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The medicinal plants of Zemenska Mt, Western Bulgaria

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Abstract: *Bulgaria is one of the European countries with the greatest biodiversity, including biodiversity of medicinal plants. The object of this study is the Zemenska Mt, located in the Western Bulgaria. As a result of our investigation, 423 medicinal plants belonging to 273 genera and 78 families, were found. The predominate life forms are hemicryptophytes (61.10%). Biological types are presented mainly by perennial herbaceous plants (61.00%). The most numerous are Euro-Asiatic floristic elements (18.67%). There are 27 protected species and 26 tertiary relicts. Anthropophytes among the medicinal plants are 34.52%.*

Keywords: Zemenska Mt, medicinal plants, list

Introduction

Due to its geographical location, Bulgaria has a rather diverse climate, which is formed by the triple influence of the Central European, East European (steppe) and Mediterranean climates. Its diversity is enhanced by the topographic features [1]. The orography of the central part of the Balkan Peninsula transforms the oceanic air masses invading from the west, transforming them into continental ones in our country. In this way, the climate of Bulgaria acquires features of a certain “autocontinentiality” [2]. The entire Znepole floristic region, which includes the Zemenska Mt (Fig. 1), is one of the formative centres of the Balkan phytogeographic province. The endemic species are distributed mainly in the low mountains of the region and are the result of hybridogenic processes between Central European, Near-Asian and Mediterranean floristic influences [3].

The Struma River Valley is a gateway for Mediterranean elements from the south, which finds favourable conditions in the warmer limestone. Therefore, Adamovich [4], Stoyanov [5] and Urumov [6] perceive the

southern parts of the Zemenski prolom Gorge as a Mediterranean oasis with sub-Mediterranean and Mediterranean elements. The highest evolutionary productivity in the mountains of the central zone of the Balkan Peninsula is between the 44th and 48th parallels and the 24th and 28th meridians (in its southwestern and southeastern parts). There the relative taxonomic diversity of endemic elements is highest. To the north and partly to the south this presence decreases. The percentage of endemism for the Balkan Peninsula is 10%, which is serious evidence of the form-forming capacity of the region. The presence of rich intraspecific variability gives reason to predict the formation of a large number of taxa with species rank, which indicates that the processes of form formation have not subsided. In Bulgaria, form formation processes are also active [7].



Figure 1. Geographical position of the Zemenska Mt

The Zemenska Mt is located in the zone of maximum evolutionary productivity of the Balkan Peninsula [8]. This, combined with the limestone base rock (Fig. 2) and the various climatic and floristic influences in the region, is a prerequisite for significant floristic richness. The limestone terrain has a significant impact on the entire complex of operating ecological and climatic factors, transforming them and giving them a certain Mediterranean character. The richest floristically speaking habitats in Europe and in our country are on limestone bedrock. The richness of species in them is a result of the thermal properties, structure and water regime of the limestone rocks.

The thermal and hydrological characteristics of limestones are due to their physical properties. Limestones are often fine-grained, gray in colour and with a rough surface, which favours their better heating and slower cooling, which is why they have the ability to accumulate heat. That is why limestones are warmer, and calcareous terrains in temperate climate zones have a relatively rich plant diversity and a strong participation of southern and steppe elements. Therefore, the so-called Mediterranean oases in the zone with a transitional or temperate climate are located on calcareous terrain [4, 9].

Limestones and calcareous soils are of great importance for shaping the genetic fund of our country, because they have sheltered a significant number of relict and more recently migrated species of different origins. In some of these habitats, a significant percentage of genetic variability, a great diversity of varieties and the so-called young species are also observed. They are the product of a modern form-forming process and the result of hybridogenic contacts of species with significant isolation in time and space, as well as of local mutagenesis. These habitats are the so-called microcenters of form-forming or form-forming foci, which can be found in all plant belts. Limestones and calcareous soils in Bulgaria are oases of Mediterranean, Near-Asian, Pontic and Irano-Turanian floral elements or often of all of them [10].



Figure 2. A view of the Zemenska Mt. At the bottom is the highest peak Tichak (1295 m a.s.l.)
(Photo Asen Asenov, May 31, 2010)

In Bulgarian's calcareous terrains takes place specific form-differentiation, resulting in the formation of the specific flora and plant communities [11]. Whole Balkan Peninsula, constitute a great refuges form by separated parts. Zemenska Mt is one of endemic speciation centers in Bulgaria [12].

Stefanov & Kitanov [13] indicate that the xerophytic and xeromesophytic belts are the most anthropogenically affected, which have largely been converted into arable land and pastures. They divide the species into: natural (stationary element), apophytes and anthropophytes (archaeophytes and neophytes). The stationary element includes plants with high ecological specialization. Apophytes are more mobile species with better adaptability. The primary composition of the plant cover is a combination of species from the stationary element and apophytes. Anthropophytes can migrate and settle in habitats created and maintained by man. Apophytes have characteristic features of anthropophytes – they can migrate and settle in habitats created and maintained by man, but at the same time they also constitute part of the natural plant cover.

Flora of Zemenska Mt have not investigated till 2006. The first complex investigation was made by Asenov [14-23] and Asenov & Dimitrov [24, 25].

Until then, there was mainly chorological data published by Velenovský [26], Urumov [27-30], Popov [31], Dimitrov [32], Vutov & Dimitrov [33], Dimitrov & Stoyanov [34], Vasilev [35].

Vegetation of Zemenska Mt was investigated by Vasilev [36] and Vasilev et al. [37]. Populations of some species of medical plants were investigated by Genova et al. [38]. The Zemenski prolom Gorge was investigated better from Adamovič [4], Stoyanov [39], Urumov [40], Velchev & Stoychev [41], Anchev [42, 43], Bancheva [44].

The aim of this research is to present a list of the medicinal plants from Zemenska Mt, their biological types, live forms, biological spectrum, phytogeographical structure, representation by families and conservation status. This study does not include Briophytes.

Object of investigation

Zemenska Mt is well differentiated, unsymmetrical massive, built of limestone, about 19 km long and 5-13 km wide, with area about 170 km². It is a part of Konjavsko-Milesvka Mt group, localized in the Kraishte geographic zone, the Znepole floristic region, the Central Western Bulgaria, in the UTM quadrants FN-30, FN-40, FN-41, FN-49 (Scale 1: 1500000). The mountain is located between the towns of Kjustendil and Zemen, and valleys of the Struma River (to the east), Uineshtica River, Dobridolska River, and Sushitzka River (to the west), Trekljanska River (to the north), and Dragovishtitsa River (to the south). Dry valley Brestnitsa divides Zemenska Mt into two parts: northern and southern. The average altitude of the northern part is about 1100 m and about 800 m of the southern part. The highest peaks are Tichak (1295 m a.s.l.) (Fig. 2), Silni vrah (1245 m a.s.l.), Glamen

(1212 m a.s.l.), Ivanov kamuk (1208 m a.s.l.), Vilna mogila (1200 m a.s.l.), Bandera (1199 m a.s.l.), Chirenets (1167 m a.s.l.), Mechka (1168 m a.s.l.) etc. [45].

Valley of Trekljanska River separate Zemenska Mt by neighboring limestone Rudina Mt (1172 m a.s.l.). The Zemenski prolom Gorge (about 20 km long and 600 m deep) separate Zemenska Mt by neighboring limestone Konqvska Mt (1487 m a.s.l.) (Fig. 3).



Figure 3. The Zemenski prolom Gorge (Photo Asen Asenov, May 15, 2015)

One of the longest and biggest Bulgarian rivers, Struma River (with a length of 415 km, of which 290 km in Bulgaria) flows through this gorge, and pours into the Aegean (Thracian) sea at the Orphano gulf, Northern Greece. Meridian orientation of Struma River's valley and short distance to the Aegean Sea (205 km) is the reason for weakly Mediterranean climatic influence, reaching to the south slopes of Zemenska Mt and Zemenski prolom Gorge.

Zemenska Mt is part of the Transitional-Continental climatic zone [46], South-Bulgarian hidrological area [47], Mediterranean soil district, Balkan-Apennine subdistrict, Sofia-Kraishte province [48], geobotanical Illyrian (Balkan) province, Sofia district, Koniavsko-Zemenski region [49].

Combination of continental climate and Mediterranean influence of calcareous base rock and low mountain relief has led to formation of *Rendzina* soils (humus-carbonate) of the *Leprosols* class. Hummus horizon

is characteristically situated immediately above the primary unconsolidated materials (AC profile). These soils are sandy-clayed up to slightly clayed, dark-gray in color. The soil is insufficiently humid (dry to fresh), which is due to the rapid passage of water to greater depth. Soil susceptibility to erosion is a serious problem [50].

The geological base is composed by sedimentary rocks (Triassic limestones, dolomites and sandstones). South slopes are composed also of breccias, conglomerates, argillites, tuffs and marls [51]. Calcareous base rock composition is one of the most typical specificities. Zemenska Mt is deeply karst, bare and dry (Fig. 2). Dry limestone valley, karst, whirlpools, uval and rocks draw relief of the mountain. This is the most important factor for existing ecological conditions.

Zemenska Mt is drained out by foothills rivers Struma, Trekljanska, and Dragovishtitsa, but there are not rivers in the mountain itself. The only constant stream is the Skakavitsa, which forms the Polska Skakavitsa Waterfall (with a height of 50 m) [47].

Area of investigation is situated in altitude belt from 525 m (Struma Valley) to 1295 m (Tichak Peak).

Limestones terrain, different habitats (grassy ridges, forests, rocky valleys, karst fields) and climatic features determinate especially rich flora.

Vegetation of Zemenska Mt is presented by forest, shrub, grassy and rocky communities, belonging to: *Aestilignosa*, *Aestifruticeta*, *Aciculifruticeta*, *Aestiduriherbosa*, *Pratoherbosa*, *Theroherbosa*.

Belt distribution of the plant cover can be observed, presented by:

- Belt of the xerothermal oak deciduous forest *Quercetum mixtum* (*Quercus pubescens* Willd., *Q. fraineto* Ten., *Q. cerris* L., *Q. virgiliana* (Ten.) Ten., *Carpinus orientalis* Mill., *Acer campestre* L., *Fraxinus ornus* L., *Syringa vulgaris* L. etc.);

- Belt of xeromesophilic hornbeam forest (*Carpinus betulus* L., *Quercus dalechampii* Ten., *Fagus sylvatica* L., *Acer campestre* L., *Acer platanoides* L., *A. pseudoplatanus* L., *Fraxinus ornus* L., *Fr. excelsior* L., *Tilia tomentosa* Moench, *T. cordata* Mill. etc.);

- Belt of mesophilic forest (beech belt): mostly mono-dominant communities of *Fagus sylvatica* L. There are steel mixed communities with participation of *Carpinus betulus* L. and small spots with domination of *Populus tremula* L.

Top of the hills are covered by grass and shrubby communities of steppe character of the following plant species: *Amygdalus nana* L., *Astragalus angustifolius* Lam., *Artemisia alba* L., *Comandra elegans* Rechb.f., *Koeleria* spp., *Melica ciliata* L., *Rosa pimpinellifolia* L., *Stippa* spp., *Thymus* spp., *Satureja montana* L. etc. Family *Orchidaceae* counts 25 species. Protected calcifile plant *Cachrys alpina* M. Bieb. cover vast areas.

Some potholes and uvals are covered by woody vegetation with the development of *Fagus sylvatica* L., *Carpinus betulus* L., *Ulmus glabra* Huds., *Pyrus amygdaliformis* Vill., *P. pyraeaster* Burgst.

Vegetation is blowing in May-June. From second half of July is very dry and there are not many flowering plants. August is the driest month [52].

The Zemenska Mt falls into the NATURA 2000 ecological network of protected areas [53], under the name "Zemen" (Zemen Protected zone), with the zone code BG0001012, as well as in the Important Plant Area (IPA) network, with the name "Zemen mountain" [54].

The two zones coincide in area. The Skakavishki waterfall natural landmark (declared 1968, area 10 ha), the Zemenski skali natural landmark (declared 1968, with an area of 13 ha) and CORINE site F00001700 Zemenski prolom fall into the Zemenska planina Important Plant Area [55].

Material and Methods

This survey was conducted on the route method. Field trips were made from 2006 to 2021. Specimens were determined according to the *Flora of P.R. Bulgaria* 1-9 [56, 57], *Flora of R. Bulgaria* 10, 11 [58, 59]. Also was used *Field Guide to the Vascular Plants in Bulgaria* [60], *Flora Europaea* [61, 62], and *Field Guide of plants in Bulgaria* [63]. Family *Brassicaceae* was checked by Ančev [43] and Ančev & Goranova [64]. Genus *Galium* was checked according to Ančev & Krendl [65]. Family *Orobanceceae* was checked by Stoyanov [66-68]. Authors of the plant names were checked by Brummitt & Powell's [69]. Updating of the plant name follows WFO (*World Flora Onlain*) [70].

Geoelement characteristic was checked by Assyov & Petrova [71]. Geoelement characteristic of *Koeleria fenzliana* Schur., *K. mitrushii* Ujhelyi, *K. penzesii* Ujhelyi and *K. schurii* Ujhelyi is according to Josifović [72].

The conservation statute is recognized using the following documents: *Council Directive 92/43/EEC of the European Community to protect natural habitats and of wild fauna and flora*, Annex II [73]; *Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)*, Appendix I [74]; *Convention on International Trade in Endangered Species of Wild Fauna and Flora*, Appendix II (CITES) [75], *Red Data Book of the Republic of Bulgaria*, Vol. 1. Plants and Fungi [76], *IUCN Red List of Bulgarian vascular plants* [77], *Biological Diversity Act*, Annex III and Annex IV, 2024) [78].

Endemites was checked according *Balkan endemics in the Bulgarian flora* [79], and *List of the Bulgarian endemic plants* [80]. The relict plants were presented by Zahariev [81].

The anthropophytes are presented by Stefanov & Kitanov [13], Petrova & Vladimirov [82], and Petrova et al. [83].

Life forms based on Raunkiaer [84] and Biological types were determinate using *Flora of the Peoples Republic of Bulgaria, Volumes 1-9* and *Flora of the Republic of Bulgaria, Volumes 10-11*.

The medical plants are according to the *Medicinal Plants Act*, 2023 [85].

Results and Discussion

The flora of Zemenska Mt includes 1360 species, 70 subspecies, 483 genera and 90 families. One third of the species and more than half of the families and genera of the Bulgarin flora are found here. As a result of our research, we found 423 species of medicinal plants. They belong to 273 genera and 78 families. This represents 31.1% of total number of species in study area and 57.31% of the medical plants in Bulgaria. The list of species of medical plants, arranged alphabetically, is presented in the Appendix 1.

Biological type. The analysis of biological types and life forms helps to understand the specific ecological conditions under which a given flora develops. The biological type reflects the adaptations of the plant to the entire complex of environmental factors. The studied area offers conditions for the development of herbaceous plants, semi-shrubs, shrubs and trees. The ridge is leveled and is covered by herbaceous-shrub and semi-shrub communities. There the species composition is richer. Forests are on the slopes and in the valleys and have a poorer species composition.

In the flora of Zemenska Mt, perennial plants dominate (55.40%), followed by annuals (24.40%), annual-biennial plants (5.10%), shrubs (4.30%), trees (3.20%), biennials (3.00%), biennial-perennials (2.88%) and others (2.88%) (Table 1). Among the medical plants dominate perennials plants (61.00%), followed by annuals plants (15.83%). Examples of perennial plants are the following: *Achillea clypeolata* (Fig. 4a), *Digitalis lanata* (Fig. 4b), *Gladiolus communis*, *Hyssopus officinalis* ssp. *aristatus* (Fig. 4c), *Lilium martagon* (Fig. 4d), *Polygonatum odoratum*, *Primula veris* (Fig. 4e), *Salvia glutinosa*, *Saponaria officinalis*, *Sedum acre* (Fig. 4f), *Stachys germanica*, *Thymus callieri*, *Trifolium alpestre*, *Valeriana officinalis* etc.

Table 1. Biological type

Biological type	Number	Percent
Perennial	258	61.00
Annual	67	15.83
Shrub	27	6.38
Tree	22	5.20
Annual-biannual	21	4.96
Biannual-perennial	10	2.36
Biannual	8	1.89
Annual-perennial	5	1.18
Semi-shrub-perennial	2	0.47
Shrub-tree	2	0.47
Perennial-semi-shrub	1	0.23
Total	423	100



Figure 4. The examples of perennial plants among the medical plants: a) *Achillea clypeolata*, b) *Digitalis lanata*, c) *Hyssopus officinalis*, d) *Lilium martagon*, e) *Primula veris*, f) *Sedum acre*
(Photo Asen Asenov, from April 12, 2009 to June 22, 2021)

Examples of annual plants are the following: *Datura stramonium*, *Fumaria officinalis*, *Melilotus officinalis*, *Solanum nigrum*, *Trigonella coerulea*, *Xanthium strumarium* etc.

The high percentage of annual plants, as mentioned above, is due to the xerophytic conditions on the dry calcareous terrains, the weak Mediterranean climatic influence in the region, and the anthropogenic impact, leading to deforestation and xerophytization.

Life forms. The analysis of life forms is an important element of the floristic analysis, which can be used as an indicator of the climatic conditions in the area. When determining the percentage ratio of life forms, the so-called biological spectrum for a given flora is obtained. The predominant life form in the flora of the Zemenska Mt is the hemicryptophytes (58.70%), which is characteristic for the temperate climatic's floras and is evidence of its moderately holarctic character. The warmer and drier limestone, the weak Mediterranean climatic influence and the extensive grassy habitats on the ridge are the reason for the relatively high percentage of therophytes (24.40%). Area of the forest habitats is vast, but species composition is poor. The phanerophytes are presented poorly (7.10%), which is typical of the temperate climate zone. The monodominant red juniper (*Jupiperus oxycedrus* L.) community, located in the southern part of the Zemenska Mt, is the largest in Bulgaria (Fig. 5).



Figure 5. The largest in Bulgaria monodominant red juniper (*Jupiperus oxycedrus* L.) community of the Zemenska Mt (Photo Asen Asenov, July 26, 2012)

The open ridge rocky terrains with shallow soil are suitable for the development of geophytes (6.80%). About 60.00% of all geophytes are found there. A significant part of them are monocotyledonous species from the

families *Liliaceae*, *Iridaceae*, *Orchidacea*. The presence of geophytes is associated with the reserve substances in the underground organs, ensuring the development of the species in an unfavorable water regime, such as that found in the calcareous terrain. Zemenska Mt is rich in *Orchidaceae* geophytes – they are 25 species.

The calcareous terrain leads to chamaephytism, which is an opportunity to extend the vegetation season. The drier and warmer limestone is a favorable environment for the development of chamaephytes (2.10%).

Helophytes (6 species) and hydrophytes (3 species) develop in riparian habitats and water bodies.

Among the medical plants dominant life form is hemicryptophytes (61.12%), next are therophytes (15.83%) - Table 2. The following species belong to hemicryptophytes: *Achillea millefolium*, *Agrimonia eupatoria*, *Althaea officinalis*, *Anemone sylvestris*, *Artemisia vulgaris*, *Carlina acanthifolia*, *Chelidonium majus*, *Cichorium intybus*, *Dictamnus albus*, *Digitalis grandiflora*, *Doronicum columnae*, *Echium vulgare*, *Hypericum perforatum*, *Origanum vulgare*, *Pulmonaria officinalis*, *Sanguisorba officinalis*, *Taraxacum officinale*, etc.

Therophytes are the following species: *Artemisia annua*, *Brassica nigra*, *Cuscuta europaea*, *Delphinium consolida*, *Fumaria officinalis*, *Linum catharticum*, *Papaver rhoeas*, *Pulicaria dysenterica*, *Solanum nigrum*, *Valerianella coronata*, *Veronica arvensis*, *Xeranthemum annuum* etc.

Table 2. Life forms

Life forms		Number		Percent	
Hemicriptopites (H)		267		61.12	
Therophytes (Th)		67		15.83	
Phanerophytes (Ph)		51		12.05	
Cryptophytes (Cr)		32		7.56	
	Hydrophyres (Hd)		0		0
	Helophytes (He)		1		0.23
	Geophytes (G)		31		7.32
Chamephytes (Ch)		6		1.41	
Total		423		100	

Phytogeographic structure. Phytogeographic analysis provides information about the origin and evolution of a given flora and its relationships with other floras. It is also an indicator of the climatic conditions in the region. The floras of the limestone terrains include more southern plants, sub-Mediterranean and steppe phytocenoses. As already mentioned, limestone offers warmer and drier habitats, which is a prerequisite for the development of more thermophilic elements entering from the south.

The flora of Zemenska Mt is a combination of different floristic elements, which have genesis from different regions. Zemenska Mt as the whole has north temperate flora, but with strong participation of sub-Mediterranean elements, because of Mediterranean climatic influence, short distance (205 km) to the Mediterranean, warm and dry calcareous base rock, and anthropogenic degradation.

The phytogeographic spectrum of Zemenska Mt includes 64 floristic elements. Sub-Mediterranean floristic elements are most (15.40%), followed by Euro-Asian floristic elements (14.80%) and Euro-Mediterranean floristic elements (12.50%). The dominance of sub-Mediterranean floristic elements at the latitude of temperate climate is characteristic of the Mediterranean Oases.

The medicinal plants belong to 30 phytogeographic elements with European, Mediterranean, Balkan, cosmopolitan, adventive, Pontic, Boreal, and Asian origin. More than half of the species of medical plants are of Euro-Asian, Euro-Mediterranean, sub-Mediterranean and Euro-Siberian origin. The largest number of species are Euro-Asian: Eur-As (18.67%), Eur-Med (14.42%), subMed (14.18%), Eur-Sib (10.40%), Eur (8.27%), subBoreal (6.85%), Boreal (5.20%), Kos (4.72%), Pont-Med (3.30%), Med (3.07%), Eur-subMed (1.89%) etc.

Protected species. The greater plant diversity of the calcareous terrains is also the reason for the greater number of protected species. The conservation status of a given flora is an indicator of its botanical value. The flora of the Zemenska Mt includes 85 conservationally significant species. This represents 2% of the higher flora of Bulgaria and 6% of the flora of the studied area. They are concentrated in the northern higher part of the mountain, where anthropogenic impact is weaker. The population of the protected species *Pontechium maculatum* (Fig. 6a) on Zemenska Mt is the largest in Bulgaria - about 4,000 individuals per three square kilometers of area observed in June 2015. Among medicinal plants there are 27 protected species (Table 3). *Himanthoglossum calcaratum* also deserve special attention (Fig. 6b).

Table 3. Protected medicinal plants

Species	<i>Biological Diversity Act</i>	<i>Red List of Bulgarian vascular plants</i>	<i>CITES</i>	<i>Concil Directive 92/43/EEC</i>	<i>Bern Convence</i>
1. <i>Anacamptis coriophora</i> (L.) R.M.Bateman, Pridgeon & M.W.Chase	Annex 4		Annex 2		

2. <i>Anacamptis morio</i> (L.) R.M.Bateman, Pridgeon & M.W.Chase	Annex 4		Annex 2		
3. <i>Anacamptis papilionacea</i> (L.) R.M.Bateman, Pridgeon & M.W.Chase	Annex 3	VU	Annex 2		
4. <i>Anacamptis pyramidalis</i> (L.) Rich.	Annex 3	VU	Annex 2		
5. <i>Anemone sylvestris</i> L.	Annex 3	NT			
6. <i>Asparagus officinalis</i> L.	Annex 4				
7. <i>Asphodelus albus</i> Mill.	Annex 4				
8. <i>Atropa bella-donna</i> L.		VU			
9. <i>Bupleurum rotundifolium</i> L.	Annex 4				
10. <i>Dryopteris filix-mas</i> (L.) Schott	Annex 4				
11. <i>Echinops sphaerocephalus</i> L.	Annex 4				
12. <i>Gladiolus communis</i> L.	Annex 4				
13. <i>Gymnadenia conopsea</i> (L.) R. Br.			Annex 2		
14. <i>Himantoglossum calcaratum</i> (Beck) Schltr.	Annex 2, 3	VU	Annex 2	Annex 4	Annex 1
15. <i>Lilium martagon</i> L.	Annex 4				
16. <i>Neotinea tridentata</i> (Scop.) R.M.Bateman, Pridgeon & M.W.Chase	Annex 4		Annex 2		
17. <i>Neotinea ustulata</i> (L.) R.M.Bateman, Pridgeon & M.W.Chase	Annex 4	VU	Annex 2		
18. <i>Orchis militaris</i> L.	Annex 3	EN	Annex 2		
19. <i>Orchis pallens</i> L.	Annex 4		Annex 2		
20. <i>Orchis purpurea</i> Huds.	Annex 4		Annex 2		
21. <i>Orchis simia</i> Lam.	Annex 4		Annex 2		
22. <i>Polygonatum odoratum</i> (Mill.) Druce	Annex 4				
23. <i>Pontechium maculatum</i> (L.) Böhle & Hilger	Annex 2, 3	VU		Annex 4	
24. <i>Primula veris</i> L.	Annex 4				
25. <i>Salix caprea</i> L.	Annex 4				
26. <i>Scilla bifolia</i> L.	Annex 4				
27. <i>Siler montanum</i> Crantz		LC			
Total	24	9	12	2	1

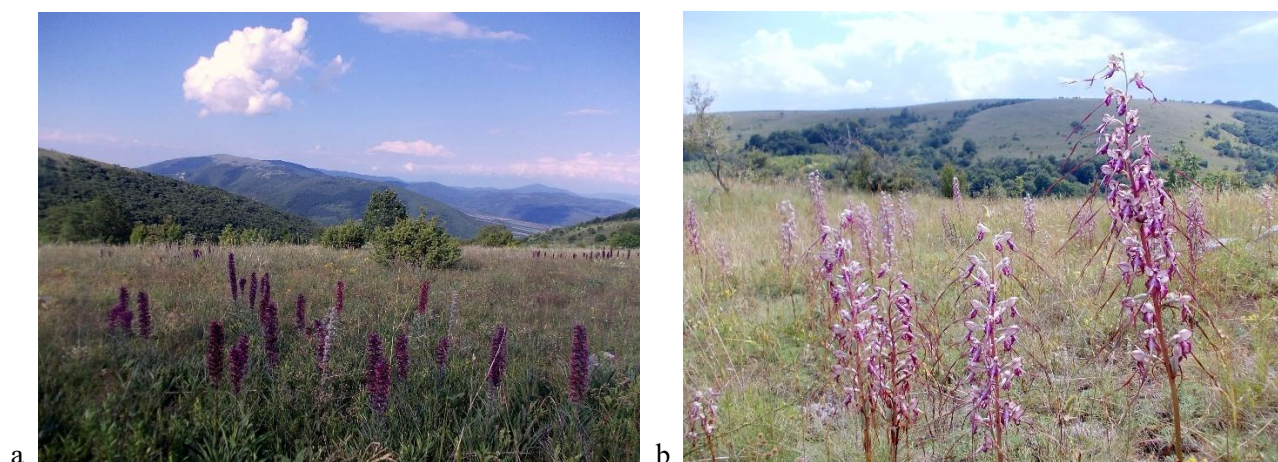


Figure 6. Some important protected medicinal plants: a) *Pontechium maculatum*, b) *Himanthoglossum calcaratum* (Photo Asen Asenov, July 26, 2014)

Endemic plants. Zemenska Mt is rich in endemics: among the medicinal plants 46 species are endemics. Endemism is an indicator of the genetic features of the formation that led to the formation of specific species. The floristic richness of the limestone terrains is one of the reasons for the richness of the endemics there. Other reasons are the geographical location, the climate and the history of the vegetation.

Balkan endemics in the flora of the Zemenska Mt are 40 species (2.90%). More than half (56.80%) of the Balkan endemics in the Znepole floristic region and 14% of the Balkan endemics in the Bulgarian flora are found there. Of these, 8 species are included in the *Red List of Bulgarian higher plants*, 7 species are included in the *Bulgarian Biodiversity Act* and 1 species is included in the *Habitats Directive*.

Bulgarian endemics in the flora of the Zemenska Mt are 6 species, which is 2.90% of the Bulgarian endemics in the Bulgarian flora and more than half (54.5%) of the Bulgarian endemics in the flora of the Znepole floristic region. One species is a local endemic – *Aubrieta columnae* Guss. ssp. *bulgarica* (Sagorski) Hartvig

Some of the endemic plants are protected by *Red List of Bulgarian vascular plants* (4) and *Bulgarian Biodiversity Act* (3).

Although the Zemenska Mt is rich in endemics, there are none among the medicinal plants.

Relict species. The flora of the Zemenska Mt includes 63 relict species (4.60%): 55 Tertiary relicts, 5 Quaternary interglacial relicts and 3 Quaternary postglacial relicts. This is evidence of its primordial nature. Among medicinal species there are 26 Tertiary relicts:

- | | |
|-------------------------------|-----------------------------------|
| 1. <i>Acer platanoides</i> | 14. <i>Hedera helix</i> |
| 2. <i>Asarum europaeum</i> | 15. <i>Isopyrum thalictroides</i> |
| 3. <i>Berberis vulgaris</i> | 16. <i>Juniperus communis</i> |
| 4. <i>Clematis vitalba</i> | 17. <i>Juniperus oxycedrus</i> |
| 5. <i>Colutea arborescens</i> | 18. <i>Lycopus europaeus</i> |
| 6. <i>Carpinus betulus</i> | 19. <i>Populus nigra</i> |
| 7. <i>Corylus avellana</i> | 20. <i>Populus tremula</i> |
| 8. <i>Cottinus cogigria</i> | 21. <i>Pterinum aquilinum</i> |
| 9. <i>Crataegus pentagyna</i> | 22. <i>Salix alba</i> |
| 10. <i>Dictamnus albus</i> | 23. <i>Salix caprea</i> |
| 11. <i>Fagus sylvatica</i> | 24. <i>Salix purpurea</i> |
| 12. <i>Fraxinus excelsior</i> | 25. <i>Sanicula europaea</i> |
| 13. <i>Fraxinus ornus</i> | 26. <i>Syringa vulgaris</i> |

Order №RD-99/05.02.2024 [86] of the Ministry of Environment and Water of the Republic of Bulgaria determines special arrangements for conservation and use of the medicinal plants. The permissible quantities of herbs (kg dry weight) from their natural habitats, outside national parks of some medicinal plant species are determined there. Under restricted collection of herbs from their natural habitats on Zemenska Mt are the following species: *Artemisia alba*, *Atropa bella-donna*, *Berberis vulgaris*, *Betonica officinalis*, *Carlina acanthifolia*, *Galium odoratum*, *Primula veris*, *Sedum acre*. For these species, collection from their natural habitats, outside the quantities and areas allocated in the appendix to this order, is prohibited.

Prohibited from being collected from their natural habitats on Zemenska Mt are following species of medicinal plants: *Althaea officinalis*, *Asarum europaeum*, *Asplenium trichomanes*, *Convallaria majalis*, *Hyssopus officinalis* ssp. *aristatus*, *Inula helenium*, *Orchis* sp. *diversa*, *Valeriana officinalis*. For these species is permitted to collect quantities for personal use, determined in accordance with § 1, point 18 of the “Additional Provisions” of the Medicinal Plants Act.

Anthropophytes. The top of Zemenska Mt have vast and flat peaks, ridges and hills. That's why in the past (till 1990's) they were used for cattle breeding, pasture, haymaking and agriculture. After politic-economical changes in 1989, there have not such activities on the north part. South part, however, still is, strongly anthropogenic affected. Therefore, the percentage of anthropophytes in Zemenska Mt is high. They are 61% of all anthropophytes from the Bulgarian flora.

Anthropophytes in the flora of Zemenska Mt are 25.30%. This value is twice as high as the percentage of anthropophytes in the Bulgarian flora. Anthropophytes among the medicinal plants are 34.52% (146 species). Some of them are distributed as ruderal plants: *Capsella bursa-pastoris*, *Conium maculatum*, *Chenopodium hybridum*, *Datura stramonium*, *Galium aparine*, *Lepidium ruderae*, *Sambucus ebulus*, *Stellaria media*, *Urtica urens*, *Xanthium strumarium* and more.

Families with the most medicinal plants. Medicinal plants belong to 78 families. The most medicinal plants are found in Asteraceae (12.76%), Lamiaceae (12.05%), Fabaceae (7.09%), Rosaceae (5.20%), Scrophulariaceae (4.96%), Apiaceae (4.72%), Brassicaceae (3.78%), Ranunculaceae (3.54%), Caryophyllaceae (3.30%), Boraginaceae: (3.07%), Orchidaceae: (2.83%), Liliaceae: (2.12%) etc.:

- | | |
|------------------------------------|---------------------------------|
| 1. Asteraceae: 12.76% (54 species) | 24. Caprifoliaceae: 0.70% (3) |
| 2. Lamiaceae: 12.05% (51) | 25. Cupressaceae: 0.70% (3) |
| 3. Fabaceae: 7.09% (30) | 26. Dipsacaceae: 0.70% (3) |
| 4. Rosaceae: 5.20% (22) | 27. Euphorbiaceae: 0.70% (3) |
| 5. Scrophulariaceae: 4.96% (21) | 28. Fumariaceae: 0.70% (3) |
| 6. Apiaceae: 4.72% (20) | 29. Geraniaceae: 0.70% (3) |
| 7. Brassicaceae: 3.78% (16) | 30. Primulaceae: 0.70% (3) |
| 8. Ranunculaceae: 3.54% (15) | 31. Tiliaceae: 0.70% (3) |
| 9. Caryophyllaceae: 3.30% (14) | 32. Violaceae: 0.70% (3) |
| 10. Boraginaceae: 3.07% (13) | 33. Alliaceae: 0.47% (2) |
| 11. Orchidaceae: 2.83% (12) | 34. Aristolochiaceae: 0.47% (2) |
| 12. Liliaceae: 2.12% (9) | 35. Betulaceae: 0.47% (2) |
| 13. Chenopodiaceae: 1.89% (8) | 36. Celastraceae: 0.47% (2) |
| 14. Malvaceae: 1.41% (6) | 37. Convolvulaceae: 0.47% (2) |
| 15. Polygonaceae: 1.41% (6) | 38. Equisetaceae: 0.47% (2) |
| 16. Solanaceae: 1.41% (6) | 39. Fagaceae: 0.47% (2) |
| 17. Plantaginaceae: 1.18% (5) | 40. Gentianaceae: 0.47% (2) |
| 18. Salicaceae: 1.18% (5) | 41. Hypericaceae: 0.47% (2) |
| 19. Asclepiadaceae: (0.94%) 4 | 42. Lythraceae: 0.47% (2) |
| 20. Crassulaceae: (0.94%) 4 | 43. Iridaceae: 0.47% (2) |
| 21. Oleaceae: (0.94%) 4 | 44. Lemnaceae: 0.47% (2) |
| 22. Poaceae: (0.94%) 4 | 45. Papaveraceae: 0.47% (2) |
| 23. Rubiaceae: (0.94%) 4 | 46. Polygalaceae: 0.47% (2) |

- | | |
|------------------------------|--------------------------------|
| 47. Saxifragaceae: 0.47% (2) | 63. Dioscoreaceae: 0.23% (1) |
| 48. Urticaceae: 0.47% (2) | 64. Globulariaceae: 0.23% (1) |
| 49. Valerianaceae: 0.47% (2) | 65. Grossulariaceae: 0.23% (1) |
| 50. Aceraceae: 0.23% (1) | 66. Hypolepidaceae: 0.23% (1) |
| 51. Alismataceae: 0.23% (1) | 67. Linaceae: 0.23% (1) |
| 52. Anacardiaceae: 0.23% (1) | 68. Orobanchaceae: 0.23% (1) |
| 53. Apocynaceae: 0.23% (1) | 69. Polypodiaceae: 0.23% (1) |
| 54. Araceae: 0.23% (1) | 70. Resedaceae: 0.23% (1) |
| 55. Araliaceae: 0.23% (1) | 71. Rutaceae: 0.23% (1) |
| 56. Aspidiaceae: 0.23% (1) | 72. Typhaceae: 0.23% (1) |
| 57. Berberidaceae: 0.23% (1) | 73. Ulmaceae: 0.23% (1) |
| 58. Campanulaceae: 0.23% (1) | 74. Verbenaceae: 0.23% (1) |
| 59. Cornaceae: 0.23% (1) | 75. Juncaceae: 0.23% (1) |
| 60. Corylaceae: 0.23% (1) | 76. Rhamnaceae: 0.23% (1) |
| 61. Cuscutaceae: 0.23% (1) | 77. Rubiaceae: 0.23% (1) |
| 62. Cucurbitaceae: 0.23% (1) | 78. Sparganiaceae: 0.23% (1) |

Conclusions

The inventory of the medicinal plants of Zemenska Mt showed that more than half of the Bulgarian medicinal plants are found in the flora of Zemenska Mt. One third of the species of the Zemenska Mt are medicinal. More research is needed to map populations, identify trends and threats, determine resource characteristics of deposits and determine the optimal regime for their exploitation. The obtained data can be used as a basis for comparison with the data of the medicinal plants in other floristic regions.

References

- [1]. Yordanov, D., On the spread of steppe vegetation in Bulgaria. *Coll. Bull. Acad. Sci.*, **1936**, 32(15), 1-105 (in Bulgarian).
- [2]. Bakalov, D., Weather types in Southeast Europe. Bulletin of the Bulgarian Geographical Society, Vol. 10, **1942** (in Bulgarian).
- [3]. Kozuharov, S., Form forming foci and endemism in the flora of Bulgaria, and the preservation of the genetic fund. *Problems of Biology*, **1977**, 10, 34-55 (in Bulgarian).
- [4]. Adamovič, L., Vegetation sverhaltnisse der Balkanlender. V. Wilhelm Engelman, Leipzig, **1909**.

- [5]. Stoyanov, N., About spreading of mediterranean vegetation in South Bulgaria and its relation with tobacco culture. Printing House “Hudozhnik”, Sofia, **1922**, 1-103 (in Bulgarian).
- [6]. Urumov, I., Flora of the Kyustendil District. Rep. Bulg. Acad. Sci., Vol. 30, Sofia, **1935b**, 1-235 (in Bulgarian).
- [7]. Peev, D. & Delcheva, M., The flora of the Republic of Bulgaria against the background of the flora of the Balkan Peninsula and its flora-forming power. In: Peev D., Petrova, A., Apostolova, I. & Asyov, B. Important places for plants in Bulgaria. Pensoft, Sofia-Moscow, **2012**, 11.
- [8]. Peev, D., Delcheva, M. & Nenova, I., Balkan vascular flora in numbers. In: Ivanova, D. (ed.). Proc. IV Balk. Bot. Congr., Sofia 2006. Prof. M. Drinov Acad. Publ. House, Sofia, **2009**, 140-143 (in Bulgarian).
- [9]. Stranski, I., Plant relations in the Middle Rhodopes. *Coll. Bull. Acad. Sci.*, **1921**, Book 26, 23-57 (in Bulgarian).
- [10]. Kozhuharov, S., Conservation of the grass gene pool in the forest zone of Bulgaria. *Proceedings of the Regional Symposium “8-MAB, UNESCO”, 20-24 October 1980*, Blagoevgrad, **1981**, 239-249 (in Bulgarian).
- [11]. Velchev, V., Floral and plant biodiversity of calcareous terrains in Bulgaria. *Phytologia Balcanica*, **1998**, 4(1-2), 81-92.
- [12]. Assenov, A., Biogeography of Bulgaria. SPO “AN-DI Adrian Tasev”, Sofia, **2006**, 5 (in Bulgarian).
- [13]. Stefanov, B. & Kitanov, B., Kultigenen plants and kultigenen vegetation in Bulgaria, Publishing House of Bulg. Accad. Sci., Sofia, **1962** (in Bulgarian).
- [14]. Asenov, A., Reports 1-3. In: Vladimirov, V. & al. (comp.), New floristic records in the Balkans: 10. *Phytologia Balcanica*, **2009a**, 15(1), 116.
- [15]. Asenov, A., Reports 1-6. In: Vladimirov, V. & al. (comp.), New floristic records in the Balkans: 10. *Phytologia Balcanica*, **2009b**, 15(2), 274.
- [16]. Asenov, A., Reports 2-26. In: Vladimirov, V. & al. (comp.), New floristic records in the Balkans: 14. *Phytologia Balcanica*, **2010**, 16(3), 416-418.
- [17]. Asenov, A., Reports 1-14. In: Vladimirov, V. & al. (comp.), New floristic records in the Balkans: 18. *Phytologia Balcanica*, **2012a**, 18(1), 70.
- [18]. Asenov, A., Report 1. In: Vladimirov, V. & al. (comp.), New floristic records in the Balkans: 20. *Phytologia Balcanica*, **2012b**, 18(3), 334.
- [19]. Asenov, A., Report 1. In: Vladimirov, V. & al. (comp.), New floristic records in the Balkans: 22 *Phytologia Balcanica*, **2013**, 19(2), 268.

- [20]. Asenov, A., Systematical and phytogeographical analysis of the vascular flora on Zemenska Mt, Western Bulgaria. PhD. Sofia University, Sofia, **2014** (in Bulgarian).
- [21]. Asenov, A., Report 1. In: Vladimirov, V. & al. (comp.), New floristic records in the Balkans: *Phytologia Balcanica*, **2015a**, 21(2), 189.
- [22]. Asenov, A., Systematical and Phytogeographycal analysis of flora of Mt. Zemenska, West Bulgaria. *Phytologia Balcanica*, **2015b**, 21(2), 161-187.
- [23]. Asenov, A., Vascular flora of Zemenska Mt. University publishing house of Sofia University „St. Kliment Ohridski”. <https://unipress.bg/prirodo-matematicheski-nauki/biologiya/visshata-flora-na-zemenskata-planina-e-kniga>, **2022** (in Bulgarian).
- [24]. Asenov, A. & Dimitrov, D., Plant with protection statute, endemites and reliks on Mt. Zemenska, Western Bulgaria. *Phytologia Balcanica*, **2012**, 18(2), 187-195.
- [25]. Asenov, A. & Dimitrov, D., The anthropophyte and invasive flora of Mt. Zemenska, West Bulgaria. *Symp. Seminar Ecology*, 25-26 April 2013, Sofia, **2013**, 204-211.
- [26]. Velenovský, J., Flora Bulgarica. Descriptio et enumeratio systematica plantarum vascularium in principatu Bulgariae sponte nascentium. Prague, **1891**.
- [27]. Urumov, I., Nova Additamenta ad Floram Bulgariae. Rep. Bulg. Acad. Sci., 5, Sofia, **1912**, 1-32 (in Bulgarian).
- [28]. Urumov, I., Twelfth contribution to the Bulgarian flora. Rep. Bulg. Acad. Sci., 2, Sofia, **1913**, 1-243 (in Bulgarian).
- [29]. Urumov, I., Thirteenth contribution to the flora of Bulgaria. Rep. Bulg. Acad. Sci., 7, Sofia, **1917**, 1-225 (in Bulgarian).
- [30]. Urumov, I., The Bulgarian representatives of the genus *Cephalaria*. Rep. Bulg. Acad. Sci., 42, Sofia, **1930**, 213-222 (in Bulgarian).
- [31]. Popov, P., Floristic materials and critical notes. III. *Phytologia* 2, **1975**, 68-77.
- [32]. Dimitrov, D., New chorological data for the flora of Bulgaria. *Annual of Sofia Univ. “St. Kliment Ohridski”, Fac. of Biology*, **1995**, 87(2), 53-57.
- [33]. Vutov, V. & Dimitrov, D., New chorological data for spreading on vascular plants with protected status in Bulgaria. *Historia Naturalis Bulgarica*, **2000**, 12, 151-156 (in Bulgarian).
- [34]. Dimitrov, D & Stoyanov, S., New Chorological data for vascular flora of Bulgaria. In: Randelovič, V. (ed.). *7-th Symposium on the flora of southern Serbia and neighbouring regions, Dimitrovgrad*, **2002**, 15–18.

- [35]. Vassilev, K., Report 99. In: Vladimirov, V. & al. (comps.), New floristic records in the Balkans. *Phytologia Balcanica*, **2009**, 15(1), 136.
- [36]. Vassilev, K., Grass vegetation on the calcareous terrains west of Sofia. Dissertation. IBER, BAS, **2013** (in Bulgarian).
- [37]. Vassilev, K., Asenov, A. & Apostolva, I., Overview on distribution and communities of *Edraianthus serbicus* in Bulgaria. *Journal of Agricultural Sciences*, **2013**, 19(2), 255–258.
- [38]. Genova, E., Evstatieva, L. Vitkova, A. Gusev, Ch., Stoeva, T. & Peshevski, N., Mapping of medicinal plants in some mountains of the Znepole floristic region. Proc. II Balk. Sci. Conf. Study, Conservation and Use of Forest Resources, 3-5 June 1996, Sofia, **1996**, Vol. 1, 367-373 (in Bulgarian).
- [39]. Stoyanov, N., About spreading of mediterranean vegetation in South Bulgaria and its relation with tobacco culture. Printing House “Hudozhnik”, Sofia, **1922**, 1-103 (in Bulgarian).
- [40]. Urumov, I., The Flora of Vratsa District. Rep. Bulg. Acad. Sci., Sofia, **1935**, Vol. 29, 1-205 (in Bulgarian).
- [41]. Velchev, V. & Stoichev, N., Changes in some plant associations under reserve conditions on the polygon-transect of the Zemen landscape station. Reg. Symp. Project 8-MAB, UNESCO Blagoevgrad, **1980**.
- [42]. Ančev, M., Karyology and features of reproduction of some synanthropic species of the *Cruciferae* family in Bulgaria. In: Velchev, V. (ed.), Fourth National Conference. Botany. BAS. Sofia, **1983**, 232-239 (in Bulgarian).
- [43]. Ančev, M., Catalogue of the family *Brassicaceae* (*Cruciferae*) in the flora of Bulgaria. *Phytologia Balcanica*, **2007**, 13(2), 153-178.
- [44]. Bancheva, Sv., The Balkan endemic *Colymbada finazzeri* (*Centaureinae*, *Asteraceae*) in the Bulgarian flora. *Phytologia Balkanica*, **2006**, 12(2), 245-248.
- [45]. Petrov, I., Zemenska Mountain. Small Tourist Library. Medicine and Physical Education, Sofia, **1986**, 5-16 (in Bulgarian).
- [46]. Velez, S., Climate of Bulgaria. Second edition. Heron Press, Sofia, **2010**, 5 (in Bulgarian).
- [47]. Yordanova, M., Hidrological divison. In: Koprarev, I. (ed.). Geography of Bulgaria, Physical Geography, Socio-Economic Geography. ForKom 2000, Sofia, **2002**, 242 (in Bulgarian).
- [48]. Ninov, N., Soils. In: Koprarev, I. (ed.). Geography of Bulgaria. Physical Geography, Socio-Economic Geography. ForKom 2000, Sofia, **2002**, 303-304 (in Bulgarian).
- [49]. Bondev, I., Phytogeographycal regioning In: Koprarev, I. (ed.) Geography of Bulgaria. Physical Geography, Socio-Economic Geography. ForKom 2000, Sofia, **2002**, 336-342 (in Bulgarian).

- [50]. Donovan, V., Forest soil science. Martilen Press, Sofia, **1993** (in Bulgarian).
- [51]. Nikolov, B. & Yordanova, M., Mountains in Bulgaria. Acad. Publ. House “Prof. M. Drinov”, Sofia, **1997**, 90-113 (in Bulgarian).
- [52]. Georgiev, M., Physical Geography of Bulgaria. Univ. Publi. House „Kliment Ohridski”, Sofia, **1991**, 299-300 (in Bulgarian).
- [53]. Natura 2000: <https://natura2000.egov.bg>.
- [54]. Peev, D., Petrova, A., Apostolova, I. & Assyov, B., Important plant areas in Bulgaria. IBER, BAS. Pensoft, Sofia-Moscow, **2012**, 8.
- [55]. Gusev, Ch., Zemenska Mountain. In: Peev D., Petrova A., Apostolova I. & Asyov B. 2012. Important plant areas in Bulgaria. PENSOFT, Sofia-Moscow, **2012**: 188-189.
- [56]. Jordanov, D. (main ed.), Flora Reipublicae Popularis Bulgaricae. Vols 1-7. Publ. House Bulg. Acad. Sci., Sofia, **1963-1979** (in Bulgarian).
- [57]. Velchev, V. (ed.), Flora Reipublicae Popularis Bulgaricae. Vols 8-9. Publ. House Bulg. Acad. Sci., Sofia, **1982-1985** (in Bulgarian).
- [58]. Kožuharov, S. (ed.), Flora Republicae Popularis Bulgaricae. Vol. 10. Editio Academica „Prof. Marin Drinov”, Serdicae, **1995** (in Bulgarian).
- [59]. Peev, D. (ed.), Flora Reipublicae Popularis Bulgaricae. Vol. 11. Editio Academica „Prof. Marin Drinov”, Serdicae, **2012** (in Bulgarian).
- [60]. Kozhuharov, S. (ed.), Handbook for Vascular Plants in Bulgaria. Publishing House „Nauka i izkustvo”, Sofia, **1992** (in Bulgarian).
- [61]. Tutin, T., Burges, N., Chater, A., Edmonson, J., Heywood, V., Moore, D., Valentine, D., Walters, S. & Webb, D. (eds). Flora Europaea. Ed. 2, Vol. 1. Cambridge Univ. Press, Cambridge, **1963**.
- [62]. Tutin, T., Heywood, V., Burges, N., Moore, D., Valentine, D., Walters, S., & Webb, D. (eds), Flora Europaea. Vols 2-5. Cambridge Univ. Press, Cambridge, **1968-1980**.
- [63]. Delipavlov, D., Cheshmedzhiev, I., Popova, M., Terziiski, D. & Kovachev, I., Handbook for Plants in Bulgaria, Publ. House of Agricultural University, Plovdiv, **2011** (in Bulgarian).
- [64]. Ančev, M. & Goranova, G.. *Aubrieta (Brassicaceae)* in the Bulgarian flora. *Phytologia Balcanica*, **2009**, 15(1), 43-50.
- [65]. Ančev, M. & Krendl, Fr. *Galium* sect. *Leiogalium (Rubiaceae)* in the Bulgarian flora. *Phytologia Balcanica*, **2011**, 17(3), 291-314.

- [66]. Stoyanov, K., Floristic materials and critical notes on the genus *Orobanch* subgen. *Phelipanche* in Bulgaria. *Flora Mediterranea*, **2005**, *15*, 461-476.
- [67]. Stoyanov, K., Chorology and critical notes on genus *Orobanch* L. (*Orobanchaceae*) in Bulgaria. Plant, fungal and habitat diversity investigation and conservation. *Rep. IV Balk. Bot. Congr.*, 20-26 June 2006. Sofia, **2006**, 45-254.
- [68]. Stoyanov, K., Biosystematic study of the family *Orobanchaceae* Vent. (Volovodetsovy) in Bulgaria. Plovdiv University, PhD Dissertation, **2009** (in Bulgarian).
- [69]. Brummitt, R. & Powell, C., Authors of Plant Names. Royal Bot. Gard., Kew, **1992**.
- [70]. WFO (World Flora online), [http://www. Worldfloraonline.org](http://www.Worldfloraonline.org) (Accessed on 08.03.2025).
- [71]. Assyov, B. & Petrova, A. (eds.), Conspectus of the Bulgarian Vascular Flora. Distribution maps and floristic elements. Bulg. Biodiv. Found., Sofia, **2012**, 5-453.
- [72]. Josifović, M. (ed.), Flore de la Republique Socialiste de Serbie. Vol 8. Acad. Serbe Sci. & Arts, Belgrade, **1976** (in Serbo-Croatian).
- [73]. Directive 92/43/EEC, Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora, Appendix II, OJ L 206, 22.07.1992. pp. 7-50.
- [74]. Bern Convention. 1979. Convention on the Conservation of European Wildlife and Natural Habitats. Appendix I. http://www.bfn.de/0302_berner+M52087573ab0.html (Accessed on 08.03.2025).
- [75]. CITES. 1975. Convention on International Trade in Endangered Species of Wild Fauna and Flora, Appendix II <http://www.cites.org/eng/resources/species.html> (Accessed on 08.03.2025).
- [76]. Peev, D. (main ed.), Red Data Book of the Republic of Bulgaria. Vol. 1. Plants and Fungi, IBER – BAS & MEW, Sofia, **2011**.
- [77]. Petrova, A. & Vladimirov, V. (eds), Red list of Bulgarian vascular plants. *Phytologia Balcanica*, **2009**, *15*(1), 63-94.
- [78]. Biological Diversity Act. Annex III and IV. (Act on Amending and Supplementing). 2007. Decree No 354 accepted by the 40th National Assembly on 1st November 2007, State Gazette, No. 94/16.11.2007. 2-44. Supplemented in State Gazette No. 70/20.08.2024 (in Bulgarian).
- [79]. Petrova, A. & Vladimirov, V., Balkan endemics in the Bulgarian flora. *Phytologia Balcanica*, **2010**, *16*(2), 293-311.
- [80]. Petrova, A. & Velchev, V., List of the Bulgarian endemic plants. In: Petrova, A. (ed.) Atlas of Bulgarian Endemic Plants. Gea Libris, Sofia, **2006**, 362-369.

- [81]. Zahariev, D., Biodiversity of Relict Vascular Plants in Bulgaria. *International Journal of Research Studies in Biosciences*, **2016**, 4(1), 38-51.
- [82]. Petrova, A. & Vladimirov, V., The Anthropophyte Flora of Bulgaria. *Proc. VI Nat. Conf. Botany, June 18-20 2001*. Sofia, **2001**, 77-82 (in Bulgarian).
- [83]. Petrova, A., Vladimirov, V & Georgiev, V., Distribution of alien and invasive plant species reported for Bulgaria in the last 20 years (1991-2011). *Seventh National Conference on Botany, 29-30 September 2011*. Sofia, **2011**, 339-348 (in Bulgarian).
- [84]. Raunkiær, C., The Life forms of plants and statistical plant geography. Clarendon Press, Oxford, **1934**.
- [85]. Medicinal Plants Act. State Gazette number 29, 7 April 2000, pp. 9-29. Last amended in State Gazette number 102, 8 December **2023** (in Bulgarian).
- [86]. Order №RD-99/5 February 2024: Special arrangements for the conservation and use of medicinal plants. State Gazette No.15, 20 February **2024** (in Bulgarian).

Appendix 1. The list of species of medical plants of the Zemenska Mt

Species	Floristic element	Live form	Family	Antropophyte
<i>Acer platanoides</i> L.	subMed	Ph	Aceraceae	
<i>Achillea clypeolata</i> Sm.	Bal	H	Asteraceae	
<i>Achillea millefolium</i> L.	Eur-Sib	H	Asteraceae	
<i>Achillea nobilis</i> L.	Eur-WAs	H	Asteraceae	
<i>Achillea ptarmicifolia</i> (Willd.) Heimerl	Bal-Anat	H	Asteraceae	
<i>Actaea spicata</i> L.	Eur-As	H	Ranunculaceae	
<i>Adonis aestivalis</i> L.	Eur-subMed	H	Ranunculaceae	+
<i>Aegonychon purpureocaeruleum</i> (L.) Holub	Eur-As	H	Boraginaceae	
<i>Aethusa cynapium</i> L.	Eur-Sib	H	Apiaceae	+
<i>Agrimonia eupatoria</i> L.	Eur-Med	H	Rosaceae	+
<i>Agrostemma githago</i> L.	Eur-As	Th	Caryophyllaceae	
<i>Ajuga chamaepitys</i> (L.) Schreb.	Pont-Med	H	Lamiaceae	

<i>Ajuga laxmannii</i> (Murray) Benth.	SSib	H	Lamiaceae	
<i>Alcea biennis</i> (Willd.) Waldst. et Kit.	subMed	H	Malvaceae	
<i>Alcea rosea</i> L.	Med	H	Malvaceae	
<i>Alkekengi officinarum</i> Moench	Eur-As	H	Solanaceae	
<i>Alisma plantago-aquatica</i> L.	Boreal	He	Alismataceae	
<i>Alliaria petiolate</i> (M. Bieb.) Cavara & Grande	Eur-As	H	Brassicaceae	
<i>Allium rotundum</i> L.	Eur-OT	G	Alliaceae	+
<i>Allium scorodoprasum</i> L.	Eur-As	G	Alliaceae	
<i>Alnus glutinosa</i> (L.) Gaertn.	Med-CAs	Ph	Betulaceae	
<i>Althaea officinalis</i> L.	Boreal	H	Malvaceae	+
<i>Alyssum alyssoides</i> (L.) L.	Eur-Med	H	Brassicaceae	
<i>Anacamptis coriophora</i> (L.) R.M.Bateman, Pridgeon & M.W.Chase	Eur-SMed	G	Orchidaceae	
<i>Anacamptis morio</i> (L.) R.M.Bateman, Pridgeon & M.W.Chase	Eur-SMed	G	Orchidaceae	+
<i>Anacamptis papilionacea</i> (L.) R.M.Bateman, Pridgeon & M.W.Chase	Eur-SMed	G	Orchidaceae	
<i>Anacamptis pyramidalis</i> (L.) Rich.	subMed	G	Orchidaceae	
<i>Anagallis arvensis</i> L.	Kos	H	Primulaceae	+
<i>Anchusa officinalis</i> L.	Pont-Med	H	Boraginaceae	+
<i>Anemone nemorosa</i> L.	subBoreal	H	Ranunculaceae	
<i>Anemone ranunculoides</i> L.	Eur-subMed	H	Ranunculaceae	
<i>Anemone sylvestris</i> L.	Eur-As	H	Ranunculaceae	
<i>Angelica sylvestris</i> L.	Eur-Sib	H	Apiaceae	
<i>Anthemis cotula</i> L.	Med	H	Asteraceae	+
<i>Anthoxanthum aristatum</i> Boiss.	Eur	H	Poaceae	
<i>Anthriscus cereifolium</i> (L.) Hoffm.	Eur-Med	Th	Apiaceae	+
<i>Anthyllisvulneraria</i> L.	Eur-Med	H	Fabaceae	

<i>Arctium minus</i> (Hill) Bernh.	Eur-As	H	Asteraceae	+
<i>Arctium tomentosum</i> Mill.	Eur-Med	H	Asteraceae	
<i>Aristolochia clematitis</i> L.	Eur-Med	H	Aristolochiaceae	+
<i>Artemisia absinthium</i> L.	Pont-Med	H	Asteraceae	
<i>Artemisia alba</i> Turra	subMed	H	Asteraceae	
<i>Artemisia annua</i> L.	Eur-Med	Th	Asteraceae	
<i>Artemisia campestris</i> L.	Eur-Sib	H	Asteraceae	
<i>Artemisia vulgaris</i> L.	subBoreal	H	Asteraceae	+
<i>Arum maculatum</i> L.	Eur-subMed	G	Araceae	+
<i>Asarum europaeum</i> L.	Eur-Sib	H	Aristolochiaceae	
<i>Asparagus officinalis</i> L.	Eur	G	Liliaceae	
<i>Asphodelus albus</i> Mill.	subMed	G	Liliaceae	
<i>Asplenium ceterach</i> L.	subMed	H	Asclepiadaceae	
<i>Asplenium ruta-muraria</i> L.	Boreal	H	Asclepiadaceae	
<i>Hyssopus officinalis</i> L.	Kos	H	Asclepiadaceae	
<i>Astragalus glycyphylloides</i> DC.	subMed	H	Fabaceae	
<i>Astragalus glycyphyllos</i> L.	SPont	H	Fabaceae	
<i>Atriplex rosea</i> L.	Eur-As	Th	Chenopodiaceae	+
<i>Atropa bella-donna</i> L.	Eur	H	Solanaceae	
<i>Ballota nigra</i> L.	Eur-Med	H	Lamiaceae	+
<i>Barbarea vulgaris</i> R. Br.	Eur-As	H	Brassicaceae	
<i>Bellis perennis</i> L.	Eur-As	H	Asteraceae	
<i>Berberis vulgaris</i> L.	Eur-Med	Ph	Berberidaceae	+
<i>Betonica officinalis</i> L.	subMed	H	Lamiaceae	
<i>Bidens tripartite</i> L.	Boreal	Th	Asteraceae	
<i>Bifora radians</i> M. Bieb.	Eur-Med	Th	Apiaceae	+
<i>Bistorta officinalis</i> Delarbre	Eur-As	H	Polygonaceae	
<i>Brassica nigra</i> (L.) K. Koch	Kos	Th	Brassicaceae	+
<i>Briza media</i> L.	subMed	H	Poaceae	

<i>Bryonia alba</i> L.	Eur-OT	H	Cucurbitaceae	+
<i>Buglossoides arvensis</i> (L.) I. M. Johnst.	Eur-As	Th	Boraginaceae	
<i>Bupleurum rotundifolium</i> L.	Eur-As	Th	Apiaceae	+
<i>Calystegia sepium</i> (L.) R. Br.	Med	H	Convolvulaceae	
<i>Campanula persicifolia</i> L.	Eur-Sib	H	Campanulaceae	
<i>Capsella bursa-pastoris</i> Medik.	Kos	H	Brassicaceae	+
<i>Cardamine bulbifera</i> (L.) Crantz	subBoreal	H	Brassicaceae	
<i>Carduus acanthoides</i> L.	Eur	H	Asteraceae	+
<i>Carlina acanthifolia</i> All.	Eur	H	Asteraceae	+
<i>Carlina vulgaris</i> L.	Eur-Med	H	Asteraceae	
<i>Carpinus betulus</i> L.	Eur-subMed	Ph	Betulaceae	
<i>Carthamus lanatus</i> L.	subMed	Th	Asteraceae	+
<i>Carum carvi</i> L.	Eur-As	H	Apiaceae	+
<i>Centaurea calcitrapa</i> L.	Med	H	Asteraceae	+
<i>Centaurea jacea</i> L. ssp. <i>banatica</i> (Roch.) Hayek	Eur	H	Asteraceae	
<i>Centaurea solstitialis</i> L.	Eur-Ned	H	Asteraceae	+
<i>Centaurium erythraea</i> Rafn.	subMed	H	Gentianaceae	
<i>Cerinthe minor</i> L.	Pont-Med	H	Boraginaceae	
<i>Chelidonium majus</i> L.	Eur-As	H	Papaveraceae	+
<i>Chenopodium album</i> L.	Kos	Th	Chenopodiaceae	+
<i>Chenopodium bonus-henricus</i> L.	Alp-Med	H	Chenopodiaceae	
<i>Chenopodium hybridum</i> L.	Boreal	Th	Chenopodiaceae	+
<i>Chenopodium polyspermum</i> L.	Eur-Sib	Th	Chenopodiaceae	
<i>Chenopodium rubrum</i> L.	subBoreal	Th	Chenopodiaceae	+
<i>Chenopodium vulvaria</i> L.	Eur-As	Th	Chenopodiaceae	+
<i>Cichorium intybus</i> L.	Eur-Sib	H	Asteraceae	+
<i>Clematis recta</i> L.	subMed	H	Ranunculaceae	
<i>Clematis vitalba</i> L.	Eur	Ph	Ranunculaceae	

<i>Clinopodium acinos</i> (L.) Kundze	Eur-Med	H	Lamiaceae	
<i>Clinopodium nepeta</i> (L.) Kuntze	Eur-Med	H	Lamiaceae	
<i>Clinopodium suaveolens</i> (Sm.) Kundze	subMed	Th	Lamiaceae	
<i>Clinopodium vulgare</i> L.	subBoreal	H	Lamiaceae	
<i>Colchicum autumnale</i> L.	Eur	G	Liliaceae	
<i>Colutea arborescens</i> L.	subMed	Ph	Fabaceae	
<i>Conium maculatum</i> L.	Eur-As	H	Apiaceae	+
<i>Convallaria majalis</i> L.	Boreal	G	Liliaceae	
<i>Convolvulus arvensis</i> L.	Kos	H	Convolvulaceae	+
<i>Cormus domestica</i> (L.) Spach	Eur-Med	Ph	Rosaceae	
<i>Cornus mas</i> L.	subBoreal	Ph	Cornaceae	
<i>Coronilla scorpioides</i> (L.) Koch	subMed	Th	Fabaceae	+
<i>Coronilla varia</i> L.	Eur-Med	H	Fabaceae	+
<i>Corydalis solida</i> (L.) Clairv.	Eur-Med-Cas	G	Fumariaceae	
<i>Corylus avellana</i> L.	Med-CAs	Ph	Corylaceae	
<i>Cota tinctoria</i> L. (J.) Gay.	Eur-Sib	H	Asteraceae	+
<i>Cotinus coggigria</i> Scop.	Med-As	Ph	Anacardiaceae	
<i>Crataegus monogyna</i> Jacq.	subBoreal	Ph	Rosaceae	
<i>Crataegus pentagyna</i> Waldst. & Kit. ex Willd.	subMed	Ph	Rosaceae	
<i>Cruciata laevipes</i> Opiz.	Med-CAs	H	Rubiaceae	+
<i>Cuscuta europaea</i> L.	subBoreal	Th	Cuscutaceae	+
<i>Cyanus segetum</i> Hill	Eur-Med	Th	Asteraceae	+
<i>Cytisus hirsutus</i> L.	Eur-Sib	Ph	Fabaceae	
<i>Datura stramonium</i> L.	Am (Adv)	Th	Solanaceae	+
<i>Delphinium consolida</i> L.	Eur-Med	Th	Ranunculaceae	+
<i>Dictamnus albus</i> L.	Eur-As	H	Rutaceae	
<i>Digitalis ferruginea</i> L.	subMed	H	Scrophulariaceae	
<i>Digitalis grandiflora</i> Mill.	Eur-Sib	H	Scrophulariaceae	

<i>Digitalis lanata</i> Ehrh.	subMed	H	Scrophulariaceae	+
<i>Dioscorea communis</i> (L.) Caddick & Wilkin	subMed	H	Dioscoreaceae	
<i>Diplotaxis tenuifolia</i> (L.) DC.	Eur-Med	H	Brassicaceae	+
<i>Doronicum columnae</i> Ten.	Pont-Med	H	Asteraceae	
<i>Dryocallis rupestris</i> (L.) Soják	Boreal	H	Rosaceae	
<i>Dryopteris filix-mas</i> (L.) Schott	Boreal	H	Aspidiaceae	
<i>Dysphania botrys</i> (L.) Mosyakin & Clemants	Boreal	Th	Chenopodiaceae	
<i>Echinops sphaerocephalus</i> L.	Eur-Med	H	Asteraceae	+
<i>Echium italicum</i> L.	subMed	H	Boraginaceae	+
<i>Echium vulgare</i> L.	Eur-As	H	Boraginaceae	+
<i>Equisetum arvense</i> L.	Boreal	G	Equisetaceae	+
<i>Equisetum palustre</i> L.	Boreal	G	Equisetaceae	+
<i>Erodium cicutarium</i> (L.) L' Hér.	Pont-Med	H	Apiaceae	+
<i>Eryngium campestre</i> L.	Pont-Med	H	Apiaceae	
<i>Euonymus europaeus</i> L.	Eur-As	Ph	Celastraceae	
<i>Euonymus verrucosus</i> Scop.	Eur-Med	Ph	Celastraceae	
<i>Euphorbia cyparissias</i> L.	Eur	H	Euphorbiaceae	
<i>Euphorbia myrsinites</i> L.	subMed	H	Euphorbiaceae	
<i>Euphrasia officinalis</i> L. ssp. <i>pratensis</i> Fr.	Eur-As	Th	Orobanchaceae	
<i>Fagus sylvatica</i> L.	Eur	Ph	Fagaceae	
<i>Ferulago sylvatica</i> (Besser) Rchb.	subMed	H	Apiaceae	
<i>Filago germanica</i> (L.) Huds.	Eur-As	Th	Asteraceae	+
<i>Filago lutescens</i> Jord.	Boreal	Th	Asteraceae	+
<i>Filipendula vulgaris</i> Moench	Eur-Med	H	Rosaceae	
<i>Foeniculum vulgare</i> Mill.	subMed	H	Apiaceae	
<i>Fragaria vesca</i> L.	subBoreal	H	Rosaceae	
<i>Fraxinus excelsior</i> L.	Eur-Med	Ph	Oleaceae	
<i>Fraxinus ornus</i> L.	subMed	Ph	Oleaceae	
<i>Fumaria officinalis</i> L.	Eur-Sib	Th	Fumariaceae	

<i>Fumaria vaillantii</i> Loisel.	Eur-Cas	Th	Fumariaceae	+
<i>Galega officinalis</i> L.	Pont-Med	H	Fabaceae	+
<i>Galeopsis ladanum</i> L.	Eur-As	Th	Lamiaceae	+
<i>Galeopsis tetrachit</i> L.	Eur-As	Th	Lamiaceae	
<i>Galinsoga parviflora</i> Cav.	SAm (Adv)	Th	Asteraceae	+
<i>Galium aparine</i> L.	Eur-As	Th	Rubiaceae	+
<i>Galium lucidum</i> All.	subMed	H	Rubiaceae	
<i>Galium odoratum</i> (L.) Scop.	subMed	H	Rubiaceae	
<i>Galium verum</i> L.	Eur-As	H	Rubiaceae	
<i>Genista sagittalis</i> L.	Eur	Ph	Fabaceae	
<i>Genista ovata</i> Waidst. & Kit.	Eur	Ph	Fabaceae	
<i>Genista tinctoria</i> L.	Eur-Sib	Ph	Fabaceae	
<i>Gentiana cruciate</i> L.	Eur-Sib	H	Gentianaceae	
<i>Geranium pyrenaicum</i> Burm. f.	subMed	H	Geraniaceae	
<i>Geranium robertianum</i> L.	subBoreal	H	Geraniaceae	
<i>Geranium sanguineum</i> L.	Eur	H	Geraniaceae	
<i>Geum urbanum</i> L.	subBoreal	H	Rosaceae	
<i>Gladiolus communis</i> L.	Med	G	Iridaceae	
<i>Glechoma hederacea</i> L.	Eur-As	H	Lamiaceae	
<i>Glechoma hirsuta</i> Waldst. & Kit.	Eur-Med	H	Lamiaceae	
<i>Globularia bisnagarica</i> L.	Eur	H	Globulariaceae	
<i>Gratiola officinalis</i> L.	Eur-Med	H	Scrophulariaceae	+
<i>Gymnadenia conopsea</i> (L.) R. Br.	Eur-As	G	Orchidaceae	
<i>Hedera helix</i> L.	Eur-As	Ph	Araliaceae	
<i>Heliotropium europaeum</i> L.	subMed	Th	Boraginaceae	+
<i>Helleborus odoratus</i> Waldst. & Kit. Ex Willd.	Eur-SMed	H	Ranunculaceae	
<i>Heracleum sphondylium</i> L. ssp. <i>sibiricum</i> (L.) Simonk.	Eur-As	H	Apiaceae	+
<i>Herniaria glabra</i> L.	Eur-As	H	Caryophyllaceae	+

<i>Herniaria hirsuta</i> L.	Eur-As	H	Caryophyllaceae	+
<i>Herniaria incana</i> Lam.	Eur-Med	H	Caryophyllaceae	+
<i>Himanthoglossum calcaratum</i> (Beck) Schltr.	Med	G	Orchidaceae	
<i>Hylotelephium maximum</i> (L.) Holub	subBoreal	H	Crassulaceae	
<i>Hyoscyamus niger</i> L.	Eur-As	H	Solanaceae	
<i>Hypericum maculatum</i> Crantz	Boreal	H	Hypericaceae	
<i>Hypericum perforatum</i> L.	Kos	H	Hypericaceae	
<i>Hypochaeris radicata</i> L.	Eur-Med	H	Asteraceae	
<i>Hyssopus officinalis</i> L. ssp. <i>aristatus</i> (Godr.) Briq	Eur-As	H	Lamiaceae	
<i>Inula aschersoniana</i> Janka	Bal	H	Asteraceae	
<i>Inula ensifolia</i> L.	Eur-Med	H	Asteraceae	
<i>Inula germanica</i> L.	subMed	H	Asteraceae	
<i>Inula helenium</i> L.	Eur-Med	H	Asteraceae	+
<i>Iris graminea</i> L.	Pont-Med	G	Iridaceae	
<i>Isopyrum thalictroides</i> L.	Eur	H	Ranunculaceae	
<i>Juncus inflexus</i> L.	subBoreal	H	Juncaceae	
<i>Juniperus communis</i> L.	subBoreal	Ph	Cupressaceae	
<i>Juniperus communis</i> L. var. <i>saxatilis</i> Pall	Boreal	Ph	Cupressaceae	
<i>Juniperus oxycedrus</i> L.	Med	Ph	Cupressaceae	
<i>Kickxia elatine</i> (L.) Dumort.	subMed	Th	Scrophulariaceae	+
<i>Kickxia spuria</i> (L.) Dumort.	subMed	Th	Scrophulariaceae	+
<i>Knautia arvensis</i> (L.) Coult.	Eur-Sib	H	Dipsacaceae	
<i>Lactuca serriola</i> L.	Eur-As	H	Asteraceae	+
<i>Lamium maculatum</i> (L.) L.	subBoreal	H	Lamiaceae	+
<i>Lamium purpureum</i> L.	Eur-Med	Th	Lamiaceae	+
<i>Laser trilobum</i> (L.) Borkh.	Eur-Med	H	Apiaceae	
<i>Lathraea squamaria</i> L.	Eur-As	H	Scrophulariaceae	
<i>Lathyrus niger</i> (L.) Bernh.	Eur-Med	H	Fabaceae	

<i>Lathyrus pratensis</i> L.	subBoreal	H	Fabaceae	
<i>Lathyrus sativus</i> L.	subMed	Th	Fabaceae	+
<i>Lathyrus sylvestris</i> L.	Eur-SMed	H	Fabaceae	
<i>Lathyrus tuberosus</i> L.	Eur-As	H	Fabaceae	+
<i>Lathyrus vernus</i> (L.) Bernh.	Eur-Sib	H	Fabaceae	
<i>Lemna minor</i> L.	Kos	H	Lemnaceae	
<i>Leonurus cardiaca</i> L.	Eur-As	H	Lamiaceae	+
<i>Lepidium campestre</i> (L.) W. T. Aitom	Eur-SMed	H	Brassicaceae	+
<i>Lepidium graminifolium</i> L.	Eur-Med	H	Brassicaceae	+
<i>Lepidium perfoliatum</i> L.	Eur-Cas	H	Brassicaceae	+
<i>Lepidium ruderalis</i> L.	Eur-As	H	Brassicaceae	+
<i>Leucanthemum vulgare</i> Lam.	Eur-Sib	H	Asteraceae	
<i>Ligustrum vulgare</i> L.	subMed	Ph	Oleaceae	
<i>Lilium martagon</i> L.	Eur-As	G	Liliaceae	
<i>Linaria vulgaris</i> Mill.	Eur-Sib	H	Scrophulariaceae	+
<i>Linum catharticum</i> L.	subBoreal	Th	Linaceae	
<i>Lithospermum officinale</i> L.	Eur-As	H	Boraginaceae	+
<i>Lolium temulentum</i> L.	Boreal	H	Poaceae	+
<i>Lonicera xilostemum</i> L.	Eur-Sib	Ph	Caprifoliaceae	
<i>Lotus corniculatus</i> L.	Eur-Med	Ph	Fabaceae	
<i>Lycopus europaeus</i> L.	Eur-As	H	Lamiaceae	
<i>Lysimachia nummularia</i> L.	Eur	H	Primulaceae	
<i>Lythrum salicaria</i> L.	subBoreal	H	Lythraceae	
<i>Lythrum virgatum</i> L.	Eur-As	H	Lythraceae	
<i>Malus sylvestris</i> (L.) Mill.	Eur	Ph	Rosaceae	
<i>Malva neglecta</i> Wallr.	subMed	H	Malvaceae	+
<i>Malva pusilla</i> Sm.	Eur-As	H	Malvaceae	+
<i>Malva thuringiaca</i> Vis.	Pont-Med	H	Malvaceae	
<i>Marrubium peregrinum</i> L.	subMed	H	Lamiaceae	

<i>Marrubium vulgare</i> L.	Eur-As	H	Lamiaceae	
<i>Malus sylvestris</i> (L.) Mill.	Eur	Ph	Rosaceae	+
<i>Melilotus albus</i> Medik.	subBoreal	Th	Fabaceae	+
<i>Melilotus officinalis</i> (L.) Pall.	Eur-As	Th	Fabaceae	+
<i>Melittis melissophyllum</i> L.	Eur	H	Lamiaceae	
<i>Mentha aquatica</i> L.	Boreal	H	Lamiaceae	
<i>Mentha arvensis</i> L.	Eur-As	H	Lamiaceae	
<i>Mentha longifolia</i> (L.) L.	Eur-Sib	H	Lamiaceae	
<i>Mentha pulegium</i> L.	Eur-As	H	Lamiaceae	
<i>Mentha spicata</i> L.	Eur	H	Lamiaceae	
<i>Mercurialis perennis</i> L.	subMed	H	Euphorbiaceae	
<i>Minuartia setacea</i> (Thuill.) Hayek	Pont	H	Caryophyllaceae	
<i>Mummenhoffia alliacea</i> (L.) Esmailbegi & Al-Shehbaz	subMed	Th	Brassicaceae	+
<i>Nasturtium officinale</i> R. Br.	Eur-As	H	Boraginaceae	
<i>Neotinea tridentata</i> (Scop.) R.M.Bateman, Pridgeon & M.W.Chase	Eur-subMed	G	Orchidaceae	
<i>Neotinea ustulate</i> (L.) R.M.Bateman, Pridgeon & M.W.Chase	Eur-Sib	G	Orchidaceae	
<i>Nepeta cataria</i> L.	Eur-As	H	Lamiaceae	+
<i>Nigella arvensis</i> L.	Eur-Med	Th	Ranunculaceae	+
<i>Onopordum acanthium</i> L.	Eur-Med	Th	Asteraceae	+
<i>Onopordum tauricum</i> Willd.	Med	Th	Asteraceae	
<i>Orchis militaris</i> L.	Pont-Med	G	Orchidaceae	
<i>Orchis pallens</i> L.	SPont	G	Orchidaceae	
<i>Orchis purpurea</i> Huds.	subMed	G	Orchidaceae	
<i>Orchis simia</i> Lam.	subMed	G	Orchidaceae	
<i>Origanum vulgare</i> L. ssp. <i>vulgare</i>	Eur-As	H	Lamiaceae	
<i>Papaver rhoeas</i> L.	Eur-Sib	Th	Papaveraceae	+

<i>Parietaria officinalis</i> L.	Eur	H	Urticaceae	
<i>Persicaria hydropiper</i> (L.) Delarbre	Eur-As	Th	Polygonaceae	
<i>Petasites hybridus</i> (L.) G. Gaertn. & al.	Eur	H	Asteraceae	
<i>Peucedanum cervaria</i> (L.) Lapeyr	subMed	H	Apiaceae	
<i>Phlomis tuberosa</i> (L.) Moench	Eur-Sib	H	Lamiaceae	
<i>Pilosella officinarum</i> F. W. Schultz & Sch. Bip.	Eur-Med	H	Asteraceae	
<i>Pimpinella saxifraga</i> L.	Eur-As	H	Apiaceae	
<i>Plantago indica</i> L.	Eur-Sib	Th	Plantaginaceae	
<i>Plantago lanceolata</i> L.	Kos	H	Plantaginaceae	
<i>Plantago major</i> L.	Boreal	H	Plantaginaceae	+
<i>Plantago media</i> L.	Boreal	H	Plantaginaceae	
<i>Plantago subulata</i> L.	Med	H	Plantaginaceae	
<i>Polygala major</i> Jacq.	Eur-Sib	H	Polygalaceae	+
<i>Polygala vulgaris</i> L.	Eur-Med	H	Polygalaceae	
<i>Polygonatum multiflorum</i> (L.) All.	Boreal	G	Liliaceae	
<i>Polygonatum odoratum</i> (Mill.) Druce	Eur-Sib	G	Liliaceae	
<i>Polygonum arenastrum</i> Boreau	Kos	Th	Polygonaceae	+
<i>Polygonum aviculare</i> L.	Kos	Th	Polygonaceae	+
<i>Polypodium vulgare</i> L.	Boreal	G	Polypodiaceae	
<i>Pontechium maculatum</i> (L.) Böhle & Hilger	subMed	H	Boraginaceae	
<i>Populus nigra</i> L.	Eur-As	Ph	Salicaceae	
<i>Populus tremula</i> L.	subBoreal	Ph	Salicaceae	
<i>Potentilla argentea</i> L.	SPont	H	Rosaceae	
<i>Potentilla erecta</i> (L.) Raeusch.	subBoreal	H	Rosaceae	
<i>Potentilla reptans</i> L.	Kos	H	Rosaceae	
<i>Primula veris</i> L.	Eur-Med	H	Primulaceae	
<i>Prunella vulgaris</i> L.	Kos	H	Lamiaceae	
<i>Prunus mahaleb</i> L.	Eur-Med	Ph	Rosaceae	

<i>Prunus spinosa</i> L.	Spont	Ph	Rosaceae	
<i>Pseudopodospermum hispanicum</i> (L.) Zaika, Sukhor. & N.Kilian	Med	H	Asteraceae	
<i>Pteridium aquilinum</i> (L.) Kuhn.	Kos	H	Hypolepidaceae	+
<i>Pulicaria dysenterica</i> (L.) Bernh.	Eur-Med	Th	Asteraceae	+
<i>Pulicaria vulgaris</i> Gaertn.	Eur-As	Th	Asteraceae	+
<i>Pulmonaria mollis</i> Hornem.	Eur	H	Boraginaceae	
<i>Pulmonaria officinalis</i> L.	Eur	H	Boraginaceae	
<i>Quercus frainetto</i> Ten.	Eur	Ph	Fagaceae	
<i>Ranunculus ficaria</i> L.	Eur-Sib	H	Ranunculaceae	
<i>Ranunculus polyanthemus</i> L.	Eur-subMed	H	Ranunculaceae	
<i>Ranunculus sceleratus</i> L.	Eur-Med	H	Ranunculaceae	+
<i>Raphanus raphanistrum</i> L.	Eur-Sib	Th	Brassicaceae	+
<i>Reseda lutea</i> L.	subBoreal	H	Resedaceae	+
<i>Rhamnus cathartica</i> L.	Eur-As	Ph	Rhamnaceae	
<i>Ribes uva-crispa</i> L.	subMed	Ph	Grossulariaceae	
<i>Rosa corymbifera</i> Borkh.	Eur-As	Ph	Rosaceae	
<i>Rosa gallica</i> L.	Eur-Med	Ph	Rosaceae	
<i>Rubus caesius</i> L.	Eur-As	Ph	Rosaceae	
<i>Rubus idaeus</i> L.	subBoreal	Ph	Rosaceae	
<i>Rumex acetosella</i> L.	Eur-subMed	H	Polygonaceae	+
<i>Rumex pulcher</i> L.	Eur-As	H	Polygonaceae	+
<i>Salix alba</i> L.	Eur-As	Ph	Salicaceae	
<i>Salix caprea</i> L.	subBoreal	Ph	Salicaceae	
<i>Salix purpurea</i> L.	Eur-Med-Cas	Ph	Salicaceae	
<i>Salvia aethiopsis</i> L.	Eur-As	H	Lamiaceae	+
<i>Salvia glutinosa</i> L.	Eur-As	H	Lamiaceae	
<i>Salvia nemorosa</i> L.	Eur-OT	H	Lamiaceae	
<i>Salvia pratensis</i> L.	Eur-Med	H	Lamiaceae	+

<i>Salvia sclarea</i> L.	Med-As	H	Lamiaceae	+
<i>Salvia verticillate</i> L.	subMed	H	Lamiaceae	+
<i>Sambucus ebulus</i> L.	Eur-Med	Ch	Caprifoliaceae	+
<i>Sambucus nigra</i> L.	Eur-Med	Ph	Caprifoliaceae	
<i>Sanguisorba minor</i> Scop.	subBoreal	Ch	Rosaceae	
<i>Sanguisorba officinalis</i> L.	subBoreal	H	Rosaceae	
<i>Sanicula europaea</i> L.	Eur-Sib	H	Apiaceae	
<i>Saponaria officinalis</i> L.	Eur-Sib	H	Caryophyllaceae	
<i>Satureja montana</i> L. ssp. <i>kitaibelii</i> (Wierzb. Ex heuffel) P.W. Ball.	Pont-Med	Ch	Lamiaceae	
<i>Saxifraga bulbifera</i> L.	subMed	H	Saxifragaceae	
<i>Saxifraga rotundifolia</i> L.	subMed	H	Saxifragaceae	
<i>Scabiosa ochroleuca</i> L.	Eur-Sib	H	Dipsacaceae	
<i>Scilla bifolia</i> L.	Pont-subMed	G	Liliaceae	
<i>Scleranthus annuus</i> L.	Eur-Sib	H	Caryophyllaceae	+
<i>Scleranthus perennis</i> L.	Eur-Med	H	Caryophyllaceae	
<i>Sclerochloa dura</i> (L.) P. Beauv.	Eur-As	H	Poaceae	
<i>Scrophularia canina</i> L.	Eur-Med	H	Scrophulariaceae	+
<i>Scrophularia nodosa</i> L.	subBoreal	H	Scrophulariaceae	+
<i>Scutellaria altissima</i> L.	Eur	H	Lamiaceae	
<i>Sedum acre</i> L.	Eur-Med	H	Crassulaceae	
<i>Sedum album</i> L.	subMed	H	Crassulaceae	
<i>Sempervivum marmoreum</i> Griseb.	subMed	H	Crassulaceae	
<i>Senecio vulgaris</i> L.	Eur-As	Th	Asteraceae	+
<i>Seseli rigidum</i> Waldst. & Kit.	subMed	H	Apiaceae	
<i>Sideritis montana</i> L.	subMed	H	Lamiaceae	+
<i>Silene coronaria</i> (L.) Claivr.	Med-OT	H	Caryophyllaceae	
<i>Silene otites</i> (L.) Wibel	Eur-Med	H	Caryophyllaceae	
<i>Silene viscaria</i> Jess.	Eur-Sib	H	Caryophyllaceae	

<i>Siler montanum</i> Crantz	subMed	H	Apiaceae	
<i>Sisymbrium loeselii</i> L.	Eur-As	Th	Brassicaceae	+
<i>Sisymbrium officinale</i> (L.) Scop.	Eur-Sib	H	Brassicaceae	
<i>Solanum dulcamara</i> L.	Eur-As	H	Solanaceae	+
<i>Solanum nigrum</i> L.	Kos	Th	Solanaceae	+
<i>Sparganium erectum</i> L.	Boreal	G	Sarganiaceae	
<i>Spergularia rubra</i> (L.) J. Presl & C. Presl	subBoreal	H	Caryophyllaceae	
<i>Spirodela polyrrhiza</i> (L.) Schleid.	Kos	H	Lemnaceae	
<i>Stachys annua</i> (L.) L.	Eur-As	Th	Lamiaceae	+
<i>Stachys germanica</i> L.	Eur-subMed	H	Lamiaceae	+
<i>Stachys recta</i> L.	Eur-Med	H	Lamiaceae	
<i>Stellaria graminea</i> L.	Eur-As	H	Caryophyllaceae	
<i>Stellaria media</i> (L.) Vill.	Kos	H	Caryophyllaceae	+
<i>Succisa pratensis</i> Moench	Eur	H	Dipsacaceae	
<i>Silybum marianum</i> (L.) Gaerth.	Med	Th	Asteraceae	+
<i>Symphytum officinale</i> L.	Eur-As	H	Boraginaceae	+
<i>Syringa vulgaris</i> L.	Carp-Bal	Ph	Oleaceae	
<i>Tanacetum vulgare</i> L.	Eur-Sib	H	Asteraceae	
<i>Taraxacum officinale</i> (L.) Weber ex F.H.Wigg.	Eur-Med	H	Asteraceae	
<i>Telekia speciosa</i> (Schreb.) Baumg.	subMed	H	Asteraceae	
<i>Teucrium chamaedrys</i> L.	subMed	H	Lamiaceae	
<i>Teucrium montanum</i> L.	subMed	H	Lamiaceae	
<i>Teucrium polium</i> L.	Pont-Med	H	Lamiaceae	
<i>Thalictrum minus</i> L.	Eur-Sib	H	Ranunculaceae	
<i>Thlaspi arvense</i> L.	Eur-As	H	Brassicaceae	+
<i>Thymus callieri</i> Borbás ex Velen.	Pont	H	Lamiaceae	
<i>Thymus glabrescens</i> Willd.	Eur	H	Lamiaceae	
<i>Thymus longicaulis</i> C. Presl.	Med	H	Lamiaceae	

<i>Thymus longidentatus</i> (Degen & Urum.) Ronniger	Bal	Ch	Lamiaceae	
<i>Thymus pulegioides</i> L.	Eur	Ch	Lamiaceae	
<i>Thymus sibthorpii</i> Benth.	Bal-Dac	H	Lamiaceae	
<i>Thymus striatus</i> Vahl.	subMed	H	Lamiaceae	
<i>Tilia cordata</i> Mill.	Eur	Ph	Tiliaceae	
<i>Tilia platyphyllos</i> Scop.	Eur	Ph	Tiliaceae	
<i>Tilia tomentosa</i> Moench	Eur-Med	Ph	Tiliaceae	
<i>Tordylium maximum</i> L.	subMed	H	Apiaceae	+
<i>Torilis arvensis</i> (Huds.) Link	Eur-As	Th	Apiaceae	
<i>Torminalis glaberrima</i> (Gand.) Sennikov & Kurtto	Pont-Med	Ph	Rosaceae	
<i>Tragopogon pratensis</i> L.	Eur-Med	H	Asteraceae	+
<i>Trifolium alpestre</i> L.	Eur-Sib	H	Fabaceae	+
<i>Trifolium arvense</i> L.	Eur-Sib	Th	Fabaceae	
<i>Trifolium pannonicum</i> Jacq.	subMed	H	Fabaceae	
<i>Trifolium pratense</i> L.	subBoreal	H	Fabaceae	
<i>Trifolium repens</i> L.	Eur-Sib	H	Fabaceae	
<i>Trigonella coerulea</i> (L.) Ser.	Eur-Med	Th	Fabaceae	+
<i>Trigonella procumbens</i> (Besser) Rchb.	Pont-Med	Th	Fabaceae	+
<i>Tripleurospermum tenuifolium</i> Freyn ex Freyn & E.Brandis	Med	H	Asteraceae	
<i>Tussilago farfara</i> L.	Eur-As	H	Asteraceae	+
<i>Typha angustifolia</i> L.	Kos	H	Typhaceae	
<i>Ulmus glabra</i> Huds.	Eur-Med	Ph	Ulmaceae	
<i>Urtica urens</i> L.	Boreal	H	Urticaceae	+
<i>Valeriana officinalis</i> L.	Eur-Sib	H	Valerianaceae	
<i>Valerianella coronata</i> (L.) DC.	Eur-Med	Th	Valerianaceae	
<i>Veratrum nigrum</i> L.	Eur-As	G	Liliaceae	

<i>Verbascum densiflorum</i> Bertol.	subMed	H	Scrophulariaceae	+
<i>Verbascum nigrum</i> L.	Pont-Cas	H	Scrophulariaceae	
<i>Verbascum phlomoides</i> L.	Eur	H	Scrophulariaceae	+
<i>Verbascum phoeniceum</i> L.	Eur-Sib	H	Scrophulariaceae	+
<i>Verbena officinalis</i> L.	Kos	H	Verbenaceae	+
<i>Veronica arvensis</i> L.	Eur-Sib	Th	Scrophulariaceae	+
<i>Veronica austriaca</i> L.	Eur-Med	H	Scrophulariaceae	+
<i>Veronica beccabunga</i> L.	Eur-As	H	Scrophulariaceae	+
<i>Veronica chamaedrys</i> L.	Eur-As	H	Scrophulariaceae	+
<i>Veronica officinalis</i> L.	Eur-Sib	H	Scrophulariaceae	+
<i>Veronica orchidea</i> Crantz	Eur	H	Scrophulariaceae	
<i>Veronica prostrata</i> L.	Eur	H	Scrophulariaceae	
<i>Vicia cracca</i> L.	Eur-As	H	Fabaceae	+
<i>Vicia grandiflora</i> Scop.	subMed	H	Fabaceae	+
<i>Vicia sativa</i> L.	Eur-Med	Th	Fabaceae	+
<i>Vinca herbacea</i> Waldst. & Kit.	Eur-Med	Ch	Apocynaceae	
<i>Vincetoxicum hirundinaria</i> Medik.	Eur-Sib	H	Asclepiadaceae	+
<i>Viola hirta</i> L.	Eur-As	H	Violaceae	
<i>Viola odorata</i> L.	Eur-Med	H	Violaceae	
<i>Viola tricolor</i> L.	Eur-As	Th	Violaceae	+
<i>Xanthium spinosum</i> L.	Kos	Th	Asteraceae	+
<i>Xanthium strumarium</i> L.	Eur	Th	Asteraceae	+
<i>Xeranthemum annuum</i> L.	subMed	Th	Asteraceae	+