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REVIEW ON THE MEDICINAL PLANTS OF THE NORTH BLACK SEA COAST (BULGARIA)

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*The paper is dedicated to Prof. D. Temniskova
on the occasion of her 80th jubilee*

Abstract: This is the first review of the studies of medicinal plants found in the region of North Black Sea Coast. It shows the significant diversity of the medicinal plants in the northern part of Black Sea Coast floristic region: 593 species of vascular plants from 357 genera and 96 families. The majority of the families and genera are represented by a small number of species, which ranges from 1 to 4. The analysis of life forms indicates that the hemicryptophytes dominante (43.17%). The biological types are represented mainly by perennial herbaceous plants (54.81%). The highest percentage of species belongs to the European type (55.48%), followed by species of the Mediterranean type (17.54%). Among the medicinal plants one Balkan endemic, one Bulgarian endemic and 32 relicts are found. The number of species with conservation status is 55 (9.27%). 18 species are protected by a law prohibiting the herb collection within their natural habitats and collecting of 9 species is restricted by the law regulating the collection of herbs from their natural habitats. The number of antropophytes is relatively high 374 (63.07%).

Key words: floristic analysis, vascular plants

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The vascular plants in Bulgaria are subject of a considerable number of publications. During the 20th Century, ca. 10,000 articles on Bulgarian flora were published. About 70% of them focus on the vascular plants in the country. To date, several handbooks for determining plants and floras were issued, all of which include chorological information but none focuses specifically on the medicinal plants in the region of North Black Sea Coast.

The known chorological data were organised for the first time as a standalone publication in *Conspectus of the Bulgarian Vascular Flora* (KOZHUHAROV & ANDREEV 1980). This information has later been updated in the last three editions of *Conspectus of the Bulgarian Vascular Flora: Distribution Maps and Floristic Elements* (ASSYOV et al. 2002, 2006, 2012). According to latest data, in Bulgaria are found 4, 102 species of vascular plants that belong to 913 genera and 155 families.

The number of medicinal plant species in Bulgaria totals 844 and they belong to 444 genera and 118 families. 730 species of vascular plants are distributed naturally and are included in the Medicinal Plants Act (2000). The remaining 114 species are also distributed naturally and are described in the literature on medicinal plants in Bulgaria (STOYANOV & KITANOV 1960; STEFANOV 1972, 1973; IVANOV ET AL. 1973; KITANOV 1987; PAMUKOV & AHTARDZHIEV 1989; NIKOLOV ET AL. 2006).

Special attention to the distribution of most commonly used medicinal plants in the country is given in *Chorological Atlas of Medicinal Plants in Bulgaria* (BONDEV 1995) and several other documents. For instance, such information can be found in the management plans of national and natural parks in the country that include lists of medicinal plants established on their territory. But only some of the most widely used medicinal plants are included in the municipal development plans and forest management plans of state forests and arboretums.

As evident from the scholarly review, to date there are no known specialized publications focusing on the distribution of medicinal plants in specific Bulgarian regions. Furthermore, there is a problem with outlining the boundaries of a region. The municipal division in regions is not appropriate for this purpose because of periodic changes of the given administrative units. It is, therefore, more appropriate to use phytogeographic zoning, even though alterations can be made over time here as well. The most widely accepted phytogeographic zoning was first published in 1966 in *Flora of PR Bulgaria*, vol. 3 (JORDANOV 1966) and has been ever since widely used in Bulgarian botanical literature. According to this research, the country is divided into 20 floristic regions. One of these areas is the Black Sea Coast, which is divided into two sub-regions: North and South Black Sea Coast. Our publication focuses on the medicinal plants that are naturally distributed in the North Black Sea Coast. This region covers the coastline of the Black Sea from the Bulgarian-Romanian border in the north to the northern slopes of the eastern part of the Balkan Mountain to the south, with a width ranging from 1 to 20 km (Fig. 1).

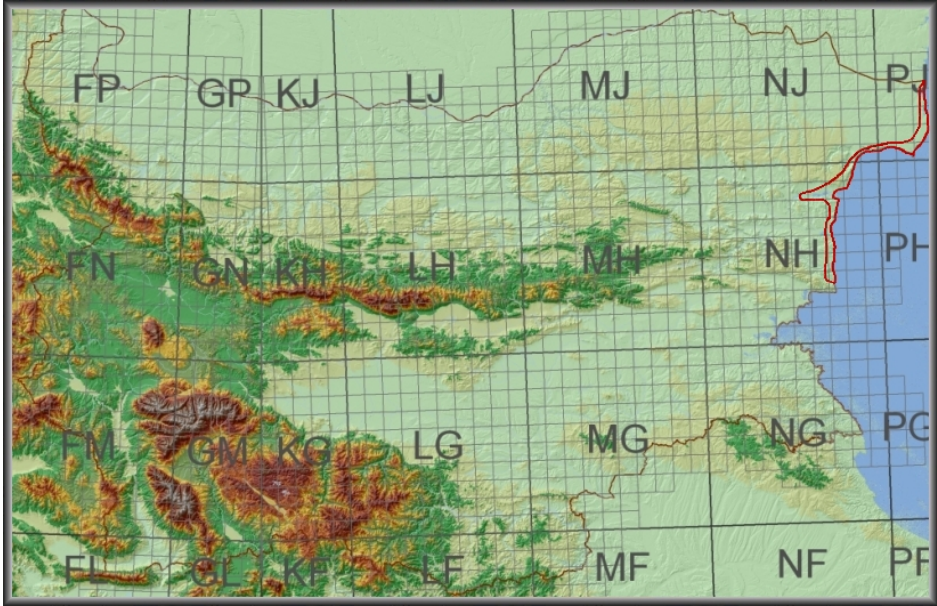


Fig. 1. UTM grid map of Bulgaria and study area: Northern Black Sea Coast floristic region.

The North Black Sea Coast is located in two climatic regions: Dobrudzha Black Sea Coast and Varna Black Sea Coast that belong to the Continental-Mediterranean climatic area (VELEV 2002). There are several lakes on the territory of the region in question, the largest among them are: Durankulashko, Shablensko, Ezeretsko, Varnensko, and Beloslavsko lakes and there are also several rivers, of which the largest are Batova and Kamchiya.

The soil consists of the following soil types and subtypes (indicated in parentheses) presented according to the classification of FAO: fluvisols (calcaric), gleysols (calcic), leptosols (lithic and rendzic), chernozems (haplic), phaeozems (luvic), luvisols (albic), planosols (dystric), nitisols (haplic) and hystosols (fibric) (NINOV 2002).

The vegetation of the Northern Black Sea Coast is very diverse. BONDEV (1991), for instance, has recorded 30 plant communities: 13 tree, 3 shrubby, 3 grassy, 2 water communities, 8 agricultural areas and 1 forestry culture.

To date, several authors have studied The North Black Sea Coast flora (DAVIDOV 1905, 1909, 1914; DELIPAVLOV ET AL. 1997; DIMITROV ET AL. 2000, 2005; KOZHUHAROV ET AL. 1997; KOCHEV 1976; MARINOVA-FILIPOVA 2000, 2002; PENEV 1981; STOYANOV 1928; TZONEV ET AL. 2005; VELCHEV 2002; VICHEREK 1971). However, there is no comprehensive study specifically of the medicinal plants in the North Black Sea Coast.

Our review is based on most recent data on the vascular plants in Bulgaria (ASSYOV ET AL. 2012). In our list of medicinal plants, distributed in the North Black

Sea Coast, we included three new species not listed by ASSYOV ET AL. (2012) as present in this region: *Phytolacca americana* L., recorded first by IVANOV et al. (2002), *Viburnum opulus* L., documented first by DIMITROV ET AL. (2000) and *Crocus pallasii* Goldb., established by the authors of the present study within the premises of the University Botanic Garden in Varna.

All taxonomic position and names of the taxa are used in accordance to *Conspectus of the Bulgarian Vascular Flora: Distribution Maps and Floristic Elements* (ASSYOV et al. 2012).

The life forms are represented according to the system of RAUNKIAER (1934). For their determination we used *Flora of PR Bulgaria*, Volumes 1 to 9 (JORDANOV 1963, 1964, 1966, 1970, 1973, 1976, 1979; VELCHEV 1982, 1989) and *Flora of the Republic of Bulgaria*, Volumes 10 and 11 (KOZHUHAROV 1995; PEEV 2013). The biological types are determined according to *Handbook for Plants in Bulgaria* (DELIPAVLOV ET AL. 2011). The floristic elements and the endemics are determined according to *Conspectus of the Bulgarian Vascular Flora: Distribution Maps and Floristic Elements* (ASSYOV ET AL. 2012). The relics are determined according to GRUEV & KUZMANOV (1994), PEEV ET AL. (1998), PEEV (2001), BOŽA ET AL. (2005).

The conservation status is recognized using the following documents: Annex II and Annex V to Council Directive 92/43/EEC of the European Community to Protect Natural Habitats of Wild Fauna and Flora, Annex I to Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention), Annex II to Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Red Data Book of the Republic of Bulgaria, Vol. 1. Plants and Fungi (PEEV et al. 2011), IUCN Red List for Bulgaria (PETROVA & VLADIMIROV 2009), Annex III and Annex IV to Biodiversity Act (2002). Recorded species are included in Bulgarian Order for Special Arrangements for the Conservation and Use of the Medicinal Plants (Nr. RD/83 from March 2, 2014).

The anthropophytes are determined according to STEFANOV & KITANOV (1962).

The results from the literature analysis show a significant diversity of medicinal plants in the northern part of the Black Sea Coast floristic region: 593 species of vascular plants from 357 genera and 96 families. They represent 70,26% of the species, 80,41% of the genera and 81,36% of the families of medicinal plants in Bulgaria. The number of identified taxa is very similar to this in the Northeastern Bulgarian floristic region: 600 species of vascular plants from 357 genera and 101 families (ZAHARIEV & IVANOV 2014). A systematic list of identified species is presented in Appendix 1.

Most of the families and genera are presented with smaller number of lower taxa – 1 to 4. The majority of families, 78 (81,25%) are presented with 1–4 genera. Only 18 (18,75%) of the families include 5 or more species. Most genera are found in the families: Asteraceae (39), Lamiaceae (26), Apiaceae (25), Brassicaceae (23) and Fabaceae (22). These are some of the families with the highest number of genera in Bulgarian flora.

Most families, 67 (69,79%), have 1–4 species. Only 29 (30,21%) of the families are represented by 5 or more species. Most species belong to the following families: Asteraceae (71), Lamiaceae (58), Fabaceae (41) and Brassicaceae (35). This correlation is reinforced by the genera: only 17 genera (4,76%) include 5 or more species. Most species belong to the following genera: *Artemisia* (8), *Rumex* (8), *Veronica* (8), *Centaurea* (7), *Salvia* (7) and *Ranunculus* (7). These genera are among the medicinal plants in Bulgaria with the largest number of species.

The analysis of life forms shows a dominance of the hemicryptophytes: 256 species (43,17%), followed by the therophytes: 100 species (16,86%) and the phanerophytes: 95 species (16,02%). The prevalence of hemicryptophytes is typical for the flora in temperate climatic zones, which is confirmed in our study of a particular group of plants, in this case, the medicinal plants. The distribution of the life forms is observed in the same order among non-medicinal and medicinal plants in the Northeastern Bulgarian floristic region.

Perennial herbaceous plants are dominant among the biological types: 325 species (54,81%). Relatively large are in number the annual herbaceous plants: 100 species (16,86%). The distribution of medicinal plant species is similar to that in the Northeastern Bulgarian floristic region, which can be explained by the geographical proximity of the two floristic regions, similar geographical location, as well as the climatic and soil conditions.

In regard to the phytogeographical structure, the highest percentage of the species represents the European type (55,48%), followed by species of Mediterranean type (17,54%) and Boreal type (11,13%). This distribution corresponds to the geographical location of the study area.

Among the medicinal plants in North Black Sea Coast there are only two endemic taxa (0,34%): one Balkan endemic (*Achillea clypeolata* Sm.) and one Bulgarian endemic (*Opopanax chironium* subsp. *bulgaricum* (Velen.) N. Andr.). The relicts are 32 species (5,40%). 31 of these, are Tertiary relicts: *Acer campestre* L., *Cotinus coggygria* Scop., *Hedera helix* L., *Ruscus aculeatus* L., *Ruta graveolens* L., *Salix alba* L., *Viscum album* L. and other. One species is a Quaternary relict: *Galanthus nivalis* L. In the study region, the number of endemic and relict species is comparable to that in the Northeastern Bulgarian floristic region, where there are 3 endemic and 35 relict species.

The species with conservation status are 55 (9,27%). Four of them are included in Directive 92/43/EEC. Two species are included in Annex II: Plant and Animal Species of Value to the Community Which Requires their Conservation in Designated Areas: *Echium russicum* J. F. Gmel. and *Himantoglossum caprinum* (M. Bieb.) Spreng. Two further species are under the protection of Annex V: Plant and Animal Species of Value to the Community Interest Which Requires Regulation of their Removal or Exploitation Under Penalty: *Galanthus nivalis* L. and *Ruscus aculeatus* L.

In the Annex I of the Bern Convention are included 3 species: *Cyclamen coum* Mill., *Himantoglossum caprinum* (M. Bieb.) Spreng. and *Paeonia tenuifolia* L.

In the Annex II of CITES Convention are included 15 species: *Adonis vernalis* L., *Anacamptis pyramidalis* (L.) Rich., *Cyclamen coum* Mill., *Cyclamen hederifolium* Aiton, *Galanthus nivalis* L., *Himantoglossum caprinum* (M. Bieb.) Spreng., *Ophrys cornuta* Steven, *Orchis coriophora* L., *Orchis morio* L., *Orchis purpurea* Huds., *Orchis simia* Lam., *Orchis tridentata* Scop., *Orchis ustulata* L., *Platanthera bifolia* (L.) Rich. and *Platanthera chlorantha* (Custer) Rchb.

In the IUCN Red List for Bulgaria are included 30 species. Two species are included in the category Critically endangered: *Astragalus dasyanthus* Pall. and *Hippophae rhamnoides* L. 8 species in the category Endangered are: *Anethum graveolens* L., *Dianthus pontederiae* A. Kern. subsp. *kladovanus* (Degen) Stoj. & Stef., *Eringium maritimum* L., *Galanthus nivalis* L., *Nuphar lutea* (L.) Sm., *Nymphaea alba* L., *Paeonia tenuifolia* L. and *Ruta graveolens* L. 12 species are in the category Vulnerable: *Anacamptis pyramidalis* (L.) Rich., *Echium russicum* J. F. Gmel., *Ephedra distachya* L., *Euphorbia peplis* L., *Himantoglossum caprinum* (M. Bieb.) Spreng., *Leucjum aestivum* L., *Limonium vulgare* Mill., *Ophrys cornuta* Steven., *Opopanax chironium* (L.) Koch subsp. *bulgaricum* (Velen.) Andreev, *Orchis ustulata* L., *Primula acaulis* (L.) L. *rubra* (Sm.) Greuter & Burdet and *Ranunculus lingua* L. 4 species are in the category Near threatened: *Anemone sylvestris* L., *Artemisia lerchiana* Waber., *Artemisia pontica* L. and *Cercis siliquastrum* L. 4 species are in the category Least concern: *Cyclamen coum* Mill., *Ficus carica* L., *Samolus valerandi* L. and *Tilia rubra* DC.

In the *Red Book of Bulgaria* are included 13 species. 2 species are included in the category Critically Endangered: *Astragalus dasyanthus* Pall. and *Hippophae rhamnoides* L. 8 species appear in the category Endangered: *Anethum graveolens* L., *Dianthus pontederiae* A. Kern. subsp. *kladovanus* (Degen) Stoj. & Stef., *Eringium maritimum* L., *Galanthus nivalis* L., *Nuphar lutea* (L.) Sm., *Nymphaea alba* L., *Paeonia tenuifolia* L. and *Ruta graveolens* L. 3 species are in the category Vulnerable: *Echium russicum* J. F. Gmel., *Himantoglossum caprinum* (M. Bieb.) Spreng. and *Opopanax chironium* (L.) Koch subsp. *bulgaricum* (Velen.) Andreev.

In the Biodiversity Act are included 44 species. 20 species are included in Annex III, Protected Species: *Anacamptis pyramidalis* (L.) Rich., *Anemone sylvestris* L., *Artemisia lerchiana* Waber., *Astragalus dasyanthus* Pall., *Cyclamen coum* Mill., *Dianthus pontederiae* A. Kern. subsp. *kladovanus* (Degen) Stoj. & Stef., *Echium russicum* J. F. Gmel., *Ephedra distachya* L., *Eringium maritimum* L., *Euphorbia peplis* L., *Galanthus nivalis* L., *Himantoglossum caprinum* (M. Bieb.) Spreng., *Hippophae rhamnoides* L., *Limonium vulgare* Mill., *Nuphar lutea* (L.) Sm., *Nymphaea alba* L., *Opopanax chironium* (L.) Koch subsp. *bulgaricum* (Velen.) Andreev, *Ophrys cornuta* Steven, *Paeonia tenuifolia* L. and *Ruta graveolens* L. In Annex IV: Under the conservation and regulated use of the nature are included 24 species: *Asparagus officinalis* L., *Bupleurum rotundifolium* L.,

Crocus chrysanthus (Herbert) Herbert, *Cyclamen hederifolium* Aiton, *Dryopteris filix-mas* (L.) Schott, *Echinops ritro* L., *Echinops sphaerocephalus* L., *Gladiolus communis* L., *Gladiolus imbricatus* L., *Helichrysum arenarium* (L.) Moench, *Leucosium aestivum* L., *Orchis coriophora* L., *Orchis morio* L., *Orchis purpurea* Huds., *Orchis simia* Lam., *Orchis tridentata* Scop., *Orchis ustulata* L., *Paeonia peregrina* Mill., *Polygonatum odoratum* (Mill.) Druce, *Primula acaulis* (L.) L., *Primula veris* L., *Ruscus aculeatus* L., *Salix caprea* L. and *Scilla bifolia* L.

Among the medicinal plants with conservation status with the highest status are as follows: *Himantoglossum caprinum* (M. Bieb.) Spreng. (included in 6 documents); *Galanthus nivalis* L. (included in 5 documents); *Cyclamen coum* Mill., *Echium russicum* J. F. Gmel. and *Paeonia tenuifolia* L. (included in 4 documents).

The number of medicinal plants with conservation status in North Black Sea Coast is close to this in floristic region in Northeastern Bulgaria, where 60 species have been identified.

In Order №RD-83 of 03.02.2014 on Special Arrangements for Conservation and Use of Medicinal Plants from 2014, 27 species are included. 18 species are protected from collection from their natural habitats: *Adonis vernalis* L., *Althaea officinalis* L., *Artemisia santonicum* L. subsp. *patens* (Neilr.) K. Pers., *Asarum europaeum* L., *Asplenium trichomanes* L., *Convallaria majalis* L., *Glaucium flavum* Crantz, *Helichrysum arenarium* (L.) Moench, *Inula helenium* L., *Orchis coriophora* L., *Orchis morio* L., *Orchis purpurea* Huds., *Orchis simia* L., *Orchis tridentata* Scop., *Orchis ustulata* L., *Ruscus aculeatus* L., *Salvia tomentosa* Mill. and *Valeriana officinalis* L. Under restricted collection of herbs from their natural habitats are 9 species: *Artemisia alba* L., *Berberis vulgaris* L., *Betonica officinalis* L., *Carlina acanthifolia* All., *Frangula alnus* Mill., *Galium odoratum* (L.) Scop., *Paeonia peregrina* Mill., *Primula veris* L. and *Sedum acre* L.

The number of anthropophytes among the medicinal plants is high – 374 species (63,07%). Many of them are distributed as weeds in the arable land or as ruderal plants: *Amaranthus retroflexus* L., *Artemisia absinthium* L., *Capsella bursa-pastoris* Moench., *Chenopodium hybridum* L., *Conium maculatum* L., *Elymus repens* (L.) Gould., *Galium aparine* L., *Melilotus officinalis* (L.) Pall., *Nigella arvensis* L., *Plantago major* L., *Sambucus ebulus* L., *Taraxacum officinale* L., *Urtica dioica* L. and more.

The inventory of medicinal plants on the territory of North Black Sea Coast shows significant taxonomic diversity. It is comparable to studies on the neighboring floristic region of Northeast Bulgaria, which is significantly larger in size. The floristic analysis showed also similar results for both regions. It is necessary to conduct a number of further studies in the future: the medicinal plants' distribution needs to be mapped out; their status needs to be studied in more detail, the threats and prospects for the population of species of great economic importance needs to be accounted for, as well as for those with a conservation status; and resource characteristics of the deposits of industrial stocks can be established. After the

preparation of such inventories for other floristic regions, the resulting data can be compared and will be possible to identify eventual regularities in the distribution of medicinal plants in Bulgaria.

Appendix 1. Systematic list of species of vascular medicinal plants, established in Northern Black Sea coast

Equisetophyta

Equisetaceae: *Equisetum arvense* L., *Equisetum palustre* L., *Equisetum telmateia* Ehrh.

Polypodiophyta

Aspidiaceae: *Dryopteris filix-mas* (L.) Schott; **Aspleniaceae:** *Asplenium adiantum-nigrum* L., *Asplenium ruta-muraria* L., *Asplenium septentrionale* (L.) Hoffm., *Asplenium trichomanes* L., *Ceterach officinarum* DC; **Hypolepidaceae:** *Pteridium aquilinum* (L.) Kuhn; **Polypodiaceae:** *Polypodium vulgare* L.

Magnoliophyta

Pinopsida

Cupressaceae: *Juniperus communis* L.

Gnetopsida

Ephedraceae: *Ephedra distachya* L.

Magnoliopsida

Aceraceae: *Acer campestre* L., *Acer negundo* L., *Acer platanoides* L., *Acer pseudoplatanus* L., *Acer tataricum* L.; **Amaranthaceae:** *Amaranthus retroflexus* L.; **Anacardiaceae:** *Cotinus coggygria* Scop., *Rhus coriaria* L.; **Apiaceae:** *Aegopodium podagraria* L., *Aethusa cynapium* L., *Anethum graveolens* L., *Angelica sylvestris* L., *Anthriscus cerefolium* (L.) Hoffm., *Apium graveolens* L., *Bifora radians* M. Bieb., *Bupleurum rotundifolium* L., *Chaerophyllum bulbosum* L., *Chaerophyllum temulentum* L., *Conium maculatum* L., *Daucus carota* L., *Eryngium campestre* L., *Eryngium maritimum* L., *Ferulago sylvatica* (Besser) Rchb., *Foeniculum vulgare* Mill., *Heracleum sibiricum* L., *Laser trilobum* (L.) Borkh., *Oenanthe aquatica* (L.) Poir., *Opopanax chironium* (L.) Koch, *Pastinaca sativa* L., *Peucedanum arenarium* Waldst. & Kit., *Sanicula europaea* L., *Scandix pecten-veneris* L., *Seseli rigidum* Waldst. & Kit., *Seseli tortuosum* L., *Tordylium maximum* L., *Torilis arvensis* (Hudson) Link; **Apocynaceae:** *Vinca herbacea* Waldst., *Vinca minor* L.; **Araliaceae:** *Hedera helix* L.; **Aristolochiaceae:** *Aristolochia clematitis* L., *Asarum europaeum* L.; **Asclepiadaceae:** *Cionura erecta* (L.) Griseb., *Periploca graeca* L., *Vincetoxicum hirsutinaria* Medicus; **Asteraceae:** *Achillea clypeolata* Sm., *Achillea millefolium* L., *Achillea nobilis* L., *Anthemis arvensis* L., *Anthemis cotula* L., *Anthemis tinctoria* L., *Arctium lappa* L., *Arctium minus* Bernh., *Arctium tomentosum* Mill., *Artemisia absinthium* L., *Artemisia alba* L., *Artemisia annua* L., *Artemisia campestris* L., *Artemisia lerchiana* Waber., *Artemisia pontica* L., *Artemisia santonicum* L. ssp. *patens* (Neilr.) K. Pers., *Artemisia vulgaris* L., *Bellis perennis* L., *Bidens tripartita* L., *Carduus acanthoides* L., *Carlina acanthifolia* All., *Carlina vulgaris* L., *Carthamus lanatus* L., *Centaurea calcitrapa* L., *Centaurea cyanus* L., *Centaurea diffusa* Lam., *Centaurea pannonica* (Heuffel) Simonk., *Centaurea rocheliana* (Heuffel) Dostál, *Centaurea stoebe* L., *Centaurea solstitialis*

L., *Chamomilla recutita* (L.) Rauscher, *Cichorium intybus* L., *Cirsium arvense* (L.) Scop., *Cirsium vulgare* (Savi) Ten., *Conyza canadensis* (L.) Cronquist, *Echinops ritro* L., *Echinops sphaerocephalus* L., *Eupatorium cannabinum* L., *Filago lutescens* Jord., *Filago vulgaris* Lam., *Galinsoga parviflora* Cav., *Gnaphalium uliginosum* L., *Helichrysum arenarium* (L.) Moench, *Hieracium pilosella* L., *Inula aschersoniana* Janka, *Inula britannica* L., *Inula ensifolia* L., *Inula germanica* L., *Inula helenium* L., *Lactuca serriola* L., *Leucanthemum vulgare* Lam., *Logfia arvensis* (L.) Holub., *Matricaria trichophylla* (Boiss.) Boiss., *Onopordum acanthium* L., *Onopordum tauricum* Wilid., *Petasites hybridus* (L.) Gaertn., *Pulicaria dysenterica* (L.) Bernh., *Pulicaria vulgaris* Gaertn., *Scorzonera hispanica* L., *Senecio jacobaea* L., *Senecio viscosus* L., *Senecio vulgaris* L., *Silybum marianum* (L.) Gaertn., *Solidago virgaurea* L., *Tanacetum vulgare* L., *Taraxacum officinale* Weber, *Tragopogon pratensis* L., *Tussilago farfara* L., *Xanthium spinosum* L., *Xanthium strumarium* L., *Xeranthemum annuum* L.; **Berberidaceae:** *Berberis vulgaris* L.; **Betulaceae:** *Alnus glutinosa* (L.) Gaertn., *Betula pendula* Roth, *Carpinus betulus* L., *Corylus avellana* L., *Corylus colurna* L.; **Boraginaceae:** *Anchusa officinalis* L., *Buglossoides arvensis* (L.) I. M. Johnst., *Buglossoides purpureocaerulea* (L.) I. M. Johnst., *Cerinthe minor* L., *Cynoglossum officinale* L., *Echium italicum* L., *Echium russicum* J. F. Gmel., *Echium vulgare* L., *Heliotropium europaeum* L., *Lithospermum officinale* L., *Myosotis arvensis* (L.) Hill., *Pulmonaria officinalis* L., *Symphytum officinale* L.; **Brassicaceae:** *Alliaria petiolata* (M. Bieb.) Cavara & Grande, *Alyssum alyssoides* (L.) L., *Armoracia rusticana* G. Gaertn., B. Mey. & Scherb., *Barbarea vulgaris* R.Br., *Beta vulgaris* L., *Brassica nigra* (L.) Koch, *Brassica juncea* (L.) Czern. & Coss., *Bunias orientalis* L., *Capsella bursa-pastoris* (L.) Medicus, *Cardamine bulbifera* (L.) Crantz, *Cardamine pratensis* L., *Cardaria draba* (L.) Desv., *Coronopus squamatus* (Forssk.) Asch., *Descurainia sophia* (L.) Webb ex Prantl, *Diplotaxis tenuifolia* (L.) DC., *Erysimum crepidifolium* Rchb., *Erysimum diffusum* Ehrh., *Erysimum repandum* L., *Eruca vasicaeia* (L.) Cav. ssp. *sativa* (Miller) Thell., *Euclidium syriacum* (L.) R. Br., *Hesperis matronalis* L., *Lepidium campestre* (L.) R. Br., *Lepidium graminifolium* L., *Lepidium latifolium* L., *Lepidium perfoliatum* L., *Lepidium ruderales* L., *Myagrum perfoliatum* L., *Nasturtium officinale* R. Br., *Raphanus raphanistrum* L., *Rorippa austriaca* (Crantz) Besser, *Rorippa pyrenaica* (L.) Rchb., *Rorippa sylvestris* (L.) Besser, *Sisymbrium loeselii* L., *Sisymbrium officinale* (L.) Scop., *Thlaspi alliaceum* L., *Thlaspi arvense* L.; **Campanulaceae:** *Campanula persicifolia* L.; **Cannabaceae:** *Cannabis sativa* L., *Humulus lupulus* L.; **Caprifoliaceae:** *Lonicera xylosteum* L., *Sambucus ebulus* L., *Sambucus nigra* L., *Viburnum opulus* L.; **Caryophyllaceae:** *Agrostemma githago* L., *Dianthus pontederiae* A. Kern., *Herniaria glabra* L., *Herniaria hirsuta* L., *Herniaria incana* Lam., *Lychnis coronaria* (L.) Desr., *Lychnis flos-cuculi* L., *Minuartia setacea* (Thuill.) Hayek, *Saponaria officinalis* L., *Scleranthus annuus* L., *Scleranthus perennis* L., *Silene otites* (L.) Wibel., *Spergularia rubra* (L.) J. & C. Presl, *Stellaria graminea* L., *Stellaria media* (L.) Vill., *Viscaria vulgaris* Röhl.; **Celastraceae:** *Euonymus europaeus* L., *Euonymus verrucosus* Scop.; **Chenopodiaceae:** *Atriplex rosea* L., *Camphorosma monspeliaca* L., *Chenopodium album* L., *Chenopodium botrys* L., *Chenopodium hybridum* L., *Chenopodium polyspermum* L., *Chenopodium rubrum* L., *Salsola ruthenica* Iljin; **Convolvulaceae:** *Calystegia sepium* (L.) R. Br., *Convolvulus arvensis* L.; **Cornaceae:** *Cornus mas* L.; **Crassulaceae:** *Sedum acre* L., *Sedum album* L., *Sedum maximum* (L.) Suter; **Cucurbitaceae:** *Bryonia alba* L., *Ecbalium elaterium* (L.) A. Rich.; **Cuscutaceae:** *Cuscuta europaea* L.; **Dioscoreaceae:** *Tamus communis* L.; **Dipsacaceae:** *Dipsacus fullonum* L., *Dipsacus*

laciniatus L., *Knautia arvensis* (L.) Coult., *Scabiosa ochroleuca* L.; **Elaeagnaceae:** *Elaeagnus angustifolia* L., *Hippophae rhamnoides* L.; **Euphorbiaceae:** *Euphorbia amygdaloides* L., *Euphorbia cyparissias* L., *Euphorbia myrsinites* L., *Euphorbia peplis* L., *Euphorbia peplus* L., *Mercurialis annua* L.; **Fabaceae:** *Amorpha fruticosa* L., *Anthyllis vulneraria* L., *Astragalus dasyanthus* Pall., *Astragalus glycyphyllos* L., *Bituminaria bituminosa* (L.) Stirt., *Cercis siliquastrum* L., *Chamaecytisus hirsutus* (L.) Link, *Chamaecytisus lejocarpus* (A.Kern) *Chamaespartium sagittale* (L.) Gibbs., *Colutea arborescens* L., *Coronilla scorpioides* (L.) C. Koch., *Coronilla varia* L., *Galega officinalis* L., *Genista ovata* Waldst. & Kit., *Genista tinctoria* L., *Gleditsia triacanthos* L., *Lathyrus niger* (L.) Bernh., *Lathyrus pratensis* L., *Lathyrus sativus* L., *Lathyrus sylvestris* L., *Lathyrus tuberosus* L., *Lathyrus vernus* (L.) Bernh., *Lotus corniculatus* L., *Medicago sativa* L., *Melilotus alba* Medicus, *Melilotus officinalis* (L.) Pall., *Ononis arvensis* L., *Ononis spinosa* L., *Robinia pseudoacacia* L., *Spartium junceum* L., *Trifolium alpestre* L., *Trifolium arvense* L., *Trifolium pannonicum* Jacq., *Trifolium pratense* L., *Trifolium repens* L., *Trigonella coerulea* (L.) Ser., *Trigonella foenum-graecum* L., *Trigonella procumbens* (Besser) Rchb., *Vicia cracca* L., *Vicia grandiflora* Scop., *Vicia sativa* L.; **Fagaceae:** *Fagus orientalis* Lipsky, *Fagus sylvatica* L., *Quercus dalechampii* Ten., *Quercus frainetto* Ten., *Quercus robur* L.; **Gentianaceae:** *Centaurium erythraea* Raf., *Centaurium pulchellum* (Sw.) Druce, *Gentiana cruciata* L.; **Geraniaceae:** *Erodium cicutarium* (L.) L'Her., *Geranium dissectum* L., *Geranium pyrenaicum* Burm. f., *Geranium robertianum* L., *Geranium sanguineum* L.; **Globulariaceae:** *Globularia aphyllanthes* Crantz; **Haloragaceae:** *Myriophyllum spicatum* L.; **Hypericaceae:** *Hypericum maculatum* Crantz., *Hypericum perforatum* L.; **Juglandaceae:** *Juglans regia* L.; **Lamiaceae:** *Acinos arvensis* (Lam.) Dandy, *Acinos suaveolens* (Sm.) Don, *Ajuga chamaepitys* (L.) Schreb., *Ajuga laxmanii* (L.) Benth., *Ajuga reptans* L., *Ballota nigra* L., *Betonica officinalis* L., *Calamintha nepeta* (L.) Savi, *Calamintha sylvatica* Bromf., *Clinopodium vulgare* L., *Galeopsis ladanum* L., *Galeopsis speciosa* Mill., *Galeopsis tetrachit* L., *Glechoma hederacea* L., *Glechoma hirsuta* Waldst. & Kit., *Lamium maculatum* L., *Lamium purpureum* L., *Leonurus cardiaca* L., *Lycopus europaeus* L., *Marrubium parviflorum* Fisch. & C. A. Mey., *Marrubium peregrinum* L., *Marrubium vulgare* L., *Melissa officinalis* L., *Melittis melissophyllum* L., *Mentha aquatica* L., *Mentha arvensis* L., *Mentha longifolia* (L.) Huds., *Mentha pulegium* L., *Mentha spicata* L., *Nepeta cataria* L., *Origanum vulgare* L., *Phlomis tuberosa* L., *Prunella vulgaris* L., *Salvia aethiops* L., *Salvia glutinosa* L., *Salvia nemorosa* L., *Salvia pratensis* L., *Salvia sclarea* L., *Salvia tomentosa* Mill., *Salvia verticillata* L., *Satureja montana* L., *Scutellaria altissima* L., *Scutellaria galericulata* L., *Scutellaria hastifolia* L., *Sideritis montana* L., *Stachys annua* L., *Stachys germanica* L., *Stachys recta* L., *Stachys sylvatica* L., *Teucrium chamaedrys* L., *Teucrium montanum* L., *Teucrium polium* L., *Teucrium scordium* L., *Thymus callieri* Borbás ex Velen., *Thymus glabrescens* Willd., *Thymus pulegioides* L., *Thymus sibthorpii* Benth., *Thymus striatus* Vahl.; **Lemnaceae:** *Lemna minor* L., *Spirodela polyrhiza* (L.) Schleid.; **Loranthaceae:** *Loranthus europaeus* Jacq., *Viscum album* L.; **Lythraceae:** *Lythrum salicaria* L., *Lythrum virgatum* L.; **Malvaceae:** *Alcea pallida* (Waldst. & Kit. ex Willd.) Waldst. & Kit., *Alcea rosea* L., *Althaea officinalis* L., *Lavatera thuringiaca* L., *Malva neglecta* Wallr., *Malva pusilla* Sm., *Malva sylvestris* L.; **Moraceae:** *Ficus carica* L., *Morus alba* L.; **Nymphaeaceae:** *Nuphar lutea* (L.) Sm., *Nymphaea alba* L.; **Oleaceae:** *Fraxinus ornus* L., *Fraxinus oxycarpa* M. Bieb. ex Willd., *Jasminum fruticans* L., *Ligustrum vulgare* L., *Phillyrea latifolia* L., *Syringa vulgaris*

L.; **Onagraceae:** *Epilobium angustifolium* Vill., *Epilobium parviflorum* Schreb., *Oenothera biennis* L.; **Paeoniaceae:** *Paeonia peregrina* Mill., *Paeonia tenuifolia* L.; **Papaveraceae:** *Chelidonium majus* L., *Corydalis bulbosa* (L.) DC., *Corydalis solida* (L.) Schwarz, *Fumaria officinalis* L., *Fumaria vaillantii* Loisel., *Glaucium flavum* Crantz, *Papaver rhoeas* L.; **Phytolaccaeae:** *Phytolacca americana* L.; **Plantaginaceae:** *Plantago lanceolata* L., *Plantago coronarius* L., *Plantago major* L., *Plantago media* L., *Plantago scabra* Moench; **Plumbaginaceae:** *Limonium vulgare* Mill., *Plumbago europaea* L.; **Polygalaceae:** *Polygala major* Jacq.; **Polygonaceae:** *Bilderdykia dumetorum* (L.) Dumort., *Persicaria hydropiper* (L.) Opiz, *Persicaria lapathifolia* (L.) Gray, *Persicaria maculata* (Raf.) Gray, *Persicaria mitis* (Schrank) Opiz, *Polygonum arenastrum* Boreau, *Polygonum aviculare* L., *Rumex acetosa* L., *Rumex acetosella* L., *Rumex crispus* L., *Rumex hydrolapathum* Huds., *Rumex obtusifolius* L., *Rumex palustris* Sm., *Rumex patientia* L., *Rumex pulcher* L.; **Portulacaceae:** *Portulaca oleracea* L.; **Primulaceae:** *Anagallis arvensis* L., *Cyclamen coum* Mill., *Cyclamen hederifolium* Aiton, *Lysimachia nummularia* L., *Primula acaulis* (L.) L., *Primula veris* L., *Samolus valerandi* L.; **Ranunculaceae:** *Actaea spicata* L., *Adonis aestivalis* L., *Adonis vernalis* L., *Anemone ranunculoides* L., *Anemone sylvestris* L., *Clematis vitalba* L., *Consolida hispanica* (Costa) Greuter & Burdet, *Consolida regalis* Gray, *Helleborus odoratus* Waldst. & Kit., *Isopyrum thalictroides* L., *Nigella arvensis* L., *Nigella damascena* L., *Pulsatilla pratensis* (L.) Mill., *Ranunculus acris* L., *Ranunculus ficaria* L., *Ranunculus flammula* L., *Ranunculus lingua* L., *Ranunculus polyanthemus* L., *Ranunculus repens* L., *Ranunculus sceleratus* L., *Thalictrum aquilegifolium* L., *Thalictrum minus* L.; **Resedaceae:** *Reseda lutea* L., *Reseda luteola* L.; **Rhamnaceae:** *Frangula alnus* Mill., *Paliurus spina-christi* Mill., *Rhamnus catharticus* L.; **Rosaceae:** *Agrimonia eupatoria* L., *Crataegus monogyna* Jacq., *Crataegus pentagyna* Waldst. & Kit., *Filipendula vulgaris* Moench, *Fragaria vesca* L., *Geum urbanum* L., *Malus sylvestris* Mill., *Potentilla argentea* L., *Potentilla cinerea* Chaix ex Vill., *Potentilla erecta* (L.) Raeusch., *Potentilla reptans* L., *Prunus avium* L., *Prunus cerasifera* Ehrh., *Prunus fruticosa* Pall., *Prunus mahaleb* L., *Prunus spinosa* L., *Pyrus pyraster* Burgsd., *Rosa canina* L., *Rosa corymbifera* Borkh., *Rosa gallica* L., *Rubus caesius* L., *Rubus idaeus* L., *Sanguisorba minor* Scop., *Sorbus aucuparia* L., *Sorbus domestica* L., *Sorbus torminalis* (L.) Crantz; **Rubiaceae:** *Cruciata glabra* (L.) Ehrend., *Cruciata laevipes* Opiz, *Galium aparine* L., *Galium odoratum* (L.) Scop., *Galium verum* L., *Rubia tinctorum* L.; **Rutaceae:** *Dictamnus albus* L., *Ruta graveolens* L.; **Salicaceae:** *Populus alba* L., *Populus nigra* L., *Populus tremula* L., *Salix alba* L., *Salix caprea* L., *Salix fragilis* L., *Salix purpurea* L.; **Saxifragaceae:** *Saxifraga rotundifolia* L.; **Scrophulariaceae:** *Digitalis lanata* Ehrh., *Euphrasia rostkoviana* Hayne, *Euphrasia stricta* D. Wolff., *Gratiola officinalis* L., *Kickxia elatine* (L.) Dumort., *Kickxia spuria* (L.) Dumort., *Lathraea squamaria* L., *Linaria vulgaris* Mill., *Scrophularia canina* L., *Scrophularia nodosa* L., *Scrophularia umbrosa* Dumort., *Verbascum densiflorum* Bertol., *Verbascum nigrum* L., *Verbascum phlomoides* L., *Verbascum phoeniceum* L., *Veronica anagallis-aquatica* L., *Veronica arvensis* L., *Veronica austriaca* L., *Veronica beccabunga* L., *Veronica chamaedrys* L., *Veronica officinalis* L., *Veronica prostrata* L., *Veronica spicata* L. subsp. *orchidea* (Crantz) Hayek; **Simaroubaceae:** *Ailanthus altissima* (Mill.) Swingle; **Solanaceae:** *Datura stramonium* L., *Hyoscyamus niger* L., *Lycium barbarum* L., *Nicandra physaloides* (L.) Gaertn., *Physalis alkekengii* L., *Solanum dulcamara* L., *Solanum nigrum* L.; **Staphyleaceae:** *Staphylea pinnata* L.; **Tamaricaceae:** *Tamarix ramosissima* Ledeb., *Tamarix tetrandia* Pall. ex M. Bieb.; **Tiliaceae:** *Tilia cordata* Mill., *Tilia platyphyllos* Scop.,

Tilia rubra DC., *Tilia tomentosa* Moench; **Ulmaceae:** *Celtis australis* L., *Ulmus glabra* Huds., *Ulmus minor* Mill.; **Urticaceae:** *Parietaria lusitanica* L., *Parietaria officinalis* L., *Urtica dioica* L., *Urtica urens* L.; **Valerianaceae:** *Valeriana officinalis* L., *Valerianella coronata* (L.) DC.; **Verbenaceae:** *Verbena officinalis* L.; **Violaceae:** *Viola hirta* L., *Viola odorata* L., *Viola tricolor* L.; **Zygophyllaceae:** *Peganum harmala* L., *Tribulus terrestris* L., *Zygophyllum fabago* L.

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Alismataceae: *Alisma plantago-aquatica* L.; **Amaryllidaceae:** *Galanthus nivalis* L., *Leucojum aestivum* L.; **Araceae:** *Arum italicum* Mill., *Arum maculatum* L.; **Butomaceae:** *Butomus umbellatus* L.; **Cyperaceae:** *Carex ligerica* J. Gay, *Carex riparia* Curtis; **Hydrocharitaceae:** *Hydrocharis morsus-ranae* L.; **Iridaceae:** *Crocus chrysanthus* (Herbert) Herbert, *Crocus pallasii* Goldb., *Gladiolus communis* L., *Gladiolus imbricatus* L., *Iris graminea* L., *Iris pseudacorus* L., *Iris pumila* L.; **Juncaceae:** *Juncus inflexus* L.; **Liliaceae:** *Allium rotundum* L., *Allium scorodoprasum* L., *Asparagus officinalis* L., *Colchicum autumnale* L., *Convallaria majalis* L., *Nectaroscordum siculum* (Ucria) Lindl., *Polygonatum multiflorum* (L.) All., *Polygonatum odoratum* (Mill.) Druce, *Ruscus aculeatus* L., *Scilla bifolia* L., *Veratrum nigrum* L.; **Najadaceae:** *Najas marina* L.; **Orchidaceae:** *Anacamptis pyramidalis* (L.) Rich., *Himantoglossum caprinum* (M. Bieb.) Spreng., *Ophrys cornuta* Steven, *Orchis coriophora* L., *Orchis morio* L., *Orchis purpurea* Huds., *Orchis simia* Lam., *Orchis tridentata* Scop., *Orchis ustulata* L., *Platanthera bifolia* (L.) Rich., *Platanthera chlorantha* (Custer) Rchb.; **Poaceae:** *Anthoxanthum odoratum* L., *Briza media* L., *Cynodon dactylon* (L.) Pers., *Elymus repens* (L.) Gould., *Lolium temulentum* L., *Sclerochloa dura* (L.) P. Beauv., *Sorghum halepense* (L.) Pers.; **Smilacaceae:** *Smilax excelsa* L.; **Sparganiaceae:** *Sparganium erectum* L.; **Typhaceae:** *Typha angustifolia* L., *Typha latifolia* L.

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