicata* L.; H; EURO-CAUCAS; K; R; G; 62A0 GP-AC
*Inula conyzae* (Griess.) DC.; H; C.EURO-W.AS; K; R; G; FOREDG; 62A0 OC-KP-AA

*Inula ensifolia* L.; H; SE.EURO-PONT; K; R; G; 62A0 OC-KP-AA, SE-CH
*Inula germanica* L.; H; EURO; K; R; G; 62A0 GP-AC
*Inula oculus-christi* L.; H; S.EURO-W.AS; K; R; G; 62A0 AC-FI-CG, OC-KP-TYP, OC-KP-AA
*Inula salicina* L.; H; EURO-CAUCAS; K; R; G; FOREDG
*Klasea radiata* (Waldst. & Kit.) Á. Löve & D. Löve; H; BALK-C.EURO; K; 62A0 SE-CH
*Lactuca serriola* L.; H; EURIMED-S.SIB; K; R; G; RUD; ANGRAS
*Lapsana communis* L.; T; PALEOTEMP; K; R; G; FOREDG
*Leontodon biscutellifolius* DC.; H; BALK-C.EURO; K [32], *Leontodon asper* var. *glabrescens* Beck)
*Leontodon crispus* Vill.; H; SE-S.SIB; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH
*Leucanthemum vulgare* Lam.; H; EUROSIB; K; R; G; 62A0 AC-FI-CG
*Logfia gallica* (L.) Coss. & Germ.; T; EURIMED; K; G; 62A0 AC-FI-CG, OC-KP-AA
*Onopordum acanthium* L.; H; EURIMED-TURAN; K [32]; RUD
*Picris hieracioides* L.; H; EUROSIB; K; R; G; 62A0 AC-FI-CG; 6510 RB-AE
*Pilosella bauhini* (Schult.) Arv.-Touv.; H; SE-S.SIB; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH; 6510 RB-AE
*Rhagadiolus stellatus* (L.) Gaertn.; T; EURIMED; K; ANGRAS; FOREDG
*Scorzonera cana* (C. A. Mey.) Griseb.; H; SE.EURO-C.AS; K; 62A0 AC-FI-CG, OC-KP-AA
*Scorzonera laciniata* L.; H; PALEOTEMP; K; ANGRAS; 62A0 AC-FI-CG, OC-KP-AA
*Senecio rupestris* Waldst. & Kit.; H; OROF-S.EURO; K; R; G; RUD
*Solidago virgaurea* L.; H; CIRCUMBOR; R; FOREDG
*Sonchus arvensis* subsp. *uliginosus* (M. Bieb.) Nyman; H; COSM; K [32], *Sonchus uliginosus* (M. Bieb.) Nyman; G; RUD
*Sonchus asper* subsp. *glaucescens* (Jord.) Ball; T; COSM; K; R; G; RUD; 62A0 OC-KP-AA
*Sonchus oleraceus* L.; T; COSM; K; R; G; RUD; 62A0 OC-KP-AA
*Taraxacum* sect. *Ruderalia* Kirschner & al.; H; COSM; K; R; G; RUD
*Tragopogon orientalis* L.; R; 62A0 AC-FI-TYP, AC-FI-CG, OC-KP-AA, SE-CH; 6510 RB-AE
*Tragopogon tommasinii* Sch.Bip.; H; NE.EURIMED; K; R; G; 62A0 AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA
*Tussilago farfara* L.; H; PALEOTEMP; R; G; RUD

**Boraginaceae**

*Aegonychon purpurocaeruleum* (L.) Holub; H; SE-PONT; K; R; G; FOREDG
*Anchusa officinalis* L.; H; PONT; R; RUD
*Anchusella cretica* (Mill.) Bigazzi, E. Nardi & Selvi; T; STENOMED-OR; K; R; G; 62A0 OC-KP-AA
*Cerinthe minor* subsp. *auriculata* (Ten.) Domac; H; S.EURO; K; 62A0 OC-KP-AA
*Cynoglossum columnae* Ten.; H; OROF-NE.MED; K; ANGRAS; 62A0 OC-KP-AA
*Echium italicum* L.; H; EURIMED; K; R; G; RUD; 62A0 AC-FI-CG
*Echium vulgare* L.; H; EURO; K; R; G; RUD
*Heliotropium europaeum* L.; T; EURIMED-TURAN; K; G; RUD
*Lithospermum officinale* L.; H; EUROSIB; R; G; FOREDG
*Myosotis arvensis* (L.) Hill; T; EURO-W.AS; K; R; G; ANGRAS
*Myosotis ramosissima* Rochel; T; EURO-CAUCAS; K; 62A0 AC-FI-CG, 6510 RB-AE
*Onosma pseudoarenaria* subsp. *fallax* (Borbás) Rauschert; H; END; K [33]; R; G; 62A0 GP-AC, OC-KP-AA, SS-ET, SE-CH
*Onosma echioides* (L.) L.; H; END; K; G; 62A0 OC-KP-AA

**Brassicaceae**

*Aethionema saxatile* (L.) W.T.Aiton; CH; MED-MONT; K; G; 62A0 SS-ET, SE-CH
*Alliaria petiolata* (M.Bieb.) Cavara & Grande; T; SUBCOSM; K; R; G; FOREDG
*Alyssum montanum* L.; H; C.EURO; K; R; G; Kopilje [32], 62A0 GP-AC, SE-CH
*Alyssum simplex* Rudolphi ; T; EURIMED; K; 62A0 OC-KP-TYP, OC-KP-AA
*Arabis collina* Ten.; CH; MED-MONT; K; 62A0 AC-FI-CG, OC-KP-AA
*Barbarea intermedia* Boreau; H; W.EURO; K; Kopilje [32]; RUD
*Berteroa mutabilis* (Vent.) DC.; H; NE.MED; K; R; G; ANGRAS; RUD
*Bunias erucago* L.; T; N.MED; K; G; ANGRAS
*Capsella bursa-pastoris* (L.) Medik.; T; COSM; K; RUD
*Capsella rubella* Reut.; T; EURIMED; K; R; G; RUD; 62A0 OC-KP-AA
*Cardamine graeca* L.; T; N.MED; K; R; G; FOREDG
*Diplotaxis tenuifolia* DC.; H; SUBMED-SUBATL; K; R; G; RUD
*Draba muralis* L.; T; N.MED-ATL; K; FOREDG

*Draba verna* L.; T; COSM; K; R; G; 62A0 OC-KP-AA, SS-ET, SE-CH
*Peltaria alliacea* Jacq.; H; SE.EURO; K; FOREDG
*Pseudoturritis turrita* (L.) Al-Shehbaz; H; S.EURO; K; R; G; FOREDG
*Rorippa lippizensis* (Wulfen) Rchb.; T; END; K; 62A0 OC-KP-AA, SE-CH
*Sisymbrium officinale* (L.) Scop.; T; COSM; K; R; G; RUD
*Thlaspi perfoliatum* L.; T; PALEOTEMP; K; G; 62A0 OC-KP-AA

**Campanulaceae**

*Asyneuma limonifolium* (L.) Janch.; H; NE.MED; G; FOREDG, 62A0 OC-KP-AA
*Campanula bononiensis* L.; H; SE-S.SIB; K; R [32]; G; FOREDG
*Campanula lingulata* Waldst. & Kit.; H; SUB-END; K; 62A0 AC-FI-TYP, OC-KP-AA
*Campanula persicifolia* L.; H; EUROAS; R; FOREDG
*Campanula rapunculus* L.; H; PALEOTEMP; K; R; G; 62A0 AC-FI-TYP
*Campanula trachelium* L.; H; PALEOTEMP; K; R; G; FOREDG
*Edraianthus tenuifolius* (Waldst. & Kit.) A. DC.; CH; END; K; R; G; 62A0 OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH

**Caprifoliaceae**

*Lonicera etrusca* Santi; P; EURIMED; K; G; FOREDG

**Caryophyllaceae**

*Arenaria leptoclados* (Rchb.) Guss.; T; PALE-OTEMP; K; R; G; ANGRAS; RUD; 62A0 AC-FI-TYP, AC-FI-CG, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH; 6510 RB-AE
*Cerastium brachypetalum* Pers. subsp. *brachy-petalum*; T; EURIMED; K; G; 62A0 OC-KP-TYP, OC-KP-AA; 6501 RB-AE
*Cerastium pumilum* subsp. *glutinosum* (Fr.) Jalas ; T; C-MED; K; R; G; ANGRAS; 62A0 AC-FI-TYP, AC-FI-CG, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH
*Cerastium ligusticum* subsp. *trichogynum* (Möschl) P. D. Sell & Whitehead; T; MED-PONT; K; 62A0 AC-FI-CG
*Dianthus armeria* L.; H; EURO-CAUCAS; R; ANGRAS
*Dianthus carthusianorum* aggr.; H; SE.OROF; K; R; G; 62A0 AC-FI-TYP, OC-KP-AA
*Dianthus petraeus* Waldst. & Kit.; H; END; R; 62A0 OC-KP-AA, SS-ET
*Dianthus sylvestris* Wulfen; H; MED-MONT; K; R; G; 62A0 GP-AC, OC-KP-AA, SS-ET, SE-CH
*Herniaria glabra* L.; T; PALEOTEMP; K; R; 62A0 OC-KP-AA, SS-ET, SE-CH
*Moenchia mantica* (L.) Bartl.; T; N.MED; K; R; G; 62A0 AC-FI-CG, OC-KP-AA
*Paronychia kapela* (Hacq.) A.Kern.; CH; MED-MONT; R; 62A0 SS-ET, SE-CH
*Petrorhagia dubia* (Raf.) G.López & Romo; T; STENOMED; K; R; G; ANGRAS, RUD
*Petrorhagia prolifera* (L.) P. W. Ball & Heywood ; T; EURIMED; K; ANGRAS; 62A0 AC-FI-CG, OC-KP-AA
*Petrorhagia saxifraga* (L.) Link; CH; EURIMED; K; R; G; ANGRAS; 62A0 AC-FI-CG, SS-ET, SE-CH
*Silene conica* L.; T; PALEOTEMP; K; ANGRAS; 62A0 OC-KP-AA
*Silene coronaria* (L.) Clairv.; H; EURIMED-TURAN; K; R; FOREDG
*Silene italica* (L.) Pers.; H; EURIMED; K; R; G; 62A0 AC-FI-CG, OC-KP-AA
*Silene latifolia* subsp. *alba* (Mill.) Greuter & Bur-det; H; PALEOTEMP; K; R; G; FOREDG, RUD
*Silene otites (*L.) Wibel; H; EUROAS; K; R; G; 62A0 OC-KP-TYP, OC-KP-AA, SE-CH
*Silene vulgaris* (Moench) Garcke; H; SUBCOSM; K; R; G; ANGRAS; 62A0 AC-FI-CG
*Stellaria media* (L.) Vill.; T; COSM; K; R; G; RUD ,62A0 AC-FI-CG, OC-KP-AA
*Viscaria vulgaris* Bernh.; H; EUROSIB; K; FOREDG

**Celasteraceae**

*Euonymus europaeus* L.; P; EUROAS; K; R; G; FOR

**Chenopodiaceae**

*Chenopodium album* L.; T; SUBCOSM; K; R; G; RUD

**Cistaceae**

*Fumana procumbens* (Dunal) Gren. & Godr.; CH; EURIMED-PONT; K; R; G; 62A0 OC-KP-AA, SS-ET, SE-CH
*Helianthemum nummularium* subsp. *obscurum* (Pers.) Holub; CH; EURO-CAUCAS; K; R; G; 62A0 AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH

**Colchicaceae**

*Colchicum autumnale* L.; G; C.EURO; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-AA

**Convolvulaceae**

*Convolvulus arvensis* L.; G; COSM; K; R; G; ANGRAS; 62A0 AC-FI-TYP, GP-AC; 6510 RB-AE
*Convolvulus cantabrica* L.; G; EURIMED; K; R; G; 62A0 OC-KP-AA, SS-ET
*Cuscuta epithymum* (L.) L.; T; EURAS; K; R; G; 62A0 AC-FI-TYP, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH

**Cornaceae**
*Cornus mas* L.; P; SE.EURO-CAUSAS; K; R; G; GRAEX; FOREDG
**Corylaceae**
*Carpinus orientalis* Mill.; P; SUBMED; K; G; GRAEX; FOREDG
*Ostrya carpinifolia* Scop.; P; MED-SUBMED; K; R; G; GRAEX; FOREDG
**Crassulaceae**
*Sedum acre* L.; CH; EURO-CAUCAS; R; 62A0 SE-CH
*Sedum hispanicum* L.; T; SE.EURO; K; R; G; 62A0 AC-FI-CG, OOC-KP-AA
*Sedum sexangulare* L.; CH; C.EURO; K; R; G; 62A0 AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH
**Cupressaceae**
*Juniperus oxycedrus* L.; P; MED-OR; K; R; G; FOR
**Cyperaceae**
*Carex caryophyllea* Latourr.; H; EURAS; K; R; G; ANGRAS; 62A0 AC-FI-TYP, AC-FI-CG AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH; 6510 RB-AE
*Carex distans* L.; H; EURIMED; K; R; G; FOREDG
*Carex flacca* Schreb.; H; EURO; K; R; G; 62A0 GP-AC, OC-KP-AA
*Carex humilis* Leyss.; H; EURAS; K; R; G; 62A0 GP-AC, OC-KP-AA, SS-ET, SE-CH
*Carex liparocarpos* Gaudin; H; SE.EURO; K; 62A0 AC-FI-CG, OC-KP-AA, SS-ET
**Juncaceae**
*Luzula campestris* (L.) DC. aggr.; H; COSM; K; R; G; 62A0 AC-FI-TYP, GP-AC; 6510 RB-AE
**Dennstaedtiaceae**
*Pteridium aquilinum* (L.) Kuhn; G; COSM; R; G; FOREDG, RUD
**Dioscoreaceae**
*Dioscorea communis* (L.) Caddick & Wilkin; G; EURIMED; K; FOREDG
**Dipsacaceae**
*Cephalaria leucantha* (L.) Roem. & Schult; H; S.EURO; K; R; G; 62A0 OC-KP-TYP, OC-KP-AA, SE-CH
*Knautia integrifolia* L.; T; EURIMED; K; ANGRAS; 62A0 OC-KP-AA
*Knautia purpurea* (Vill.) Borbás; H; W.MED-PONT; K; R; G; 62A0 AC-FI-TYP, GP-AC; 6510 RB-AE
*Scabiosa columbaria* L.; H; EURAS; K; R; G; 62A0 GP-AC, OC-KP
*Scabiosa ochroleuca* L.; H; S.EURO-S.SIBIR; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, OC-KP-TYP, OC-KP-AA, SS-ET
*Scabiosa triniifolia* Friv.; H; END; K; R; ANGRAS; 62A0 AC-FI-CG, OC-KP-TYP, OC-KP-AA, SE-CH; 6510 RB-AE
*Succisella petteri* (Jos. Kern. & Murb.) Beck; H; END; K; RUD
*Succisa pratensis* Moench; H; EUROSIB; R; 62A0 GP-AC
**Euphorbiaceae**
*Euphorbia cyparissias* L.; T; C.EURO; K; R; G; ANGRAS; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SE-CH; 6510 RB-AE
*Euphorbia falcata* L.; T; EURIMED-TURAN; K; R; G; 62A0 OC-KP-AA
*Euphorbia helioscopia* L.; T; COSM; K; R; G; ANGRAS, RUD
*Euphorbia myrsinites* L.; CH; S.EURO-PONT; G; 62A0 SS-ET
*Euphorbia spinosa* L; CH; N.MED; R; 62A0 SS-ET
**Fabaceae**
*Anthyllis vulneraria* subsp. *polyphylla* (DC.) Nyman; H; EURIMED; K; R; G; 62A0 AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH
*Astragalus glycyphyllos* L.; H; EURO-S.SIB; K; R; G; FOREDG, RUD
*Astragalus monspessulanus* subsp. *wulfenii* (W. D. J. Koch) Arcang.; CH; END; K; 62A0 SS-ET, SE-CH
*Chamaecytisus hirsutus* (L.) Link; CH; EUROSIB; K; GRAEX; FOREDG
*Colutea arborescens* L.; P; EURIMED; K; GRAEX; FOREDG
*Dorycnium pentaphyllum* subsp. *germanicum* (Gremli) Gams ; H; S.EURO-S.SIBIR; K; R; G; 62A0 GP-AC, SE-CH, OC-KP-AA
*Genista sericea* Wulfen ; CH; END; K; R; G; 62A0 GP-AC
*Genista sylvestris* subsp. *dalmatica* (Bartl.) H. Lindb.; CH; END; K; R; 62A0 GP-AC, OC-KP-AA, SE-CH
*Genista tinctoria* L.; CH; EURAS; R; Radovče [32], 62A0 GP-AC
*Hippocrepis comosa* L.; H; S.E.C.EURO; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SE-CH
*Hippocrepis emerus* subsp. *emeroides* (Boiss. & Spruner) Lassen; P; MED-PONT; K; GRAEX; FOREDG
*Lathyrus aphaca* L.; T; EURIMED; K; ANGRAS
*Lathyrus cicera* L.; T; EURIMED; K; R; G; ANGRAS; 62A0 OC-KP-AA
*Lathyrus latifolius* L.; H; SE.EURO; K; R; G; RUD; 62A0 OC-KP-AA
*Lathyrus pratensis* L.; H; PALEOTEMP; K; R; G; 6510 RB-AE
*Lathyrus sphaericus* Retz.; T; EURIMED; K; G; 62A0 AC-FI-CG

*Lotus angustissimus* L.; H; EURIMED; R; 6510 RB-AE
*Lotus corniculatus* L.; H; COSM; K; R; G; 62A0 AC-FI-TYP, GP-AC, OC-KP, SE-CH; 6510 RB-AE
*Medicago arabica* (L.) Huds.; T; EURIMED; K; G; ANGRAS; RUD
*Medicago falcata* L.; H; EURAS; K; RUD
*Medicago lupulina* L.; T; PALEOTEMP; K; R; G; 62A0 AC-FI-CG; 6510 RB-AE
*Medicago minima* (L.) L.; T; COSM; K; R; G; ANGRAS; 62A0 AC-FI-CG; OC-KP
*Medicago orbicularis* (L.) Bartal.; T; EURIMED; K; R; G; ANGRAS, RUD
*Medicago prostrata* Jacq.; CH; S.EURO; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, SS-ET, SE-CH; 6510 RB-AE
*Medicago rigidula* (L.) All.; T; EURIMED; K; ANGRAS
[i]*Medicago sativa* L.; H; ADV; K; R; 62A0 GP-AC
*Ononis spinosa* L.; G; EURIMED; K; R; G; 62A0 AC-FI-TYP, GP-AC; 6510 RB-AE
*Securigera varia* (L.) Lassen; H; SE.EURO; K; R; G; 62A0 AC-FI-CG
*Trifolium incarnatum* L.; T; EURIMED; K; R; G; ANGRAS; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC; 6510 RB-AE
*Trifolium alpestre* L.; H; EURO-CAUCAS; K; R; G; 62A0 GP-AC
*Trifolium arvense* L.; T; PALEOTEMP; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, OC-KP-AA
*Trifolium campestre* Schreb.; T; PALEOTEMP; K; R; G; ANGRAS; 62A0 AC-FI-CG, OC-KP, GP-AC, OC-KP-AA, SS-ET, SE-CH; 6510 RB-AE
*Trifolium dalmaticum* Vis.; T; END; K; ANGRAS; 62A0 AC-FI-TYP, AC-FI-CG, OC-KP-TYP, OC-KP-AA
*Trifolium diffusum* Ehrh.; T; S.EURO-CAUCAS; K; ANGRAS
*Trifolium montanum* L.; H; S.EURO-S.SIBIR; K; R; G; 62A0 AC-FI-TYP, GP-AC, OC-KP-AA, SE-CH; 6510 RB-AE
*Trifolium nigrescens* Viv.; T; EURIMED; K; ANGRAS; 62A0 AC-FI-CG
*Trifolium patens* Schreb.; T; W.SUBMED-ATL; K; G; ANGRAS
*Trifolium patulum* Tausch; H; NE.MED-MONT; G; 62A0 AC-FI-CG
*Trifolium pratense* L.; H; SUBCOSM; K; R; G; 62A0 AC-FI-TYP, GP-AC, OC-KP-AA; 6510 RB-AE
*Trifolium repens* L.; H; SUBCOSM; K; R; G; 6510 RB-AE
*Trifolium scabrum* L.; T; EURIMED; K; 62A0 AC-FI-CG, OC-KP-AA
*Trifolium striatum* L.; T; PALEOTEMP; K; 62A0 AC-FI-CG, OC-KP-AA
*Trifolium strictum* L.; T; EURIMED; K; R; G; 62A0 AC-FI-CG, OC-KP-AA, SS-ET, SE-CH
*Trifolium subterraneum* L.; T; EURIMED; K; ANGRAS; 62A0 AC-FI-CG, OC-KP-AA
*Vicia crac*ca L.; H; EURAS; K; RUD
*Vicia grandiflora* Scop.; T; SE.EURO-PONT; K; R; G; ANGRAS; 62A0 AC-FI-CG, OC-KP-AA
*Vicia sativa* subsp. *nigra* (L.) Ehrh.; T; SUB-COSM; K; R; G; ANGRAS; 62A0 AC-FI-TYP, AC-FI-CG, OC-KP-AA; 6510 RB-AE
*Vicia villosa* subsp. *varia* (Host) Corb.; T; EURIMED; K; R; G; 62A0 AC-FI-CG, OC-KP-AA

**Fagaceae**
*Quercus pubescens* Willd.; P; SE.EURO-PONT; K; 62A0 AC-FI-CG

**Gentianaceae**
*Blackstonia perfoliata* (L.) Huds.; T; EURIMED; K; R; G; 62A0 AC-FI-CG
*Centaurium erythraea* Rafn; H; PALEOTEMP; K; R; G; ANGRAS; 62A0 AC-FI-CG, SE-CH
*Centaurium pulchellum* (Sw.) Druce; T; PALE-OTEMP; K; 62A0 AC-FI-CG; OC-KP-AA
*Gentiana cruciata* L.; H; EURAS; R; G; 62A0 AC-FI-CG
*Gentiana utriculosa* L.; T; OROF-SE.EURO; R; G; 62A0 GP-AC

**Geraniaceae**
*Erodium cicutarium* (L.) L'Hér.; H; COSM; K; R; G; 62A0 OC-KP-AA
*Geranium columbinum* L.; T; EURO-S.SIB; K; ANGRAS; 62A0 AC-FI-TYP, AC-FI-CG, OC-KP-TYP, OC-KP-AA
*Geranium dissectum* L.; T; SUBCOSM; K; G; ANGRAS, RUD
*Geranium lucidum* L.; T; EURIMED; K; AN-GRAS, RUD
*Geranium molle* L.; T; NE.MED; K; R; G; AN-GRAS; 62A0 OC-KP-AA; 6510 RB-AE
*Geranium purpureum* Vill.; T; EURIMED; K; R; G; ANGRAS, RUD
*Geranium rotundifolium* L.; T; PALEOTEMP; K; G; ANGRAS; RUD
*Geranium sanguineum* L.; H; EURO-CAUCAS; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC; 6510 RB-AE

**Hypericaceae**
*Hypericum perforatum* L.; H; COSM; K; R; G; ANGRAS; 62A0 AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH; 6510 RB-AE

**Iridaceae**
*Crocus dalmaticus* Vis.; G; END; K; R; G; 62A0 GP-AC, SE-CH

*Crocus tommasinianus* Herb.; G; END; R; FOREDG
*Crocus biflorus* subsp. *weldenii* (Hoppe & Fürnr.) K. Richt. (*Crocus weldenii* f. *lutescens* Pulević); NE-STENOMED; K [36]; R; 62A0 GP-AC, SE-CH
*Iris reichenbachii* Heuff.; G; END; K; R; 62A0 GP-AC, SE-CH

**Lamiaceae**

*Ajuga chamaepitys* (L.) Schreb.; T; EURIMED; K; 62A0 SS-ET
*Ajuga genevensis* L.; H; EURAS; K; R; G; ANGRAS; 62A0 OC-KP-AA, SS-ET; 6510 RB-AE
*Ballota hispanica* (L.) Benth.; H; NE.MEDMONT; K; R; G; RUD
*Clinopodium acinos* (L.) Kuntze; T; EURIMED; K; R; G; ANGRAS; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SS-ET
*Clinopodium menthifolium* (Host) Stace; CH; EURO-CAUCAS; K; FOREDG
*Clinopodium nepeta* subsp. *glandulosum* (Req.) Govaerts; CH; MED-MONT; K; R; G; ANGRAS; 62A0 AC-FI-CG
*Clinopodium thymifolium* (Scop.) Kuntze; CH; END; K; FOREDG
*Clinopodium vulgare* L.; H; CIRCUMBOR; K; R; G; RUD; 62A0 AC-FI-CG, OC-KP-TYP, OC-KP-AA
*Hyssopus officinalis* subsp. *aristatus* (Godr.) Nyman; CH; OROF-SE.EURO; R [34]; FOREDG
*Lamium maculatum* (L.) L.; T; EURAS; K; R; G; FOREDG
*Leonurus cardiaca* L.; T; EURAS; K; R [32]; G; RUD
*Marrubium incanum* Desr.; H; SE.MED; K; R; G; ANGRAS; RUD
*Mentha longifolia* (L.) L.; H; END; K; R; G; RUD
*Micromeria juliana* (L.) Benth. ex Rchb; CH; STENOMED; K; 62A0 OC-KP-AA, SS-ET
*Nepeta cataria* L.; H; E.MED-TURAN; K; R; G; 62A0 AC-FI-CG
*Origanum vulgare* L.; H; EURAS; K; R; G; 62A0 AC-FI-CG
*Prunella laciniata* (L.) L.; H; EURIMED; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, OC-KP-TYP, OC-KP-AA, SE-CH
*Prunella vulgaris* L.; H; CIRKUMBOR; K; R; G; ANGRAS, RUD
*Salvia pratensis* subsp. *bertolonii* (Vis.) Soó; H; EURIMED; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SE-CH
*Salvia verbenaca* L.; H; MED-ATL; K; ANGRAS;
*Salvia verticillata* L.; H; SE-CAUSAS; K; R; G; ANGRAS
*Satureja subspicata* Bartl. ex Vis.; CH; END; K, R [32], *Satureja illyrica* Host); G;, 62A0 AC-FI-CG, GP-AC, SS-ET, SE-CH
*Stachys annua* (L.) L.; T; EURIMED; K; RUD
*Stachys germanica* L.; H; EURIMED; K; R; G; 62A0 OC-KP-AA
*Stachys officinalis* (L.) Trevis.; H; EURO-CAUCAS; K; R; G; 62A0 AC-FI-TYP, GP-AC, OC-KP-AA, SE-CH
*Teucrium capitatum* L.; CH; STENOMED; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH
*Teucrium chamaedrys* L.; CH; EURIMED; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SE-CH; 6510 RB-AE
*Teucrium montanum* L.; CH; OROF.SE; K; R; G; 62A0 OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH
*Thymus longicaulis* C. Presl; CH; EURIMED; K; R; G; 62A0 AC-FI-TYP, GP-AC, OC-KP-AA, SS-ET, SE-CH
*Thymus pulegioides* L.; CH; EURAS; K; R; G; 62A0 AC-FI-CG, GP-AC; 6510 RB-AE
*Vitex agnus-castus* L.; P; STENOMED-TURAN; K; R; G; GRAEX

**Liliaceae**

*Erythronium dens-canis* L.; G; S.EURO-S.SIBIR; K; R; G; FOREDG
*Fritillaria messanensis* subsp. *gracilis* (Ebel) Rix; G; END; R; FOREDG
*Lilium martagon* L.; G; EURAS; R; FOREDG
*Tulipa sylvestris* L.; G; EURIMED; K; FOREDG

**Linaceae**

*Linum bienne* Mill.; H; EURIMED; K; 62A0 AC-FI-CG; OC-KP-TYP, OC-KP-AA
*Linum catharticum* L.; T; EURIMED; K; R; G; 62A0 GP-AC, SE-CH
*Linum tenuifolium* L.; H; SUBMED-PONT; K; R; G; 62A0 AC-FI-CG, GP-AC, SS-ET, SE-CH

**Malvaceae**

*Abutilon theophrasti* Medik.; T; ADV; K; RUD
*Malva sylvestris* L.; H; COSM; K; RUD

**Oleaceae**

*Fraxinus ornus* L.; P; SE.EURO; K; G; FOR
*Ligustrum vulgare* L.; P; EURO-W.AS; K; R; G; FOREDG

**Onagraceae**

*Epilobium angustifolium* L.; H; CIRKUMBOR; K; R; RUD

**Orchidaceae**

**,***[b]Anacamptis coriophora* (L.) R.M.Bateman, Pridgeon & M.W.Chase; G; EURIMED; K; R; G; 62A0 AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SE-CH
**,***[b]Anacamptis laxiflora* (Lam.) R. M. Bateman & al.; G; EURIMED; K; R; FOREDG

*,***[b]*Anacamptis morio* (L.) R.M.Bateman, Pridgeon & M.W.Chase; G; EURO-CAUCAS; K; R; G; 62A0 AC-FI-CG, SS-ET, SE-CH
*,**[b]*Anacamptis pyramidalis* (L.) Rich.; G; EURIMED; K; R; G; 62A0 AC-FI-CG
*,***[b]*Gymnadenia conopsea* (L.) R.Br.; G; EURAS; K; 62A0 AC-FI-CG, GP-AC
**[b]*Himantoglossum jankae* Somlyay & al; G; END; K; FOREDG
*,***[b]*Neotinea ustulata* (L.) R. M. Bateman & al.; G; EURO-CAUCAS; K; R; G; 62A0 AC-FI-CG, GP-AC, SE-CH
*,***[b]*Ophrys scolopax* subsp. *cornuta* (Steven) E.G.Camus; G; SE.EURO; K; R; G; FOREDG
*,***[b]*Orchis provincialis* Balb. ex Lam. & DC.; G; STENOMED; K; R; G; 62A0 AC-FI-CG, GP-AC
*,***[b]*Platanthera chlorantha* (Custer) Rchb.; G; EUROSIB; K; FOREDG
*,***[b]*Serapias bergonii* E. G. Camus; G; STENOMED; K; G; 62A0 OC-KP-AA, SE-CH
*,***[b]*Spiranthes spiralis* (L.) Chevall.; G; EURO-CAUCAS; K; FOREDG

**Orobanchaceae**

*Euphrasia liburnica* Wettst. ; T; OROF-S.EURO; K; R; G; 62A0 AC-FI-TYP, GP-AC, OC-KP-TYP, OC-KP-AA, SE-CH
*Melampyrum barbatum* subsp. *carstiense* Ronniger; R; T; SE.EURO; K; G; 62A0 AC-FI-CG, SE-CH
*Odontites luteus* (L.) Clairv.; T; EURIMED; K; R; G; ANGRAS; 62A0 AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SE-CH
*Odontites vulgaris* Moench; T; EURAS; K; R; G; ANGRAS; 6510 RB-AE
*Orobanche minor* Sm.; G; COSM; R; 6510 RB-AE
*Orobanche gracilis* Sm.; G; EURO-CAUCAS; K; R; G; 62A0 SE-CH
*Orobanche ramosa* L.; G; PALEOTEMP; K; ANGRAS; 62A0 OC-KP-AA
*Orobanche reticulata* Wallr.; G; C.EURO; K; R; 62A0 GP-AC
*Rhinanthus alectorolophus* subsp. *freynii* (Sterneck) Hartl; T; MED-MONT; K; R; 62A0 AC-FI-CG, OC-KP-AA; 6510 RB-AE
*Rhinanthus rumelicus* Velen.; T; BALK-EUROP; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-AA

**Papaveraceae**

*Corydalis pumila* (Host) Rchb.; G; C.EURO; K; R; G; FOREDG

**Plantaginaceae**

*Globularia meridionalis* (Podp.) O. Schwarz; CH; OROF.SE; K; R; G; 62A0 GP-AC, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH
*Linaria pelisseriana* (L.) Mill.; T; MED-ATL; K; R; G; ANGRAS; 62A0 AC-FI-CG, OC-KP-AA
*Linaria vulgaris* Mill.; H; EURAS; K; R; G; ANGRAS; 62Ao AC-FI-TYP; 6510 RB-AE
*Chaenorhinum minus* (L.) Lange; T; EURIMED; K; R; G; GRAEX
*Plantago argentea* Chaix.; H; S.EURO-S.SIBIR; R; 62A0 GP-AC, SE-CH
*Plantago holosteum* Scop.; H; SE.EURO; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP, SS-ET, SE-CH
*Plantago lanceolata* L.; H; EURAS; K; R; G; ANGRAS; 62A0 AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA; 6510 RB-AE
*Plantago major* L.; H; EURAS; K; R; G; RUD
*Plantago media* L.; H; EURAS; K; R; G; 62A0 AC-FI-TYP, GP-AC, OC-KP-TYP; 6510 RB-AE
*Veronica arvensis* L.; T; PALEOTEMP; K; G; ANGRAS; 62A0 AC-FI-CG, GP-AC, OC-KP-AA,; 6510 RB-AE
*Veronica austriaca* subsp. *dentata* (F. W. Schmidt) Watzl; H; SE.EURO; K; R; G; ANGRAS; 62A0 OC-KP-AA; 6510 RB-AE
*Veronica austriaca* subsp. *jacquinii* (Baumg.) Eb. Fisch.; H; SE.EURO; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-AA, SE-CH; 6510 RB-AE
*Veronica chamaedrys* L.; H; EUROSIB; K; R; G; 62A0 AC-FI-CG
*Veronica officinalis* L.; H; EURAS; K; R; FOREDG
[i]*Veronica persica* Poir.; T; ADV; K; R; G; RUD; ANGRAS
*Veronica serpyllifolia* subsp. *humifusa* (Dicks.) Syme; CH; COSM; K; RUD
*Veronica spicata* L.; H; EURAS; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, SS-ET, SE-CH

**Poaceae**

*Achnatherum calamagrostis* (L.) P.Beauv.; CH; OROF-S.EURO; K; R; G; GRAEX
*Aegilops geniculata* Roth; T; EURIMED-TURAN; K; R; G; 62A0 SS-ET
*Aegilops neglecta* Req. ex Bertol.; T; EURIMED-TURAN; K; 62A0 AC-FI-CG, OC-KP-AA,
*Aegilops triuncialis* L.; T; EURIMED; K; 62A0 AC-FI-CG
*Aegilops uniaristata* Vis.; T; END; K; 62A0 AC-FI-CG, OC-KP-AA
*Agrostis castellana* Boiss. & Reut.; H; EURIMED; K; R; G; 62A0 GP-AC, OC-KP-AA
*Aira elegantissima* SchuR; T;EURIMED; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC
*Anthoxanthum odoratum* L.; T; EURAS; K; R; G; ANGRAS, 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SE-CH; 6510 RB-AE

*Arrhenatherum elatius* (L.) P. Beauv. ex J. Presl & C. Presl; H; PALEOTEMP; K; G; 6510 RB-AE
*Avena barbata* Pott ex Link; T; EURIMED-TURAN; K; R; G; ANGRAS; RUD
*Bothriochloa ischaemum* (L.) KenG; H; COSM; K; 62A0 OC-KP-AA
*Brachypodium rupestre* (Host) Roem. & Schult.; H; SUBATL; K; R; G; FOREDG
*Brachypodium sylvaticum* (Huds.) P. Beauv.; H; PALEOTEMP; K; R; G; FOREDG; 62A0 AC-FI-CG
*Briza media* L.; T; EUROSIB; K; R; G; 62A0 GP-AC
*Bromus condensatus* Hack.; H; END; R; 62A0 OC-KP-AA
*Bromus hordeaceus* L.; T; SUBCOSM; K; R; G; ANGRAS; 62A0 AC-FI-CG, OC-KP-AA
*Bromus pannonicus* Kumm. & Sendtn.; H; S.EURO; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG GP-AC, OC-KP-AA, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH
*Bromus squarrosus* L.; T; PALEOTEMP; K; R; G; 62A0 OC-KP-AA
*Bromus sterilis* L.; T; EURIMED-TURAN; K; R; G; ANGRAS; RUD
*Chrysopogon gryllus* (L.) Trin.; H; S.EURO-S.SIBIR; K; R; G; 62A0 AC-FI-CG, OC-KP-AA
*Cleistogenes serotina* (L.) Keng; T; MED-S.SIB; K; R; G; 62A0 AC-FI-CG, OC-KP-AA
*Cynodon dactylon* (L.) Pers.; G; COSM; K; R; G; 62A0 AC-FI-CG, OC-KP-TYP, OC-KP-AA
*Cynosurus echinatus* L.; T; EURIMED; K; R; G; 62A0 OC-KP-AA
*Dactylis glomerata* L.; H; PALEOTEMP; K; R; G; ANGRAS; 62A0 AC-FI-TYP, GP-AC, OC-KP-AA; 6510 RB-AE
*Danthonia alpina* Vest; H; SE.EURO; R; 62A0 GP-AC
*Dasypyrum villosum* (L.) Borbás; T; EURIMED-TURAN; K; G; ANGRAS; 62A0 AC-FI-CG, OC-KP-AA
*Elymus repens* (L.) Gould; G; COSM; K; R; G; ANGRAS; 62A0 AC-FI-CG
*Eragrostis minor* Host; T; COSM; K; R; G; RUD
*Eragrostis pilosa* (L.) P. Beauv.; T; COSM; K; RUD
*Festuca hercegovinica* Markgr.-Dann.; H; END; R; 62A0 SS-ET, SE-CH
*Festuca rupicola* Heuff.; H; S.EURO; K; R; G; ANGRAS; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH; 6510 RB-AE
*Hordeum murinum* L.; T; EURIMED; K; R; G; ANGRAS, RUD
*Koeleria pyramidata* (Lam.) P. Beauv.; H; N.C.EURO; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SE-CH
*Koeleria splendens* C. Presl; H; MED-MONT; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH
*Lolium perenne* L.; H; COSM; K; R; G; RUD
*Melica ciliata* L.; H; EURIMED-TURAN; K; R; G; 62A0 SE-CH
*Phleum bertolonii* DC.; H; EURIMED; K; R; G; 6510 RB-AE
*Poa annua* L.; T; COSM; K; R; G; RUD, ANGRAS
*Poa angustifolia* L; H; EURAS; K; 62A0 AC-FI-CG; 6510 RB-AE
*Poa bulbosa* L.; H; PALEOTEMP; K; R; ANGRAS; 62A0 AC-FI-TYP, AC-FI-CG, OC-KP-TYP, OC-KP-AA, SE-CH
*Poa nemoralis* L.; H; CIRCUMBOR; K; R; G; FOREDG
*Poa pratensis* L.; H; CIRCUMBOR; K; R; G; ANGRAS; 62A0 AC-FI-TYP, AC-FI-CG
*Poa trivialis* subsp. *sylvicola* (Guss.) H. Lindb.; H; EURIMED; K; R; G; 62A0 OC-KP-TYP
*Sesleria autumnalis* (Scop.) F. W. Schultz; H; S.EURO; K; R; G; FOREDG
*Setaria viridis* (L.) P. Beauv.; T; COSM; K; R; G; RUD; 62A0 OC-KP-AA
*Stipa eriocaulis* Borbás; H; EURIMED; K; R; G; 62A0 GP-AC, SS-ET, SE-CH
*Ventenata dubia* (Leers) Coss.; T; EURIMED; K; R; G; 62A0 GP-AC
*Vulpia myuros* (L.) C. C. Gmel.; T; COSM; K; R; G; ANGRAS; 62A0 OC-KP-AA, SS-ET, SE-CH; 6510 RB-AE

**Polygalaceae**

*Polygala comosa* Schkuh; R; H; C.EURO-S.SIB; K; R; G; 62A0 SE-CH
*Polygala monspeliaca* L.; T; STENOMED; K; 62A0 AC-FI-TYP, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH
*Polygala vulgaris* L.; H; EURAS; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH

**Polygonaceae**

*Fallopia convolvulus* (L.) Á. Löve; T; CIRCUMBOR; K; G; RUD
*Polygonum arenastrum* Boreau; T; COSM; K; R; G; RUD; 62A0 SE-CH
*Rumex acetosella* L.; H; SUBCOSM; K; R; G; ANGRAS; 62A0 AC-FI-CG, OC-KP-AA
*Rumex pulcher* L.; H; EURIMED; K; R; G; RUD

**Primulaceae**

*Anagallis arvensis* L.; T; COSM; K; R; G; 62A0 OC-KP-AA

*Anagallis foemina* Mill.; T; SUBCOSM; K; 62A0 OC-KP-AA
*,**[b]*Cyclamen hederifolium* Aiton; G; N.MED; K; FOREDG
*Primula vulgaris* Huds.; H; EURO-CAUCAS; K; G; FOREDG

**Ranunculaceae**

*Adonis aestivalis* L.; T; EURO; K; RUD
*Clematis vitalba* L.; P; EURO-CAUCAS; K; R; G; RUD; FOREDG
*Delphinium fissum* Waldst. & Kit.; H; OROF-EURAS; K; FOREDG
*Nigella arvensis* L.; T; EURIMED; K; 62A0 OC-KP-AA
*Nigella damascena* L.; T; EURIMED; K; G; ANGRAS
*Ranunculus bulbosus* L.; H; NE.MED; K; R; G; 62A0 AC-FI-TYP; 6510 RB-AE
*Ranunculus ficaria* subsp. *calthifolius* (Rchb.) Arcang.; G; SUBMED-PAN; K; R; G; FOREDG
*Ranunculus illyricus* L.; H; END; R; 62A0 GP-AC
*Ranunculus millefoliatus* Vahl.; G; MED-MONT; K; R; G; ANGRAS; 62A0 AC-FI-CG, GP-AC, OC-KP-AA
*Ranunculus neapolitanus* Ten.; T; MED-MONT; K; G; 62A0 AC-FI-CG
*Thalictrum minus* L.; H; EURAS; K; R; G; 62A0 GP-AC, SE-CH, OC-KP-AA

**Resedaceae**

*Reseda phyteuma* L.; T; EURIMED; K; R; RUD

**Rosaceae**

*Agrimonia eupatoria* L.; H; COSM; K; R; G; 6510 RB-AE
*Aremonia agrimonoides* (L.) DC.; H; NE.STENOMED; R; FOREDG
*Crataegus monogyna* Jacq.; P; PALEOTEMP; K; R; G; FOREDG
*Filipendula vulgaris* Moench; H; C.EURO-S.SIB; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SS-ET; 6510 RB-AE
*Fragaria vesca* L.; H; COSM; K; R; G; FOREDG
*Geum urbanum* L.; H; CIRCUMBOR; K; R; G; RUD; FOREDG
*Potentilla argentea* L.; H; CIRCUMBOR; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA; 6510 RB-AE
*Potentilla recta* subsp. *pilosa* (Poir.) Jáv.; H; MED-PONT; K [32]; R; G; ANGRAS; 62A0 AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH
*Potentilla reptans* L.; H; COSM; K; R; G; RUD
*Prunus cerasifera* Ehrh.; P; ADV; K; R; G; 62A0 AC-FI-CG
*Pyrus spinosa* Forssk.; P; EURO-CAUCAS; K; R; G; FOREDG
*Rosa corymbifera* Borkh.; P; S.EURO-S.SIBIR; K; G; 62A0 AC-FI-TYP
*Rosa gallica* L.; P; S.EURO-S.SIBIR; K; FOREDG
*Rubus aetnicus* Weston; P; EURIMED; K; RUD
*Rubus ulmifolius* Schott; P; EURIMED; K; G; RUD
*Sanguisorba minor* subsp. *balearica* (Bourg. ex Nyman) Muñoz Garm. & C. Navarro; H; PALE-OTEMP; K; R; G; ANGRAS; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH; 6510 RB-AE

**Rubiaceae**

*Asperula aristata* subsp. *scabra* (J. Presl & C. Presl) Nyman; CH; MED-MONT; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-AA, SS-ET, SE-CH
*Asperula purpurea* (L.) Ehrend.; CH; OROF-SE.EURO; K; R; G; 62A0 SS-ET, SE-CH
*Asperula scutellaris* Vis.; CH; END; K; R; G; 62A0 OC-KP-AA
*Cruciata laevipes* Opiz; H; EURAS; K; R; G; 62A0 AC-FI-CG
*Galium aparine* L.; T; COSM; K; R; G; 62A0 OC-KP-TYP
*Galium divaricatum* Lam.; T; STENOMED; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, OC-KP-AA
*Galium lucidum* All.; H; EURIMED; K; R; G; 62A0 GP-AC, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH, 6510 RB-AE
*Galium mollugo* L; H; EURIMED; K; R; G; RUD; 6510 RB-AE
*Galium verum* L.; H; EURAS; K; R; G; 62A0 AC-FI-TYP, GP-AC
*Sherardia arvensis* L.; T; COSM; K; R; G; ANGRAS; 62A0 AC-FI-CG, OC-KP-TYP, OC-KP-AA

**Rutaceae**

*Dictamnus albus* L.; H; EURO-S.SIB; K; FOREDG

**Salicaceae**

*Salix eleagnos* Scop.; P; OROF-S.EURO; K; R; G; GRAEX

**Saxifragaceae**

*Saxifraga tridactylites* L.; T; EURIMED; K; R; G; 62A0 OC-KP-AA, SS-ET, SE-CH

**Scrophulariaceae**

*Scrophularia canina* L.; CH; EURIMED; K; R; G; 62A0 OC-KP-AA
*Verbascum blattaria* L.; H; COSM; K [32]; R; G; RUD
*Verbascum lychnitis* L.; H; EURO-CAUCAS; K; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP; 6510 RB-AE
*Verbascum nigrum* L.; H; S.EURO-S.SIBIR; K; R; FOREDG
*Verbascum phoeniceum* L.; H; SE.EURO-S.SIBIR; K; RUD

*Verbascum pulverulentum* Vill.; H; C.EURO; K; R; G; ANGRAS; 6510 RB-AE

**Solanaceae**

[i]*Datura stramonium* L.; T; ADV; K; RUD

*Solanum nigrum* L.; T; COSM; K; R; G; RUD

**Santalaceae**

*Thesium divaricatum* Jan ex Mert. & W. D. J. Koch; H; EURIMED; K; R; G; 62A0 AC-FI-CG, GP-AC, OC-KP-TYP, OC-KP-AA, SS-ET, SE-CH

*Thesium ramosum* Hayne; H; BALK-EUROP; K; R; G; 62A0 AC-FI-CG, SS-ET, SE-CH

**Thymelaeaceae**

*Daphne alpina* L.; CH; NE.MED-MONT; R [32]; 62A0 OC-KP-AA

*Thymelaea passerine* (L.) Coss. & Germ.; T; EURIMED; K; R; 62A0 AC-FI-CG, SS-ET, SE-CH

**Urticaceae**

*Urtica dioica* L.; H; COSM; K; R; G; RUD

**Valerianaceae**

*Valeriana tuberosa* L.; G; MED-MONT; K; R; G; 62A0 OC-KP-AA

*Valerianella dentata* (L.) Pollich; T; SUBMED-SUBATL; K; 62A0 AC-FI-TYP, AC-FI-CG, OC-KP-AA; 6510 RB-AE

*Valerianella eriocarpa* Desv.; T; EURIMED; K; G; ANGRAS; RUD

*Valerianella locusta* (L.) Laterr.; T; EURIMED; K; R; G; ANGRAS; RUD

*Valerianella rimosa* Bastard; T; EURIMED; K; 62A0 AC-FI-CG, OC-KP-AA

**Verbenaceae**

*Verbena officinalis* L.; H; COSM; K; R; G; RUD

**Viburnaceae**

*Sambucus ebulus* L.; G; EURIMED; K; R; G; RUD

**Violaceae**

*Viola arvensis* Murray; T; EURAS; K; R; G; ANGRAS; RUD

*Viola riviniana* Rchb.; H; EURAS; K; R; G; FOREDG; 6510 RB-AE

*Viola kitaibeliana* Schult.; T; MED-CAUCAS; K; R; G; 62A0 AC-FI-TYP, AC-FI-CG, GP-AC, OC-KP-AA

*Viola tricolor* L.; T; EURAS; K; R; G; ANGRAS; RUD

**Vitaceae**

*Vitis vinifera* L.; P; ADV; K; G; GRAEX

According to the expected taxonomic spectra, the following families are the richest in species number: *Asteraceae*, *Fabaceae*, and *Poaceae*. Among the genera, the richest are *Trifolium*, *Medicago*, *Veronica*, and *Geranium*. The predominant life form is hemicryptophytic, with significant participation of therophytes and geophytes. In terms of chorological spectra, Eurimediterranean species prevail (Tab. 1).

**Table 1.** Dominant or significant families and genera, life forms and chorological elements in terms of number of species in the flora of the studied karst fields: Kopilje, Radovče, Gostilje Martinićko.

| | Kopilje | Radovče | Gostilje Martinićko |
|---|---|---|---|
| Total number of species and subspecies (%) | 437 (100 %) | 337 (100 %) | 337 (100 %) |
| **Families** | | | |
| *Asteraceae* | 58 (13.3 %) | 68 (20.2 %) | 45 (13.4 %) |
| *Fabaceae* | 57 (13.0 %) | 48 (14.2 %) | 30 (8.9 %) |
| *Poaceae* | 45 (10.3 %) | 48 (14.2 %) | 38 (11.3 %) |
| **Genera** | | | |
| *Trifolium* | 15 (3.4 %) | 16 (4.7 %) | 10 (3.0 %) |
| *Medicago* | 8 (1.8 %) | 8 (2.4 %) | 5 (1.5 %) |
| *Veronica* | 8 (1.8 %) | 8 (2.4 %) | 6 (1.8 %) |
| *Geranium* | 7 (1.6 %) | 7 (2.1 %) | 5 (1.5 %) |
| **Life forms** | | | |
| *Hemicriptophytes* | 289 (66.1 %) | 169 (50.1 %) | 158 (46.9 %) |
| *Therophytes* | 143 (32.7 %) | 84 (24.9 %) | 101 (30.0 %) |
| *Geophytes* | 53 (12.1 %) | 44 (13.1 %) | 38 (11.3 %) |
| *Chamaephytes* | 30 (6.9 %) | 28 (8.3 %) | 23 (6.8 %) |
| **Chorological types** | | | |
| *Eurimediterranean* | 102 (23.3 %) | 65 (19.3 %) | 72 (21.4 %) |
| *Euroasian* | 31 (7.1 %) | 28 (8.3 %) | 26 (7.7 %) |
| *Cosmopolitan* | 53 (12.1 %) | 43 (12.8 %) | 46 (13.6 %) |
| *Endemic* | 33 (7.6 %) | 27 (8.0 %) | 19 (5.6 %) |
| *Invasive alien* | 8 (1.8 %) | 4 (1.2 %) | 5 (1.5 %) |

The calculation of the Sørensen index showed a fairly high similarity between the floras of all the fields studied (Tab. 2). Nevertheless, each field has its own peculiarities. Due to its lower altitude (604 m a.s.l.) and openness to Bjelopavlićka Ravnica, the flora of Kopilje polje contains some thermophilous and Mediterranean elements that do not occur at higher altitudes. These include *Asparagus acutifolius*, *Bombycilaena erecta*, *Crepis sancta*, *Rhagadiolus stellatus*, *Astragalus monspessulanus* subsp. *wulfenii*, *Colutea arborescens*, *Hippocrepis emerus* subsp. *emeroides*, *Trifolium subterraneum*, and *Micromeria juliana*. The flora of Radovče polje contains some montane or alpine elements: *Cirsium eriophorum*, *Dianthus petraeus*, *Gentiana utriculosa*, *G. cruciata*, *Danthonia alpina*. The flora of Gostilje Martinićko includes both alpine species, such as *Gentiana utriculosa* and *G. cruciata*, as well as thermophilous and Mediterranean elements like *Nigella damascena*, *Ranunculus neapolitanus*, *Rubus ulmifolius*, and *Serapias bergonii*.

**Table 2.** Values of Sørensen index of similarity for floras of the studied karst fields

| | Total number of species and subspecies | Number of common species and subspecies | Sørensen index |
|---|---|---|---|
| Kopilje-Radovče | 774 | 299 | 0.77 |
| Kopilje-Gostilje | 774 | 326 | 0.84 |
| Gostilje-Radovče | 674 | 292 | 0.87 |

All three fields are settled and traditionally used primarily as pasture or mown meadows. Nine grassland communities have been documented in the surveyed karst fields (Table 3). Seven of these are classified under NATURA 2000 habitat 62A0, one under habitat 6510, while the annual grasslands with *Dasypyrum villosum* represent anthropogenic habitats (Tab. 3, Fig. 2).

**Table 3.** Plant communities and NATURA 2000 habitat types documented in the studied karst fields: Kopilje, Radovče and Gostilje Martinićko

| | Habitat type | Kopilje | Radovče | Gostilje Martinićko |
|---|---|---|---|---|
| *Armerio canescenti-Festucetum illyricae typicum* | 62A0 | | + | + |
| *Armerio canescenti-Festucetum illyricae chrysopogonetosum grylii* | 62A0 | + | | |
| *Gladiolo palustri-Agrostietum castellanae* | 62A0 | | + | |
| *Ornithogalo comosi-Koelerietum pyramidatae typicum* | 62A0 | + | | + |
| *Ornithogalo comosi-Koelerietum pyramidatae artemisietosum albae* | 62A0 | + | + | + |
| *Saturejo subspicatae-Edraianthetum tenuifolii* | 62A0 | + | + | |
| *Stipo eriocauli-Caricetum humilis* | 62A0 | + | + | + |
| *Ranunculo bulbosi-Arrhenatheretum elatioris* | 6510 | | | + |
| Ruderalized annual grasslands with *Dasypyrum villosum* | Anthropogenic | + | | |

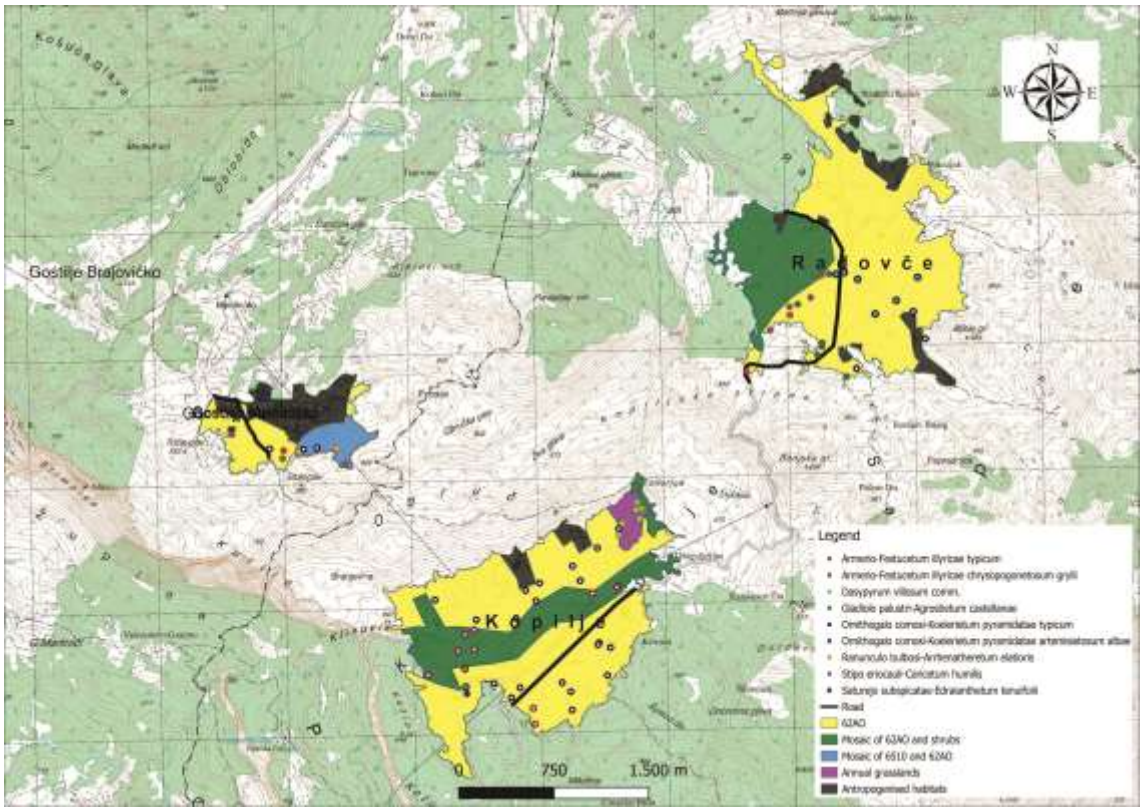


**Figure 2.** Habitat map of the investigated karst fields: Kopilje, Radovče, and Gostilje Martinićko in Montenegro.

The landscape of the arid karst fields in Piperi is predominantly characterized by the perennial grassland type 62A0 East Sub-Mediterranean dry grasslands (*Scorzoneretalia villosae*) (Fig. 2, Tab. 4). In areas where the soil is skeletal and shallow, and the vegetation is sparse, associations of *Saturejion subspicatae* develop in the following sequence (from the most open and skeletal): *Saturejo subspicatae-Edraianthetum tenuifolii*, *Stipo eriocauli-Caricetum humilis*, and *Ornithogalo comosi-Koelerietum pyramidatae*. The latter is considered a transition to *Scorzonerion villosae* grasslands, which develop on less skeletal and deeper soils, such as *Armerio canescenti-Festucetum illyricae* and *Gladiolo palustri-Agrostietum castellanae*. Including mosaic area with wood vegetation and lowland hay meadows, 62A0 covers an area of 4.46 km². *Ranunculo bulbosi-Arrhenatheretum elatioris*, classified as habitat type 6510 Lowland hay meadows, grows on abandoned cultivated land. This habitat type occupies a relatively small area of 0.09 km² and is limited to Gostilje Martinićko. Annual grasslands were recorded only on Kopilje, covering a small area of 0.085 km². However, due to the significant presence of ruderal elements, they are not considered a part of NATURA 2000 habitat type 6220 Pseudo-steppe with grasses and annuals of *Thero-Brachypodietea*.

**Table 4.** Cover area of habitat of investigated karst fields: Kopilje, Radovče, Gostilje Martinićko in Montenegro

| Habitat | Kopilje | Radovče | Gostilje Martinićko |
|---|---|---|---|
| 62A0 (km$^2$) | 1.79 | 1.79 | 0.24 |
| Share of 62A0 in the mosaic with 6510 (km$^2$) | | | 0.05 |
| Mosaic of 62A0 and 6510 (km$^2$) | | | 0.13 |
| Mosaic of 62A0 and woody vegetation (km$^2$) | 0.61 | 0.52 | |
| Share of 62A0 in the mosaic with woody vegetation (km$^2$) | 0.27 | 0.31 | |
| 6510 (km$^2$) | | | 0.09 |
| Annual grasslands (km$^2$) | 0.08 | | |
| Antropogenised habitats (km$^2$) | 0.08 | 0.25 | 0.27 |

Here, we present the plant syntaxa recorded in the karst fields, some of which are described provisionally.

***Saturejo subspicatae-Edraianthetum tenuifolii* Horvat in Horvat et al. 1974** (Fig. 3) is found in Kopilje and Radovče (Fig. 2). This open pasture community develops on fluvioglacial sediments as well as moraine deposits. The soil is shallow and highly skeletal, typically of the rendzina type. The terrain is flat to slightly inclined, predominantly exposed to the E and SE. The total vegetation cover ranges from 40 % to 70 (85) %, which is lower compared to other communities. Although considered a species-poor grassland, it is rich in Balkan endemic species (e.g., *Edraianthus tenuifolius*, *Satureja subspicata*, *Hyacinthella dalmatica*, *Seseli montanum* subsp. *tommasinii*, *Vincetoxicum huteri*). Most species are characteristic of *Saturejion subspicatae* (*Edraianthus tenuifolius*, *Satureja subspicata*, *Bunium alpinum* subsp. *montanum*, *Genista sericea*), *Scorzoneretalia villosae* (*Carex caryophyllea*, *Teucrium montanum*, *Plantago holosteum*, *Anthyllis vulneraria* subsp. *polyphylla*, *Koeleria splendens*, *Bromus pannonicus*), and *Festuco-Brometea* (*Leontodon crispus*, *Sanguisorba minor*, *Bupleurum veronense*, *Helianthemum nummularium* subsp. *obscurum*, *Ornithogalum comosum*) [35].

***Stipo eriocauli-Caricetum humilis* Trinajstić 1987** (Fig. 4) was documented in Gostilje Martinićko and Radovče, in the altitudinal zone 812 to 856 m above sea level (Fig. 2). It is a species-poor, open pasture community that has developed on moraine deposits and shallow and very skeletal rendzina. The terrain is mostly inclined between 5° and 17° and has different exposures. The total vegetation cover ranges from 50 to 90(95) %. The majority of species are characteristic of *Saturejion subspicatae* (*Carex humilis*, *Satureja subspicata*, *Bunium alpinum* subsp. *montanum*, *Edraianthus tenuifolius*), *Scorzoneretalia villosae* (*Carex caryophyllea*, *Anthyllis vulneraria* subsp. *polyphylla*, *Eryngium amethystinum*, *Plantago holosteum*, *Koeleria splendens*, *Asperula aristata* subsp. *scabra*), *Festuco-Brometea* (*Leontodon crispus*, *Muscari comosum*, *Helianthemum nummularium* subsp. *obscurum*, *Centaurea alba* subsp. *deusta*) [35].

**Figure 3.** *Saturejo subspicatae-Edraianthetum tenuifolii* (Radovče)

**Figure 4**. *Stipo eriocauli-Caricetum humilis* (Gostilje Martinićko)

***Armerio canescenti-Festucetum illyricae* Trinajstić et Šugar 1972** (Fig. 5, 6). In the Piperi area, the *Armerio canescenti-Festucetum illyricae* grasslands are the best quality hay meadows beside the *Ranunculo bulbosi-Arrhenatheretum elatioris* meadows. The stands are mowed regularly, once or twice a year. The geological substrates are glacial sediments and moraine sediments, while the soil is a deep rendzina, rich in nutrients and not skeletal. The vegetation cover ranges from 95 to 100 %. The association is characterized by the dominance of *Festuco-Brometea* species: *Bromus erectus, Chrysopogon gryllus, Festuca rupicola, Filipendula vulgaris*, with a significant participation of *Scorzoneretalia villosae* species (*Eryngium amethystinum, Seseli montanum* subsp. *tommasinii, Medicago prostrata, Hippocrepis comosa, Anthyllis vulneraria* subsp. *polyphylla, Asperula aristata* subsp. *scabra, Thymus longicaulis*) and the *Scorzonerion villosae* species (*Filipendula vulgaris, Veronica spicatum, Koeleria pyramidata, Plantago holosteum, Ononis spinosa*) [35]. Within *Armerio canescenti-Festucetum illyricae*, two sub-associations are distinguished: *typicum* nom. prov. Stanišić-Vujačić 2023 and *chrysopogonetosum grylli* nom. prov. Stanišić-Vujačić 2023. The first is distributed in Radovče and Gostilje Martinićko, while the second is documented only in Kopilje (Fig. 2). In the floristic composition of the typical subassociation, elements of the *Molinio-Arrhenatheretea* are common (*Lotus corniculatus, Trifolium incarnatum, Tragopogon orientalis, Achillea millefolium, Ranunculus bulbosus*), which is due to mowing. Nevertheless, these grasslands are also used as pastures and contain ruderal elements of the classes *Artemisietea vulgaris*, *Chenopodietea* and *Papaveretea rhoeadis*. The subassociation *chrysopogonetosum grylli* occurs near forest fringes and is characterized by the dominance of *Chrysopogon gryllus*. The endemic species *Chaerophyllum coloratum* also differentiates it from the typical subassociation. The presence of the species *Trifolio-Geranietea* and *Quercetea pubescentis* species indicates an overgrowing process, as these meadows are not mowed.

**Figure 5.** *Armerio canescenti-Festucetum illyricae typicum* (Radovče)

**Figure 6.** *Armerio canescentis-Festucetum illyricae chrysopogonetosum grylii* (Kopilje)

***Gladiolo palustri-Agrostietum castellanae* nom. prov.** (Stanišić-Vujačić 2023). According to current knowledge, this pasture community is only reported in Radovče (Fig. 2). The geological substrate is fluvioglacial sediments and moraine deposits. The soil is deep rendzina with a small proportion of skeletal components. The vegetation cover ranges from (70)90 to 100 % (Fig. 7). The vegetation optimum is dominated by the grass species *Agrostis castellana* together with *Bromus pannonicus* and *Festuca rupicola*. The community is characterized by the *Scorzonerion villosae* species (*Plantago holosteum, Scorzonera villosa, Ononis spinosa, Plantago media*), the *Scorzoneretalia villosae* species (*Asperula aristata* subsp. *scabra*, *Dorycnium pentaphyllum* subsp. *germanicum*, *Seseli montanum* subsp. *tommasinii*, *Hippocrepis comosa*, *Thymus longicaulis*), and the *Festuco-Brometea* species (*Pilosella bauhini, Muscari comosum, Sanguisorba minor, Hypericum perforatum, Centaurea jacea* subsp. *angustifolia, Euphorbia cyparissias*) [35].

**Figure 7.** *Gladiolo palustri-Agrostietum castellanae* (Radovče)

***Ornithogalo comosi-Koelerietum pyramidatae* nom. prov.** (Stanišić-Vujačić 2023) is considered a transitional variant between the Armerio canescenti-Festucetum illyricae and the more open and skeletal grasslands of *Saturejo subspicatae-Edraianthetum tenuifolii* and *Stipo eriocauli-Carcetum humilis*. The floristic composition is dominated by species of *Festuco-Brometea*: *Anthyllis vulneraria* subsp. *polyphylla, Artemisia alba, Bromus pannonicus, Festuca rupicola, Sanguisorba minor* and *Koeleria pyramidata*. The characteristic species of *Saturejion subspicatae* that occur in grasslands include: *Bunium alpinum* subsp. *montanum*, Satureja subspicata, Edraianthus tenuifolius, Muscari botryoides and Inula ensifolia, and from the *Scorzonerion villosae*: *Filipendula vulgaris, Lathyrus latifolius, Scorzonera villosa, Ononis spinosa*. Elements of the *Molinio-Arrhenatheretea* also form this grasslands: *Tragopogon tommasinii, Lotus corniculatus, Trifolium incarnatum, Rhinanthus rumelicus*. Within *the Ornithogalo comosi-Koelerietum pyramidatae* association, two sub-associations are distinguished: *typicum* (Fig. 8) and *artemisietosum albae* (Fig. 9). The first community is common in Gostilje Martiničko and Kopilje, while the second is found at higher elevations across all three fields (Fig. 2). A typical subassociation is an open pasture community, occasionally mowed. The geological substrates include both glacial and moraine sediments, with the soil being shallow and skeletal rendzina, though less so compared to other communities within the *Saturejion subspicatae*. The total vegetation cover ranges from 75 % to 95(100) %. The subassociation *artemisietosum albae* is a more open pasture community that develops on moraine sediments and shallow, skeletal rendzina. The vegetation cover here ranges from 70 % to 90(95) %. Differential species for this subassociation include *Artemisia alba*, *Chrysopogon gryllus*, *Carex humilis*, and *Stipa eriocaulis*. In areas where grazing has been abandoned, overgrowth processes have been observed.

**Figura 8**. *Ornithogalo comosi-Koelerietum pyramidatae typicum* (Kopilje)

**Figura 9.** *Ornithogalo comosi-Koelerietum pyramidatae artemisietosum albae* (Kopilje)

***Ranunculo bulbosi-Arrhenatheretum elatioris*** **Ellmauer in Mucina et al. 1993** (Fig. 10) is a mown meadow community growing on Gostilje Martinićko (Fig. 2), on abandoned cultivated land, on deep eutric cambisol and deep carbonate rendzina. The geological substrates are moraine deposits and fluvioglacial and glacial sediments. These meadows are rich in biomass and are regularly mowed once or twice a year. The total vegetation cover is very high, between 90 and 100 %. The majority of species are characteristic of *Arrhenatherion elatioris* and *Arrhenatheretalia elatioris*: *Arrhenatherum elatius, Tragopogon orientalis, Rhinanthus rumelicus, Achillea millefolium, Anthoxantum odoratum, Trifolium pratense, Leucanthemum vulgare, Daucus carota, Dactylis glomerata*, as well as the *Festuco-Brometea* (*Euphorbia cyparissias, Ajuga genevensis, Festuca rupicola, Galium verum*). Also present are species characteristic of the ruderal vegetation of *Artemisietea vulgaris*, *Papaveretea rhoeadis*, *Chenopodietea*

and *Sisymbrietea* (*Crepis setosa*, *Convolvulus arvensis*, *Sherardia arvensis*, *Dasypyrum villosum*, *Geranium molle*). The presence of ruderal elements is to be expected, as the community develops on abandoned fields and nutrient-rich substrate.

**Ruderalized annual grasslands with the dominant *Dasypyrum villosum* (Fig. 11)** develop in Kopilje polje (Fig. 2) on abandoned cultivated land and very deep, nitrophilous rendzina. These areas are regularly mowed and species-poor, with ruderal elements such as *Avena barbata*, *Convolvulus arvensis*, and *Verbascum* sp. predominating. Further studies are needed for the syntaxonomic classification of this community to better understand its syngenesis and its relationship to other grasslands in the Piperi karst fields.

**Figure 10.** *Ranunculo bulbosi-Arrhenatheretum elatioris* (Gostilje Martinićko)

**Figure 11.** Ruderalized annual grasslands with the dominant *Dasypyrum villosum* (Kopilje)

Syntaxonomical classification of grasslands communities in Piperi

*Festuco-Brometea* Br.-Bl. et Tx. ex Soó 1947
*Scorzoneretalia villosae* Kovačević 1959
*Saturejion subspicatae* Tomić-Stanković 1970
*Saturejo subspicatae-Edraianthetum tenuifolii* Horvat in Horvat et al. 1974
*Stipo eriocauli-Caricetum humilis* Trinajstić 1987
*Ornithogalo comosi-Koelerietum pyramidatae* nom. prov. Stanišić-Vujačić 2023
-*typicum* nom. prov.
-*artemisietosum albae* nom. prov.
*Scorzonerion villosae* Horvatić ex Kovačević 1959
*Armerio canescenti-Festucetum illyricae* Trinajstić et Šugar 1972
-*typicum*
-*chrysopogonetosum grylli* nom. prov. Stanišić-Vujačić 2023
*Gladiolo palustri-Agrostietum castellanae* nom. prov. Stanišić-Vujačić 2023

*Molinio-Arrhenatheretea* Tx. 1937
*Arrhenatheretalia elatioris* Tx. 1931
*Arrhenatherion elatioris* Luquet 1926
*Ranunculo bulbosi-Arrhenatheretum elatioris* Ellmauer in Mucina et al. 1993

*Helianthemetea guttati* Rivas Goday et Rivas-Mart. 1963
*Vulpietalia* Pignatti 1953
*Vulpio-Lotion* Horvatić 19633
*Dasypyrum villosum* comm.

## DISCUSSION

A relatively large number of vascular plant species (480 species and subspecies) were recorded in a relatively small area of the arid karst field in Piperi (approximately 7.4 km²). The flora of the karst fields is not only rich but also diverse, containing various chorological elements, ecological forms, and life forms. In addition to 18 species of conservation value, the fields are home to some rare species that occur only in one or a few localities in Montenegro, such as *Galatella linosyris*, *Crocus weldenii* f. *lutescens*, and *Succisella petteri* [36]. The vegetation of the fields is also unique, and according to current knowledge, the distribution of three plant communities is restricted to the karst fields in Piperi: *Armerio canescenti-Festucetum illyricae chrysopogonetosum grylli*, *Ornithogalo comosi-Koelerietum pyramidatae artemisietosum albae*, and *Stipo eriocauli-Caricetum humilis*.

The *Armerio canescenti-Festucetum illyricae* association was originally described in the Croatian Dinara Mountains [37] and has also been documented in Montenegro [31]. The Montenegrin stands are differentiated into two subassociations: *typicum* and *chrysopogonetosum grylli*. Both are characterized by the dominance of *Festuca rupicola*, while the nominal species *Armeria canescens* is completely absent in *chrysopogonetosum grylli*. Besides the Piperi fields, the typical subassociation has been reported from Grahovsko polje, Dragalj, Lukovo, Seoca, Radovče, and Gostilje Martinićko at altitudes ranging from 614 to 945 m a.s.l., while the second subassociation is restricted to Kopilje polje at an altitude of 614 m a.s.l. [31]. The Montenegrin stands of the typical subassociation differ from the Croatian ones by a lower presence of *Armeria canescens*. Both subassociations are classified as NATURA 2000 habitat type 62A0.

Another association from *Scorzonerion villosae* present in the karst fields of Piperi is *Gladiolo palustri-Agrostietum castellanae*. In Montenegro, it has also been reported from Dragaljsko polje, where it alternates with *Saturejo subspicatae-Edraianthetum tenuifolii* [31]. Compared to other *Scorzonerion villosae* communities, it is poorer in species and more similar to *Saturejion subspicatae* in species composition, as indicated by the presence of *Globularia meridionalis*, *Carex humilis*, and *Genista sericea*. It is also classified as NATURA 2000 habitat type 62A0.

The majority of plant communities in the studied fields belong to *Saturejion subspicatae*, which comprises rocky pastures in the Mediterranean montane zone and represents an extreme degradation stage of the climatozonal forest community *Seslerio-Ostryetum* [38, 39]. In the sub-Mediterranean part of Montenegro and in Piperi, it is represented by *Saturejo subspicatae-Edraianthetum tenuifolii*, *Stipo eriocauli-Caricetum humilis*, and *Ornithogalo comosi-Koelerietum pyramidatae* (*typicum* and *artemisietosum albae*). The first two communities have also been reported from Croatia [35, 39], while the last two are restricted to Montenegro. *Saturejo subspicatae-Edraianthetum tenuifolii* is one of the most representative rocky grassland communities [40], distributed in the Mediterranean montane zone of the Adriatic Sea, with stands that are physiognomically very similar but geographically distinct [40, 38]. In Montenegro, it is also reported from Grahovsko and Dragalj polje [31]. All Montenegrin stands are more or less homogeneous and contain endemic Balkan species

that are absent in the Croatian stands (e.g., *Hyacinthella dalmatica*, *Festuca hercegovinica*, *Vincetoxicum huteri*), while the Croatian stands contain more Balkan-Apennine elements, such as *Centaurea rupestris*, *Crepis chondrilloides*, and *Sesleria juncifolia*. Physiognomically, the stands in Montenegro and Croatia are very similar, and due to the strong winds to which they are exposed, the dwarf form dominates. The association is classified as NATURA 2000 habitat type 62A0.

*Stipo eriocauli-Caricetum humilis* is another typical rocky pasture exposed to strong winds, but is physiognomically characterized by the tall grass *Stipa eriocaulis*. For Montenegro, the stands are so far only known from Piperi [31]. The most obvious difference from the Croatian stands is the absence of chasmophytes and/or endemic elements such as *Moltkia petraea*, *Asperula scutellaris*, *Anthyllis montana* subsp. *jacquinii*, *Sesleria juncifolia*, as well as the presence of *Salvia officinalis* and the phanerophytes *Ostrya carpinifolia*, *Pyrus amygdaliformis*, and *Rhamnus intermedia* [40].

The analysis of the plant communities of *Saturejion subspicatae* on the Balkan Peninsula, conducted by (Stanišić-Vujačić) [31], showed that *Ornithogalo comosi-Koelerietum pyramidatae* clearly separates from the others and occupies an intermediate position between *Armerio canescenti-Festucetum illyricae* and *Saturejo subspicatae-Edraianthetum tenuifolii* and *Stipo eriocauli-Caricetum humilis*. It develops on deeper and less skeletal soils and has higher vegetation cover values. *Carex humilis*, which frequently occurs in other *Saturejion subspicatae* associations, is almost completely absent, while species of *Scorzonerion villosae* play a significant role. Thus, *Ornithogalo comosi-Koelerietum pyramidatae* has a transitional character to *Scorzonerion villosae*. This recently reported association [31] is differentiated into two subassociations: *typicum* and *artemisietosum albae*. The first is characterized by higher vegetation cover values and the dominance of *Teucrium capitatum*; it is used as pasture and occasionally mowed, while the second is more open, differentiated by *Artemisia alba* and used exclusively as pasture. Both subassociations are considered the vegetation equivalent of NATURA 2000 habitat 62A0.

A *Molinio-Arrhenatheretea* community has been reported in the arid environment of Piperi—specifically, the most xerophilous variant of *Ranunculo bulbosi-Arrhenatheretum elatioris*. This community shows a transitional character to *Scorzonerion villosae* grasslands. A comparative analysis of grassland communities of *Arrhenatherion* [31] showed the greatest similarity with *Arrhenatheretum elatioris* subass. *litorale* from Cetinje and Njeguši. It has been documented on Gostilje Martinićko and, together with *Armerio canescenti-Festucetum illyricae*, represents the best-quality hay meadows. *Ranunculo bulbosi-Arrhenatheretum elatioris* is included in NATURA 2000 habitat 6510.

Grazing abandonment and overgrowth are among the greatest threats to grassland habitats on the arid karst fields in Piperi. According to a recent EPA report [41], these processes are recognized as a general threat to biodiversity in Montenegro. Possible solutions at the national level could include programs to promote livestock farming or subsidies for mowing. In recent years, the inhabitants of Kopilje have attempted to prevent further overgrowth of grasslands with *Juniperus oxycedrus* by deliberately setting fires.

The trend of urbanization and house construction is becoming noticeable in Radovče, and if this trend continues, habitat fragmentation will be inevitable.

Invasive alien species are also identified as a general threat to biodiversity [42], though their impact on the flora of the arid fields in Piperi remains relatively low. They are primarily found in anthropogenic habitats (e.g., trampled areas, roadsides, and agricultural fields) and rarely in semi-natural grasslands. However, as anthropogenic pressure, habitat degradation, and disturbance intensify, their impact is likely to grow.

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## ФЛОРА, ВЕГЕТАЦИЈА И ЗНАЧАЈНИ ВИДОВИ ЖИВЕАЛИШТА НА СУШНОТО КАРСТНО ПОЛЕ ВО ПИПЕРИ (ЦРНА ГОРА)

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Локалитетите Копиље, Радовче и Гостиље Мартиниќко се сушни карстни полиња сместени во регионот на Пипери (централен дел на Црна Гора) на надморска височина од 600 до 950 м, во зоните на термофилни габерови и дабови шуми, како и мезофилни букови шуми. На прилично малата површина покриена со три полиња (околу 7,4 км$^2$) се регистрирани 480 видови и подвидови васкуларни растенија, класифицирани во 284 родови и 63 фамилии. Најбогати меѓу фамилиите се *Asteraceae, Fabaceae* и *Poaceae*, додека меѓу родовите *Trifolium, Medicago, Veronica* и *Geranium*. Од животните форми преовладуваат хемикриптофитите, со значително учество на терофити и геофити, додека во хоролошкиот спектар преовладуваат евримедитеранските видови. Осумнаесет видови имаат конзервациска вредност, додека три се наведуваат само за еден или за неколку локалитети во Црна Гора: *Galatella linosyris, Crocus weldenii* f. *lutescens* и *Succisella petteri*. Полуприродната тревеста вегетација која се развива на карстните полиња е уникатна и е претставена со 9 растителни заедници, меѓу кои 3 растителни заедници се ограничени само на карстните полиња во Пипери: *Armerio canescenti-Festucetum illyricae* subass. *chrysopogonetosum grylli, Ornithogalo comosi-Koelerietum pyramidatae* subass. *artemisietosum albae* и *Stipo eriocauli-Caricetum humilis*. Со исклучок на рудерализираните едногодишни пасишта, другите пасишни заедници се вегетациски еквиваленти на два типа живеалишта NATURA 2000: 62A0 и 6510.

**Клучни зборови**: суви брдски пасишта; *Festuco-Brometea; Scorzoneretalia villosae; Saturejion subspicatae; Scorzonerion villosae; Arrhenatheretum*