

# Vascular flora of the Beli Lom Nature Reserve in Northeast Bulgaria

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**Abstract:** The Beli Lom Nature Reserve is one of the most interesting plain-protected areas in North Bulgaria, owing to the surviving remnants of thermophilous *Quercus* forests in Europe. Considering the fact that wood ecosystems from the lowlands are very rare in Europe and that no purposeful floristic researches have been conducted on that territory, the aim of this work is to provide a rather extensive picture of the floristic diversity of this protected area. As a result of the current study, 367 species of vascular plants belonging to 202 genera and 63 families were identified. The ecological analysis showed that the flora of the investigated area was of the hemicytopyta type, similarly to the flora of the Balkan Peninsula. For the chorological analysis, all plant taxa were classified into 35 chorological groups. Six populations of species with high conservation value were localized during the research.

**Key words:** Bulgaria, flora, protected area, vascular plants, vegetation

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## Introduction

The Beli Lom Nature Reserve is one of the most interesting protected areas in North Bulgaria. It covers part of the valley of river Beli Lom that flows into river Rousenski Lom, the last right-side tributary of the Danube. The river Rousenski Lom and its own tributaries form a system of canyons with meanders, named *Lomovete*. That area includes two protected territories: Beli Lom Nature Reserve and Roussenski Lom Nature Park, surrounded by farmlands. Low altitude and plain relief have contributed to very strong human pressure, dating many centuries back.

The *Lomovete* area is very important from a floristic viewpoint, because it includes some of the surviving remnants of thermophilous *Quercus* forests in Europe. The valley of river Rousenski Lom is an ornithologically important site. About 190 bird species can be observed there, with 110 of them nesting in the territory. A relatively extensive research has been carried out of the vertebrate fauna and especially of the

ornithofauna. The floristic studies are very poor and scanty. Bearing in mind that lowland wood ecosystems are very rare in Europe and that no detailed floristic research has been carried out in the Beli Lom Nature Reserve, the aim of this work is to provide a rather extensive picture of the floristic diversity of this protected area.

In 1779, in his travel notes *From Constantinople to Bucharest*, Sestini provided the first floristic information concerning the investigated territory (Kovachev 1900). Subsequently, the works of Kovachev (1900, 1903), Stefanov (1943), and Bondev (1991) contributed to the knowledge of the flora in Northeast Bulgaria. The only recent study is that of Stoyanov (2005), on the flora of the Roussenski Lom Nature Park.

## Study area and methods

The Beli Lom Nature Reserve covers an area of 773 ha and is situated in the Northeast Bulgaria, along the valley of river Beli Lom. The Reserve is located

20 km off the town of Rousse. The river valley falls into both Rousse and Razgrad administrative districts. The study area is part of the Danube Plain region – Loudogorsko-Dobroudzha sub-region (Ninov 2002). The typical relief consists of lowlands and hilly plateaus.

Tectonically, the Danube Plain has a typically placid structure and consists of a deep Palaeozoic fundament and a thick layer of Mesozoic superstructure, covered by Pleistocene loess veil. According to the geological map of Bulgaria (Michailov 1982), the study area is covered by loess and sediments of the Lower Quaternary. The sediments are represented by limestones, marbles and sandstones.

The karst is another important element in this region. The Beli Lom Reserve is included in the karst-caves area of the Danube Plain (Popov 1982). The area falls into the Temperate-Continental Climatic Zone characteristic with a cold winter, hot summer, and warm and dry autumn (Nikolova & al. 2002). The mean January temperature is  $-1.8^{\circ}\text{C}$ , while the mean July temperature is  $24^{\circ}\text{C}$ . Annual precipitation amounts to 580–620 mm, with spring-time maximum and 2 minimums: in February and August. The late-spring maximum precipitation values (May 60 mm and June 81 mm) coincide with the moderately continental precipitation regime (Dimitrov & Velev 1982).

According to the FAO classification (FAO 1988), chernozem soils predominate in the investigated area. Fluvisols occur, too, at the bottom of the wide valley of river Beli Lom (Ninov 2002).

The field observations were carried out during 2001 and 2002. Route and semi-stationary methods were used. Transects and representative sites were selected, in order to cover to the maximum the habitats diversity (Fig. 1). About 920 herbarium specimens from dif-



Fig. 1. Geographical position on the Beli Lom Nature Reserve.

List of the transects and sites:

1. Open grassy area at the entrance of the Beli Lom Nature Reserve;
2. Along to the main path, woody habitat;
3. The western part of the reserve;
4. Above the hut, woody habitat;
5. Along the path lead to the Beli Lom River;
6. Grassy community between the forest and the river;
7. Along to the river;
8. Rocky places, above the river;
9. Lime forest;
10. Open grassy area between lime and oak forest.

ferent parts of the Reserve were collected. The most significant of them are deposited in the Herbarium of the Institute of Botany in Sofia (SOM). The following keys were used for identification of the plant material: *Guide to the Vascular Plants in Bulgaria* (Kozhuharov 1992), *Flora of RP Bulgaria* (Jordanov 1963–1979; Velchev 1982–1989), *Flora of R Bulgaria* (Kozhuharov 1995), and *Flora Europaea* (Tutin & al. 1964; Tutin & al. 1968–1980). Determination of the floristic elements follows Dimitrov (2002). The life forms were estimated according to Raunkiaer (1934).

## Results and discussion

### Vegetation

According to Bondev (1991), the *Lomovete* locality is inhabited by mixed oak-lime forest vegetation, typical of the Loudogorsko Phytogeographical Subregion and not represented in any other protected territory in Bulgaria. About 80% of the territory of the Beli Lom Nature Reserve is covered by forests composed by *Quercus cerris*, *Q. frainetto*, *Q. dalechampii*, *Carpinus betulus*, *C. orientalis*, *Tilia platyphyllos*, *T. cordata*, *T. tomentosa*, as well as *Fraxinus ornus*, *Malus dasyphylla*, *Pyrus pyraeaster*, and *Ulmus minor*. The age of the forests is about 60–70 years, but single individuals exceed 100 years.

The river banks are covered with *Salix alba*, *S. purpurea*, *Alnus glutinosa*, *Populus alba*, and *P. nigra*. The main hydrophytes are *Lemna minor*, *Myriophyllum spicatum*, *M. verticillatum*, etc.

### Flora

As a result of the current study, 367 species of vascular plants belonging to 202 genera and 63 families have been identified in the Beli Lom Nature Reserve (Appendix 1). Most of them, 79.36% (50 families), are *Dicotyledonae* species, whereas 19.05% (12 families) are *Monocotyledonae* species. The *Pteridophyta* group is represented by one family, or 1.59%.

The families with the highest number of genera (Table 1) are: *Asteraceae* (21), *Brassicaceae* (14), *Lamiaceae* (14), *Rosaceae* (13), *Poaceae* (12), *Apiaceae* (10), *Fabaceae* (10), *Boraginaceae* (9), *Liliaceae* (8), *Caryophyllaceae* (7), and *Ranunculaceae* (7).

The richest in species families (Table 2) are: *Lamiaceae* (33), *Asteraceae* (31) and *Fabaceae* (31), followed by *Poaceae* (25), *Rosaceae* (22), *Ranunculaceae* (17), *Brassicaceae* (16), *Apiaceae* (14) etc. The leading position of *Lamiaceae* is in discrepancy with the 9<sup>th</sup> place it occupies in the Bulgarian flora. The high number of *Lamiaceae* species can be explained with the geographical position of the Reserve on the boundary of the East Mediterranean and Pontic Phytogeographic Centres, as well as with the high adaptive capacity of the species belonging to this family under the xerophytic conditions of the studied area. Similar ordering was established in the neighbouring Rousenski Lom Nature Park (Stoyanov 2005).

The species-richest genera are: *Ranunculus* (9), *Geranium* (8), *Viola* (8), *Bromus* (7), *Vicia* (7), *Potentilla* (6), *Trifolium* (6), *Galium* (5), *Lathyrus* (5), *Poa* (5), *Quercus* (5), and *Stachys* (5). They represent 20.82% of all species (Table 1).

For the chorological analysis, all plant taxa were classified into 35 chorological groups (Table 3). The Euroasian chorological type dominates the flora of the Beli Lom Nature Reserve with 19.30%, followed by the Euro-Mediterranean (16.08%) and Sub-Mediterranean (13.35) groups. Its good representation reflects the xerothermic conditions in the area and the calcareous bedrock.

The Boreal and Euro-Siberian chorological groups are relatively poorly represented, by 6.81% and 7.08% respectively, which can be explained with the low altitude and lack of sufficient humidity. The Cosmopolitan group is represented by 6.00%. The Pontic group (Pont and S Pont) participates with 3.26%. This low percentage can be explained with the small surface of the open places, although the geographical position of the Reserve predisposes their highest representation. The other chorological groups are poorly represented.

The ecological analysis has shown that the flora of the investigated area is of the hemicryptophyta type (Table 4), similarly to the flora of the Balkan Peninsula (Turill 1929). The hemicryptophytes are represented by 53.41%, followed by therophytes 24.52%, phanerophytes 10.08%, geophytes 6.27%, etc.

An interesting characteristic of the investigated area is the comparatively high participation of phanerophytes (10.08%), while the mean percentage for the country is 8–9%. It is a result of the domination of the forest formation in the Reserve. We have counted 12 families, whose representatives are only trees and



shrubs: *Aceraceae*, *Betulaceae*, *Cornaceae*, *Juglandaceae*, *Fagaceae*, *Moraceae*, *Oleaceae*, *Rhamnaceae*, *Salicaceae*, *Tiliaceae*, *Ulmaceae*, and *Vitaceae*.

Some families consist only of perennial plants: *Cyperaceae* (14), *Convolvulaceae* (4), *Euphorbiaceae* (4), and *Polygonaceae* (4). Predominantly of perennial plants are: *Lamiaceae* (29), *Poaceae* (18), *Asteraceae* (16), *Boraginaceae* (11), *Brassicaceae* (9), *Ranunculaceae* (8), *Rubiaceae* (6), and *Violaceae* (6).

The group of annual plants is well presented in the Reserve. The reasons for this are the high anthropogenic pressure, low altitude and the fact that the Reserve is surrounded by agrobiocoenoses. This group includes some weeds, such as *Centaurea cyanus* (= *Cyanus segetim.*), *Bromus arvensis*, *B. mollis*. etc. The richest families of annual plants are: *Fabaceae* (16), *Apiaceae* (6), *Asteraceae* (6), and *Poaceae* (6).

During the study, five populations of species with high conservation value have been localized: *Achillea clypeolata* Sm., *Galanthus nivalis* L., *Himantoglossum hircinum* (L.) Spreng., *Oenanthe angulosa* Griseb., and *Pulmonaria mollis* Wolf. ex Horn. Three of them are included in the *Red Data Book of RP Bulgaria* (Velchev 1984): one in the category of threatened plants (*Galanthus nivalis*) and two in the category of rare plants (*Oenanthe angulosa* and *Pulmonaria mollis*). *Galanthus nivalis* and *Himantoglossum hircinum* are listed under the Law on Biological Diversity (2002), and *Achillea clypeolata* is a Balkan endemic.

The population of *G. nivalis* is in good condition and vital abilities and consists of two groups, each under 100 specimens; this of *O. angulosa* consists of single specimens located around the river, and *H. hircinum* has a mosaic structure and consists of a few dozens of individuals.

The populations of other conservation species are in good condition and consist of numerous individuals.

**Table 1.** Taxonomical range of the vascular flora of the Beli Lom Nature Reserve.

№	Family	Number of genera	Number of species	The richest in taxa genera
1	2	3	4	5
1	<i>Aceraceae</i>	1	3	<i>Acer</i> -3
2	<i>Alismataceae</i>	2	2	
3	<i>Amaranthaceae</i>	1	1	
4	<i>Amaryllidaceae</i>	1	1	
5	<i>Anacardiaceae</i>	1	1	
6	<i>Apiaceae</i>	10	14	<i>Oenanthe</i> -2, <i>Orlaya</i> -2, <i>Peucedanum</i> -2

**Table 1.** Continuation

1	2	3	4	5
7	<i>Apocynaceae</i>	1	1	
8	<i>Araceae</i>	1	1	
9	<i>Aristolochiaceae</i>	2	2	
10	<i>Aspleniaceae</i>	1	1	
11	<i>Asteraceae</i>	21	31	<i>Achillea</i> -3, <i>Centaurea</i> -3, <i>Tragopogon</i> -3, <i>Hieracium</i> -2, <i>Senecio</i> -2, <i>Tanacetum</i> -2, <i>Taraxacum</i> -2
12	<i>Berberidaceae</i>	1	1	
13	<i>Betulaceae</i>	2	4	<i>Carpinus</i> -2
14	<i>Boraginaceae</i>	9	14	<i>Buglossoides</i> -2, <i>Cynoglossum</i> -2, <i>Echium</i> -2, <i>Myosotis</i> -2, <i>Symphytum</i> -2
15	<i>Brassicaceae</i>	14	16	<i>Allysum</i> -2, <i>Rorippa</i> -2
16	<i>Campanulaceae</i>	2	2	
17	<i>Caprifoliaceae</i>	2	3	<i>Sambucus</i> -2
18	<i>Caryophyllaceae</i>	7	9	<i>Silene</i> -2, <i>Stellaria</i> -2
19	<i>Celastraceae</i>	1	2	<i>Euonymus</i> -2
20	<i>Chenopodiaceae</i>	1	1	
21	<i>Convolvulaceae</i>	2	4	<i>Calystegia</i> -2, <i>Convolvulus</i> -2
22	<i>Cornaceae</i>	1	2	<i>Cornus</i> -2
23	<i>Crassulaceae</i>	1	1	
24	<i>Cuscutaceae</i>	1	1	
25	<i>Cyperaceae</i>	3	14	<i>Carex</i> -12
26	<i>Dipsacaceae</i>	2	2	
27	<i>Euphorbiaceae</i>	2	4	<i>Euphorbia</i> -3
28	<i>Fabaceae</i>	10	31	<i>Vicia</i> -7, <i>Trifolium</i> -6, <i>Lathyrus</i> -5, <i>Medicago</i> -3, <i>Astragalus</i> -2, <i>Chamaecytisus</i> -2, <i>Coronilla</i> -2, <i>Melilotus</i> -2
29	<i>Fagaceae</i>	1	5	<i>Quercus</i> -5
30	<i>Geraniaceae</i>	2	9	<i>Geranium</i> -8
31	<i>Haloragaceae</i>	1	2	<i>Myriophyllum</i> -2
32	<i>Hypericaceae</i>	1	1	
33	<i>Iridaceae</i>	2	2	
34	<i>Juglandaceae</i>	1	1	
35	<i>Juncaceae</i>	1	1	
36	<i>Lamiaceae</i>	14	33	<i>Stachys</i> -5, <i>Ajuga</i> -4, <i>Salvia</i> -4, <i>Scutellaria</i> -4, <i>Lamium</i> -3, <i>Glechoma</i> -2, <i>Phlomis</i> -2, <i>Thymus</i> -2
37	<i>Lemnaceae</i>	1	1	
38	<i>Liliaceae</i>	8	14	<i>Allium</i> -3, <i>Polygonatum</i> -3, <i>Asparagus</i> -2, <i>Scilla</i> -2
39	<i>Malvaceae</i>	1	1	
40	<i>Moraceae</i>	1	1	
41	<i>Oleaceae</i>	2	4	<i>Fraxinus</i> -3
42	<i>Orchidaceae</i>	2	2	
43	<i>Papaveraceae</i>	3	3	
44	<i>Plantaginaceae</i>	1	4	<i>Plantago</i> -4
45	<i>Poaceae</i>	12	25	<i>Bromus</i> -7, <i>Poa</i> -5, <i>Festuca</i> -3
46	<i>Polygonaceae</i>	2	4	<i>Rumex</i> -3
47	<i>Potamogetonaceae</i>	1	1	
48	<i>Primulaceae</i>	1	1	
49	<i>Ranunculaceae</i>	7	17	<i>Ranunculus</i> -9, <i>Adonis</i> -3
50	<i>Resedaceae</i>	1	1	
51	<i>Rhamnaceae</i>	1	1	

Table 1. Continuation

1	2	3	4	5
52	<i>Rosaceae</i>	13	22	<i>Potentilla</i> -6, <i>Fragaria</i> -3, <i>Crataegus</i> -2, <i>Rubus</i> -2
53	<i>Rubiaceae</i>	3	8	<i>Galium</i> -5, <i>Cruciata</i> -2
54	<i>Salicaceae</i>	2	5	<i>Salix</i> -3, <i>Populus</i> -2
55	<i>Scrophulariaceae</i>	6	11	<i>Veronica</i> -4, <i>Verbascum</i> -3
56	<i>Solanaceae</i>	1	2	<i>Solanum</i> -2
57	<i>Tiliaceae</i>	1	3	<i>Tilia</i> -3
58	<i>Typhaceae</i>	1	1	
59	<i>Ulmaceae</i>	1	1	
60	<i>Urticaceae</i>	1	1	
61	<i>Verbenaceae</i>	1	1	
62	<i>Violaceae</i>	1	8	<i>Viola</i> -8
63	<i>Vitaceae</i>	1	1	
<b>Total</b>		<b>202</b>	<b>367</b>	

Table 2. The species-richest families in the Beli Lom Nature Reserve.

Nº	Family	Number of species	% of the total number of taxa of the species in the Reserve
1	2	3	4
1	<i>Lamiaceae</i>	33	8.99
2-3	<i>Asteraceae</i>	31	8.45
	<i>Fabaceae</i>	31	8.45
4	<i>Poaceae</i>	25	6.81
5	<i>Rosaceae</i>	22	5.99
6	<i>Ranunculaceae</i>	17	4.63
7	<i>Brassicaceae</i>	16	4.36
8-11	<i>Apiaceae</i>	14	3.81
	<i>Boraginaceae</i>	14	3.81
	<i>Cyperaceae</i>	14	3.81
	<i>Liliaceae</i>	14	3.81
12	<i>Scrophulariaceae</i>	11	3.00
13-14	<i>Caryophyllaceae</i>	9	2.45
	<i>Geraniaceae</i>	9	2.45
15	<i>Rubiaceae</i>	8	2.18

Table 3. Chorological range in the Beli Lom Nature Reserve

Nº	Chorological type	Number of taxa	% of the total number of taxa in the Reserve
1	2	3	4
1	Eurasian (Euro-As)	71	19.30
2	Euro-Mediterranean (Euro-Med)	59	16.08
3	Submediterranean (Sub-Med)	49	13.35
4	Boreal	25	6.81
5	Euro-Siberian (Euro-Sib)	26	7.08
6	Cosmopolitan (Cos)	22	6.00
7	European (Eur)	20	5.45
8	Sub-Boreal	14	3.81
9	Mediterranean (Med)	13	3.54
10	Pontic-Mediterranean (Pont-Med)	10	2.72

Table 3. Continuation

1	2	3	4
11	Euro-Submediterranean (Euro-Sub-Med)	8	2.18
12	Pontic (Pont)	6	1.63
13	South Pontic (S-Pont)	6	1.63
14	Mediterranean-Central-Asiatic (Med-C-As)	6	1.63
15	Euro-Oriental-Turanian (Euro-O-T)	5	1.36
16	Pontic-Submediterranean (Pont-Sub-Med)	3	0.82
17	Euro-Mediterranean-Central-Asiatic (Euro-Med-C-As)	2	0.54
18	Balkan (Bal)	2	0.54
19	Euro-South-Mediterranean (Euro-S-Med)	2	0.54
20	Balkan-Anatolian (Bal-Anat)	2	0.54
21	Balkan-Dacian (Bal-Dac)	2	0.54
22	Asiatic (As)	1	0.27
23	Euro-Pontic (Euro-Pont)	1	0.27
24	Pannonian-Pontic (Pann-Pont)	1	0.27
25	Mediterranean-Asiatic (Med-As)	1	0.27
26	Apenninian-Balkan (Ap-Bal)	1	0.27
27	Mediterranean-Oriental-Turanian (Med-O-T)	1	0.27
28	Euro-Asiatic-Paleo-Adventive (Euro-As-Paleo)	1	0.27
29	Carpathian-Balkan (Carp-Bal)	1	0.27
30	Pontic-Central-Asiatic (Pont-C-As)	1	0.27
31	South-Mediterranean-Central-Asiatic (S-Med-C-As)	1	0.27
32	South-Mediterranean-Asiatic (S-Med-As)	1	0.27
33	South-Siberian (SSib)	1	0.27
34	Pannonian-Balkan (Pann-Bal)	1	0.27
35	Adventive-Asiatic (Adv/As)	1	0.27
<b>Total</b>		<b>367</b>	<b>99.87*</b>

\*The total percentage is below 100% owing to the rounding up to the second digit after the decimal point.

Table 4. Life form range in the Beli Lom Nature Reserve.

Life form	Number of the taxa	% of the total number of taxa of the species in the Reserve
1	2	3
Hemicryptophytes (H)	196	53.41
Therophytes (T)	90	24.52
Phanerophytes (P)	37	10.08
Geophytes (G)	23	6.27
Chamaephytes (Ch)	13	3.54
Hydrophytes (Hy)	4	1.09
Parasites (Pa)	2	0.54
Climbes and Vines (S)	2	0.54

## Appendix 1. Floristic list.

Families, genera and species are listed in alphabetical order. The first abbreviation, after the species name, refers to the life forms (see Table 4); then follow the chorological type (see Table 3) and the transects (see Fig. 1).

### Aceraceae

*Acer campestre* L. – P; Euro-O-T; 1, 3  
*A. platanoides* L. – P; Sub-Med; 3, 5  
*A. tataricum* L. – P; Sub-Med; 1, 3

### Alismataceae

*Alisma plantago-aquatica* L. – H; Boreal; 7  
*Sagittaria sagittifolia* L. – H; Euro-As; 7

### Amaranthaceae

*Amaranthus retroflexus* L. – T; Cos; 1, 3, 10

### Amaryllidaceae

*Galanthus nivalis* L. – G; Eur; 4, 5

### Anacardiaceae

*Cotinus coggygria* Scop. – P; Med-As; 2, 9

### Apiaceae

*Anthriscus cerefolium* (L.) Hoffm. – T; Euro-Med; 4  
*A. nemorosa* (M. Bieb.) Spreng. – H; Euro-As; 3  
*Bupleurum affine* Sadler – T; Sub-Med; 3, 10  
*Daucus carota* L. – T; Euro-As; 7  
*Myrrhoides nodosa* (L.) Cannon – T; Euro-As; 1  
*Oenanthe angulosa* Griseb. – H; Sub-Med; 7  
*O. silaifolia* M. Bieb. – H; Euro-Med; 10  
*Orlaya grandiflora* (L.) Hoffm. – T; Ap-Bal; 2  
*O. kochii* Heywood – T; Euro-As; 10  
*Peucedanum alsaticum* L. – H; Sub-Med; 3  
*P. officinale* L. – H; Euro-Med; 9  
*Sium latifolium* L. – H; Boreal; 7  
*Tordylium maximum* L. – T; Sub-Med; 10  
*Torilis ucranica* Spreng. – T; S-Pont; 3

### Apocynaceae

*Vinca herbacea* Waldst. & Kit. – Ch; Euro-Med; 3

### Araceae

*Arum maculatum* L. – G; Euro-Sub-Med; 5

### Aristolochiaceae

*Aristolochia clematitis* L. – H; Euro-Med; 3  
*Asarum europaeum* L. – H; Euro-Sib; 5

### Aspleniaceae

*Asplenium trichomanes* L. – H; Boreal; 4

### Asteraceae

*Achillea clypeolata* Sm. – H; Bal; 10  
*A. millefolium* L. – H; Euro-Sib; 10  
*A. setacea* Waldst. & Kit. – H; Sub-Med; 3  
*Anthemis austriaca* Jacq. – T; Euro-Med; 3  
*Arctium lappa* L. – T; Euro-Med; 1, 3  
*Artemisia absinthium* L. – H; Pont-Med; 1, 3  
*Centaurea cyanus* L. – T; Euro-Med; 10  
*C. cuneifolia* Sm. – H; Bal; 4  
*C. orientalis* L. – H; Pont-Med; 3  
*Chamomilla recutita* (L.) Rauschert – T; Euro-As; 3  
*Cichorium intybus* L. – H; Euro-Sib; 1  
*Cirsium pannonicum* (L. f.) Link – H; Euro-Med; 2  
*Crepis setosa* Haller f. – T; Euro-Med; 4

*Crupina vulgaris* Cass. – T; Sub-Med; 3, 4  
*Erigeron annuus* (L.) Pers. – H; Boreal; 7  
*Hieracium cymosum* L. – H; Euro-Sib; 3  
*H. pilosella* L. – H; Euro-Med; 4  
*Inula conyza* DC. – H; Euro-Med; 2  
*Lactuca serriola* L. – T; Euro-As; 3  
*Lapsana communis* L. – T; Euro-Sib; 3, 4  
*Senecio vernalis* Waldst. & Kit. – T; Euro-Med; 2  
*S. vulgaris* L. – T; Euro-As; 1  
*Silybum marianum* (L.) Gaertn. – T; Med; 1  
*Tanacetum corymbosum* (L.) Sch.Bip. – T; Euro-Med; 5  
*T. vulgare* L. – T; Euro-Sib; 3  
*Taraxacum officinale* Weber – H; Euro-Med; 1, 3  
*T. serotinum* (Waldst. & Kit.) Poir. – H; Pont; 2  
*Tragopogon dubius* Scop. – T; Euro-Med; 10  
*T. orientalis* L. – H; Euro-Med; 10  
*T. pratensis* L. – T; Euro-Med; 10  
*Tussilago farfara* L. – H; Euro-As; 1

### Berberidaceae

*Berberis vulgaris* L. – Ch; Euro-Med; 2

### Betulaceae

*Alnus glutinosa* (L.) Gaertn. – P; Med-C-As; 3  
*Betula pendula* Roth – P; Euro-Sib; 9  
*Carpinus betulus* L. – P; Euro-Sub-Med; 1, 2, 8  
*C. orientalis* Mill. – P; Sub-Med; 8, 9

### Boraginaceae

*Anchusa azurea* Mill. – H; Sub-Med; 2  
*Buglossoides arvensis* (L.) I.M. Johnst. – T; Euro-As; 1  
*B. purpureoacerulea* (L.) I.M. Johnst. – H; Euro-As; 4  
*Cerinth minor* L. – H; Pont-Med; 10  
*Cynoglossum hungaricum* Simonk. – H; Sub-Med; 1, 3  
*C. officinale* L. – H; S-Pont; 3  
*Echium russicum* J.F. Gmel. – H; Sub-Med; 4  
*E. vulgare* L. – H; Euro-As; 1, 3, 10  
*Lithospermum officinale* L. – H; Euro-As; 5  
*Myosotis arvensis* (L.) Hill – T; Euro-As; 3  
*M. sicula* Guss. – T; Euro-As; 4, 7  
*Pulmonaria mollis* Wolf. ex Hornem. – H; Eur; 2  
*Symphytum officinale* L. – H; Euro-As; 7  
*S. ottomanum* Friv. – H; Bal-Anat; 2

### Brassicaceae

*Alliaria petiolata* (M. Bieb.) Cavara & Grande – H; Euro-As; 2  
*Alyssum alyssoides* (L.) L. – T; Euro-Med; 10  
*A. montanum* L. – H; Euro-Med; 5  
*Arabis glabra* (L.) Bernh. – H; Boreal; 2  
*Barbarea vulgaris* R. Br. – H; Euro-As; 1, 10  
*Cardamine bulbifera* (L.) Grantz. – H; Sub-Boreal; 2, 10  
*Cardaria draba* (L.) Desv. – H; Euro-Med; 6  
*Capsella bursa-pastoris* (L.) Medic. – T; Cos; 1, 3, 8  
*Descurainia sophia* (L.) Webb ex Prantl – T; Euro-As; 3  
*Diplotaxis muralis* (L.) DC. – T; Euro-Med; 8  
*Erysimum diffusum* Ehrh. – H; Sub-Boreal; 2  
*Lunaria annua* subsp. *pachyrhiza* (Borbás) Hayek – T; Med; 1  
*Neslia paniculata* (L.) Desv. – T; As; 10  
*Rorippa prolifera* (Heuff.) Neilr. – H; Bal-Dac; 6, 7  
*R. sylvestris* (L.) Besser – H; Euro-As; 7  
*Thlaspi arvense* L. – T; Euro-As; 1

### Campanulaceae

*Campanula sibirica* L. – H; Sub-Med; 9  
*Legousia speculum-veneris* (L.) Chaix – T; Euro-Med; 2

### Caprifoliaceae

*Sambucus ebulus* L. – H; Euro-Med; 5

*S. nigra* L. – Ch; Euro-Med; 4

*Viburnum lantana* L. – P; Euro-Med; 4

#### **Caryophyllaceae**

*Arenaria leptoclados* (Rchb.) Guss. – T; Euro-As; 2

*Cerastium glomeratum* Thuill. – T; Cos; 7

*Lychnis coronaria* (L.) Desr. – H; Med-O-T; 2

*Myosoton aquaticum* (L.) Moench – H; Euro-As; 7

*Scleranthus annuus* L. – T; Euro-Sib; 3

*Silene alba* (Mill.) E.H.L. Krause – H; Euro-Sib; 1

*S. vulgaris* (Moench) Garcke – H; Euro-As; 1, 3, 10

*Stellaria graminea* L. – H; Euro-As; 3

*S. media* (L.) Vill. – T; Cos; 3

#### **Celastraceae**

*Euonymus europaeus* L. – P; Euro-Med; 3

*E. latifolius* (L.) Mill. – P; Euro-Med; 2

#### **Chenopodiaceae**

*Beta trigyna* Waldst. & Kit. – H; Med; 7

#### **Convolvulaceae**

*Calystegia sepium* (L.) R. Br. – H; Cos; 3

*C. sylvatica* (Kit.) Griseb. – H; Med; 5

*Convolvulus arvensis* L. – H; Cos; 2, 3

*C. cantabrica* L. – H; Pont; 1, 3

#### **Cornaceae**

*Cornus mas* L. – P; Sub-Med; 2

*C. sanguinea* L. – P; Sub-Med; 4

#### **Crassulaceae**

*Sedum hispanicum* L. – T; Euro-Med; 9

#### **Cuscutaceae**

*Cuscuta epithimum* (L.) L. – Pa; Eur; 10

#### **Cyperaceae**

*Bolboschoenus maritimus* (L.) Palla – H; Cos; 7

*Carex acutiformis* Ehrh. – H; Cos; 6

*C. caryophyllea* Latourr. – H; Boreal; 2

*C. divulsa* Stokes – H; Euro-As; 3

*C. hirta* L. – H; Boreal; 7

*C. melanostachya* M. Bieb. ex Willd. – H; Sub-Med; 7

*C. montana* L. – H; Euro-Sib; 10

*C. ovalis* Gooden. – H; Cos; 1

*C. panicea* L. – H; Boreal; 7

*C. pilosa* Scop. – H; Euro-As; 5

*C. praecox* Schreb. – H; Euro-Sib; 3

*C. riparia* Curtis – H; Euro-As; 7, 6

*C. sylvatica* Huds. – H; Sub-Med; 3

*Eleocharis palustris* (L.) Roem. & Schult. – H; Cos; 7

#### **Dipsacaceae**

*Knautia arvensis* (L.) Coult. – H; Euro-Sib; 3

*Scabiosa ochroleuca* L. – H; Euro-Sib; 10

#### **Euphorbiaceae**

*Euphorbia amygdaloides* L. – H; Eur; 5

*E. polychroma* A. Kern. – H; Eur; 3

*E. seguierana* Neck. – H; Euro-As; 5

*Mercurialis perennis* L. – H; Sub-Med; 2

#### **Fabaceae**

*Astragalus cicer* L. – H; Euro-As; 2

*A. glycyphyllos* L. – H; S-Pont; 3

*Chamaecytisus ciliatus* (Wahlenb.) Rothm. – Ch; Pont-Med; 3

*Ch. hirsutus* (L.) Link – Ch; Euro-Sib; 4

*Coronilla elegans* Pančić. – H; Pont; 6

*C. varia* L. – H; Euro-Med; 2, 3

*Dorycnium herbaceum* Vill. – H; Euro-Med; 3

*Lathyrus aphaca* L. – T; Sub-Boreal; 6

*L. inconspicuus* L. – T; Med-C-As; 10

*L. nissolia* L. – T; Euro-S-Med; 6

*L. sphaericus* Retz. – T; Euro-As; 1

*L. tuberosus* L. – H; Euro-As; 2

*Lotus corniculatus* L. – H; Euro-Med; 6

*Medicago falcata* L. – H; Euro-As; 2, 10

*M. minima* (L.) Bartal. – T; Euro-As; 1, 6

*M. orbicularis* (L.) Bartal. – T; Euro-Med; 2

*Melilotus officinalis* (L.) Pall. – T; Sub-Med; 10

*M. alba* Medik. – T; Sub-Boreal; 3

*Trifolium arvense* L. – T; Euro-Sib; 3

*T. campestre* Schreb. – T; Euro-Med; 1, 3

*T. medium* L. – H; Euro-As; 2, 4

*T. purpureum* Loisel. – T; Med; 10

*T. repens* L. – H; Euro-Sib; 1, 4

*T. resupinatum* L. – T; Med; 6

*Vicia cassubica* L. – H; Euro-Med; 3

*V. cracca* L. – H; Euro-As; 1, 2

*V. grandiflora* Scop. – T; Sub-Med; 5, 8

*V. hybrida* L. – T; Med-C-As; 1

*V. narbonensis* L. – T; Euro-As; 3

*V. pannonica* Crantz. – T; Euro-Med; 3, 5

*V. sativa* L. – T; Euro-Med; 1

#### **Fagaceae**

*Quercus cerris* L. – P; Euro-Sub-Med; 2, 4

*Q. dalechampii* Ten. – P; Sub-Med; 2

*Q. frainetto* Ten. – P; Eur; 2, 4

*Q. pedunculiflora* K. Koch – P; Pont-Med; 2, 4

*Q. robur* L. – P; Sub-Med; 2

#### **Geraniaceae**

*Erodium cicutarium* (L.) L'Hér. – T; Sub-Boreal; 3

*Geranium brutium* Gasp. – H; Med; 10

*G. columbinum* L. – T; Sub-Med; 5

*G. dissectum* L. – T; Euro-As; 4, 7

*G. divaricatum* Ehrh. – T; Euro-As; 3

*G. lucidum* L. – T; Euro-As; 4

*G. molle* L. – T; Euro-Med; 3

*G. pyrenaicum* Burm. f. – H; Sub-Med; 2

*G. rotundifolium* L. – T; Euro-As; 3

#### **Haloragaceae**

*Myriophyllum spicatum* L. – Hy; Boreal; 7

*M. verticillatum* L. – Hy; Boreal; 7

#### **Hypericaceae**

*Hypericum perforatum* L. – H; Cos; 3

#### **Iridaceae**

*Crocus chrysanthus* (Herb.) Herb. – G; Bal-Anat; 1, 2, 3, 10

*Iris pseudacorus* L. – G; Eur; 7

#### **Juglandaceae**

*Juglans regia* L. – P; Euro-As-Paleo; 1

#### **Juncaceae**

*Juncus effusus* L. – H; Sub-Boreal; 7

#### **Lamiaceae**

*Ajuga chamaepytis* subsp. *chia* (Schreb.) Acrang. – H; Pont-Med; 3

*A. genevensis* L. – H; S-Pont; 1, 3, 7, 8, 10

*A. laxmannii* (L.) Benth. – H; Pont-Med; 3

*A. reptans* L. – H; Euro-Med; 3

*Ballota nigra* L. – H; Euro-Med; 2, 10

*Calamintha sylvatica* Bromf. – H; Euro-O-T; 2



*Galeopsis speciosa* Mill. – T; Euro-As; 4, 8  
*Glechoma hirsuta* Waldst. & Kit. – H; Euro-Med; 1  
*G. hederacea* L. – H; Euro-As; 5  
*Lamium galeobdolon* (L.) Ehrend. & Polatschek – H; Med; 1, 4, 10  
*Lamium garganicum* L. – H; Med; 7  
*L. maculatum* L. – H; Sub-Boreal; 5  
*L. purpureum* L. – T; Euro-Med; 1, 3, 10  
*Leonurus cardiaca* L. – T; Euro-As; 1  
*Phlomis herba-venti* L. – H; Euro-As; 10  
*Ph. tuberosa* L. – H; Euro-Sib; 10  
*Prunella vulgaris* L. – H; Cos; 3  
*Salvia nemorosa* L. – H; Euro-O-T; 10  
*S. pratensis* L. – H; Euro-Med; 7  
*S. verticillata* L. – H; Sub-Med; 3  
*S. virgata* Jacq. – H; Med-C-As; 10  
*Scutellaria albida* L. – H; Sub-Med; 1  
*S. altissima* L. – H; Eur; 4  
*S. columnae* All. – H; Sub-Med; 3  
*S. galericulata* L. – H; Boreal; 4  
*Stachys annua* (L.) L. – T; Euro-As; 1  
*S. atherocalyx* C. Koch – H; Pont-Med; 3  
*S. germanica* L. – H; Euro-Sub-Med; 2, 3  
*S. officinalis* (L.) Trevis. – H; Sub-Med; 3  
*S. sylvatica* L. – H; Euro-As; 1  
*Teucrium polium* L. – H; Pont-Med; 10  
*Thymus callieri* Borbás ex Velen. subsp. *urumovii* Velen. – H; Pont; 9  
*Th. sibthorpii* Benth. – H; Bal-Dac; 7

#### **Lemnaceae**

*Lemna minor* L. – Hy; Cos; 7

#### **Liliaceae**

*Allium atroviolaceum* Boiss. – G; Euro-As; 3  
*A. rotundum* L. – G; Euro-O-T; 3  
*A. sphaerocephalon* L. – G; Med; 5  
*Asparagus officinalis* L. – H; Eur; 3  
*A. tenuifolius* Lam. – G; Pont-Med; 4  
*Lilium martagon* L. – G; Euro-As; 7  
*Muscari racemosum* (L.) Lam. & DC. – G; Sub-Med; 9  
*Ornithogalum refractum* Kit. ex Schlecht. – G; Sub-Med; 4  
*Polygonatum latifolium* (Jacq.) Desf. – G; Boreal; 5  
*P. multiflorum* (L.) All. – G; Boreal; 5  
*P. odoratum* (Mill.) Druce – G; Euro-Sib; 3  
*Ruscus aculeatus* L. – Ch; S-Pont; 10  
*Scilla autumnalis* L. – G; Pont-Sub-Med; 2, 5  
*S. bifolia* L. – G; Pont-Sub-Med; 2, 3

#### **Malvaceae**

*Malva sylvestris* L. – T; Cos; 2

#### **Moraceae**

*Morus alba* L. – P; Adv/As; 10

#### **Oleaceae**

*Fraxinus excelsior* L. – P; Euro-Med; 4  
*F. ornus* L. – P; Sub-Med; 9  
*F. oxycarpa* M. Bieb. ex Willd. – P; Med; 7  
*Syringa vulgaris* L. – Ch; Carp-Bal; 5, 9

#### **Orchidaceae**

*Cephalanthera longifolia* (L.) Fritsch – G; Euro-O-T; 5  
*Himantoglossum hircinum* (L.) Spreng. – G; Med; 4

#### **Papaveraceae**

*Chelidonium majus* L. – H; Euro-As; 5  
*Corydalis solida* (L.) Clairv. – G; Euro-Med-C-As; 4  
*Papaver rhoeas* L. – T; Euro-Sib; 1, 3, 6, 10

#### **Plantaginaceae**

*Plantago altissima* L. – H; Euro-Sib; 10  
*P. argentea* Chaix – H; Sub-Med; 7  
*P. lanceolata* L. – H; Cos; 3  
*P. major* L. – H; Boreal; 1

#### **Poaceae**

*Aegilops neglecta* Req. ex Bertol. – T; Sub-Med; 2  
*Alopecurus pratensis* L. – H; Euro-As; 7  
*Bromus arvensis* L. – T; Euro-As; 1  
*B. commutatus* Schrad. – T; Sub-Med; 3  
*B. erectus* Huds. – H; Sub-Med; 3  
*B. inermis* Leyss. – H; Euro-As; 1  
*B. mollis* L. – T; Boreal; 7  
*B. sterilis* L. – T; Boreal; 1  
*B. tectorum* L. – T; Boreal; 1  
*Dactylis glomerata* L. – H; Euro-As; 3  
*Elymus hispidus* (Opiz) Melderis – H; Pont-C-As; 6  
*Festuca heterophylla* Lam. – H; Boreal; 3  
*F. pratensis* L. – H; Boreal; 1, 3  
*F. valesiaca* Schleich. ex Gaudin – H; Pont; 1  
*Hordeum murinum* L. – T; Boreal; 1  
*Koeleria macrantha* (Ledeb.) Schult. – H; Eur; 3  
*K. nitidula* Velen. – H; Pont; 1  
*Lolium perenne* L. – H; Euro-As; 1  
*Phalaris arundinacea* L. – H; Boreal; 7  
*Phragmites australis* (Cav.) Trin. ex Steud. – H; Cos; 7  
*Poa bulbosa* L. – H; Euro-As; 2  
*P. nemoralis* L. – H; Boreal; 1, 3  
*P. pratensis* L. – H; Cos; 6  
*P. sylvicola* Guss. – H; Euro-As; 1, 7  
*P. trivialis* L. – H; Boreal; 7

#### **Polygonaceae**

*Persicaria amphibia* (L.) S.F. Gray. – H; Cos; 6  
*Rumex crispus* L. – H; Boreal; 1  
*R. patientia* L. – H; Euro-As; 7  
*R. sanguineus* L. – H; Euro-Med; 7

#### **Potamogetonaceae**

*Potamogeton gramineus* L. – Hy; Boreal; 7

#### **Primulaceae**

*Cyclamen hederifolium* Aiton – G; Sub-Med; 4

#### **Ranunculaceae**

*Adonis aestivalis* L. – T; Euro-Sub-Med; 1, 10  
*A. flammea* Jacq. – T; Euro-Sub-Med; 8  
*A. vernalis* L. – H; Euro-Sib; 6  
*Clematis vitalba* L. – S; Eur; 3, 4  
*Consolida regalis* S.F. Gray – T; Euro-Med; 1  
*Delphinium fissum* Waldst. & Kit. – G; Sub-Med; 10  
*Helleborus odoratus* Waldst. & Kit. – H; Euro-S-Med; 3, 5  
*Isopyrum thalictroides* L. – G; Eur; 5, 8  
*Ranunculus acris* L. – H; Cos; 2  
*R. ficaria* L. – H; Euro-Sib; 3, 8  
*R. lanuginosus* L. – H; Eur; 5  
*R. oxyspermus* Willd. – G; Med-C-As; 3  
*R. polyanthemus* L. – H; Euro-Sub-Med; 1  
*R. repens* L. – H; Sub-Med; 8  
*R. sardous* Crantz – T; Euro-Med; 7  
*R. scleratus* L. – T; Euro-Med; 6  
*Ranunculus villosus* DC. subsp. *constantinopolitanus* (DC.) Jelen. – H; Sub-Med; 5, 8

#### **Resedaceae**

*Reseda lutea* L. – H; Sub-Boreal; 6



**Rhamnaceae**

*Paliurus spina-christi* Mill. - Ch; Euro-As; 2, 9

**Rosaceae**

*Agrimonia eupatoria* L. - H; Euro-Med; 5  
*Aremonia agrimonoides* (L.) DC. - H; Sub-Med; 2, 3  
*Crataegus monogyna* Jacq. - Ch; Sub-Boreal; 1, 3  
*C. pentagyna* Waldst. & Kit. ex Willd. - Ch; Sub-Med; 3  
*Fragaria moschata* Duchesne - H; Euro-Pont; 10  
*F. vesca* L. - H; Sub-Boreal; 3  
*F. viridis* Duchesne - H; Euro-Sib; 2, 3  
*Geum urbanum* L. - H; Sub-Boreal; 2, 3, 4, 10  
*Malus dasyphylla* Borkh. - P; Pann-Pont; 2  
*Potentilla argentea* L. - H; S-Pont; 1, 3, 6, 10  
*P. cinerea* Chaix ex Vill. - H; Eur; 6, 8  
*P. erecta* (L.) Raeusch. - H; Sub-Boreal; 2, 6  
*P. micrantha* Ramond ex DC. - H; Euro-Sub-Med; 6  
*P. neglecta* Baumg. - H; Sub-Boreal; 1, 4  
*P. reptans* L. - H; Cos; 6  
*Prunus cerasifera* Ehrh. - P; Euro-As; 3, 10  
*Pyrus pyraeaster* Burgsd. - P; Sub-Med; 10  
*Rosa canina* L. - Ch; Sub-Med; 3, 4, 10, 6  
*Rubus canescens* DC. - Ch; Euro-Med; 1, 10  
*R. lloydianus* Genev. - Ch; Eur; 4  
*Sanguisorba minor* Scop. - H; Sub-Boreal; 3  
*Sorbus torminalis* (L.) Crantz - P; Pont-Med; 10

**Rubiaceae**

*Cruciata glabra* (L.) Ehrend. - H; S-Med-C-As; 2  
*C. laevipes* Opiz - H; S-Med-As; 5  
*Galium aparine* L. - T; Euro-As; 2, 4  
*G. octonarium* (Klokov) Pobed. - H; Med-C-As; 9  
*G. odoratum* (L.) Scop. - H; Euro-As; 2, 3, 4  
*G. paschale* Forssk. - H; Bal-Anat; 3  
*G. pseudoaristatum* Schur - H; Pann-Bal; 5  
*Sherardia arvensis* L. - T; Med; 10

**Salicaceae**

*Populus alba* L. - P; Euro-As; 7  
*P. nigra* L. - P; Euro-As; 7  
*Salix alba* L. subsp. *alba* - P; Euro-As; 7  
*S. alba* L. subsp. *coerulea* (Sm.) Rech. f. - P; Euro-As; 7  
*S. purpurea* L. - P; Euro-Med-C-As; 7

**Scrophulariaceae**

*Lathraea squamaria* L. - Pa; Euro-As; 5  
*Linaria vulgaris* Mill. - H; Euro-Sib; 1  
*Pseudolysimachion barrelieri* (Schott. ex Roem. & Schult.) Holub. - H; Eur; 3  
*Rhinanthus rumelicus* Velen. - T; Euro-Med; 10  
*Verbascum densiflorum* Bertol. - H; Sub-Med; 10  
*V. phoeniceum* L. - H; Euro-Sib; 2  
*V. speciosum* Schrad. - H; Euro-Med; 7  
*Veronica chamaedrys* L. - H; Euro-As; 1, 3, 10  
*V. hederifolia* L. - T; Euro-Med; 4  
*V. triloba* Opiz - T; Sub-Med; 3  
*V. vindobonensis* (M. Fischer) M. Fischer - H; Eur; 3

**Solanaceae**

*Solanum dulcamara* L. - H; Euro-As; 4  
*S. luteum* Mill. - T; Sub-Med; 3

**Tiliaceae**

*Tilia cordata* Mill. - P; Eur; 10  
*T. platyphyllos* Scop. - P; Eur; 10  
*T. tomentosa* Moench - P; Euro-Med; 2, 8, 10

**Typhaceae**

*Typha latifolia* L. - H; Cos; 7

**Ulmaceae**

*Ulmus minor* Mill. - P; Euro-Med; 2

**Urticaceae**

*Urtica dioica* L. - H; Boreal; 3

**Violaceae**

*Viola elatior* Fries - H; Euro-As; 5  
*V. jordanii* Hanry - H; Euro-Med; 2  
*V. kitaibeliana* Schult. - T; Euro-Med; 1  
*V. mirabilis* L. - H; Euro-As; 2  
*V. odorata* L. - H; Euro-Med; 2  
*V. reichenbachiana* Jord. ex Boreau - H; Euro-As; 4  
*V. suavis* M. Bieb. - H; Euro-As; 1  
*V. tricolor* L. - T; Euro-As; 5

**Verbenaceae**

*Verbena officinalis* L. - H; Cos; 7

**Vitaceae**

*Vitis vinifera* L. - S; Sub-Med; 7

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