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The ecological and floristic characteristics of natural population of *Micromeria juliana* (L.) Benth. ex Rchb. in Bulgaria

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***Abstract*:**

Aneva, I., Zhelev, P., Nikolova, M., Evtimov, I.: ***The ecological and floristic characteristics of natural population of Micromeria juliana (L.) Benth. ex Rchb. in Bulgaria. Biologica Nyssana, 7 (2), December 2016: 91-99.***

Micromeria juliana is a rare species in Bulgaria. It is included in the Red Data Book of the country with conservation status "endangered" and is protected by the Biodiversity Act. The present report focuses to the study of natural populations and plant communities of *M. juliana* in the two regions of its occurrence in Bulgaria – Eastern Rhodopes and the Valley of Mesta River. In the first locality the species grows on steep stony slopes and on walls of a medieval fortress, and the second one – on a steep calcareous slope, and on abandoned agricultural land. We present results of a survey on the species composition of plant communities of *M. juliana* together with analyses of floristic elements and ecological forms. The floristic composition indicates that the participation ratio of elements with Mediterranean origin is high. The ecological factors that have the highest impact on the floristic composition are intensive light, air temperature and humidity. The area occupied by the species is limited due to its very specific requirements and low competition ability.

Key words: Medicinal plant, species composition, floristic elements

***Apstrakt*:**

Aneva, I., Zhelev, P., Nikolova, M., Evtimov, I.: ***Ekološke i florističke karakteristike prirodnih populacija vrste Micromeria juliana (L.) Benth. ex Rchb. u Bugarskoj. Biologica Nyssana, 7 (2), Decembar 2016: 91-99.***

Micromeria juliana je retka vrsta u Bugarskoj. Nalazi se u Crvenoj knjizi ove zemlje sa konzervacionim statusom "ugrožena" i zaštićena je Zakonom o biodiverzitetu. Ovde prezentovano istraživanje je bilo usmereno na proučavanje prirodnih populacija i biljnih zajednica vrste *M. juliana* unutar dva regiona u kojima se ova vrsta pojavljuje u Bugarskoj – Istočnim Rodopima i dolini reke Mesta. Na prvom lokalitetu vrsta raste na strmim kamenitim padinama, kao i na zidinama srednjevekovne tvrđave, dok na drugom – na strmim krečnjačkim padinama i napuštenim poljoprivrednim zemljištima. Mi smo prezentovali rezultate pregleda sastava vrsta biljnih zajednica *M. juliana*, zajedno sa analizom florističkih elemenata i ekoloških formi. Floristički sastav ukazuje da je udeo mediteranskih elemenata visok. Intenzivna svetlost, temperature vazduha

i vlažnost su ekološki faktori koji imaju najznačajniji uticaj na floristički sastav. Oblast koju zauzima vrsta je ograničena zbog veoma specifičnih prohteva i niske kompetitivne sposobnosti vrste.

Ključne reči: lekovite biljke, sastav vrsta, florni elementi

Introduction

Genus *Micromeria* Benth. (Lamiaceae) is represented in Bulgaria by four species (Ančev, 1989), two of them (*M. juliana* (L.) Benth. ex Rchb. and *M. cristata* (Hampe) Griseb.) belonging to section *Micromeria* and two (*M. dalmatica* Benth. and *M. frivaldszkyana* (Degen) Velen.) – to section *Pseudomelissa* Benth. The species of the latter section were transferred to genus *Clinopodium* based on the evidence of recent phylogenetic studies (Bräuchler et al., 2005, 2006; Ryding 2006). According to Bräuchler et al. (2008) there are still a lot of taxonomic problems to be solved, despite of the success achieved using modern cladistic analyses based on molecular data (Wagstaff et al., 1995; Bräuchler et al., 2005; see Bräuchler et al., 2008, for synopsis and review).

Many species of the genus possess substantial interest as medicinal and aromatic plants. There were some studies on the cytology, morphology and chemical composition of the essential oil of some *Micromeria* representatives in Balkans and at least part of them addressed also the question of antibacterial and antifungal activity of the species (Marinkovic et al., 2002; Slavkovska et al., 2005; Kostadinova et al., 2007; Martin et al., 2011; Karousou et al., 2012; Kremer et al., 2014, Marin et al., 2015).

Fig. 1. *Micromeria juliana*

Bulgarian species of the genus are considered important as medicinal and aromatic plants and also from conservation point of view. Two of them – *M. juliana* (**Fig. 1**) and *M. frivaldszkyana* – are listed in the different editions of the Red Data Book of Bulgaria with the category "endangered" (Ančev, 1984; Apostolova, 2015; Stoyanov, 2015). Even though not an endemic, *M. juliana* is a rare species and occurs only in two small localities in the Eastern Rhodopes (Ančev, 1984, 1989; Stoyanov, 2015). However, Tashev (2015) reported another occurrence in the valley of river Mesta. The information about biological peculiarities, habitat requirements and natural resources of *Micromeria* species is very important for designing of proper strategy for their conservation and sustainable use.

Therefore, the objective of the present study was to characterize the natural localities of *Micromeria juliana* as a part of a program for conservation and sustainable use of the species of genus *Micromeria* in Bulgaria.

Material and methods

The objects of the study included the two known localities of the species in Bulgaria. The first one is located in the Eastern Rhodopes, locality called "Kaleto", close to Gugutka village, Ivaylovgrad district (41°23'52.60", 25°57'17.96"), which will be referred to hereafter as Rhodopes. The second one is in the valley of river Mesta, locality called "Dimanska stena", close to the village Godeshevo (41°27'57.41", 24° 3'31.53") and will be referred to hereafter as Mesta.

The field observations took place in the period April-July 2016. Full floristic inventory was performed in the two natural localities of the species. Taxonomic treatment followed Assyov & Petrova (eds., 2012). Phytogeographic affinity of the species was determined according to Walter (1985), summarized by Assyov & Petrova (eds., 2012), and the life forms – according to Raunkiaer (1934).

Fig. 2. Locality 1 (Eastern Rhodopes) – the medieval fortress

Fig. 3. Locality 2 (Mesta)

Results and discussion

In the locality "Kaleto", Eastern Rhodopes, *M. juliana* was found mostly on the wall of the medieval fortress (**Fig. 2**), and also one small spot was found on the road ledge close to the fortress. The populations of *M. juliana* are represented by small number of individuals. The main reason can be traced in its ecological requirements to specific type of habitats – stony and rocky places or open soils free of turf grasses. Usually on Balkans *M. juliana* occurs in the plant communities known as Aegean phrygana (EUNIS 2016), and these habitats are characterized by open stony and sandy spots. However, even though the habitats in the studied locality resemble the phrygana, they are not identical. The potential vegetation on the place could be classified as *Quercus pubescens* forests (B o n d e v , 1991), and these forests, even rather dry, often form dense herbaceous cover, thus preventing the establishment of *M. juliana* individuals. Therefore, the most visible occurrence of the species was on the walls of the fortress. It occurred also on the rocky places and on the slopes free of turf grasses. Occurrence of the species on walls is not unprecedented, as reported by L a g i o u et al. (1998). *M. juliana* is heat demanding species and is therefore found predominantly on eastern and southern expositions. The area occupied by the species in Rhodopes is about 0.1 ha and the population size is about 40 individuals. Further studies are necessary to reveal whether there are more spots of this rare species in the rocky slopes of Byala reka River. In the second locality, in the valley of river Mesta, the species was found on a steep (30-40°) rocky slope in the place called "Dimanska stena", but also few isolated and smaller spots were found in the adjacent abandoned arable land (**Fig. 3**). All these spots were bulked together when analyzing the locality. The area occupied by the species in the Valley of Mesta River is about 0.4 ha. The population size is larger and consists of about 90 individuals, whose dimensions tend to be larger than those in Rhodopes.

M. juliana is not collected by people, and direct anthropogenic pressure cannot be considered as a threat, with the exception of some potential incidental fire, as suggested by S t o y a n o v (2015).

Total 124 species were recorded in the two localities – 47 species in the Eastern Rhodopes and 89 species in the Valley of Mesta River. It should be noted that these values represent a minimum species number, because some short-lived spring annuals and/or geophytes could have terminated their vegetation at the time of the field study. Also, some species with insufficiently developed diagnostic traits at that moment could have been overlooked or misidentified. The higher number of species recorded in the locality Mesta is due to its larger occupied area on the rocky slope and on the abandoned arable land. There were 4 species of ferns, one gymnosperm, and 119 angiosperm species – 107 dicots and 12 monocots (**Tab. 1**).

The species recorded belong to 39 families and 103 genera. The most numerous family is Asteraceae – 13 genera and 14 species, followed by Lamiaceae – 10 genera and 13 species, Poaceae – 9 genera and 11 species, and Rosaceae – 7 genera and 9 species. Eighteen families are represented by only one species.

The flora in these two localities had not been studied in detail previously. T a s h e v (2015) mentioned few species occurring in the community of Mesta locality together with *M. juliana*, like *Asyneuma limonifolium* (L.) Janch,, *Inula aschersoniana* Janka, *Teucrium polium* L., *Euphorbia myrsinites* L., and *Dichanthium ischaemum* (L.) Roberty, all of them recorded during our field survey.

Classification of species regarding their light dependence, or luminosity of the environment,

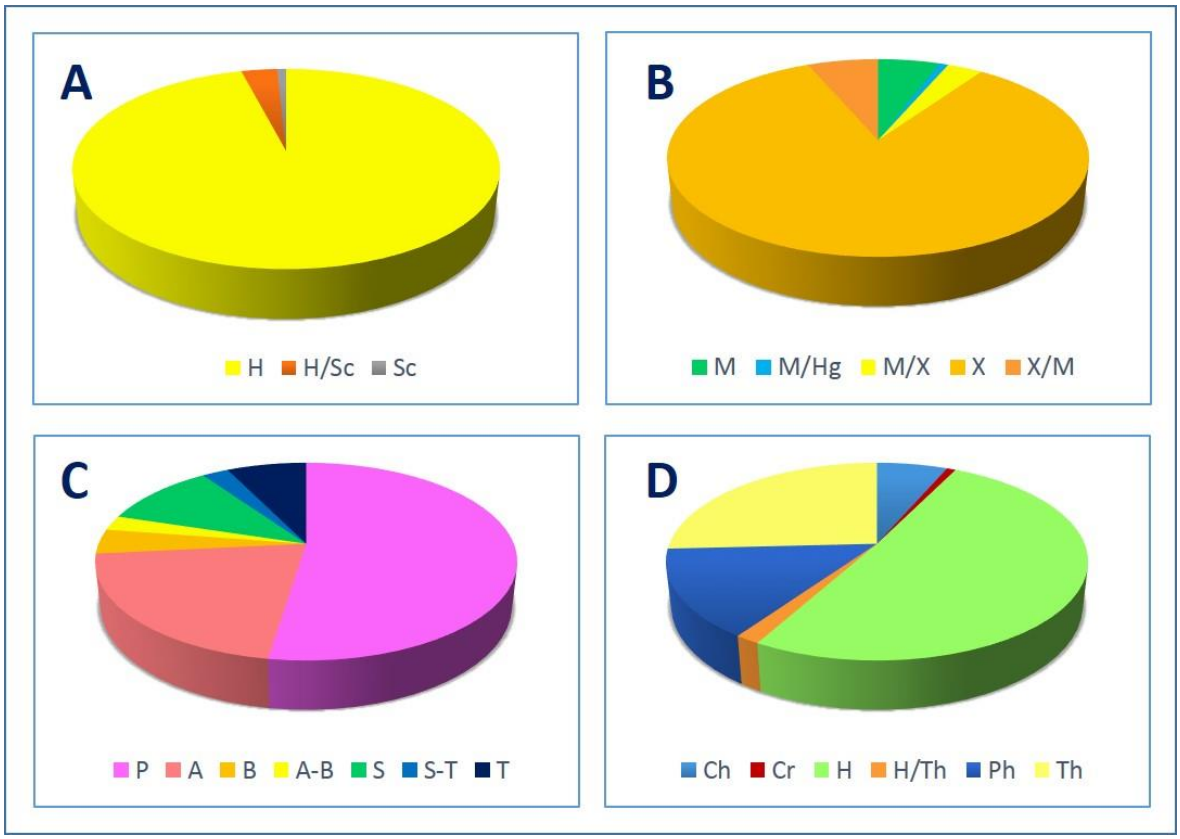

Fig. 4. (See Table 1 for Legend.)
A. Species distribution according to their light dependence
B. Species distribution according to their dependence on humidity
C. Species distribution according to their biological type
D. Species distribution according to their life form

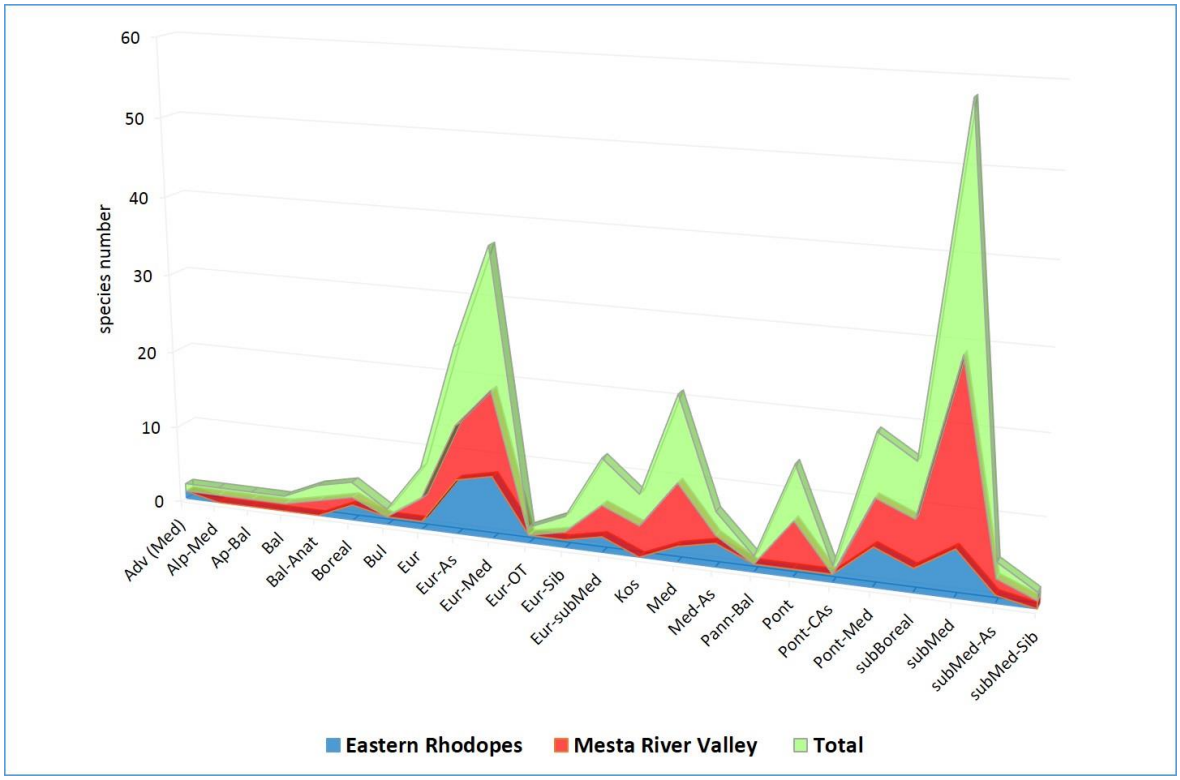

Fig. 5. Distribution of the floristic elements. See Table 1 for Legend.

revealed that 119 species (96%) are heliophytes, only one can be classified as sciophyte and four species are of transitional character (**Fig. 4A**).

Xerophytes represent the most numerous type regarding dependence on water availability (104 species, 84%). The other species are classified as mesophytes (7 species), xero-mesophytes (8 species) and 5 species belong to other categories (**Fig. 4B**).

Perennial species predominate – 65 (52%) followed by annuals – 26 (21%), plus 3 species (2%), which are of transitional type annual-biennial. Thirteen species (10%) are shrubs and 9 species (7%) are trees (**Fig. 4C**). This fact reflects the potential vegetation type of the locality, which can be defined as *Quercus pubescens* forests, like in Eastern Rhodopes. Currently, trees and shrubs are represented by a few individuals and even though they do not shape the physiognomy of the plant community, they show the natural trend towards restoring the indigenous vegetation.

Classification by life forms could be predicted by the biological type. Hemi-cryptophytes are the predominating type – 63 species (52%), which is expected because most perennial plants fall into this category (**Fig. 4D**). The second most numerous group is the one of therophytes – 32 (26%) and the third one – of phanerophytes – 18 (15%).

Distribution of floristic elements reflects the Mediterranean character of the flora. The predominant elements are: Sub-Mediterranean – 29 species (23%), Euro-Mediterranean – 18 (14.5%), Typical Mediterranean – 11 (9%), and Euro-Asian – 10 (8%). However, if all elements having Mediterranean component are considered (for example, Eur-Med, Eur-subMed, Med, Med-As, Pont-Med etc.) they would amount to 80 species (65%). The trends are the same in the two studied localities, in spite of some minor differences (**Fig. 5**).

The results of the study underline the sub-Mediterranean character of the flora and vegetation of the two localities (Pavlova et al., 2004; Petrova, 2004; Goranova et al., 2013).

Conclusion

Species composition and characteristics of the two natural localities of *M. juliana* in Bulgaria revealed that the plant communities the species is part of are typical for the dray and hot habitats in the zone of strong Mediterranean influence. The locality in the Valley of Mesta River is larger both in terms of area occupied and population size. The status of the species can be evaluated as relatively stable. It is practically not affected by the human activities and only some incidental fire could pose a threat.

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Table 1. List of plant taxa recorded in the two localities, together with their characteristics (**ER**-Eastern Rhodopes, **MR**-Mesta River Valley)

Taxon	Light dependence	Humidity dependence	Biological type	Life form	Floristic element	ER	MR
POLYPODIOPHYTA							
POLYPODIOPSIDA							
Aspleniaceae							
Asplenium adianthum-nigrum L.	Sc	M/Hg	P	H	subBoreal	+	
Asplenium ruta-muraria L.	H	X	P	H	Boreal	+	+
Ceterach officinarum DC.	H	X	P	H	subMed	+	
MAGNOLIOPHYTA							
Hypolepidaceae							
Pteridium aquilinum (L.) Kuhn	H	M	P	H	Kos		+
PINOPHYTINA							
PINOPSIDA							
Cupressaceae	-	-	-	-	-	-	-
Juniperus deltoides R.P. Adams	H	X	S	Ph	Eur-Med	+	+
MAGNOLIOPHYTINA							
MAGNOLIOPSIDA							
Aceraceae							
Acer campestre L.	H	X/M	T	Ph	Eur-OT	+	
Acer monspessulanum L.	H	X/M	T	Ph	subMed	+	
Anacardiaceae	-	-	-	-	-	-	-
Pistacia terebinthus L.	H	X	T	Ph	Pont-Med	+	
Rhus coriaria L.	H	X	T	Ph	Med-As	+	
Apiaceae	-	-	-	-	-	-	-
Eryngium campestre L.	H	M/X	P	H	Pont-Med	+	
Scandix pecten-veneris	H	X	A	Th	Eur-As		+
Asteraceae	-	-	-	-	-	-	-
Carlina vulgaris L.	H	M/X	A	Th	Eur-Med	+	+
*Centaurea stoebe*L.	H	X	P	H	subMed		+
Centaurea salonitana Vis.	H	X	P	H	Pont-Med		+
Chondrilla juncea L.	H	X	A	Th	Eur-Sib	+	
*Cirsiumligulare*Boiss.	H	X	A-B	Th	Med		+
*Crepis biennis*L.	H	X	A	Th	subMed		+
*Crupina vulgaris*Cass.	H	X	A	Th	subMed	+	
*Inula aschersoniana*Janka	H	X	P	H	Bal-Anat		+
Jurinea consanguinea DC.	H	X	P	H	subMed-Sib		+
*Leontodon hispidus*L.	H	X	P	H	Eur-Med		
Logfia arvensis (L.) Holub	H	X	A	Th	Eur-Med		+
Picnomon acarna (L.) Cass.	H	X	P	H	Med		+
Scorzonera laciniata L.	H	X	P	H	Med		+
Tragopogon pratensis L.	H	X	A	Th	Eur-Med	+	
Betulaceae	-	-	-	-	-	-	-
*Carpinus betulus*L.	H	X/M	T	Ph	Eur-subMed	+	
Carpinus orientalis Miller	H	X/M	T	Ph	subMed		+
Boraginaceae	-	-	-	-	-	-	-
Buglossoides purpurocaerulea (L.) I. M. Johnst.	H	X	P	H	Eur-As		+
Myosotis arvensis (L.) Hill	H	X	A	Th	Eur-As	+	+
Onosma echioides L.	H	X	P	H	Med		+
Brassicaceae	-	-	-	-	-	-	-
Aethionema saxatile (L.) R. Br.	H	X	P	H	subMed		+
Alyssum alyssoides (L.) L.	H	X	P	H	Eur-Med	+	
Alyssum murale Waldst. & Kit.	H	X	P	H	Eur-subMed		+
Clypeola jonthlaspi L.	H	X	A	Th	Med		+
Erysimum diffusum Ehrh.	H	X/M	A-B	H/Th	Eur		+
Campanulaceae							
Asyneuma limonifolium (L.) Janchen	H	X	P	Cr	Ap-Bal		+
Caryophyllaceae	-	-	-	-	-	-	-
Cerastium bulgaricum Uechtr.	H	X	A	Th	Bul	+	
Herniaria incana Lam.	H	X	A	Th	Eur-Med		+
Minuartia caespitosa (Ehrh.) Degen	H	X	P	H	Eur-Med	+	
Minuartia hirsuta (M. Bieb.) Hand.-Mazz.	H	X	P	H	subMed		+
Scleranthus perennis Roch. ex Baumg.	H	X	P	H	Eur-Med		+
Silene conica L.	H	X	A	Th	subMed-As	+	+

Silene italica (L.) Pers.	H/Sc	M/X	P	H	Eur-Med		+
Stellaria graminea L.	H	X	P	H	Eur-As	+	
Cistaceae	-	-	-	-	-	-	-
Cistus incanus L.	H	X	S	Ch	Med	+	
Fumana procumbens (Dunal) Gren. &Godr.	H	X	S	Ch	Pont-Med	+	+
Helianthemum numularium (L.) Mill.	H	X	S	Ch	Alp-Med		+
Rhodax canus (L.) Fuss	H	X	S	Ch	Pont		+
Convolvulaceae							
Convolvulus cantabrica L.	H/Sc	X	P	H	Pont		+
Crassulaceae	-	-	-	-	-	-	-
Sedum anopetalum DC.	H	X	P	Ch	subMed		+
Sedum hispanicum L.	H	X	P	H	Eur-Med	+	
Dipsacaceae							
Scabiosa rotata M. Bieb.	H	X	P	H	Med		+
Euphorbiaceae							
Euphorbia cyparissias L.	H/Sc	M	P	H	Eur		+
Euphorbia myrsinites L.	H	X	P	H	subMed		+
Euphorbia plathyphyllos L.	H	X	A	Th	Eur-Med		+
Fabaceae	-	-	-	-	-	-	-
Astragalus onobrychis L.	H	X	P	H	Eur-As		+
Coronilla cretica L.	H	X	P	H	Med		
Coronilla scorpioides (L.) C. Koch	H	X	A	Th	subMed		
Dorycnium herbaceum Vill.	H	X	P	H	Eur-Med		+
Lathyrus nissolia L.	H	X	P	H	Eur-subMed		+
Lotus aegaeus (Griseb.) Boiss.	H	X	P	H	Med		+
Medicago lupulina L.	H	X	P	H	Eur-As	+	
Medicago minima (L.) Bartal.	H	X	A	Th	Eur-As	+	+
Onobrychis arenaria (Kit.) DC.	H	X	P	H	Pont		+
Ononis pusilla L.	H	X	A	Th	subMed		+
Vicia dalmatica A. Kern.	H	X	P	H	subMed		+
Fagaceae							
Quercus pubescens Willd.	H	X/M	T	Ph	Eur-subMed		+
Geraniaceae	-	-	-	-	-	-	-
Erodium cicutarium (L.) L'Hér.	H	X	A	Th	subBoreal		+
Geranium robertianum L.	H	X	A	Th	subBoreal	+	+
Geranium rotundifolium L.	H	X	A	Th	Eur-As	+	+
Hypericaceae							
Hypericum cerastoides (Spach) N.K.B. Roloson.	H	M	P	H	subMed		+
Hypericum olympicum L.	H	X/M	P	H	subMed		+
Lamiaceae	-	-	-	-	-	-	-
Acinos suaveolens (Sm.) Don	H	X	P	H	subMed	+	+
Ajuga chamaepitys (L.) Schreber	H	X	A-B	H/Th	Pont-Med		+
Calamintha nepeta (L.) Savi	H	X	P	H	Eur-Med	+	
Clinopodium vulgare L.	H	X	P	H	subBoreal		+
Micromeria dalmatica Bentham ssp. *bulgarica* (Velen.) Guinea	H	X	P	H	Bal		+
Micromeria juliana (L.) Benth. ex Rchb.	H	X	P	H	Med	+	
Satureja coerulea Janka	H	X	S	Ch	subMed	+	
Satureja cuneifolia Ten.	H	X	S	Ch	subMed		+
Sideritis montana L.	H	X	A	Th	subMed		+
Stachys germanica L.	H	X	P	H	Eur-subMed		+
Teucrium chamaedrys L.	H/ Sc	X/M	P	H	subMed		+
Teucrium polium L.	H	X	P	H	Pont-Med	+	+
Thymus atticus Čelak.	H	X	S	Ch	Bal-Anat		+
Linaceae							
Linum hologynum Rchb.	H	X	P	H	subMed		+
Moraceae	-	-	-	-	-	-	-
Ficus carica L.	H	X	T	Ph	Adv (Med)	+	
Oleaceae	-	-	-	-	-	-	-
Fraxinus ornus L.	H	X	T	Ph	subMed	+	
Jasminum fruticans L.	H	X	S	Ph	Pont-CAs	+	
Plantaginaceae							
Plantago lanceolata L.	H	M	P	H	Kos		+
Primulaceae							
Anagalis arvensis L.	H	X	A	Th	Kos		+

Ranunculaceae	-	-	-	-	-	-	-
Clematis vitalba L.	H	X	S	Ph	Eur	+	
Resedaceae							
Reseda lutea L.	H	X	P	H	subBoreal		+
Rhamnaceae	-	-	-	-	-	-	-
Paliurus spina-christi Mill.	H	X	S	Ph	Eur-As	+	
Rosaceae	-	-	-	-	-	-	-
Agrimonia eupatoria L.	H	M	P	H	Eur-Med		+
Crataegus monogyna Jacq.	H	X	S	Ph	subBoreal		+
Potentilla argentea L.	H	X	P	H	Pont		+
Potentilla sulphurea Lam.	H	X	P	H	subMed		+
Prunus spinosa L.	H	X	S	Ph	Pont		+
Rosa myriacantha DC.ex Lam. & DC.	H	X	S	Ph	subMed		+
Rubus discolor Weihe & Nees	H	X	S	Ph	subMed		+
Rubus sanguineus Friv.	H	X	S	Ph	Pont-Med	+	+
Sanguisorba minor Scop.	H	X	P	H	subBoreal	+	+
Rubiaceae	-	-	-	-	-	-	-
Cruciata pedemontana (Bellardi) Ehrend	H	X	A	Th	Med-As	+	+
Galium pseudoaristatum Schur.	H	X	P	H	Pann-Bal	+	
Santalaceae							
Thesium linophyllon L.	H	M	P	H	subMed		+
Scrophulariaceae	-	-	-	-	-	-	-
Linaria vulgaris Mill.	H	M	P	H	Eur-Sib		+
Misopates orontium (L.) Raf.	H	X	A	Th	Eur-Med	+	
Verbascum densiflorum Bertol.	H	X	A	Th	subMed		+
Veronica triphyllos L.	H	X	A	Th	Eur-Med		+
Urticaceae	-	-	-	-	-	-	-
Parietaria lusitanica L.	H	X	A	Th	Med-As	+	
Valerianaceae							
Valerianella carinata Loisel.	H	X	A	Th	Eur-Med		+
LILIOPSIDA							
Cyperaceae	-	-	-	-	-	-	-
Carex otrubae Podp.	H	M/X	P	H	Eur		+
Poaceae	-	-	-	-	-	-	-
Aegilops neglecta Req. ex Bertol.	H	X	A	Th	subMed		+
Bromus squarrosus L.	H	X	A	Th	subMed		+
Bromus sterilis L.	H	X	A	Th	Boreal	+	
Chrysopogon gryllus (L.) Trin.	H	X	P	H	Pont-Med		+
Dichanthium ischaemum (L.) Roberty	H	X	P	H	subMed-As		+
Echinaria capitata (L.) Desf.	H	X	A	Th	Med		+
Festuca valesiaca Scheicher ex Gaudin	H	X	P	H	Pont		+
Koeleria nitidula Velen.	H	X	P	H	Pont	+	
Melica ciliata L.	H	X	P	H	Eur-subMed	+	
Poa bulbosa L.	H	X	P	H	Eur-As	+	+
Poa pratensis L.	H	X	P	H	Kos		+

Legend:

Light dependence: H - heliophyte; H/Sc – helio-sciophyte; Sc/H – scio-heliophyte; Sc - sciophyte.

Humidity dependence: X - xerophyte; M - mesophyte; M/X – meso-xerophyte; X/M – xero-mesophyte; M/Hg – meso-hygrophyte.

Biological type: A – annual; A-B – annual to biennial; B – biennial; P – perennial; S – shrub; T – tree.

Life form: Th - therophyte; H - hemicryptophyte; Ch - chamaephyte; Ph – phanerophyte.

Floristic element: Adv – Adventive; Anat – Anatolian; Ap – Appenine; As – Asian;Bal – Balkan; Boreal; Bul – Bulgarian; Eur – European; Kos – cosmopolitan; Med– Mediterranean; OT – Oriental-Turanian; Pann – Pannonian; Pont – Pontic; Sib – Siberian; Additional abbreviation: S – southern; E – Eastern; W – Western; N – Northern; C – Central.