Excursion guide III

Devínska Kobyla and Sandberg National Nature Reserve and Protected Site

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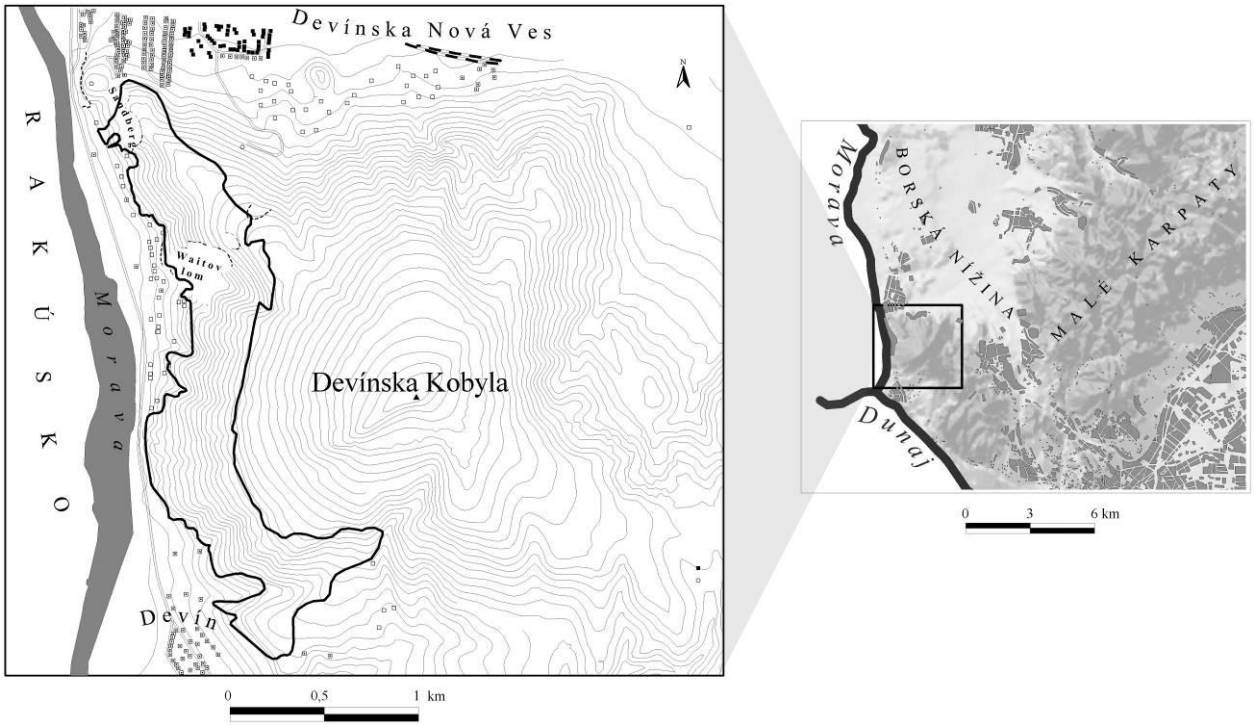
Geography

The National Natural Reserve (NNR) Devínska Kobyla and the protected site Sandberg, a well known botanical, palaeontological and geological localities, are the southern-most parts of the Protected Landscape Area Malé Karpaty, called also Devínske Karpaty, located between the Morava and Danube rivers, where the Carpathian Mountains meet with the Pannonian Basin. The Slovak-Austrian border, the municipal parts of Bratislava, former villages Devínska Nová Ves

and Devín, surround it also. This unique geographical position resulted in the extraordinary physical-geographical conditions, such as topography and climate, with specific, rare and rich species steppe flora and fauna. From a morphometrical point of view Devínska Kobyla has an approximately symmetrical shape and is distinctive by its peripheral slopes, with slope angle ranging from 25 to 30°, and by vaulted central part where slope angles range from 10 to 15°. Its elevation ranges from 135 at the Danube, and Morava floodplain, to 514 m, at its highest point. The altitudinal difference between the Morava River (135 m) and the top of Devínska Kobyla Hill (514 m) is 379 m. Total area of reservation is 114.38 ha and it represents one of the NATURA 2000 sites and also Important Plant Area (IPA). It is located about 10 km from centre of Bratislava, capital city of Slovakia. The unique area of the instructive path is maximum 2880 m long and 825 m width, with plenty of natural details to look at and the breathtaking panoramathic view of the confluence of the Danube and Morava rivers, the Devín castle and the Austrian Hainburg hills. In good weather conditions even the Alps may be visible.



Geology and paleontology

In term of geology, Devínska Kobyla represents a very interesting territory "a treasure of geological processes", remarkable especially for its Neogene fauna from the surrounding of Devínska Nová Ves village. About 300 million years ago the mountain was part of the pre-continent Pangea. Several times subsequently the area was covered by the sea and during this period limestone and dolomite were formed (found in Devínska hradná skala rock, Weitov lom quarry). The unique range of the Carpathians begins by the Devín castle rock on the confluence of two rivers Dunaj and Morava. Southern slopes of the NNR are created mainly by grey limestones, dolomites and carbonate breccia, the strata are 160-180 million years old. The top of the hill Devínska Kobyla with the same name, which is not part of the reserve, is formed by Mesozoic quartzite. The territory of the sand pit Sandberg represents a stratotype locality for stratigraphical sub-stage called "devín", which was discovered because of sand mining. Rock

remains of Neogene Sea that covered the Vienna basin create its area. It is also a Neogene paleontological locality of European importance. More than 300 species of fossil organisms (algae, fungi, marine invertebrates and vertebrates, especially mammals) are known from there. With regard to the terrestrial ones, rare findings of primates *Sivapithecus* sp., occurs only in this locality within Slovakia (Feráková et al. 1997, Hegedüšová 2009).

Soils

The prevailing soil types on shallow and dry places are Eutric Cambisols developed on the Mesozoic quartzite and on diluvia of carbonate-silicate deposits. They are mostly covered with oak-hornbeam forests. Rendzic Leptosols are developed on limestones and dolomites covered mainly with dry grasslands and open Mediterranean xero-thermophilous oak forests. Regosols and sands are less frequent (Sandberg, Merice) developed on sandstones (Bedrna 1997).

Climate

The climate of the NNR Devínska Kobyla is sub-continental, summer-warm, moderate dry with mild winter (Holec 1997). The extra warm and dry climate is characteristic for sun-exposed, south-western steep slopes. The mean annual temperature is 9° C, with maximum temperature 32.8° C and minimum temperature –15.5° C. The mean annual precipitation is 604.9 mm. of which 360,1 mm falls in the vegetation season (March, September). Monthly rain sums vary considerably between the years, and long periods of drought are common (in 2003). This type of climate supports the development of forest-steppe vegetation.

Landscape history and nature conservation

Due to its favourable geographical location and climatic conditions Devínska Kobyla and its surrounding was one of the first parts of Slovakia to be inhabited (Viceníková et al. 2002). Neolithic people built the first dwellings in this area on the left side of the riverbank Dunaj between 5000 and 3500 BC. The strategic position of this place, the cliff (altitude of 212 m) at the confluence of the Dunaj and Morava was an ideal place for a fort. Its owner could control the famous trade route along the Danube as well as one branch of the Amber Road. That is why the site had become a strategic military post in the time of the Bronze and Iron Age (900 BC). In the Younger Iron Age, the territory was populated with Celts, which started to cut down the trees. At the times of the Roman Empire, Devin was still an important military station. In that period the Romans started growing wine grape in vineyards on the Devínska Kobyla hills. Devín fortress was first mentioned in the documents from 864 AD under the name Dowina. During the Greater Moravian Empire (9th century), the castle was a significant boundary fortress as well as one of the political and administrative centres. Two Slavonic fortresses (Sandberg and quarry) were built on the hillsides of Devínska Kobyla to protect the kingdom of prince Rastislav. After the fall of the Greater Moravian Empire, the castle served as a boundary castle of the Hungarian state. It witnessed also invasion of Turkish armies, German and Croatian colonisation (Devínska Nová Ves village). In 1809, the castle was destroyed by the by Napoleonic troops. Since 1965 archaeological research in the castle area and partial reconstruction of the ruins have been made.

Devínska Kobyla is included nowadays in the Protected Landscape Area Malé Karpaty Mts. (PLA). It was proposed as an Important Plant Area with total area of 127 ha in 2004. The NNR Devínska Kobyla was originally established as two separate reserves, the first one Sandberg in 1964 and the State Nature Reserve Devínska Kobyla on SW slopes with thermophilous vegetation (27.97 ha) in 1965. Both reserves were united in 1986 and the part Merice above

Devín village was added. This area is under the fifth level of nature protection (the highest possible in Slovakia). A nature trail across the western slope was opened in 1988 and renewed in 2000.

Vegetation, flora and fauna

The typical feature of Devínska Kobyla and Sandberg is a high flora and also fauna biodiversity, due to the unique position, the heterogeneity of its geological substratum, the specific climatic conditions, the human influence and the vicinity of the Malé Karpaty Mts. The original vegetation was formed by oak-hornbeam forests, xero-thermophilous oak forests with *Quercus pubescens* on steep slopes with a limestone base and rocky grasslands, which are conserved in spite of human influence (vineyards, orchards, grazing, burning of grasslands, afforestation by non-native trees e.g. *Pinus nigra*, *Fraxinus ornus*). Since 1949, a continuous area of xero-thermophilous pastures (at the time 85.8 % of the total area) has been greatly fragmented into the present mosaic vegetation of rocky and dry grasslands (33.4 %) – steppe communities along with sub-Mediterranean xero-thermophilous oak woods *Corno-Quercetum* and *Pruno mahaleb-Quercetum pubescentis*. Among the trees on the south-western slopes we can find *Cerasus fruticosa, C. mahaleb, Cornus mas, Quercus pubescens, Q. cerris* and *Ulmus minor*. Altogether the forests communities cover now 50.7 % of the NNR. On the northern slopes beech forests as *Melico uniflorae-Fagetum* and fragments of *Carici pilosae- Fagetum* and *Carici albae-Fagetum* are developed. *Fagus sylvatica* reaches here the lowest altitudes in the Western Carpathians Mts. On screes there are stands with *Tilia cordata* and *Acer campestre*, which belong to the alliance *Tilio-Acerion*. The most frequently occurring community in the NNR is *Carici pilosae-Carpinetum* with characteristic spring aspect created by *Galanthus nivalis*, later replaced by *Hepatica nobilis*, *Corydalis cava* and *Anemone ranunculoides*. Among non-native trees *Robinia pseudoacacia* and *Syringa vulgaris* are the most common. The continuous human impact on the area has increased the diversity of plant species. Cutting down and burning the woods created more space for plant species and communities that are typical of rocky areas. In phytosociological terms they belong to the class of Euro-Siberian steppes, *Festuco-Brometea*. The prevailing vegetation types of the xero-thermophilous grasslands communities are *Poo badensis-Festucetum pallentis, Festuco pallentis-Caricetum humilis, Festuco valesiacae-Stipetum capillatae, Polygalo majoris-Brachypodietum pinnati* and Pannonian fringe vegetation *Geranio sanguinei-Dictamnetum albae* and *Peucedanetum cervariae*. The stands of *Festuco valesiacae-Stipetum capillatae* (alliance *Festucion valesiacae*) represent a type of continental steppe. These communities were traditionally maintained by extensive grazing, mowing and burning.

According to the phytogeographical division of Slovakia (Futák 1984), Devínska Kobyla is situated on the border of two phytogeographical regions: the region of Pannonian flora and the region of West Carpathian flora. Finally it belongs to the region Eupannonicum with close phytogeographic relationship to the Hundsheimer hills in Austria. In Devínska Kobyla we can find Western Carpathian, Pannonian and Mediterranean species growing together, and reaching the most western or northern boundaries of their natural occurrence. In the species composition of vegetation xero-thermophilous and calciphilous elements dominate. Altogether, more than 1500 vascular plant species and subspecies including adventive taxa (Feráková et Hodálová unpubl.) were recorded here. All communities host a high number of endangered and rare species. 376 are threatened and 33 of them categorized as critically endangered (CR), endangered (EN) and vulnerable (VU), as well as 10 species in the category extinct (EX) are included in the Red Data Book, Vol. 5 of the Slovak and Czech Republics (Čeřovký et al., 1999). Species such as

Conringia austriaca, *Ononis pussila*, *Orobanche artemisiae-campestris*, *O. teucrii*, *Peucedanum arenarium* and on the limestone rocks *Rhamnus saxatilis* subsp. *saxatilis* were recorded here and nowhere else in Slovakia. *Gypsophila paniculata* is on the verge of extinction. A famous spring aspect is created by *Adonis vernalis*, *Pulsatilla pratensis* subsp. *bohemica* and *P. grandis*, later joined by *Iris pumila* in three colour tones – purple, yellow and white. The rare orchids *Anacamptis pyramidalis*, *Ophrys apifera*, *O. holoserica*, *O. insectifera*, *O. sphegodes*, *Orchis morio*, *O. tridentata* subsp. *tridentata*, *O. ustulata* subsp. *ustulata* bloom in May together with *Stipa* grasses. On the steep slopes and open sands with the shallowest substratum colline calcareous grasslands can be found. The dominating *Festuca pallens* is accompanied by *Fumana procumbens, Linum tenuifolium, Potentilla arenaria and Scorzonera austriaca.* On the gentle slopes *Carex humilis* is dominant with numerous chamaephytes and ephemeral therophytes such as *Allysum montanum, Globularia punctata, Helianthemum nummularium, Jurinea mollis, Thymus praecox, Teucrium montanum* and *T. chamaedrys*. On the rocky and moderately deep soils *Stipa capillata* and *Festuca valesiaca* stands are developed. The extra-zonal vegetation is represented by Pannonian fringe vegetation with common species *Geranium sanguineum, Dictamnus albus, Cyanus triumfettii, Anemone sylvestris* and *Tephroseris integrifolia*. In those parts of the forests that are more exposed to sunlight it is possible to find the originally Mediterranean species *Smyrnium perfoliaum,* which was rare in the past and is quickly spreading nowadays. An important feature of the floristic composition of the NNR is occurrence of various species and hybrids of the genus *Viola*. The area of the NNR is important also because of diversity of cryptogams: 110 lichen species, 100 bryophyte species and 331 fungi have been recorded.

From the zoological point of view Devínska Kobyla is one of the places with the highest biodiversity in Slovakia. According to the zoogeographical classification of terrestrial bio-cycle of Slovakia (Jedlička & Kalivodová 2002), the area of the NNR belongs to the region of West Carpathians, province of Pannonian steppe, part Devínska Kobyla Mts., on a border of region of deciduous forests and steppes. It is particularly characterized by a high abundance of thermophilous and xerophilous species of insects, which create unique zoological communities. A lot of species reach the most northern boundary of their natural occurrence. A many species are rare, such as insect *Mantispa styriaca*, beetles *Lucanus cervus*, *Oryctes nasicornis, Rosalia alpina* and butterflies *Zanclegnatha tarsicristalis, Yponemeuta vigintipunctatus* and *Procris gerryon.* Xerothermic species including cicadas (*Tibicina haematodes*), crickets (*Gryllus desertus*), neuroptera (*Ascalaphus macaronius*), spiders (*Eresus cinnaberinus*), grasshoppers (*Saga pedo*) and *Mantis religiosa* contribute to the exotic atmosphere. *Mantis religiosa*, with two coloured varieties, is the only representative of *Mantodae*. A lot of them are protected and endangered, e.g. *Papilio machaon*, *Iphiclides podalirius*, *Ascalaphus macaronius*, *Lucanus cervus*, *Parnassius mnemosine*. On the open sandy places *Meloe violaceus* is also frequent. Altogether, 44 species of the terrestrial gastropods were found here. The most abundant are *Granaria frumentum, Balea biplicata* and *Truncatellina cylindrical.* The amphibians are represented by *Bufo bufo, Bufo viridis* and *Salamandra salamandra*. In the southern slopes emerald coloured of male lizard *Lacerta viridis* can be frequently seen. From the reptiles there are also *Anguis fragilis, Natrix natrix* and *N. tesselata*. The deciduous forests are the home of *Elaphe longissima*, the biggest snake in Slovakia. The endangered bird species, which nest here, are *Corvus corax, Falco subbuteo, Tichodroma muraria* and *Upupa epops*. The sandstone walls of Sandberg are attractive with the appearance of European bee-eaters *Merops apiaster*. Mammals are not as strongly represented as other animal groups. Among the typical

representative of rodents (*Rodentia*) are *Sciurus vulgaris, Microtus arvalis* and *Glis glis*. *Lagomorpha* represents *Lepus europaeus*. Typical representatives of *Carnivora* are *Meles meles* and *Vulpes vulpes*. *Artiodactyla* are here represent by *Capreolus capreolus* and *Sus scrofa*.

Threats

The present state of vegetation on the Devínska Kobyla NNR is conditioned predominantly by succession (Hegedüšová 2009). The xero-thermophilous grassland vegetation is strongly threatened by changes in management, and soil conditions, the first of all by abandonment of the traditional use of the landscape and an inappropriate human intervention. During the state afforestation programme many non-native species were planted, mostly *Pinus nigra* further *Prunus serotina* and *Aesculus hippocastanum*. Obscuration and needles cast, which changes pH of soils, are liable for the treat of many rare endangered species. Big problems are especially soil erosion caused by cyclists who ride on the sensitive south-western slopes and construction of new open fires. The absence of grazing, meadow cutting, and burning resulted in spreading of competitively strong grasses such as *Bromus erectus*, *Arrhenatherum elatius* and shrubs *Crataegus* sp., *Rosa* sp. div. and *Prunus spinosa*. The diversity of the plant communities was declining and many species disappeared. Another big problem is represented by non-native plant species, which grow in surrounding of gardens, spread to the protected area and make it difficult for native species to survive.

The nomenclature of vascular plants follows Marhold & Hindák (1998). The nomenclature of syntaxa has been unified according to Janišová et al. (2007).

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Appendix 1. Short list of Vascular plants of the National Nature Reserve Devínska Kobyla

Acer campestre
Acer platanoides
Acer pseudoplatanus
Acinos arvensis
Adonis vernalis
Agrimonia eupatoria
Agrostis capillaris
Achillea collina
Achillea millefolium agg.
Achillea pannonica
Achillea setacea
Alliaria petiolata
Allium flavum
Allium senescens subsp. *montanum*
Alyssum montanum
Anacamptis pyramidalis
Anemone sylvestris
Anthericum ramosum
Anthyllis vulneraria
Arabidopsis thaliana
Arabis hirsuta
Arabis turrita
Arenaria serpyllifolia agg.
Arrhenatherum elatius
Artemisia absinthium
Artemisia campestris
Asparagus officinalis
Asperula cynanchica
Asperula tinctoria
Aster amelloides
Astragalus onobrychis
Avenula pratensis
Berberis vulgaris
Betonica officinalis
Bothriochloa ischaemum
Brachypodium pinnatum
Brachypodium sylvaticum
Briza media
Bromus erectus
Bromus hordeaceus
Bupleurum falcatum
Camelina microcarpa
Campanula bononiensis
Campanula glomerata
Campanula rotundifolia
Campanula sibirica
Cerasus vulgaris
Cerasus fruticosa
Cerasus mahaleb
Carex alba
Carex caryophyllea
Carex hirta
Carex humilis
Carex michelii
Carex pilosa
Carlina acaulis
Carlina vulgaris
Carpinus betulus
Centaurea stoebe s.lat.
Centaurea triumfettii
Cerastium arvense
Cerastium brachypetalum
Cerastium glomeratum
Cerastium glutinosum
Cerastium semidecandrum
Clematis recta

Colymbada scabiosa
Conringia austriaca
Convallaria majalis
Conyza canadensis
Cornus mas
Corydalis cava
Corydalis pumila
Corydalis solida
Corylus avellana
Cotoneaster integerrimus
Cotoneaster tomentosus
Crataegus laevigata
Crataegus monogyna
Crinitina linosyris
Cruciata glabra
Cuscuta species
Cyanus triumfetti
Cynodon dactylon
Dactylis glomerata
Daucus carota
Dianthus deltoides
Dianthus pontederae
Dictamnus albus
Dorycnium herbaceum
Echium vulgare
Elytrigia intermedia
Erophila verna
Eryngium campestre
Erysimum diffusum agg.
Erysimum odoratum
Euonymus europaeus
Euonymus verrucosus
Fagus sylvatica
Falcaria vulgaris
Fallopia convolvulus
Festuca pallens subsp. *pallens*
Festuca pratensis agg.
Festuca rubra
Festuca rupicola
Festuca valesiaca
Fragaria vesca
Fragaria viridis
Fraxinus excelsior
Fraxinus ornus
Fumana procumbens
Galanthus nivalis
Galeobdolon luteum
Galium glaucum
Galium odoratum
Galium pycnotrichum
Galium verum
Genista germanica
Genista pilosa
Genista tinctoria
Geranium sanguineum
Geranium sylvaticum
Geum urbanum
Glechoma hederacea
Globularia punctata
Grammica campestris
Gypsophila paniculata
Hedera helix
Helianthemum grandiflorum
Helianthemum grandiflorum subsp. *obscurum*
Helichrysum arenarium
Hepatica nobilis
Heracleum sphondylium
Hesperis tristis
Hieracium sabaudum
Himantoglossum adriaticum
Holosteum umbellatum
Hypericum perforatum
Hypochaeris radicata
Chamaecytisus austriacus
Chamaecytisus hirsutus
Chamaecytisus supinus
Chondrilla juncea
Chrysopogon gryllus
Inula conyza
Inula ensifolia
Inula hirta
Inula oculus-christi
Iris pumila
Iris variegata
Juniperus communis
Jurinea mollis
Koeleria macrantha
Lamium maculatum
Lathraea squamaria
Lathyrus vernus
Lembotropis nigricans
Leontodon hispidus
Leopoldia comosa

Libanotis pyrenaica
Ligustrum vulgare
Lilium martagon
Linaria genistifolia
Linum catharticum
Linum flavum
Linum hirsutum
Linum tenuifolium
Lithospermum purpurocaeruleum
Lonicera xylosteum
Lotus borbasii
Lotus corniculatus
Medicago falcata
Medicago lupulina
Medicago minima
Medicago monspeliaca
Melica ciliata
Melica nutans
Melica transsilvanica
Melica uniflora
Melilotus officinalis
Minuartia glaucina
Minuartia rubra
Minuartia setacea
Muscari neglectum
Myosotis ramosissima
Myosotis stricta
Nonnea pulla
Odontites vulgaris
Onobrychis viciifolia
Ononis pusilla
Ononis spinosa
Ophrys apifera
Ophrys holoserica
Ophrys insectifera
Ophrys sphegodes
Orchis militaris
Orchis morio
Orchis tridentata subsp. *tridentata*
Orchis ustulata subsp. *ustulata*
Origanum vulgare
Ornithogalum kochii
Orobanche artemisiae-campestris
Orobanche caryophyllacea
Orobanche lutea
Orobanche teucrii
Orthantha lutea
Petrorhagia saxifraga
Peucedanum alsaticum
Peucedanum arenarium
Peucedanum carvifolia
Peucedanum cervaria
Peucedanum oreoselinum
Phelipanche arenaria
Phleum phleoides
Phleum pratense
Pilosella bauhinii
Pilosella macrantha
Pilosella officinarum
Pimpinella saxifraga agg.
Plantago lanceolata
Plantago media
Poa angustifolia
Poa bulbosa
Poa pratensis
Polygonatum multiflorum
Polygonatum odoratum
Populus tremula
Potentilla arenaria
Primula veris
Prunella laciniata
Prunella vulgaris
Prunus spinosa
Pseudolysimachion spicatum
Pulmonaria mollis
Pulmonaria officinalis
Pulsatilla grandis
Pulsatilla pratensis subsp. *bohemica*
Pyrethrum corymbosum
Quercus cerris
Quercus petraea
Quercus pubescens
Ranunculus bulbosus
Reseda lutea
Rhamnus cathartica
Rhamnus saxatilis subsp. *saxatilis*
Rhodax canus
Robinia pseudacacia
Rosa canina agg.
Rosa pimpinellifolia
Rosa rubiginosa
Salsola kali
Salvia nemorosa
Salvia pratensis

Sanguisorba minor
Scabiosa ochroleuca
Scorzonera austriaca
Scorsonera hispanica
Scorzonera purpurea
Securigera varia
Sedum acre
Sedum album
Sedum sexangulare
Senecio jacobaea
Seseli hippomarathrum
Seseli osseum
Silene otites
Silene vulgaris
Smyrnium perfoliatum
Stachys recta
Stipa capillata
Stipa joannis
Stipa pulcherrima
Syringa vulgaris
Swida sanguinea
Taraxacum sect. *Erythrosperma*
Taraxacum serotinum
Tephroseris integrifolia
Teucrium chamaedrys
Teucrium montanum
Thalictrum minus
Thesium linophyllon
Thlaspi perfoliatum
Thymus pannonicus
Thymus praecox
Tilia cordata
Tilia platyphyllos
Tithymalus cyparissias
Tithymalus seguierianus
Tragopogon dubius
Tragopogon orientalis
Trifolium alpestre
Trommsdorfia maculata
Ulmus minor
Valeriana stolonifera subsp. *angustifolia*
Verbascum lychnitis
Verbascum phoeniceum
Veronica austriaca
Veronica hederifolia agg.
Veronica chamaedrys
Veronica officinalis
Veronica prostrata
Viburnum lantana
Vicia tenuifolia
Vincetoxicum hirundinaria
Viola alba subsp. *alba*
Viola ambigua
Viola canina
Viola hirta
Viola kitaibeliana
Viola mirabilis
Viola odorata
Viola reichenbachiana
Viola riviniana
Viola rupestris
Viola suavis
Viola tricolor
Xeranthemum annuum