Medicinal plants of the Bulgarian dendroflora

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Abstract. The paper offers characterisation of the medicinal plants of the Bulgarian dendroflora. Of the 406 species of arboreal plants found on the Bulgarian territory, 180 (44.3%) belonging to 97 genera and 44 families are considered medicinal and are used in different areas of medicine. *Pinophyta* is represented by 11 species, while *Magnoliophyta* by 169 species. Most medicinal plants belong to the families *Rosaceae* – 44 species (24.4%), *Fabaceae* – 17 (9.4%), *Fagaceae* – 10 (5.6%), *Lamiaceae* – 9 (5.0%), *Salicaceae* and *Oleaceae* – 8 species each (4.4%), etc. The most represented genera are *Rubus* – 10 species (5.6%), *Prunus, Quercus* and *Rosa* – 7 species each (3.9%), *Acer, Pyrus* and *Salix* – 5 species each (2.8%), etc. According to their biological type, the trees are represented by 59 species (32.8%), trees and shrubs – 8 species (4.4%), shrubs or trees – 25 species (13.9%), shrubs by 68 species (37.7%), shrubs to sub-shrubs – 1 species (0.6%), sub-shrubs – 6 species (3.3%), sub-shrubs to perennial herbaceous plants – 6 species (3.3%), and perennial herbaceous plants to sub-shrubs – 7 species (3.9%). Among the plants of interest the floristic elements with an European component (Eur) predominate – 67 species (37.2%), followed by the Mediterranean species (Med) – 46 (25.6%), Boreal elements (Boreal) – 19 (10.6%), Pontian species (Pont) – 18 (10.0%), adventive species (Adv) – 16 (8.9%), Balkan endemics (Bal) – 4, Euxinian elements (Eux) - 3, and Alpine (Alp), Arcto-Alpine (Arct-Alp), Pannonian (Pann), hybrid species (Hybr) and Bulgarian endemics – one species each. The distribution of species in the different floristic regions indicates that 70 species (40%) can be found in all floristic regions of Bulgaria, and 12 species (6.7%) occur in one floristic region only. The distribution of species is presented by floristic regions and sub-regions. Most medicinal arboreal plants fall into the floristic regions of the Rhodopes – 148 species (36.5% of the Bulgarian denroflora), Balkan Range – 143 (35.2%), Black Sea Coast – 121 (29.8%), Pirin Mts – 117 (28.8%), Thracian Lowland – 116 (28.6%), and Mt Vitosha – 114 species (28.1%). Most species – 43 (23.9%) are distributed within the altitudinal range of 0–1500 m a.s.l. A total of 27 species (15.0%) are included in the *Red Data Book of the PR Bulgaria* (Velchev 1984) and 22 (12.2%) species are protected by the Biodiversity Act. A full list of the medicinal plants of the Bulgarian dendroflora is presented.

Key words: Bulgaria, dendroflora, medicinal plants

Introduction

Application of medicinal plants in human life is constantly increasing. The need in more thorough knowledge about their biology and use has attracted the attention of researchers. Mention deserves the fact that Bulgaria is among the first countries in Europe in the export of medicinal and aromatic plants (Hardalova & al. 1994; Lange 1998; Hamilton 2003; Kathe & al. 2003; Gussev 2005; Vitkova & Tashev 2007).

According to Kozhuharov & al. (1988) and Peev & al. (1993), the Bulgarian dendroflora consists of 359 species, including 368 infraspecific taxa (60 subspecies, 200 varieties and 108 forms). This estimate was based on the *Flora of Bulgaria*. According to the authors, of highest species diversity are the floristic regions of the Rhodopi Mts and the Balkan Range (210

species), Rila Mts (164 species), and Mt Vitosha (148 species). In terms of vertical distribution, most species occur within the altitudinal range of 0–600 m, and 36 species grow in the xerothermic oak forest belt. Also, 61 species are included in the *Red Data Book of the PR Bulgaria* (Velchev 1984).

Tashev (1999) considered that there are about 360 species in the Bulgarian dendroflora, 16 of them Gymnosperms and 344 Angiosperms. They include 88 trees, 237 shrubs and 35 sub-shrubs (fruticose plants).

Yurukov & Zhelev (2001) maintained that there are 370 species in the Bulgarian dendroflora, 16 of them Gymnosperms.

Alexandrov & al. (2005), relying on the principal references about the Bulgarian dendroflora (Stefanov 1934; Stefanov & Ganchev 1953, 1958; Tschernyavsky & al. 1959; Delkov 1992), reported some 290 species, including 110 trees and 180 shrubs, belonging to 93 genera and 42 families.

The Medicinal Plants Act (2000) covers 739 species of higher plants, 113 of them arboreal, which constitute about 28 % of the Bulgarian dendroflora and 63 % of the arboreal plants that can be used as medicinal. Hardalova & al. (1994) noted that 15 % of the medicinal plants are shrubs and 11 % are trees, but these proportions relate only to 244 species, 207 of them belonging to the indigenous flora. According to Gussev (2005), there are 768 medicinal plants in the Bulgarian flora, and 764 are plants of indigenous or adventive origin.

The aim of the present study is to offer a complete list of the medicinal plants of the Bulgarian dendroflora. Furthermore, the authors wanted to present a thorough characteristic of their taxonomic structure, biological types, and phytogeographic origin; distribution in the floristic regions, and dependence on altitude. Also, their national and international conservation importance was considered.

Material and methods

A critical analysis of the existing literature sources on the Bulgarian vascular flora (Jordanov 1966, 1970, 1973, 1976, 1979; Velchev 1982, 1984, 1989; Kozhuharov 1992, 1995; Delipavlov & Cheshmedzhiev 2003; Assyov & Petrova 2006) helped building up a database on the arboreal species (trees, shrubs, sub-shrubs, and arboreal vines), which includes the systematic and phytogeographic affinity of the taxa, their distribution in the floristic regions and sub-regions of Bulgaria, their vertical distribution and conservation significance (Velchev 1984; Biodiversity Act of Bulgaria 2002; Assyov & Petrova 2006). The phytogeographic origin of species of the medicinal dendroflora was determined according to Walter's classification adapted to Bulgarian conditions (Assyov & Petrova 2006). The life-forms are given according to Raunkiaer (1934).

A species was considered a medicinal plant when meeting the legal definition published in the *Medicinal Plants Act* (2000). According to it these are "... plants that are used, in fresh or dry condition, for cure or prophylactics, for production of pharmaceuticals, for food, for cosmetic and technical purposes". According to Dudka (1984), the medicinal plants are "a large group of plants used in human or veterinary medicine for medicinal or prophylactic purposes". Many of these species are used for more than one purpose and have multifunctional importance. Therefore, the term "medicinal plants" has conditional meaning (Gussev 2005). In the present work we identify as medicinal plants the species included in the above-mentioned Act, and some others not mentioned in the Act but for which there is information in literature about their medicinal and prophylactic characteristics.

The list includes autochtonous and introduced species that have been naturalized and belong to the adventive elements in the Bulgarian flora (Assyov & Petrova 2006). Examples are: *Acer negundo*, *Ailanthus altissima*, *Amorpha fruticosa*, *Cercis siliquastrum*, *Elaeagnus angustifolia*, *Ficus carica*, *Gleditsia triacanthos*, *Lavandula angustifolia*, *Prunus domestica*, *Robinia pseudoacacia*, *Salvia officinalis*, *Spartium junceum*, *Ziziphus jujuba*.

We did not include in the list the arboreal plants that have been introduced to Bulgaria and are developing and fructifying successfully. They are used for medicinal purposes but are not part of the indigenous, albeit in some cases adventive Bulgarian flora. Of this group we could mention: *Ginkgo biloba*, *Thuja occidentalis*, *Amygdalus communis*, *Aronia melanocarpa*, *Buxus sempervirens*, *Cydonia oblonga*, *Gossypium hirsutum*, *Laburnum anagyroides*, *Laurus nobilis*, *Lonicera caprifolium*, *Nerium oleander*, *Olea europaea*, *Prunus armeniaca*, *P. persica*, *Punica granatum*, *Rosa damascena*, *R. rugosa*, *Rosmarinus officinalis*, *Sophora japonica*, *Vitis vinifera*, and some others. Also, in our

opinion there are many more species of the Bulgarian dendroflora that could be used for medical purposes but which are not yet studied in detail. Therefore, we believe that this list will be continued. In this group we could classify all species of the genera *Pinus, Juniperus*, *Alnus, Crataegus, Rubus, Rosa, Sorbus, Pyrus, Thymus, Vitis, Daphne, Ilex* and some others, which were not studied to date. Some of them with similar morphological, chorological and medicinal characteristics can be classified to groups of species or complexes of species (Hardalova & al. 1994).

The list follows the taxonomic framework of Takhtajan (1987). The nomenclature of taxa is according to *Flora Europaea* (Tutin & al. 1964–1980, 1993). The abbreviations of the authors' names are after Brummit & Powel (1992). The names of floristic regions in Bulgaria are according to Assyov & Petrova (2006).

Results and discussion

According to the latest data (Assyov & Petrova 2006; Tashev 2007a, b), the higher flora of Bulgaria comprises of 4000 species belonging to 906 genera and 153 families.

We classify 406 species from 139 genera and 55 families as belonging to the dendroflora. The higher number of species in comparison to the other reports is due to the fact that we have included some species of transitional nature indicated in the Floras as perennial to subshrubs, or sub-shrubs to perennial. Also some species that are naturalized in Bulgaria and have become a part of the adventive elements (Assyov & Petrova 2006) are included, as well as some recently discovered species as new for the country (Petrova & al. 2005).

On the basis of a literature survey (Williams 1951; Ivanov & al. 1973; Stoyanov 1973; Petkov 1982; Neshev & Landzhev 1989; Hardalova & al. 1994; Bondev 1995; Assenov 1998; Medicinal Plants Act of Bulgaria 2000; Delipavlov & Cheshmedzhiev 2003; Gulko 2005; Gussev 2005; Minarchenko 2005; Landzhev 2005; Bolotina 2006; Nikolov 2007), we have found that the medicinal arboreal plants of the Bulgarian flora amount to 180 species from 97 genera and 44 families (Annex 1). This accounts for 4.5 % of the species, 10.7 % of the genera and 28.8 % of the families of the Bulgarian flora and 44.3 % of the species, 69.8 % of the genera and 80 % of the families of the dendroflora.

Pinophyta is represented by 11 species, and *Magnoliophyta* by 169 species, of which only two species belong to *Liliopsida*, while the remaining 167 species belong to *Magnoliopsida*. The first eight most numerous families regarding the arboreal medicinal plants include 120 species, or 66.7 % of the medicinal dendroflora of Bulgaria. These are *Rosaceae* – 44 species (24.4 %), *Fabaceae* – 17 (9.4 %), *Fagaceae* – 10 (5.6 %), *Lamiaceae* – 9 (5.0 %), *Salicaceae* and *Oleaceae* – 8 species each (4.4 %), *Betulaceae*, *Ericaceae* – 7 species each (3.9 %), and *Aceraceae* and *Pinaceae* – 5 species each (2,8 %). Nineteen families are represented by only one species.

Annex 1. List of medicinal plants of the Bulgarian dendroflora.

Pinophyta

Cupressaceae
Juniperus communis L.
J. oxycedrus L.
J. sabina L.
J. sibirica Burgsd.

Ephedraceae
Ephedra distachya L.

Pinaceae
Abies alba Mill.
Picea abies (L.) Karst.
Pinus nigra Arnold
P. peuce Griseb.
P. sylvestris L.

Taxaceae
Taxus baccata L.

Magnoliophyta
Magnoliopsida

Aceraceae
Acer campestre L.
A. negundo L.
A. platanoides L.
A. pseudoplatanus L.
A. tataricum L.

Anacardiaceae
Cotinus coggygria Scop.
Rhus coriaria L.

Aquifoliaceae
Ilex aquifolium L.

Araliaceae
Hedera helix L.

Asclepiadaceae
Cionura erecta (L.) Griseb.
Periploca graeca L.

Berberidaceae
Berberis vulgaris L.

Betulaceae
Alnus glutinosa (L.) Gaertn.
A. incana (L.) Moench
Betula pendula Roth
Carpinus betulus L.

Annex 1. Continuation.

C. orientalis Mill.
Corylus avellana L.
C. colurna L.

Caprifoliaceae
Lonicera xylosteum L.
Sambucus nigra L.
S. racemosa L.
Viburnum opulus L.

Celastraceae
Euonymus europaeus L.
E. verrucosus Scop.

Chenopodiaceae
Camphorosma monspeliaca L.

Cornaceae
Cornus mas L.

Elaeagnaceae
Elaeagnus angustifolia L.
Hippophae rhamnoides L.

Ericaceae
Arctostaphylos uva-ursi (L.) Spreng.
Calluna vulgaris (L.) Hull
Rhododendron ponticum L.
Vaccinium arctostaphylos L.
V. myrtillus L.
V. uliginosum L.
V. vitis-idaea L.

Fabaceae
Amorpha fruticosa L.
Cercis siliquastrum L.
Chamaecytisus albus (Jacq.) Rothm.
Ch. hirsutus (L.) Link
Ch. lejocarpus (A. Kern.) Rothm.
Ch. ratisbonensis (Schaeff.) Rothm.
Chamaespartium sagittale (L.) Gibbs
Colutea arborescens L.
Genista depressa M. Bieb.
G. ovata Waldst. & Kit.
G. tinctoria L.
Gleditsia triacanthos L.
Glycyrrhiza glabra L.
Ononis repens L.
O. spinosa L.
Robinia pseudoacacia L.
Spartium junceum L.

Fagaceae
Castanea sativa Mill.
Fagus orientalis Lipsky
F. sylvatica L.
Quercus cerris L.
Q. coccifera L.
Q. dalechampii Ten.
Q. frainetto Ten.
Q. petraea (Matt.) Liebl.
Q. pubescens Willd.
Q. robur L.

Globulariaceae
Globularia cordifolia L.

Hippocastanaceae
Aesculus hippocastanum L.

Hypericaceae (Guttiferae)
Hypericum androsaemum L.

Juglandaceae
Juglans regia L.

Lamiaceae (Labiatae)
Hyssopus officinalis L.
Lavandula angustifolia Mill.
Salvia officinalis L.
S. tomentosa Mill.
Satureja cuneifolia Ten.
S. montana L.
Thymus longedentatus (Degen & Urum.) Ronn.
Th. perinicus (Velen.) Jalas
Th. pulegioides L.

Loranthaceae
Loranthus europaeus L.
Viscum album L.

Moraceae
Ficus carica L.
Morus alba L.
M. nigra L.

Oleaceae
Fraxinus excelsior L.
F. ornus L.
F. oxycarpa M. Bieb. ex Willd.
F. pallisiae Wilm.
Jasminum fruticans L.
Ligustrum vulgare L.
Phillyrea latifolia L.
Syringa vulgaris L.

Platanaceae
Platanus orientalis L.

Ranunculaceae
Clematis recta L.
C. vitalba L.

Rhamnaceae
Frangula alnus Mill.
F. rupestris (Scop.) Schur
Paliurus spina-christi Mill.
Rhamnus catharticus L.
Ziziphus jujuba

Rosaceae
Amygdalus nana L.
Crataegus monogyna Jacq.
C. orientalis L.
C. pentagyna Waldst. & Kit.
Dryas octopetala L.
Laurocerasus officinalis M. Roem.
Malus dasyphylla Borkh.
M. praecox (Pall.) Borkh.
M. sylvestris Mill.
Mespilus germanica L.
Potentilla palustris (L.) Scop.
Prunus avium L.
P. cerasus L.
P. domestica L.
P. fruticosa Pall.
P. mahaleb L.
P. padus L.
P. spinosa L.
Pyrus amygdaliformis Vill.
P. bulgarica Kuth. & Sachokia
P. elaeagrifolia Pall.
P. nivalis Jacq.
P. pyraster Burgsd.
Rosa caesia Sm.
R. canina L.
R. corymbifera Borkh.
R. dumalis Bechst.
R. gallica L.
R. pendulina L.
R. tomentosa Sm.
Rubus caesius L.
R. canescens DC.
R. discolor Weihe & Nees

Annex 1. Continuation.

R. hirtus Waldst. & Kit.
R. idaeus L.
R. lloydianus Genev.
R. macrophyllus Weihe & Nees
R. sanguineus Friv.
R. saxatilis L.
R. thyrsanthus Focke
Sorbus aucuparia L.
S. domestica L.
S. torminalis (L.) Crantz
Spiraea chamaedrifolia L.

Rutaceae
Dictamnus albus L.
Ruta graveolens L.

Salicaceae
Populus alba L.
P. nigra L.
P. tremula L.
Salix alba L.
S. caprea L.
S. fragilis L.
S. pentandra L.
S. purpurea L.

Saxifragaceae
Ribes nigrum L.
R. uva-crispa L.

Simaroubaceae
Ailanthus altissima (Mill.) Swingle

Solanaceae
Solanum dulcamara L.

Staphyleaceae
Staphylea pinnata L.

Tamaricaceae
Tamarix ramosissima Ledeb.
T. tetrandra Pall. ex M. Bieb.

Thymeleaceae
Daphne mezereum L.

Tiliaceae
Tilia cordata Mill.
T. plathyphyllos Scop.
T. rubra DC.
T. tomentosa Moench

Ulmaceae
Celtis australis L.
Ulmus glabra Huds.
U. minor Mill.

Vitaceae
Vitis sylvestris L.

Liliopsida

Liliaceae
Ruscus aculeatus L.

Smilacaceae
Smilax excelsa L.

The most represented genera are *Rubus* – 10 species (5.7 %), *Prunus*, *Quercus* and *Rosa* – 7 species each (4.0 %), *Acer*, *Pyrus* and *Salix* – 5 species each (2.8 %), *Chamaecytisus, Fraxinus, Juniperus, Tilia* and *Vaccinium* – 4 species each (2.3 %), *Crataegus, Genista, Malus, Pinus, Populus* and *Sorbus* – 3 species each (1.7 %), etc. Sixty-three genera are represented by one species only.

According to their biological type (life-form), the medicinal arboreal plants can be classified into eight groups, five of them transitional. The generalized distribution of species according to their biological type is presented in Fig. 1. The groups are as follows: trees – 59 species (32.8 %), trees or shrubs – 8 species (4.4 %), shrubs or trees – 25 species (13.9 %), shrubs – 68 species (37.7 %) (6 species are lianas: *Clematis vitalba*, *Hedera helix*, *Periploca graeca*, *Rubus macrophyllus*, *Smilax excelsa*, *Vitis sylvestris*), shrubs to semi-shrubs (fruticose plants) – 1 species (0.6 %), semi-shrubs – 6 species (3.3 %), semi-shrubs to perennial plants 6 species (3.3 %) and perennial plants to semi-shrubs – 7 species each (3.9 %). Six shrubs species are also vines (3.3 %).

According to the classification of Raunkiaer (1934), 153 species (85 %) are phanerophytes (Ph), 13 species (7.2 %) are chamaephytes (Ch) and the transitional categories are represented as follows: chamaephytes to hemicryptophytes (Ch-H) – 6 (3.3 %) and hemicryptophytes to chamaephytes (H-Ch) – 7 species (3.9 %) (Fig. 2).

Fifty-two species altogether are described in literature as "sub-shrubs", "perennial plant to sub-shrubs" and "sub-shrubs to perennial plants". The discussion group of the "sub-shrubs" includes plants with lignified lower parts of the stem and perennial upper parts. Another form within the sub-shrubs includes perennial plants with wooden basal part, which survive sev-

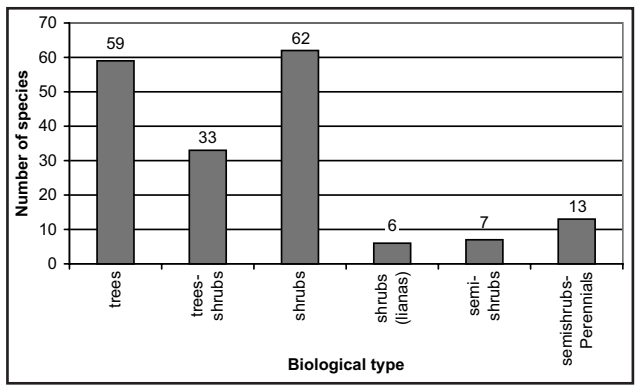

Fig. 1. Distribution of the medicinal plants of Bulgarian dendroflora according to their biological type.

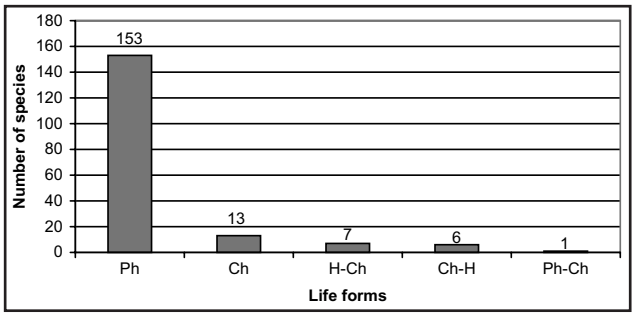

Fig. 2. Distribution of the medicinal plants of Bulgarian dendroflora according to their life forms (after Raunkiaer).

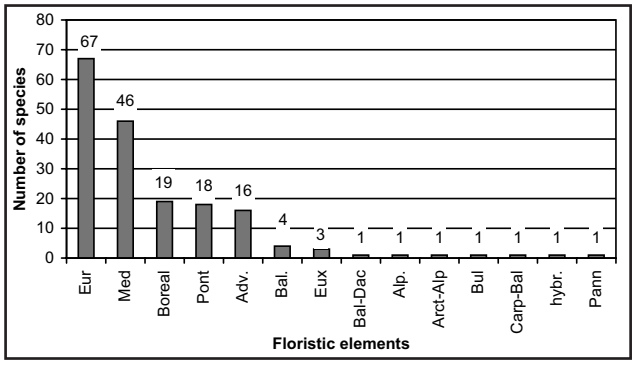

Fig. 3. Distribution of the medicinal plants of Bulgarian dendroflora by floristic elements.

eral years at the level of soil surface, bearing regeneration buds as, for example, several representatives of *Artemisia* (Dudka & al. 1984). Therefore, the dendroflora of Bulgaria could include the species *Convolvulus boissieri*, *C. holosericeus*, *Dictamnus albus*, *Glycyrrhiza glabra*, *Hyssopus officinalis*, *Mathiola fruticulosa*, *M. odoratissima*, *Otanthus maritimus*, *Ruta graveolens*, *Satureja coerulea*, *S. cuneifolia*, *S. montana*, *S. pilosa*, *Salvia scabiosifolia*, *S. tomentosa*, *Thymus* spp.

Distribution of species according to their phytogeographic origin shows as most numerous the geoelements with a European component of origin: 67 species (37.2 %). Of these, twenty-three species are Euro-Asiatic elements (Eur-As), followed by the European elements (Eur) – 16 species and Euro-Mediterranean (Eur-Med) – 13 species. Second rates the group of the Mediterranean elements (Med) with 46 species (25.6 %). Among them the Sub-Mediterranean ones predominate – 28 species, followed by the pure Mediterranean – 13 species. Third come the Boreal elements – 19 species (10.6 %), 10 of which are typically Boreal (Boreal) and 9 are sub-Boreal (subBoreal), followed by the elements with Pontian component of origin – 18 species (10.0 %) altogether, classified into six groups. The adventive geoelements (Adv) amount to 16 species (8.9 %). Of these, 4 species are of unknown origin, 5 species are Mediterranean, 2 species are from Asia (As), 4 – from North America (NAm) and one species is Euro-Asiatic (Eur-As). The species of Balkan origin are 6 in number (3.3 %) and 4 of them are Balkan endemics (Bal) (Fig. 3): *Aesculus hippocastanum*, *Pinus peuce*, *Pyrus bulgarica,* and *Thymus longedentatus* belong to this group. The Euxinian elements are three species (1.7 %), and the Alpine (Alp), Arcto-Alpine (Arct-Alp), Pannonian (Pann) and the hybrids (Hybr) are represented by one species each. One species is a Bulgarian endemic (Bul): *Thymus perinicus*.

The territory of Bulgaria is subdivided into 20 floristic regions. Seven of them are subdivided into sub-regions (Jordanov 1966). Table 1 presents the distribution of medicinal plants of the Bulgarian dendroflora by floristic regions, with their percentile share in the total dendroflora. The floristic region of the Rhodopi Mts is the richest – 148 species (36.5 % of the Bulgarian dendroflora), followed by the Balkan Range – 143 (35.2 %), Black Sea Coast – 121 (29.8 %), Pirin Mts – 117 (28.8 %), the Thracian Lowland – 116 (28.6 %), and Mt Vitosha – 114 species each (28.1 %). The least represented are the regions of Mt Belasitsa – 97 (23.9 %), Sofia region – 90 (22.2 %) and the Valley of River Mesta – 85 species (20.9 %). The floristic regions rank similarly in the percentage of their medicinal dendroflora to the total number of the Bulgarian dendroflora, and the percentage varies from 82.2 % (Rhodopes) to 47.2 % (Valley of River Mesta).

According to their distribution by floristic regions, the medicinal plants of the Bulgarian dendroflora were classified into four groups (Fig. 4). The first group includes widely distributed species occurring in 16 to 20 floristic regions – 83 species (46.1 % of the medicinal dendroflora) and 70 of them (40 %) occur

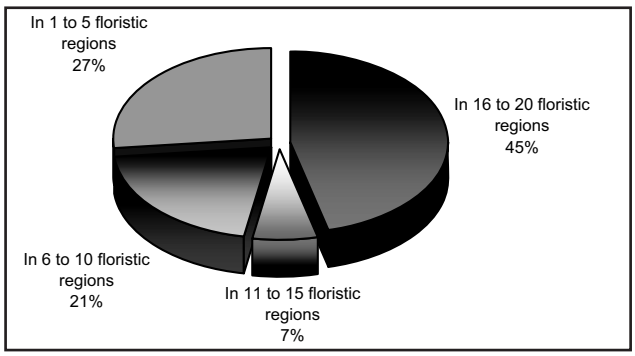

Fig. 4. Distribution of the medicinal plants (in %) of Bulgarian dendroflora in different floristic regions.

Table 1. Distribution of species of the Bulgarian medicinal dendroflora by floristic regions and subregions.

Floristic regions and sub-regions	Total dendroflora	Medicinal dendroflora	% of the total dendroflora	% of medicinal dendroflora of the floristic region: total dendroflora of the floristic region	% of medicinal dendroflora of the region: total medicinal dendroflora of Bulgaria (180 species)
1	2	3	4	5	6
Black Sea Coast (*Southern*)	171	119	29.3	69.6	66.1
Black Sea Coast (*Northern*)	173	117	28.8	67.6	65.0
Black Sea Coast (total)	182	121	29.8	66.5	67.2
Northeast Bulgaria	156	106	26.1	67.9	58.9
Danubian Plain	146	100	24.6	68.5	55.6
Forebalkan (*Western*)	150	102	25.1	68.0	56.7
Forebalkan (*Eastern*)	145	97	23.9	66.9	53.9
Forebalkan (total)	154	102	25.1	66.2	56.7
Balkan Range (*Western*)	186	116	28.6	62.4	64.4
Balkan Range (*Central*)	214	121	29.8	56.5	67.2
Balkan Range (*Eastern*)	196	129	31.8	65.8	71.7
Balkan Range (total)	266	143	35.2	53.8	79.4
Sofia region	132	90	22.2	68.2	50.0
Znepole region	169	106	26.1	62.7	58.9
Mt Vitosha	184	114	28.1	62.0	63.3
West Frontier Mts	157	107	26.4	68.2	59.4
Valley of River Strouma (*Northern*)	147	105	25.9	71.4	58.3
Valley of River Strouma (*Southern*)	158	108	26.6	68.4	60.0
Valley of River Strouma (total)	158	108	26.6	68.4	60.0
Mt Belasitsa	142	97	23.9	68.3	53.9
Mt Slavyanka	163	103	25.4	63.2	57.2
Valley of River Mesta	118	85	20.9	72.0	47.2
Pirin Mts (*Northern*)	190	111	27.3	58.4	61.7
Pirin Mts (*Southern*)	198	114	28.1	57.6	63.3
Pirin Mts (total)	203	117	28.8	57.6	65.0
Rila Mts	212	113	27.8	53.3	62.8
Mt Sredna Gora (*Western*)	155	106	26.1	68.4	58.9
Mt Sredna Gora (*Eastern*)	144	102	25.1	70.8	56.7
Mt Sredna Gora (total)	156	106	26.1	67.9	58.9
Rhodopi Mts (*Western*)	190	120	29.6	63.2	66.7
Rhodopi Mts (*Central*)	204	125	30.8	61.3	69.4
Rhodopi Mts (*Eastern*)	209	130	32.0	62.2	72.2
Rhodopi Mts (total)	259	148	36.5	57.1	82.2
Thracian Lowland	176	116	28.6	65.9	64.4
Toundzha Hilly Country	159	111	27.3	69.8	61.7
Mt Strandzha	161	107	26.4	66.5	59.4

in all floristic regions. The second group consists of species occurring in 11 to 15 floristic regions and includes 12 species (6.7 %). The third group contains species with relatively limited distribution in six to 10 floristic regions and includes 37 species (20.6 %). The fourth group includes species of limited distribution to rare species: 48 species altogether (26.7 %). Five of these species (2.8 %) occur in two floristic regions, and 12 species (6.7 %) in one floristic region only, namely *Aesculus hippocastanum*, *Calluna vulgaris*, *Chamaecytisus ratisbonensis*, *Glycyrrhiza glabra*, *Hippophae rhamnoides*, *Hypericum androsaemum*, *Rhododendron ponticum*, *Ribes nigrum*, *Salix pentandra*, *Thymus perinicus*, and *Vaccinium arctostaphylos*.

The rating of floristic regions by the number of medicinal arboreal plants related to the respective dendroflora is as follows: Valley of River Mesta – 85 species (72 %), Toundzha Hilly Country – 111 (69.8 %), Danubian Plain – 100 (68.5 %), Valley of River Strouma – 108 (68.4 %), Mt Belasitsa – 97 (68.3 %), and West Frontier Mountains – 107 (68.2). The lowest rating goes to the floristic regions of Pirin Mts – 117 species (57.6 %), Balkan Range – 143 (53.8 %) and Rila Mts – 113 (53.3 %) (Table 1.).

According to their altitudinal ranges of distribution, the arboreal medicinal plants can be classified as follows. The species occurring within the altitudinal range 0–1500 m dominate – 43 (23.9 %), followed by the species distributed from 0 to 1000 m – 39 (21.7 %), from 0 to 2000 – 32 (17.8 %), and from 0 to 500 m – 31 (17.2 %). The lowest number of arboreal medicinal plants was recorded in the high-mountain zone: for example, only four species occur within the range 2000–2900 m a.s.l.

Some medicinal arboreal plant species have also a conservation status in Bulgaria. A total of 27 species (15.0 %) are included in the *Red Data Book of the PR Bulgaria* (Velchev 1984), of these 17 species (9.4 %) are rated in the Rare category, and 10 species (5.5 %) are Threatened by Extinction. Twenty-two species (12.2 %) are protected under the Biodiversity Act of Bulgaria (2002). Seven species included in the *Red Data Book of the PR Bulgaria*

(Velchev 1984) are not protected by the Biodiversity Act of Bulgaria. The protected species include: *Aesculus hippocastanum*, *Calluna vulgaris*, *Chamaecytisus ratisbonensis*, *Crataegus orientalis*, *Ephedra distachya*, *Glycyrrhiza glabra*, *Hippophae rhamnoides*, *Hypericum androsaemum*, *Ilex aquifolium*, *Juniperus sabina*, *Mespilus germanica*, *Potentilla palustris*, *Pyrus bulgarica*, *Quercus coccifera*, *Rhododendron ponticum*, *Ribes nigrum*, *Rubus macrophyllus*, *Ruta graveolens*, *Salix pentandra*, *Taxus baccata*, *Thymus perinicus*, and *Vaccinium arctostaphylos*. Of these species, *Crataegus orientalis* and *Ephedra distachya* are not included in the *Red Data Book of the PR Bulgaria* (Velchev 1984). Collection of these plants for economic and personal use is prohibited. There are several species with limited use – their list is published annually in an *Amendment* to the *Medicinal Plants Act*. For example, in 2007 by *Order no. RD-71* a list of species was published whose collection was prohibited for commercial purposes, but was allowed for personal use: *Arctostaphylos uva-ursi, Hyssopus officinalis, Ruscus aculeatus,* and *Salvia tomentosa*. There is another group with a limited regime of use determined by regional quotas. This group consists of *Berberis vulgaris* and *Frangula alnus*. *Vaccinium arctostaphyllos* is listed in the *List of Rare, Threatened and Endemic Plants of Europe* (Lucas 1983) as *Rare*, and *Pinus peuce* is included in the *1997 IUCN Red List of Endangered Plants* (Walter & Gillet 1998) also as *Rare*.

Conclusions

The first survey aimed at the elaboration of a complete list and characteristics of the medicinal plants of the Bulgarian dendroflora has contributed to the following conclusions:

The Bulgarian medicinal dendroflora includes 180 species belonging to 97 genera and 44 families, which stands for a considerable dendrological diversity with high resource significance. This is further supported by the fact that over one half (13) of the most intensively exported medicinal plants from Bulgaria (Gussev 2005) are woody plants, and the woody plants constitute only 23.6 % of all wild medicinal plants in Bulgaria.

The species of the Bulgarian dendroflora are relatively widely distributed in the floristic regions of the country. More than a half of the species occur in 16–20 floristic regions of Bulgaria, and 39 % can be found in all floristic regions. The species-richest regions are the Rhodopi Mts (148 species) and the Balkan Range (143), and the lowest number of these species was recorded in Sofia region (90) and the Valley of River Mesta (85). Trees and shrubs are predominant biological types. Most species (113) occur within the altitudinal range of 0 to 1500 m a.s.l. The European and Mediterranean floristic elements predominate among the medicinal arboreal plants. Four species are Balkan endemics and one is a Bulgarian endemic.

The medicinal dendroflora of Bulgaria is characterized by a high conservation importance: 27 species are included in the *Red Data Book of Bulgaria of the PR Bulgaria* (Velchev 1984), 22 species are protected by the Biodiversity Act, four species are prohibited for collection for commercial purposes, and two species are under a limited regime of use. Two species are of international conservation importance.

The list of medicinal plants of the Bulgarian dendroflora could lay a foundation for further phytochemical and resource studies of these species in Bulgaria.

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