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Original Scientific Paper

Ruderal flora and vegetation of the town of Žabljak (Montenegro) – an overview for the period 1990 – 1998

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ABSTRACT: The paper represents the results of floristic and vegetation studies of ruderal habitats in urban and suburban areas of the town of Žabljak (Montenegro) within the last decade of the 20th century. A total of 279 vascular plant taxa (species or subspecies level) was recorded, as well as 6 ruderal plant communities. Detailed taxonomic-systematic, ecological and phytogeographic analyses identified certain specificities of ruderal habitats of this mountain town (1450 m a.s.l.) which is the administrative seat of the Durmitor National Park. The results of these studies support the thesis that even mountain regions, which are considered to be at low risk of ruderalization and allochthonization, are not exempt from this process. In this sense, the paper affirms the need for future complex and comparative geobotanic research of other urban mountain areas in Montenegro and the Balkan Peninsula.

Key words: ruderal flora and vegetation, Žabljak, Montenegro

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INTRODUCTION

It is known that ruderal flora and vegetation generally represent one of the most dynamic floristic-vegetation complexes. The first research in the field of urban ecology in Europe was directed on certain habitat types (e.g. old fortifications, ruins, gardens and parks), while overall urban ecosystem studies started in the seventies of the last century (Sukopp 2002).

In the former Yugoslavia, particular interest in ruderal flora and vegetation appeared during the last few decades of the 20th century (Jovanović 1993). However, its exploration on the territory of Montenegro is not satisfactory, except for the wider area of the capital city Podgorica (Stešević and Jovanović 2005, 2008; Stešević *et al*. 2009).

Several years of research within the project "Flora and vegetation of the National Park Durmitor" have been conducted during the last decade of the 20th century, a special attention being paid to plants that grow in different types of ruderal habitats in urban and suburban areas of the town of Žabljak, which is the administrative seat of Durmitor National Park (NP) and the urban area with the highest altitude in the Balkan Peninsula (1450 m a.s.l.).

The results of this project have not yet been published in an integrated form. Hence, the goal of this study was to provide insight into the ecological and phytogeographical specificities of plant life that has evolved in different types of ruderal habitats in mountain, urban and suburban areas of Žabljak during the period from 1990 to 1998. This would provide a good basis for future comparative geobotanic research not only in this area, but also in other mountain urban areas in Montenegro and the Balkan Peninsula. This work is of particular important because even mountain regions, which are usually considered to be at low risk of ruderalization and allochthonization, are not exempt from this process (Humphries *et al*. 1991; Rouget *et al*. 2003; Baret *et al*. 2006; Pauchard *et al*. 2009; McDougall *et al*. 2011).

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MATERIALS AND METHODS

Investigation of the ruderal flora and vegetation of Žabljak was conducted in the period 1990-1998. The plant material collected was deposited in the Herbarium of the University of Belgrade - BEOU (Holmgren et al. 1990)

Identification and review of plants were performed according to standard botanical (floristic) literature, while the nomenclature follows Flora Europaea (Tutin *et al.* 1968-1980, 1993).

For each species floristic elements were determined, with minor changes, according to the principle of division of Meusel *et al.* (1965, 1978) and Meusel & Jäger (1992), while for all adventive and cosmopolitan species their authentic areals were specially determined. Classification of floristic elements in the basic area types and area groups was determined by the principle of floristic-vegetation phytogeographical regionalization of Serbia used by Jovanović (1994).

Life forms of plants were determined according to Ellenberg & Mueller-Dambois (1967). Phytocoenological research of ruderal vegetation was performed using standard methods of Braun-Blanquet (1965).

RESULTS

Floristic richness and taxonomical analysis. On different types of ruderal habitats in urban and suburban areas of Žabljak in the last decade of the 20th century, 279 species and subspecies of vascular plants have been found, representing 158 genera and 37 families (Appendix 1).

Gymnosperms were represented by 2 species (*Juniperus communis* and *Picea abies*), while within angiosperms the majority of taxa belonged to the classis *Dicotyledones* (247 taxa within 136 genera and 32 families). The classis of *Monocotyledones* was represented by significantly fewer taxa (30 taxa, within 20 genera and 3 families).

The most frequent families in the ruderal habitats of Žabljak were: *Asteraceae* (52 sp.), *Poaceae* (28 sp.), *Caryophyllaceae* and *Rosaceae* (each with 21 sp.), *Lamiaceae* (20 sp.), *Fabaceae* (18 sp.) and *Scrophulariaceae* (17 sp.). Within the taxonomic structure of flora of the Žabljak area the most numerous were the following genera: *Potentilla*, *Ranunculus* and *Veronica* (each with seven sp.), *Trifolium* (six sp.), *Campanula*, *Cerastium* and *Cirsium* (each with five sp.), *Festuca*, *Galium*, *Hieracium*, *Poa*, *Rumex*, *Silene*, *Trifolium* and *Viola* (each with four sp.).

This involvement of the most frequent families and genera in the ruderal flora of Žabljak corresponds with their presence in the whole flora of the Balkan Peninsula, where the particularly prominent families are *Asteraceae* and *Poaceae*, and genera *Potentilla*, *Ranunculus* and *Veronica* (Turill 1929).

Table 1. Biological spectrum of ruderal flora of Žabljak.

Life form	No	%
Hemicryptophytes (H)	182	65.2
Therophytes (T)	64	22.9
Geophytes (G)	12	4.3
Chamaephytes (Ch)	12	4.3
Phanerophytes (P)	8	2.9
Scandentophytes (S)	1	0.4

Table 2. Chorological spectrum of ruderal flora of Žabljak.

Area type	No	%
Holarctic (HOL)	179	64.2
Mediterranean-Continental (MED-CONT)	38	13.6
Cosmopolitan (COSM)	30	10.8
Central European-Mediterranean (CE-MED)	12	4.3
Central European (CE)	10	3.6
"Adventive" (ADV)	7	2.5
Pontic-South Siberian (PONT-SSIB)	3	1.0

The specificity of the ruderal flora of Žabljak was the absence of genera typical of the ruderal type (e.g. *Amaranthus),* as well as the presence of only two species of the genus *Chenopodium.* On the other hand, it was characterized by the sporadic presence of some typical mountain species which are not specific to ruderal habitats (e.g. *Acinos alpinus, Linum capitatum* and *Ranunculus montanus*), and some endemic and subendemic species (*Pimpinella serbica, Silene sendtneri* and *Hypericum barbatum*).

Biological spectrum. The ecological analysis showed that flora of the Žabljak area was of the hemicryptophytes type (182 sp., 65.2% of total). Therophytes participated significantly less (64 sp., 22.9% of total). Other life forms were present with a smaller number of representatives (Table 1).

The domination of hemicryptophytes in the biological spectrum of the ruderal flora of Žabljak corresponds with the dominant presence of these life forms in the whole

flora of the Balkans (Turill 1929). However, the presence of therophytes was low compared with the ruderal flora of other urban areas. This is understandable knowing that Žabljak is situated at high altitude under the influence of a cold, harsh mountain climate. It may also be the consequence of less degradation, i.e. lower anthropo-zoogenic pressure compared with typical urban areas.

Phytogeographical analysis. Phytogeographical analysis of the ruderal flora of Žabljak showed the presence of nearly 200 different floristic elements, included into 26 area groups, i.e. seven basic area types (Table 2). The most abundant were the Holarctic area type of species (179 sp., 64.2% of total), within which the Euroasian group of floristic elements dominated (81 sp., 46% of total).

A total of 38 taxa belonged to the Mediterranean-Continental area type, of which the majority (19 sp.) belonged to the Mediterraneo-Pontic-South Siberian areal group.

The area type of cosmopolitan species was represented by 30 taxa (10.8%). At the same time, a detailed analysis of the structure of native ranges of cosmopolitan species indicated the domination of Palearctic representatives (14 sp.), with high participation of cosmopolitan species of Mediterranean origin (eight sp.).

Central European-Mediterranean area type was represented by 12 taxa and Central European by 10 representatives.

The presence of adventive species in the Žabljak area was low (only seven sp.). The majority of these taxa (four sp.) originated from the Pontic - Submediterranean area (*Armoracia rusticana*, *Cannabis sativa*, *Erysimum cheiri* and *Medicago sativa*), two taxa were of Neoarctic origin (*Erigeron annuus* and *Rudbeckia laciniata*), and one of Neotropical-Neoarctic origin (*Matricaria suaveolens*).

The Pontic-South Siberian area type was least represented with only three representatives (*Festuca rupicola, Nepeta nuda* and *Veronica austriaca*).

Phytogeographical analysis showed the dominance of taxa of Holarctic area type, which was generally dominant in this region, while the proximity of the Mediterranean influenced the second most dominant type, Mediterranean-Continental, by the number of taxa in the areal-spectrum of the ruderal flora. The low presence of the "adventive area type" (seven taxa), as a conditional chorological category, may be explained by the position of Žabljak as the highest urban area in the Balkans.

Vegetation. Within the ruderal habitats in urban and suburban areas of Žabljak, six different plant communities have been recorded (Appendix 1). They group into 5 alliances, 5 orders and 5 vegetation classes:

Classis: *GALIO – URTICETEA* Pass. ex Kopecky 1969
Ordo: *Glechometalia hederaceae* Tx. in Tx. et Brun-Hool 1975 nom.conserv.prop.
Alliance: *Aegopodion podagrariae* Tx. 1967 nom.conserv. propos.
ass: ***Chaerophylletum aurei*** Oberdorfer 1957
Classis: *ARTEMISIETEA VULGARIS* Lohm.,Prsg. et R.Tx. 1950
Ordo: *Onopordetalia acanthii* Br.- Bl. et Tx. 1943 em.Görs 1966
Alliance: *Onopordion acanthii* Br.- Bl. 1926
ass: ***Carduuetum acanthoides*** Felfoldy 1942
Ordo *Artemisietalia vulgaris* Lohm. apud R. Tx.1947
Alliance: *Arction lappae* Tx.(1937) 1942 em.Gutte 1972
ass: ***Arctio-Artemisietum vulgaris*** (R.Tx.1942) Oberd. et al.1967
ass: ***Tanaceto-Urticetum dioicae* – ass. nov. prov.**
Classis: *AGROPYRETEA REPENTIS* Oberd., Th.Muller et Görs 1967
Ordo: *Agropyretalia repentis* Oberd.,Th.Muller et Görs 1967
Alliance: *Convolvulo-Agropyrion repentis* Görs 1966
ass: ***Tussilaginetum farfarae*** Oberd.1949
Classis: *PLANTAGINETEA MAJORIS* Tx.et Prsg. 1950
Ordo: *Plantaginetalia majoris* Tx.et Prsg. 1950
Alliance: *Polygonion avicularis* Br.- Bl.1931
ass: ***Matricario - Polygonetum avicularis*** Müller ex Oberdorfer 1971

The association *Chaerophylletum aurei* was recorded at seven locations within the Žabljak area. It develops on filled, relatively humid, nitrophilous and sheltered surfaces near roads or at boundaries, where direct mechanical anthropogenic activities are little expressed. In addition to the edificator species *Chaerophyllum aureum,* other species characterized by high levels of abundance and cover were: *Achillea millefolium*, *Crepis biennis*, *Trifolium pratense*, *Elymus repens*, *Dactylis glomerata*, *Urtica dioica* and *Poa trivialis*. Fifty-one members were recorded as being present in the stands of this community.

The association *Carduuetum acanthoides* was represented by four typically-developed stands. It develops on neglected, dry, sunny and warm surfaces near the secondary roads or trails created by construction waste and garbage, mostly in peripheral areas of the town. The edificator species *Carduus acanthoides* was characterized by the highest level of abundance and cover, and the main accompanying species were: *Achillea millefolium*, *Plantago major* and *Plantago lanceolata.* A total of 58 taxa were recorded within stands of this community.

The association *Arctio-Artemisietum vulgaris* develops in the form of high and robust closed-canopy stands on neglected surfaces along the streets with limited circulation, on empty patches of land which are not

tilled, in neglected economic yards etc. In Žabljak this community was represented by two typical stands. In addition to the edificator species (*Arctium lappa* and *Artemisia vulgaris)*, other species characterized by high levels of abundance and cover were: *Achillea millefolium*, *Crepis biennis*, *Trifolium pratense*, *Carduus acanthoides*, *Chaerophyllum aureum*, *Plantago major*, *Taraxacum officinale*, *Trifolium repens*, *Urtica dioica*, *Capsella bursa-pastoris*, *Silene latifolia* subsp. *alba*, *Poa trivialis*, *Conium maculatum*, *Galeopsis speciosa* and *Thlaspi arvense*. Stands of this community were represented by 38 taxa.

The association *Tanaceto-Urticetum dioicae* – ass. nov. prov. develops similarly to the previous one and as an ecologically-close community of the *Arction lappae* alliance, mostly in the peripheral urban, suburban and village entities. Typical habitats of this community are moderately nitrophilous, sunny or partially shadowed surfaces which are slightly moist, or habitats on deep humus land of neglected spaces between houses and fences. In Žabljak only one typically-developed stand of this community was recorded. In addition to the edificator species *Tanacetum vulgare* and *Urtica dioica*, the following species were characterized by high levels of abundance and cover: *Mentha longifolia* and *Arctium lappa.* In this community, 23 taxa were recorded.

The association *Tussilaginetum farfarae* was represented by four typical stands in the Žabljak area. This community develops mostly on the intensively sunny and extremely dry, freshly filled deposits of construction waste, along road crevices, in pastures near roads, sidewalks and fences. Direct anthropo-zoogenic influences are absent, while indirect influences are present in the form of fertilization by organic waste which improves the mineral regime of the soil. Besides the domination of the edificator species *Tussilago farfara,* other species characterized by high levels of abundance and cover were *Trifolium pratense* and *Trifolium repens.* Within stands of this community 58 taxa were recorded.

The association *Matricario - Polygonetum avicularis* develops mostly on dry, sunny, relatively warm, intensively trampled and moderately nitrophilous surfaces near sidewalks, streets, paths, yards, bus stops, fences and similar-exposed places. It was represented by four typical stands. The edificator species *Matricaria suaveolens* and *Polygonum aviculare,* as well as *Plantago major*, *Poa annua* and *Taraxacum officinale* clearly indicated the presence of intense anthropogenic trampling as a determinant anthropogenic influence of the community's development. The community was floristically the poorest, represented by only 18 recorded taxa.

The ruderal flora and vegetation in urban and suburban areas of Žabljak (Montenegro), as the highest town in the Balkan Peninsula, were investigated to determine the richness, taxonomic structure, biological and phytogeographical spectrum, and to determine the vegetation units present at this specific type of habitat.

Ruderal flora of the Žabljak area was represented by 279 taxa of vascular plants, categorized into 158 genera and 37 families. The participation of the most frequent families and genera in the ruderal flora of Žabljak corresponds with their presence in the whole flora of the Balkan Peninsula, where particularly prominent families are *Asteraceae* and *Poaceae*, and the genera *Potentilla*, *Ranunculus* and *Veronica*.

The specificity of the ruderal flora of Žabljak was the absence of typical ruderal genera (e.g. *Amaranthus*), and the presence of only two species of *Chenopodium*. On the other hand, the sporadic presence of some typical mountain species (*Acinos alpinus, Linum capitatum* and *Ranunculus montanus*), and some endemic and subendemic species (*Pimpinella serbica, Silene sendtneri* and *Hypericum barbatum*), indicated the refugial character of the entire area of NP "Durmitor", as well as the eurivalence of these species in terms of habitat selection.

Ecological analysis has shown that the flora of the investigated region had a hemicryptophytic character with less participation than usual of annuals and therophytes. Phytogeographical analysis showed that the majority of the representatives belonged to the Holarctic area type, and foremost to the Euroasian area group. The low presence of species of the "adventive area type" is explaned by the specific location of Žabljak as the highest urban area in the Balkans.

In the urban and suburban areas of Žabljak, six ruderal communities were recorded: *Chaerophylletum aurei*, *Carduuetum acanthoides*, *Arctio-Artemisietum vulgaris*, *Tanaceto-Urticetum dioicae* – ass. nov. prov., *Tussilaginetum farfarae* and *Matricario - Polygonetum avicularis*.

This research affirms the need for future detailed and comparative geobotanical studies of other mountain urban entities in Montenegro and the Balkan Peninsula.

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REZIME

Ruderalna flora i vegetacija Žabljaka (Crna Gora) pregled za period 1990 – 1998

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U radu su predstavljeni rezultati florističkih i vegetacijskih istraživanja ruderalnih staništa urbane i suburbane zone grada Žabljaka (Crna Gora) tokom poslednje dekade 20. veka. Konstatovano je prisustvo 279 taksona vaskularnih biljaka (ranga vrste ili podvrste), kao i 6 biljnih zajednica ruderalnog tipa. Detaljna taksonomsko-sistematska, ekološka i fitogeografska analiza ukazuje na neke specifičnosti ruderalnih staništa ovog planinskog grada (1450 m.n.v.) koji predstavlja administrativno sedište poznatog Nacionalnog parka ''Durmitor''. Rezultati ovih istraživanja podržavaju tezu da čak ni planinski regioni, za koje se smatra da su pod malim rizikom od ruderalizacije i alohtonizacije, nisu izuzeti od ovih procesa. U tom smislu, u radu se afirmiše potreba budućih kompleksnih i komparativnih geobotaničkih istraživanja i drugih planinskih urbanih celina na prostoru Crne Gore i Balkanskog poluostrva.

Ključne reči: ruderalna flora i vegetacija, Žabljak, Crna Gora

Appendix 1. Survey of the ruderal flora and vegetation of Žabljak (1 - *Arctio-Artemisietum vulgaris*; 2 - *Carduuetum acanthoides*; 3 - *Chaerophylletum aurei*; 4 - *Matricario-Polygonetum avicularis*; 5 - *Tanaceto-Urticetum dioicae* – ass. nov. prov.; 6 - *Tussilaginetum farfarae*).

Area type	Life form	Taxon	1	2	3	4	5	6
HOL	H scap	*Achillea distans* Waldst. & Kit. ex Willd. subsp. *tanacetifolia* Janchen						
HOL	H scap	*Achillea millefolium* L.	+-1	+-1	+-1	+-1	+	+-1
MED-CONT	H scap	*Acinos alpinus* (L.) Moench						
CE	T scap	*Acinos arvensis* (Lam.) Dandy						
HOL	G rhiz scap	*Aegopodium podagraria* L.						
HOL	H scap	*Agrimonia eupatoria* L.						
COSM	H rept	*Agrostis stolonifera* L.		+				+
CE-MED	H rept	*Ajuga reptans* L.						
HOL	H	*Alchemilla monticola* Opiz			+			
MED-CONT	G bulb	*Allium carinatum* L.						
MED-CONT	H	*Alyssum montanum* L.						
HOL	H scap bienn/ H scap	*Anchusa officinalis* L.						
MED-CONT	T scap	*Anthemis arvensis* L.						
HOL	H caesp	*Anthoxanthum odoratum* L.						1
MED-CONT	T scap	*Anthriscus cerefolium* (L.) Hoffm.						
HOL	H scap	*Anthriscus nemorosa* (Bieb.) Sprengel			+			
HOL	H scap	*Anthyllis vulneraria* L.		+				+
HOL	H semiros bienn	*Arabis hirsuta* (L.) Scop.						
HOL	H scap bienn	*Arctium lappa* L.	3-3	+	+-1		1	+
HOL	T scap	*Arenaria serpyllifolia* L.		+				+
ADV	G rad scap	*Armoracia rusticana* P. Gaertn., B. Mey. & Scherb.	+					
HOL	Ch suff caesp	*Artemisia absinthium* L.						
HOL	H scap	*Artemisia vulgaris* L.	1-2		+-1			
MED-CONT	H scap/Ch suffr	*Asperula aristata* subsp. *scabra* (J. & C. Presl) Nyman						
HOL	Ch suff caesp	*Asperula cynanchica* L.		+				
HOL	T scap	*Atriplex hastata* L.						
HOL	H scap	*Balsamita major* Desf.						
CE-MED	H ros	*Bellis perennis* L.						
HOL	G rhiz	*Blysmus compressus* (L.) Panzer ex Link						

Area type	Life form	Taxon	1	2	3	4	5	6
CE	H caesp	*Briza media* L.						
HOL	T scap	*Bromus commutatus* Schrader						
CE	H caesp	*Bromus erectus* Hudson						1
COSM	T scap	*Bromus hordeaceus* L.	+			+		1
HOL	H scap	*Bupleurum falcatum* L.						
MED-CONT	H scap bienn	*Calendula officinalis* L.						
HOL	H scap	*Campanula bononiensis* L.						
HOL	H scap	*Campanula glomerata* L.						
HOL	H scap bienn	*Campanula patula* L.						
HOL	H scap	*Campanula persicifolia* L.						+
MED-CONT	H scap	*Campanula trichocalycina* Ten.						+
ADV	T scap	*Cannabis sativa* L.						
COSM	T ros/H ros bienn	*Capsella bursa-pastoris* (L.) Medicus	+		+	1		
HOL	H scap bienn	*Carduus acanthoides* L.	1-1	3-5	+-1	+		+
MED-CONT	H ros	*Carlina acanthifolia* All.						
HOL	H scap	*Carum carvi* L.	+		+-1			
HOL	H scap	*Centaurea jacea* L.						
HOL	H scap	*Centaurea scabiosa* L.		1				+
HOL	H scap	*Centaurea stenolepis* A. Kerner						
CE-MED	T scap semiros	*Cerastium brachypetalum* Pers.		+				+
HOL	T scap	*Cerastium fontanum* Baumg.						
COSM	H scap	*Cerastium fontanum* Baumg. subsp. *vulgare* (Hartman) Greuter & Burdet			+			
COSM	T scap semiros	*Cerastium glomeratum* Thuill.						
HOL	Ch herb caesp	*Cerastium grandiflorum* Waldst. & Kit.						
CE-MED	H scap	*Chaerophyllum aureum* L.	2-2		3-4			
HOL	T scap	*Chenopodium album* L.	+			1		
HOL	H scap	*Chenopodium bonus-henricus* L.	+		+-1	+		
HOL	T scap	*Chenopodium hybridum* L.						
HOL	H scap	*Chondrilla juncea* L.						
COSM	H scap	*Cichorium intybus* L.	+					
MED-CONT	H ros	*Cirsium acaule* Scop.			+			
HOL	G rad scap	*Cirsium arvense* (L.) Scop.		1-2	+-2			1-3

Area type	Life form	Taxon	1	2	3	4	5	6
MED-CONT	H scap bienn	*Cirsium candelabrum* Griseb.						1
HOL	H scap	*Cirsium eriophorum* (L.) Scop.						
HOL	H scap bienn	*Cirsium vulgare* (Savi) Ten.		+-2	+		+	+-1
MED-CONT	H scap	*Clinopodium vulgare* L.						+
HOL	H scap bienn	*Conium maculatum* L.	+	1				
COSM	SG herb rhiz	*Convolvulus arvensis* L.		2	1			
HOL	H scap	*Coronilla varia* L.						
HOL	H scap bienn	*Crepis biennis* L.	+-1	+-1	+-1		+	+
MED-CONT	H scap	*Cruciata glabra* (L.) Ehrend.						
HOL	H scap	*Cruciata laevipes* Opiz						
HOL	H scap bienn	*Cynoglossum officinale* L.						
HOL	H caesp	*Cynosurus cristatus* L.		+				
HOL	H caesp	*Dactylis glomerata* L.	1	1	+-2		+	+-1
HOL	H scap/T scap	*Daucus carota* L.					1	
HOL	H scap	*Dianthus carthusianorum* L.						
MED-CONT	H scap semiros	*Dianthus tristis* Velen.						
HOL	H scap bienn/H scap	*Echium vulgare* L.		1				+
COSM	G rhiz caesp	*Elymus repens* (L.) Gould	+-1	+	+-3			+
HOL	H scap	*Epilobium angustifolium* L.						
HOL	H scap	*Epilobium hirsutum* L.						
HOL	H scap	*Epilobium montanum* L.						
ADV	T scap/a H scap bienn	*Erigeron annuus* (L.) Pers.						
ADV	Ch suffr	*Erysimum cheiri* (L.) Crantz						
HOL	T scap	*Euphorbia amygdaloides* L.						+
HOL	H scap	*Euphorbia cyparissias* L.						
MED-CONT	T scap	*Euphrasia pectinata* Ten.						
HOL	T scap	*Euphrasia rostkoviana* Hayne						
MED-CONT	H caesp	*Festuca panciciana* (Hackel) K. Richter						
HOL	H caesp	*Festuca pratensis* Hudson	1		1-2			
HOL	H caesp	*Festuca rubra* L.						
PONT-SSIB	H caesp	*Festuca rupicola* Heuffel						
HOL	H caesp	*Festulolium loliaceum* (Huds.) C.E.Hubb.		+-1				

Area type	Life form	Taxon	1	2	3	4	5	6
HOL	H scap	*Filipendula ulmaria* (L.) Maxim.						
HOL	H scap	*Filipendula vulgaris* Moench						
HOL	H rept	*Fragaria vesca* L.					1	1
HOL	T scap	*Galeopsis ladanum* L.						
HOL	T scap	*Galeopsis speciosa* Miller	+		+			
CE	T scap	*Galeopsis tetrahit* L.	+					
HOL	H scap	*Galium album* Miller						+
HOL	H scap	*Galium palustre* L.						
MED-CONT	H scap	*Galium rubioides* L.						
HOL	H scap	*Galium verum* L.		+-1	+-1			
HOL	G rad	*Gentiana cruciata* L.			+			
HOL	H ros	*Gentiana utriculosa* L.						
HOL	H bienne	*Gentianella crispata* (Vis.) J. Holub						
CE-MED	T scap/H scap bienn	*Geranium molle* L.			+			
MED-CONT	T scap semiros	*Geranium robertianum* L.					+	
HOL	H scap/G rhiz	*Geum molle* Vis. & Pancic						
HOL	H scap	*Geum urbanum* L.					1	
HOL	Hyd G rhiz	*Glyceria maxima* (Hartman) Holmberg						
HOL	Ch suffr caesp	*Helianthemum nummularium* (L.) Miller						+
HOL	H scap	*Heracleum sphondylium* L.	1		+-2			
HOL	T scap/H scap	*Herniaria glabra* L.		+				
HOL	H rept	*Hieracium bauhini* Schult.		+				
CE	H ros	*Hieracium hoppeanum* Schultes						
CE	H ros/scap	*Hieracium murorum* L.						
HOL	H ros-scap	*Hieracium piloselloides* Vill.						+
MED-CONT	H caesp	*Hordeum murinum* L.						
HOL	T scap/H scap bienn	*Hyoscyamus niger* L.						
MED-CONT	H scap	*Hypericum barbatum* Jacq.						
HOL	H scap	*Hypericum maculatum* Crantz						
HOL	H scap	*Hypericum perforatum* L.						+
HOL	H ros	*Hypochoeris radicata* L.						
HOL	P caesp/semp	*Juniperus communis* L.						+

Area type	Life form	Taxon	1	2	3	4	5	6
HOL	H scap/a H scap bienn	*Knautia arvensis* (L.) Coulter						
HOL	H scap	*Knautia dipsacifolia* Kreutzer						
HOL	H scap	*Knautia drymeia* Heuffel						
HOL	H caesp	*Koeleria pyramidata* (Lam.) Beauv.						
HOL	T scap	*Lapsana communis* L.					+	1
HOL	H scap	*Lathyrus pratensis* L.						+-1
HOL	G tub rept	*Lathyrus tuberosus* L.						
HOL	H ros	*Leontodon autumnalis* L.						
HOL	H ros	*Leontodon crispus* Vill.		+				+
HOL	H ros	*Leontodon hispidus* L.						
HOL	T scap/H scap bienn	*Lepidium campestre* (L.) R. Br.						
CE	H	*Leucanthemum heterophyllum* (Willd.) DC.						
HOL	H scap	*Leucanthemum vulgare* Lam.		+				
MED-CONT	H scap	*Linaria genistifolia* (L.) Miller						
HOL	H scap	*Linaria vulgaris* Miller			+			+
HOL	H ros/scap	*Linum capitatum* Kit. ex Schultes						
HOL	T scap	*Linum catharticum* L.						
CE-MED	H caesp	*Lolium perenne* L.			+	+		
COSM	H caesp	*Lolium temulentum* L.						
HOL	H scap	*Lotus corniculatus* L.		+		+		+-1
COSM	T scap/H scap bienn	*Matricaria perforata* Mérat	+					
ADV	T scap	*Matricaria suaveolens* L.	1			2 - 4		
HOL	T scap/a H scap	*Medicago lupulina* L.		1	+			+-1
ADV	H scap	*Medicago sativa* L.						
HOL	H scap	*Medicago sativa* L. subsp. *falcata* (L.) Arcangeli						
HOL	T scap/ep Semipar	*Melampyrum scardicum* Wettst.						
HOL	T scap	*Melampyrum sylvaticum* L.						
COSM	T scap/H scap bienn	*Melilotus albus* Medik.						
HOL	H scap	*Mentha longifolia* (L.) Hudson						
HOL	H scap	*Mentha pulegium* L.		+				
MED-CONT	H scap	*Mentha spicata* L.						
HOL	H caesp	*Minuartia verna* subsp. *collina* (Neilr.) Domin						

Area type	Life form	Taxon	1	2	3	4	5	6
HOL	H caesp	*Molinia caerulea* (L.) Moench						
HOL	H scap	*Mycelis muralis* (L.) Dumort.					+	
MED-CONT	H scap bienn	*Myosotis arvensis* (L.) Hill						
PONT-SSIB	H scap	*Nepeta nuda* L.						
HOL	H rept	*Omalotheca sylvatica* (L.) Schultz Bip. & F.W. Schultz						
CE	Ch suff caesp	*Ononis spinosa* L.						
HOL	H scap bienn	*Onopordum acanthium* L.						
HOL	H scap	*Origanum vulgare* L.						
HOL	H bienne	*Pastinaca sativa* L.						
HOL	a Mes T scap	*Petrorhagia prolifera* (L.) P. W. Ball & Heywood						1
MED-CONT	H caesp/Ch herb caesp	*Petrorhagia saxifraga* (L.) Link						
HOL	H scap	*Peucedanum austriacum* (Jacq.)Koch.						
HOL	H caesp	*Phleum alpinum* L.						
COSM	H caesp	*Phleum pratense* L.		+-1	+			1
HOL	P scap	*Picea abies* (L.) Karsten subsp. *abies*						
HOL	H scap bienn/H scap	*Picris hieracioides* L.			+			
CE	H scap	*Pimpinella major* (L.) Hudson						
HOL	H scap	*Pimpinella saxifraga* L.						
MED-CONT	H scap semiros	*Pimpinella serbica* (Vis.) Bentham & Hooker fil. ex Drude			+			
HOL	H ros	*Plantago lanceolata* L.		+-1	2	1		+
COSM	H ros	*Plantago major* L.	+	+-2	+	1-2		+
HOL	H ros	*Plantago media* L.				1		
HOL	H caesp	*Poa alpina* L.						
COSM	T caesp	*Poa annua* L.		1		+-1		
COSM	H caesp	*Poa pratensis* L.					+	+
COSM	H caesp	*Poa trivialis* L.	+-1		+-1			
HOL	H scap	*Polygala major* Jacq.						
COSM	T rept	*Polygonum aviculare* L.	+	+	+	1-3		
HOL	T scap	*Polygonum lapathifolium* L.	+			+		
HOL	H scap	*Potentilla argentea* L.						
HOL	H semiros-scap	*Potentilla crantzii* (Crantz) G. Beck ex Fritsch						
HOL	H scap	*Potentilla erecta* (L.) Raeuschel						

Area type	Life form	Taxon	1	2	3	4	5	6
HOL	H	*Potentilla heptaphylla* L.		+				
MED-CONT	H scap	*Potentilla pedata* Nestler						
HOL	H scap	*Potentilla recta* L.						
COSM	H rept	*Potentilla reptans* L.		+			1	
MED-CONT	H scap	*Prunella laciniata* (L.) L.		+-1				
HOL	H scap-semiros	*Prunella vulgaris* L.		+	+		+	+
HOL	P scap	*Pyrus pyraster* Burgsd.						
MED-CONT	H scap/G rhiz	*Ranunculus acris* L.	+		+-1			
HOL	T scap-semiros	*Ranunculus arvensis* L.						
CE-MED	T scap-semiros	*Ranunculus bulbosus* L.		+-1				
HOL	H rept	*Ranunculus montanus* Willd.						
HOL	H scap-semiros	*Ranunculus polyanthemos* L.						
HOL	H rept	*Ranunculus repens* L.						
HOL	T semiros	*Ranunculus sardous* Crantz						
CE-MED	T scap	*Raphanus raphanistrum* L.						
CE	T scap	*Rhinanthus alectorolophus* (Scop.) Pollich		+				+
HOL	T scap	*Rhinanthus minor* L.						
MED-CONT	T scap/H scap bienn	*Rorippa prolifera* (Heuffel) Neilr.						
MED-CONT	H scap	*Rorippa sylvestris* (L.) Besser						
HOL	NP caesp	*Rosa canina* L.						
HOL	Mi P caesp	*Rosa rubiginosa* L.						
HOL	NP rept	*Rubus caesius* L.						
HOL	NP caesp	*Rubus idaeus* L.					1	
ADV	G	*Rudbeckia laciniata* L.						
HOL	H scap	*Rumex acetosella* L.						
HOL	H scap	*Rumex conglomeratus* Murray			+-1			
COSM	H scap	*Rumex crispus* L.			+		+	
HOL	H scap	*Rumex obtusifolius* L.	1	1	+-1			+
HOL	P	*Salix appendiculata* Vill.			+			
MED-CONT	H scap	*Salvia pratensis* L.						
HOL	H scap	*Salvia verticillata* L.		+				
HOL	G rad scap/H scap	*Sambucus ebulus* L.						

Area type	Life form	Taxon	1	2	3	4	5	6
HOL	H scap	*Sanguisorba minor* Scop.		1				
HOL	H ros	*Sanguisorba officinalis* L.						+
CE-MED	Ch herb caesp	*Satureja montana* L.						+
HOL	H scap	*Scabiosa columbaria* L.						
MED-CONT	T scap/H scap bienn	*Scleranthus annuus* L.						
CE-MED	Ch herb succ	*Sedum acre* L.						
CE-MED	Ch succ	*Sedum grisebachii* subsp. *flexuosum* (Wettst.) Greuter & Burdet						
MED-CONT	Ch herb succ	*Sedum hispanicum* L.						
HOL	H scap	*Senecio rupestris* Waldst. & Kit.	+					
COSM	T scap	*Senecio vulgaris* L.						
COSM	T caesp	*Setaria pumila* (Poiret) Schultes						+
HOL	H scap bienn/H scap	*Silene latifolia* subsp. *alba* (Miller) Greuter & Burdet	+		+			+
HOL	H ros	*Silene nutans* L.						
MED-CONT	Ch subsufrut caesp	*Silene sendtneri* Boiss.						
HOL	H scap/G rad	*Silene vulgaris* (Moench) Garcke		+	+			+
COSM	T scap	*Sinapis arvensis* L.		+	+			
MED-CONT	T scap	*Sisymbrium officinale* (L.) Scop.						
COSM	H scap	*Sonchus arvensis* L.						
COSM	T scap/H scap bienn	*Sonchus asper* (L.) Hill					+	
COSM	T scap/H scap bienn	*Sonchus oleraceus* L.						
HOL	H scap	*Stachys recta* L.						
MED-CONT	H scap	*Stachys tymphaea* Hausskn.						
HOL	H scap	*Stellaria graminea* L.						
COSM	T rept	*Stellaria media* (L.) Vill.	+					
CE-MED	H scap rept	*Stellaria nemorum* L.						
HOL	H scap	*Tanacetum macrophyllum* (Waldst. & Kit.) Schultz Bip.						
HOL	H scap	*Tanacetum vulgare* L.					3	
COSM	H ros	*Taraxacum officinale* Weber	+	+	+	+-1		+
MED-CONT	Ch suff caesp	*Teucrium chamaedrys* L.						
HOL	T scap	*Thlaspi arvense* L.	+-1					
HOL	Ch suffr caesp	*Thymus pulegioides* L.						
HOL	H scap bienn	*Tragopogon dubius* Scop.		+				

Area type	Life form	Taxon	1	2	3	4	5	6
MED-CONT	H scap	*Tragopogon pratensis* L.						
HOL	H scap	*Trifolium alpestre* L.						
HOL	T scap	*Trifolium campestre* Schreber		+				+
HOL	H scap	*Trifolium montanum* L.		+				
HOL	T scap	*Trifolium patens* Schreber						
HOL	H scap	*Trifolium pratense* L.	+-1	1-2	+-2		1	+-2
COSM	H rept	*Trifolium repens* L.	+	+-1	+	+	+	+-1
HOL	H scap	*Trinia glauca* (L.) Dumort.						
HOL	H caesp	*Trisetum flavescens* (L.) Beauv.						
HOL	G rhiz	*Tussilago farfara* L.	+	+	+-1	+-1	+	4-5
HOL	H scap	*Urtica dioica* L.	+-1	2	+-2		2	1-2
HOL	H semiros	*Verbascum nigrum* L.						
HOL	H ros bienn	*Verbascum phlomoides* L.						
PONT-SSIB	H scap	*Veronica austriaca* L.						
HOL	H rept	*Veronica beccabunga* L.						
HOL	H scap	*Veronica chamaedrys* L.						
HOL	H rept	*Veronica officinalis* L.						
COSM	T scap	*Veronica persica* Poiret	+		+			
COSM	H rept	*Veronica serpyllifolia* L.						
HOL	T scap	*Veronica verna* L.			+			
HOL	H scap/SH herb	*Vicia cracca* L.		1	+-1			
HOL	H scap/SH herb	*Vicia sepium* L.			+			
HOL	T scap/H scap bienn	*Viola arvensis* Murray						+
HOL	T scap	*Viola tricolor* L.		+-1				
HOL	T/H caesp	*Viola tricolor* subsp. *macedonica* (Boiss. & Heldr.) A. Schmidt						
HOL	T scap/ H bienn	*Viola tricolor* subsp. *subalpina* Gaudin	+					