

CONTRIBUTION TO KNOWLEDGE OF THE VASCULAR FLORA OF THE RESAVA GORGE, EASTERN SERBIA

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Abstract – The Resava Gorge is situated in Eastern Serbia in the region of the Gornja Resava River, extending westward from Mt. Globški Krš to the town of Lisine. In floral research conducted during 1997 and 1998, 297 taxa of vascular flora belonging to 68 families were discovered. The families *Poaceae* (28), *Asteraceae* (21), *Fabaceae* (20) and *Lamiaceae* (19) were best represented. The presence of 49 floral elements was also noted. The greatest number of plants are sub-Central European (18,86 %), Eurasian (14,14 %), sub-Mediterranean (8,75 %), Central European (6,40 %) and sub-Eurasian (6,40 %). As for life forms, hemi-cryptophytes (49,50 %), phanerophytes (19,53 %) and geophytes (11,11 %) were noted as dominant.

Key words: Resava Gorge, vascular flora, biodiversity, relics, endemics, Eastern Serbia.

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INTRODUCTION

Owing to their specific geographical position, meso- and microclimatic conditions, and great geological and geomorphological diversity, the limestone canyons and gorges of the Balkan Peninsula, including the Resava Gorge in Eastern Serbia (Fig. 1), represent refugia for many Tertiary species whose ranges shrank during glacial periods in Europe and which are preserved nowadays as relics and endemorelics.

This area belongs to a region with a moderately continental climate. Passing through the gorge this climate collides with sub-Mediterranean and steppe climatic influences and changes in keeping with altitude and exposure, which results in different types of microclimates. Their presence caused the formation of specific kinds of habitats housing a great variety of flora, vegetation, and plots. The orography of canyons and gorges caused inversion of climatic conditions and consequent inversion of vegetation. Owing to the circumstances mentioned, a significant number of geologically and horologically distant species can be found co-existing in a relatively small space.

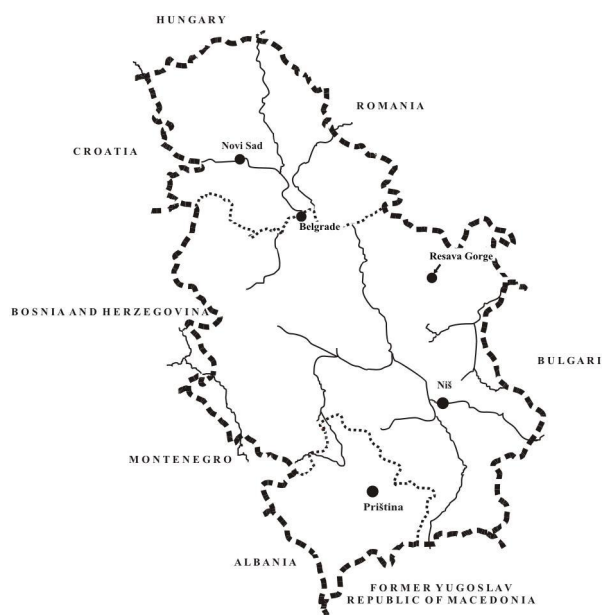


Fig. 1. Geographical position of the Resava Gorge.

Table 1. Vascular flora of the Resava Gorge.

SPECIES	FLORISTIC ELEMENT	LIFE FORM
ACERACEAE		
<i>Acer campestre</i> L.	Sub-Central European	Phanerophytic
<i>Acer intermedium</i> Panč.	Sub-Moesian	Phanerophytic
<i>Acer monspessulanum</i> L.	Sub-Mediterranean	Phanerophytic
<i>Acer platanoides</i> L.	Sub-Central European	Phanerophytic
<i>Acer pseudoplatanus</i> L.	Central European	Phanerophytic
<i>Acer tataricum</i> L.	Pontic-Pannonian	Phanerophytic
ALLIACEAE		
<i>Allium flavum</i> L.	Pontic-Central Asian-sub-Mediterranean	Geophytic
<i>Allium fuscum</i> W. et K.	Sub-Illyrian	Geophytic
ANACARDIACEAE		
<i>Cotynus coggygria</i> Scop.	Pontic-Central Asian-sub-Mediterranean	Nano-phanerophytic
APIACEAE		
<i>Aegopodium podagraria</i> L.	Eurasian	Geophytic
<i>Angelica sylvestris</i> L.	Eurasian	Hemi-cryptophytic
<i>Chaerophyllum aureum</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Chaerophyllum temulum</i> L.	Sub-Central European	Therophytic / Chamaephytic
<i>Daucus carota</i> L.	Sub-Eurasian	Therophytic / Chamaephytic
<i>Laserpitium siler</i> L.	Sub-Mediterranean	Hemi-cryptophytic
<i>Pastinaca sativa</i> L.	Eurasian	Therophytic / Chamaephytic
<i>Pimpinella major</i> (L.) Huds.	Sub-Central European	Hemi-cryptophytic
<i>Pleurospermum austriacum</i> Hoffm.	Sub-Boreal-Eurasian	Hemi-cryptophytic
<i>Sanicula europaea</i> L.	European-African	Hemi-cryptophytic
<i>Seseli rigidum</i> W. et K.	Moesian-Dacian	Hemi-cryptophytic
<i>Smyrniolum perfoliatum</i> L.	Sub-Mediterranean	Therophytic / Chamaephytic
ARACEAE		
<i>Arum maculatum</i> L.	Central European	Geophytic
ARALIACEAE		
<i>Hedera helix</i> L.	Sub-Atlantic-sub-Mediterranean	Phanerophytic liana
ARISTOLOCHIACEAE		
<i>Asarum europaeum</i> L.	Eurasian	Geophytic
ASCLEPIADACEAE		
<i>Cynanchum vincetoxicum</i> (L.) Pers.	Pontic-Central Asian	Hemi-cryptophytic
ASTERACEAE		
<i>Achillea crithmifolia</i> W. et K.	Sub-Moesian-sub-Pannonian	Geophytic
<i>Achillea millefolium</i> L.	Eurasian	Hemi-cryptophytic
<i>Aster tradescanti</i> L.	Adventive	Geophytic
<i>Carduus personata</i> (L.) Jacq.	Central European	Hemi-cryptophytic
<i>Carlina vulgaris</i> L.	Eurasian	Hemi-cryptophytic
<i>Centaurea phrygia</i> L.	Central European	Hemi-cryptophytic
<i>Centaurea scabiosa</i> L.	Sub-Pontic- Central Asian	Hemi-cryptophytic
<i>Cirsium candelabrum</i> Griseb.	Balkan	Therophytic / Chamaephytic
<i>Cirsium eriophorum</i> (L.) Scop.	Sub-Central European	Hemi-cryptophytic
<i>Cirsium erisithales</i> (Jacq.) Scop.	Sub-Central European	Hemi-cryptophytic
<i>Cirsium palustre</i> (L.) Scop.	Sub-Eurasian	Hemi-cryptophytic
<i>Crepis bienis</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Lactuca viminea</i> (L.) Presl.	Pontic-sub-Mediterranean	Therophytic / Chamaephytic
<i>Leontodon hispidus</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Leucanthemum vulgare</i> Lam.	Eurasian	Hemi-cryptophytic
<i>Mycelis muralis</i> (L.) Rchb.	Central European	Hemi-cryptophytic
<i>Pisicris hieracoides</i> L.	Sub-Pontic- Central Asian	Hemi-cryptophytic
<i>Senecio jacobea</i> L.	Sub-Eurasian	Hemi-cryptophytic
<i>Senecio rupester</i> W. et K.	Sub-Balkan-sub-Apennine	Therophytic / Chamaephytic
<i>Tanacetum parthenium</i> (L.) Schultz.	Sub-Mediterranean	Hemi-cryptophytic
<i>Tragopogon orientalis</i> L.	Sub-Mediterranean-Pontic	Hemi-cryptophytic
BERBERIDACEAE		
<i>Berberis vulgaris</i> L.	Sub-Central European	Nano-phanerophytic
BORAGINACEAE		
<i>Anchusa officinalis</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Echium vulgare</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Lithospermum purpureo-coeruleum</i> L.	Pontic-sub-Mediterranean	Herbaceous-chamaephytic
<i>Pulmonaria officinalis</i> L.	Sub-Central European	Hemi-cryptophytic
BRASSICACEAE		
<i>Alliaria officinalis</i> Andrž.	Subm-Middle-European	Hemi-cryptophytic
<i>Alyssum murale</i> Waldst. et Kit.	Pontic	Hemi-cryptophytic
<i>Arabis alpina</i> L. subsp. <i>alpina</i>	Arctic	Herbaceous-chamaephytic
<i>Arabis hirsuta</i> (L.) Scop.	Circumpolar	Therophytic / Chamaephytic
<i>Arabis turrata</i> (L.) Scop.	Sub-Mediterranean	Hemi-cryptophytic

The flora of the Resava Gorge was first mentioned in "Flora Kneževine Srbije" (Flora of the Principality of Serbia) by P a n č i ć (1874). Investigations were also conducted by J o v a n o v i ć (1970), D i k l i ć (1970), T u c o v i ć (1970), G a j i ć (1970–1972), N i k o l i ć (1972), S t a j i ć (1972), V u k i ć e v i ć (1992), and others. Relict vegetation in this region was researched and described in studies of M i š i ć (1971, 1981, 1982), with special emphasis on forest communities.

MATERIALS AND METHODS

Seasonal research on flora in the Resava Gorge was conducted in 1997 and 1998 from Lisine to Globski Krš, in the canyon of the Suvaja, and on the slopes of Mt. Beljanica (Golovršac locality).

The collected plants were herbarized according to the method of J a n k o v i ć (1971) and deposited in the Institute of Botany and Jevremovac Botanical Garden.

The files opened for every plant species contain information about the area, locality, altitude, exposure and slope, geological base, and soil type in the place where the species was found. Identification of plant taxa was carried out according to "Flora SR Srbije" (1970–1992) and "Iconographia Florae Partis Austro-orientalis Europae Centralis" (1975).

Determination of floristic elements was carried out in accordance with the phytogeographical classifications of G a j i ć (1984), S t e v a n o v i ć (1992), and J o v a n o v i ć (1994).

The life forms defined by R a u n k i e r (1934) are supplemented and developed according to S t e v a n o v i ć (1992) and J o v a n o v i ć (1994).

RESULTS AND DISCUSSION

Floristic research in the Resava Gorge revealed the presence of 297 species and subspecies (Tab. 1) belonging to 68 families, among which *Poaceae* (28), *Asteraceae* (21), *Fabaceae* (20), *Lamiaceae* (19), *Brassicaceae* (15), *Rosaceae* (15), *Apiaceae* (12), and *Caryophyllaceae* (11) are the best represented.

Further analysis demonstrates the presence of 187 genera. Of these, *Trifolium* (eight), *Campanula* (eight), *Galium* (seven), and *Acer* (six) have the greatest number of species.

There are 49 floristic elements in the vascular flora of the Resava Gorge, belonging to nine range types. The greatest number of species (27,95 %) belong to the Eurasian range type. In the Moesian province, the Eurasian floristic element is represented with just 14,13 % (G a j i ć, 1984). That points to great diversity of habitats and ecological factors in the region of the Resava Gorge, as well as to its refugial character. Fifteen of the total number of Eurasian species [*Cornus mas* L. (Pontic-sub-Mediterranean), *Cotinus coggygria* Scop. (Pontic-Central Asian-sub-Mediterranean), *Allium flavum* L. (Pontic-Central Asian-sub-Mediterranean) etc.] represent a connection between xerothermal Mediterranean - sub-Mediterranean habitats and steppes and forest-steppes of Europe and Asia, their presence occurring due to specific climatic conditions in the gorge created by collision of different climatic influences from the mentioned regions. As for the Eurasian range type, the greatest number of plants (19) belong to the floristic element of the same name: *Juniperus sabina* L., *Calamagrostis varia* (Schrad.) Host., *Epipogium aphyllum* S. W. etc.

In second place is the Central European range type, with 88 taxa. The greatest number of species belong to the category of sub-Central European floristic elements (18,86%).

According to G a j i ć (1984), species of this range type found optimal conditions for their survival in oak-hornbeam forests, in which they participate with 20,76%. In these communities, Central European floristic elements are represented with 14 species (4,26%), indicating that the flora of the Resava Gorge is connected to the Central European floristic region through transitional floristic elements (G a j i ć, 1984).

The Mediterranean range type is in the third place with respect to the number of species in the investigated area (14,48%) among which sub-Mediterranean floristic elements (8,75%) are dominant. Extending westward, the gorge is surrounded by many mountain ranges, and this is the main reason for the minor presence of Mediterranean species. Sub-Atlantic-sub-Mediterranean floristic elements are represented with nine species, East-sub-Mediterranean floristic elements with seven, and Mediterranean-sub-Mediterranean floristic elements with one. *Acer monspessulanum* L., *Achnatherum calamagrostis* (L.) P. Beauv., *Bromus mollis* L., *Calamintha officinalis* Moench., *Viburnum lantana* L., and *Quercus pubescens* Willd. are typical representatives of this range type.

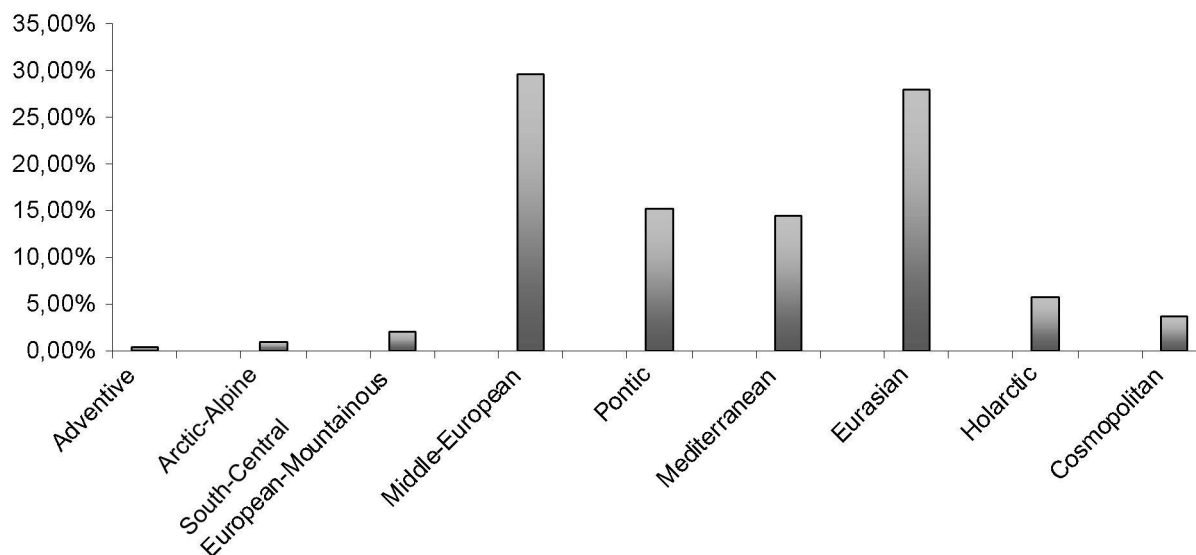


Fig. 2. Percentage of range types in the Resava Gorge.

Wind exposed, relatively dry and thermophyllous habitats are populated by species of the Pontic range type (12,12%): *Melica transsilvanica* Schr. (Pontic), *Thymus marchallianus* Willd. (Pontic-Pannonian), *Calamintha acinos* (L.) Clairv. (Sub-Pontic), etc. The most frequent are representatives of sub-South Siberian (3,03%), sub-Pontic-Central Asian (2,69%), Pontic (1,68%), sub-Pontic (1,68%), and other floristic elements.

There are also species of the Holarctic (5,72%),

Cosmopolitan (3,70%), Central-Southern-European-Mountainous (2,02%), Arctic-Alpine (1,01%), and Adventive (0,34%) range types (Fig. 2).

The research revealed the presence of one endemic of the Moesian Province (*Erysimum chrysanthum* Panč.), one west-Moesian endemic [*Dianthus petraeus* Waldst. et Kit. subsp. *noeanus* (Boiss.) Tutin], and two sub-Moesian endemics (*Dianthus petraeus* Waldst. et Kit. f. *liliodorus* and *Viola macedonica* Boiss. et Heldr.).

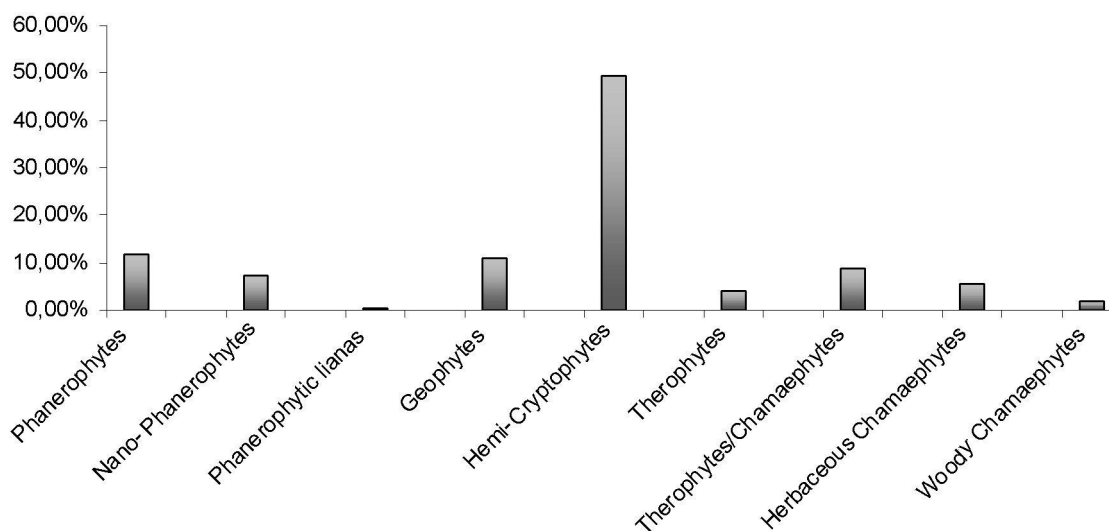


Fig. 3. Percentage of life forms in the Resava Gorge.

The extraordinary presence of different trees (11,78%) and shrubs (7,41%) recorded in the analyzed forest communities is the main evidence of their poly-dominancy. Including one phanerophytic liana (*Hedera helix* L.), the total number of phanerophytes in the Resava Gorge is about 58. Among them there are numerous relics: *Pinus nigra* Arn., *Abies alba* Mill., *Taxus baccata* L., *Juniperus sabina* L., *Juglans regia* L., *Ostrya carpinifolia* Scop., etc.

The significant number of microhabitats with specific ecological conditions resulted in the occurrence of a great number of herbaceous species especially hemi-cryptophytes, which are represented with 147 species (49,50 %) in the flora of the Resava Gorge - a percentage higher than in the flora of the Republic of Serbia (46,8 %).

With respect to the spectrum of life forms, geophytes (11,11%) were in third place in the flora of the investigated area. *Oxalis acetosella* L., *Pteridium aquilinum* (L.) Kuhn., *Equisetum telmateia* Ehrh., and others were found in humid habitats with low radiant energy.

The spectrum of life forms in this region also includes therophytes/chamaephytes (8,75%), herbaceous chamaephytes (5,39%), and woody chamaephytes (1,68 %) (Fig. 3).

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ПРИЛОГ ПОЗНАВАЊУ ВАСКУЛАРНЕ ФЛОРЕ КЛИСУРЕ РЕСАВЕ У ИСТОЧНОЈ СРБИЈИ

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Ресавска клисура се налази у пределу Горње Ресаве и простира се од Глобског крша на истоку до варошице Лисине на западу. Флористичка истраживања на овом подручју вршена су током 1997. и 1998. године, када је забележено 297 врста васкуларних биљака сврстаних у 68 фамилија. Највећи број врста припада фамилијама *Poaceae* (28), *Asteraceae* (21), *Fabaceae* (20) и *Lamiaceae* (19). Констатовано је присуство 49 флор-

них елемената, од којих су најзаступљенији субсредњеевропски (18,86 %), евроазијски (14,14 %), субмедитерански (8,75 %), средњеевропски (6,40 %) и субевроазијски (6,40 %). У спектру животних форми доминирају хемикриптофите (49,50 %), фанерофите (19,53 %) и геофите (11,11 %). Велики проценат дрвенастих врста у овом региону, указује на полидоминантну структуру и на реликтност биљних заједница.

ERRATA CORRIGE

In the paper “**Contribution to knowledge of the vascular flora of the Resava Gorge, Eastern Serbia**” coauthored by Miroslava Mijatović, B. Karadžić, Snežana Jarić, Zorica Popović, P. Pavlović, Miroslava Mitrović, and L. Đurđević (Arch. Biol. Sci., Belgrade, 59, 1, 75-80, 2007) part of Table 1 was erroneously omitted. Please find enclosed the missing table:

Table 1. Vascular flora of the Resava Gorge.

SPECIES	FLORISTIC ELEMENT	LIFE FORM
ACERACEAE		
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<i>Acer monspessulanum</i> L.	Sub-Mediterranean	Phanerophytic
<i>Acer platanoides</i> L.	Sub-Central European	Phanerophytic
<i>Acer pseudoplatanus</i> L.	Central European	Phanerophytic
<i>Acer tataricum</i> L.	Pontic-Pannonian	Phanerophytic
ALLIACEAE		
<i>Allium flavum</i> L.	Pontic-Central Asian-sub-Mediterranean	Geophytic
<i>Allium fuscum</i> W. et K.	Sub-Illyrian	Geophytic
ANACARDIACEAE		
<i>Cotinus coggygria</i> Scop.	Pontic-Central Asian-sub-Mediterranean	Nano-phanerophytic
APIACEAE		
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<i>Angelica sylvestris</i> L.	Eurasian	Hemi-cryptophytic
<i>Chaerophyllum aureum</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Chaerophyllum temulum</i> L.	Sub-Central European	Therophytic / Chamaephytic
<i>Daucus carota</i> L.	Sub-Eurasian	Therophytic / Chamaephytic
<i>Laserpitium siler</i> L.	Sub-Mediterranean	Hemi-cryptophytic
<i>Pastinaca sativa</i> L.	Eurasian	Therophytic / Chamaephytic
<i>Pimpinella major</i> (L.) Huds.	Sub-Central European	Hemi-cryptophytic
<i>Pleurospermum austriacum</i> Hoffm.	Sub-Boreal-Eurasian	Hemi-cryptophytic
<i>Sanicula europaea</i> L.	European-African	Hemi-cryptophytic
<i>Seseli rigidum</i> W. et K.	Moesian-Dacian	Hemi-cryptophytic
<i>Smyrniolum perfoliatum</i> L.	Sub-Mediterranean	Therophytic / Chamaephytic
ARACEAE		
<i>Arum maculatum</i> L.	Central European	Geophytic
ARALIACEAE		
<i>Hedera helix</i> L.	Sub-Atlantic-sub-Mediterranean	Phanerophytic liana
ARISTOLOCHIACEAE		
<i>Asarum europaeum</i> L.	Eurasian	Geophytic
ASCLEPIADACEAE		
<i>Cynanchum vincetoxicum</i> (L.) Pers.	Pontic-Central Asian	Hemi-cryptophytic
ASTERACEAE		
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<i>Centaurea phrygia</i> L.	Central European	Hemi-cryptophytic
<i>Centaurea scabiosa</i> L.	Sub-Pontic- Central Asian	Hemi-cryptophytic
<i>Cirsium candelabrum</i> Griseb.	Balkan	Therophytic / Chamaephytic
<i>Cirsium eriophorum</i> (L.) Scop.	Sub-Central European	Hemi-cryptophytic
<i>Cirsium erisithales</i> (Jacq.) Scop.	Sub-Central European	Hemi-cryptophytic
<i>Cirsium palustre</i> (L.) Scop.	Sub-Eurasian	Hemi-cryptophytic
<i>Crepis biennis</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Lactuca viminea</i> (L.) Presl.	Pontic-sub-Mediterranean	Therophytic / Chamaephytic
<i>Leontodon hispidus</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Leucanthemum vulgare</i> Lam.	Eurasian	Hemi-cryptophytic
<i>Mycelis muralis</i> (L.) Rchb.	Central European	Hemi-cryptophytic

Table 1. Continued.

SPECIES	FLORISTIC ELEMENT	LIFE FORM
<i>Piscris hieracoides</i> L.	Sub-Pontic- Central Asian	Hemi-cryptophytic
<i>Senecio jacobea</i> L.	Sub-Eurasian	Hemi-cryptophytic
<i>Senecio rupester</i> W. et K.	Sub-Balkan-sub-Apennine	Therophytic / Chamaephytic
<i>Tanacetum parthenium</i> (L.) Schultz.	Sub-Mediterranean	Hemi-cryptophytic
<i>Tragopogon orientalis</i> L.	Sub-Mediterranean-Pontic	Hemi-cryptophytic
BERBERIDACEAE		
<i>Berberis vulgaris</i> L.	Sub-Central European	Nano-phanerophytic
BORAGINACEAE		
<i>Anchusa officinalis</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Echium vulgare</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Lithospermum purpureo-coeruleum</i> L.	Pontic-sub-Mediterranean	Herbaceous-chamaephytic
<i>Pulmonaria officinalis</i> L.	Sub-Central European	Hemi-cryptophytic
BRASSICACEAE		
<i>Alliaria officinalis</i> Andr.	Subm-Middle-European	Hemi-cryptophytic
<i>Alyssum murale</i> Waldst. et Kit.	Pontic	Hemi-cryptophytic
<i>Arabis alpina</i> L. subsp. <i>alpina</i>	Arctic	Herbaceous-chamaephytic
<i>Arabis hirsuta</i> (L.) Scop.	Circumpolar	Therophytic / Chamaephytic
<i>Arabis turrata</i> (L.) Scop.	Sub-Mediterranean	Hemi-cryptophytic
<i>Cardamine bulbifera</i> (L.) Crantz.	Sub-Central European	Geophytic
<i>Cardamine impatiens</i> L.	Eurasian	Therophytic / Chamaephytic
<i>Draba lasiocarpa</i> Roch.	Sub-Pannonian	Hemi-cryptophytic
<i>Erysimum chrysanthum</i> Panč.	Endemic-Moesian	Hemi-cryptophytic
<i>Erysimum crepidifolium</i> Reichenb.	Sub-Pannonian	Therophytic / Chamaephytic
<i>Erysimum hieracifolium</i> L.	Central European	Therophytic / Chamaephytic
<i>Erysimum odoratum</i> Ehrh. var. <i>odoratum</i>	Pontic-Pannonian	Therophytic / Chamaephytic
<i>Lunaria rediviva</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Roripa sylvestris</i> (L.) Bess.	Sub-Eurasian	Hemi-cryptophytic
<i>Syrenia cuspidata</i> (M. Bieberst.) Reichenb.	Pontic	Therophytic / Chamaephytic
CAMPANULACEAE		
<i>Campanula cervicaria</i> L.	Sub-South Siberian	Hemi-cryptophytic
<i>Campanula glomerata</i> L.	Eurasian	Hemi-cryptophytic
<i>Campanula lingulata</i> W. et K.	Central Balkan-South Apennine	Therophytic / Chamaephytic
<i>Campanula patula</i> L.	Sub-Central European	Therophytic / Chamaephytic
<i>Campanula persicifolia</i> L.	Eurasian	Hemi-cryptophytic
<i>Campanula rapunculoides</i> L.	Sub-Central European	Geophytic
<i>Campanula sphaerotrix</i> Griseb.	Sub-Moesian	Therophytic
<i>Campanula trachelium</i> L.	Sub-Eurasian	Hemi-cryptophytic
CAPRIFOLIACEAE		
<i>Viburnum lantana</i> L.	Sub-Mediterranean	Nano-phanerophytic
CARYOPHYLLACEAE		
<i>Dianthus armeria</i> L.	Central European	Therophytic / Chamaephytic
<i>Dianthus carthusianorum</i> L.	Sub-Mediterranean	Hemi-cryptophytic
<i>Dianthus liburnicus</i> Bartl.	Sub-Mediterranean	Hemi-cryptophytic
<i>Dianthus petraeus</i> Waldst. et Kit. f. <i>liliodorus</i>	Endemic-sub-Moesian	Hemi-cryptophytic
<i>Dianthus petraeus</i> Waldst. et Kit. subsp. <i>noeanus</i> (Boiss.) Tutin	Endemic-West Moesian	Herbaceous-chamaephytic
<i>Lychnis coronaria</i> (L.) Desr.	Pontic-Central Asian	Hemi-cryptophytic
<i>Moehringia trinervia</i> (L.) Clairv.	Eurasian	Therophytic / Chamaephytic
<i>Petrohragia saxifraga</i> (L.) Link.	Sub-Mediterranean	Herbaceous-chamaephytic
<i>Silene pussila</i> W. et K.	Alpine-Carpathian	Hemi-cryptophytic
<i>Silene vulgaris</i> (Moench.) Garcke.	Sub-Eurasian	Hemi-cryptophytic
<i>Stellaria graminea</i> (L.) Scop.	Eurasian	Hemi-cryptophytic
CELASTRACEAE		
<i>Evonymus europaeus</i> L.	Sub-Central European	Nano-phanerophytic
<i>Evonymus latifolius</i> (L.) Mill.	Sub-Mediterranean	Nano-phanerophytic
<i>Evonymus verrucosus</i> Scop.	Sub-Pontic	Nano-phanerophytic
CISTACEAE		
<i>Helianthemum ovatum</i> (Viv.) Dum.	Mediterranean-sub-Mediterranean-Atlantic-Central European-Pontic-Central Asian	Woody-chamaephytic
CONVOLVULACEAE		
<i>Convolvulus arvensis</i> L.	Cosmopolitan	Geophytic
CORNACEAE		
<i>Cornus mas</i> L.	Pontic-sub-Mediterranean	Nano-phanerophytic
CORYLACEAE		

Table 1. Continued.

SPECIES	FLORISTIC ELEMENT	LIFE FORM
<i>Carpinus betulus</i> L.	Central European	Phanerophytic
<i>Carpinus orientalis</i> Mill.	East-sub-Mediterranean	Phanerophytic
<i>Corylus avellana</i> L.	Sub-Central European	Phanerophytic
<i>Corylus colurna</i> L.	Euxine-Iranian	Phanerophytic
CRASSULACEAE		
<i>Sedum album</i> L.	Sub-Central European	Herbaceous-chamaephytic
<i>Sedum telephium</i> L.	Eurasian	Hemi-cryptophytic
<i>Sempervivum zeleborii</i> Schott.	Pontic	Hemi-cryptophytic
CUPRESSACEAE		
<i>Juniperus sabina</i> L.	Eurasian	Nano-phanerophytic
CUSCUTACEAE		
<i>Cuscuta europaea</i> L.	Central European	Therophytic
CYPERACEAE		
<i>Carex caespitosa</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Carex pendula</i> Huds.	Sub-Atlantic-sub-Mediterranean	Hemi-cryptophytic
<i>Carex pilulifera</i> L.	Eurasian	Hemi-cryptophytic
DIPSACACEAE		
<i>Dipsacus laciniatus</i> L.	Pontic-Central Asian-sub-Mediterranean	Therophytic / Chamaephytic
<i>Dipsacus sylvester</i> Huds.	Sub-Central European	Therophytic / Chamaephytic
<i>Scabiosa columbaria</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Scabiosa ochroleuca</i> L.	Pontic-Central Asian	Hemi-cryptophytic
EQUISETACEAE		
<i>Equisetum arvense</i> L.	Circumpolar	Geophytic
<i>Equisetum telmateia</i> Ehrh.	Circumpolar	Geophytic
EUPHORBIACEAE		
<i>Euphorbia amygdaloides</i> L.	Sub-Atlantic-sub-Mediterranean	Herbaceous-chamaephytic
<i>Euphorbia platyphyllos</i> L.	Sub-Mediterranean	Therophytic
<i>Mercurialis perennis</i> L.	Sub-Central European	Geophytic
FABACEAE		
<i>Astragalus depressus</i> L. var. <i>depressus</i>	Sub-Mediterranean	Hemi-cryptophytic
<i>Coronilla varia</i> L.	Sub-Pontic	Hemi-cryptophytic
<i>Dorycnium herbaceum</i> Vill.	East-sub-Mediterranean	Woody-chamaephytic
<i>Lathyrus niger</i> (L.) Bernh.	Sub-Pontic	Geophytic
<i>Lathyrus pratensis</i> L.	Sub-Eurasian	Geophytic
<i>Lathyrus vernus</i> (L.) Bernh.	Sub-Central European	Geophytic
<i>Lotus corniculatus</i> L.	Sub-Eurasian	Hemi-cryptophytic
<i>Lotus siliquosus</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Medicago falcata</i> L.	Sub-Pontic-Central Asian	Hemi-cryptophytic
<i>Melilotus dentatus</i> (Waldst. et Kit.) Pers.	Pontic-Central Asian	Therophytic / Chamaephytic
<i>Ononis arvensis</i> L.	Sub-Central European	Herbaceous-chamaephytic
<i>Trifolium alpestre</i> L.	Sub-Pontic-Central Asian	Hemi-cryptophytic
<i>Trifolium campestre</i> Schreb.	Sub-Central European	Therophytic / Chamaephytic
<i>Trifolium diffusum</i> Ehrh.	Pontic-sub-Mediterranean	Therophytic
<i>Trifolium medium</i> Huds.	Sub-Central European	Hemi-cryptophytic
<i>Trifolium meneghenianum</i> Clem.	Moesian	Hemi-cryptophytic
<i>Trifolium pannonicum</i> L.	Pontic-East-sub-Mediterranean	Hemi-cryptophytic
<i>Trifolium repens</i> L.	Sub-Eurasian	Hemi-cryptophytic
<i>Trifolium strepens</i> Crantz.	Sub-Central European	Therophytic
<i>Vicia sparsiflora</i> Ten.	Sub-Pannonian	Hemi-cryptophytic
FAGACEAE		
<i>Fagus sylvatica</i> L. subsp. <i>moesiaca</i> (K. Maly) Hjelquist.	Moesian	Phanerophytic
<i>Quercus cerris</i> L.	East-sub-Mediterranean	Phanerophytic
<i>Quercus petraea</i> (Matt.) Liebl.	Central European	Phanerophytic
<i>Quercus pubescens</i> Willd.	Sub-Mediterranean	Phanerophytic
GERANIACEAE		
<i>Geranium dissectum</i> L.	Eurasian	Therophytic
<i>Geranium macrorrhizum</i> L.	East-sub-Mediterranean	Hemi-cryptophytic
<i>Geranium pusillum</i> Burm.	Sub-Central European	Therophytic / Chamaephytic
<i>Geranium robertianum</i> L.	Sub-Circumpolar	Therophytic / Chamaephytic
<i>Geranium rotundifolium</i> L.	Eurasian	Therophytic
GROSSULARIACEAE		
<i>Ribes multiflorum</i> Kit.	Balkan-Apennine	Nano-phanerophytic
HYPERICACEAE		
<i>Hypericum perforatum</i> L.	Sub-Eurasian	Hemi-cryptophytic
JUGLANDACEAE		
<i>Juglans regia</i> L.	Sub-Iranian-East-sub-Mediterranean	Phanerophytic

Table 1. Continued.

SPECIES	FLORISTIC ELEMENT	LIFE FORM
JUCACEAE		
<i>Juncus effusus</i> L.	Cosmopolitan	Hemi-cryptophytic
<i>Juncus glaucus</i> Ehrh.	Sub-Circumpolar	Hemi-cryptophytic
<i>Luzula luzuloides</i> (Lam.) Dandy et Wilmett. f. <i>laxa</i>	Central European	Hemi-cryptophytic
LAMIACEAE		
<i>Calamintha acinos</i> (L.) Clairv.	Sub-Pontic	Therophytic / Chamaephytic
<i>Calamintha officinalis</i> Moench.	Sub-Mediterranean	Hemi-cryptophytic
<i>Calamintha vulgaris</i> (L.) Druce.	Circumpolar	Hemi-cryptophytic
<i>Glechoma hirsuta</i> W. et K.	Pontic-East-sub-Mediterranean	Hemi-cryptophytic
<i>Mentha longifolia</i> Huds.	Sub-Central European	Geophytic
<i>Nepeta nuda</i> L.	Sub-Pontic	Hemi-cryptophytic
<i>Origanum vulgare</i> L.	Eurasian	Geophytic
<i>Prunella laciniata</i> L.	Pontic-sub-Mediterranean	Hemi-cryptophytic
<i>Prunella vulgaris</i> L.	Sub-Eurasian	Hemi-cryptophytic
<i>Salvia glutinosa</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Salvia verticillata</i> L.	Sub-Pontic-sub-Mediterranean	Hemi-cryptophytic
<i>Stachys germanica</i> L.	Pontic-sub-Mediterranean	Hemi-cryptophytic
<i>Stachys officinalis</i> (L.) Trevis.	Sub-Central European	Hemi-cryptophytic
<i>Teucrium chamaedrys</i> L.	Sub-Pontic-sub-Mediterranean	Woody-chamaephytic
<i>Teucrium montanum</i> L.	Sub-Mediterranean	Woody-chamaephytic
<i>Thymus jankea</i> Čel.	Moesian-Dacian	Herbaceous-chamaephytic
<i>Thymus marchallianus</i> Willd.	Pontic-Pannonian	Herbaceous-chamaephytic
<i>Thymus montanus</i> W. et K.	Eurasian	Herbaceous-chamaephytic
<i>Thymus pulegioides</i> L.	Sub-Central European	Herbaceous-chamaephytic
LILIACEAE		
<i>Leopoldia comosa</i> (L.) Burm.	Sub-Mediterranean	Geophytic
LYTHRACEAE		
<i>Lythrum salicaria</i> L.	Pontic-Central Asian-sub-Mediterranean	Hemi-cryptophytic
MALVACEAE		
<i>Crataegus calycina</i> Peter.	Central European	Phanerophytic
<i>Crataegus monogyna</i> Jacq.	Sub-Central European	Phanerophytic
<i>Crataegus oxyacantha</i> L.	Sub-Central European	Phanerophytic
<i>Crataegus pentagyna</i> W. et K.	Pontic-Pannonian	Phanerophytic
<i>Sorbus torminalis</i> (L.) Crantz.	Sub-Atlantic-sub-Mediterranean	Phanerophytic
MALVACEAE		
<i>Althea palida</i> (W. et K.) Willd.	Pontic-Pannonian	Therophytic / Chamaephytic
OENOTHERACEAE		
<i>Circaea alpina</i> L.	Sub-Boreal-Circumpolar	Geophytic
<i>Epilobium hirsutum</i> L.	Sub-Eurasian	Hemi-cryptophytic
<i>Epilobium montanum</i> L.	Eurasian	Hemi-cryptophytic
OLEACEAE		
<i>Fraxinus excelsior</i> L.	Sub-Central European	Phanerophytic
<i>Fraxinus ornus</i> L.	Sub-Mediterranean	Phanerophytic
<i>Ligustrum vulgare</i> L.	Sub-Central European	Nano-phanerophytic
<i>Syringa vulgaris</i> L.	Moesian-Dacian	Phanerophytic
ORCHIDACEAE		
<i>Epipogium aphyllum</i> S.W.	Eurasian	Geophytic
OROBANCHACEAE		
<i>Orobanche lutea</i> Baumg.	Sub-Pontic-Central Asian	Geophytic
OXALIDACEAE		
<i>Oxalis acetosella</i> L.	Circumpolar	Geophytic
PINACEAE		
<i>Abies alba</i> Mill.	Central European	Phanerophytic
<i>Picea abies</i> (L.) Karst.	Boreal-European	Phanerophytic
<i>Pinus nigra</i> Arn.	Sub-Mediterranean	Phanerophytic
PLANTAGINACEAE		
<i>Plantago altissima</i> L.	East-sub-Mediterranean	Hemi-cryptophytic
<i>Plantago lanceolata</i> L.	Eurasian	Hemi-cryptophytic
<i>Plantago maior</i> L.	Eurasian	Hemi-cryptophytic
POACEAE		
<i>Achnatherum calamagrostis</i> (L.) P. Beauv.	Sub-Mediterranean	Hemi-cryptophytic
<i>Agrostis tenuis</i> Sibth.	Circumpolar	Hemi-cryptophytic
<i>Agrostis verticillata</i> Vill.	Sub-Mediterranean	Hemi-cryptophytic
<i>Arrhenatherum elatius</i> (L.) W. et K.	Sub-Central European	Hemi-cryptophytic
<i>Brachypodium pinnatum</i> (L.) P. Beauv.	Sub-South Siberian	Hemi-cryptophytic
<i>Brachypodium silvaticum</i> (Huds.) P. Beauv.	Sub-South Siberian	Hemi-cryptophytic

Table 1. Continued.

SPECIES	FLORISTIC ELEMENT	LIFE FORM
<i>Briza media</i> L.	Eurasian	Hemi-cryptophytic
<i>Bromus mollis</i> L.	Sub-Mediterranean	Therophytic
<i>Bromus ramosus</i> Huds.	Sub-Eurasian	Hemi-cryptophytic
<i>Bromus squarrosus</i> L.	Sub-Mediterranean	Therophytic
<i>Bromus sterilis</i> L.	Sub-Eurasian	Therophytic
<i>Calamagrostis varia</i> (Schrad.) Host.	Eurasian	Hemi-cryptophytic
<i>Calamagrostis epigeios</i> (L.) Roth.	Eurasian	Hemi-cryptophytic
<i>Cynosurus cristatus</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Cynosurus echinatus</i> L.	Sub-Atlantic-sub-Mediterranean	Therophytic
<i>Festuca heterophylla</i> Lam.	Central European	Hemi-cryptophytic
<i>Festuca pratensis</i> Huds.	Eurasian	Hemi-cryptophytic
<i>Festuca rubra</i> L.	Circumpolar	Hemi-cryptophytic
<i>Festuca valesiaca</i> Schl.	Eurasian	Hemi-cryptophytic
<i>Holcus lanatus</i> L.	Eurasian	Hemi-cryptophytic
<i>Melica ciliata</i> L.	Sub-Mediterranean	Hemi-cryptophytic
<i>Melica transsilvanica</i> Schr.	Pontic	Hemi-cryptophytic
<i>Melica uniflora</i> Retz.	Central European	Geophytic
<i>Oryzopsis holciformis</i> (M.B.) Hack.	Iranian-Euxine	Hemi-cryptophytic
<i>Phleum pretense</i> L.	Sub-Eurasian	Hemi-cryptophytic
<i>Phragmites communis</i> Trin.	Cosmopolitan	Geophytic
<i>Poa nemoralis</i> L.	Circumpolar	Hemi-cryptophytic
<i>Poa trivialis</i> L.	Sub-Eurasian	Hemi-cryptophytic
POLYGALACEAE		
<i>Polygala comosa</i> Schk.	Sub-South Siberian	Hemi-cryptophytic
POLYGONACEAE		
<i>Rumex crispus</i> L.	Eurasian	Hemi-cryptophytic
<i>Rumex sanguineus</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Rumex stenophyllus</i> Ledeb.	Pontic-Central Asian	Hemi-cryptophytic
POLYPODIACEAE		
<i>Asplenium trichomanes</i> L.	Cosmopolitan	Hemi-cryptophytic
<i>Athyrium filix-femina</i> (L.) Roth.	Cosmopolitan	Hemi-cryptophytic
<i>Ceterach officinarum</i> D.C.	Sub-Atlantic-sub-Mediterranean	Hemi-cryptophytic
<i>Cystopteris fragilis</i> (L.) Berhnardi et Schr.	Cosmopolitan	Hemi-cryptophytic
<i>Dryopteris filix-mas</i> (L.) Rich.	Cosmopolitan	Hemi-cryptophytic
<i>Phyllitis scolopendrium</i> (L.) Newman.	Circumpolar	Hemi-cryptophytic
<i>Polypodium vulgare</i> L.	Sub-Circumpolar	Hemi-cryptophytic
<i>Polystichum aculeatum</i> (L.) Roth.	Cosmopolitan	Hemi-cryptophytic
<i>Polystichum lonchitis</i> (L.) Roth.	Sub-Arctic	Hemi-cryptophytic
<i>Polystichum setiferum</i> (Forsk.) Moore.	Cosmopolitan	Hemi-cryptophytic
<i>Pteridium aquilinum</i> (L.) Kuhn.	Cosmopolitan	Geophytic
PRIMULACEAE		
<i>Lysimachia nummularia</i> L.	Sub-Central European	Herbaceous-chamaephytic
<i>Lysimachia vulgaris</i> L.	Eurasian	Hemi-cryptophytic
RANUNCULACEAE		
<i>Aconitum anthora</i> L.	Sub-South Siberian	Hemi-cryptophytic
<i>Aconitum paniculatum</i> Lam.	Central European	Hemi-cryptophytic
<i>Anemone nemorosa</i> L. f. bosniaca	Circumpolar	Geophytic
<i>Clematis vitalba</i> L.	Sub-Atlantic-sub-Mediterranean	Phanerophytic
<i>Helleborus odorus</i> W. et K.	Central European	Hemi-cryptophytic
<i>Hepatica nobilis</i> Mill.	Circumpolar	Hemi-cryptophytic
<i>Ranunculus platanifolius</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Thalictrum flavum</i> L.	Eurasian	Hemi-cryptophytic
<i>Thalictrum minus</i> L.	Eurasian	Hemi-cryptophytic
RHAMNACEAE		
<i>Frangula alnus</i> Mill.	Sub-Central European	Nano-phanerophytic
<i>Rhamnus catharticus</i> L.	Sub-Pontic-Central Asian	Nano-phanerophytic
ROSACEAE		
<i>Agrimonia eupatoria</i> L.	Eurasian	Hemi-cryptophytic
<i>Aremonia agrimonioides</i> (L.) Neck.	East-sub-Mediterranean	Hemi-cryptophytic
<i>Fragaria vesca</i> L.	Eurasian	Hemi-cryptophytic
<i>Geum urbanum</i> L.	Eurasian	Hemi-cryptophytic
<i>Potentilla inclinata</i> Vill.	Sub-Pontic-Central Asian	Hemi-cryptophytic
<i>Prunus mahaleb</i> L.	Pontic-Central Asian-sub-Mediterranean	Phanerophytic
<i>Prunus spinosa</i> L.	Sub-Pontic	Nano-phanerophytic
<i>Pirus piraster</i> Burgs.	Sub-Central European	Phanerophytic
<i>Rosa arvensis</i> Huds.	Sub-Atlantic-sub-Mediterranean	Nano-phanerophytic
<i>Rosa canina</i> L.	Sub-Central European	Nano-phanerophytic

Table 1. Continued.

SPECIES	FLORISTIC ELEMENT	LIFE FORM
<i>Rosa vosagiaca</i> Desp.	Sub-Central European	Nano-phanerophytic
<i>Rubus canescens</i> D.C.	Pontic-sub-Mediterranean	Nano-phanerophytic
<i>Rubus hirtus</i> W. et K.	Central European	Nano-phanerophytic
<i>Rubus idaeus</i> L.	Circumpolar	Nano-phanerophytic
<i>Sanguisorba minor</i> Scop.	Sub-Eurasian	Hemi-cryptophytic
RUBIACEAE		
<i>Asperula odorata</i> L.	Sub-Eurasian	Geophytic
<i>Asperula purpurea</i> (L.) Ehrend.	Mediterranean-sub-Mediterranean	Herbaceous-chamaephytic
<i>Galium aparine</i> L.	Eurasian	Therophytic
<i>Galium aristatum</i> Schr.	Alpine-Balkan	Hemi-cryptophytic
<i>Galium lucidum</i> All.	Sub-Mediterranean	Herbaceous-chamaephytic
<i>Galium mollugo</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Galium purpureum</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Galium schultesii</i> Vest.	Sub-Pontic-sub-Pannonian	Geophytic
<i>Galium verum</i> L.	Eurasian	Geophytic
SALICACEAE		
<i>Populus alba</i> L.	Sub-South Siberian	Phanerophytic
SAMBUCACEAE		
<i>Sambucus ebulus</i> L.	Sub-Pontic-sub-Mediterranean	Geophytic
<i>Sambucus nigra</i> L.	Sub-Central European	Nano-phanerophytic
SAXIFRAGACEAE		
<i>Saxifraga aizoon</i> Jacq.	Arctic	Herbaceous-chamaephytic
<i>Saxifraga rotundifolia</i> L.	Sub-Mediterranean	Hemi-cryptophytic
SCROPHULARIACEAE		
<i>Digitalis ferruginea</i> L.	East-sub-Mediterranean	Geophytic
<i>Linaria vulgaris</i> (L.) Mill.	Sub-Central European	Hemi-cryptophytic
<i>Scrophularia nodosa</i> L.	Eurasian	Hemi-cryptophytic
<i>Verbascum nigrum</i> L.	Eurasian	Hemi-cryptophytic
<i>Verbascum phlomoides</i> L.	Sub-Pontic-sub-Mediterranean	Therophytic / Chamaephytic
<i>Veronica teucrium</i> L.	Eurasian	Herbaceous-chamaephytic
SOLANACEAE		
<i>Atropa belladonna</i> L.	Sub-Central European	Hemi-cryptophytic
<i>Solanum dulcamara</i> L.	Sub-Eurasian	Woody-chamaephytic
STAPHYLEACEAE		
<i>Staphylea pinnata</i> L.	Sub-Euxine	Nano-phanerophytic
TAXACEAE		
<i>Taxus baccata</i> L.	Sub-Atlantic-sub-Mediterranean	Phanerophytic
THYMELACEAE		
<i>Daphne mesereum</i> L.	Sub-South Siberian	Nano-phanerophytic
TILIACEAE		
<i>Tilia cordata</i> Mill.	Sub-Central European	Phanerophytic
<i>Tilia platyphyllos</i> Scop.	Central European	Phanerophytic
<i>Tilia tomentosa</i> Moench.	Endemic-sub-Balkan	Phanerophytic
TYPHACEAE		
<i>Typha angustifolia</i> L.	Circumpolar	Geophytic
ULMACEAE		
<i>Ulmus glabra</i> Huds.	Sub-Central European	Phanerophytic
URTICACEAE		
<i>Parietaria officinalis</i> L.	Sub-Mediterranean	Hemi-cryptophytic
<i>Urtica dioica</i> L.	Eurasian	Hemi-cryptophytic
VIOLACEAE		
<i>Viola elatior</i> Fr.	Sub-South Siberian	Hemi-cryptophytic
<i>Viola hirta</i> L.	Sub-South Siberian	Hemi-cryptophytic
<i>Viola macedonica</i> Boiss. Et Heldr.	Endemic-sub-Moesian	Herbaceous-chamaephytic