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HABITATS AND FLORA IN PROTECTED SITES „PREOBRAZHENSKI MONASTERY" AND „DERVENTA", NORTH-CENTRAL BULGARIA

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Abstract: The work contains the results from the investigation of habitats and flora in protected sites „Preobrazhenski Monastery" and „Derventa", Veliko Tarnovo, Northern Bulgaria. Four phytocoenological relevés were made in represented stands of the forest vegetation. Habitats were determined according to EUNIS habitat classification and mapped. Totally 102 species of 81 genera, belonging to 44 families were established in the flora of the two protected sites. More than one fifth of the flora consists of Euro-Mediterranean elements including the Euro-subMediterranean. The larger part of the area of the two protected sites is covered by habitat G1.7C41 Silver lime forest (91Z0 in Natura 2000). These forests are an element of intrazonal relic forest vegetation. Forests of *Acer spp*. and *Tilia platyphyllos* distributed on steeper and eroded slopes are affiliated to habitat G1.A46 Southeastern European ravine forests (9180 in Natura 2000). The anthropogenic structures are affiliated to J2.2 Rural public buildings and J4.2 Road networks. On the basis of the obtained results some conclusions and recommendations for the conservation and management of the two protected territories are proposed.

INTRODUCTION

The nationally designated protected territories in Bulgaria cover 5.3% of the area of the country. According to the Executive Environmental Agency in Bulgaria there are 563 protected sites, VIth category of protected territory according to

the Protected Areas Act (1998). Most scientific projects and research, however more or less have been concentrated in the national and nature parks and the reserves since there are strict legal rules and obligations for their management and conservation. The scientific investigations in the protected sites are fragmentary or missing. Since the protected sites are designated to preserve any rare and endangered species or valuable natural habitats or landscapes there is a strong necessity of profound and systematical studies of their biota also.

The objects of the present study are the neighboring protected sites „Preobrazhenski monastery" and „Derventa" located near Veliko Tarnovo town, Nortern Bulgaria. Both sites were designated to protect old natural silver lime forests in the region of Preobrazhenski Monastery which is a preferred tourist destination for many Bulgarian and foreign tourists. These forests maintain a favorable and attractive environment for the guests of the Monastery which raises the question for the application of adequate measures for their conservation. Silver lime forests could be considered as a relic residual of the mesophyllous broadleaved forests with limes and oaks which had been widely distributed in the continental part of Southern Europe during ancient times (Bondev, 1991; Tzonev, 2003; Tzonev, 2015). Their economic value and health status were also of scientific interest (Kalmukov, 1987). Occupying about 1.5% of the forested area of the country these forests are highly productive and in a relatively good health condition but particular measures for their management are necessary for the creation and maintenance of stable forest stands (Kalmukov, 2014). Syntaxonomically the silver lime forests from the Middle Danube Plain were investigated (Tzonev, 2003) and affiliated to *ass. Staphyleo-Tilietum tomentosae*. In "Preobrazhenski Monastery" protected site these forests are a habitat of a hundred years old Corylus colurna population.

According to the results of the project "Mapping and determination of the conservation status of nature habitats and species – phase I" implemented under the Operational Programme Environment 2007-2013 of the EU *Tilia tomentosa* forests in the protected site "Preobrazhenski Monastery" were mapped as habitat 9180 Tilio-Acerion forests of slopes, screes and ravines. The results of the mapping are available in the Natura 2000 information system in Bulgaria at http://natura2000.moew.government.bg.

The aims of the present study were the following: 1) Identification of the floristic composition and analysis of the phytogeographical structure and biological spectrum of the vascular flora of the protected sites „Preobrazhenski monastery" and „Derventa"; 2) Determination of the habitats of the two protected sites according to the classification of EUNIS (European Nature Information System) , and 3) Mapping the habitats (including the artificial ones) in the studied area for practical purposes and recommendations for management and protection.

MATERIALS AND METHODS

Study area

The protected sites are located in the land of Samovodene village, situated in a few kilometres north from Veliko Tarnovo town on a hilly terrain at about 300 m a.s.l. According to the physical-geographic division of the country the protected sites are located in the middle part of the North Low Forebalkan (Yordanova *et al.* 2002).

The climate is typical temperate continental with some of the lowest average January temperatures in the country and with a May-June maximum and February rainfall minimum (Velev, 2002). The soil cover is dense with a predominant composition of gray forest soils (Ninov, 2002). Rocks are mainly lower cretaceous limestones. The water resources in the territory consist of the passing Yantra River and its tributary Rositsa River which have a rainy-snow regime and maximum river flow in the spring (Yordanova, 2002).

The protected site "Preobrazhenski Monastery" was designated in 1974 to conserve a natural location of *Corylus colurna*. It overlaps partially with protected site "Derventa", which was declared in 1971 to conserve typical zonal broadleaved forests in the region. The two protected sites fall within the territory of Natura 2000 site BG0000213 Tarnovski visochini announced under the Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora).

Methods

The region was visited several times during the period April – July 2018 along a route with transects which were chosen to cover maximum area of the two protected sites. The determination of the vascular plants is according to Delipavlov and Cheshmedzhiev (2012). Geoelements are indicated in accordance with Walter's system (Assyov *et al.,* 2012). Life-forms are assigned according to the system of Raunkiaer (1934).

The determination of the habitats and the characterization of the plant communities in the territory were made in accordance with the principles of the Braun-Blanquet phytosociological school (Braun-Blanquet, 1964). Four phytocoenological relevés were made in representative plots in the forest vegetation of the protected sites. Species abundances were estimated and recorded according to the 9th degree Braun-Blanquet scale (Muller-Dombois and Ellenberg, 1974). The habitats were characterized on the basis of floristic and ecological features of the plant communities and determined (including the artificial ones) according to the classification of EUNIS (European Union Nature Information System, Moss, 2008). For practical purposes of management and conservation of the protected sites the correspondence of the EUNIS habitats to Annex 1 of the Habitats Directive and Annex 3 of the Biological Diversity Act are also indicated.

The determined EUNIS habitats are mapped in a GIS environment. The GIS project was created using digital forest maps for the forest divisions and subdivisions in the region of Preobrazhenski Monastery situated at the territory of Regional Forest

Directorate Veliko Tarnovo. The information is also available at an interactive platform Forests of Bulgaria (https://gis.wwf.bg). A satellite image was used as a basis and the GPS coordinates of the four phytocoenological relevés were added.

RESULTS AND DISCUSSION

Flora

Totally 102 species of 81 genera, belonging to 44 families were established in the flora of the protected sites "Preobrazhenski Monastery" and "Derventa". The richest family is Rosaceae presented by 10 species. The richest genera are Lamium (presented by 4 species) followed by Ranunculus and Viola both presented by 3 species each. The full list of species is presented at an Appendix to the paper.

The species originating and distributed in Eurasia and Siberia (the Euro-Asian and Euro-Siberian geoelements) are 23% totally (Fig. 1). The European elements originating from Central Europe are 13% (Galanthus elwesii, Pulmonaria officinalis, Tilia platyphyllos, etc.). The relatively high share of the European floristic element, in its broader sense, shows the origin of the investigated flora and vegetation from the European continent. More than one fifth of the flora of the two protected sites consists of Euro-Mediterranean elements including the Euro-subMediterranean. These are species with origin and distribution mainly in Europe but also in the Mediterranean to some extent, such as Carpinus betulus, Helleborus odorus, Quercus cerris, the dominant Tilia tomentosa, the relic Staphylea pinnata and many others (see Appendix). The participation of the Mediterranean geoelements (5%) shows clear floristic relations to southern floras of the region. The category "others" combines floristic elements presented by one species each. These are the Adventive, the Alpo-Balkan and species belonging to the Pontic floristic element (in the broad sense) with low weight in the investigated flora. There are no (sub)-endemics which confirms the European origin and distribution of the forests in the two protected sites.

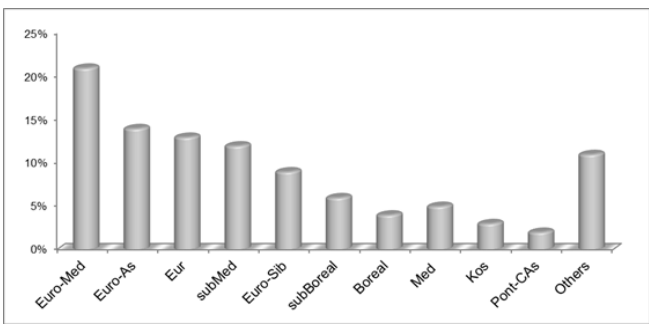

Fig. 1 Proportions of the geoelements in the investigated flora

There are two adventive geoelements in the investigated flora included also in the category "others". These are the aliens *Erigeron canadensis* (syn. *Conyza canadensis*) and *Ailanthus altissima* (Petrova *et al.* 2013). These species are one of the real threats for the natural character of the flora and vegetation of the region, especially as their control is extremely difficult.

The biological spectrum shows the typical for the temperate zone distribution of broadleaved forest vegetation with predominance of hemicryptophytes. The proportions of the life forms, especially these of hemicryptophytes (H) and therophytes (Th) are very close to these of the forests in the temperate-cold zone (Pavlov and Dimitrov, 2012) (Table 1). This fact underlies the origin and relations of the forest vegetation in the two protected sites to the typical Middle European and even Boreal forests. The comparatively large number of phanaerophytes (Ph) presented by trees and shrubs shows the closeness of the neighboring xerophilous oak forests. The relatively large size of the geophytes (G) can be associated with the presence of a well-expressed complex of ephemeroids during spring (*Corydalis solida, Ranunculus ficaria, Cyclamen hederifolium, Polygonatum latifolium, Polygonatum odoratum, Galanthus elwesii, Neottia nidus-avis).* Chamaephytes (Ch) are presented by 2%.

Table 1. Biological spectrum of the flora in the two protected sites and comparisons with other floras (according to Pavlov and Dimitrov, 2012)

Type of vegetation	Raunkiaer life forms, %				
	Ph	Ch	H	G	Th
Flora of the protected sites "Preobrazhenski Monastery" and "Derventa"	26	2	55	12	5
Normal biological spectrum (flora of the Earth)	46	9	26	6	3
Forests of the temperate-warm zone	54	9	24	9	4
Forests of the temperate-cold zone	10	17	54	2	7

Several plant species of conservation significance grow in the protected sites "Preobrazhenski Monastery" and "Derventa". These are the following:

- Galanthus elwesii - Annex 3 of the Biological Diversity Act, Red Data Book of the Republic of Bulgaria, category Endangered (Evstatieva, 2015).
- Neottia nidus-avis – Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora – CITES.
- Ruscus aculeatus – Annex 4 of the Biological Diversity Act (2002).
- Ruscus hypoglossum - Annex 4 of the Biological Diversity Act (2002).

The primary origin of the investigated flora and vegetation are the tertiary relics *Acer campestre, Carpinus betulus, Corylus avellana, C. colurna, Quercus cerris, Ruscus aculeatus, R. hypoglossum, Staphylea pinnata* and *Tilia tomentosa*.

Habitats

The larger part of the area of the two protected sites is covered by old forests dominated by *Tilia tomentosa*. They occupy southern and eastern slopes with 5-35° inclination on humid and fertile soils. The total coverage of the vegetation is 70-80%. Co-dominant or accompanying tree species are *Tilia platyphyllos, Quercus robur, Q. cerris* and *Acer spp.* at some stands. In the tree layer the relic species *Corylus colurna* also participates presented by a hundred years old individuals. Its old population was the motive for the designation of the protected site "Preobrazhenski Monastery". There is clear stratification in the forest structure with shrub and herbaceous layer. The coverage of the herbaceous layer is between 35 and 70% and most abundant species are *Polygonatum odoratum, Hedera helix, Viola odorata, Geum urbanum, Arum maculatum, Helleborus odorus, Tamus communis, Mercurialis ovata, Melittis melissophyllum, Stellaria holostea* (Table 2). Many of these species show relation of this habitat to the order Fagetalia and alliance Carpinion betuli (Tzonev, 2003).

A specific feature of these forests is the relatively high soil and air humidity. The participation of *Staphylea pinnata, Ruscus aculeatus, R. hypoglossus,* and more rarely *Corylus avellana* in the shrub layer emphasizes their relic character.

Table 2. Phytocoenological relevés in protected sites "Preobrazhenski Monastery" and "Derventa"

№ of relevé	**1**	**2**	**3**	**4**
Altitude, m	213	325	320	263
Exposition	S-SE	S	S	SE
Slope, degrees	5-10°	35°	15°	30-35°
Canopy, %	70%	70%	65%	80%
Date	29.6.2018	29.6.2018	29.6.2018	29.6.2018
GPS coordinates	N43.1081	N43.11478	N43.11558	N43.11909
	E25.6119	E25.60656	E25.60653	E25.60800
Trees				
Tilia tomentosa	4	3	3	4
Tilia platyphyllos	+	2b		
Quercus robur	2a		2b	
Quercus cerris	2a			
Acer platanoides		2a		+
Acer campestre	2m		2a	

Corylus colurna		2a	2a	+
Ailanthus altissima				+
Prunus cerasifera		+		
Fraxinus ornus		1		
Shrubs				
Acer campestre	2a		2a	
Acer platanoides		2a		+
Crataegus monogina	2a			
Cornus sangvinea	2b		2b	2a
Carpinus orientalis		+	3	
Ruscus aculeatus	2a			3
Ruscus hypoglossum		2a	1	2a
Fraxinus ornus			2m	
Tilia tomentosa	2a		2a	2a
Tilia platyphyllos		3		
Ligustrum vulgare	2m			
Viburnum lantana	2a			
Staphylea pinnata	2m	3		2a
Sorbus torminalis			+	
Ulmus glabra	+	+		+
Herbaceous layer				
Buglossoides purpurocaerulea	2m			
Pulmonaria officinalis	2a		+	
Polygonatum odoratum	2a	+	+	2m
Carex pilosa	2a			
Hedera helix	2a	2m	2m	2a
Ranunculus sp.	1			
Fragaria moschata	+		+	
Aremonia agrimonoides	+		+	

Melittis melissophyllum	1		+	
Mercurialis ovata	1	2m		
Hypnum cupressiforme	1	+		
Tamus communis	2m	+		2m
Arum maculatum	2m	+	1	+
Viola odorata	2m	2m	2m	2a
Brachypodium sylvaticum	+			+
Geum urbanum	+	+	+	
Lathyrus venetus	+			
Vincetoxicum hirundinaria	+			
Arctium minus	+			
Viburnum opulus		1		
Neottia nidus-avis		2m		
Helleborus odorus		+	2m	
Stellaria holostea			3m	
Lamium maculatum			2m	
Glechoma hirsuta			+	
Glechoma hederacea			3	
Melica uniflora			2m	
Scutellaria altissima				+
Poa nemoralis				+
Laser trilobum	+			
Piptatherum virescens				+

In the EUNIS classification these forests are affiliated to habitat G1.7C41 Silver lime woods which correspond to habitat 91Z0 Moesian silver lime woods in Natura 2000. Our analysis shows that this habitat occupies more than 2/3 of the area of both protected sites – 20.147 ha totally although during the implementation of the project "Mapping and determination of the conservation status of nature habitats and species – phase I" within the Operational Programme Environment 2007-2013 the whole territory of the protected site "Preobrazhenski Monastery" was mapped as habitat 9180.

A small area of the territory of the protected site "Derventa" enclosing two forest subdivisions with dominant tree species *Acer campestre* and *Tilia platyphyllos* on steep and stony slopes are considered and mapped during this study as habitat G1.A46 Southeastern European ravine forests corresponding to Natura 2000 habitat 9180 Tilio-Acerion forests of slopes, screes and ravines (**Fig. 2**). Their total area is 5.043 ha. Further investigations and phytocoenological relevés are necessary to verify this determination.

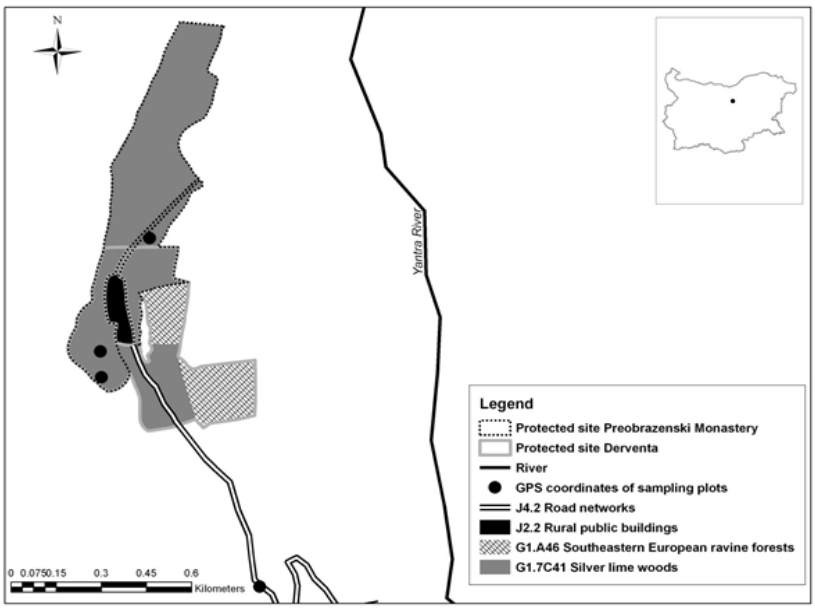

Fig. 2 A map of the EUNIS habitats in protected sites "Preobrazhenski Monastery" and "Derventa"

The monastery and the roads in the region are treated as anthropogenic (artificial) habitats and affiliated to J2.2 Rural public buildings and the roads – J4.2 Road networks respectively. It could be seen on Fig. 2 that there is partial overlapping of the two protected sites in the region of the monastery. Although the anthropogenic structure causes habitat fragmentation of the natural forest vegetation the map of the habitats illustrates the potential sustainable use of the landscape, which should be achieved according to the management and conservation regimes in the two protected sites.

During the field work and the analysis, we noticed some threats for the natural vegetation in the protected territories. One of them is the penetration of the invasive plant *Ailanthus altissima* in the forest and another is the illegal

motorcycling along the paths which causes noise pollution for animals and leads to erosion of the steep slopes. If people do not observe the rules prescribed by the law when visiting protected sites, the intensive stream of tourists during holidays could also be considered as a threat.

CONCLUSION

The flora of the protected sites consisting of 102 vascular plant species equals to 2.5% of the vascular flora of the country calculated on the basis of 4 064 species reported by Petrova and Vladimirov, 2018. More than a half of the flora consists of species that originate and are distributed in Europe and Eurasia. The larger part of the area of the two protected sites is occupied by Silver lime forests distributed also in the Eastern part of the Danube Plain. These primary relic forests with many mesophyllous species in their composition could be considered as a residual of the continental mesophyllous forest vegetation since the time of their maximal distribution in the Danube Plain (Tzonev, 2003). In this sense they are an element of intrazonal relic forest vegetation which is underlined by the relics in them (*Staphylea pinnata, Ruscus aculeatus, Tilia tomentosa, Corylus colurna*). The habitat diversity of the two protected sites is complemented by Southeastern European ravine forests occupying about 5 ha and two anthropogenic habitats – Rural public buildings and Road networks.

The analysis of the phytogeographic spectrum showed the Central-European origin of the investigated flora and marked relations with Southwest Asia and the Sub-Mediterranean. The abundance of trees and shrubs determines the area as a typical forest habitat and the predominant in the biological spectrum hemicryptophytes show the characteristic vegetation for temperate latitudes with a strong continental influence. The results of the present research give us a reason to make a recommendation for the merging of the two protected sites which will optimize their management and conservation.

Appendix. Vascular flora of the protected sites "Preobrazhenski Moastery" and "Derventa"

Species	Family	Geoelement	Life form
Acer campestre L.	Aceraceae	Eur-OT	Ph
Acer platanoides L.	Aceraceae	subMed	Ph
Galanthus elwesii Hook.f.	Amaryllidaceae	Eur	Cr
Aegopodium podagraria L.	Apiaceae	Eur-Sib	H
Angelica sylvestris L.	Apiaceae	Eur-Sib	H
Laser trilobum (L.) Borkh.	Apiaceae	Eur-Med	H

Arum maculatum L.	Araceae	Eur-subMed	Cr
Hedera helix L.	Araliaceae	Eur-As	H
Vincetoxicum hirundinaria Medicus	Asclepiadaceae	Eur-Sib	H
Ruscus aculeatus L.	Asparagaceae	SPont	Ch
Ruscus hypolossum L.	Asparagaceae	Pont	Ch
Arctium minus (Hill) Bernh.	Asteraceae (Compositae)	Eur-As	H
Artemisia vulgaris L.	Asteraceae (Compositae)	subBoreal	H
Bellis perennis L.	Asteraceae (Compositae)	Eur-As	H
Cichorium intybus L.	Asteraceae (Compositae)	Eur-Sib	H
Erigeron canadensis L.	Asteraceae (Compositae)		H
Mycelis muralis (L.) Dumort.	Asteraceae (Compositae)	Med	H
Taraxacum officinale (L.) Weber ex F.H.Wigg.	Asteraceae (Compositae)	Eur-Med	H
*Buglossoides purpurocaerulea (*L.) I.M.Johnst.	Boraginaceae	Eur-As	H
Pulmonaria officinalis L.	Boraginaceae	Eur	H
Cardamine bulbifera (L.) Crantz	Brassicaceae	subBoreal	Cr
Campanula bononiensis L.	Campanulaceae	Eur	H
Sambucus ebulus L.	Caprifoliaceae	Eur-Med	H
Sambucus nigra L.	Caprifoliaceae	Eur-Med	Ph
Viburnum lantana L.	Caprifoliaceae	Eur-Med	Ph
Viburnum opulus L	Caprifoliaceae	Eur-Sib	Ph
Saponaria officinalis L	Caryophyllaceae	Eur-Sib	H
Stellaria holostea L	Caryophyllaceae	Eur-Sib	H
Stellaria media (L.) Vill.	Caryophyllaceae	Kos	H
*Calystegia silvatica (*Kit.) Griseb.	Convolvulaceae	Med	H
Cornus mas L.	Cornaceae	subMed	Ph
Cornus sanguinea L.	Cornaceae	subMed	Ph
Carpinus betulus L.	Corylaceae	Eur-subMed	Ph
Carpinus orientalis Mill.	Corylaceae	subMed	Ph

Corylus avellana L.	Corylaceae	Med-Cas	Ph
Corylus colurna L.	Corylaceae	Pont-Cas	Ph
Carex pilosa Scop.	Cyperaceae		H
Tamus communis L.	Dioscoreaceae	subMed	H
Euphorbia cyparissias L.	Euphorbiaceae	Eur	Th
*Mercurialis ovata S*ternb. & Hoppe	Euphorbiaceae	subMed	H
*Lathyrus venetus (*Mill.) Wohlf.	Fabaceae (Papilionaceae)	Eur-Med	H
Trifolium hybridum L.	Fabaceae (Papilionaceae)	Eur-Med	H
Quercus cerris L.	Fagaceae	Eur-subMed	Ph
Quercus robur L.	Fagaceae	subMed	Ph
Corydalis solida (L.) Clairv.	Fumariaceae	Eur-Med-Cas	Cr
Geranium macrorrhizum L.	Geraniaceae	Eur-Med	H
Glechoma hirsuta Waldst. & Kit.	Lamiaceae	Eur-Med	H
Glechoma hederacea L.	Lamiaceae	Eur-As	H
Lamium garganicum L.	Lamiaceae	Med	H
*Lamium maculatum (*L.) L.	Lamiaceae	subBoreal	H
Lamium purpureum L.	Lamiaceae	Eur-Med	H
Lamium galeobdolon (L.) L.	Lamiaceae	Med	H
Melittis melissophyllum L.	Lamiaceae	Eur	H
Scutellaria altissima L.	Lamiaceae	Eur	H
Ornithogalum montanum Cirillo	Liliaceae	Ap-Bal	Cr
Polygonatum latifolium Desf.	Liliaceae	Boreal	Cr
Polygonatum odoratum (Mill.) Druce	Liliaceae	Eur-Sib	Cr
Fraxinus ornus L.	Oleaceae	subMed	Ph
Ligustrum vulgare L.	Oleaceae	subMed	Ph
Epilobium montanum L.	Onagraceae	Eur-OT	H
*Neottia nidus-avis (*L.) Rich.	Orchidaceae	Eur-As	Cr
Chelidonium majus L.	Papaveraceae	Eur-As	H

Plantago major L.	Plantaginaceae	Boreal	H
*Brachypodium sylvaticum (*Huds.) P.Beauv.	Poaceae	Eur-As	H
Melica uniflora Retz.	Poaceae	Eur	H
Poa nemoralis L.	Poaceae	Boreal	H
*Piptatherum virescens (*Trin.) Boiss.	Poaceae	Med	H
Rumex crispus L.	Polygonaceae	Boreal	H
Cyclamen hederifolium Aiton	Primulaceae	subMed	Cr
Anemone ranunculoides L.	Ranunculaceae	Eur-subMed	H
Clematis vitalba L.	Ranunculaceae	Eur	Ph
Helleborus odorus Waldst. & Kit. ex Willd.	Ranunculaceae	Eur-subMed	Cr
Ranunculus auricomus L.	Ranunculaceae	Eur-Med	H
Ranunculus ficaria L.	Ranunculaceae	Eur-Sib	Cr
Ranunculus lanuginosus L.	Ranunculaceae	Eur	H
Aremonia agrimonoides (L.) DC.	Rosaceae	subMed	H
Crataegus monogyna Jacq.	Rosaceae	subBoreal	Ph
Fragaria moschata (Duchesne) Duchesne	Rosaceae	Eur-Pont	H
Geum urbanum L.	Rosaceae	subBoreal	H
Potentilla obscura Willd.	Rosaceae	Eur	H
Prunus cerasifera Ehrh.	Rosaceae	Eur-As	Ph
Rosa sp.	Rosaceae		Ph
Rubus caesius L.	Rosaceae	Eur-As	Ph
Sorbus aucuparia L.	Rosaceae	subBoreal	Ph
Sorbus torminalis (L.) Crantz	Rosaceae	Pont-Med	Ph
Cruciata laevipes Opiz	Rubiaceae	subMed-Cas	H
Galium aparine L.	Rubiaceae	Eur-As	Th
Lathraea squamaria L.	Scrophulariaceae	Eur-As	Cr
Verbascum nigrum L.	Scrophulariaceae	Pont-Cas	H
Veronica chamaedrys L.	Scrophulariaceae	Eur-As	H
Veronica hederifolia L.	Scrophulariaceae	Eur-Med	Th
Ailanthus altissima (Mill.) Swingle	Simaroubaceae	Adv	Ph

Staphylea pinnata L.	Staphyleaceae	Eur-Med	Ph
Tilia platyphyllos Scop.	Tiliaceae	Eur	Ph
*Tilia tomentosa (*MOENCH*)*	Tiliaceae	Eur-Med	Ph
Ulmus glabra Huds.	Ulmaceae	Eur-Med	Ph
Parietaria officinalis L.	Urticaceae	Eur	Th
Urtica dioica L.	Urticaceae	Boreal	H
Verbena officinalis L.	Verbenaceae	Kos	H
Viola arvensis L.	Violaceae	Eur	Th
Viola odorata L.	Violaceae	Eur-Med	H
Viola reichenbachiana Jord. ex Boreau	Violaceae	Eur-As	H

CONFLICT OF INTERESTS AND AN AUTHORSHIP STATEMENT

This manuscript has not been submitted to, nor is under review at, another journal or other publishing venue. The authors have no affiliation with any organization with a direct or indirect financial interest in the subject matter discussed in the manuscript.

G.N. and K.P. planned the research, implemented the field sampling and performed the analyses. G.N. also led the writing of the manuscript. G.P. made the map of the habitats. All authors revised the manuscript.

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