

Floristic analysis of the central part of Mt Shipka (Central Balkan, Bulgaria)

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Abstract. The object of investigation is the region of peak Malusha, Kozyata Reka river and the adjacent territories. The studied area is located in the main watershed ridge of the Shipka divide of Central Balkan Range. Identified are 621 species of vascular plants belonging to 355 genera and 88 families. A description of the floristic composition is made. Attached is the so far compiled list of the identified plant species. A table is offered with the important plant species that occur within the mountain massif. Identified are 23 plant species with international protection status, subject to conservation in the Protected Zone Balgarka BG0000399 and Protected Zone Central Balkan - buffer BG0001493.

Key words: Balgarka Natural Park, Central Balkan, flora, peak Malusha, protected plants

Introduction

Peak Malusha is situated on the main watershed ridge of the Balkan Range, in the central part of the Shipka divide of Central Balkan Range (Fig. 1). To the south lies the Kazanlak Valley and Sheinovo village. Westwards of the peak is Uzana locality and to the east is situated the historical peak Shipka. The area is part of the Protected Zone Balgarka BG0000399 and the Protected Zone Central Balkan - buffer BG0001493, which fall into the European Ecological Network NATURA 2000. The total area of the research site is about 200 ha, including the treeless zone at the very top that covers 37.73 ha.

Vertical amplitude of the study area is about 650 m (between 700 and 1341 m a.s.l.). River Golyama Varovita and Shadravanite locality form the western



Fig. 1. General view of the treeless zone of peak Malusha.

boundary of the area. To the east are the springs of river Kozyata Reka. The north and the south positions dominate in the area. The terrain is uneven, with rocky outcrops. The inclination generally ranges between 25° and 40°, only the ridge parts are more moderate. The study area is formed mainly of Middle Triassic limestone. Soils are predominantly brown, only occasionally humus-carbonate, often quite shallow and stony. In many places there are rocky outcrops. The highest part of the territory is peak Malusha (1341.1 m). There is no specified information about the climate in the research area.

Some more comprehensive floristic studies of the area have been conducted by the Neichev (1909), who reported 141 species of vascular plants, belonging to 45 families.

Material and methods

The basic theoretical and methodological approaches adopted in modern assessments of plant diversity for scientific and conservation purposes were used for elucidating the botanical characteristics of the region. A floristic survey was conducted in the period 2004–2014. The field studies were carried out intermittently across ten growing seasons, with the earlier visits in late February and the latest at the end of October, which permitted to cover biodiversity and its seasonal dynamics.

In the inventory of floristic composition, the route method with transect transitions was used. Transects were selected to cover a maximum area of the region and areas that are representative of habitat diversity.

Nomenclature of species composition was according to Delipavlov & Cheshmedjiev (2003). Floristic elements followed Assyov & Petrova (2012). Localization and characterization of taxa populations with conservation status was carried out parallel to the route research.

Results and discussion

During the ten-year study of the investigated area, 88 families, 355 genera and 621 species of vascular plants were identified. The floristic wealth (Petrova & al. 2005) included 55.3% of the plant families, 39% of the genera and 15.5% of the species in Bulgaria.

Largest was the share of angiosperms (*Magnoliophyta*): 93.1% of the families, 95.8% of the genera and 96.3% of the species so far identified within the array. Dicots accounted for 487 species and monocots for 111 species. Gymnosperms (*Pinophyta*) comprised five species of four genera and three families. Ferns (*Polypodiophyta*) were represented by 16 species, 10 genera and five families and Horsetails (*Equisetophyta*) comprised two species of one genus and one family. Club mosses (*Lycopodiophyta*) have not been identified during the earlier field studies (Appendix 1).

Most species-rich families were: *Asteraceae* 80, *Poaceae* 52, *Rosaceae* 40, *Caryophyllaceae* 35, *Lamiaceae* 34, *Fabaceae* 33, *Apiaceae* 31, *Brassicaceae* 30, *Scrophulariaceae* 26, *Orchidaceae* 21, *Ranunculaceae* 16, *Liliaceae* 13, *Boraginaceae* 13, and *Campnulaceae* 9.

Seventy species of trees and shrubs (23 tree, 17 tree/shrub and 30 shrub species) and 551 species of herbaceous plants have been identified in the territory. The greatest participation in grasses claimed the perennial species: 415, 51 annual, 26 biennial and 59 species of transitional biological groups (24 species of one-two year, nine species of one to many years, 23 species of two to many years, and three shrub species). Distribution of species by biological type has generally shown signs of the mountain floras of the temperate zone of the Northern Hemisphere, with a relatively large number of perennial species.

Biological spectrum of the research area was characterized by close in value percentages of cryptophytes (9%), phanerophytes (12%), chamaephytes (17%), terrophytes (21%), and a significant preponderance of hemicryptophytes (41%) (Table 1). This reflected better the climate of the research area – a mountain version of the temperate continental climate. As compared to the normal biological spectrum (Gorishina 1979), the study area was characterized by strong preponderance of hemicryptophytes and a significantly smaller share of phanerophytes (about 3.5 times). Biological range of the investigated flora has shown a variety of forest and grassland communities in the mountain area with a temperate continental climate,

Table 1. Biological spectrum of peak Malusha, river Kozyata Reka area and adjacent territories.

Region	Ph, %	Ch, %	H, %	Cr, %	Th, %
Peak Malusha, Kozyata Reka area	12	17	41	9	21
Bulgaria		12	55	6	27
Normal biological range	46	9	26	6	13

confirmed by the share of therophytes and hamephytes. The percentage of life forms did not deviate from the typical one for Bulgaria (Pachedjieva 2012).

Analysis of the floristic elements gives an idea of the phytogeographic characteristics of the investigated flora. The identified higher plants in the investigated territory belong to eight main groups of floristic elements. As the region of peak Malusha and river Kozyata Reka is situated centrally to Bulgaria and consequently to the Balkan Peninsula, the flora is characterized by a wide variety of floristic elements. Euro-Asian species predominate, including Euro-Central and West Asian (95), sub-Mediterranean (83), Euro-Mediterranean (70), European (63), Euro-Siberian (53), sub-Boreal (45), Boreal (43) and Cosmopolitan (22) groups of floristic elements. The following groups of floristic elements are presented by 10–20 species: Pontic-Mediterranean (16), Euro-sub-Mediterranean (15), and Mediterranean, including East Mediterranean (14). The remaining groups of floristic elements are represented with a relatively small number of taxa, such as the Balkan-Anatolian (9), Pontic, including South-Pontic (9), Carpathian-Balkan (7), Euro-Oriental-Turanian (7), Pontic-sub-Mediterranean (5), Alpine-Carpathian-Balkan (5), Arctic-Alpine (2), Alpine-Mediterranean (4), Alpine-Carpathian (4), Apennine-Balkan (4), Balkan-Dacian (2), Mediterranean-Asian (2), Mediterranean-Oriental-Turanian (3), Pontic-Central Asian (2), sub-Mediterranean-Central Asian (2), Euro-Mediterranean - Central Asiatic (2), and South-Siberian (2). The remaining groups of floristic elements are presented by one species: Alpine-Balkan-Apennine, Panonic-Balkan, Pontic-Asian, Alpine-Balkan, Pontic-Balkan, Pontic-Panbalkan, Pontic-Siberian, sub-Mediterranean-Anatolian, sub-Mediterranean-Siberian, Euro-North American, Euxinous, Balkan-Aegean and sub-Balkan (*Sempervivum erythraeum*).

Close proximity of the Triglav Massif and Mt Ispolin (1524.4) is a fundamental prerequisite for good representation of the species in the group of Alpine floristic elements. Arctic-alpine floristic elements are represented by the species *Nardus stricta* and *Antennaria dioica*; Alpine-Carpathian-Balkan floristic elements by *Hieracium alpicola*, *Homogyne alpina*, *Knautia drymeia*, *Rumex alpinus*, and *Sorbus mougeotii*; Alpine-Carpathian by the species *Stachys alpina*, *Acinos alpinus*, *Alchemilla flabellata*, and *Scabiosa luci-*

da; Alpine-Balkan by the species *Koeleria eriostachya*; Alpine-Balkan-Apennine by *Hieracium villosum*; Apennine-Balkan by *Campanula lingulata*, *Linum capitatum*, *Orlaya grandifolia*, and *Verbascum lychnitis*; Alpine-Mediterranean by *Chenopodium bonus-henricus*, *Verbascum lanatum*, *Helianthemum nummularium*, and *Anthyllis montana*.

Forty-five rare and endangered plant species of conservation importance and protected by the Bulgarian and European legislation (Table 2) were identified in the investigated area. One plant species (*Haberlea rhodopensis*) is included in Annex 1 of the Bern Convention (1979); 22 species are listed in Appendix II of CITES (1975): *Cephalanthera damasonium*, *C. longifolia*, *C. rubra*, *Dactylorhiza saccifera*, *D. sambucina*, *Epipactis atrorubens*, *E. exilis*, *E. helleborine*, *E. microphylla*, *E. purpurata*, *Epipogium aphyllum*, *Galanthus elwesii*, *Gymnadenia conopsea*, *Listera ovata*, *Neottia nidus-avis*, *Orchis mascula*, *O. militaris*, *O. pallens*, *O. pinetorum*, *O. ustulata*, *Platanthera bifolia*, *P. chlorantha*; 13 species are included in the Biological Diversity Act of Bulgaria (2002) and its Amendments and Supplements (2007): *Arabis nova*, *Cynoglossum germanicum*, *Galanthus elwesii*, *Geranium palustre*, *Haberlea rhodopensis*, *Lilium albanicum*, *Micromeria frivaldszkyana*, *Orchis militaris*, *Paeonia mascula*, *Rhynchocorys elephas*, *Seseli bulgaricum*, *Taxus baccata*, *Trinia glauca*.

Twenty-nine species of plants are included in the Red List of the Bulgarian Vascular Plants (Petrova & Vladimirov 2009): *Angelica pancicii*, *Arabis nova*, *Atropa bella-donna*, *Betonica bulgarica*, *Carum graecum*, *Cynoglossum germanicum*, *Draba lasiocarpa*, *Epipactis exilis*, *E. microphylla*, *E. purpurata*, *Epipogium aphyllum*, *Festuca balcanica*, *Galanthus elwesii*, *Geranium palustre*, *Haberlea rhodopensis*, *Hieracium villosum*, *Jovibarba heuffelii*, *Laserpitium siler*, *Lilium albanicum*, *Micromeria frivaldszkyana*, *Orchis militaris*, *O. ustulata*, *Paeonia mascula*, *Rhynchocorys elephas*, *Sempervivum erythraeum*, *Seseli bulgaricum*, *Silene nutans*, *Sison amomum*, and *Taxus baccata*.

Eleven species are included in the Red Data Book of the Republic of Bulgaria (Peev & al. 2015). Two species are assigned to the Critically Endangered (CR) category (*Lilium albanicum*, *Seseli bulgaricum*) and nine species to the Endangered (EN) category (*Betonica bulgarica*, *Cynoglossum germanicum*, *Epipactis purpurata*, *Galanthus elwesii*, *Hieracium villosum*, *Micromeria frivaldszkyana*, *Orchis militaris*, *Paeonia mascula*, *Taxus baccata*).

The Central Balkan Range is one of the powerful speciation centres in the flora of the Balkan Peninsula. The field studies confirmed the presence of 13 Balkan endemics: *Achillea clypeolata*, *Angelica panicicii*, *Carum graecum*, *Centaurea napulifera*, *Cephalaria flava*, *Crocus veluchensis*, *Dianthus noeanus*, *Haberlea rhodopensis*, *Lilium albanicum*, *Pastinaca hirsuta*, *Scabiosa triniifolia*, *Sesleria latifolia*, and *Viola aetolica*.

There are four species and three subspecies of identified Bulgarian endemics, including three species and two subspecies local* for the Central Balkan Range: *Betonica bulgarica**, *Festuca balcanica*, *Micromeria frivaldszkyana**, *Seseli bulgaricum**. The endemic subspecies are *Festuca balcanica* subsp. *neicevii**, *Jurinea consanguinea* subsp. *neicevii* and *Veronica austriaca* subsp. *neiceffii**.

Our study has confirmed the occurrence of *Cynoglossum germanicum* in Bulgaria (Fig. 2). On the territory of the country this species was found in July

1899 and referred to the Shipka divide of the Central Balkan Range in the Malusha locality, Gabrovo (Neichev 1909; Herb. Specimen SOM 58993). Evs-tatieva (1984) referred this species to the *Extinct* category. The species was found again in 2006 by Marinov (2009) in the PA Sokolovo Monastery Forest: SOA 059276, 059277, SOM 163833, 164406. The species got a new status of *Endangered* (EN) on the territory of Bulgaria (Genova 2009, 2015). This study demonstrated the presence of the species in its original habitat on peak Malusha.

The species *Seseli bulgaricum* (Fig. 3) known for the southern slopes of Kaloferski share of Central Stara Planina Mountain (Peev 1982) is reported for Shipka Mountain. (Herb. Specimen SOM 171250).

The species *Lilium albanicum* reported by Neichev (1909) for the Triglav Massif and peak Ispolin (SOM 12448, 12451) was found during our field study on peak Malusha. According to the chorological data, the species was not mentioned for the floristic region

Table 2. Rare and endangered plant species of conservation importance.

No.	Species	Bern Convention (1979)	Peev & al. (2015)	BDA (2002)	CITES (1975)	Petrova & Vladimirov (2009)
1	2	3	4	5	6	7
1	<i>Angelica panicicii</i>					VU
2	<i>Arabis nova</i>			Annex III		VU
3	<i>Atropa bella - donna</i>					VU
4	<i>Betonica bulgarica</i>		EN			EN
5	<i>Carum graecum</i>					NT
6	<i>Cephalanthera damasonium</i>					+
7	<i>Cephalanthera rubra</i>					+
8	<i>Cephalanthera longifolia</i>					+
9	<i>Cynoglossum germanicum</i>		EN	Annex III		EN
10	<i>Dactylorhiza saccifera</i>					+
11	<i>Dactylorhiza sambucina</i>					+
12	<i>Draba lasiocarpa</i>					LC
13	<i>Epipactis atrorubens</i>					+
14	<i>Epipactis exilis</i>					+
15	<i>Epipactis helleborine</i>					+
16	<i>Epipactis microphylla</i>					+
17	<i>Epipactis purpurata</i>		EN			+
18	<i>Epipogium aphyllum</i>					+
19	<i>Festuca balcanica</i>					NT
20	<i>Galanthus elwesii</i>					EN
21	<i>Geranium palustre</i>					Annex III
22	<i>Gymnadenia conopsea</i>					+
23	<i>Haberlea rhodopensis</i>					R
24	<i>Hieracium villosum</i>					EN
25	<i>Jovibarba heuffelii</i>					
26	<i>Laserpitium siler</i>					LC
27	<i>Lilium albanicum</i>					CR
28	<i>Listera ovata</i>					+
29	<i>Micromeria frivaldszkyana</i>					EN
30	<i>Neottia nidus-avis</i>					+
31	<i>Orchis mascula</i>					+
32	<i>Orchis militaris</i>					EN
33	<i>Orchis pallens</i>					+
34	<i>Orchis pinetorum</i>					+
35	<i>Orchis ustulata</i>					+
36	<i>Paeonia mascula</i>					EN
37	<i>Platanthera bifolia</i>					+
38	<i>Platanthera chlorantha</i>					+
39	<i>Rhynchocorys elephas</i>					Annex III
40	<i>Sempervivum erythraeum</i>					LC
41	<i>Seseli bulgaricum</i>					CR
42	<i>Silene nutans</i>					VU
43	<i>Sison amomum</i>					VU
44	<i>Taxus baccata</i>					EN
45	<i>Trinia glauca</i>					Annex III



Fig. 2. *Cynoglossum germanicum*.



Fig. 3. *Seseli bulgaricum*.



Fig. 4. *Lilium albanicum*.

of the Central Balkan Range. The specimens found were about 50 cm high, with leaves seldom with leaning pappuses (which brings the plants close to *Lilium jankae*). Flowers were on the top, single or 2–3 in a sparse raceme. Perigon petals were golden-yellow, without blots (characteristics bringing our specimens closer to *Lilium albanicum*). The species *Geranium palustre* reported by Neichev (1909) for the area was not confirmed in this floristic study.

Appendix 1. List of vascular plants found on peak Malusha, river Kozyata Reka area and the adjacent territories (PZ Balgarka BG0000399 and PZ Central Balkan – buffer zone BG0001493).

Equisetaceae

1. *Equisetum* L.
- E. arvense* L.
- E. telmateia* Ehrh.

Aspidiaceae

2. *Dryopteris* Adans.
- D. carthusiana* (Vill.) H.P. Fuchs
- D. dilatata* (Hoffm.) A. Gray
- D. filix-mas* (L.) Schott
3. *Polystichum* Roth
- P. aculeatum* (L.) Roth
- P. setiferum* (Forssk.) Woyn.

Aspleniaceae

4. *Asplenium* L.
- A. adiantum-nigrum* L.
- A. ruta muraria* L.
- A. trichomanes* L.
- A. viride* Huds.
5. *Ceterach* DC
- C. officinarum* L.
6. *Phyllitis* Hill
- Ph. scolopendrium* (L.) Newman

Athyriaceae

7. *Athyrium* Roth
- A. filix-femina* (L.) Roth
8. *Cystopteris* Bernh.
- C. fragilis* (L.) Bernh.

Hypolepidaceae

9. *Pteridium* Gled. ex Scop.
- P. aquilinum* (L.) Kuhn

Ophioglossaceae

10. *Botrychium* Sw.
- B. lunaria* (L.) Sw.

Polypodiaceae

11. *Polypodium* L.
- P. vulgare* L.

Cupressaceae

12. *Juniperus* L.
- J. communis* L.

Pinaceae

13. *Abies* Miller
- A. alba* Miller
14. *Pinus* L.
- P. nigra* Arnold
- P. sylvestris* L.

Taxaceae

15. *Taxus* L.
- T. baccata* L.

Aceraceae

16. *Acer* L.
- A. campestre* L.
- A. hyrcanum* Fischer & C.A. Mey.

- A. platanoides* L.
A. pseudoplatanus L.
- Amaranthaceae**
 17. *Amaranthus* L.
A. retroflexus L.
- Anacardiaceae**
 18. *Cotinus* Adanson
C. coggygria Scop.
- Apiaceae**
 19. *Aegopodium* L.
A. podagraria L.
 20. *Angelica* L.
A. panicii Vandas
A. sylvestris L.
 21. *Anthriscus* Pers.
A. sylvestris (L.) Hoffm.
 22. *Bupleurum* L.
B. commutatum Boiss. & Balansa
B. falcatum L.
B. sibthorpiianum Sm.
 23. *Carum* L.
C. carvi L.
C. graecum Boiss. et Heldr.
 24. *Caucalis* L.
C. platycarpus L.
 25. *Chaerophyllum* L.
Ch. aureum L.
Ch. bulbosum L.
Ch. byzantinum Boiss.
Ch. temulentum L.
 26. *Daucus* L.
D. carota L.
 27. *Eryngium* L.
E. campestre L.
 28. *Heracleum* L.
H. sibiricum L.
H. ternatum Velen.
 29. *Laserpitium* L.
L. latifolium L.
L. siler L.
 30. *Orlaya* Hoffm.
O. grandiflora (L.) Hoffm.
 31. *Pastinaca* L.
P. hirsuta Pančić
 32. *Peucedanum* L.
P. carvifolia Vill.
33. *Pimpinella* L.
P. tragium Vill.
 34. *Sanicula* L.
S. europaea L.
 35. *Seseli* L.
S. bulgaricum P. W. Ball
S. libanotis (L.) Koch
S. peucedanoides (M. Bieb.)
 Kos.-Pol.
 36. *Sison* L.
S. amomum L.
 37. *Torilis* Adanson
T. japonica (Houtt.) DC.
 38. *Trinia* Hoffm.
T. glauca (L.) Dumort.
- Araliaceae**
 39. *Hedera* L.
H. helix L.
- Aristolochiaceae**
 40. *Asarum* L.
A. europaeum L.
- Asclepiadaceae**
 41. *Vincetoxicum* N.M. Wolf
V. hirundinaria Medicus
- Asteraceae**
 42. *Achillea* L.
A. clypeolata Sm.
A. grandifolia Friv.
A. pannonica Scheele
 43. *Antennaria* Gaertner
A. dioica (L.) Gaertner
 44. *Anthemis* L.
A. tinctoria L.
 45. *Arctium* L.
A. lappa L.
A. nemorosum Lej.
A. tomentosum Miller
 46. *Artemisia* L.
A. absintium L.
A. vulgaris L.
 47. *Bellis* L.
B. perennis L.
 48. *Carduus* L.
C. kernerii Simonkai ssp. *austro-orientalis* Franco
C. nutans L.
C. personata (L.) Jacq.
C. thoermeri Weinm.
 49. *Carlina* L.
C. acanthifolia All.
C. vulgaris L.
 50. *Centaurea* L.
C. calvescens Pančić
C. jacea L.
C. napulifera Rochel
C. rhenana Boreau
C. splendens L.
C. triumfetti All.
 51. *Chondrilla* L.
Ch. juncea L.
 52. *Cichorium* L.
C. intybus L.
 53. *Cirsium* Miller
C. arvense (L.) Scop.
C. candelabrum Griseb.
C. ligulare Boiss.
 54. *Crepis* L.
C. biennis L.
C. conyzifolia (Gouan) A. Kerner
C. foetida L.
 55. *Crupina* (Pres.) Cass.
C. vulgaris Cass.
 56. *Doronicum* L.
D. columnae Ten.
 57. *Echinops* L.
E. ritro L.
 58. *Erigeron* L.
E. acer L.
 59. *Eupatorium* L.
E. cannabinum L.
 60. *Gnaphalium* L.
G. sylvaticum L.
 61. *Hieracium* L.
H. alpicola Gaudin
H. cymosum L.
H. gentile Boreau
H. hoppeanum Schultes
H. pannosum Boiss.
H. pilosella L.
H. racemosum Waldst. & Kit. ex Willd.
H. villosum Jacq.
 62. *Homogyne* Cass.
H. alpina (L.) Cass.
63. *Hypochoeris* L.
H. radicata L.
 64. *Inula* L.
I. aschersoniana Janka
I. coniza DC.
I. ensifolia L.
I. hirta L.
 65. *Jurinea* Cass.
J. consanguinea DC. subsp. *neicevii* Kožuharov
 66. *Lactuca* L.
L. aurea (Pančić) Stebbins = *Mulgedium sonchifolium*
L. quercina L.
 67. *Lapsana* L.
L. communis L.
 68. *Leontodon* L.
L. autumnalis L.
L. crispus Vill.
 69. *Leucanthemum* Mill.
L. vulgare Lam.
 70. *Matricaria* L.
M. trichophylla (Boiss.) Boiss.
 71. *Mycelis* Cass.
M. muralis (L.) Dumort.
 72. *Onopordum* L.
O. acanthium L.
 73. *Petasites* Miller
P. hybridus (L.) P. Gaertn., B. Mayer & Scherb.
 74. *Picris* L.
P. hieracioides L.
 75. *Prenanthes* L.
P. purpurea L.
 76. *Ptilostemon* Cass.
P. afer (Jacq.) W. Greuter
 77. *Pulicaria* Gaertner
P. dysenterica (L.) Bernh.
 78. *Scorzonera* L.
S. hispanica L.
 79. *Senecio* L.
S. nemorensis L.
S. rupestris Waldst. & Kit.
S. viscosus L.
 80. *Solidago* L.
S. virgaurea L.
 81. *Tanacetum* L.
T. macrophyllum (Waldst. & Kit.) Sch. Bip.

- T. parthenium* (L.) Sch. Bip.
T. vulgare L.
- 82. Taraxacum** Weber
T. palustre (Lyons) Symons
T. officinale Weber
T. serotinum (Waldst. & Kit.)
 Poirlet
- 83. Telekia** Baumg.
T. speciosa (Schreb.) Baumg.
- 84. Tragopogon** L.
T. pratensis L.
- 85. Tussilago** L.
T. farfara L.
- Balsaminaceae**
- 86. Impatiens** L.
I. noli-tangere L.
- Boraginaceae**
- 87. Anchusa** L.
A. barrelieri (All.) Vitman
- 88. Buglossoides** Moench
B. purpureo-caerulea (L.) I.M.
 Johnston
- 89. Cynoglossum** L.
C. germanicum Jacq.
C. hungaricum Simonk.
- 90. Echium** L.
E. vulgare L.
- 91. Heliotropium** L.
H. europaeum L.
- 92. Lappula** Gilib.
L. squarrosa (Retz.) Dumort.
- 93. Myosotis** L.
M. stricta Roem. & Schult.
M. sylvatica Hoffm.
- 94. Pulmonaria** L.
P. officinalis L.
P. rubra Schott
- 95. Symphytum** L.
S. ottomanum Friv.
S. tuberosum L. ssp. *nodosum*
 (Schur) Soó
- Brassicaceae**
- 96. Alliaria** Scop.
A. petiolata (M. Bieb.) Cavara
 & Grande
- 97. Alyssum** L.
A. alyssoides (L.) L.
- 98. Arabidopsis** (DC.) Heynh.
A. thaliana (L.) Heynh.
- 99. Arabis** L.
Arabis auriculata Lam.
A. hirsuta (L.) Scop.
A. nova Vill.
A. procurrens Waldst. & Kit.
A. sagittata (Bertol.) DC.
A. turrita L.
- 100. Barbarea** R. Br.
B. vulgaris R. Br.
- 101. Berteroa** DC.
B. incana (L.) DC.
- 102. Capsella** Medicus
C. bursa-pastoris (L.) Medicus
- 103. Cardamine** L.
C. flexuosa With.
C. hirsuta L.
C. impatiens L.
- 104. Dentaria** L.
D. bulbifera L.
- 105. Descurainia** Webb &
 Berth.
D. sophia (L.) Prantl
- 106. Draba** L.
D. aizoides L.
D. lasiocarpa Rochel
- 107. Erophila** DC.
E. verna (L.) Besser
- 108. Erysimum** L.
E. cuspidatum (M. Bieb.) DC.
E. diffusum Ehrh.
- 109. Hesperis** L.
H. matronalis L.
- 110. Iberis** L.
I. sempervirens L.
- 111. Lepidium** L.
L. campestre (L.) R. Br.
- 112. Lunaria** L.
L. rediviva L.
- 113. Rorippa** Scop.
R. pyrenaica (L.) Rchb.
- 114. Sisymbrium** L.
S. altissimum L.
- 115. Thlaspi** L.
T. praecox Wulfen
- 116. Turrritis** L.
T. glabra L.
- Callitrichaceae**
- 117. Callitriche** L.
B. cophocarpa Sendtner
- Campanulaceae**
- 118. Asyneuma** Griseb. &
 Schenk
A. canescens (Waldst. & Kit.)
 Griseb. & Schenk
- 119. Campanula** L.
C. glomerata L.
C. lingulata Waldst. & Kit.
C. patula L.
C. persicifolia L.
C. rapunculoides L.
C. sibirica L.
C. trachelium L.
- 120. Jasione** L.
J. heldreichii Boiss. & Orph.
- Cannabaceae**
- 121. Humulus** L.
H. lupulus L.
- Caprifoliaceae**
- 122. Lonicera** L.
L. xylosteum L.
- 123. Sambucus** L.
S. ebulus L.
S. nigra L.
- 124. Viburnum** L.
V. lantana L.
V. opulus L.
- Caryophyllaceae**
- 125. Agrostemma** L.
A. githago L.
- 126. Arenaria** L.
A. serpyllifolia L.
- 127. Cerastium** L.
C. arvense L.
C. banaticum (Rochel) Heuffel
C. tauricum Spreng.
- 128. Dianthus** L.
D. armeria L.
D. cruentus Griseb.
D. giganteus D'Urv.
D. noëanus Boiss.
- 129. Herniaria** L.
H. glabra L.
H. incana Lam.
- 130. Holosteum** L.
H. umbellatum L.
- 131. Lychnis** L.
L. coronaria (L.) Desr.
- 132. Minuartia** L.
M. caespitosa (Ehrh.) Degen
M. glomerata (M. Bieb.) Degen
M. verna (L.) Hiern
- 133. Moehringia** L.
M. muscosa L.
M. trinervia (L.) Clairv.
- 134. Myosoton** Moench
M. aquaticum (L.) Moench
- 135. Sagina** L.
S. procumbens L.
- 136. Saponaria** L.
S. officinalis L.
- 137. Scleranthus** L.
S. neglectus Rochel ex Baumg.
- 138. Silene** L.
S. armeria L.
S. flavescens Waldst. & Kit.
S. italica (L.) Pers.
S. nutans L.
S. viridiflora L.
S. vulgaris (Moench) Garcke
- 139. Spergula** L.
S. arvensis L.
- 140. Spergularia** (Pers.) J. & C.
 Presl
S. rubra (L.) J. & C. Presl
- 141. Stellaria** L.
S. graminea L.
S. holostea L.
S. media L.
S. nemorum L.
- 142. Viscaria** Röhring
V. vulgaris Röhring
- Celastraceae**
- 143. Euonymus** L.
E. latifolius (L.) Miller
E. verrucosus Scop.
- Chenopodiaceae**
- 144. Chenopodium** L.
Ch. bonus-henricus L.

Cistaceae

145. *Helianthemum* Spach
H. nummularium (L.) Miller
 146. *Rodax* Spach
R. canus (L.) Fuss

Convolvulaceae

147. *Calystegia* R. Br.
C. sepium (L.) R. Br.
C. sylvatica (Kit.) Griseb.
 148. *Convolvulus* L.
C. arvensis L.

Cornaceae

149. *Cornus* L.
C. mas L.
C. sanguinea L.

Corylaceae

150. *Carpinus* L.
C. betulus L.
 151. *Corylus* L.
C. avellana L.
 152. *Ostrya* Scop.
O. carpinifolia Scop.

Crassulaceae

153. *Jovibarba* Opiz
J. heuffelii (Schott) A. & D.
 Löve
 154. *Sedum* L.
S. acre L.
S. album L.
S. annuum L.
S. hispanicum L.
S. maximum (L.) Suter
S. ochroleucum Chaix
 155. *Sempervivum* L.
S. erythraeum Velen.

Cuscutaceae

156. *Cuscuta* L.
C. epithimum (L.) L.

Dipsacaceae

157. *Cephalaria* Schrader ex
 Roemer & Schultes
C. flava (Sibth. & Sm.) Szabó
 158. *Dipsacus* L.

- D. laciniatus* L.
D. pilosus L.
 159. *Knautia* L.
K. arvensis (L.) Coulter
K. drymeia Heuffel
 160. *Scabiosa* L.
S. columbaria L.
S. lucida Vill.
S. ochroleuca L.
S. trinifolia Friv.

Euphorbiaceae

161. *Euphorbia* L.
E. amygdaloides L.
E. cyparissias L.
E. polychroma A. Kerner
 162. *Mercurialis* L.
M. perennis L.

Fabaceae

163. *Anthyllis* L.
A. montana L. ssp. *jacquinii* (A.
 Kerner) Hayek
A. vulneraria L.
 164. *Astragalus* L.
A. glycyphyllos L.
A. onobrychis L. ssp.
chlorocarpus (Griseb.)
 Kožuharov & Pavlova
 165. *Chamaecytisus* Link
Ch. albus (Jacq.) Rothm.
Ch. ciliatus (Wahlenb.) Rothm.
 166. *Chamaespartium* Adanson
Ch. sagittale (L.) P. Gibbs
 167. *Coronilla* L.
C. varia L.
 168. *Dorycnium* Miller
D. herbaceum Vill.
 169. *Galega* L.
G. officinalis L.
 170. *Genista* L.
G. carinalis Griseb.
G. depressa M. Bieb.
G. januensis Viv.
 171. *Lathyrus* L.
L. pratensis L.
L. venetus (Miller) Wohlff.
L. vernus (L.) Bernh.
 172. *Lotus* L.

- L. corniculatus* L.
 173. *Medicago* L.
M. falcata L.
M. lupulina L.
 174. *Melilotus* Miller
M. alba Medicus
M. officinalis (L.) Pallas
 175. *Onobrychis* Miller
O. alba (Waldst. & Kit.) Desv.
 176. *Ononis* L.
O. arvensis L.
 177. *Trifolium* L.
T. alpestre L.
T. aureum Pollich
T. ochroleucon Hudson
T. pannonicum Jacq.
T. pratense L.
T. repens L.
 178. *Vicia* L.
V. cracca L.
V. cassubica L.
V. sepium L.
V. tenuifolia Roth

Fagaceae

179. *Fagus* L.
F. sylvatica L. ssp. *moesiaca* (K.
 Malý) Hjelmquist
 180. *Quercus* L.
Q. dalechampii Ten.

Fumariaceae

181. *Corydalis* Vent.
C. bulbosa (L.) DC.
C. slivenensis Velen.

Gentianaceae

182. *Gentiana* L.
G. cruciata L.
G. verna L.
 183. *Gentianella* Moench
G. ciliata (L.) Borkh.

Geraniaceae

184. *Erodium* L'Her.
E. cicutarium L'Her.
 185. *Geranium* L.
G. lucidum L.
G. macrorrhizum L.

- G. phaeum* L.
G. palustre L.
G. pyrenaicum Burm. f.
G. robertianum L.
G. sanguineum L.

Gesneriaceae

186. *Haberlea* Friv.
H. rhodopensis Friv.

Hypericaceae

187. *Hypericum* L.
H. hirsutum L.
H. perforatum L.
H. tetrapterum Fries

Lamiaceae

188. *Acinos* Miller
A. alpinus (L.) Moench
A. arvensis (Lam.) Dandy
 189. *Ajuga* L.
A. genevensis L.
A. laxmannii (L.) Benth
 190. *Betonica* L.
B. bulgarica Degen & Nejceff
 191. *Calamintha* Miller
C. sylvatica Bromf.
 192. *Clinopodium* L.
C. vulgare L.
 193. *Galeopsis* L.
G. speciosa Miller
G. tetrahit L.
 194. *Glechoma* L.
G. hederacea L.
G. hirsuta Waldst. & Kit.
 195. *Lamium* Heister ex
 Fabr.
L. galeobdolon (L.) Ehrend. &
 Polatschek
 196. *Lamium* L.
L. garganicum L.
L. purpureum L.
 197. *Lycopus* L.
L. exaltatus L.
 198. *Marrubium* L.
M. vulgare L.
 199. *Melissa* L.
M. officinalis L.
 200. *Mentha* L.

M. longifolia (L.) Hudson
201. *Micromeria* Bentham
M. frivaldszkyana (Degen)
 Velen.

202. *Nepeta* L.

N. nuda L.

203. *Origanum* L.

O. vulgare L.

204. *Prunella* L.

P. grandiflora (L.) Scholler

P. vulgaris L.

205. *Salvia* L.

S. glutinosa L.

S. verticillata L.

206. *Scutellaria* L.

S. altissima L.

207. *Sideritis* L.

S. montana L.

208. *Stachys* L.

S. alpina L.

S. germanica L.

S. sylvatica L.

209. *Teucrium* L.

T. chamaedrys L.

T. montanum L.

210. *Thymus* L.

Th. pulegioides L.

Th. vandasii Velen.

Linaceae

211. *Linum* L.

L. capitatum Kit. ex Schultes

L. catharticum L.

Lythraceae

212. *Lythrum* L.

L. salicaria L.

Malvaceae

213. *Malva* L.

M. neglecta Wallr.

M. sylvestris L.

Monotropaceae

214. *Monotropa* L.

M. hypopitys L.

Oleaceae

215. *Fraxinus* L.

F. excelsior L.

F. ornus L.

216. *Ligustrum* L.

L. vulgare L.

217. *Syringa* L.

S. vulgaris L.

Onagraceae

218. *Chamaenerion* Adanson

Ch. angustifolium (L.) Scop.

219. *Circea* L.

C. lutetiana L.

220. *Epilobium* L.

E. hirsutum L.

E. montanum L.

Orobanchaceae

221. *Orobanche*

O. alba Steph. ex Willd.

O. caryophyllacea Sm.

222. *Phelipanche*

Ph. purpurea (Jacq.) Sojak

Oxalidaceae

223. *Oxalis* L.

O. acetosella L.

Paeoniaceae

224. *Paeonia* L.

P. mascula (L.) Miller

Papaveraceae

225. *Chelidonium* L.

Ch. majus L.

Plantaginaceae

226. *Plantago* L.

P. argentea Chaix

P. lanceolata L.

P. major L.

P. media L.

Polygalaceae

227. *Polygala* L.

P. major Jacq.

P. vulgaris L.

Polygonaceae

228. *Persicaria* Miller

P. maculata (Rafin.) S. F. Gray

229. *Polygonum* L.

P. aviculare L.

230. *Rumex* L.

R. acetosa L.

R. acetosella L.

R. alpinus L.

Primulaceae

231. *Anagalis* L.

A. arvensis L.

232. *Lysimachia* L.

L. nummularia L.

L. punctata L.

233. *Primula* L.

P. veris L.

Pyrolaceae

234. *Orthilia* Rafin.

O. secunda (L.) House

Ranunculaceae

235. *Aconitum* L.

A. lycoctonum L. = *A. lamarckii*
 Rchb.

236. *Actaea* L.

A. spicata L.

237. *Anemone* L.

A. ranunculoides L.

238. *Caltha* L.

C. palustris L.

239. *Clematis* L.

C. vitalba L.

240. *Ficaria* Adanson

F. verna Hudson

241. *Helleborus* L.

H. odoratus Waldst. & Kit.

242. *Hepatica* Miller

H. nobilis Miller

243. *Isopyrum* L.

I. thalictroides L.

244. *Ranunculus* L.

R. acris L.

R. carinathiacus Hoppe

R. millefoliatus Vahl

R. platanifolius L.

R. polyanthemus L.

R. repens L.

245. *Thalictrum* L.

Th. aquilegifolium L.

Resedaceae

246. *Reseda* L.

R. lutea L.

Rhamnaceae

247. *Rhamnus* L.

Rh. saxatilis Jacq.

Rosaceae

248. *Agrimonia* L.

A. eupatoria L.

249. *Alchemilla* L.

A. acutiloba Opiz

A. flabellata Buser

A. glaucescens Wallr.

A. monticola Opiz

250. *Amelanchier* Medicus

A. ovalis Medicus

251. *Aremonia* Nestler

A. agrimonoides (L.) DC.

252. *Cerasus* Juss.

C. avium (L.) Moench

253. *Cotoneaster* Medicus

C. integerrimus Medicus

C. nebrodensis (Guss.) C. Koch

254. *Crataegus* L.

C. monogyna Jacq.

255. *Filipendula* Miller

F. ulmaria (L.) Maxim.

F. vulgaris Moench

256. *Fragaria* L.

F. vesca L.

F. viridis Duchesne

257. *Geum* L.

G. rivale L.

G. urbanum L.

258. *Laurocerasus* M. J. Roemer

L. officinalis M. J. Roemer

259. *Malus* Miller

M. sylvestris Miller

260. *Potentilla* L.

P. argentea L.

P. cinerea Chaix ex Vill.

P. erecta (L.) Rauschel

P. micrantha Ramond ex DC.

P. pilosa L.

P. reptans L.

261. *Prunus* L.
P. cerasifera Ehrh.
P. spinosa L.
262. *Pyrus* L.
P. pyrastrer Burgsd.
263. *Rosa* L.
R. canina L.
R. pendulina L.
264. *Rubus* L.
R. canescens DC.
R. discolor Weihe & Nees
R. hirtus Waldst. & Kit.
R. idaeus L.
265. *Sanguisorba* L.
S. minor Scop.
266. *Sorbus* L.
S. aria (L.) Crantz
S. aucuparia L.
S. mougeotii Soy.-Will. & Gordon
= *S. austriaca* (Beck) Heldr.
S. torminalis (L.) Crantz
267. *Spirea* L.
S. chamaedryfolia L.
- Rubiaceae**
268. *Asperula* L.
A. cynanchica L.
269. *Cruciata* Miller
C. glabra (L.) Ehrend.
C. laevipes Opiz
270. *Galium* L.
G. album Miller
G. odoratum (L.) Scop.
G. schultesii Vest
G. verum L.
- Salicaceae**
271. *Populus* L.
P. tremula L.
272. *Salix* L.
S. alba L.
S. caprea L.
S. fragilis L.
S. purpurea L.
S. triandra L.
- Santalaceae**
273. *Thesium* L.
Th. bavarum Schrank
- Saxifragaceae**
274. *Chrysosplenium* L.
Ch. alternifolium L.
275. *Saxifraga* L.
S. rotundifolia L.
S. tridactylites L.
- Scrophulariaceae**
276. *Chaenorhinum* (DC.)
Rchb.
Ch. minus (L.) Lange
277. *Digitalis* L.
D. grandiflora Miller
278. *Euphrasia* L.
E. hirtella Jordan ex Reuter
E. rostkoviana Hayne
E. salisburgensis Funck
279. *Lathraea* L.
L. squamaria L.
280. *Linaria* Miller
L. genistifolia (L.) Miller
L. vulgaris Miller
281. *Misopates* Rafin.
M. orontium (L.) Rafin.
282. *Odontites* Ludw.
O. verna (Bellardi) Dumort
283. *Rhinanthus* L.
Rh. angustifolius C. C. Gmelin
Rh. wagneri Degen
284. *Rhynchosorys* Griseb.
Rh. elephas (L.) Griseb.
285. *Scrophularia* L.
S. nodosa L.
S. scopoli Hoppe ex Pers.
286. *Verbascum* L.
V. densiflorum Bertol.
V. lanatum Schrader
V. longifolium Tem. ssp.
pannosum (Vis.) Murb.
V. lychnitis L.
V. nigrum L.
287. *Veronica* L.
V. baccabunga L.
V. chamaedrys L.
V. austriaca L. ssp. *neiceffii*
(Degen) Peev
V. montana L.
V. officinalis L.
V. serpyllifolia L.
- Solanaceae**
288. *Atropa* L.
A. bella-donna L.
- Staphyleaceae**
289. *Staphylea* L.
S. pinnata L.
- Thymelaeaceae**
290. *Daphne* L.
D. mezereum L.
- Tiliaceae**
291. *Tilia* L.
T. cordata L.
- Ulmaceae**
292. *Ulmus* L.
U. glabra Hudson
U. minor Miller
- Urticaceae**
293. *Urtica* L.
U. dioica L.
294. *Parietaria* L.
P. erecta Mert. & Koch
- Valerianaceae**
295. *Valeriana* L.
V. officinalis L.
- Verbenaceae**
296. *Verbena* L.
V. officinalis L.
- Violaceae**
297. *Viola* L.
V. aetolica Boiss. & Heldr.
V. hirta L.
V. reichenbachiana Jord. ex
Boreau
V. tricolor L.
- Alliaceae**
298. *Allium* L.
A. carinatum L.
A. paniculatum L.
A. ursinum L.
A. webbiai G.C. Clementi
- Amaryllidaceae**
299. *Galanthus* L.
G. elwesii Hooker f.
- Araceae**
300. *Arum* L.
A. maculatum L.
- Asparagaceae**
301. *Ruscus* L.
R. hypoglossum L.
- Cyperaceae**
302. *Carex* L.
C. caryophyllea Latourr.
C. digitata L.
C. humilis Leysser
C. kitaibeliana Degen ex
Becherer
C. muricata L. = *Carex pairaei*
F. Schultz
C. pendula Hudson
C. sylvatica Hudson
- Diospyraceae**
303. *Tamus* L.
T. communis L.
- Iridaceae**
304. *Crocus* L.
C. veluchensis Herbert
305. *Iris* L.
I. reichenbachii Heuffel
- Juncaceae**
306. *Juncus* L.
J. effusus L.
J. inflexus L. (*J. glaucus* Ehrh.)
307. *Luzula* DC.
L. campestris (L.) DC.
L. forsteri (Sm.) DC.
L. luzuloides (Lam.) Dandy &
Wilmott
L. pilosa (L.) Willd.
- Liliaceae**
308. *Antericum* L.
A. ramosum L.
309. *Colchicum* L.

- C. autumnale* L.
310. *Erythronium* L.
E. dens-canis L.
311. *Gagea* Salisb.
G. lutea (L.) Ker-Gawler
G. pratensis (Pers.) Dumort.
312. *Lilium* L.
L. albanicum Griseb.
L. martagon L.
313. *Muscari* Miller
M. neglectum Guss.
314. *Ornithogalum* L.
O. kochii Parl.
O. oligophyllum E.D. Clarke
O. sibthorpii W. Greuter
315. *Polygonatum* Miller
P. odoratum (Miller) Druce
P. verticillatum (L.) All.
316. *Scilla* L.
S. bifolia L.
317. *Veratrum* L.
V. album L.
- Orchidaceae**
318. *Cephalanthera* L. C. M. Richard
C. damasonium (Miller) Druce
C. longifolia (L.) Fritsch
C. rubra (L.) L. C. M. Richard
319. *Dactylorhiza* Necker ex Nevski
D. saccifera (Brongn.) Soó
D. sambucina (L.) Soó
320. *Epipactis* Zinn
E. atrorubens (Hoffm.) Besser
E. exilis P. Delforge
E. helleborine (L.) Crantz
- E. microphylla* (Ehrh.) Swartz
E. purpurata Sm.
321. *Epipogium* R. Br.
E. aphyllum Swartz
322. *Gymnadenia* R. Br.
G. conopsea (L.) R. Br.
323. *Listera* R. Br.
L. ovata (L.) R. Br.
324. *Neottia* Ludwig
N. nidus-avis (L.) L. C. M. Richard
325. *Platanthera* L. C. M. Richard
P. bifolia (L.) L. C. M. Richard
P. chlorantha (Custer) Rchb.
326. *Orchis* L.
O. mascula (L.) L. ssp. *signifera* (Vest) Soó
O. militaris L.
O. pallens L.
O. pinetorum Boiss. et Kotschy
O. ustulata L.
- Poaceae**
327. *Agrostis* L.
A. capillaris L.
328. *Alopecurus* L.
A. pratensis L.
329. *Anthoxanthum* L.
A. odoratum L.
330. *Arrhenatherum* Beauv.
A. elatius (L.) Beauv. ex J. & C. Presl
331. *Bellardiachloa* Chiov.
B. variegata (Lam.) Kerguélen
332. *Brachypodium* Beauv.
B. pinnatum (L.) Beauv.
B. sylvaticum (Hudson) Beauv.
333. *Briza* L.
B. media L.
334. *Bromus* L.
B. barcensis Simonkai
B. mollis L.
B. tectorum L.
335. *Calamagrostis* Adanson
C. arundinacea (L.) Roth
C. epigeios (L.) Roth
336. *Cleistogenes* Keng
C. serotina (L.) Keng
337. *Cynodon* L. C. M. Richard
C. dactylon (L.) Pers.
338. *Cynosurus* L.
C. cristatus L.
C. echinatus L.
339. *Dactylis* L.
D. glomerata L.
340. *Danthonia* DC.
D. alpina Vest
341. *Deschampsia* Beauv.
D. caespitosa (L.) Beauv.
D. flexuosa (L.) Trin. = *Lerchenfeldia flexuosa* (L.) Schur
342. *Elymus*
E. hispidus (Opiz) Melderis
343. *Festuca* L.
F. airoides Lam.
F. altissima All.
F. balcanica (Acht.) Markgr.-Dannenb. ssp. *neicevii*
F. dalmatica (Hackel) K. Richter
F. drymeja Mert. & Koch
F. heterophylla Lam.
F. nigrescens Lam.
F. pratensis L.
344. *Holcus* L.
H. mollis L.
345. *Hordelymus* (Jessen) C. O. Harz
H. europaeus (L.) C. O. Harz
346. *Koeleria* Pers.
K. eryostachya Pančić
K. macrantha (Ledeb.) Schultes
347. *Lolium* L.
L. perenne L.
348. *Melica* L.
M. ciliata L.
M. nutans L.
M. uniflora Retz.
349. *Milium* L.
M. effusum L.
350. *Nardus* L.
N. stricta L.
351. *Phleum* L.
Ph. phleoides (L.) Karsten
Ph. pratense L.
352. *Poa* L.
P. alpina L.
P. badensis Haenke ex Willd.
P. compressa L.
P. nemoralis L.
353. *Sesleria* Scop.
S. coeruleans Friv.
S. coerulea (L.) Ard.
S. latifolia (Adamovič) Degen
S. rigida Rchb. ssp. *achtarovii* (Deyl) Deyl
354. *Stipa* L.
S. pulcherrima C. Koch
355. *Trisetum* Pers.
T. flavescens (L.) Beauv.

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