

Biodiversity and resource assessment of medicinal plants of the Bezden-Ponorsko Plateau and Beledie Han area (Western Stara Planina), Bulgaria

Antonina A. Vitkova¹, Alexander N. Tashev² & Kiril V. Vassilev¹

¹ Institute of Biodiversity and Ecosystem Research, Department of Plant and Fungal Diversity and Resources, BAS, Sofia. 1113 Sofia, Acad. Georgi Bonchev Str. bl. 23; e-mail: avitkova@bio.bas.bg (corresponding author); kiril5914@abv.bg

² Faculty of Forestry, University of Forestry, 1797 Sofia, 10 Kliment Ochridski Bld.10; e-mail: altashev@abv.bg

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Abstract. Two hundred and fifty medicinal plants belonging to 189 genera and 65 families were found in the area of Bezden-Ponorsko Plateau and Beledie Han. Twenty-eight species are of conservation significance. Two species are covered by the Bern Convention. The Bulgarian Biodiversity Act included 17 of the recorded species, two are subject to the Directive 92/43/EEC, six are regulated by CITES, and three are included in the *Red Data Book* of Bulgaria. Eleven species have a special mode of protection and use under the Bulgarian Medicinal Plants Act. The operational stocks of 10 medicinal plants have been determined, four of them with economically significant resources.

Key words: Calcareous terrains, habitats, medicinal plants, protected species, resources

Introduction

The Bezden-Ponorsko Plateau (eastern part) and Beledie Han area are part of Mt Mala Planina and the Western Balkan Range. According to Bulgarian climatic division (Velev & Velev 2002), it falls into the Temperate-Continental Region. Limestone rocks in the region are responsible for the karst forms of the relief. Water resources are provided mainly by the rainfalls, and only river Kriva Reka and its tributaries run across the area. The soil cover consists mainly of rendsina, brown forest, leached cinnamonic, cinnamonic forest, and meadow cinnamonic soils (Ninov 2002). According to the geobotanical division of Bulgaria, the study area is situated in the Sofia region (Bondev 1997). The territory is covered by well-preserved grassland, shrubland and woodland calcareous vegetation, which has been investigated by Velchev (1962), Vassilev (2012) and Vassilev

& al. (2012). According to Vassilev (2012), the calcareous grassland vegetation in the study area is referred to the *Festuco-Brometea* and *Molinio-Arrhenatheretea* classes and *Arrhenatherion elatioris*, *Saturejion montanae*, and *Festucion valesiacae* alliances. Shrubland vegetation, which belongs to the *Rhamno-Prunetea* class (unpublished data), is dominated by *Fraxinus ornus*, *Prunus spinosa*, *Rosa* sp., and *Crataegus monogyna*. Woody vegetation is represented by xerophyllous woodlands dominated by *Quercus pubescens*, *Q. cerris*, *Carpinus orientali* and xero-mesophyllous woodlands, which are formed by *Carpinus betulus*, *Fagus sylvatica* and *Quercus petraea* agg. These two types of woody vegetation are referred to the *Quercetea pubescentis* and *Quercu-Fagetea* classes, respectively. The study area also falls partly into the NATURA 2000 network in Bulgaria. Two Natura 2000 sites (BG0002001 Rayanovtsi

protected by Directive 2009/147/EC and BG0000322 Dragoman protected by Directive 92/43/EEC) cover partly the territory of the research area. Floristic diversity of the region has been studied by Velchev (1962), Russakova & al. (1999), Petrova & Genova (2000), Petrova & Assyov (2008), Vassilev & al. (2008), Petrova & al. (2010), Tashev & al. (2010), Vassilev & al. (2012), and Vasilev (2012). A literature review shows that the species diversity and the medicinal plant resources in the area of Bezden-Ponorsko Plateau and Beledie Han have not been researched up to now. In the last 20 years, Bulgaria has become one of the biggest exporters of herbs in Europe and the world (Lange 1998; Mladenova 2000; Hamilton 2003; Kathe & al. 2003, Evstatieva & al. 2007). The increasing of the amount of the medicinal plants harvested from their natural habitats entailed an increase of the number of studies related to their distribution, mapping of the populations and evaluation of operational stocks. In this connection, surveys have been conducted in different areas, such as the Znepole region (Genova & al. 1996), Central Balkan National Park (Evstatieva & Vitkova 2000), Rila National Park (Vitkova & Evstatieva 2000), Mt Lozenska (Vitkova & Gyurova 2006), Western Stara Planina (Savev 2003, Delcheva & al. 2016), and Mt Chepan (Angelova & Tashev 2004). The present study was carried out in order to extend research into the distribution and resources of medicinal plants in the country.

The following goals were set in this study: (1) investigation of the species diversity of medicinal plants and their resource assessment in the region of Bezden-Ponorsko Plateau (eastern part) and Beledie Han area; (2) identification of areas rich in species of conservation significance and preparation of recommendations for their protection; (3) determination of operational stocks and possible annual yield of medicinal plants with commercially significant resources.

Material and methods

During the period 2008–2014, a research was carried out into the species diversity, distribution and resources of the medicinal plants in the eastern part of the Bezden-Ponorsko Plateau and Beledie Han area. During the field studies, the authors have visited the territories situated southwards of the Bezden-Ponorsko Plateau, in the region of Opitsvet, Bezden and Bogyovtzi villages, and north-eastwards of the Beledie Han, in the area of Tsarichina, Chibaovtzi and Dramsha villages which were also included in the research (Fig. 1). The investigated area covered 70 km². The altitude varied from 564 m a.s.l. at Bezden village, up to 982 m a.s.l. at peak Vartoyno Bardo. The medicinal plants distribution was studied by the transect method. During the field trips, a list of medicinal plants

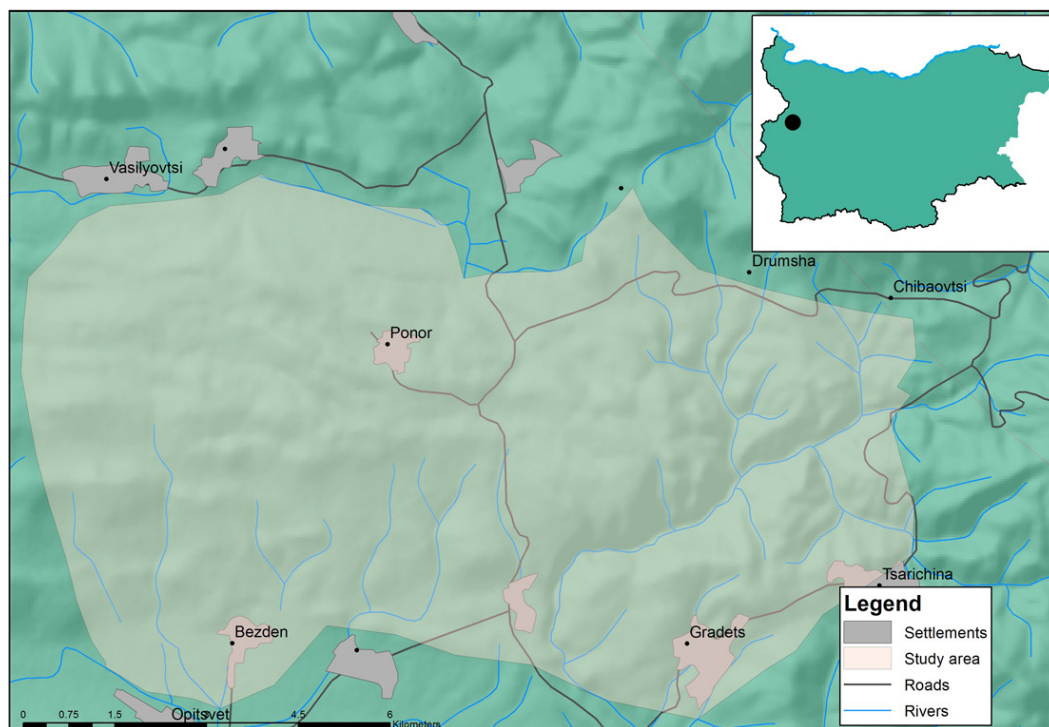


Fig. 1. Study area of Bezden-Ponorsko Plateau (eastern part), Beledie Han and the adjacent territories.

was prepared according to Application to Art. 1 of the Medicinal Plants Act (2000). The plant taxa were identified according to Delipavlov & Cheshmedzhiev (2011) and the *Flora of Bulgaria*, vol. I-XI (Jordanov 1963–1979; Velchev 1982, 1989; Kozuharov 1995; Kozuharov & Anchev 2012). The names of the species follow the *Conspectus of the Bulgarian Vascular Flora* (Asyov & al. 2012). The family names are given according to Angiosperm Phylogeny Group (2016). The medicinal plants encountered in the area are presented in a systematic list in an Appendix to the text. Con-

servation significance of the species was determined by the *Red List of Bulgarian vascular plants* (Petrova & Vladimirov 2009) (RL), *Red Data Book of the Republic of Bulgaria* (Peev & al. 2015) (RDB), Biological Diversity Act (the Act on its Amending and Supplementing) (2007) (BDA), and international normative documents (Bern Convention 1979; Directive 92/43/EEC; CITES 1973). The conservation significant species are presented in Table 1. Habitats of European importance have been determined according to Kavrakova & al. (2005) and Biserkov (2015). All habitat types

Table 1. Medicinal plants of conservation significance in the area of Bezden-Ponorsko Plateau (eastern part), Beledie Han and adjacent territories.

Taxon (group)	RDB, RL	BDA Application №	SRPU	D	BC	CITES
<i>Adonis vernalis</i> L. (III)			prohibited for commercial use			+
<i>Anemone sylvestris</i> L. (I)	Near Threatened (RL)	3				
<i>Asarum europaeum</i> L. (III)			prohibited for commercial use			
<i>Asparagus officinalis</i> L. (II)		4				
<i>Asphodelus albus</i> Mill. (II)		4				
<i>Asplenium trichomanes</i> L. (III)			prohibited for commercial use			
<i>Artemisia alba</i> L. (IV)			an annual quota			
<i>Betonica officinalis</i> L. (IV)			an annual quota			
<i>Carlina acanthifolia</i> All. (IV)			an annual quota			
<i>Dryopteris filix-mas</i> L. (II)		4				
<i>Echium russicum</i> J.E.Gmel. (I)	Vulnerable (RDB, RL)	3		+		
<i>Galium odoratum</i> L. (IV)			an annual quota			
<i>Gladiolus communis</i> L. (II)		4				
<i>Gymnadenia conopsea</i> (L.) R. Br.(III)						+
<i>Himantoglossum caprinum</i> (M. Bieb.) Spreng. (I)	Vulnerable (RDB, RL)	3		+	+	+
<i>Hyssopus officinalis</i> L.(III)			prohibited for commercial use			
<i>Lilium martagon</i> L.(II)		4				
<i>Orchis coriophora</i> L. (II)		4				
<i>Orchis laxiflora</i> Lam (I)	Vulnerable (RL)	3				+
<i>Orchis morio</i> L. (II)		4				+
<i>Orchis purpurea</i> L. (II)		4				+
<i>Paeonia tenuifolia</i> L. (I)	Endangered (RL,RDB)	3				
<i>Polygonatum odoratum</i> (Mill.) Druce (II)		4			+	
<i>Primula veris</i> L. (IV)		4	an annual quota			
<i>Pulsatilla montana</i> (Hopp.) Rchb. (II)		4				
<i>Scilla bifolia</i> L. (II)		4				
<i>Sedum acre</i> L. (IV)			an annual quota			
<i>Valeriana officinalis</i> L. (III)			prohibited for commercial use			

RL – Red List of Bulgarian vascular plants; RDB – Red Data Book of Bulgaria; BDA – Biological Diversity Act (Act on its Amending and Supplementing) (2007); SRPU – Special Regime of Protection and Use according to Medicinal Plants Act (2000)(Order of MOEW RD No. 89/03.02.2017); D – Directive 92/43/EEC; BC – Bern Convention (1979); CITES – Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973), Groups I–V determined according to the conservation status of the species and the possibilities for harvesting of plant materials from their natural populations.

found during field investigations have been mapped for BG0000322 Dragoman site by Tashev & al. (2010). A 1:25000 map of the region was used for the cited localities. The medicinal plants were divided into five groups, according to their conservation significance and capacity for harvesting from their natural populations:

Group One (I): Species covered by the Biological Diversity Act, Supplement 3, strictly forbidden for collection from their natural habitats in the country.

Group Two (II): Species with protection regime and regulated use under the Biological Diversity Act, Supplement 4. The regimes and conditions for their use are set in dependence to the status of their populations.

Group Three (III): Species with a special regime of use, forbidden for commercial use, but permitted for collection for personal needs and in quantities set in the Medicinal Plants Act (2000).

Group Four (IV): Species with a special regime of use permitted for collection for personal needs and commercial purposes, with a regime and regional quotas set every year by the Ministry of Environment and Waters (MoEW).

Group Five (V): Widely distributed species, which could be harvested freely under observation of permissible norms.

The species of Groups III and IV, which are with a special regime of protection and use are given according to Order No. RD-89/03.02.2017, SG, No. 18/27.02.2017 of MoEW, based on Article 10, para 1, 2 and 3 of the MPA (2000).

Determination of the operating stocks and possible annual yield of 10 medicinal and aromatic species was carried out during the period 2012–2014 according to the Method for Determination of Medicinal Plants Resources (Shrëter & al. 1986). Habitat area, species projection cover, production of fresh plant material (kg/ha), operating stocks and the possible annual yield are presented in Table 2. Operating stocks were calculated by the fresh plant material yield (kg/ha) multiplied on the area of the localities (ha) and represent the permissible percentage for harvesting under Art. 5 of the Regulation No.2 (State Gazette, No.14/20.02.2004). The permissible annual yield (kg) was calculated as a result from the division of the operating stocks

by the yield turnover. Yield turnover for the species was specified in Regulation No.2 (State Gazette No.14/20.02.2004) and indicated the time needed by the population to restore itself before the next harvest of plant material. The names of researched drugs follow Nikolov (2007).

Results

Two hundred and fifty medicinal plants belonging to 189 genera and 65 families, presented in the Appendix, have been identified in the course of the research. According to the collected data, four families contained the greatest number of species and genera: *Asteraceae* (27 genera, 34 species), *Lamiaceae* (19 genera, 32 species), *Rosaceae* (11 genera, 17 species), and *Fabaceae* (11 genera, 17 species). Distribution of medicinal plants is referred to four vegetation types: grasslands, shrublands, woodlands, and wetlands.

Grassland vegetation

In terms of humidity, the grassy coenoses in the area of Bezden-Ponorsko Plateau and Beledie Han are referred to two types: xerothermic and mesophylous herbaceous communities (Velchev, 1962), occupying about 70 % of the researched territory.

Mesophylous vegetation comprises the coenoses of *Poa sylvicola* Guss., *Agrostis capillaris* L., *Festuca pratensis* L., and *Anthoxanthum odoratum* L., which covered a small area in the researched region and had limited distribution. Within the framework of this vegetation, there were identified 92 medicinal plant species, including nine conservation significant species: *Asphodelus albus*, *Gladiolus communis*, *Orchis laxiflora*, *O. coriophora*, *O. morio*, *Gymnadenia conopsea*, *Betonica officinalis*, *Carlina acanthifolia*, and *Primula veris*. Mesophylous grassy phytocoenoses with considerable species diversity of medicinal plants and economically important resources were found in the following localities: Gradishki Livadi (Ponor village), Padalishte (Dramsha village), Gradetski Livadi, Vlashko Bardo (Gradets village), Sivil (Tsarichina village), and Markovtsi (Chibaovtsi) village. Species with higher cover and abundance are: *Galium verum*, *Filipendula vulgaris*, *Pastinaca hirsuta*, *Veronica chamaedrys*, *Hypericum perforatum*,

Rumex acetosa, *Arrhenatherum elatior*, and *Leucanthemum vulgare*.

Habitat 6510 Lowland hay meadow (Tashev & al. 2010) was identified in some of the above-men-

tioned localities, which were subject to protection under Directive 92/43/EEC and in which medicinal plants of conservation significance were found. The habitat was identified in the following localities:

Table 2. Resources of medicinal plants in the Bezden – Ponorsko Plateau (eastern part) and Beledie Han area.

Group	Species (type of herb)	Locality (GPS)	Area of locality (ha)	Average projection coverage (%)	Yield plant material (kg/ha)	Operational stocks (kg)	Allowable annual yield (kg)	Turnover of the yield (years)
Group III – species forbidden for economic use, but permitted for gathering for personal needs	<i>Adonis vernalis</i> L. Herba Adonidis	Lokva (Bezden) 42°53'32.9" N 23°09'38.5" E	1.00	20	600.80±36.50	420.65±25.55	105.14±6.37	4
		Starata Klisura (Ponor) 42°92.340 N 23°13.799 E	0.50	20	540.50±25.50	189.18±17.85	47.30±4.46	4
		Slopes above Ponor village 42°91.290 N 23°12.791 E	0.35	4	105.13±8.66	25.76±2.12	6.44±0.19	4
		Eastern slope of Beledie Han 42°53'51.7" N 23°10'05.6" E	0.15	3	90.23±1.06	9.47±0.11	2.36±0.03	4
		Peak Mezдина (Gradets) 42°53'02.3" N 23°12'41.5" E	0.20	3	90.63±2.29	12.69±0.12	3.17±0.03	4
Group IV – species permitted for gathering for personal needs and economic use (with annual quota)	<i>Artemisia alba</i> L. Herba Artemisiae albae	Boin Vrah (Bezden) 42°53'20.1" N 23°06'39.6" E	0.30	10	4080.00±334.20	856.80±70.16	428.40±35.08	2
		Chisti Kamak (Bogyovtsi) 42°87.795 N 23°13.510 E	7.00	3	624.00±56.16	3057.00±275.38	1528.50±137.69	2
		Beledie Han 42°53'51.7" N 23°10'05.6" E	6.00	2	616.00±55.44	2587.20±232.84	1293.60±116.42	2
		Biloto (Gradets) 42°88.141 N 23°20.622 E	0.40	10	3880.43±271.63	1086.51±76.05	543.26±38.03	2
	<i>Primula veris</i> L. Flos Primulae Radix Primulae	Dedina Glava (Beledie Han) 42°50'53.4" N 23°01'32.0" E	0.20	20	18.10±3.00 284.00±4.13	2.53±0.42 9.76±0.57	0.63.53±0.05 13.25±0.19	4 3
		Ponor village 42°55'05.6" N 23°06'35.5" E	1.00	2	2.40±0.19 33.60±3.52	1.68±0.22 23.52±2.46	0.42±0.06 7.84±0.82	4 3
	<i>Betonica officinalis</i> L. Herba Betonicae	Gradetski Livadi (Gradets) 42°75.501 N 23°30.320 E	0.20	20	519.90±70.00	72.79±9.80	72.79±9.80	0
		Sivil (Tzarichina) 42°53'13.2" N 23°13'48.9" E	0.30	25	560.32±57.00	117.67±12.00	117.67±12.00	0
		Gradishki Livadi (north of Beledie Han) 42°56'52.1" N 23°14'47.1" E	0.25	10	248.00±18.12	43.40±3.16	43.40±3.16	0

Table 2. Continuation

Group	Species (type of herb)	Locality (GPS)	Area of locality (ha)	Average projection coverage (%)	Yield plant material (kg/ha)	Operational stocks (kg)	Allowable annual yield (kg)	Turnover of the yield (years)
V group – species free for gathering	<i>Satureja montana</i> L. Herba <i>Saturejae montanae</i>	Southern slopes of Beledie Han 42°53'51.7" N 23°10'05.6" E	8.00	12	244.80±29.70	1370.88±166.32	685.44±83.16	2
		Area between Bezden, Bogyovtsi, Ponor 42°88.176 N 23°11.210 E; 42°87.782 N 23°13.512 E; 42°92.340 N 23°13.799 E	80.00	3	91.80±8.26	5140.80±462.56	2570.04±231.28.64	2
	<i>Galium verum</i> L. Herba <i>Galii veri</i>	Gradishki Livadi (north of Beledie Han) 42°56'52.1" N 23°14'47.1" E	5.00	20	705.00±66.00	2467.50±231.00	2467.50±231.00	0
		Gradetski Livadi (Gradets) 42°75.501 N 23°30.320 E	0.30	25	811.25±82.50	170.36±17.33	170.36±17.33	0
		Markovtsi (Chibaovtsi) 42°91.427 N 23°23.939 E	0.40	15	528.75±49.50	148.05±13.86	148.05±13.86	0
	<i>Thymus</i> sp. Herba <i>Serpylli</i>	Dedina Glava (southern slope) 42°50'53.4" N 23°01'32.0" E	1.40	30	430.00±55.00	421.40±53.90	210.70±26.95	2
		Dedina Glava ridge 42°51'52.0" N 23°09'35.0" E	0.60	15	460.00±75.00	193.20±31.50	96.60±15.75	2
		Southern slope of Beledie Han 42°53'51.7" N 23°10'05.67" E	2.00	15	482.26 ±49.14	675.52±68.80	337.76±34.40	2
	<i>Filipendula vulgaris</i> Lam. Herba <i>Filipendulae</i>	Gradishki Livadi (north of Beledie Han) 42°56'52.1" N 23°14'47.1" E	3.50	15	236.50±17.00	579.42±41.65	579.42±41.65	0
	<i>Teucrium polium</i> L. Herba <i>Teucrii polii</i>	Southern slope of Beledie Han 42°53'51.7" N 23°10'05.67" E	10.00	6	62.90±11.50	440.03±80.50	220.00±40.25	2
<i>Viola tricolor</i> L. Herba <i>Violae</i> <i>tricoloris</i>	Bakin Krast (southwest of Dramsha) 42°88.318 N 23°20.830 E	1.00	16	744.00±37.80	520.08±26.46	130.02±6.62	4	

- Balkan Range (Western), Sivil locality southwards of Tsarichina village; 820 m a.s.l. 42°53'13.2"N; 23°13'48.9"E (medicinal plants of conservation significance: *Asphodelus albus*, *Gladiolus communis*, *Gymnadenia conopsea*, *Betonica officinalis*, *Orchis coriophora*, *O. laxiflora*, and *O. morio*).
- Balkan Range (Western), Markovtsi locality southeastwards of Chibaovtsi village, 860 m a.s.l. 42°55'41.8"N; 23°15'23.9"E (medicinal plants of conservation significance: *Betonica officinalis*, *Orchis coriophora*, and *O. morio*);
- Western Balkan Range, Padalishte locality between Chibaovtsi and Dramsha villages, 870 m a.s.l. 42°56'02.9"N; 23°13'57.1"E (medicinal plants of conservation significance: *Gladiolus communis*, *Gymnadenia conopsea*, *Betonica officinalis*, *Orchis coriophora*, and *O. morio*);
- Balkan Range (Western), westwards of Ponor village, 960 m a.s.l. 42°55'56.5"N; 23°06'39.0"E (medicinal plants of conservation significance: *Gladiolus communis*, *Gymnadenia conopsea*, *Betonica officinalis*, and *O. morio*).

Xerophytic grassy vegetation has wider distribution in the researched territory. It is characterized by a richer species composition with high abundance of gramineous species such as *Festuca valesiaca* Schleich. ex Gaudin, *F. dalmatica* (Hack.) K. Richt., *Poa angustifolia* L., and *Stipa eriocaulis* Borbás as edificators, as well as herbage species such as *Thymus* spp., *Artemisia alba* and *Teucrium chamaedrys*. In the xerothermic grassy vegetation, 99 species were identified, seven of which were conservation significant: *Artemisia alba*, *Adonis vernalis*, *Pulsatilla montana*, *Paeonia tenuifolia*, *Himanthoglossum caprinum*, *Sedum acre*, and *Hyssopus officinalis*. The following species had economically important resources: *Satureja montana*, *Artemisia alba*, *Teucrium chamaedrys*, *T. polium*, and *Thymus* sp. *div.* in the localities of Vartoyno Bardo, Poyatitsa (Ponor village), Lokva, Kladenetsa and Zimnitsa (Bezden village), Gradetski Livadi and Kamiko (Gradets village), Bozhurishte (Vasilovtsi village), and peak Dedina Glava (Beledie Han). Two habitats of European importance – 6210 Semi-natural dry grassland and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (*important orchid sides) and 62A0 Eastern sub-Mediterranean dry grasslands (*Scorzoneratalia villosae*) according to Directive 92/43/EEC were found in these regions.

Habitat 6210 Semi-natural dry grassland and scrubland facies on calcareous substrates was studied in the following localities:

- Balkan Range (Western), above Bezden village, Lokva locality, 780 m a.s.l. 42°53'32.9"N, 23°09'38.5"E (medicinal plants of conservation significance: *Echium russicum*, *Adonis vernalis*);
- Balkan Range (Western), eastwards of Gradets village, at 820 m a.s.l., 42°53'02.3"N, 23°12'41.5"E (medicinal plants of conservation significance: *Primula veris*, *Adonis vernalis*);
- Balkan Range (Western), Beledie Han, at 820 m a.s.l., 42°53'51.7"N, 23°10'05.6"E (medicinal plants of conservation significance: *Hyssopus officinalis*, *Artemisia alba*, *Adonis vernalis*).

Habitat 62A0 Eastern sub-Mediterranean dry grasslands (*Scorzoneratalia villosae*) was identified in the following localities:

- Balkan Range (Western), southern slope of the Bezden-Ponorsko Plateau, above Bezden village; 650 m a.s.l., 42°53'20.1"E; 23°06'39.6"E (medicinal plants of conservation significance: *Artemisia alba*, *Pulsatilla montana*);
- Balkan Range (Western), southern slope above Gradets village; 820 m a.s.l. 42°53'02.3"N; 23°12'41.5"E (medicinal plants of conservation significance: *Adonis vernalis*, *Primula veris*);
- Balkan Range (Western), between Ponor and Vasilovtsi villages, at 890 m a.s.l., 42°55'05.6"N, 23°06'35.5"E (medicinal plants of conservation significance: *Paeonia tenuifolia*, *Adonis vernalis*, *Primula veris*).

Shrubland vegetation

Shrub phytocoenoses rated second in distribution in the research territory. The following medicinal plant species occurred in these phytocoenoses: *Syringa vulgaris*, *Cotinus coggygria*, *Prunus spinosa*, *Crataegus monogyna*, *Corylus avellana*, *Cornus mas*, *Rubus caesius*, *Sorbus aucuparia*, and *Sambucus nigra*. A total of 113 medicinal species were identified, of which 17 were conservation significant species: *Adonis vernalis*, *Anemone sylvestris*, *Asplenium trichomanes*, *Artemisia alba*, *Betonica officinalis*, *Asparagus officinalis*, *Asphodelus albus*, *Lilium martagon*, *Orchis morio*, *O. purpurea*, *Polygonatum odoratum*, *Scilla bifolia*, *Himanthoglossum caprinum*, *Paeonia tenuifolia*, *Primula veris*, *Pulsatilla montana*, and *Valeriana*

officinalis. Considerable parts of the localities Boin Vrah and Beledie Han were covered with communities of *Syringa vulgaris*. Among these, in the area of Beledie Han a population of *Cotinus coggygria* was found with economically significant resources. The medicinal plants *Dictamnus albus*, *Digitalis lanata*, *Tamus communis*, and *Arum maculatum* occurred there. The southern slopes of peaks Dedina Glava and Bakin Krast were covered with shrub communities with the participation of *Crataegus monogyna*, *Rosa* sp. and *Prunus spinosa*, with economically important resources. The coenoses of *Amygdalus nana* were also referred to the shrub communities characteristic of the area of Bezden-Ponorsko Plateau, Beledie Han, Golemi Ostri Vrah, and the region between Vasilovtsi and Ponor villages. In the study area, *Amygdalus nana* communities were referred to habitat 40A0 *Sub-continental peri-Pannonic scrub (Tashev & al. 2010). This habitat was identified in following localities:

- Balkan Range (Western), southern slope of Beledie Han, at 830 m a.s.l., 42°54'56.1"N, 23°09'05.5"E (medicinal plants of conservation significance: *Adonis vernalis*, *Pulsatilla montana*, *Valeriana officinalis*, *Anemone sylvestris*, *Asparagus officinalis*, *Polygonatum odoratum*, and *Scilla bifolia*).

Woodland vegetation

Woodland vegetation in the region has limited distribution. It was strongly degraded and was represented mainly by shrub forms. On a larger area, it occurred in the localities of Beledie Han, Kamiko, Dedina Glava, Vlashko Bardo (Gradets village), and near Tsarichina village. In the forest phytocoenoses, 75 medicinal plants were found in total, nine of which were with conservation significance: *Asarum europaeum*, *Dryopteris filix-mas*, *Galium odoratum*, *Lilium martagon*, *Polygonatum odoratum*, *Primula veris*, *Scilla bifolia*, *Valeriana officinalis*, and *Orchis purpurea*. Most frequent medicinal plants in the *Quercus pubescens* and *Carpinus orientalis* woodlands were: *Syringa vulgaris*, *Crataegus monogyna*, *Prunus spinosa*, *Rosa* sp. div., *Rubus caesius*, *Hedera helix*, *Thymus* sp. div., *Helleborus odoratus*, *Achillea millefolium*, *Fragaria vesca*, *Glechoma hirsuta*, *Lathyrus vernus*, *Geranium robertianum*, *Sorbus aucuparia*, and the species of conservation significance *Primula veris*, *Polygonatum odoratum*, and *Lilium martagon*. The western slopes of the locality Dedina Glava were overgrown with a popula-

tion of *Prunus mahaleb*, which was economically important and covered an area of 2 ha manifested average abundance of 2 specimen/100 m². Near Tsarichina village, in a forest of *Fagus sylvatica* L., were found the conservation significant species *Asarum europaeum*, *Valeriana officinalis*, *Dryopteris filix-mas*, *Angelica sylvestris*, *Lilium martagon*, and without conservation status – *Polypodium vulgare*, *Hepatica nobilis*, *Pulmonaria officinalis*, and *Veronica officinalis*. These species formed small-area populations of no economic importance. Near Lyulayka chalet, in a beech forest, there was a locality of *Asarum europaeum*, on an area of 0.2 ha and with projection cover of the species reaching 45–50 %, as well as the medicinal fern *Asplenium ruta-muraria* occupying a considerable area on sheer wet rocks.

Wetland vegetation

In the southern part of the investigated area, along the banks of river Blato and the water dams Bezden and Bistritsa, a high number of mesophytic medicinal plants occurred, such as: *Achillea asplenifolia*, *Angelica sylvestris*, *Alisma plantago-aquatica*, *Butomus umbellatus*, *Centaurium erythraea*, *Equisetum arvense*, *Lysimachia nummularia*, *Lythrum salicaria*, *Mentha aquatica*, *Parnassia palustris*, *Persicaria hydropiper*, *Valeriana officinalis*, etc. On the shore of Bezden water dam, there was a population of *Achillea asplenifolia*, a species so far identified only in Sofia floristic region (Saukel & al. 2003). The population covered an area over 1 ha and the projection cover of the species was 25–30 %. The wet rocky places above the karst springs near Bezden village were covered by small groups of medicinal fern species, *Ceterach officinarum* and *Asplenium trichomanes*. Downstream river Kriva, in the stretch of its inflow into river Dramshanska and up to Lyulyaka chalet, a considerable diversity of medicinal plants was observed. Over 50 species occurred there, out of which in great numbers and with economically important resources were: *Agrimonia eupatoria*, *Crataegus monogyna*, *Colchicum autumnale*, *Geranium sanguineum*, *Filipendula ulmaria*, *Mentha spicata* complex, *Ononis arvensis*, *Orchis morio*, *Origanum vulgare*, and *Sanguisorba officinalis*.

Conservation significant medicinal plants

In the region of Bezden-Ponorsko Plateau and Beledie Han, as well as in the researched adjacent ter-

ritories, 28 conservation significant medicinal plants were identified (Table 1). Of these, two species were protected by the Bern Convention (1979), two species by Directive 92/43/EEC (1992), and six species by CITES (1973). Five species were included in the *RL* (Petrova & Vladimirov 2009), three species in the *RDB* (Peev & al. 2015), five species in Supplement 3, and 12 species in Supplement 4 of BDA (2007). Eleven species were under special protection and utilization regime under Art.10, para 1,2 and 3 of the Medicinal Plants Act (2000). According to the adopted division, to Group I of the protected species included in Supplement 3 of BDA (2007) were referred: *Himantoglossum caprinum*, *Echium russicum*, *Paeonia tenuifolia*, *Orchis laxiflora*, and *Anemone sylvestris*. In the investigated region, these species occurred seldom and with small populations. In the Beledie Han locality, a group of six specimen of *Himantoglossum caprinum* was identified within the composition of a grassy coenosis on open, dry, calcareous terrains. The species is protected by the Bern Convention (1979), Directive 92/43/EEC, and CITES (1973), and is classified as Vulnerable in *RL* and *RDB*, according to IUCN. The habitat of this species was subject to anthropogenic impact. Seldom and with single individuals, in the same locality occurred *Anemone sylvestris*, a species included as Near Threatened in *RL*. A small population of *Echium russicum* was found in the region of Bezden village, in Lokva locality, in a community of *Dichantium ischaemum*, *Festuca valesiaca*, *F. dalmatica*, *Poa angustifolia*, *Adonis vernalis*, *Teucrium chamaedrys*, and *Thymus* sp. div. The species is protected by the Directive 92/43/EEC, and is classified as Vulnerable in *RL* and *RDB*. During this investigation, an inventory of the population of *Paeonia tenuifolia* was made in the Bozhurishte locality, between Vasilovtsi and Ponor villages, which covers an area of 1 ha. The species was included in *RL* and *RDB* as Endangered and is protected by the Bern Convention (1979). The population of *Paeonia tenuifolia* was in a good state, the plants were vital and 90 % of them were in generative age. Traces of anthropogenic activity were not found within the boundaries of the habitat, but it was established that its area has shrunk, as compared to the data reported by Velchev (1962). Fifty-five years ago, the habitat covered an area exceeding 2 ha, and the species grew in considerably

higher numbers. Another species of Group I identified there was *Orchis laxiflora* which was included in CITES (1973), and classified as Vulnerable in *RL* and *RDB*. The species participated in the composition of wet hay meadows in the Sivil locality. The habitat covered an area of 0.01 ha and comprised about 20 individuals. The population was in a good state, but any change in the meadows management in the future could have a negative impact on it. Of Group II, 12 species included in Supplement 4 to BDA, were identified. Of these species in the shrub communities in the northeastern part of Beledie Han, seldom occurred *Pulsatilla montana*, *Asparagus officinalis*, *Polygonatum odoratum*, and *Scilla bifolia*. *Orchis coriophora*, *O. morio*, *O. purpurea*, *Gladiolus communis*, and *Asphodelus albus* participated in the composition of mesophyllous grassy communities in the Sivil locality. Single individuals of *Lilium martagon* and *Dryopteris filix-mas* occurred in the beech forest near Tsarichina village. The species of Group II in the investigated territory had no economic importance. The species under a special regime of protection and use according to MPA (Groups III and IV) were also referred to the conservation significant species. Of Group III, medicinal plants permitted for gathering only for personal needs, six species were identified: *Adonis vernalis*, *Asarum europaeum*, *Asplenium trichomanes*, *Hyssopus officinalis*, *Gymnadenia conopsea*, and *Valeriana officinalis*. *Adonis vernalis* and *Gymnadenia conopsea* were included in CITES. A comparison of the data from this investigation with earlier studies has shown shrinking of the areas of the populations of both species, as well as reducing the number of plants. According to Velchev (1962), *Adonis vernalis* was a frequently occurring species in the investigated area, participating as dominant or subdominant in the grassy communities. Its habitats used to cover scores of hectares, and in places its projection cover reached 30–35 %. The habitats visited during this investigation were most often with an area from 0.15 to 0.50 ha. The biggest of them was in the Lokva locality, with an area of 1 ha. The projection cover of the species in different parts of the population varied from 3 % to 20 %. *Hyssopus officinalis* was another object of earlier research. Russakova & al. (1999) studied the phytocoenotic and ecological characteristics of the species in the area of Beledie Hna. They found out

that *Hyssopus officinalis* occurred seldom, with single individuals, mainly on eroded terrains without grassy vegetation. A small locality of the species was studied, where its projection cover was 80 %. Subsequently, in the same locality the operational stocks of species were studied (Petrova & Genova 2000). By the moment of research, the habitat covered an area of 0.2 ha with average number of the plants of 4 individuals/m². The authors reported a considerable anthropogenic pressure and regression of the population. During this investigation were visited several localities of *Hyssopus officinalis*, where the species occurred with single individuals or small groups. In the area of Beledie Han, the locality studied by Russakova & al. (1999) and Petrova & Genova (2000) was investigated. The results have shown that the habitat covered an area of 0.2 ha, the projection cover of the species was 25–30 %, and it numbered 2 individuals/m². The projection cover and numbers of the species have been reduced twice since the data reported by Russakova & al. (1999) and Petrova & Genova (2000). The same authors reported that with the development of soil-formation processes and increase of the vegetation cover, the species becomes extinct or occupies new eroded stretches. Of the species of Group IV, with annual gathering quotas, six species were identified: *Artemisia alba*, *Primula veris*, *Betonica officinalis*, *Carlina acanthifolia*, *Galium odoratum*, and *Sedum acre*. The populations of some of these species cover considerable areas and have economically important resources.

Resources of economically important plants

The resources of one species of Group III, three species of Group IV and six species of Group V (Table 2) were determined during this investigation. The results have shown that *Adonis vernalis* (Group III) occurred often in the study area. The resources of this species have been determined in five habitats, with an area between 0.15 ha and 1 ha, and projection cover varying from 3 % to 20 %. It was established that the habitats in the Lokva and Stara Klisura localities (Table 2) had the highest operational stocks and possible annual yield. For five habitats, the possible annual yield totaled 164.41 kg at four-year yield turnover. The results have shown that in the investigated territory the following species had the highest resources: *Artemisia alba* (Group IV), *Satureja mon-*

tana (Group V), *Filipendula vulgaris* (Group V) and *Galium verum* (Group V).

Four habitats of *Artemisia alba* were studied to determine its resources. The greatest operational stocks and possible annual yield of *Herba Artemisiae albae* were reported for the habitats in the localities Chist Kamak and Beledie Han. These habitats covered sizeable areas (6–7 ha), but with a low projection cover of the species (2–3 %). The other two habitats (Boin Vrah and Biloto) covered a considerably smaller area (0.3–0.4 ha), but with a higher projection cover of the species (10 %). The possible annual yield of the four habitats altogether was determined at 3793.76 kg at a two-year yield turnover.

Satureja montana was the second species with considerable resources in the region. These resources were determined in the two biggest habitats on the southern slopes of Bezden-Ponorsko Plateau and Beledie Han area (Table 2). The results have shown that the operational stocks of the two habitats amounted to 6511.68 kg and the possible annual yield was 3255.48 kg (Table 2).

Galium verum rated as the third species with economically important resources. The habitat in the locality Gradishki Livadi had the highest operational stocks and possible annual yield of 2467.50 kg of *Herba Galii verum*. The annual yield of the three habitats totaled 2785.91 kg (Table 2).

The population of *Thymus* sp. div. (Group V) was also economically important in the region. Resources of the species were determined in three localities (Table 2). The operational stock of *Herba Serpylli* totaled 1290.12 kg and the possible annual yield was 645.05 kg at a two-year yield turnover.

The investigation has shown that *Filipendula vulgaris* (Group V) also had economically important resources in the region. The species was widely distributed, but its abundance varied considerably in the different localities. The operational stocks of *Herba Filipendulae* was determined at 579.42 kg in the biggest habitat in the locality Gradishki Livadi. Considering the wide distribution of the species in the study area, an annual yield of *Herba Filipendulae* up to 4–5 tons could be expected.

Teucrium polium was a medicinal plant participating in the phytocoenoses of *Satureja montana*, which covered considerable areas. The projection cover of the species was low, between 2 % and 3 %,

and only in some places it reached 15–20 %. The operational stocks of *Herba Teucree polii* in the locality Beledie Han reached 440.03 kg, while the possible annual yield was 220.00 kg.

Betonica officinalis (Group IV) occurred seldom in the investigated territory, chiefly in more humid habitats. The resources of this species were determined in three localities, with small area and strongly varying projection cover (Table 2). The Sivil locality (Gradets village) was reported with the highest operational stocks (117.67 kg). The possible annual yield of *Herba Betonice* for the three habitats totaled 233.86 kg.

Near Dramsha village in the Bakin Krast locality, a population of *Viola tricolor* (Group V) was found on an area of over 1 ha. This species participates in the composition of mesophyllous grassy vegetation, with a projection cover of 18 %. The possible annual yield of *Herba Violae tricoloris* was determined to amount to 130.02 kg, at a four-year yield turnover.

Discussion

The area of Bezden-Ponorsko Plateau and Beledie Han is characterized by calcareous terrains and specific microclimate, which determines its rich floristic diversity, part of which is formed by medicinal plants. During this investigation, 250 species of medicinal plants have been identified, which belong to 65 families. They present 34 % of the medicinal plants of Bulgaria, according to the Supplement to Article 1, para 2 of MPA (2000). The study found that the greatest number of medicinal plants participate in the composition of grassy phytocoenoses (182 species), followed by the shrub phytocoenoses (113 species). In the study area, 28 conservation significant species have been identified, which account for 12 % of all medicinal plants. Some of these species occur seldom and with single individuals: *Anemone sylvestris*, *Gladiolus communis*, *Gymnadenia conopsea*, *Pulsatilla montana*, *Valeriana officinalis*, *Lilium martagon*, or with small populations – *Hyssopus officinalis*, *Asparagus officinalis*, *Asplenium trichomanes*, *Dactylorhiza incarnata*, *Scilla bifolia*, *Polygonatum odoratum*, and *Sedum acre*. Other species have been found with only one population: *Paeonia tenuifolia*, *Himantoglossum caprinum*, *Echium russicum*, and *Orchis laxiflora*.

Owing to the small numbers of their populations, any change in the ecological and phytocoenotic characteristics of the habitats of these species could lead to their extinction. Affected populations restore with difficulty. This is due to the specific ecological conditions of the habitats: calcareous base rocks, numerous eroded patches and only atmospheric humidity. Comparative analysis has shown shrinking of the areas and numbers of the populations of species *Paeonia tenuifolia*, *Adonis vernalis* and *Hyssopus officinalis*, for which there have been available data from earlier studies. These changes are due, on the one hand, to the biological specificities of the species, the natural processes in the plant communities, anthropogenic activity, and climatic changes. It has been also found that grazing of domestic animals in the region has considerably reduced, which has led to increasing of shrub vegetation and to changes in the composition and structure of the communities. One of the tasks of the present investigation is finding territories with protected species. The results have shown that such territories are the localities Bozhurishte, Beledie Han, Sivil, and Lokva, where species with high conservation status have been identified: *Paeonia tenuifolia*, *Himantoglossum caprinum*, *Echium russicum*, and *Orchis laxiflora*. Phytocoenotic researches in the region in recent years have shown that the populations of these species are in habitats of European importance, protected by Directive 92/43/EC (Tashev et. al. 2010). The small numbers of the populations, the inseting changes in the composition of the plant communities, and the climatic changes call for monitoring activity. It is also necessary to engage carefully all economic activities in these regions. It has been found that the populations of many medicinal and aromatic plants are of economic importance, such as: *Cotinus coggygia*, *Syringa vulgaris*, *Prunus mahaleb*, *Rosa* sp., *Achillea millefolium*, *Hypericum perforatum*, and *Fragaria vesca*. The resource studies have shown that in Group IV *Artemisia alba* is a species with economically valuable resources, followed by *Betonica officinalis* with considerably smaller resources, and *Primula veris* with negligibly small resources. From species of Group V, *Satureja montana*, *Galium verum*, *Filipendula vulgaris*, *Thymus* sp. div., and *Teucrium polium* have shown resources suitable for economic use.

Appendix. Systematic list of medicinal plants of Bezden-Ponorsko plateau and Beledie Han area (Western Stara Planina).

Division Equisetophyta

Fam. Equisetaceae: *Equisetum arvense* L. (V); *E. sylvaticum* L. (V).

Division Polypodiophyta

Fam. Aspleniaceae: *Asplenium ruta-muraria* L. (V); *A. trichomanes* L. (III); *Ceterach officinarum* DC. (V); **Fam. Aspidiaceae:** *Dryopteris filix-mas* (L.) Schott. (II); **Fam. Polypodiaceae:** *Polypodium vulgare* L. (V).

Division Magnoliophyta**Class Magnoliopsida**

Fam. Aceraceae: *Acer platanoides* L. (V); *A. tataricum* L. (V); **Fam. Anacardiaceae:** *Cotinus coggygia* Scop. (V); **Fam. Apiaceae:** *Angelica sylvestris* L. (V); *Chaerophyllum bulbosum* L. (V); *Conium maculatum* L. (V); *Eryngium campestre* L. (V); *Ferulago sylvatica* (Besser) Reich. (V); *Heracleum sibiricum* L. (V); *Pastinaca hirsuta* Pančić. (V); *Pimpinella saxifraga* L. (V); **Fam. Apocynaceae:** *Vinca herbacea* Waldst. & Kit. (V); *V. minor* L. (V); **Fam. Araliaceae:** *Hedera helix* L. (V); **Fam. Asclepiadaceae:** *Vincetoxicum hirundinaria* Medicus (V); **Fam. Aristolochiaceae:** *Aristolochia clematitis* L. (V); *Asarum europaeum* L. (III); **Fam. Asteraceae:** *Achillea asplenifolia* Vent. (V); *A. collina* J. Becker ex Rchb. (V); *A. clypeolata* Sm. (V); *A. millefolium* L. (V); *Artemisia alba* L. (IV); *A. vulgaris* L. (V); *Anthemis tinctoria* L. (V); *Arctium lappa* L. (V); *Bellis perennis* L. (V); *Bidens tripartita* L. (V); *Carlina acanthifolia* All. (IV); *C. vulgaris* L. (V); *Carthamus lanatus* L. (V); *Centaurea cyanus* L. (V); *C. pannonica* (Heuffel) Simonk. (V); *Cichorium inthybus* L. (V); *Carduus acanthoides* L. (V); *Echinops sphaerocephalus* L. (V); *Hieracium pilosella* L. (V); *Hypochaeris radicata* L. (V); *Inula germanica* L. (V); *I. ensifolia* L. (V); *Lactuca serriola* L. (V); *Leucanthemum vulgare* Lam. (V); *Matricaria chamomilla* L. (V); *Onopordum acanthium* L. (V); *Petasites hybridus* (L.) Gaertn. (V); *Solidago virgaurea* L. (V); *Scorzonera hispanica* L. (V); *Tanacetum vulgare* L. (V); *Taraxacum officinale* L. (V); *Tragopogon pratensis* L. (V); *Tussilago farfara* L. (V); *Xeranthemum annuum* L. (V); **Fam. Betulaceae:** *Alnus glutinosa* (L.) Gaertn. (V); *Betula pendula* Roth. (V); *Carpinus betulus* L. (V); *C. orientalis* Mill.; *Corylus avellana* L. (V); **Fam. Boraginaceae:** *Cerintho minor* L. (V); *Cynoglossum officinale* L. (V); *Echium italicum* L. (V); *E. russicum* J. F. Gmel. (I); *E. vulgare* L. (IV); *Lithospermum officinale* L. (V); *Pulmonaria officinalis* L. (V); **Fam. Brassicaceae:** *Alliaria petiolata* (M. Bieb.) Cavara & Grande (V); *Alyssum alyssoides* (L.) L. (V); *Capsella bursa-pastoris* (L.) Medicus (V); *Lepidium campestre* (L.) R. Br. (V); *Thlaspi arvense* L. (V); **Fam. Butomaceae:** *Butomus umbellatus* L. (V); **Fam. Campanulaceae:** *Campanula persicifolia* L. (V); **Fam. Caprifoliaceae:** *Sambucus ebulus* L. (V); *S. nigra* L. (V); **Fam. Caryophyllaceae:** *Minuartia setacea* (Thuill.) Hayek (V); *Herniaria hirsuta* L. (V); *Scleranthus annuus* L. (V); *S. perennis* L. (V); *Silene otites* (L.) Wibel (V); *Stellaria graminea* L. (V); *Viscaria vulgaris* Röhl. (V); **Fam. Celastraceae:** *Evonymus europaeus* L. (V); *E. verrucosus* Scop. (V); **Fam. Chenopodiaceae:** *Chenopodium album* L. (V); *Ch. hybridum* L. (V); **Fam. Convolvulaceae:** *Convolvulus arvensis* L. (V); **Fam. Cornaceae:** *Cornus mas* L. (V); **Fam. Crassulaceae:** *Sedum acre* L. (IV); *Sempervivum marmoratum* Griseb. (V); **Fam. Dipsacaceae:** *Knautia arvensis* (L.) Coult. (V); *Scabiosa ochroleuca* L. (V); **Fam. Dioscoreaceae:** *Tamus communis* L. (V); **Fam. Euphorbiaceae:** *Euphorbia cyparissias* L. (V); **Fam. Fabaceae:** *Anthyllis vulneraria* L. (V); *Astragalus glycyphyllos* L. (V); *Coronilla scorpioides* (L.) C. Koch (V); *C. varia* L. (V); *Chamaespartium sagittale* (L.) Gibbs (V); *Genista*

tinctoria L. (V); *Lathyrus pratensis* L. (V), *L. vernus* (L.) Bernh. (V); *Lotus corniculatus* L. (V); *Melilotus officinalis* (L.) Pall. (V); *Ononis arvensis* L. (V); *Trifolium alpestre* L. (V); *T. arvense* L. (V); *T. pratense* L. (V); *T. repens* L. (V); *Vicia grandiflora* Scop. (V); *V. sativa* L. (V) **Fam. Fagaceae:** *Fagus sylvatica* L. (V); *Quercus frainetto* Ten. (V); **Fam. Gentianaceae:** *Centaurium erythraea* Raf. (V); *C. pulchellum* (Sw.) Druce (V); **Fam. Geraniaceae:** *Geranium robertianum* L. (V); *G. rotundifolium* L. (V); *G. sanguineum* L. (V); *Erodium cicutarium* (L.) L'Her. (V); **Fam. Globulariaceae:** *Globularia aphyllanthes* Grantz (V); **Fam. Hypericaceae:** *Hypericum maculatum* Grantz (V); *H. perforatum* L. (V); **Fam. Iridaceae:** *Gladiolus communis* L. (II); **Fam. Lamiaceae:** *Acinos arvensis* (Lam.) Dandy (V); *A. suaveolens* (Sm.) Don (V); *Ajuga chamaepitys* (L.) Schreb. (V); *A. laxmannii* (L.) Benth. (V); *Betonica officinalis* L. (IV); *Clinopodium vulgare* L. (V); *Glechoma hederacea* L. (V); *G. hirsuta* Waldst. & Kit. (V); *Hyssopus officinalis* L. (III); *Lamium maculatum* L. (V); *Leonurus cardiaca* L. (V); *Marrubium peregrinum* L. (V); *Mentha aquatica* L. (V); *M. spicata* L. (V); *Origanum vulgare* L. (V); *Phlomis tuberosa* L. (V); *Prunella vulgaris* L. (V); *Salvia aethiops* L. (V); *S. nemorosa* L. (V); *S. pratensis* L. (V); *S. verticillata* L. (V); *Satureja montana* L. (V); *Sideritis montana* L. (V); *Stachys germanica* L. (V); *S. recta* L. (V); *S. sylvatica* L. (V); *Teucrium chamaedrys* L. (V); *T. montanum* L. (V); *T. polium* L. (V); *Thymus callieri* Borbas. ex Velen. (V); *T. glabrescens* Willd. (V); *T. sibthorpii* Benth. (V); **Fam. Linaceae:** *Linum catharticum* L. (V); **Fam. Lythraceae:** *Lythrum salicaria* L. (V); **Fam. Oleaceae:** *Fraxinus ornus* L. (V); *Ligustrum vulgare* L. (V); *Syringa vulgaris* L. (V); **Fam. Onagraceae:** *Epilobium angustifolium* L. (V); **Fam. Paeoniaceae:** *Paeonia tenuifolia* L. (I); **Fam. Papaveraceae:** *Chelidonium majus* L. (V); *Corydalis bulbosa* (L.) DC. (V); *Fumaria officinalis* L. (V); *Papaver rhoeas* L. (V); **Fam. Plantaginaceae:** *Plantago lanceolata* L. (V); *P. major* L. (V); *P. media* L. (V); *P. subulata* L. (V); **Fam. Polygalaceae:** *Polygala major* Jacq. (V); *P. vulgaris* L. (V); **Fam. Polygonaceae:** *Persicaria hydropiper* (L.) Opiz (V); *Polygonum aviculare* L. (V); *Rumex acetosa* L. (V); *R. acetosella* L. (V); **Portulacaceae:** *Portulaca oleracea* L. (V); **Fam. Primulaceae:** *Lysimachia nummularia* L. (V); *Primula veris* L. (IV); **Fam. Ranunculaceae:** *Adonis vernalis* L. (III); *Anemone sylvestris* L. (I); *A. ranunculoides* L. (V); *Clematis vitalba* L. (V); *Pulsatilla montana* (Hoppe.) Rchb. (II); *Helleborus odoratus* Waldst. & Kit. (V); *Hepatica nobilis* Mill. (V); *Isopyrum thalictroides* L. (V); *Nigella arvensis* L. (V); *Ranunculus polyanthemos* L. (V); *R. repens* L. (V); *Thalictrum aquilegifolium* L. (V); *T. minus* L. (V); **Fam. Resedaceae:** *Reseda lutea* L. (V); **Fam. Rosaceae:** *Agrimonia eupatoria* L. (V); *Crataegus monogyna* Jacq. (V); *Filipendula ulmaria* (L.) Maxim. (V); *F. vulgaris* Moench (V); *Fragaria vesca* L. (V); *Geum urbanum* L. (V); *Potentilla alba* L. (V); *P. argentea* L. (V); *P. erecta* (L.) Rauschel (V); *P. reptans* L. (V); *Prunus mahaleb* L. (V); *P. spinosa* L. (V); *Rosa gallica* Pourret (V); *Rubus caesius* L. (V); *Sanguisorba minor* Scop. (V); *S. officinalis* L. (V); *Sorbus aucuparia* L. (V); **Fam. Rubiaceae:** *Cruciata laevipes* Opiz (V); *Galium lucidum* All. (V); *G. odoratum* (L.) Scop. (IV); *G. verum* L. (V); **Fam. Rutaceae:** *Dictamnus albus* L. (V); **Fam. Saxifragaceae:** *Parnassia palustris* L. (V); *Saxifraga bulbifera* L. (V); **Fam. Scrophulariaceae:** *Digitalis lanata* Ehrh. (V); *Euphrasia rostkoviana* Hayne (V); *Linaria vulgaris* Mill. (V); *Scrophularia canina* L. (V); *Verbascum phlomoides* L. (V); *V. phoeniceum* L. (V); *Veronica austriaca* L. (V); *V. chamaedrys* L. (V); *V. officinalis* L. (V); *V. prostrata* L. (V); **Fam. Solanaceae:** *Solanum nigrum* L. (V); **Fam. Tiliaceae:** *Tilia tomentosa* Moench. (V); **Fam. Valerianaceae:** *Valeriana officinalis* L. (III); **Fam. Violaceae:** *Viola odorata* L. (V); *V. tricolor* L. (V); **Fam. Urticaceae:** *Urtica dioica* L. (V); **Fam. Zygophylaceae:** *Tribulus terrestris* L. (V).

Appendix. Continuation.

Class *Liliopsida*

Fam. Alismataceae: *Alisma plantago-aquatica* L. (V); **Fam. Amaryllidaceae:** *Allium rotundum* L. (V); **Fam. Araceae:** *Arum maculatum* L. (V); **Fam. Asparagaceae:** *Asparagus officinalis* L. (II); *Polygonatum odoratum* (Mill.) Druce (II); *Scilla bifolia* L. (II); **Fam. Colchicaceae:** *Colchicum autumnale* L. (V); **Fam. Iridaceae:** *Iris pumila* L. (V); **Fam. Liliaceae:** *Asphodelus albus* Miller. (II); *Lilium*

martagon L. (II); *Veratrum nigrum* L. (V); **Fam. Orchidaceae:** *Gymnadenia conopsea* (L.) R. Br. (III); *Himantoglossum caprinum* (M. Bieb.) Spreng. (I); *Orchis laxiflora* Lam. s. str. (I); *O. coriophora* L. (III); *O. morio* L. (III); *O. purpurea* Huds. (III); **Fam. Poaceae:** *Anthoxanthum odoratum* L. (V); *Briza media* L. (V); *Dactylis glomerata* L. (V); **Fam. Typhaceae:** *Typha angustifolia* L. (V).

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