

Melliferous plants of Bulgarian dendroflora

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Abstract. The paper offers characterisation of the melliferous plants of the Bulgarian dendroflora. Out of the 433 species belonging to 148 genera and 60 families of arboreal plants found on the Bulgarian territory, 307 (70.9%) belonging to 96 genera (64.9%) and 39 families (65.0%) are considered honey-bearing plants. *Pinophyta* is represented by four species and *Magnoliophyta* by 303 species. Most melliferous plants belong to the family *Rosaceae*: 118 species. According to their biological type, shrubs are represented by 175 species, trees by 58 species, and shrubs or trees by 29 species. The distribution of species is presented by floristic regions and subregions of Bulgaria. It indicates that 81 species can be found in all floristic regions, and 43 species occur in one floristic region only. Most melliferous arboreal plants fall into the floristic regions of the Balkan Range (226 species) and Rhodope Mts (206 species). Most species (241) are distributed within the altitudinal range of 500–1000 m a.s.l. Most blooming melliferous species of Bulgarian dendroflora flower in June (201). It is significant for the conservation importance of these plants at national and international level. A full list of the melliferous plants of the Bulgarian dendroflora is presented.

Key words: Bulgaria, dendroflora, melliferous plants

Introduction

According to Kozuharov & al. (1988) and Peev & al. (1993), the Bulgarian dendroflora consists of 359 species. This estimate was based on the *Flora of Bulgaria*. According to the authors, the highest species diversity could be found in the floristic regions of the Balkan Range (282 species) and the Rhodopes (280 species), Rila Mts (279 species) and Mt Pirin (215 species). In terms of vertical distribution, most species occur within the altitudinal range of 0–500 m. Also, 79 species are included in the *Red Data Book of the PR Bulgaria* (Velchev 1984), and 59 species in the *Red Data Book of R Bulgaria*, volume I – Plant and Fungi (Peev 2011). Tashev (1999) considered that there are about 360 species in the Bulgarian dendroflora, 16

of them Gymnosperms and 344 Angiosperms. They included 88 trees, 237 shrubs and 35 subshrubs (fruticose plants). Yurukov & Zhelev (2001) maintained that there are 370 species in the Bulgarian dendroflora, 16 of them Gymnosperms. Relying on the principal references on the Bulgarian dendroflora (Stefanov 1934; Stefanov & Ganchev 1953, 1958; Tschernyavsky & al. 1959; Delkov 1992), Alexandrov & al. (2005) reported some 290 species, including 110 trees and 180 shrubs, belonging to 93 genera and 42 families. According to Tashev & Tsavkov (2008), who are working on the Bulgarian flora database, the Bulgarian dendroflora consists of 406 plants. The latest data show that the Bulgarian dendroflora includes 433 species.

On the basis of the critical analysis of literature data and our own studies, it was established that wild melliferous plants in Bulgaria are represented by 1064 species belonging to 302 genera, 86 families and two phyla (Tashev & Pancheva 2009a, b, c, 2010, 2011; Tashev & Velinova 2014).

The aim of the present study is to provide a complete list of the melliferous 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 subregions, dependence on distribution by vertical belts and blooming period. 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; Kozuharov 1992, 1995; Delipavlov & Cheshmedzhiev 2011; Kozuharov & Anchev 2012; Assyov & Petrova 2012) has helped building up a database on the arboreal species (trees, shrubs, subshrubs, and arboreal lianas), which includes the systematic and phytogeographic affinity of the taxa, their distribution in the floristic regions and subregions of Bulgaria, their vertical distribution and conservation significance (Velchev 1984; Biodiversity Act of Bulgaria 2002; Act for Amendment and Updating of the Biodiversity Act of Bulgaria 2007; Assyov & Petrova 2012; Convention on the Conservation of European Wildlife and Natural Habitats, Appendix I 1979; Lucas 1983; Walter & Gillett 1998; Velchev 1984; Peev 2011). The phytogeographic origin of the melliferous dendroflora species was determined according to Walter's classification adapted to Bulgarian conditions (Assyov & Petrova 2012). The life forms are given according to Raunkiaer (1934).

Melliferous plants are plants, whose flowers are a natural food source for honey-bees (*Apis mellifera* L.). The full list of melliferous plants has been confirmed in the last seven years (Tashev & Pancheva 2009a,b,c, 2010, 2011; Tashev & Velinova 2014). Also, in our opinion there are many more species of the Bulgarian dendroflora that could be regarded as melliferous but which are not yet studied in detail. Therefore, we believe that this list will be continued.

The names of floristic regions and subregions in Bulgaria are according to Bondev (1966).

Results and discussion

According to the latest data (Tashev 2008; Assyov & Petrova 2012), the higher flora of Bulgaria comprises 4102 species belonging to 913 genera and 156 families. We classify 433 species from 148 genera and 60 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 subshrubs to perennial. Also, some species that are naturalized in Bulgaria and have become part of the adventive elements (Assyov & Petrova 2012) are included, as well as some recently discovered species as new for the adventive flora of the country (Petrova & al. 2005; 2013). On the basis of a literature survey (Stefanov 1934; Stefanov & Ganchev 1953; 1958; Delkov 1992; Tashev 1999; Yurukov & Zhelev 2001; Alexandrov & al. 2005; Petrova & al. 2005; Assyov & Petrova 2006, 2012; Tashev & Tsavkov 2008; Tashev & Velinova 2014;) we have found that the melliferous arboreal plants of the Bulgarian flora amount to 307 and belong to 96 genera and 39 families (see Appendix 1). This accounts for 7.5 % of the species, 10.5 % of the genera and 25.0 % of the families of the Bulgarian flora and 70.9 % of the species, 64.9 % of the genera and 65.0 % of the families of the dendroflora. *Pinophyta* is represented by four species, and *Magnoliophyta* by 303 species, all of which belonging to *Magnoliopsida*. The first 10 most numerous families regarding the arboreal melliferous plants include 244 species, or 79.5 % of the melliferous dendroflora of Bulgaria. These are *Rosaceae* 118 species (38.4 %), *Fabaceae* 43 (14.0 %), *Lamiaceae* 20 (6.5 %), *Salicaceae* 18 (5.9 %), *Ericaceae* 9 species (2.9 %), *Caprifoliaceae* 8 (2.6 %), and *Betulaceae*, *Cistaceae*, *Fagaceae* and *Oleaceae* with seven species each (2.3 %). Ten families are represented by only one species.

The best represented genera are: *Rubus* 44 species (14.3 %), *Rosa* 26 species (8.5 %), *Chamaecytisus* 20 species (6.5 %), *Salix* 14 species (4.6 %), *Genista* 12 species (3.9 %), *Sorbus* 10 species (3.3 %), *Prunus* 9 species (2.9 %), *Thymus* 7 species (3.0 %), *Acer* and *Spiraea* 6 species (2.0 %), *Fraxinus*, *Pyrus*, *Satureja* and *Ribes* 5 species each (1.6 %), *Lonicera*, *Popu-*

lus, Quercus, Tilia, Crataegus and Vaccinium 4 species each (1.3%), *Alnus, Cotoneaster, Hypericum, Teucrium, Daphne, Malus, Salvia* and *Ulmus* 3 species each (1.0%), etc. Fifty-one genera are represented by one species only.

According to their biological type (life form), the honey-bearing arboreal plants can be classified into nine groups, six of them transitional. The distribution of species according to their biological type is presented in Fig. 1. The groups are as follows: shrubs comprise 175 species (57.0%) (8 species are lianas: *Clematis vitalba* L., *Hedera helix* L., *Lonicera etrusca* Santi, *Rubus koehleri* Weihe & Nees, *R. macrophyllus* Weihe & Nees, *R. thysiflorus* Weihe & Nees, *Parthenocissus inserta* (A. Kern.) Fritsch), trees 58 species (18.9%), shrubs or trees 29 species (9.4%), perennials to semishrubs 13 species (4.3%), semishrubs to perennials 11 species each (3.6%), trees or shrubs 10 species (3.3%), semishrubs 7 species (2.3%) and shrubs to semishrubs 4 species (1.3%).

According to the classification of Raunkiaer (1934), 251 species (81.8%) are phanerophytes (Ph), 20 species (6.5%) are chamaephytes (Ch) and the transitional categories are represented as follows: hemicryptophytes to chamaephytes (H-Ch) 13 species each (4.2%), chamaephytes to hemicryptophytes (Ch-H) 11 species (3.6%), chamaephytes to phanerophytes (Ch-Ph) 10 species (3.3%), and phanerophytes to chamaephytes (Ph-Ch) 2 species (0.7%) (Fig. 2).

Distribution of species according to their phytogeographic origin shows as most numerous the European elements (Eur) 53 species (17.3%). Second rates the group of the sub-Mediterranean elements (subMed) with 48 species (15.6%). Third come the Euro-Asiatic elements (Eur-As) with 24 species (7.8%). The Euro-Mediterranean elements (Eur-Med) amount to 19 species (6.2%), followed by Mediterranean elements (Med) 17 species (5.5%), Pontic-Mediterranean elements (Pont-Med) 14 species (4.6%), Euro-Siberian elements (Eur-Sib), and sub-Boreal (subBoreal) 10 species (3.3%). The Balkan endemics (Bal) comprise 9 species (2.9%) (Fig. 3): *Aesculus hippocastanum* L., *Chamaecytisus absinthioides* (Janka) Kuzmanov, *C. calcareus* (Velen.) Kuzm., *C. janka* (Velen.) Rothm., *Genista rumelica* Velen., *G. subcapitata* Panč., *Pyrus bulgarica* Khutath. & Sachok., *Salix xanticola* Christensen, *Satureja pilosa* Velen., and *Thymus longedenatus* (Degen & Urum.) Ronn. Eight species are North

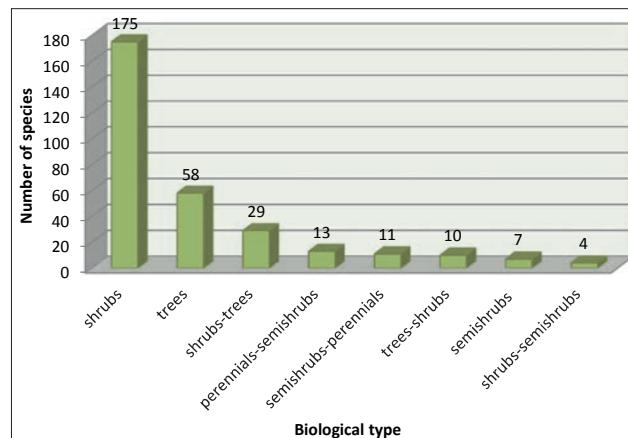


Fig. 1. Description of melliferous plants of the Bulgarian dendroflora according to their biological type.

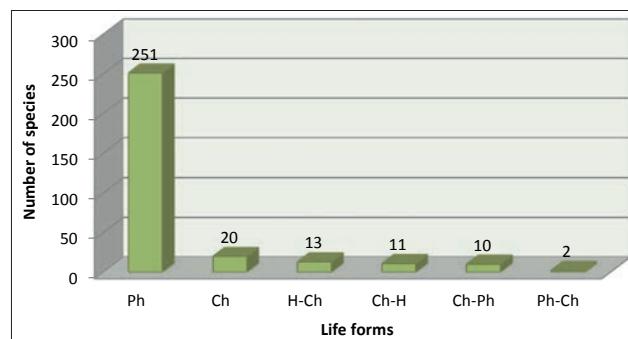


Fig. 2. Distribution of melliferous plants of the Bulgarian dendroflora according to their life forms (after Raunkiaer 1934).

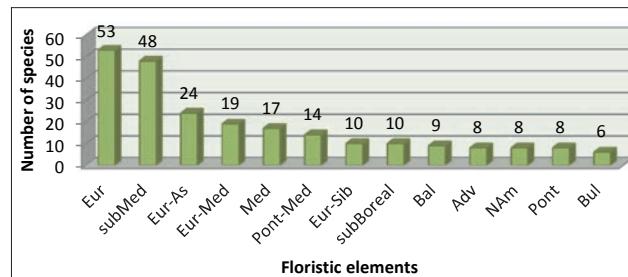


Fig. 3. Distribution of melliferous plants of the Bulgarian dendroflora by floristic elements.

American (NAm), Boreal and Pontic (Pont) elements. The Bulgarian endemics (Bul) comprise six species: *Chamaecytisus frivaldszkyanus* (Deg.) Kuzm., *C. kovačevii* (Velen.) Rothm., *C. neičeffii* (Urum.) Rothm., *Rubus oblongoobovatus* Markowa, and *Satureja rumelica* Velen. The Adventive (Asiatic) (Adv (As)), Alpine-Carpathian-Balkan (Alp-Carp-Bal), Alpine-Mediterranean (Alp-Med), Balkan-Anatolian (Bal-Anat) are represented by four species each, Carpathian-Balkan (Carp-Bal), Mediterranean-Central Asiatic (Med-CAs) and Adventive (Mediterranean) (Adv (Med)) by three species, Balkan-Dacian (Bal-Dac), European-

Oriental-Turanian (Eur-OT), sub-Mediterranean-European (Eur-subMed), Euxinian (Eux), Mediterranean-Asiatic (Med-As), Pannonian-Balkan (Pann-Bal), Pontic-Central Asiatic (Pont-CAs), Pontic-Siberian (Pont-Sib), Adventive (North American) (Adv (NAm) by two species, Adventive (Asiatic) (Adv (As.)), Adventive (East Asiatic) (Adv (EAs), Adventive (European-Asiatic-paleo) (Adv (Eur-As-paleo), Adventive (hybridogenous) (Adv (hybr.), Alpine-Balkan (Alp-Bal), Arctic-Alpine (Arct-Alp), European (hybridogenous) (Eur (hybr.), European-Caucasus (Eur-Cauc), European-Mediterranean-Central Asiatic (Eur-Med-CAs), hybridogenous (hybr.), Mediterranean-Oriental-Turanian (Med-OT), Pannonian-Pontic (Pann-Pont), Pontic-Asiatic (Pont-As), South Euxinian (SEux), South Pontic (SPont), subBalkan (subBal), subMediterranean-Asiatic (subMed-As), and Adventive (Chinese) (Adv (Ch) species with unknown origin by one species only.

According to their distribution by floristic regions, melliferous 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 – 102 species (33.2 % of the melliferous dendroflora) and 81 of them (26.4 %) occurring in all floristic regions. The second group consists of species occurring in 11 to 15 floristic regions and includes 18 species (5.9 %). The third group contains species with relatively limited distribution in six to 10 floristic regions and includes 54 species (17.6 %). The fourth group includes species of limited distribution to rare species: 133 species altogether (43.3 %). Thirty-three of these species (10.7 %) occur in two floristic regions, and 43 species (14.0 %) in one floristic region only.

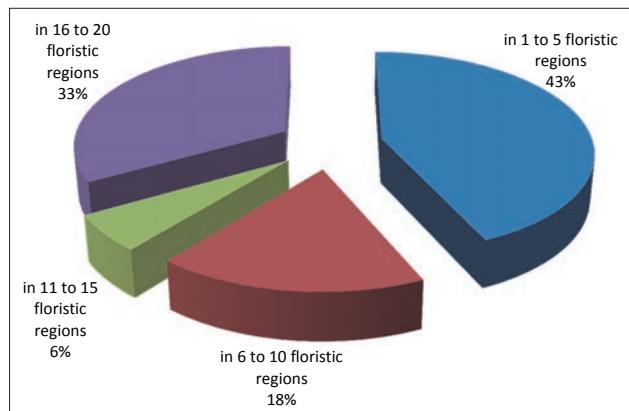


Fig. 4. Distribution of melliferous plants (in %) of the Bulgarian dendroflora in different floristic regions.

Table 1. Distribution of melliferous plants of the Bulgarian dendroflora by floristic regions and subregions.

Floristic regions and subregions	Total dendroflora	Melliferous dendroflora	% of the total dendroflora	% of the melliferous dendroflora of the floristic region: total dendroflora of the floristic region	% of the melliferous dendroflora of the floristic region: total melliferous dendroflora of Bulgaria (307 species)
1	2	3	4	5	6
Black Sea Coast (<i>Southern</i>)	188	145	47.2	77.1	33.5
Black Sea Coast (<i>Northern</i>)	191	150	48.9	78.5	34.6
Black Sea Coast (total)	200	155	50.5	77.5	35.8
Northeast Bulgaria	170	138	45.0	81.2	31.9
Danubian Plain	155	129	42.0	83.2	29.8
Forebalkan (<i>Western</i>)	164	139	45.3	84.8	32.1
Forebalkan (<i>Eastern</i>)	158	136	44.3	86.1	31.4
Forebalkan (total)	170	145	47.2	85.3	33.5
Balkan Range (<i>Western</i>)	202	167	54.4	82.7	38.6
Balkan Range (<i>Central</i>)	223	184	59.9	82.5	42.5
Balkan Range (<i>Easternn</i>)	211	172	56.0	81.5	39.7
Balkan Range (total)	283	226	73.6	79.9	52.2
Sofia region	154	131	42.7	85.1	30.3
Znepole region	185	152	49.5	82.2	35.1
Mt Vitosha	198	162	52.8	81.8	37.4
West Frontier Mts	169	140	45.6	82.8	32.3
Valley of River Struma (<i>Northern</i>)	156	124	40.4	79.5	28.6
Valley of River Struma (<i>Southern</i>)	166	125	40.7	75.3	28.9
Valley of River Struma (total)	167	125	40.7	74.9	28.9
Mt Belasitsa	158	127	41.4	80.4	29.3
Mt Slavyanka	171	126	41.0	73.7	29.1
Valley of River Mesta	130	106	34.5	81.5	24.5
Pirin Mts (<i>Northern</i>)	202	153	49.8	75.7	35.3
Pirin Mts (<i>Southern</i>)	210	157	51.1	74.8	36.3
Pirin Mts (total)	217	161	52.4	74.2	37.2
Rila Mts	219	170	55.4	77.6	39.3
Mt Sredna Gora (<i>Western</i>)	170	138	45.0	81.2	31.9
Mt Sredna Gora (<i>Eastern</i>)	153	128	41.7	83.7	29.6
Mt Sredna Gora (total)	171	139	45.3	81.3	32.1
Rodope Mts (<i>Western</i>)	202	153	49.8	75.7	35.3
Rodope Mts (<i>Central</i>)	223	170	55.4	76.2	39.3
Rodope Mts (<i>Eastern</i>)	223	165	53.7	74.0	38.1
Rodope Mts (total)	283	206	67.1	72.8	47.6
Thracian Lowland	186	141	45.9	75.8	32.6
Tundzha Hilly Country	175	133	43.3	76.0	30.7
Mt Strandzha	168	137	44.6	81.5	31.6

According to their altitudinal ranges of distribution, the arboreal melliferous plants can be classified as follows. The number of species occurring within the 500–1000 m altitudinal range dominates – 241 (78.5 %), followed by the species distributed from 0 to 500 m a.s.l. – 237 (77.2 %), from 1000 to 1500 m a.s.l. – 178 (58.0 %), from 1500 to 2000 m a.s.l. – 92 (30.0 %). The lowest number of arboreal medicinal plants was recorded in the high mountain zone – from 2000 to 2500 m a.s.l. – 22 species (7.2 %), and only eight species occur within the range 2500–2900 m a.s.l. The empirical relationship is $y = -53.943x + 318.47$, where y is the number of species, and x is the altitudinal belt. Regression coefficient is $R^2 = 0.9419$ ($p=0.002$) (Fig. 5).

Most blooming melliferous species of the Bulgarian dendroflora flower in June: 201 (65.5 %). The second richest month of flowering melliferous species is May, with 200 species (65.1 %), followed by July 158 species (51.5 %), April 82 species (26.7 %), August 81 species (26.7 %), March 25 species (8.3 %), September 16 species (5.3 %), February 6 species (2.0 %), and October 4 species (1.3 %). In January, November and December only one blooming species flowers: *Arbutus unedo* L. (Fig. 6).

Some melliferous arboreal plant species have also a conservation status in Bulgaria. A total of 44 species (14.5 %) are included in the *Red Data Book of the PR Bulgaria* (Velchev 1984); of these, 24 species

(7.9 %) are rated as Rare, 17 species (6.6 %) are considered Threatened by Extinction, 3 species (1.0 %) have the category Extinct. A total of 27 species (8.9 %) are included in the new edition of the *Red Data Book of R Bulgaria*, volume I – Plant and Fungi (Peev 2011); of these, 1 species is rated as Vulnerable, 14 species (4.6 %) as Endangered, and 12 species (4.0 %) as Critically Endangered. Forty species (13.2 %) are protected under the Biodiversity Act of Bulgaria (2002) and 36 species (11.9 %) are protected under the Act for Amendment and Updating of the Biodiversity Act of Bulgaria (2007). Strictly protected by the Bern Convention (1979) and included in Appendix 1 to the Convention (1998) is *Vaccinium arctostaphylos* L. The *Red List of IUCN* (1998) contains four melliferous species of the Bulgarian dendroflora: *Chamaecytisus kovačevii* (Velen.) Rothm., *Chamaecytisus neiceffii* (Urum.) Rothm., *Salix xanticola* Christensen, *Thymus pernicicus* (Velen.) Jalas. The *List of Rare, Threatened and Endemic Plants in Europe* (1983) contains seven melliferous species from the Bulgarian dendroflora: *Chamaecytisus kovačevii* (Velen.) Rothm., *C. neiceffii* (Urum.) Rothm., *Hyssopus officinalis* L., *Salix xanticola* Christensen, *Satureja pilosa* Velen., *Spiraea crenata* L., *Vaccinium arctostaphylos* L. Sixty-one species are Tertiary relicts (20.1 %). Three species are Glacial relicts: *Potentilla fruticosa* L., *Salix lapponum* L. and *S. pentandra* L.

Numerous melliferous species of the Bulgarian dendroflora have medicinal properties: 154 species belonging to 78 (64.9 %) genera and 33 (65.0 %) families (Tashev & Tsavkov 2008).

Conclusion

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

The Bulgarian melliferous dendroflora includes 307 species from 96 genera and 39 families, which stands for a considerable dendrological diversity with high resource significance. They could be found blooming round the year. The species of the Bulgarian dendroflora are relatively widely distributed in the 16–20 floristic regions of Bulgaria, and 26.4 % can be found in all floristic regions. The species-richest regions are the Balkan Range (226 species) and the Rhodope Mountains (160 species).

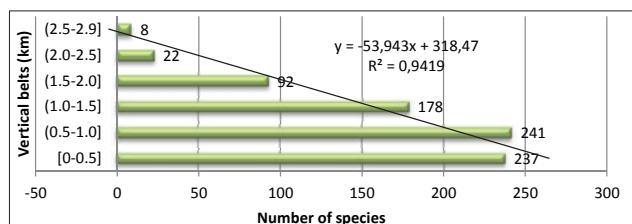


Fig. 5. Distribution by number of melliferous plants of the Bulgarian dendroflora by vertical belts.

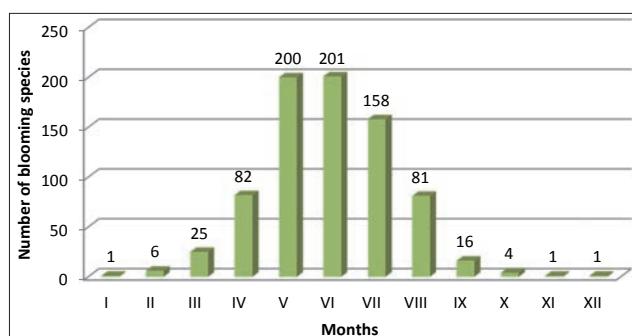


Fig. 6. Number of blooming melliferous species of the Bulgarian dendroflora per month.

dope Mts (206 species), and the lowest number of these species was recorded in the Valley of River Mesta (106 species) and the Valley of River Struma (124 species). Trees and shrubs are the prevailing biological types. Most species (241) are distributed within

the altitudinal range of 500–1000 m a.s.l. A total of 100 melliferous species are with conservation status. Nine species are Balkan endemics (Bal) and six species are Bulgarian endemics. Half of melliferous species of the Bulgarian dendroflora have medicinal properties.

Appendix 1. List of melliferous plants of the Bulgarian dendroflora.

Divisio Pinophyta

Cupressaceae: *Juniperus communis* L., *Juniperus oxycedrus* L.; **Pinaceae:** *Abies alba* Mill., *Pinus sylvestris* L.

Divisio Magnoliophyta

Classis Dicotyledonae (Magnoliopsida)

Aceraceae: *Acer campestre* L., *A. monspessulanum* L., *A. negundo* L., *A. platanoides* L., *A. pseudoplatanus* L., *A. tataricum* L.; **Anacardiaceae:** *Cotinus coggyria* Scop., *Rhus coriaria* L.; **Apocynaceae:** *Vinca major* L., *V. minor* L.; **Araliaceae:** *Hedera helix* L.; **Berberidaceae:** *Berberis vulgaris* L., *Mahonia aquifolium* Nutt.; **Betulaceae:** *Alnus glutinosa* (L.) Gaertn., *A. incana* (L.) Moench, *A. viridis* (Chaix) DC., *Betula pendula* Roth, *Corylus avellana* L., *C. colurna* L., *Ostrya carpinifolia* Scop.; **Brassicaceae:** *Aurinia saxatilis* (L.) Desv., *Matthiola fruticulosa* (L.) Maire, *M. odoratissima* (M. B.) R. Br; **Buddlejaceae:** *Buddleja davidii* Planch.; **Caprifoliaceae:** *Lonicera caerulea* L., *L. etrusca* Santi, *L. nigra* L., *L. xylosteum* L., *Sambucus nigra* L., *S. racemosa* L., *Viburnum lantana* L., *V. opulus* L.; **Cistaceae:** *Cistus incanus* L., *C. salvifolius* L., *Fumana arabica* (L.) Spach, *F. procumbens* (Dunal) Gren. & Godr., *Helianthemum nummularium* (L.) Mill., *Rhodax alpestris* (Jacq.) Fuss, *R. canus* (L.) Fuss; **Cornaceae:** *Cornus mas* L., *C. sanguine* L.; **Elaeagnaceae:** *Elaeagnus angustifolia* L., *Hippophae rhamnoides* L.; **Ericaceae:** *Arbutus andrachne* L., *A. unedo* L., *Calluna vulgaris* (L.) Hull, *Erica arborea* L., *Rhododendron ponticum* L., *Vaccinium arctostaphylos* L., *V. myrtillus* L., *V. uliginosum* L., *V. vitis-idaea* L.; **Fabaceae:** *Amorpha fruticosa* L., *Cercis siliquastrum* L., *Chamaecytisus absinthioides* (Janka) Kuzmanov, *C. albus* (Jacquet) Rothm., *C. austriacus* (L.) Link, *C. banaticus* (Griseb. & Schenk.) Rothm., *C. calcareous*, (Velen.) Kuzmanov, *C. ciliates* (Wahlenb.) Rothm., *C. danubialis* (Velen.) Rothm., *C. frivaldszkyanus* (Degen) Kuzmanov, *C. glaber* (L.f.) Rothm., *C. heuffelii* (Wierzb.) Rothm., *C. hirsutus* (L.) Link, *C. jankae* (Velen.) Rothm., *C. kova-*

cevi (Velen.) Rothm., *C. lejocarpus* (A. Kern.) Rothm., *C. neiceffii* (Urum.) Rothm., *C. polytrichus* (M. Bieb.) Rothm., *C. pygmaeus* (Willd.) Rothm., *C. ratisbonensis* (Schaeff.) Rothm., *C. rochelii* (Wierzb.) Rothm., *C. supinus* (L.) Link, *Chamaespartium sagittale* (L.) Gibbs, *Colutea arborescens* L., *Dorycnium graecum* (L.) Ser., *Genista anatolica* Boiss., *G. carinalis* Griseb., *G. depressa* M. Bieb., *G. germanica* L., *G. januensis* Viv., *G. lydia* Boiss., *G. ovata* Waldst. & Kit., *G. pilosa* L., *G. rumelica* Vel., *G. sessilifolia* DC., *G. subcapitata* Panč., *G. tinctoria* L., *Gleditsia triacanthos* L., *Lembotropis nigricans* (L.) Griseb., *Ononis repens* L., *O. spinosa* L., *Robinia pseudoacacia* L.; **Fagaceae:** *Castanea sativa* Mill., *Fagus orientalis* Lipsky, *F. sylvatica* L., *Quercus cerris* L., *Q. frainetto* Ten., *Q. pubescens* Willd., *Q. robur* L.; **Hippocastanaceae:** *Aesculus hippocastanum* L.; **Hypericaceae:** *Hypericum androsaemum* L., *H. calycinum* L., *H. olympicum* L.; **Juglandaceae:** *Juglans regia* L.; **Lamiaceae:** *Hyssopus officinalis* L., *Lavandula angustifolia* Mill., *Salvia officinalis* L., *S. scabiosifolia* Lam., *S. tomentosa* Mill., *Satureja coerulea* Janka, *S. cuneifolia* Ten., *S. montana* L., *S. pilosa* Velen., *S. rumelica* Velen., *Teucrium chamaedrys* L., *T. montanum* L., *T. polium* L., *Thymus bracteosus* Vis. ex Bentham, *Th. longedentatus* (Degen & Urum.) Ronn., *Th. leucotrichus* Hall., *Th. perinicus* (Velen.) Jalas, *Th. pulegioides* L., *Th. thracicus* Velen., *Th. zygoides* Griseb.; **Moraceae:** *Morus alba* L.; **Oleaceae:** *Fraxinus americana* L., *F. excelsior* L., *F. ornus* L., *F. oxycarpa* Bieb. ex Willd., *F. pennsylvanica* Marsh., *Ligustrum vulgare* L., *Syringa vulgaris* L.; **Ranunculaceae:** *Clematis vitalba* L. **Rhamnaceae:** *Frangula alnus* Mill., *Paliurus spina-christi* Mill., *Rhamnus catharticus* L., *Ziziphus jujuba* Mill.; **Rosaceae:** *Amelanchier ovalis* Medicus, *Amygdalus nana* L., *Cotoneaster integerrimus* Medicus, *C. nebrodensis* (Guss.) C. Koch, *C. niger* (Thunb.) Fries, *Crataegus media* Bechst., *C. monogyna* Jacq., *C. orientalis* All. ex Bieb., *C. pentagyna* Waldst. & Kit., *Eriolobus trilobata*

M. J. Roemer, *Laurocerasus officinalis* M. J. Roemer, *Malus dasypylla* Borkh., *M. praecox* (Pall.) Borkh., *M. sylvestris* Mill., *Mespilus germanica* L., *Potentilla fruticosa* L., *P. palustris* (L.) Scop., *Prunus avium* L., *P. cerasifera* Ehrh., *Prunus cerasus* L., *P. domestica* L., *P. fruticosa* Pall., *P. mahaleb* L., *P. padus* L., *P. serotina* Ehrh., *P. spinosa* L., *Pyracantha coccinea* M. J. Roemer, *Pyrus amygdaliformis* Vill., *P. bulgarica* Khutath. & Sachok., *P. elaeagrifolia* Pall., *P. nivalis* Jacq., *P. pyraster* Burgsd., *Rosa agrestis* Savi, *R. arvensis* Hudson, *R. caesia* Sm., *R. canina* L., *R. caryophyllacea* Besser, *R. corymbifera* Borkh., *R. dumalis* Bechst., *R. elliptica* Tausch, *R. gallica* L., *R. glauca* Pourret, *R. heckeliana* Tratt., *R. jundzillii* Besser, *R. micrantha* Borrer ex Sm., *R. mollis* Sm., *R. myriacantha* DC. ex Lam. & DC., *R. nitidula* Besser, *R. obtusifolia* Desv., *R. oxyodon* Boiss., *R. pendulina* L., *R. pimpinellifolia* L., *R. pulverulenta* M. Bieb., *R. pumila* Jacq., *R. tomentosa* Sm., *R. turcica* Rouy, *R. villosa* L., *R. vosagiaca* Desportes, *Rubus anoplocladus* Sudre, *R. apiculatus* Weihe & Nees, *R. caesius* L., *R. canescens* DC., *R. cerasifolius* Sudre, *R. condensatus* Mueller, *R. crassus* J. Holuby, *R. discolor* Weihe & Nees, *R. euryanthemus* W. Watson, *R. finitimus* Sudre, *R. fragariiflorus* Mueller, *R. geniculatus* Kaltenb., *R. glandulosus* Bellardi, *R. guentheri* Weihe & Nees, *R. hebecaulis* Sudre, *R. hercynicus* G. Braun ex Focke, *R. hirtus* Waldst. & Kit., *R. humifusus* Weihe & Nees, *R. idaeus* L., *R. incultus* Wirtg. ex Focke, *R. koechleri* Weihe & Nees, *R. lloydianus* Genev., *R. macrophyllus* Weihe & Nees, *R. macrostachys* Mueller, *R. melanoxyylon* Mueller & Wirtg. ex Genev., *R. minutidentatus* Sudre, *R. minutiflorus* Mueller, *R. miostilus* Boulay, *R. oblongoobovatus* Markowa, *R. pectinatus* Sudre & Gravet, *R. posoniensis* Sabr., *R. radula* Wei-

he ex Boenn., *R. rivularis* Wirtg. & Mueller, *R. sanguineus* Friv., *R. saxatilis* L., *R. scaber* Weihe & Nees, *R. schleicheri* Weihe ex Tratt., *R. serpens* Weihe ex Lej. & Court., *R. spinosulus* Sudre, *R. tereticaulis* Mueller, *R. thyrsanthus* Focke, *R. thrysiflorus* Weihe & Nees, *R. trachyadenes* Sudre, *R. vepallidus* Sudre, *Sorbus aria* (L.) Crantz, *S. aucuparia* L., *S. austriaca* (Beck) Hedl., *S. borbasii* Javorka, *S. chamaemespilus* (L.) Crantz, *S. domestica* L., *S. graeca* (Spach) Kotschy, *S. mougeotii* Soy.-Will. & Godr., *S. torminalis*, (L.) Crantz, *S. umbellata* (Desf.) Fritsch, *Spiraea chamaedryfolia* L., *S. crenata* L., *S. hypericifolia* L., *S. media* F. Schmidt, *S. pseudosalicifolia* Silverside, *S. salicifolia* L.; **Rutaceae:** *Dictamnus albus* L., *Ruta graveolens* L.; **Salicaceae:** *Populus alba* L., *P. canescens* (Ait.) Sm., *P. nigra* L., *P. tremula* L., *Salix alba* L., *S. aurita* L., *S. caprea* L., *S. cinerea* L., *S. elaeagnos* Scop., *S. fragilis* L., *S. lapponum* L., *S. pentandra* L., *S. purpurea* L., *S. rosmarinifolia* L., *S. silesiaca* Willd., *S. triandra* L., *S. waldsteiniana* Willd., *S. xantica* Christensen; **Sapindaceae:** *Koelreuteria paniculata* Laxm.; **Saxifragaceae:** *Ribes alpinum* L., *R. aureum* Pursch, *R. nigrum* L., *R. petraeum* Wulfen, *R. uva-crispa* L.; **Simaroubaceae:** *Ailanthus altissima* (Mill.) Swingle; **Solanaceae:** *Lycium barbarum* L., *Solanum dulcamara* L.; **Staphyleaceae:** *Staphylea pinnata* L.; **Tamaricaceae:** *Tamarix ramosissima* Ledeb., *T. tetrandra* Pallas ex M. B.; **Thymelaeaceae:** *Daphne laureola* L., *D. mezereum* L., *D. pontica* L.; **Tiliaceae:** *Tilia cordata* Mill., *T. plathyphyllos* Scop., *T. rubra* DC., *T. tomentosa* Moench; **Ulmaceae:** *Ulmus glabra* Hudson, *U. laevis* Pallas, *U. minor* Miller; **Verbenaceae:** *Vitex agnus-castus* L.; **Vitaceae:** *Parthenocissus quinquefolia* (L.) Planch., *P. inserta* (A. Kern.) Fritsch.

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