Pavlov Hills: Botanical Excursion Guide

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Introduction

The Pavlov Hills (in Czech Pavlovské vrchy, Pálava) is a range of limestone hills in southern Moravia situated between the Dyje River (in German Thaya) and the Czech-Austrian border near the town of Mikulov. Its northernmost point is located about 30 km south of the southern margin of the city of Brno. The area is 11 km long and 2 to 3 km wide. The altitudinal difference between the Dyje River in Pavlov (165 m) and the top of Děvín Hill (554 m) is 389 m. The northernmost hilltop with the ruin of the 14th century castle Děvičky (= Dívčí hrady, Maidenstein) stands out above the village of Pavlov. Southwards, the highest Děvín Hill (554 m) follows, which is separated in the south by the narrow gorge called Soutěska from Kotelná Hill (462 m). Růžový vrch Hill, with another castle ruin on the top, and Stolová hora Hill (459 m), with a prominent plateau, form the central part of the range. Turold Hill (385 m) and Svatý kopeček Hill (363 m), the latter with a church on its top, surround the town of Mikulov from the north and
the east, respectively. The southernmost Šibenčíčnik Hill (238 m) is situated south of the town near the border with Austria. Schweinbarther Berg, Höhlenstein, and Falkenstein Hills in the adjacent part of Lower Austria belong to the same range.

Geology

The landscape of the Pavlov Hills is strongly modulated, with outcrops and cliffs of pure, hard and white limestone of Upper Jurassic origin, called Ernstbrunn limestone. Sedimentation of Ernstbrunn limestone was preceded by the sedimentation of grey calcareous claystone and clay limestone, called Klentnice layers. The Pavlov Hills are situated at the margin of the flysch zone of the Eastern Alps and Western Carpathians. The flysch beds consist of strongly folded Lower Tertiary claystone, sandstone and conglomerate. During the periods of orogenetic activity in the Tertiary, large blocks of Jurassic and Lower Cretaceous rocks were torn from their Jurassic ground (now situated up to 2 km below the surface), and re-deposited over the younger flysch beds.

In the Lower Badenian period (Upper Tertiary), the Pavlov Hills were surrounded by a warm sea. Pieces of Jurassic rock present in the littoral gravel from that period indicate that limestone may have been already denuded at that time. At 15 Ma BP (before present) a strong subsidence formed the Vienna Basin. During the following 9 Ma, up to 3 km thick layers of maritime and lacustrine sediments were deposited on its bottom.

During the Quaternary, loess and debris, comprising also re-deposited Tertiary clay and fossil soils, were deposited on the footslopes of the Pavlov Hills. A complete sequence of loess sedimentation from the last two glacials and two interglacials, with buried chernozem horizons, can be observed in excavation pits near the village of Dolní Věstonice.

Soils

The prevailing soil types are rendzinas, calcareous pelosols, chernozems, and luvisols. Rendzinas were formed over hard Ernstbrunn limestone; they are shallow and dry, of neutral to moderately alkaline reaction. They are covered mainly with dry grasslands and open thermophilous oak forests. Calcareous pelosols are developed on Mesozoic and Tertiary calcareous clays and mostly covered with forests. Chernozems are found on loess deposits on the foothills of the Pavlov hills. Luvisols occur on moderately inclined hillsides covered with slope deposits or decalcified loess. These soils are deep and have a more balanced water supply; they support mainly oak-hornbeam forests.

Climate

The climate of the Pavlov Hills is subcontinental, summer-warm and dry. The mean annual temperature at Mikulov is 9.5 °C, the mean temperature of the growing season (April-September) is 15.9 °C. The warmest and coldest months are July and December with mean temperatures of 19.4 °C and -1.6 °C,
respectively. Due to its location in the lee of the Bohemian-Moravian Highlands (Českomoravská vrchovina), the area around the Pavlov Hills is one of the driest in the Czech Republic. The mean annual precipitation is 571 mm, of which 367 mm falls in the growing season. Monthly rain sums vary considerably, and long periods of drought are common. Such climate supports the development of forest-steppe vegetation.

Nature conservation

The Pavlov Hills are included in the Protected Landscape Area (PLA) Pálava, which was established in 1976. Ten years later the area became a UNESCO Biosphere Reserve. The particular limestone hills and other valuable sites within the PLA are protected as National Nature Reserves (NNR), Nature Reserves (NR) and Nature Monuments (NM). There are two NNRs (Děvín-Kotel-Soutěška and Tabulová, Růžový vrch a Kočičí kámen), three NRs (Tuřold, Svatý kopeček and Šibeníčník) und three NMs (Kočičí skála, Růžový kopec and Anenský vrch).

Landscape history

The Pavlov Hills and their surroundings are world-famous for a series of Upper Palaeolithic archaeological sites on their foothills, most notably between the villages of Dolní Věstonice and Pavlov. These sites provided a rich source of prehistoric artefacts (especially art) from the settlements of mammoth hunters from the Gravettian period (28–22 ka BP). These artefacts include carved representations of animals, humans and enigmatic engravings, a figure of a young man carved in mammoth ivory, which may represent the first example of portraiture (i.e., representation of an actual person), the earliest examples of ceramics (burned clay) figurines, including the famous Venus of Dolní Věstonice. One of the burials revealed a human female skeleton, ritualistically placed beneath a pair of mammoth scapulae, which is believed to be the first proof of a female shaman.

In 1991 palynologists E. Rybníčková and K. Rybníček analysed a peat sediment from the nearby Bulhary site, dated to around 26 ka BP. Besides indicators of steppe (Artemisia, Chenopodiaceae, Ephedra and Plantago cf. media) and tundra (Betula nana) they found a surprisingly abundant tree pollen, including drought- and cold-adapted species such as Pinus cembra, P. sylvestris, Larix and Betula pendula, but also moisture-demanding species such as Picea, Alnus and rarely also some broad-leaved deciduous trees. This was the first evidence of the full-glacial forests in eastern-central Europe, which was later confirmed by new data from Hungary and Slovak, Polish and Czech Carpathians. Based on the analogy with contemporary landscapes of continental southern Siberia, we can imagine the landscape of the Gravettian mammoth hunters as a forest-steppe with steppic grasslands on the loess plains and southern slopes, Picea-Alnus woodland in the river floodplains, Pinus cembra-P. sylvestris-Larix-Betula woodland on north-facing slopes and patches of Betula nana tundra in colder and wetter places. This
interpretation is supported by the fossil mollusc faunas found in the Quaternary sediments on the foothills of the Pavlov Hills.

Due to lack of peat deposits in the dry area of southern Moravia, Holocene history of the Pavlov Hills can be reconstructed mainly based on the malacozoological evidence. It indicates that loess sedimentation was followed by spread of some warm-demanding continental species in the Late Glacial. In the Early Holocene, the area was covered by forest-steppe. At the beginning of the Atlanticum (8 ka BP) there was a sudden increase in precipitation which supported spread of mesic forests. However, Neolithic farmers colonized the area at approximately 7.5 ka BP and started a large-scale deforestation of the surrounding lowland areas, including the Pavlov Hills. The area has been permanently settled by humans ever since, with a remarkable peak in the Bronze Age, when settlements were built also on the hilltops. Although patches of mesic deciduous forest were always present on the hills, particularly on the north-facing slope of Děvín Hill, several species of molluscs and plants typical of such forests are missing there, because they failed to immigrate through the surrounding deforested landscape. Steppes in the Pavlov Hills are primary in the sense that they represent a direct continuation of the Pleistocene continental steppes. At the same time, they are secondary in many places, because they spread to the areas deforested by humans since the Neolithic.

Vegetation

The Pavlov Hills are situated in the Pannonian phytogeographical region, which reaches its north-western limit in Lower Austria and southern Moravia. This region represents the westernmost extremity of the continuous zone of the Euro-Siberian forest-steppe, which extends through the Danube valley and Pannonian Basin up to the southern fringes of the Western Carpathians, eastern fringes of the Eastern Alps, and south-eastern edge of the Bohemian Massif. The following description of vegetation mainly concerns Děvín Hill (National Nature Reserve Děvín-Kotel-Soutěška), the highest and largest of the Pavlov Hills, which harbours most of the natural and semi-natural vegetation types found in the area.

Forests

Natural vegetation of the lower hillsides of the Pavlov Hills is Pannonian oak-hornbeam forest of the association Primulo veris-Carpinetum (alliance Carpinion betuli). The main tree species are Quercus petraea and Carpinus betulus, accompanied by Acer campestre, Tilia cordata and T. platyphyllos. The shrub layer is well developed and rich in species, including Cornus mas, Euonymus verrucosa, Ligustrum vulgare and Staphylea pinnata. The herb layer includes Campanula persicifolia, C. rapunculoides, Festuca heterophylla, Melittis melissophyllum, Primula veris and Viola mirabilis.

Upwards, on sites with soils still deep and moist enough to support more or less closed canopy, oak-hornbeam forests are replaced by thermophilous oak forests of the association Corno-Quercetum (alliance Quercion pubescenti-petraeae).
Dominant trees are *Quercus petraea* and *Q. pubescens*. The shrub layer is usually luxuriant, consisting of thermophilous shrubs such as *Cornus mas*, *Ligustrum vulgare* and *Viburnum lantana*. The herb layer contains thermophilous species *Lithospermum purpurocaeruleum*, *Tanacetum corymbosum* and *Teucrium chamaedrys*, along with nutrient-demanding species of mesic forests, such as *Alliaria petiolata* and *Geum urbanum*.

The steep upper slopes with limestone outcrops support open stands of thermophilous oak forests classified as *Pruno mahaleb-Quercetum pubescentis* (alliance *Quercion pubescenti-petraeae*). Their tree and shrub layers can be hardly separated, as *Quercus pubescens* trees are usually low and bushy, and shrubs, e.g. *Cornus mas*, *Viburnum lantana* and *Ligustrum vulgare*, are numerous and vigorously growing. In the ground layer, many species of thermophilous forest fringes are present, such as *Dictamnus albus*, *Geranium sanguineum* and *Vincetoxicum hirundinaria*, as well as dry grassland species such as *Aster amellus*, *Carex humilis*, *Festuca rubricola*, *Inula ensifolia* and *Stachys recta*. At a finer scale, shrub association *Violo hirtae-Cornetum maris* (Berberidion) and herbaceous fringe communities of the alliance *Geranion sanguinei* can be distinguished here, along with different types of dry grasslands.

On the north-facing slopes of Děvín Hill, two types of broad-leaved ravine forest (alliance *Tilio-Acerion*) occur. The first one, *Aceri-Carpinetum betuli*, is more widespread and includes stands with *Tilia platyphyllos*, *Carpinus betulus* and *Acer pseudoplatanus*. It is confined to sites with well developed, moderately humid soils. The shrub layer is scarce due to the closed canopy and high densities of mouflon. The herb layer contains *Alliaria petiolata*, *Asarum europaeum*, *Campanula trachelium*, *Lathyrus vernus* and *Pulmonaria officinalis*; in early summer, they are overgrown by tall stands of *Aconitum lycoctonum*. Upwards, at the foot and ledges of limestone cliffs, this type of ravine forest is replaced by patches of *Seslerio albicantis-Tilietum cordatae*. This relict community, here with *Tilia platyphyllos* as the dominant tree, harbours several species of *Sesleria* grasslands, such as *Anthericum ramosum*, *Bupleurum falcatum*, *Erysimum odoratum*, *Hylotelephium maximum*, *Sesleria caerulea* and *Vincetoxicum hirundinaria*.

Most forests of the Pavlov Hills used to be coppiced in the past, but this traditional management has been abandoned since the mid 20th century. Overgrown coppices have developed closed canopy which led to retreat of light-demanding species and spread of mesophilous forest herbs. The game preserve for bezoar goat (*Capra aegagrus*) and mouflon existed on Děvín Hill until 1996.

**Grasslands**

Dry grasslands of the Pavlov Hills have always attracted botanists, and formal phytosociological descriptions of their most important types were already done by Zlatník (1928) and most notably by Klika (1931). In phytosociological terms, they belong to the class of Euro-Siberian steppes, *Festuco-Brometea*. The stands of *Festuco valesiacae-Stipetum capillatae* (alliance *Festucion valesiacae*) represent a type of continental steppe. They are associated with very dry places with
moderately developed soil. Besides the name-giving species, they contain *Bothriochloa ischaemum*, *Centaurea stoebe*, *Festuca rupicola* and *Stipa pulcherrima*. The association *Poo badensis-Festucetum pallentis* (alliance *Bromo pannonici-Festucion pallentis*) is related to submediterranean grasslands of southern Europe and limestone or dolomite grasslands of the fringes of the Alps and Carpathians, although it contains several species of continental steppe as well. It occupies more extreme habitats with shallow soils of limestone outcrops. Several succulent *Crassulaceae*, such as *Jovibarba globifera*, *Sedum acre* and *S. album*, are confined to these places, together with *Allium flavum*, *Campanula sibirica*, *Festuca pallens*, *Iris pumila*, *Poa badensis* and *Teucrium montanum*. Short-living spring therophytes, such as *Arabis auriculata*, *Cerastium pumilum agg.*, *Erophila spathulata* and *Holosteum umbellatum*, are typical of both types of dry grassland. The north- and west-facing rocky slopes support *Sesleria caerulea* grasslands of the association *Minuartio setaceae-Seslerietum caeruleae* (alliance *Diantholumitzeri-Seslerion*). These are related to *Sesleria* grasslands which occur on limestones of the montane and subalpine belt of the Alps and the Carpathians. It is supposed that in the Pleistocene full-glacial periods these grasslands occupied lowland mesic sites on base-rich soils, but they retreated due to spread of other vegetation types in the Holocene. Currently they are restricted to high-altitudinal limestone areas in the Alps and the Carpathians and to a few lowland sites such as the Pavlov Hills. They harbour several relict or alpine species, e.g. *Arenaria grandiflora*, *Biscutella laevigata* subsp. *varia*, *Dianthus lumnitzeri*, *Saxifraga paniculata* and *Tephroseris integrifolia*.

Dry grassland types described above are natural in many places, but at some sites they developed due to deforestation and grazing. There are also other grassland types of secondary origin in the Pavlov Hills which are of high interest for biodiversity conservation. For example, deep soils on loess and other soft sediments on the foothills support semi-dry grasslands with *Bromus erectus* and *Brachypodium pinnatum* (*Polygalo majoris-Brachypodietum pinnati*, alliance *Cirsio-Brachypodion pinnati*). Some of these grasslands developed on abandoned fields, and during few decades they became very rich in species and attained a high conservation value.

Other examples of remarkable plant communities of the Pavlov Hills include xeric shrub communities (alliances *Berberidion* and *Prunion spinosae*), weed communities of calcareous soils (alliance *Caucalidion lappulae*) and communities of fallow land (*Dauco-Picridetum*, alliance *Dauco-Melilotion*).

### Flora

The Pavlov Hills have, due to their geographic position at the northeastern edge of Pannonia, a very remarkable flora. Steppe and rock habitats harbour two major plant groups with contrasting distribution ranges: (1) “eastern” species, i.e. those with Pannonian, Pontic-Pannonian, or Continental distribution ranges, and (2) “southern” species, i.e. mainly those with Submediterranean distribution ranges. Several species of the first group reach their western distribution limits in southern Moravia, while those of the second group grow here near their northern
distribution limits. Continental species are represented, among others, by *Adonis vernalis*, *Astragalus austriacus*, *Carex stenophylla*, *Helictotrichon desertorum*, *Peucedanum alsaticum*, *Phlomis tuberosa*, *Stipa pennata* s. str., *Thalictrum foetidum* and *Viola ambigua*; they may be considered relics of late Pleistocene and early Holocene continental steppe. *Cytisus procumbens*, *Iris pumila*, *Jurinea mollis*, *Linum hirsutum* and *Medicago prostrata* are Pontic-Pannonian or Pannonian species. The group of species with Submediterranean distribution ranges includes *Ficaria calthifolia*, *Fumana procumbens*, *Globularia bisnagarica*, *Linum tenuifolium*, *Lithospermum purpurocaeruleum*, *Minuartia fastigiata*, *M. setacea*, *Orlaya grandiflora*, *Parietaria officinalis*, *Quercus pubescens*, *Salvia aethiopis*, *Stipa pulcherrima*, *Teucrium montanum*, *Trinia glauca* and *Viola kitaibeliana*, the latter known in the Czech Republic only from the castle ruin Děvičky on Děvín Hill. *Stipa eriocaulis*, in the Czech Republic growing only on Svatý kopeček Hill above the town of Mikulov, also belongs to this group. Central European species are represented by *Viola tricolor* subsp. *saxatilis* and by species of broad-leaved deciduous forests, such as *Aconitum lycoctonum*, *Corydalis pumila* and *Hepatica nobilis*. *Dianthus lumnitzeri*, protected under the EU Habitats Directive, is endemic to western Pannonia. It occurs in southern Moravia (only in the Pavlov Hills), Lower Austria, south-western Slovakia and northern Hungary. The rocks of Děvín Hill harbour *Arenaria grandiflora* at the northernmost point of its distribution range.

**National Nature Reserve Děvín-Kotel-Soutěška**

The National Nature Reserve Děvín-Kotel-Soutěška is situated in the northernmost part of the Pavlov Hills between the villages of Pavlov, Dolní Věstonice, Horní Věstonice, Perná and Klentnice. It includes Děvín Hill (Maidenberg in German; 554 m) in the north-east and Kotelná Hill (also Obora Hill; 462), separated by the narrow and deep gorge Soutěška. On the northernmost hilltop of Děvín there is a ruin of the medieval castle Děvičky (in German Maidenstein). The hills are built mainly of hard and white Ernstbrunn limestone, forming spectacular cliffs above the Soutěška gorge, above the north-western slopes of Děvín Hill and on the western slope of Kotelná Hill. The nature reserve, established in 1946, is 381 ha large. Its vegetation has been basically described above in the characteristics of vegetation of the Pavlov Hills as a whole. Flora of the reserve consist of 643 species, recorded in 1992–2004–2007 and listed in Appendix 1.

Human impact on the ecosystems of Děvín Hill has been very long. In the Upper Palaeolithic Gravettian Period, there were human settlements on lower slopes of the hill. A fortified settlement was established in the northeast of the hilltop in the Upper Bronze Age. The castle Děvičky, built in late-Romanic and early-Gothic style, was first mentioned in written documents in the early 13th century. In the 14th century, another castle, known as Neuhaus or Domus nova, was established in the northern part of Kotel Hill. Small limestone quarries existed at several places.
Svatý kopeček (363 m; Heiliger Berg in German) is flanking the town of Mikulov from the east. The hill, elongated roughly from the northeast to the southwest, is formed of white and hard Jurassic limestone. Its northwestern part was destroyed by the quarrying of limestone, lasting from 1816 to the early 1970s.

On the northwestern slopes of the hill, fragments of chasmophytic vegetation with *Aurinia saxatilis* subsp. *arduini* and *Thalictrum foetidum* are developed. The steep west-facing slope above the town of Mikulov is covered by *Sesleria caerulea* grasslands of the association *Minuartio setaceae-Seslerietum caeruleae*, harbouring a small population of *Pulsatilla grandis*. South- and southeast-facing slopes of Svatý kopeček support a patchy mosaic of dry grasslands of the associations *Poo badensis-Festucetum pallentis* and *Koelerio macranthae-Stipetum joannis*, the latter containing large stands of *Stipa pulcherrima* and *S. eriocaulis*. In mid-April, stands of flowering *Iris pumila* may be observed along the tourist trail, followed by another iris, *I. humilis* subsp. *arenaria* two weeks later. *Prunus mahaleb* and *Crataegus monogyna* are dominant species of dense shrubberies on the southeast-facing slope.

The forest stands on the hill are mainly secondary, with *Fraxinus excelsior*, *Quercus robur* and *Acer platanoides* as dominant species. Also *Pinus nigra* was planted here at the turn of the 19th century or somewhat later, as was *Syringa*...
vulgaris, introduced here by the Scenic Improvement Society ("Verschönerungsverein") and now encroaching large patches on the west-facing slope. Further invasive trees are Robinia pseudacacia and Ailanthus altissima, both spreading mainly on the east-facing slope. The thermophilous oak forests of the association Corno-Quercetum survived only as a small stand in the northeastern part of the reserve.

The flora of the reserve includes about 407 species and hybrids of vascular plants, recorded here in 1992–2004 (Appendix 2). Svatý kopeček is one of the most species-rich sites for the genera Orobanche (s. lat.) and Viola in the Czech Republic, supporting seven species of the former, and eleven species and five hybrids of the latter. The most remarkable species of these genera are Orobanche arenaria, O. artemisiae-campestris and Viola ambigua. Due to the geographic location above the western edge of the town of Mikulov and strong human influence, the proportion of alien species is very large.

The fifteen Stations of the Cross along the path to the hilltop were established in 1626–1723. The white Baroque pilgrimage Church of St. Sebastian and the neighbouring campanile on the flat top were built in the 17th century. By construction of these buildings catholic church tried to support the Counter-Reformation and to break up the old pagan belief that the hill summit was the meeting point of witches, as documented by the original German name of the hill – Tanzberg (Hill of Dances). From the top of Svatý kopeček there is a nice view of the medieval town of Mikulov, dominated by a chateau, built in the 17th century on the fundaments of the original gothic castle by Cardinal Franz von Dietrichstein, Bishop of Olomouc and Governor of Moravia. Since 1946, Svatý kopeček has been protected as nature reserve.

References

Appendix 1. Vascular plants of the National Nature Reserve Děvín-Kotel-Soutěška. Alien species are marked by (al.)

Acer campestre
Acer platanoides
Acer pseudoplatanus
Acinos arvensis
Aconitum lycoctonum subsp.
lycoctonum
Adonis aestivalis
Adonis vernalis
Adoxa moschatellina
Aegopodium podagraria
Aegilops hippocastanum (al.)
Aethusa cynapium s. lat.
Agrimonia eupatoria
Agrostis gigantea
Achillea collina
Achillea pannonica
Ailanthus altissima (al.)

Ajuga genevensis
Ajuga chamaepitys
Ajuga reptans
Alliaria petiolata
Allium angulosum
Allium flavum
Allium oleraceum
Allium scorodoprasum
Allium senescens subsp. montanum
Alopecurus pratensis
Alyssum alyssoides
Alyssum montanum
Amaranthus powellii
Amaranthus retroflexus
Anagallis foemina
Androsace elongata
Anemone nemorosa
Anemone ranunculoides
Anemone sylvestris
Anthericum ramosum
Anthriscus cerefolium subsp. trichosperma
Anthriscus sylvestris
Anthyllis vulneraria
Arabis auriculata
Arabis glabra
Arabis hirsuta
Arabis sagittata
Arabis turrita
Arctium lappa
Arctium tomentosum
Arenaria grandiflora
Arenaria serpyllifolia
Armoracia rusticana (al.)
Arrhenatherum elatius
Artemisia absinthium
Artemisia campestris
Artemisia vulgaris
Arum cylindraceum
Asarum europaeum
Asparagus officinalis
Asperula cynanchica
Asplenium ruta-muraria
Asplenium trichomanes
Aster amellus
Aster lanceolatus
Aster linosyris
Astragalus austriacus
Astragalus cicer
Astragalus glycyphyllus
Astragalus onobrychis
Atriplex oblongifolia
Atriplex patula
Atriplex sagittata
Aurinia saxatilis subsp. arduini
Avenula pratensis
Avenula pubescens
Ballota nigra subsp. nigra
Barbarea stricta
Barbarea vulgaris subsp. vulgaris
Bellis perennis
Berberis vulgaris
Berteroa incana
Betonica officinalis
Betula pendula
Bidens frondosa
Biscutella laevigata subsp. varia
Bothriochloa ischaemum
Botrychium lunaria
Brachypodium pinnatum
Brachypodium sylvaticum
Briza media
Bromus benekenii
Bromus erectus
Bromus hordeaceus subsp. hordeaceus
Bromus inermis
Bromus japonicus
Bromus sterilis
Bromus tectorum
Bryonia alba
Bupleurum falcatum
Calamagrostis epigejos
Camelina microcarpa
Campanula bononiensis
Campanula glomerata
Campanula persicifolia
Campanula rapunculoides
Campanula sibirica
Campanula trachelium
Capsella bursa-pastoris
Cardamine impatiens
Carduus acanthoides
Carduus crispus
Carduus nutans
Carex caryophyllea
Carex contigua
Carex digitata
Carex humilis
Carex micchelli
Carex montana
Carex muricata
Carex pilosa
Carex praeox
Carex supina
Carlina acaulis subsp. acaulis
Carlina biebersteinii
Carpinus betulus
Carum carvi
Caucalis platycarpos
Centaurea jacea subsp. angustifolia
Centaurea scabiosa
Centaurea stoebe
Centaurea triumfettii subsp. axillaris
Cephalanthera damasonium
Cephalanthera rubra
Cerastium arvense
Cerastium glutinosum
Cerastium holosteoides subsp. triviale
Cerastium pumilum
Cerastium semidecandrum
Cerinthe minor
Chaerophyllum bulbosum
Chaerophyllum temulon
Chamaecytisus ratisbonensis
Chamaecytisus virescens
Chelidonium majus
Chenopodium album
Chenopodium hybridum
Chenopodium opulifolium
Chenopodium polyspermum
Chenopodium pumilio
Chondrilla juncea
Cichorium intybus
Cirsium arvense
Cirsium vulgar
Clematis recta
Clematis vitalba
Clinopodium vulgare
Colchicum autumnale
Conium maculatum
Consolida regalis
Convallaria majalis
Convolvulus arvensis
Coryza canadensis
Cornus mas
Cornus sanguinea
Corydalis cava
Corydalis intermedia
Corydalis pumila
Corylus avellana

Cotoneaster integerrimus
Crataegus laevigata
Crataegus monogyna
Crepis biennis
Crepis foetida subsp. rhoeadifolia
Crepis praemorsa
Cuscuta epithymum
Cuscuta europaea
Cyclamen purpurascens
Cynoglossum officinale
Cytisus nigricans
Cytisus procumbens
Dactylis glomerata
Dactylis polygama
Datura stramonium
Daucus carota subsp. carota
Dentaria bulbifera
Dentaria enneaphyllos
Descurainia sophia
Dianthus lumnitzeri
Dianthus pontederae
Dictamnus albus
Digitalis grandiflora
Dipsacus laciniatus
Dorycnium germanicum
Dryopteris filix-mas
Echinops sphaerocephalus
Echium vulgare
Elymus caninus
Elytrigia intermedia
Elytrigia repens
Epilobium montanum
Epilobium roseum
Epipactis helleborine
Epipactis microphylla
Erigeron podolicus
Erigeron serotinus
Erodium cicutarium
Erophila spathulata
Eryngium campestre
Erysimum durum
Erysimum cheiranthoides
Erysimum odoratum
Euonymus europaea
Euonymus verrucosa
Eupatorium cannabinum
<table>
<thead>
<tr>
<th>Euphorbia amygdaloides</th>
<th>Galium odoratum</th>
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<tbody>
<tr>
<td>Euphorbia cyparissias</td>
<td>Galium spurium</td>
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<tr>
<td>Euphorbia epithymoides</td>
<td>Galium sylvaticum</td>
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<tr>
<td>Euphorbia esula</td>
<td>Galium verum</td>
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<tr>
<td>Euphorbia exigua</td>
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<td>Hieracium brachiatum (H. baehni – H. pilosella)</td>
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<td>Hieracium pilosellinum (H. densiflorum/zizianum &lt; H. pilosella)</td>
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<td>Hieracium rothianum (H. echioidees &gt; H. pilosella)</td>
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<td>Galeopsis angustifolia</td>
<td>Hordelymus europaeus</td>
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Hordeum murinum
Humulus lupulus
Hylotelephium maximum
Hyoscyamus niger
Hypericum hirsutum
Hypericum montanum
Hypericum perforatum
Impatiens parviflora
Inula britannica
Inula conyza
Inula ensifolia
Inula hirta
Inula oculus-christi
Inula salicina subsp. salicina
Inula ×stricta (= I. ensifolia × I. salicina)
Iris graminea
Iris humilis subsp. arenaria
Iris pumila
Iris variegata
Isatis tinctoria subsp. tinctoria
Isopyrum thalictroides
Jovibarba globifera subsp. hirta
Juglans regia (al.)
Jurinea mollis
Kickxia spuria
Knautia arvensis
Knautia ×posoniensis (= K. arvensis × K. kitaibelii)
Koeleria macrantha
Lactuca quercina
Lactuca serriola
Lactuca viminea
Lamium album
Lamium amplexicaule
Lamium maculatum
Lamium purpureum
Lappula squarrosa
Lapsana communis
Larix decidua (al.)
Lathraea squamaria
Lathyrus latifolius
Lathyrus niger
Lathyrus pratensis
Lathyrus tuberosus
Lathyrus vernus
Lavatera thuringiaca
Leontodon hispidus
Leonurus cardiaca var. cardiaca
Leonurus marrubiastrum
Lepidium campestrum
Leucanthemum vulgare subsp. vulgare
Libanotis pyrenaica
Ligustrum vulgare
Lilium martagon
Limodorum abortivum
Linaria genistifolia
Linaria vulgaris
Linum catharticum
Linum hirsutum
Linum tenuifolium
Lithospermum arvense
Lithospermum officinale
Lithospermum purpurocaeruleum
Lotus perenne
Lonicera xylosteum
Loranthus europaeus
Lotus borbasi
Lotus corniculatus
Lycopus europaeus
Lysimachia nummularia
Malus domestica (al.)
Malus sylvestris
Malva alcea
Medicago falcata
Medicago lupulina
Medicago minima
Medicago prostrata
Medicago sativa (al.)
Medicago ×varia (= M. falcata × M. sativa)
Melampyrum arvense
Melampyrum cristatum
Melampyrum nemorosum
Melampyrum pratense
Melica ciliata
Melica nutans
Melica picta
Melica transsilvanica
Melica uniflora
Melilotus alba
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<td>Populus ×canadensis (al.)</td>
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Taraxacum parnassicum
Taraxacum sect. Ruderalia
Taraxacum serotinum
Taxus baccata
Tephroseris integrifolia
Teucrium chamaedrys
Teucrium montanum
Thalictrum flavum
Thalictrum minus
Thesium dollineri
Thesium linophyllon
Thlaspi arvense
Thlaspi perfoliatum
Thuja occidentalis (al.)
Thuja plicata (al.)
Thymelaea passerina
Thymus glabrescens
Thymus pannonicus
Thymus praecox
Tilia cordata
Tilia platyphyllos
Torilis arvensis
Torilis japonica
Tragopogon dubius
Tragopogon orientalis
Trifolium alpestre
Trifolium arvense
Trifolium campestre
Trifolium dubium
Trifolium montanum
Trifolium pratense
Trifolium repens
Tripleurospermum inodorum
Ulmus glabra
Ulmus laevis
Ulmus minor
Urtica dioica
Valeriana stolonifera subsp. angustifolia
Valerianella locusta
Verbascum blattaria
Verbascum chaixii subsp. austriacum
Verbascum lychnitis
Veronica arvensis
Veronica chamaedrys s. str.
Veronica persica
Veronica polita
Veronica praecox
Veronica prostrata
Veronica sublobata
Veronica teucrium
Veronica triloba
Veronica vindobonensis
Viburnum lantana
Vicia angustifolia
Vicia cracca
Vicia dumetorum
Vicia hirsuta
Vicia pisiformis
Vicia tenuifolia
Vicia tetrasperma
Vinca minor
Vincetoxicum hirundinaria
Viola ambigua
Viola arvensis
Viola hirta
Viola kitaibeliana
Viola mirabilis
Viola odorata
Viola reichenbachiana
Viola rupestris
Viola suavis
Viola tricolor subsp. saxatilis
Viola ×scabra (= V. hirta × V. odorata)
Viola ×vindobonensis (= V. odorata × V. suavis)
Viscum album subsp. album
Vitis sp. (al.)
Appendix 2. Vascular plants of the Nature Reserve Svatý kopeček. Alien species, mainly planted trees and shrubs, and rather recent garden escapees, are marked by (al.).

Acer campestre  
Acer negundo  
Acer platanoides  
Acer pseudoplatanus  
Acinos arvensis  
Aesculus hippocastanum (al.)  
Agrimonia eupatoria  
Achillea collina  
Achillea pannonica  
Ailanthus altissima (al.)  
Ajuga genevensis  
Ajuga chamaepitys  
Alliaria petiolata  
Allium flavum  
Allium oleraceum  
Allium rotundum  
Allium scorodoprasum  
Allium senescens subsp. montanum  
Alyssum alsyssoides  
Alysium montanum  
Anemone ranunculoides  
Anthericum ramosum  
Anthriscus caucalis  
Anthriscus cerefolium subsp. trichosperma  
Anthriscus sylvestris  
Anthyllis vulneraria  
Arabis auriculata  
Arabis glabra  
Arabis hirsuta  
Arabis sagittata  
Arctium lappa  
Arenaria serpyllifolia  
Arrhenatherum elatius  
Artemisia absinthium  
Artemisia campestris  
Artemisia vulgaris  
Asparagus officinalis  
Asperula cynanchica  
Asplenium ruta-muraria  
Asplenium trichomanes  
Aster amellus  
Aster linosyris  
Astragalus austriacus  
Astragalus onobrychis  
Atriplex oblongifolia  
Atriplex patula  
Aurinia saxatilis subsp. arduini  
Avenula pratensis subsp. hirtifolia  
Avenula pubescens  
Ballota nigra subsp. nigra  
Berberis vulgaris  
Berteroa incana  
Betonica officinalis  
Bothriochloa ischaemum  
Brachypodium pinnatum  
Brachypodium sylvaticum  
Bromus benekenii  
Bromus erectus  
Bromus inermis  
Bromus japonicus  
Bromus sterilis  
Bromoia alba  
Bupleurum falcatum  
Calamagrostis epigejos  
Camelina microcarpa  
Campanula bononiensis  
Campanula persicifolia  
Campanula rapunculoides  
Campanula sibirica  
Campanula trachelium  
Capsella bursa-pastoris  
Carduus acanthoides  
Carduus crispus  
Carduus nutans  
Carex contigua  
Carex humilis  
Carex michelii  
Carex montana  
Carex muricata s. str.  
Carex supina  
Carlina biebersteinii  
Carpinus betulus
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<th>Common Name</th>
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<td>Centaurea stoebe</td>
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<td>Centaurea triumfettii subsp. axillaris</td>
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<td>Cymbalaria muralis (al.)</td>
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<td>Globularia bisnagarica</td>
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<td>Hedera helix</td>
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<td>obscurum</td>
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<td>Heracleum sphondylium</td>
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Hieracium murorum  Lycium barbarum  
Hieracium pilosella  Mahonia aquifolium (al.)  
Hieracium rothianum  Medicago falcata  
Hieracium sabaudum  Medicago lupulina  
Hieracium umbellatum  Medicago minima  
Holosteum umbellatum  Medicago sativa (al.)  
Hordeum murinum  Medicago ×varia (= M. falcata × M. sativa)  
Hylotelephium maximum  Melampyrum arvense  
Hypericum hirsutum  Melica altissima (al.?)  
Hypericum montanum  Melica ciliata  
Hypericum perforatum  Melica uniflora  
Impatiens parviflora  Melilotos officinalis  
Inula conyza  Holosteum umbellatum  
Inula ensifolia  Hylotelephium maximum  
Inula hirta  Hypericum hirsutum  
Inula oculus-christi  Hypericum montanum  
Iris humilis subsp. arenaria  Hypericum perforatum  
Iris pumila  Impatiens parviflora  
Isopyrum thalictroides  Isopyrum thalictroides  
Jovibarba globifera subsp. hirta  Jovibarba globifera subsp. hirta  
Juglans regia (al.)  Jovibarba globifera subsp. hirta  
Jurinea mollis  Jovibarba globifera subsp. hirta  
Koeleria macrantha  Jovibarba globifera subsp. hirta  
Laburnum anagyroides  Jovibarba globifera subsp. hirta  
Lactuca quercina  Jurinae mollis  
Lactuca serriola  Koeleria macrantha  
Lactuca viminea  Laburnum anagyroides  
Lamium album  Laburnum anagyroides  
Lamium amplexicaule  Lactuca serriola  
Lamium maculatum  Lactuca viminea  
Lamium purpureum  Lapsana communis  
Lapsana communis  Larix decidua (al.)  
Larix decidua (al.)  Lavatera thuringiaca  
Lavatera thuringiaca  Leontodon hispidus  
Papaver maculosum subsp. austromoravicum  
Lepidium campestre  Papaver maculosum subsp. austromoravicum  
Ligustrum vulgare  Parthenocissus inserta  
Linaria genistifolia  Pastinaca sativa subsp. sativa  
Linaria vulgaris  Petrorhagia prolifera  
Linum tenuifolium  Peucedanum alsaticum  
Lithospermum purpurocaeruleum  Phleum phleoides  
Lolium perenne  Picris hieracioides  
Lonicera caprifolium  Pimpinella saxifraga subsp. nigra  
Loranthus europaeus  Pinus nigra (al.)  
Lotus borbasii  Pinus sylvestris (al.)  
Lotus corniculatus  Plantago lanceolata
Plantago major
Plantago media
Platycladus orientalis (al.)
Poa angustifolia
Poa annua
Poa badensis
Poa bulbosa
Poa compressa
Poa nemoralis
Polygonatum multiflorum
Polygonatum odoratum
Polygononum aviculare s. lat.
Populus alba
Potentilla arenaria
Potentilla argentea
Potentilla heptaphylla
Potentilla inclinata
Potentilla recta
Primula veris
Prunus avium
Prunus cerasifera (al.)
Prunus fruticosa
Prunus mahaleb subsp. simonkaii
Prunus spinosa
Prunus ×eminens (= P. fruticosa × P. cerasus)
Pseudolysimachion spicatum
Pulmonaria officinalis
Pulsatilla grandis
Pyrus pyraster
Quercus cerris (al.)
Quercus petraea
Quercus pubescens
Quercus robur
Ranunculus auricomus agg.
Ranunculus illyricus
Ranunculus polyanthemos
Reseda lutea
Rhamnus cathartica
Ribes rubrum
Ribes uva-crispa
Robinia pseudacacia (al.)
Rosa canina subsp. canina
Rosa canina subsp. corymbifera
Rosa pimpinellifolia
Rubus caesius

Rumex patientia
Salix caprea
Salvia officinalis (al.)
Salvia pratensis
Salvia verticillata
Sambucus nigra
Sanguisorba minor
Saponaria officinalis
Saxifraga tridactylites
Scabiosa ochroleuca
Scilla sibirica
Scorzonera austriaca
Scorzonera cana
Scrophularia nodosa
Securigera varia
Sedum acre
Sedum album
Sedum spurium
Senecio jacobaea
Seseli annuum
Seseli hippocammaranthrum
Seseli osseum
Sesleria albicans
Setaria viridis
Silene latifolia subsp. alba
Silene nutans
Silene otites
Silene vulgaris subsp. antelopum
Silene vulgaris subsp. vulgaris
Sisymbrium orientale
Solidago canadensis (al.)
Solidago virgaurea subsp. virgaurea
Sorbus torminalis
Stachys recta
Staphylea pinnata
Stellaria media
Stipa capillata
Stipa eriocaulis
Stipa pennata s. str.
Stipa pulcherrima
Syringa vulgaris
Tanacetum corymbosum subsp. corymbosum
Taraxacum sect. Erythroserma
Taraxacum sect. Ruderalia
<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Plant Name</th>
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<tbody>
<tr>
<td><em>Taxus baccata</em></td>
<td><em>Veronica arvensis</em></td>
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<tr>
<td><em>Teucrium chamaedrys</em></td>
<td><em>Veronica polita</em></td>
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<tr>
<td><em>Teucrium montanum</em></td>
<td><em>Veronica praecox</em></td>
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<tr>
<td><em>Thalictrum foetidum</em></td>
<td><em>Veronica prostrata</em></td>
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<tr>
<td><em>Thalictrum minus</em></td>
<td><em>Veronica sublobata</em></td>
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<tr>
<td><em>Thesium linophyllon</em></td>
<td><em>Veronica teucrium</em></td>
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<tr>
<td><em>Thlaspi perfoliatum</em></td>
<td><em>Veronica vindobonensis</em></td>
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<td><em>Thymus glabrescens</em></td>
<td><em>Viburnum lantana</em></td>
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<td><em>Thymus praecox</em></td>
<td><em>Vicia tenuifolia</em></td>
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<td><em>Tilia platyphyllos</em></td>
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<td><em>Vincetoxicum hirundinaria</em></td>
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<td><em>Viola ambigua</em></td>
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<td><em>Viola arvensis</em></td>
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<td><em>Viola reichenbachiana</em></td>
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<td><em>Viola riviniana</em></td>
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<td><em>Tulipa ×gesnerana</em> (al.)</td>
<td><em>Viola rupestris</em></td>
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<td><em>Ulmus glabra</em></td>
<td><em>Viola suavis</em></td>
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<td><em>Viola tricolor subsp. saxatilis</em></td>
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<tr>
<td><em>Urtica dioica</em></td>
<td><em>Viola ×haynaldii</em> (= V. ambigua × V. suavis)</td>
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<tr>
<td><em>Valeriana stolonifera</em></td>
<td><em>Viola ×hungarica</em> (= V. ambigua × V. odorata)</td>
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<td>subsp. angustifolia*</td>
<td><em>Viola ×kernerii</em> (= V. hirta × V. suavis)</td>
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<td><em>Valerianella locusta</em></td>
<td><em>Viola ×scabra</em> (= V. hirta × V. odorata)</td>
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<td><em>Viola ×vindobonensis</em> (= V. odorata × V. suavis)</td>
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<td>subsp. austriacum*</td>
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<tr>
<td><em>Verbascum ×pseudolychnitis</em> (= V. chaixii subsp. austriacum × V. lycnitis)</td>
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17th International Workshop European Vegetation Survey
Using phytosociological data to address ecological questions

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Abstracts and Excursion Guides

Edited by
Milan Chytrý

Excursion Guides by
Jiří Danihelka, Milan Chytrý, Jan Roleček & Vít Grulich

Published by Masaryk University, Brno
1st edition, 2008
Serial number Př-4/08-02/58
Printed by www.knihovnicka.cz, Tribun EU s. r. o.