

Medicinal species of conservation importance from the Bulgarian flora

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Abstract

From antiquity to the present day, man has used plants for various purposes, most of them being used for the treatment of various diseases. However, some medicinal plants are of varying degrees of threat. The purpose of this study is to establish and analyse the conservation status of medicinal plants from the flora of Bulgaria. Of total 954 species of medicinal plants in the flora of Bulgaria, 290 are considered to be of conservation importance: Bulgarian and Balkan endemics; species listed in the Red Data Book of Bulgaria and their categories of endangerment; species in the Annexes of the Biodiversity Conservation Act in Bulgaria; species included in the Bern Convention; species in the Annexes to the Habitats Directive; species under the protection of the International Convention on Trade in Wildlife; medicinal plants in Bulgaria listed in the World Red List of Plants; species in the European Red List and European Red List of Medicinal plants of different categories; List of rare and endangered endemic plants in Europe; species, which are tertiary and glacial relicts. The collection of these species must take into account their condition and comply with the regulations governing their use and conservation.

Key words: Bern Convention, Biodiversity Act, protection category, Red Data book.

Introduction

From ancient times to the present day, man has used plants for various purposes, many of which are used to treat various diseases.

For the purposes of the present study, medicinal plants are those included in the Medicinal Plants Act (Anonymous 2000), as well as some species that are cited in the literature related to phytotherapy (Stoyanov 1972, 1973; Ivanov et al. 1977).

This law regulates the management of activities for conservation and sustainable use of medicinal plants, including the collection and purchase of herbs obtained from them. It includes 733 species of plants. However, there are gaps in the list, such as *Rosa canina* L. In our manuscript we have attempted to fill these gaps.

Classification of medicinal plants in Bulgaria, depending on the regime of use or protection according to Medicinal Plants Act (Anonymous 2000), is as follows:

1. Protected species of medicinal plants, according to the Law of Biological Diversity (Appendix 3), prohibited for collection on the territory of the country for personal and commercial purposes – *Orchis laxiflora* Lam., *Diphysastrum alpinum* (L.) Holub, *Taxus baccata* L., *Galanthus elwesii* Hook.f., *Rhodiola rosea* L., *Gentiana lutea* L., *G. punctata* L., *Thymus perinicus* (Velen.) Jalas, *Th. stojanovii* De-gen.

2. Medicinal plants under protection and regulated-use regime, according to the Biodiversity Act (Appendix 4) – *Asparagus tenuifolius* Lam.

3. Medicinal plants under a special regime of protection and use, on the basis of the Medicinal Plants Act (Art. 10, para. 1, 2 and 3)

The special regime includes two groups of plants:

3.1. Species prohibited for collection from all over the country (restrictions and prohibitions do not apply to quantities of herbs collected for personal use) – *Asarum europaeum* L., *Arctostaphylos uva-ursi* (L.) Spreng., *Sideritis scardica* Griseb., *Orchis* spp. diversa.

3.2. Species, which are determined annually, eligible for collection for business and personal use – *Berberis vulgaris* L.

4. Species permitted for both personal and commercial use – these are plants that do not have conservation status compared to current regulations and are not subject to a restrictive collection regime with annual quotas.

Characteristic of wild medicinal plants resources in Bulgaria and recommendations for their long-term development can be found in publications of Hardalova et al. (1994), Gushev (2005) and Evstatieva et al. (2007). Biodiversity and problems of conservation of medicinal plants in protected areas are commented by Evstatieva

and Hardalova (2000). The development of the status of medical resources in the country is considered by Vitkova and Tashev (2007). Tashev and Tsavkov (2008) point out that 180 species of the Bulgarian dendroflora have different medical applications. Tashev (2017) also presents the distribution of medicinal plants in Bulgaria by biological types, floristic elements and life forms. Dimitrova and Tashev (2019) identify 140 species of medicinal plants on the territory of Petrohan Training and Experimental Forest Range (PTEFR), indicating for them the usable part, content of biologically active substances and their action. Tashev and Dimitrova (2019) present ecological structure of medicinal plants in Bulgaria. The methods of herbal collection and storage of medicinal plants are discussed by Assenov et al. (1998). Many authors as Stoyanov (1972, 1973), Ivanov et al. (1977), Petkov (1982), Gateva et al. (2006), Ivanov (2007), Nikolov (2007), Ivanova (2009), Kaniskov (2011), Kunovski (2012) give a description of medicinal plants in Bulgaria, indicating their medicinal properties and what they can be used for. The cited plants vary between 777 (Ivanov et al. 1977) and 1020 (Kaniskov 2011). The difference is because some authors have included mosses, lichens and ornamental plants in their lists.

The above-mentioned publication, as well as Tauchen and Kokoska (2017), are referred in creating of present list of medicinal plants.

Medicinal plants have been also studied by many authors from abroad. Issues of conservation and sustainable use are discussed by Chen et al. (2016). The authors discuss *in situ* and *ex situ* conservation and cultivation practices, good agricultural practices and sustainable use solutions, as well as biotechnical approaches (e.g. tissue culture, micro-

propagation, synthetic seed technology, and molecular markerbased approaches, which should be applied to improve the yield of medicinal plants). Jamshidi-Kia et al. (2018) investigate and describe the process of using medicinal plants throughout history. Their review focuses on the important challenges in quality evaluation of medicinal plants. Other authors (Dihoru and Boruz 2014) make lists of naturally occurring medicinal plants, indicating the organs that are collected, the frequency of collection and whether they are included in the country's Red Book. For medicinal plants that are included in Red List of Romania, for example, it is recommended: to forbid their collection from spontaneous flora or limited collection, at 1–3 years; to cultivate and to multiply these plants in specialized centres in order to use their active substances; to designate protected areas; to preserve them *in vitro*. Redžić (2010) applies ethnobotanical method to gather information about wild medicinal plants used in traditional medicine in Bosnia and Herzegovina. He cited 96 medicinal species and their use for treatment of different illnesses. Ssenku et al. (2022) comment that conservation of medicinal plants is highly threatened by multiple factors, such as habitat loss, population pressure and the increasing dependence on herbal medicine as a source of income in some countries of Africa. The authors discuss different conservation strategies of medicinal plants as spiritually protected forests, gender restricted harvesting, avoiding destructive harvesting, preservation of propagules, safeguard from herbivores, homestead cultivation, night and naked restricted harvesting, and mouth restricted harvesting. Some organizations (Anonymous 1993), related to the conservation of natural resources, issue a handbook on the conservation of me-

dicinal plants with guidelines for action, emphasizing the role of international organizations in identification of the medicinal plants, outline their distributions and assess their abundance; for utilization – wherever possible, to cultivate the medicinal plants as the source of supply; to ensure that any collecting from the wild is sustainable; to improve techniques for harvesting, storage and production; to conserve populations of medicinal plant species in natural habitats; to conserve populations of medicinal plant species *ex situ*; to build public support for the conservation of medicinal plants through communication and cooperation.

Despite all protective measures, some medicinal plants are of varying degrees of endangerment. Exploring their conservation significance is an important step towards protecting these resources of Bulgarian flora.

In relation with the above mentioned, the aim of the present study is to establish the conservation status of medicinal plants from the flora of Bulgaria and measures taken for their protection.

Material and Methods

The taxonomy of plant species is given according to: Yordanov (1963–1979), Velchev (1982, 1989), Kozhuharov (1995), Delipavlov and Cheshmedzhiev (2011), Kozhukharov and Anchev (2012), Stoyanov et al. (2021).

The conservation significance of medicinal plants of the Bulgarian flora at national level is presented according to the following documents: Red Data Book of Republic Bulgaria, Volume I – Plants and fungi (Peev 2015), the Balkan and Bulgarian endemics (Petrova and Vladimirov 2010, Assyov and Petrova 2012). The bi-

odiversity of relict vascular plants in Bulgaria is according to Zahariev (2016). The conservation significance at international level is according to Red List of Endangered Plants of IUCN (Walter and Gillett 1998), as well as the List of rare, endangered and endemic plants of Europe (Lucas 1983), European Red List of vascular plants (Bilz et al. 2011) and European Red List of medicinal plants (Allen et al. 2014).

The conservation measures taken are presented in accordance with Biodiversity Act (Anonymous 2002, amend. SG 98/2018), the CITES (1973), Bern Convention – the Convention on the conservation of European wildlife and natural habitats, 1979 (Council of Europe 2022) and Council Directive 92/43/EEC, 1992 (EUR-lex 2022).

Results and Discussion

Two hundred ninety (30.4 % of the medicinal plants in Bulgaria) of the 954 species of medicinal plants in the flora of Bulgaria are considered to be of conservation importance. They are presented in Table A1 (Annex A). They belong to 81 families and 176 genera. Many of these plants are included into protected areas and sites of community importance. For comparison, 748 species of medicinal plants have been described in Romania, of which 115 are in the country's Red Book, i.e. 15 %.

Twenty two percent of investigated species are listed in the Red Data Book of Republic of Bulgaria (2015) (Fig. 1): 36 % of them are critically endangered (CR): *Adiantum capillus-veneris* L., *Allium angulosum* L., *Myricaria germanica* (L.) Desv. and others; 59 % are endangered (EN): *Vaccinium arctostaphylos* L. (Fig. 2), *Castanea sativa* Mill., *Alkanna tinctoria* Tausch. and others; 5 % are vulnerable

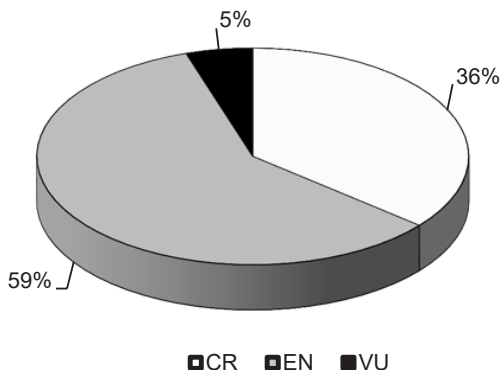


Fig. 1. Categories of endangerment (%) of medicinal species included in the Red Data Book of Republic of Bulgaria (2015).



Fig. 2. *Vaccinium arctostaphylos*
(photo A. Tashev).

(VU): *Campanula lanata* Friv., *Echium russicum* Gmel. and *Opopanax chironium* W.D.J.Koch.

Two percent of the medicinal plants in Bulgaria are listed in the 1997 IUCN Red List of Threatened Plants (1998): *Alchemilla achtarowii* Pawl., *A. asteroantha* Rothm., *A. jumrukczalica* Pawl., *Campanula lanata* and *Rheum rhaponticum* L. In the latest version of the list on the Internet, four of the species have been dropped.

There are 41 % of species in the European Red List (Bilz et al. 2011) with different categories: 109 species – Least concern (LC) (Fig. 3): *Alisma plantago-aquatica* L., *Bidens tripartita* L., *Hydrocharis*

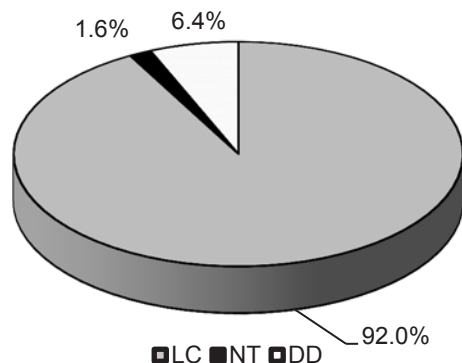


Fig. 3. Categories of endangerment (%) of medicinal species included in the European Red List of vascular plants (Bilz et al. 2011).

morsus-ranae L., *Asparagus officinalis* L., *Caltha palustris* L. and others; 2 plants – near threatened (NT): *Galanthus nivalis* L. and *Orchis spitzelii* Sauter ex W. Koch; 8 species – data deficient (DD): *Allium albidum* Fischer ex Bieb., *A. atrovioaceum* Boiss., *Campanula lanata*, *Galanthus elwesii* (Fig. 4), *Malus sylvestris* Mill., *Prunus cerasifera* Ehrh., *P. fruticosa* Pall., *Vaccinium arctostaphylos*.



Fig. 4. *Galanthus elwesii*
(photo A. Tashev).

There are 19 % of species in the European Red List of Medicinal Plants (ER-LMP 2014), for example: *Rhodiola rosea* (Fig. 5), *Ruscus aculeatus* L. etc.



Fig. 5. *Rhodiola rosea* (photo A. Tashev).

The List of rare and endangered endemic plants in Europe (1983) includes 2 % of the species: *Astragalus dasyanthus* Pall., *Ligularia glauca* (L.) O. Hoffm., *Rheum rhaponticum*, *Vaccinium arctostaphylos*, *Sempervivum erythraeum* Velen. and *S. leucanthum* Panc.

Six percent of plants are endemic – five of these species are Bulgarian endemics: *Alchemilla achtarowii*, *A. jumrukczalica*, *Colchicum diampolis* Delip. & Cheshm., *Rheum rhaponticum* and *Sempervivum leucanthum*. Eleven are Balkan endemics: *Sideritis scardica*, *Sambucus deborensis* Koš., *Alchemilla asteroantha*, *A. catachnoa* Rothm., *A. indivisa* (Buser) Rothm., *Campanula lanata*, *Opopanax chironium*, *Sempervivum erythraeum*, *Thymus stojanovii*, *T. perinicus* (Velen.) Jalas, *Verbascum pseudonobile* Stoj. & Stef.

Fourty one percent are relicts. Eighty-six species are tertiary relicts: *Adiantum capillus-veneris*, *Aesculus hippocastanum* L., *Butomus umbellatus* L., *Calluna vulgaris* (L.) Hulland, *Daphne pontica* L., *Ephedra distachya* L. and others. Twenty-seven are quaternary glacial relicts: *Dasiphora fruticosa* Raf., *Drosera rotundifolia* L., *Equisetum fluviatile* L., *Galanthus nivalis*, *Gymnadenia conopsea* (L.) R.Br.,

Menyanthes trifoliata L., *Rheum rhaponticum*, *Rhodiola rosea*, *Salix pentandra* L. and others. Four species are quaternary interglacial relicts: *Adonis vernalis* L., *Asparagus tenuifolius*, *Iris pumila* L., *Amygdalus nana* L. One plant is quaternary postglacial relict – *Rubus saxatilis* L. (Annex B).

The Annex III of the Biodiversity Act (Anonymous 2007) in Bulgaria lists 23 % of species of medicinal plants in the country: *Limonium vulgare* Mill., *Acanthus spinosus* L., *Acorus calamus* L., *Adiantum capillus-veneris*, *Alchemilla mollis* (Buser) Rothm., *Alkanna tinctoria*, *Artemisia lerschiana* Web., *Chamaecytisus ratisbonensis* (Schaeff.) Rothm., and others.

There are 8 % of the species under the protection of the International Convention on Trade in Wildlife (1973): *Platanthera chlorantha* Reich., *Orchis simia* Lam., *Gymnadenia conopsea*, *Anacamptis pyramidalis* Rich., *Cyclamen hederifolium* Aiton, *Galanthus elwesii*, *G. nivalis* and others.

Two percent of species are covered by the Bern Convention, 1979 (Council of Europe 2022): *Armoracia macrocarpa* (Waldst. & Kit.) Kit. ex Baumg., *Campanula lanata*, *Cyclamen coum* Mill., *Haberlea rhodopensis* Friv., *Orchis provincialis* Balb. ex Lam. & DC., *Rheum rhaponticum* and *Vaccinium arctostaphylos*.

Two percent of species that occur in Bulgaria, are included in the Annexes of the Habitats Directive: *Echium russicum*, *Galanthus nivalis* L., *Gentiana lutea*, *Himantoglossum jankae* Somlyay, Kreutz & Óvári, *Lycopodium clavatum* L., *Ruscus aculeatus* L.

As examples of overexploited species, well-known species, such as *Gentiana lutea*, *G. punctata*, *Leontopodium alpinum* (Ten.) Huet ex Hand.-Mazz., *Haberlea rhodopensis*, etc., can be mentioned

as more recognizable by people and collected in greater quantities for medicinal and ornamental purposes. As measures to prevent overexploitation of resources of rare and endangered species, it can be recommended to strengthen the control at the time when the relevant species are collected.

Conclusions

The medicinal plants with conservational significance in the Bulgarian flora are 290. Of these, 5 species are Bulgarian endemics; 11 are Balkan endemics. 63 species are listed in the Red Data Book of Bulgaria, of which 23 are critically endangered (CR), 37 are endangered (EN), and 3 are vulnerable (VU). The Annexes of the Biodiversity Conservation Act in Bulgaria list 81 species of medicinal plants in the country. There are 7 species covered by the Bern Convention. Of the species in the Annexes to the Habitats Directive, 5 species occur in Bulgaria. There are 23 species under the protection of the International Convention on Trade in Wildlife (CITES 1973). Of the common medicinal plants in Bulgaria 5 are listed in the World Red List of Plants. There are 119 species in the European Red List of different categories. Of these, 110 are Least concern (LC), 2 are Near threatened (NT), and 8 are Data deficient (DD). The list of species included in European Red List of Medicinal plants comprises 54 species. The List of rare and endangered endemic plants in Europe includes 6 species. There are 4 species in the Rare category (R), and the species *Sempervivum erythraeum* Velen. and *Sempervivum leucanthum* Pancic. are listed as taxa whose populations have been conserved. There are 86 species, which are tertiary and 33, which are gla-

cial relicts.

With the highest conservational status among them are: *Campanula lanata*, *Rheum rhaponticum* included in 7 documents. They are followed by *Galanthus nivalis*, *Vaccinium arctostaphylos*, which are present in 6 lists. *Orchis provincialis* is a part of 6 documents. *Haberlea rhodopensis* and *Galanthus elwesii* are part of four documents. *Mentha aquatica* L., *Hydrocharis morsus-ranae* and others are included only in one document.

The results indicate that substantial part of the medicinal plant species of the Bulgarian flora are of high conservation value.

The regulations governing their exploitation must be strictly observed during the collection of these species, in which the protection of their habitats by the competent state authorities is provided.

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Annex A

Table A1. Conservational status of medicinal plants of Bulgarian flora.

Species	Conservation importance						Measures taken				No of documents including the taxon
	Red Data Book of Bulgaria (2015)	IUCN	ERLMP	ERLVP	LRTEP	Endemic	Biodiv. Act (2002)	CITES Appendix 2	Bern Conv. (1979)	Habitats Directive	
1	2	3	4	5	6	7	8	9	10	11	12
<i>Acanthus spinosus</i> L.							+				1
<i>Acorus calamus</i> L.							+				1
<i>Adiantum capillus-veneris</i> L.	CR		+				+				4
<i>Aesculus hippocastanum</i> L.			+				+				3
<i>Alchemilla achtarowii</i> Pawl.	EN	+				Bul	+				4
<i>Alchemilla asteroantha</i> Rothm.	CR	+				Bal	+				4
<i>Alchemilla jumrukczalica</i> Pawl.	CR	+				Bul	+				4
<i>Alchemilla mollis</i> (Buser) Rothm.	CR						+				2
<i>Alchemilla catachnoa</i> Rothm.	EN					Bal					2
<i>Alchemilla fissa</i> Günther & Schummel	EN										1
<i>Alchemilla indivisa</i> (Buser) Rothm.	EN					Bal					2
<i>Alchemilla plicata</i> Buser	EN										1
<i>Alchemilla pyrenaica</i> Dufour	EN										1
<i>Alisma plantago-aquatica</i> L.				LC							1
<i>Alkanna tinctoria</i> Tausch.	EN		+				+				3
<i>Allium albidum</i> Fischer ex Bieb.				DD							1
<i>Allium amethystinum</i> Tausch				LC							1
<i>Allium ampeloprasum</i> L.				LC							1
<i>Allium angulosum</i> L.	CR						+				2
<i>Allium atrovioleaceum</i> Boiss.				DD							1
<i>Allium carinatum</i> L.				LC							1
<i>Allium flavum</i> L.				LC							1
<i>Allium fuscum</i> Waldst. & Kit.				LC							1
<i>Allium guttatum</i> Steven				LC							1
<i>Allium melanantherum</i> Pancic				LC							1
<i>Allium schoenoprasum</i> L.			+	LC							2
<i>Allium scorodoprasum</i> L.				LC							1
<i>Allium ursinum</i> L.			+	LC							2

1	2	3	4	5	6	7	8	9	10	11	12
<i>Allium victorialis</i> L.				LC							1
<i>Anacamptis pyramidalis</i> Rich.			+	LC			+	+			4
<i>Anethum graveolens</i> L.	EN										1
<i>Angelica archangelica</i> L.			+				+				2
<i>Apium graveolens</i> L.				LC							1
<i>Aquilegia nigricans</i> Baumg.			+				+				2
<i>Aristolochia rotunda</i> L.	EN						+				2
<i>Armoracia macrocarpa</i> (Waldst. & Kit.) Kit. ex Baumg.	EN		+						+		3
<i>Artemisia lerchiana</i> Web.							+				1
<i>Asparagus officinalis</i> L.			+	LC							2
<i>Asparagus tenuifolius</i> Lam.				LC							2
<i>Astragalus dasyanthus</i> Pall.					R		+				2
<i>Barbarea vulgaris</i> W. T. Aiton				LC							1
<i>Bidens tripartita</i> L.				LC							1
<i>Brassica nigra</i> L.				LC							1
<i>Bupleurum longifolium</i> L.	CR						+				2
<i>Butomus umbellatus</i> L.				LC							2
<i>Calluna vulgaris</i> (L.) Hull			+				+				3
<i>Caltha palustris</i> L.				LC							1
<i>Campanula lanata</i> Friv.	VU	+		DD		Bal	+		+		7
<i>Cardamine amara</i> L.				LC							1
<i>Cardamine pratensis</i> L.				LC							1
<i>Castanea sativa</i> Mill.	EN		+								3
<i>Chamaecytisus ratisbonensis</i> (Schaeff.) Rothm.							+				1
<i>Cichorium intybus</i> L.			+	LC							2
<i>Cicuta virosa</i> L.	CR		+	LC			+				4
<i>Colchicum diampolis</i> Delip. & Cheshm.	CR					Bul	+				3
<i>Cyclamen coum</i> Mill.				LC			+	+	+		5
<i>Cyclamen hederifolium</i> Aiton			+					+			2
<i>Dasiphora fruticosa</i> Raf.		+					+				3
<i>Daphne pontica</i> L.	EN						+				3
<i>Diphysastrum alpinum</i> (L.) Holub							+				1
<i>Diploaxis tenuifolia</i> (L.) DC.				LC							1
<i>Dracunculus vulgaris</i> Schott							+				1
<i>Drosera rotundifolia</i> L.			+				+				3
<i>Echium russicum</i> Gmel.	VU			LC						II/IV	3

1	2	3	4	5	6	7	8	9	10	11	12
<i>Ephedra distachya</i> L.							+				2
<i>Equisetum arvense</i> L.			+	LC							2
<i>Equisetum fluviatile</i> L.				LC							2
<i>Equisetum palustre</i> L.				LC							1
<i>Eriophorum angustifolium</i> Honck.				LC							1
<i>Eryngium maritimum</i> L.	EN		+				+				3
<i>Euphorbia peplis</i> L.							+				1
<i>Fragaria vesca</i> L.			+	LC							2
<i>Galanthus elwesii</i> Hook.f.	EN			DD			+	+			4
<i>Galanthus nivalis</i> L.	EN			NT			+	+		V	6
<i>Gentiana lutea</i> L.	EN		+	LC			+			V	6
<i>Gentiana punctata</i> L.	EN		+				+				3
<i>Glycyrrhiza glabra</i> L.			+				+				2
<i>Gratiola officinalis</i> L.			+	LC							2
<i>Gymnadenia conopsea</i> (L.) R.Br.			+	LC				+			4
<i>Haberlea rhodopensis</i> Friv.				LC			+		+		4
<i>Himantoglossum jankae</i> Somlyay, Kreutz & Óvári				LC			+	+		II	4
<i>Hippophae rhamnoides</i> L.	CR						+				2
<i>Hordeum vulgare</i> L.				LC							1
<i>Hottonia palustris</i> L.	EX			LC			+				4
<i>Hydrocharis morsus-ranae</i> L.				LC							1
<i>Hypericum androsaemum</i> L.	EN						+				3
<i>Ilex aquifolium</i> L.	EN		+				+				4
<i>Ilex colchica</i> Pojark.	EN						+				3
<i>Iris pseudacorus</i> L.			+	LC							2
<i>Juniperus sabina</i> L.	EN		+				+				3
<i>Juniperus excelsa</i> M.Bieb.							+				2
<i>Lactuca serriola</i> L.				LC							1
<i>Lathyrus sylvestris</i> L.				LC							1
<i>Lathyrus tuberosus</i> L.				LC							1
<i>Lemna minor</i> L.				LC							1
<i>Leontopodium alpinum</i> (Ten.) Huet ex Hand.-Mazz.	EN	+	+	LC			+				5
<i>Lepidium campestre</i> (L.) W.T.Aiton				LC							1
<i>Lepidium graminifolium</i> L.				LC							1
<i>Lepidium latifolium</i> L.				LC							1
<i>Lepidium perfoliatum</i> L.				LC							1

1	2	3	4	5	6	7	8	9	10	11	12
<i>Lepidium rudera</i> L.				LC							1
<i>Ligularia glauca</i> (L.) O. Hoffm.	CR				R		+				3
<i>Limonium vulgare</i> Mill.							+				1
<i>Lolium temulentum</i> L.				LC							1
<i>Lotus corniculatus</i> L.				LC							1
<i>Lycopodium clavatum</i> L.			+	LC							2
<i>Lycopus europaeus</i> L.				LC							1
<i>Lysimachia nummularia</i> L.				LC							1
<i>Lythrum salicaria</i> L.			+	LC							2
<i>Lythrum virgatum</i> L.				LC							1
<i>Malus sylvestris</i> Mill.			+	DD							2
<i>Medicago disciformis</i> DC.				LC							1
<i>Melilotus alba</i> Medik.				LC							1
<i>Melilotus officinalis</i> Pallas			+	LC							2
<i>Mentha aquatica</i> L.				LC							1
<i>Mentha pulegium</i> L.			+	LC							2
<i>Mentha spicata</i> L.				LC							1
<i>Menyanthes trifoliata</i> L.	EN		+	LC			+				5
<i>Myricaria germanica</i> (L.) Desv.	CR			LC			+				3
<i>Najas marina</i> L.				LC							1
<i>Nuphar lutea</i> Sm.	EN		+	LC			+				4
<i>Nymphaea alba</i> L.	EN		+	LC			+				4
<i>Oenanthe aquatica</i> L.			+	LC							3
<i>Opopanax chironium</i> W.D.J.Koch	VU					Bal					2
<i>Orchis coriophora</i> L.								+			1
<i>Orchis laxiflora</i> Lam.								+			1
<i>Orchis mascula</i> L.				LC				+			2
<i>Orchis militaris</i> L.	EN		+	LC			+	+			5
<i>Orchis morio</i> L.								+			1
<i>Orchis pallens</i> L.			+	LC				+			3
<i>Orchis papilionacea</i> L.							+	+			2
<i>Orchis provincialis</i> Balb. ex Lam. & DC.	CR		+	LC			+	+	+		6
<i>Orchis punctulatum</i> Stev.								+			1
<i>Orchis purpurea</i> Hudson			+	LC				+			3
<i>Orchis simia</i> Lam.			+	LC				+			3
<i>Orchis spitzelii</i> Sauter ex W. Koch	CR		+	NT			+	+			5
<i>Orchis tridentata</i> Scop.								+			1

1	2	3	4	5	6	7	8	9	10	11	12
<i>Orchis ustulata</i> L.								+			1
<i>Osmunda regalis</i> L.	CR		+				+				3
<i>Pedicularis palustris</i> L.	CR						+				2
<i>Persicaria hydropiper</i> (L.) Delabre				LC							1
<i>Persicaria lapathifolia</i> (L.) Delarbre				LC							1
<i>Peucedanum ruthenicum</i> M. Bieb	CR						+				2
<i>Pimpinella major</i> (L.) Huds.	EX										1
<i>Platanthera bifolia</i> Rich.				LC				+			2
<i>Platanthera chlorantha</i> Reich.			+	LC				+			3
<i>Polygala amarella</i> Crantz	EN						+				2
<i>Polypodium cambriacum</i> L.							+				1
<i>Potentilla palustris</i> (L.) Scop.							+				1
<i>Prangos ferulacea</i> (L.) Lindl.	EN						+				2
<i>Prunus cerasifera</i> Ehrh.				DD							1
<i>Prunus fruticosa</i> Pall.				DD							2
<i>Prunus mahaleb</i> L.				LC							1
<i>Prunus padus</i> L.				LC							1
<i>Prunus spinosa</i> L.			+	LC							2
<i>Pyrola rotundifolia</i> L.							+				1
<i>Quercus coccifera</i> L.	EN						+				3
<i>Ranunculus flammula</i> L.				LC							1
<i>Ranunculus lingua</i> L.				LC							1
<i>Ranunculus repens</i> L.				LC							1
<i>Ranunculus sceleratus</i> L.				LC							1
<i>Raphanus raphanistrum</i> L.				LC							1
<i>Rhamnus alpinus</i> L.	EN										1
<i>Rheum rhaponticum</i> L.	CR	+			R	Bul	+		+		7
<i>Rhodiola rosea</i> L.	CR		+				+				4
<i>Rhododendron ponticum</i> L.							+				2
<i>Ribes nigrum</i> L.	CR		+				+				3
<i>Rorippa austriaca</i> (Crantz) Besser				LC							1
<i>Rorippa sylvestris</i> (Crantz) Besser				LC							1
<i>Rubus macrophyllus</i> Weihe & Nees							+				1
<i>Rumex hydrolapathum</i> Huds.				LC							1
<i>Ruscus aculeatus</i> L.			+	LC						V	4
<i>Ruta graveolens</i> L.	EN		+				+				4
<i>Salix pentandra</i> L.	CR						+				3

1	2	3	4	5	6	7	8	9	10	11	12
<i>Sambucus deborensis</i> Koš.	CR					Bal	+				3
<i>Samolus valerandi</i> L.				LC							1
<i>Sempervivum erythraeum</i> Velen.					NT	Bal					2
<i>Sempervivum leucanthum</i> Panc.					NT	Bul					2
<i>Senecio paludosus</i> L.	EN						+				2
<i>Sideritis scardica</i> Griseb.	EN		+			Bal	+				4
<i>Sideritis syriaca</i> L.	CR						+				2
<i>Sinapis alba</i> L.				LC							1
<i>Sparganium erectum</i> L.				LC							1
<i>Spiraea salicifolia</i> L.							+				1
<i>Spirodela polyrrhiza</i> (L.) Schleid.				LC							1
<i>Taxus baccata</i> L.	EN						+				2
<i>Tetragonolobus maritimus</i> (L.) Roth							+				1
<i>Teucrium scordium</i> L.				LC							1
<i>Thymus perinicus</i> (Velen.) Jalas	EN					Bal	+				3
<i>Thymus stojanovii</i> Degen	CR					Bal					2
<i>Trachomitum venetum</i> (L.) Woodson	EN						+				2
<i>Trifolium alpestre</i> L.				LC							1
<i>Trifolium arvense</i> L.				LC							1
<i>Trifolium pratense</i> L.			+	LC							2
<i>Trifolium repens</i> L.				LC							1
<i>Typha angustifolia</i> L.				LC							1
<i>Typha latifolia</i> L.				LC							1
<i>Urtica dioica</i> L.			+	LC							2
<i>Vaccinium arctostaphylos</i> L.	EN			DD	R		+		+		6
<i>Verbascum pseudonobile</i> Stoj. & Stef.	EN					Bal	+				3
<i>Veronica anagallis-aquatica</i> L.				LC							1
<i>Veronica beccabunga</i> L.				LC							1
<i>Vicia grandiflora</i> Scop.				LC							1
<i>Vicia sativa</i> L.				LC							1
<i>Vitis vinifera</i> L.			+	LC							2

Note: CR – critically endangered; EN – endangered; VU – vulnerable; IUCN – International union for conservation of nature; ERLVP – European Red List of vascular plants; NT – near threatened; LC – least concern; DD – data deficient; LRTEP – List of rare, threatened and endemic plants in Europe; R – rare; Bal – Balkan endemic; Bul – Bulgarian endemic; CITES – Convention on international trade in endangered species of wild fauna and flora; Bern Conv. – the Convention on the conservation of European wildlife and natural habitats; Habitats Directive – Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora.

Annex B

List of relict medicinal vascular plants in Bulgaria

Tertiary relicts: *Adiantum capillus-veneris* L., *Juniperus communis* L., *J. oxycedrus* L., *J. sabina* L., *Ephedra distachya* L., *Abies alba* Mill., *Picea abies* (L.) Karst, *Pinus nigra* J.F. Arnold, *P. peuce* Griseb., *P. sylvestris* L., *Taxus baccata* L., *Butomus umbellatus* L., *Tamus communis* L., *Hydrocharis morsus-ranae* L., *Acer campestre* L., *A. platanoides* L., *A. pseudoplatanus* L., *A. tataricum* L., *Cotinus coggygria* Scop, *Rhus coriaria* L., *Oenanthe aquatica* (L.) Poir., *Sanicula europaea* L., *Ilex aquifolium* L., *I. colchica* Pojark., *Hedera helix* L., *Asarum europaeum* L., *Periploca graeca* L., *Berberis vulgaris* L., *Alnus glutinosa* (L.) Gaertn., *A. incana* (L.) Moench, *Betula pendula* Roth, *Campanula lanata* Friv., *Sambucus racemosa* L., *Carpinus betulus* L., *C. orientalis* Mill., *Corylus avellana* L., *C. colurna* L., *Arctostaphylos uva-ursi* (L.) Spreng., *Calluna vulgaris* (L.) Hull, *Rhododendron ponticum* L., *Vaccinium arctostaphylos* L., *V. myrtillus* L., *V. uliginosum* L., *Cercis siliquastrum* L., *Colutea arborescens* L., *Castanea sativa* Mill., *Cistus creticus* L., *Fagus orientalis* Lipsky, *Quercus cerris* L., *Q. coccifera* L., *Q. dalechampii* Ten., *Q. pubescens* Willd., *Gentiana lutea* L., *Haberlea rhodopensis* Friv., *Aesculus hippocastanum* L., *Hypericum androsaemum* L., *Juglans regia* L., *Lycopus europaeus* L., *Viscum album* L., *Fraxinus excelsior* L., *F. ornus* L., *Jasminum fruticans* L., *Phillyrea latifolia* L., *Syringa vulgaris* L., *Platanus orientalis* L., *Rumex acetosa* L., *Cyclamen coum* Mill., *Clematis vitalba* L., *Isopyrum thalictroides* L., *Ranunculus lingua* L., *Crataegus pentagyna* Waldst. & Kit., *Laurocerasus officinalis* Roem, *Mespilus germanica* L., *Potentilla palustris* (L.) Scop., *Prunus fruticosa* Pall., *Dictamnus albus* L., *Ruta graveolens* L., *Populus alba* L., *P. nigra* L., *P. tremula* L., *Salix alba* L., *S. caprea* L., *S. fragilis* L., *S. purpurea* L., *S. triandra* L., *Smilax excelsa* L., *Staphylea pinnata* L., *Daphne mezereum* L., *D. pontica* L., *Celtis australis* L., *Ulmus minor* Mill., *Vitis sylvestris* C.C.Gmel.

Quaternary glacial relicts: *Equisetum fluviatile* L., *Diphasiastrum alpinum* (L.) Holub, *Galanthus nivalis* L., *Eriophorum vaginatum* L., *Gymnadenia conopsea* (L.) R.Br., *Meum athamanticum* Jacq., *Antennaria dioica* (L.) Gaertn., *Rhodiola rosea* L., *Drosera rotundifolia* L., *Vaccinium vitis-idaea* L., *Gentiana asclepiadea* L., *G. verna* L., *Gentianella bulgarica* (Velen.) Holub, *Menyanthes trifoliata* L., *Parnassia palustris* L., *Bistorta major* S. Gray, *Oxyria digyna* (L.) Hill, *Rheum rhaponticum* L., *Pyrola chlorantha* Sw., *Dasiphora fruticosa* (L.) Rydb, *Dryas octopetala* L., *Geum montanum* L., *G. reptans* L., *Spiraea salicifolia* L., *Salix pentandra* L., *S. reticulata* L., *Ribes nigrum* L., *Myricaria germanica* (L.) Desv.

Quaternary interglacial relicts: *Adonis vernalis* L., *Asparagus tenuifolius* Lam., *Iris pumila* L., *Amygdalus nana* L.

Quaternary postglacial relict: *Rubus saxatilis* L.