

Medicinal plants of Tarnovski Heights (Northern Bulgaria)

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Abstract

As a result of our studies of Tarnovski Heights in the period 2015-2016 are described 444 species of medicinal plants belonging to 284 genera and 81 families. This represents 52.54% of the medicinal plant species in Bulgaria. Most families (71.60%) and genera (96.83%) are presented with smaller number species: from 1 to 4. The described medicinal plants belong to 30 floristic elements. We established 3 Balkan endemic species and 44 relic species. Most commonly spread life forms are the hemicryptophytes (47.75%). Perennial herbaceous plants (56.53%) dominate among the biological types. The number of plant species with conservation status is 31 (6.98%). The anthropophytes among the vascular plants are 290 species (65.32%). The results were compared with data for medicinal plants of Frangensko Plateau (Northeastern Bulgaria).

Keywords: analysis, anthropophytes, endemics, protected plants, relics

1. Introduction

Tarnovski Heights (also called Tarnovska Mountain) are characterized by hilly uplands and located in Northern Bulgaria (Figure 1). i.e. in the northern part of Middle Forebalkan between the rivers Vesselina and Negovanka. At the Tarnovski Heights foot is located the nominal border between the Middle Danubian Plain and the Middle Forebalkan. In the north, the heights border on the upper river beds of Negovanka and Bohot (right tributaries of Rosica River) and the valley of Yantra River. In the east, the Valley of Vesselina River separates Tarnovski Heights from Romana Height. In the south, the valley of Yantra River separates them from Melovete Height near the villages Pushevo and Shemshevo. In the area of Sheremetya Village, the Heights connect with a col to Prisovski Ridge that we included in the study area. South of the Prisovski Ridge, in the area of the Pchelishte Village, begin the northern spurs of Elenski Heights. In the southwest, near the villages of Vetrinzi, Balvan and Novo Selo, Tarnovski Heights are associated with a low-mountain ridge called Stenite. In the west, the Valley of Negovanka River separates Tarnovski Heights from Pluzhna Plateau.

The total area of Tarnovski Heights and Prisovski Ridge is about 360 km². The length of Tarnovski Heights from west to east is about 48 km, and their maximum

width in the middle is about 12.5 km. The average altitude is 360-400 m, which in the western and in the eastern parts greatly recedes. The maximum height is 439.8 m and is located in Arbanasi Plateau to the west of Petropavlovski Monastery. The northern slopes facing Yantra River are steep and the rest of the slopes are slanting. Between Veliko Tarnovo and the village of Samovodene, these slopes are separated by Yantra River in Derwent Gorge (Tarnovski Gorge). West from the gorge is located Belyakovo Plateau and east of it is Arbanasi Plateau [1].



Fig. 1. Geographic position of Tarnovski Heights (with red point) and Frangensko Plateau (with yellow point)

The oldest existing data about botanical studies in the area of Veliko Tarnovo is found in the first botanical survey by Josef Velenovsky in Bulgaria in 1885. He examines the entire region of Northern Bulgaria, focusing also on the surroundings of Lyaskovets and Veliko Tarnovo. The materials collected by him were used for the preparation and publication of the first Bulgarian flora [2]. Several years later, Vasil Kovachev conducts his own research in the area of Veliko Tarnovo that he published in 1892 together with studies of other regions in his second botanical article, „Materials on the Flora of North Bulgaria” [3]. In 1901, Ivan Urumov publishes a list of identified plants in the then so-called Tarnovo and Lovech District [4].

Later data about individual species in the region of Veliko Tarnovo are presented by Stoyanov & Stefanov [5, 6, 7, 8], Stoyanov, Stefanov & Kitanov [9, 10], Flora of

the People's Republic of Bulgaria [11, 12] and Flora of the Republic of Bulgaria [13, 14].

So far, the flora of Tarnovski Heights as a single geographic site has not been studied. There are no published studies of the medicinal plants on this territory.

2. Materials and Methods

The present study of medicinal plants of Tarnovski Heights was conducted on the route method in the period 2015-2016. The medicinal plants are under the Annex to the Medicinal Plants Act of the Republic of Bulgaria [15], Stoyanov [16, 17], Stoyanov & Kitanov [18], Petkov [19], Pamukov & Ahtardzhiev [20], Landzhev [21], Nikolov [22].

In determining the taxa are used: Handbook for Plants in Bulgaria [23], Flora of the People's Republic of Bulgaria, Volumes 1 to 9 [11, 12] and Flora of the Republic of Bulgaria, Volumes 10 and 11 [13, 14]. The names of the species are under Conspectus of the Bulgarian Vascular Flora [24]. The abbreviations of the authors' names of the plants are according to the International Plant Names Index [25]. The names of the family are according to Angiosperm Phylogeny Group III [26].

The life forms are represented in the system of Raunkiaer [27]. Biological types are defined by Delipavlov & al. [23]. The floristic elements and the endemics are according to Asyov & al. [24]. The relics are presented according to Zahariev [28]. The anthropophytes are presented by Stefanov & Kitanov [29].

The conservation statute is recognized using the following documents: Annex II to Council Directive 92/43/EEC of the European Community to protect natural habitats and of wild fauna and flora [30], Appendix I to the Convention on Conservation of European Wildlife and Natural Habitats (Bern Convention) [31], Appendix II to Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) [32], Red Data Book of the Republic of Bulgaria, Vol. 1. Plants and Fungi [33], Red List of Bulgarian vascular plants [34], Annex III and Annex IV to the Act on Amending and Supplementing the Biological Diversity Act of the Republic of Bulgaria [35]. Recorded are the species included in the Bulgarian Order for Special Arrangements for Conservation and Use of Medicinal Plants [36].

3. Results and Discussion

As a result of our investigations of the medicinal plants of Tarnovski Heights, 444 species belonging to 284 genera and 81 families were identified. They represent 52.54% of the species, 63.96% of the genera and 68.64% of the families of medicinal plants in Bulgaria. The medicinal plants of Tarnovski Heights are 10.82% of the species, 31.11% of the genera and 58.27% of the families

of vascular plants in Bulgaria. A systematic list of identified species is presented in Appendix 1.

The majority of families, 68 (83.95%) were represented with 1–4 genera. Only 13 (16.05%) families included 5 or more genera. Most genera were found in the following families: Asteraceae (37), Lamiaceae (24), Apiaceae (21) and Fabaceae (19).

Most families, 58 (71.60%) have 1–4 species. Only 23 (28.40%) families are represented by 5 or more species. Most species belong to the following families: Asteraceae (53), Lamiaceae (42), Fabaceae (36), Rosaceae (24) and Apiaceae (24).

The majority of genera, 275 (96.83%), were represented with 1–4 species. Only 9 genera (3.17%) had 5 or more species. Most genera were found in the genera *Rumex* L. (7) and *Veronica* L. (6). The other 7 genera had 5 species.

A broad taxonomic diversity is characteristic for areas with karst topography in Bulgaria. It is comparable to the results obtained in a survey of Frangensko Plateau that is a karst plateau with approximately the same area as the Tarnovski Heights and is located in the eastern part of Danubian Plain. The medicinal plants of Frangensko Plateau are 362 species, belonging to 242 genera and 80 families [37].

The specific physical and geographical conditions of Tarnovski Heights determine considerable diversity of floristic elements. We have established 30 different floristic elements. Among these prevail European-Asiatic floristic elements (19.59%), European-Mediterranean floristic elements (15.09%) and sub-Mediterranean floristic elements (12.61%). The percentage of adventive species and cosmopolitans is relatively small: 19 species (4.28%) and 24 species (5.41%) respectively. The endemic component is relatively underrepresented (0.68%), which is typical for regions in Bulgaria defined by low altitude [38]. This component includes three Balkan endemic species: *Acanthus balcanicus* Heywood & I. Richardson, *Achillea clypeolata* Sm., *Angelica pancicii* Vandas ex Velen. The number of endemic species among the medicinal plants within the Frangensko Plateau is also 3 species [37].

Among the medicinal plants of Tarnovski Heights is significant number of relic species, 44 (9.91%). The majority of these relic species are Tertiary relics. They are 40 species: *Acer campestre* L., *A. platanoides* L., *A. pseudoplatanus* L., *A. tataricum* L., *Asarum europaeum* L., *Betula pendula* Roth, *Butomus umbellatus* L., *Carpinus betulus* L., *Clematis vitalba* L., *Colutea arborescens* L., *Corylus avellana* L., *C. colurna* L., *Cotinus coggygria* Scop., *Crataegus pentagyna* Waldst. & Kit. ex Willd., *Dictamnus albus* L., *Fraxinus excelsior* L., *F. ornus* L., *Hedera helix* L., *Isopyrum thalictroides* L., *Juglans regia* L., *Juniperus communis* L., *Lycopus*

europaeus L., *Paliurus spina-christi* Mill., *Populus alba* L., *P. nigra* L., *P. tremula* L., *Quercus dalechampii* Ten., *Rumex acetosa* L., *Ruscus aculeatus* L., *Ruta graveolens* L., *Salix alba* L., *S. caprea* L., *S. fragilis* L., *S. purpurea* L., *Sanicula europaea* L., *Staphylea pinnata* L., *Syringa vulgaris* L., *Tamus communis* L., *Ulmus minor* Mill., *Viscum album* L. The Quaternary interglacial relics are 3 species: *Galanthus nivalis* L., *Gymnadenia conopsea* (L.) R.Br., *Parnassia palustris* L. The Quaternary interglacial relics are represented by only one species: *Iris pumila* L. The number of relic species is higher than that of medicinal plants found on Frangensko Plateau: 30 species (8.29%) [37].

The analysis of life forms shows dominant participation of hemicryptophytes – 212 species (47.75%) and phanerophytes – 74 species (16.67%). This can be explained by the study area's location in the temperate climatic zone and significant contribution of forest habitats. The phanerophytes are represented with all subgroups except for epiphytes: megaphanerophytes, mesophanerophytes, microphanerophytes, nanophanerophytes and succulents.

The therophytes are also significant in number. They are 63 species (14.19%). This number is related to the inclusion of a large number of ruderal and weed plants in this group, as well as to anthropogenic influence.

The remaining life forms include a lower number of species. For instance, 50 species are cryptophytes (11.26%). They are represented with all subgroups: geophytes, helophytes and hydrophytes. The transitional group therophytes-hemicryptophytes includes 27 species (6.08%). 18 species are chamaephytes (4.05%).

The distribution of life forms among the medicinal plants within Frangensko Plateau is similar [37].

All biological types are represented among the medicinal plants of Tarnovski Heights as well as almost all possible transitional forms among them. The largest is the group of perennial plants with 251 species (56.53%). Next are the groups of annual herbaceous plants, 63 species (14.19%), and trees, 37 species (8.33%). With a lower number of species are represented shrubs, biennial herbaceous plants and the transitional forms between the basic biological types. The distribution of biological types among medicinal plants within Frangensko Plateau is very similar [37].

The dominance of perennial herbaceous plants can be explained by the wide variety of communities and habitats of Tarnovski Heights. The relatively high number of annual herbaceous plants results from settlements and arable land. Tree species are represented in relatively large numbers because of preserved forest habitats.

The species with conservation status are 31 (6.98%). One of them is *Himantoglossum caprinum* Spreng. It is included in Annex II of Directive 92/43/EEC

(Plant and animal species of Community interest whose conservation requires the designation of special areas of conservation) and in Appendix I of the Bern Convention.

Two species are included in Annex V of Directive 92/43/EEC (Animal and plant species of Community interest whose taking in the wild and exploitation may be subject to management measures): *Galanthus nivalis* L. and *Ruscus aculeatus* L.

In Appendix II of CITES Convention are included 12 species: *Anacamptis pyramidalis* (L.) Rich., *Cyclamen hederifolium* Aiton, *Galanthus elwesii* Hook.f., *G. nivalis* L., *Gymnadenia conopsea* (L.) R.Br., *Himantoglossum caprinum* Spreng., *Ophrys cornuta* Steven ex M.Bieb., *Orchis morio* L., *O. purpurea* Huds., *O. simia* Lam., *O. tridentata* Scop., *Platanthera chlorantha* (Custer) Rchb.

In the Red List of Bulgarian vascular plants are included 13 species. In the category Endangered are enlisted 3 species: *Galanthus elwesii* Hook.f., *G. nivalis* L., *Ruta graveolens* L. In category Vulnerable are included 5 species: *Anacamptis pyramidalis* (L.) Rich., *Angelica pancicii* Vandas ex Velen., *Fraxinus pallisiae* Wilmott, *Himantoglossum caprinum* Spreng., *Ophrys cornuta* Steven ex M.Bieb. In the category Nearly Threatened are 3 species: *Anemone sylvestris* L., *Cercis siliquastrum* L., *Vicia pisiformis* L. In the category Least Concern are 2 species: *Acanthus balcanicus* Heywood & I. Richardson, *Pulmonaria mollis* Ten.

In the Red Data Book of Republic of Bulgaria are included 5 species. Three of them are in the category Endangered: *Galanthus elwesii* Hook.f., *G. nivalis* L., *Ruta graveolens* L. One species is in the category Vulnerable: *Himantoglossum caprinum* Spreng.

In the Act on Amending and Supplementing the Biological Diversity Act of the Republic of Bulgaria are included 22 species. In Annex III (Protected species) are included 6 species: *Anacamptis pyramidalis* (L.) Rich., *Anemone sylvestris* L., *Galanthus elwesii* Hook.f., *G. nivalis* L., *Himantoglossum caprinum* Spreng., *Ophrys cornuta* Steven ex M.Bieb. In Annex IV (Species under the conservation and regulated use of the nature) are included 16 species: *Crocus pallasii* Goldb., *Cyclamen hederifolium* Aiton, *Dryopteris filix-mas* (L.) Schott, *Echinops sphaerocephalus* L., *Gladiolus communis* L., *Lilium martagon* L., *Orchis morio* L., *O. purpurea* Huds., *O. simia* Lam., *O. tridentata* Scop., *Paeonia peregrina* Mill., *Polygonatum odoratum* (Mill.) Druce, *Primula veris* L., *Ruscus aculeatus* L., *Salix caprea* L., *Scilla bifolia* L.

In the Order on special arrangements for conservation and use of medicinal plants from 2014 are included 16 species. Gathering herbs from natural habitats is prohibited for 10 species: *Angelica pancicii* Vandas ex Velen., *Asarum europaeum* L., *Asplenium trichomanes* L., *Inula helenium* L., *Orchis morio* L., *O. purpurea* Huds., *O. simia* L., *O. tridentata* Scop., *Ruscus aculeatus* L.,

Valeriana officinalis L. Under restricted collection of herbs from their natural habitats are 6 species: *Betonica officinalis* L., *Carlina acanthifolia* All., *Galium odoratum* (L.) Scop., *Paeonia peregrina* Mill., *Primula veris* L., *Sedum acre* L. That order does not reflect the conservation status of the species under question, so they are not included in the list at the beginning of this article. However, we believe that these types deserve to be mentioned for the purpose of their conservation.

The number of species of conservation status among the medicinal plants within Frangensko Plateau is relatively similar, 34 species (9.39%) [37].

The presence of antropophytes among medicinal plants on Tarnovski Heights is considerable – 290 species (65.32%). It is a result of human activities in the past and especially nowadays.

4. Conclusions

We have established a large number of medicinal plants at Tarnovski Heights – little more than half of medicinal plants in Bulgaria. This considerable biodiversity is characteristic for areas with karst topography in Bulgaria. Received results are comparable to the results obtained in a survey of Frangensko Plateau that is a karst plateau with approximately the same area as the Tarnovski Heights and is located in the eastern part of Danubian Plain.

Appendix

Systematic list of medicinal plants, established in Tarnovski Heights (Northern Bulgaria)

Equisetophyta

Equisetaceae: *Equisetum telmateia* Ehrh.

Polypodiophyta

Aspidiaceae: *Dryopteris filix-mas* (L.) Schott;

Aspleniaceae: *Asplenium adiantum-nigrum* L., *A. rutamuraria* L., *A. trichomanes* L., *Ceterach officinarum* DC.;

Hypolepidaceae: *Pteridium aquilinum* (L.) Kuhn;

Polypodiaceae: *Polypodium vulgare* L.

Magnoliophyta

Pinopsida

Cupressaceae: *Juniperus communis* L.

Magnoliopsida

Acanthaceae: *Acanthus balcanicus* Heywood & I. Richardson; **Amaranthaceae:** *Amaranthus paniculatus* L., *A. retroflexus* L., *Beta vulgaris* L., *Chenopodium album* L., *C. hybridum* L., *C. polyspermum* L., *C. vulvaria* L.; **Anacardiaceae:** *Cotinus coggygria* Scop.; **Apiaceae:** *Aegopodium podagraria* L., *Aethusa cynapium* L., *Angelica panicicii* Vandas ex Velen., *A. sylvestris* L., *Anthriscus cerefolium* Hoffm., *Bifora radians* M.Bieb., *Chaerophyllum bulbosum* L., *C. temulentum* L., *Conium*

maculatum L., *Daucus carota* L., *Eryngium campestre* L., *Ferulago sylvatica* (Besser) Rchb., *Foeniculum vulgare* Mill., *Heracleum sibiricum* L., *Laser trilobum* (L.) Borkh., *Pastinaca sativa* L., *Peucedanum officinale* L., *Pimpinella saxifraga* L., *Sanicula europaea* L., *Scandix pecten-veneris* L., *Seseli rigidum* Waldst. & Kit., *S. tortuosum* L., *Tordylium maximum* L., *Torilis arvensis* (Huds.) Link; **Apocynaceae:** *Vinca herbacea* Waldst. & Kit., *V. minor* L., *Vincetoxicum hirundinaria* Medik.; **Araliaceae:** *Hedera helix* L.; **Aristolochiaceae:** *Aristolochia clematitis* L., *Asarum europaeum* L.; **Asteraceae:** *Achillea clypeolata* Sm., *A. millefolium* L., *Arctium lappa* L., *A. minus* Bernh., *A. tomentosum* Mill., *Artemisia absinthium* L., *A. annua* L., *A. vulgaris* L., *Bellis perennis* L., *Bidens tripartita* L., *Carduus acanthoides* L., *Carlina acanthifolia* All., *C. vulgaris* L., *Carthamus lanatus* L., *Centaurea calcitrapa* L., *C. cyanus* L., *C. diffusa* Lam., *C. rocheliana* (Heuff.) Dostál, *C. solstitialis* L., *Cichorium intybus* L., *Cirsium arvense* (L.) Scop., *C. vulgare* (Savi) Ten., *Cota tinctoria* (L.) J.Gay., *Echinops sphaerocephalus* L., *Erigeron canadensis* L., *Eupatorium cannabinum* L., *Filago lutescens* Jord., *Galinsoga parviflora* Cav., *Hieracium pilosella* L., *Hypochoeris maculata* L., *Inula aschersoniana* Janka, *I. britannica* L., *I. ensifolia* L., *I. germanica* L., *I. helenium* L., *Jacobaea vulgaris* Gaertn., *Lactuca serriola* L., *Leucanthemum vulgare* Lam., *Matricaria chamomilla* L., *Onopordum acanthium* L., *Petasites hybridus* (L.) G.Gaertn., B.Mey. & Scherb., *Pulicaria dysenterica* (L.) Bernh., *Scorzonera hispanica* L., *Senecio vulgaris* L., *Solidago gigantea* Aiton, *Tanacetum vulgare* L., *Taraxacum officinale* F.H.Wigg., *Tragopogon pratensis* L., *Tripleurospermum tenuifolium* Freyn ex Freyn & E.Brandis, *Tussilago farfara* L., *Xanthium spinosum* L., *X. strumarium* L., *Xeranthemum annuum* L.; **Betulaceae:** *Betula pendula* Roth, *Carpinus betulus* L., *Corylus avellana* L., *C. colurna* L.; **Boraginaceae:** *Anchusa officinalis* L., *Buglossoides arvensis* (L.) I.M.Johnst., *B. purpureo-caerulea* (L.) I.M.Johnst., *Cerinth minor* L., *Echium italicum* L., *E. vulgare* L., *Heliotropium europaeum* L., *Myosotis arvensis* (L.) Hill, *Pulmonaria mollis* Ten., *P. officinalis* L.; **Brassicaceae:** *Alliaria petiolata* (M.Bieb.) Cavara & Grande, *Alyssum alyssoides* (L.) L., *Armoracia rusticana* G.Gaertn., B.Mey. & Scherb., *Barbarea vulgaris* W.T.Aiton, *Capsella bursa-pastoris* (L.) Medik., *Cardamine bulbifera* Crantz, *Cardaria draba* (L.) Desv., *Descurainia sophia* (L.) Webb. ex Prantl, *Erysimum crepidifolium* Rchb., *E. diffusum* Ehrh., *Lepidium campestre* (L.) W.T.Aiton, *Nasturtium officinale* R.Br., *Rorippa austriaca* Spach, *R. sylvestris* (L.) Besser, *Sisymbrium loeselii* L., *S. officinale* (L.) Scop., *Thlaspi alliaceum* L., *T. arvense* L.; **Campanulaceae:** *Campanula persicifolia* L.; **Cannabaceae:** *Cannabis sativa* L., *Humulus lupulus* L.;

Caprifoliaceae: *Dipsacus fullonum* L., *D. laciniatus* L., *Sambucus ebulus* L., *S. nigra* L., *Scabiosa ochroleuca* L., *Valeriana officinalis* L., *Viburnum opulus* L.; **Caryophyllaceae:** *Herniaria glabra* L., *H. hirsuta* L., *Lychnis coronaria* (L.) Desr., *L. flos-cuculi* L., *Minuartia setacea* (Thuill.) Hayek, *Saponaria officinalis* L., *Silene otites* (L.) Wibel, *Stellaria graminea* L., *S. media* (L.) Vill., *Viscaria vulgaris* Roehl.; **Celastraceae:** *Euonymus europaeus* L., *E. verrucosus* Scop., *Parnassia palustris* L.; **Convolvulaceae:** *Calystegia sepium* (L.) R.Br., *Convolvulus arvensis* L., *Cuscuta europaea* L.; **Cornaceae:** *Cornus mas* L.; **Crassulaceae:** *Sedum acre* L., *S. album* L., *S. maximum* Suter; **Dioscoreaceae:** *Tamus communis* L.; **Elaeagnaceae:** *Elaeagnus angustifolia* L.; **Euphorbiaceae:** *Euphorbia amygdaloides* L., *E. cyparissias* L., *E. myrsinites* L., *E. peplus* L., *Mercurialis perennis* L.; **Fabaceae:** *Amorpha fruticosa* L., *Anthyllis vulneraria* L., *Astragalus glycyphylloides* DC., *A. glycyphyllos* L., *Bituminaria bituminosa* (L.) C.H.Stirt., *Cercis siliquastrum* L., *Chamaecytisus albus* (Hacq.) Rothm., *C. hirsutus* Link, *Colutea arborescens* L., *Coronilla scorpioides* W.D.J.Koch, *C. varia* L., *Galega officinalis* L., *Genista ovata* Waldst. & Kit., *G. tinctoria* L., *Gleditsia triacanthos* L., *Lathyrus niger* (L.) Bernh., *L. pratensis* L., *L. sylvestris* L., *L. tuberosus* L., *L. vernus* (L.) Bernh., *Lotus corniculatus* L., *Medicago sativa* L., *Melilotus alba* Medik., *M. officinalis* Pall., *Ononis arvensis* L., *O. spinosa* L., *Robinia pseudoacacia* L., *Trifolium alpestre* L., *T. arvense* L., *T. pannonicum* Jacq., *T. pratense* L., *T. repens* L., *Vicia cracca* L., *V. grandiflora* Scop., *V. pisiformis* L., *V. sativa* L.; **Fagaceae:** *Quercus dalechampii* Ten., *Q. frainetto* Ten., *Q. robur* L.; **Gentianaceae:** *Centaurium erythraea* Rafn, *C. pulchellum* (Sw.) Druce; **Geraniaceae:** *Erodium cicutarium* (L.) L'Hér., *Geranium dissectum* L., *G. pyrenaicum* Burm.f., *G. robertianum* L., *G. sanguineum* L.; **Haloragaceae:** *Myriophyllum spicatum* L.; **Hypericaceae:** *Hypericum perforatum* L.; **Juglandaceae:** *Juglans regia* L.; **Lamiaceae:** *Acinos arvensis* (Lam.) Dandy, *Ajuga chamaepitys* (L.) Schreb., *A. laxmanii* (L.) Benth., *A. reptans* L., *Ballota nigra* L., *Betonica officinalis* L., *Calamintha nepeta* (L.) Savi, *C. sylvatica* Bromf., *Clinopodium vulgare* L., *Galeopsis speciosa* Mill., *Glechoma hederacea* L., *G. hirsuta* Waldst. & Kit., *Lamium maculatum* L., *L. purpureum* L., *Leonurus cardiaca* L., *Lycopus europaeus* L., *Marrubium peregrinum* L., *M. vulgare* L., *Melissa officinalis* L., *Melittis melissophyllum* L., *Mentha aquatica* L., *M. arvensis* L., *M. longifolia* (L.) Huds., *M. pulegium* L., *M. spicata* L., *Nepeta cataria* L., *Origanum vulgare* L., *Prunella vulgaris* L., *Salvia glutinosa* L., *S. nemorosa* L., *S. sclarea* L., *S. verticillata* L., *Scutellaria altissima* L., *Sideritis montana* L., *Stachys annua* L., *S. germanica* L., *S. recta* L., *S. sylvatica* L., *Teucrium chamaedrys* L., *T.*

polium L., *Thymus callieri* Halácsy ex Litv., *T. pulegioides* L.; **Loranthaceae:** *Viscum album* L.; **Lythraceae:** *Lythrum salicaria* L., *L. virgatum* L.; **Malvaceae:** *Alcea pallida* (Waldst. & Kit. ex Willd.) Waldst. & Kit., *A. rosea* L., *Lavatera thuringiaca* L., *Malva pusilla* Sm., *M. sylvestris* L., *Tilia cordata* Mill., *T. platyphyllos* Scop., *T. tomentosa* Moench; **Moraceae:** *Morus alba* L., *M. nigra* L.; **Oleaceae:** *Fraxinus excelsior* L., *F. ornus* L., *F. oxycarpa* Willd., *F. pallisiae* Wilmott, *Ligustrum vulgare* L., *Syringa vulgaris* L.; **Onagraceae:** *Epilobium parviflorum* Schreb.; **Paoniaceae:** *Paonia peregrina* Mill.; **Orobanchaceae:** *Orobanche minor* Sm.; **Papaveraceae:** *Chelidonium majus* L., *Fumaria officinalis* L., *Papaver rhoeas* L.; **Phytolaccaceae:** *Phytolacca americana* L.; **Plantaginaceae:** *Globularia aphyllanthes* Crantz, *Plantago lanceolata* L., *P. major* L., *P. media* L.; **Plumbaginaceae:** *Plumbago europaea* L.; **Polygalaceae:** *Polygala major* Jacq.; **Polygonaceae:** *Bilderdykia dumetorum* (L.) Dumort., *Persicaria amphibia* (L.) Gray, *P. hydropiper* (L.) Spach, *P. lapathifolia* (L.) Gray, *P. maculata* (Sibth.) Gray, *P. mitis* (Schrank) Assenov, *Polygonum aviculare* L., *Rumex acetosa* L., *R. acetosella* L., *R. aquaticus* L., *R. crispus* L., *R. obtusifolius* L., *R. patientia* L., *R. pulcher* L.; **Portulacaceae:** *Portulaca oleracea* L.; **Primulaceae:** *Anagallis arvensis* L., *Cyclamen hederifolium* Aiton, *Lysimachia nummularia* L., *Primula veris* L.; **Ranunculaceae:** *Anemone ranunculoides* L., *A. sylvestris* L., *Clematis vitalba* L., *Consolida regalis* Gray, *Helleborus odoratus* Waldst. & Kit. ex Willd., *Hepatica nobilis* Mill., *Isopyrum thalictroides* L., *Nigella arvensis* L., *N. damascena* L., *Ranunculus acris* L., *R. ficaria* L., *R. repens* L., *R. sceleratus* L., *Thalictrum aquilegifolium* L., *T. minus* L.; **Resedaceae:** *Reseda lutea* L.; **Rhamnaceae:** *Paliurus spina-christi* Mill.; **Rosaceae:** *Agrimonia eupatoria* L., *A. procera* Wallr., *Crataegus monogyna* Jacq., *C. pentagyna* Waldst. & Kit. ex Willd., *Filipendula vulgaris* Moench, *Fragaria vesca* L., *Geum urbanum* L., *Malus sylvestris* Mill., *Potentilla argentea* L., *P. reptans* L., *Prunus avium* L., *P. cerasifera* Ehrh., *P. mahaleb* L., *P. spinosa* L., *Pyrus pyraeaster* Burgsd., *P. sativa* DC., *Rosa canina* L., *R. corymbifera* Borkh., *Rubus caesius* L., *R. hirtus* Waldst. & Kit., *Sanguisorba minor* Scop., *Sorbus aucuparia* L., *S. domestica* L., *S. torminalis* (L.) Crantz; **Rubiaceae:** *Cruciata glabra* (L.) Ehrend., *C. laevipes* Opiz, *Galium aparine* L., *G. odoratum* (L.) Scop., *G. verum* 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. purpurea* L.; **Sapindaceae:** *Acer campestre* L., *A. negundo* L., *A. platanoides* L., *A. pseudoplatanus* L., *A. tataricum* L.; **Scrophulariaceae:** *Digitalis ferruginea* L., *D. lanata* Ehrh., *Kickxia elatine* (L.) Dumort., *Linaria vulgaris* Mill., *Pseudolysimachion orchideum* (Crantz) Wraber,

Scrophularia canina L., *S. nodosa* L., *S. umbrosa* Dumort., *Verbascum nigrum* L., *V. phlomoides* L., *V. phoeniceum* L., *Veronica anagalis-aquatica* L., *V. arvensis* L., *V. austriaca* L., *V. beccabunga* L., *V. chamaedrys* L., *V. officinalis* L.; **Simaroubaceae:** *Ailanthus altissima* (Mill.) Swingle; **Solanaceae:** *Datura stramonium* L., *Lycium barbarum* L., *Physalis alkekengi* L., *Solanum dulcamara* L., *S. nigrum* L.; **Staphyleaceae:** *Staphylea pinnata* L.; **Ulmaceae:** *Ulmus glabra* Huds., *U. minor* Mill.; **Urticaceae:** *Parietaria lusitanica* L., *P. officinalis* L., *Urtica dioica* L., *U. urens* L.; **Verbenaceae:** *Verbena officinalis* L.; **Violaceae:** *Viola odorata* L., *V. tricolor* L.; **Zygophyllaceae:** *Tribulus terrestris* L.

Liliopsida

Alismataceae: *Alisma plantago-aquatica* L.; **Amaryllidaceae:** *Allium rotundum* L., *A. scorodoprasum* L., *Galanthus elwesii* Hook.f., *G. nivalis* L.; **Araceae:** *Arum maculatum* L., *Lemna minor* L.; **Asparagaceae:** *Polygonatum multiflorum* (L.) All., *P. odoratum* (Mill.) Druce, *Ruscus aculeatus* L., *Scilla bifolia* L.; **Butomaceae:** *Butomus umbellatus* L.; **Hydrocharitaceae:** *Najas marina* L.; **Iridaceae:** *Crocus pallasii* Goldb., *Gladiolus communis* L., *Iris graminea* L., *I. pumila* L.; **Juncaceae:** *Juncus inflexus* L.; **Liliaceae:** *Lilium martagon* L.; **Orchidaceae:** *Anacamptis pyramidalis* (L.) Rich., *Gymnadenia conopsea* (L.) R.Br., *Himantoglossum caprinum* Spreng., *Ophrys cornuta* Steven ex M.Bieb., *Orchis morio* L., *O. purpurea* Huds., *O. simia* Lam., *O. tridentata* Scop., *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.; **Typhaceae:** *Sparganium erectum* L., *Typha angustifolia* L., *T. latifolia* L.

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