# Podyjí National Park: Botanical Excursion Guide

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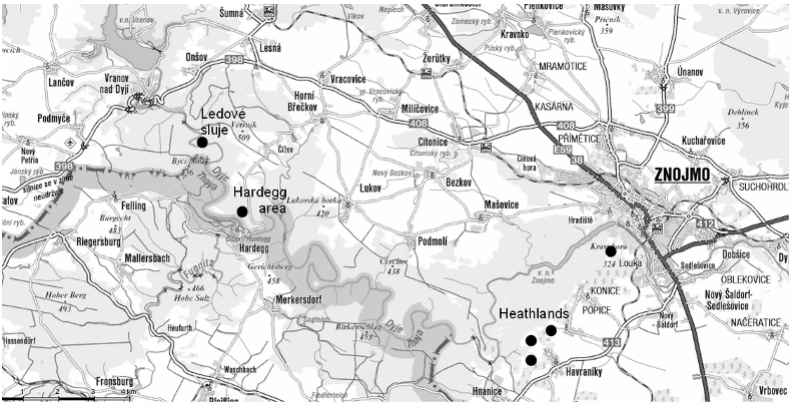
## Introduction

Podyjí National Park is situated in southwestern Moravia between the towns of Znojmo and Vranov nad Dyjí along the Czech-Austrian border. Austrian Thaytal National Park is adjacent on the other side of the national border.




*Podyjí National Park with indication of the sites to be visited*

The territory of the National Park is at the southeastern edge of the Bohemian-Moravian Highlands (Českomoravská vrchovina). A remarkable landscape element is the 60–200 m deep, V-shaped valley of the Dyje (in German Thaya) River. The slopes of the valley are steep, with abundant rock outcrops, and dissected by numerous ravines. The valley is surrounded by a gently undulating landscape, which is rather typical of the Bohemian Massif in the central and south-western part of the Czech Republic. The highest point of the National Park is Býčí hora Hill (536 m) in its western part, the lowest point (208 m) is the level of the Dyje River at the eastern edge of the National Park.

The area is built of Proterozoic crystalline rocks of the Bohemian Massif. Granitoids (granites and granodiorites) predominate in the eastern part of the National Park, south-west of the town of Znojmo, where they are locally overlaid by soft Miocene (Upper Tertiary) deposits. Gneiss is the main bedrock type in the western part of the National Park, between the towns of Vranov nad Dyjí and Hardegg. Acidic mica shist is the most common bedrock in the central part of the National Park, but in this area outcrops of more base-rich bedrock (amphibolite,

marble) are also encountered. Quaternary eolian deposits (loess) are found mainly in the eastern part of the area.

Predominant soil type is cambisol. Orthic luvisols occur on crystalline plateaus and gentle slopes with a thick layer of weathering products of ancient rocks or young deposits. Outcrops of ancient hard bedrock are covered by shallow rankers and lithosols, and marble outcrops with rendzinas. Gleysols are found in shallow wet depression on the plateaus, and loamy-sandy fluvisols on the alluvial terraces of the valley bottom. In the eastern part of the area, chernozems are developed on the fine-grained Tertiary or Quaternary deposits, whereas albic luvisols prevail on Neogene sand and gravel.

The climate in the east of the National Park is dry and warm. The mean annual temperature in Znojmo-Kuchařovice is 8.8 °C and the mean annual precipitation of 564 mm, which is similar to the warm and dry lowland area of southern Moravia. Moving to the northwest, the climate becomes increasingly cooler and wetter. Complex topography of the river valley generates remarkable mesoclimatic patterns. Whereas the gently undulating landscape, at least in the central and north-western part of the area, has oceanic climatic features with smaller differences between minimum and maximum temperatures, the climate of the river valley is more continental. Upper parts of the south-facing slopes may warm up considerably during the daytime but they cool off to temperatures lower than elsewhere in the valley during clear nights. There are two types of temperature inversion in the valley. Inversion due to topographical shading mainly affects the lower parts and foots of the north-facing slopes. It is most intense during the daytime and limits temperature maxima. This type of inversion supports occurrence of montane plants in these habitats. The second type of inversion is caused by the cold-air drainage, which occurs from time to time during clear and calm nights, and creates a temperature difference of up to 3 °C between the warmer upper slopes and cooler valley bottom. Particularly in spring, this inversion may cause a frost injury to sensitive plants. It is possible that some species of oceanic distribution and even Fagus sylvatica may be outcompeted from the valley due to frost injuries.

**History of botanical research and nature conservation**

The flora of the area was studied in detail by Adolf Oborny, a secondary school teacher, in 1870-1920. Since then hardly any species new to the region have been found except for a few ones from taxonomically intricate groups. The comprehensive *Flora des Znaimer Kreises* (Flora of the Znojmo District; Oborny 1879) enables a comparison with the current situation.

After 1948 the whole territory was closed to the public being a state border area (iron courtain). The Podyjí Landscape Protected Area was established in 1978. In the 1980s, research was resumed, and its results were later used as arguments for establishing a national park. This happened in 1991 when the Podyjí National Park was established on an area of 63 $km^2$, covering nearly the whole territory of the former Landscape Protected Area. Particularly valuable sites, formerly nature reserves, e.g. Hamerské vrásy, Havranické vřesoviště, Hradišťské terasy, Kraví

hora, Popické kopečky and Údolí Dyje, are now protected under the regulations of the first zone (core area) of the National Park. The activities on the Czech side of the border were coordinated with those in Austria. On 1 January 2000, the National Park became bilateral through the establishment of the Thaytal National Park in the adjacent area in Austria.

Intensive botanical research, coordinated by Professor Jiří Vicherek at Masaryk University, Brno, took place in the whole area of the Podyjí National Park and in adjacent areas of Austria in the early 1990s. This research included inventories of macromycetes, lichens, bryophytes, vascular plants and plant communities, and resulted in three monographs and a series of journal papers.

**Vegetation**

The Podyjí National Park is situated in the transitional area between continental (Pannonian) and Central European (Hercynian) phytogeographical regions. The Pannonicum corresponds to the continental forest-steppe biome, and the Hercynicum to the deciduous forest biome. The boundary between these regions generally follows the geological dividing line between the Bohemian Massif (north-western and central part of the National Park, with higher altitudes, lower temperatures, higher precipitation, ancient siliceous bedrock, and a landscape mosaic of forest tracts and treeless areas) and the outer depressions of the Western Carpathians and the Eastern Alps (southeastern part of the National Park, with lower altitudes, warmer and drier climate, Tertiary and Quaternary deposits, and a landscape largely deforested since prehistoric times).

The predominant vegetation type of the National Park is the broad-leaved deciduous forest. In the western (Hercynian) part, near the towns of Vranov nad Dyjí and Hardegg, submontane beech forests (associations *Melico unifloraeFagetum sylvaticae*, *Carici pilosae-Fagetum sylvaticae* and *Tilio cordataeFagetum sylvaticae*; alliance *Fagion sylvaticae*) are the main types of potential natural vegetation. They are found in the gently undulating landscape at altitudes above 450 m. Hercynian oak-hornbeam forests (*Melampyro nemorosi-Carpinetum betuli; Carpinion betuli*) are predominant in the central part of the National Park and in the river valleys. Moving to the east towards the region of Pannonian flora, oak-hornbeam forests are replaced by acidophilous oak forests (*Genisto germanicae-Quercion*) and, on the south-eastern slope of the Bohemian Massif, by thermophilous oak forests (*Sorbo torminalis-Quercetum*; *Quercion petraeae*). In the outer depressions of the Carpathians, which are adjacent to the Bohemian Massif in the east, a mosaic of thermophilous oak forests (*Quercetum pubescenti-roboris*; *Aceri tatarici-Quercion*) and Pannonian oak-hornbeam forests (*Primulo veris-Carpinetum; Carpinion betuli*) is supposed to be the potential natural vegetation; however, this area has been largely deforested since the Neolithic.

A remarkable vegetation pattern is encountered in the river valleys. The alluvium is covered by riverine alder forests (*Stellario-Alnetum glutinosae; Alnion incanae*). Lower slopes support ravine forests (*Aceri-Carpinetum; Tilio-Acerion*) at steeper sites and oak-hornbeam forests (*Melampyro nemorosi-Carpinetum; Carpinion betuli*) at less inclined sites. South-facing upper slopes are covered by

thermophilous oak forests (*Sorbo torminalis-Quercetum* and *Genisto pilosae-Quercetum petraeae*; both *Quercion petraeae*) whereas the north-facing slopes support acidophilous oak forests (*Luzulo albidae-Quercetum*; *Genisto germanicae-Quercion*). On the tops of ridges and cliffs, small patches of pine forests (*Cardaminopsio petraeae-Pinetum sylvestris*; *Dicrano-Pinion*) are found.

The river valley includes patches of primary treeless habitats on cliffs, rock faces and talus slopes. On south-facing slopes, these are covered by scrub (*Prunion spinosae*, *Berberidion*) or dry grasslands (*Festucion valesiacae*; *Alysso-Festucion pallentis*). North-facing treeless patches are dominated by rocky grasslands of *Calamagrostis arundinacea* on siliceous bedrock, and by *Sesleria caerulea* grassland (*Diantho lumnitzeri-Seslerion*) on marble. Talus slopes are covered with cryptogamic vegetation and, near the forest edges, with species-poor communities of mosses and ferns. There are rich bryophyte communities especially on open north-facing talus slopes, where several species of boreal distribution are found.

Secondary treeless vegetation is mainly found in the border area of the National Park and in the adjacent landscape. In the western and central part, *Arrhenatherion elatioris* and *Calthion palustris* meadows are predominant types of secondary meadows. *Arrhenatherion elatioris* meadows are also found on the Dyje deforested terraces in the river floodplain. The river is fringed by the *Phalaridion arundinaceae* riverine reeds with *Phalaris arundinacea* and *Carex buekii*. The largely deforested south-eastern slope of the Bohemian Massif in the eastern part of the National Park is well-known for its extensive dry heathland with thermophilous and continental species (*Euphorbio cyparissiae-Callunetum vulgaris; Euphorbio cyparissiae-Callunion vulgaris*) and acidophilous dry grasslands (*Potentillo heptaphyllae-Festucetum rupicolae; Koelerio-Phleion phleoidis*). The area of the outer depression of the Western Carpathians is mainly dominated by arable land and vineyards, and the most remarkable type of semi-natural vegetation is the *Convolvulo-Agropyrion* grassland in road verges on loess.

**Flora**

During the inventory of the flora of the Czech Podyjí and Austrian Thaytal National Parks and adjacent areas in the 1990s approximately 1290 species of vascular plants were recorded. Of these, 27% Central European, 26% are Eurasian temperate species, 12% submediterranean and 9% neophytes.

Deforested area of the southern Moravian lowlands, which is adjacent to the eastern border of the National Park, contains thermophilous Pannonian and continental species of steppe, ruderal habitats on loess and inland saline grasslands. The group of species that are only found in this area includes *Alcea biennis*, *Astragalus onobrychis*, *Atriplex oblongifolia*, *Carex hordeistichos*, *Cytisus procumbens*, *Iris pumila*, *Kochia prostrata* (only in Austria), *Peucedanum alsaticum*, *Ranunculus illyricus*, *Salvia austriaca* (only in Austria), *Scabiosa canescens*, *Sclerochloa dura*, *Scorzonera cana* and *Seseli hippomarathrum*. Some thermophilous species occur in this warm and dry eastern area, but are also found in the river valley in the central and western part of the National Park, e.g.

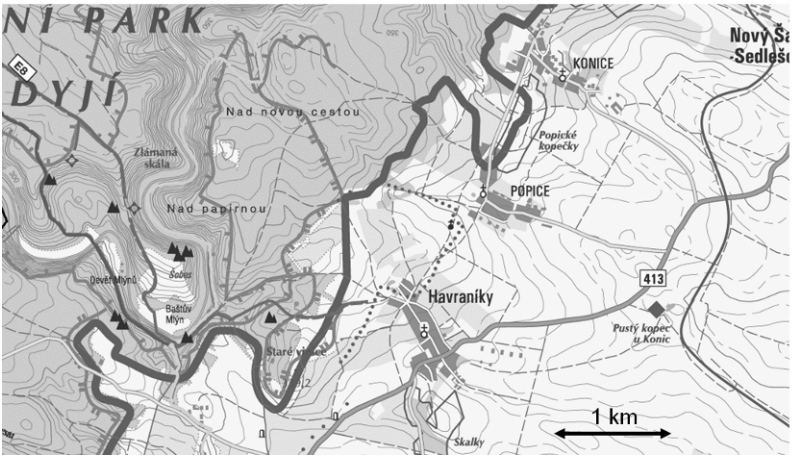
*Armeria vulgaris*, *Carex supina*, *Rosa jundzillii*, *R. spinosissima*, *Salvia pratensis* and *Scabiosa ochroleuca*. Another group of thermophilous species is confined to the areas with base-rich soils, found in the eastern lowland area and on the marble bedrock around the town of Hardegg in the central-western part of the National Park, e.g. *Aster amellus*, *Inula ensifolia* and *Polygala major*. A group of species phytogeographically related to the limestone fringes of the Alps is found on the marbles near Hardegg, e.g. *Buphthalmum salicifolium* (the only current locality in the Czech Republic), *Bupleurum longifolium* (now only in Austria), *Euphorbia angulata*, *Laserpitium latifolium* (only in Austria), *Polygala amara* and *Sesleria caerulea*. This marble area also harbours some orchids, such as *Cypripedium calceolus*, *Orchis militaris* and *O. purpurea*. Some thermophilous species are confined to the rock outcrops and forest edges in the Dyje river valley, including *Aconitum anthora*, *Aurinia saxatilis* and *Bupleurum affine*. Species of acidic rock outcrops are found in the river valley and in the area of the south-eastern edge of the Bohemian Massif; this group includes *Gagea bohemica*, *Genista pilosa*, *Scleranthus perennis*, *Sedum reflexum* and *Veronica dillenii*.

Montane species such as *Aconitum variegatum*, *Aruncus dioicus*, *Lunaria rediviva*, *Polystichum aculeatum*, *Rosa pendulina* and *Taxus baccata* are found in the shaded parts of the river valley. Another group of montane species, including *Atropa bella-donna*, *Equisetum sylvaticum*, *Hordelymus europaeus*, *Petasites albus*, *Prenanthes purpurea* and *Vicia sylvatica*, occurs on the plateaus dominated by beech forest in the western part of the National Park. Deforested plateaus in the central and western part of the National Park contain some wet meadows and patches of wet alder forest with submontane species such as *Bistorta major*, *Carex appropinquata*, *C. elongata*, *C. umbrosa*, *Salix rosmarinifolia*, *Scorzonera humilis*, *Tephroseris crispa* and *Trollius altissimus*.

**Sites worth visiting**

**Dry heathlands near the villages of Popice and Havraníky** (Appendix 1)

Gentle slopes of the south-eastern edge of the Bohemian Massif in the eastern part of the National Park are formed of granitoids, which are noticeable as slightly elevated outcrops. In places granitoids are covered by Tertiary deposits or loess. Natural vegetation of that area would be a mosaic of thermophilous oak forests with *Quercus petraea*, locally also *Q. pubescens*, and oak-hornbeam forests with *Carpinus betulus* and *Q. petraea*. However, the area has been deforested probably since the Neolithic period and shallow soils on the granitic bedrock were used as oligotrophic pastures for livestock. In the 18th and 19th centuries there was extensive sheep farming, but most pastures were abandoned already at the end of 19th century. Secondary succession of woody vegetation is rather slow on shallow granitic soils in the dry local climate, therefore an extensive area of former pastures has been preserved as an open land until the present. Preservation of grasslands and heathlands was facilitated by occasional grazing, accidental fires, and using some parts of the area as military training ground. Nature conservation management of grasslands and heathlands is applied since the early 1990s.




*Area of heathlands in the eastern part of the Podyjí National Park (SW of the city of Znojmo).*

Thermophilous acidophilous grasslands of the association *Potentillo heptaphyllae-Festucetum rupicolae* (alliance *Koelerio-Phleion phleoidis*) and heathlands of the association *Euphorbio cyparissiae-Callunetum vulgaris* (*Euphorbio cyparissiae-Callunion vulgaris*) developed here as the main types of semi-natural vegetation, encompassing also small patches of pioneer communities of the association *Festuco-Veronicetum dillenii* (*Arabidopsion thalianae*) on shallow soils adjacent to rock outcrops. In the 1990s, the competetively strong grass *Arrhenatherum elatius* expanded in the area, probably due to increased atmospheric nitrogen deposition. The shallow valleys between the flat elevations used to support patches of wet *Calthion palustris* meadows, most of which have been destroyed. *Carex cespitosa*, *Cirsium canum* and *Iris sibirica* occurred here until recently.

The heathland vegetation comprises an unusual combination of plant geographic elements, all being more or less xerophilous. Pannonian species are well represented and some of them reach their western distribution limits here (e.g. *Cytisus procumbens*, *Iris pumila*, *Linaria genistifolia*, *Pulsatilla grandis* and *Saxifraga bulbifera*). Acidophilous heathland species, some of them with sub-Atlantic distribution ranges, form another distinct group, including *Armeria vulgaris*, *Calluna vulgaris*, *Gagea bohemica*, *Scleranthus perennis*, *Sedum reflexum*, *Veronica dillenii* and *V. verna*. Species of sand grasslands, such as *Corynephorus canescens*, *Filago minima* and *Vulpia myuros*, are confined to granite outcrops and coarse sand produced through granite weathering. *Avenella flexuosa*, *Danthonia decumbens*, *Nardus stricta* and *Sambucus racemosa* are typical Hercynian elements. *Biscutella laevigata* subsp. *varia* and *Cotoneaster integerrimus* have perialpine distribution ranges. Endangered species *Helichrysum*

*arenarium*, *Melampyrum arvense* and *Orchis morio* still form large populations in this area.

*Heathland management*

Heathland is an Atlantic vegetation type, which becomes increasingly rare in the more continental climate of dry areas of Central Europe. As a secondary vegetation, they require regular disturbance to prevent succession into scrub or woodland. The heathlands in the area were grazed by sheep in the 19th century, but no other details on the traditional management are known. In the 20th century the land was largely abandoned. In the 1990s, some parts of the heathland area were covered with open scrub, groups of *Betula pendula* and *Pinus sylvestris* trees. Competitive grasses *Arrhenatherum elatius* and *Calamagrostis epigejos* started to expand in many places. In 1992 a series of management experiments was established to test whether some management practices used in Western European heathlands are applicable for the dry, continental, and species-rich heathlands in the Podyjí National Park.

The management practices tested were burning, sod-cutting with vegetation and topsoil removal, and cutting of the above-ground biomass. Burning promoted successful regeneration of *Calluna vulgaris*. Dense heathlands containing large amount of woody biomass support medium-intensity fire, which destroys moss mats and litter. On bare ground *Calluna* regeneration by seed can take place, in addition to vegetative regrowth. In contrast, open heathlands with patches of herbaceous vegetation support only low-intensity fires, which do not open bare mineral soil. Almost all *Calluna* regeneration is vegetative in this case, and regrowth is slower.

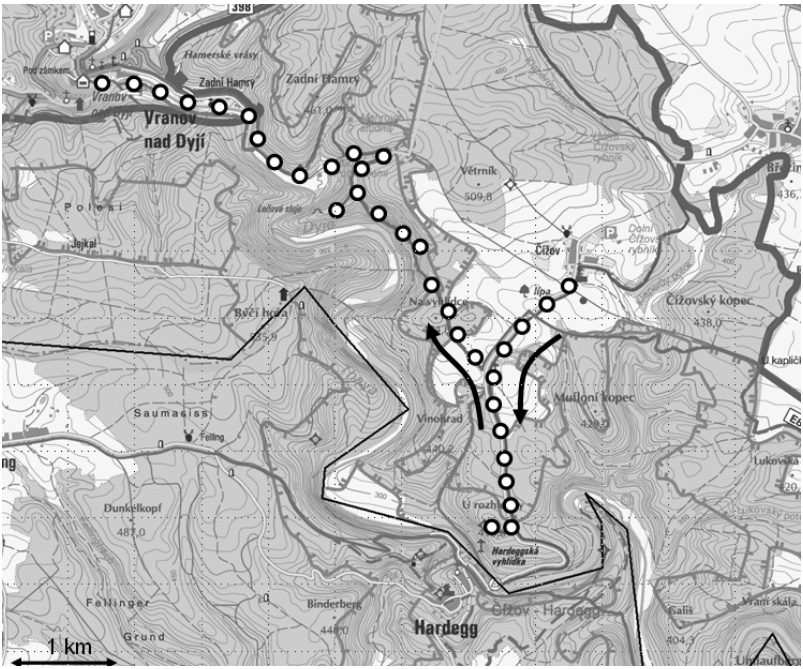
Heathland recovery after sod-cutting depends on whether or not *Calluna* seed germination occurs in the plot. With germination, the community develops towards heathland; otherwise it changes into dry grassland. Cutting of the above-ground biomass leads to a striking increase in grass cover, which is followed by a slow recovery of *Calluna*.

All of these management practices result in an increased species richness of vascular plants, bryophytes, and lichens which are natural constituents of the community. No spread of alien species was observed. The number of species in experimental plots peaks 3–4 years after the disturbance. The highest increase in species richness is in the sod-cut plots, where species germinate on the exposed mineral soil. This experiment suggests that proper nature conservation management of heathland can be based on sheep grazing combined with rotational sod-cutting or burning of restricted patches.

Serious threat to the heathland biodiversity is the rapid expansion of *Arrhenatherum elatius*, which started in the mid 1990s. Spread of this grass is probably caused by nitrogen accumulation due to long-time abandonment combined with increased atmospheric deposition. The National Park staff are trying to stop this expansion by sheep grazing, mowing, and litter removing, but so far the results are unsatisfactory.

**Dyje valley near Hardegg** (Appendix 2)

The site worth visiting includes the surroundings of the Hardegg observation point (Hardeggská vyhlídka) and the slope opposite the town of Hardegg (Hardeggská stráň). It is situated in the region where the Dyje River valley and its right-side tributary Fugnitz deeply cut through different layers of the Moravicum rock series. Various sorts of rock, such as base-rich marble and amphibolite on the one hand, and acidic orthogneiss on the other, strongly affect the local distribution pattern of plant species and vegetation types.




*Dyje valley in the western part of the Podyjí National Park between the towns of Vranov nad Dyjí and Hardegg. Dots indicate the excursion route.*

From the Hardegg observation point, located on the upper edge of the Dyje valley on the Czech side of the state border, there is a romantic view of the small Austrian town of Hardegg with its castle, built on the cliff above the confluence of the Dyje and Fugnitz rivers. It was built at the turn of the 11th and 12th centuries as one of the fortresses that protected the Austrian border. A parallel chain of fortresses was built on the Czech (Moravian) side of the border. In the 17th century the castle lost its original purpose, and was turned into hunting lodge, and after a major restoration at the end of 19th century, it became a public museum

dedicated to Emperor Maximilian of Mexico, brother of Emperor Franz-Josef of Austria.

This area is very rich in species. During the detailed grid mapping of the flora in the 1990s more than 600 vascular plant species per 1' × 0.6' square (about 1.2 $km^2$) were recorded. This number is even more striking when we consider the low human influence in the area. Arable fields and ruderal habitats are almost absent, and even in the past no settlements other than the Austrian town of Hardegg existed here.

The plateau above the valley is covered by Hercynian oak-hornbeam forests (association *Melampyro nemorosi-Carpinetum betuli*, alliance *Carpinion betuli*) with *Dentaria bulbifera*, *Hepatica nobilis* and *Stellaria holostea* in the herb layer, accompanied by perialpidic species *Carex pilosa* and *Cyclamen purpurascens*. *Abies alba* is remarkable here not only for its presence but also for its natural regeneration. In a stand of an oak-hornbeam forest over a marble outcrop, *Cypripedium calceolus* grows together with *Corallorhiza trifida*, *Daphne mezereum*, *Euphorbia angulata* and *Hierochloë australis*.

The south-facing slopes with outcrops of amphibolite and amphibolitic gneiss support thermophilous oak forests of the association *Sorbo torminalis-Quercetum* (alliance *Quercion petraeae*) with acidophilous species *Agrostis vinealis*, *Avenella flexuosa* and *Festuca ovina* in the herb layer. Acidophilous dry grasslands of the alliance *Alysso-Festucion pallentis* are confined to the gneiss outcrops. *Gagea bohemica* and *Veronica dillenii* occur here on rock edges and narrow terraces. On marble, acidophilous oak forests are replaced by basiphilous ones, represented here by the associations *Corno-Quercetum* and *Pruno mahaleb-Quercetum pubescentis* (alliance *Quercion pubescenti-petraeae*); *Quercus pubescens* is, however, absent from this part of the valley due to its isolated location outside the Pannonian region. In open places, forest edge communities of the alliance *Geranion sanguinei* with *Buphthalmum salicifolium*, *Dictamnus albus*, *Geranium sanguineum*, *Inula hirta* and *Peucedanum cervaria* are found, together with dry grasslands of the alliance *Festucion valesiacae*, including *Carex humilis*, *Festuca valesiaca*, *Inula ensifolia*, *Orchis militaris*, *Polygala major* and *Stipa pennata*. Grasslands dominated by *Sesleria caerulea*, accompanied by *Aster amellus* and *Hypochaeris maculata*, occur rarely on west-facing slopes. Pioneer communities of the association *Cerastietum* (alliance *Alysso alyssoidis-Sedion*) with spring therophytes, such us *Arabis auriculata*, *Saxifraga tridactylites* and *Veronica praecox*, are restrictedto marble outcrops. *Sorbus hardeggensis*, named after the town of Hardegg, occurs here among scattered shrubs. This recently described hybridogenous apomictic species is derived from a crossing between *S. aria* s. lat. and *S. torminalis*.

The species composition of most forest stands is nearly natural. Plantations of Scots pine (*Pinus sylvestris*), Norwegian spruce (*Picea abies*) and European larch (*Larix decidua*) will be gradually replaced by autochthonous tree species according to the management plan of the National Park. Rock vegetation, thermophilous oak forests, their thermophilous fringes and dry grasslands require no management in the area. The bottom of the Dyje River valley used to be farmed. It was covered mainly with the *Arrhenatherion elatioris* meadows but

also with strips of arable land. They have been regrassed since the mid 1990s. The meadows will be preserved here as a valuable component of the cultural landscape.

**Ledové sluje (Ice Caves)**

Ledové sluje (in German Eisleiten) is a system of pseudocarst caves situated in the Dyje valley between the towns of Vranov nad Dyjí and Hardegg. Since several centuries these caves have been famous for containing ice until late summer. In a broader sense, Ledové sluje is a local name for the whole ridge where these caves occur.

The ridge of Ledové sluje is located above the left bank of the Dyje river, between flat hills of Větrník (510 m) and Býčí hora (514 m). The river flows in deeply entrenched meanders between these two hills at an altitude of ca. 300 m. The ridge is formed of Proterozoic orthogneiss. On the steep valley slopes there are several slope failures, which gave rise to about twenty crevice-type caves. The longest cave system is more than 400 m long. On the NW-facing slopes of the ridge there is a talus slope formed of large gneiss blocks originated through rock falls from the above cliffs.

The Ledové sluje ridge is remarkable for a large diversity of habitats, including south- and north facing slopes, rock outcrops, steep slopes, rock debris and deep soils on the lower slopes and in the narrow river floodplain. This is reflected both in the species-rich flora and the high number of vegetation types recognized in this rather small area (< 0.5 $km^2$).

*Vegetation*

Most of the area of Ledové sluje is forested. Mesic and deep cambisols on the middle and lower slopes are occupied by oak-hornbeam forests with Carpinus betulus and *Quercus petraea* (association *Melampyro nemorosi-Carpinetum betuli*, alliance *Carpinion betuli*) and species of mesic broad-leaved forests in the herb layer, e.g. *Campanula persicifolia*, *Cyclamen purpurascens*, *Dactylis polygama*, *Galium odoratum*, *G. sylvaticum*, *Hepatica nobilis*, *Poa nemoralis* and *Stellaria holostea*. Shallower cambisols (up to 40 cm deep) on the upper north-facing slopes support acidophilous oak forests dominated by *Quercus petraea* (association *Luzulo luzuloidis-Quercetum petraeae*; alliance *Genisto germanicae-Quercion*). These open-canopy forests have a species-poor herb layer with calcifuge species such as *Avenella flexuosa*, *Luzula luzuloides*, *Festuca ovina* and *Vaccinium myrtillus*. Their rich moss layer contains *Dicranum scoparium*, *Hypnum cupressiforme*, *Polytrichum formosum*, *P. juniperinum* and other species. In similar topographic situations on south-facing slopes acidophilous oak forests are replaced by thermophilous oak forests (association *Sorbo torminalis-Quercetum petraeae*; alliance *Quercion petraeae*). Their canopy is also dominated by *Quercus petraea*, but they contain a number of shrubs (e.g., *Cornus mas*, *Ligustrum vulgare* and *Rosa canina* agg.) and a species-rich herb layer. It is mostly dominated by *Festuca ovina*, which is accompanied by *Anthericum*

*ramosum*, *Bupleurum falcatum*, *Euphorbia cyparissias*, *Hylotelephium maximum*, *Poa nemoralis*, *Polygonatum odoratum*, *Teucrium chamaedrys*, *Trifolium alpestre*, *Vincetoxicum hirundinaria* and other species. Broad-leaved ravine forests (association *Aceri-Carpinetum betuli*; alliance *Tilio-Acerion*) are found on steep lower slopes with accumulation of rock debris. They have a species-rich tree layer, including *Acer platanoides*, *A. pseudoplatanus*, *Carpinus betulus*, *Tilia cordata* and *Tilia platyphyllos* and shrub layer with C*orylus avellana*, *Euonymus verrucosa*, *Lonicera xylosteum* and *Ribes uva-crispa*. There is a species-poor herb layer with nutrient-demanding and shade-tolerant forest species, such as *Dryopteris filix-mas*, *Galeobdolon montanum*, *Geranium robertianum* and *Urtica dioica*. Moss layer is luxuriant, with most common species including *Dicranum scoparium*, *Hypnum cupressiforme* and *Polytrichum formosum*. Small patches of natural pine forests (association *Cardaminopsio petraeae-Pinetum sylvestris*, alliance *Dicrano-Pinion sylvestris*) are found on the tops and faces of gneiss outcrops. Besides *Pinus sylvestris* they contain some individuals of *Quercus petraea* and *Betula pendula*. Their species-poor herb layer is dominated by *Festuca ovina* and contains also *Avenella flexuosa*, *Genista pilosa* and *Polypodium vulgare*. Moss layer contains *Dicranum scoparium*, *Hypnum cupressiforme*, *Polytrichum piliferum* and a number of lichens, including *Parmelia conspersa*, *P. pulla*, *P. saxatilis* and *P. somloensis*.

Natural treeless vegetation is found on the open talus slopes and rock faces. Talus slopes have a rich flora of lichens and bryophytes. Most common macrolichen is *Cladonia rangiferina* and most common bryophytes include *Antitrichia curtipendula*, *Dicranum scoparium*, *Hypnum cupressiforme* and *Polytrichum formosum*. Large areas of the talus slopes contain only cryptogamic vegetation with abundant epilithic microlichens. Vascular plant flora in this habitat is species-poor, including *Dryopteris filix-mas*, *Festuca ovina*, *Poa nemoralis* and *Polypodium vulgare*. Well-insolated rock faces harbour *Aurinia saxatilis*, *Festuca ovina* and *Polypodium vulgare*. In contrast, shaded rocks are covered with moss polsters, mainly by *Hypnum cupressiforme* and contain some ferns growing in crevices, most frequently *Polypodium vulgare*.

*Flora (Appendix 3)*

Detailed inventories done in the early 1990s recorded 163 species of lichens, 28 species of liverworts, 95 species of mosses and 502 species of vascular plants. Lichen *Endocarpon psorodeum* was found here as the first record for the Czech Republic. Several species of lichens and bryophytes occurring on talus slopes in Ledové sluje are more typical of high-altitude areas, but they occur here in places influenced by cold air flowing out of the ice caves. These include lichens *Cladonia squamosa subsp. subsquamosa*, *Fuscidea cyathoides*, *Peltigera aphtosa*, *Pertusaria corallina*, *Rhizocarpon geographicum* subsp. *geographicum* and *Umbilicaria polyphylla*, liverworts *Anastreptophyllum minutum*, *Barbilophozia hatcheri*, *Calypogeia muelleriana*, *Jamesoniella autumnalis*, *Lophozia longidens*, *Porella cordeana* and *Tritomaria quinquedentata* and moss *Polytrichum alpinum*.

Flora of vascular plants is dominated by Central European (35%) and temperate Eurasian (34%) species, but submediterranean species are also relatively common (13%), the latter represented for example by *Allium flavum*, *Arabis turrita* and *Cornus mas*. Particularly remarkable is the occurrence of *Carex pediformis*, *Cimicifuga europaea* and *Rubus saxatilis*, species typical of southern Siberian hemiboreal forests, which are rather rare in Central Europe. Ledové sluje is an isolated locality for some thermophilous species which are more common in the dry lowlands of southern Moravia east of the town of Znojmo, but they largely disappear in the Bohemian Massif. In this area, they are confined to sunny slopes and rock outcrops in the river vallyes. This group of species includes both submediterranean and temperate continental species such as *Allium flavum*, *Dictamnus albus*, *Iris variegata* (westernmost locality in Moravia), *Lithospermum purpurocaeruleum* and *Melica picta*. *Aconitum anthora*, a species belonging to a group of closely related taxa with temperate continental distrubution, is found at sunny forest edges on the ridge summit. In Moravia this species is confined to the river valleys of the Bohemian Massif. *Carex cespitosa* and *Pseudolysimachion maritimum*, species of wet continental meadows, are found in a small wetland on the river terrace west of the Ledové sluje ridge.

**References**


Ambrozek L. & Chytrý M. (1990): Die Vegetation der Zwergstrauchheiden im xerothermen Bereich am Südostrand des Böhmischen Massivs. – Čas. Morav. Muz., Sci. Natur., 75: 169–184.

Antonín V., Gruna B., Hradílek Z., Vágner A. & Vězda A. (2000): Houby, lišejníky a mechorosty Národního parku Podyjí/ Pilze, Flechten und Moose des Nationalparks Thayatal. – Masarykova univerzita, Brno.

Chytrý M., Grulich V., Tichý L. & Kouřil M. (1999): Phytogeographical boundary between the Pannonicum and Hercynicum: a multivariate analysis in the landscape of the Podyjí/Thayatal National Park, Czech Republic/Austria. – Preslia 71: 23–41.

Chytrý M., Mucina L., Vicherek J., Pokorny-Strudl M., Strudl M., Koó A.J. & Maglocký Š. (1997): Die Pflanzengesellschaften der westpannonischen Zwergstrauchheiden und azidophilen Trockenrasen. – Diss. Bot. 277: 1–108.

Chytrý M., Sedláková I. & Tichý L. (2001): Species richness and species turnover in a successional heathland. – Appl. Veg. Sci. 4: 89–96.

Chytrý M. & Tichý L. (1998): Phenological mapping in a topographically complex landscape by combining field survey with an irradiation model. – Appl. Veg. Sci. 1: 225–232.

Chytrý M. & Vicherek J. (1995): Lesní vegetace Národního parku Podyjí/ Thayatal. Die Waldvegetation des Nationalparks Podyjí/Thayatal. – Academia, Praha.

Chytrý M. & Vicherek J. (2003): Travinná, keříčková a křovinná vegetace Národního parku Podyjí/Thayatal [Grassland, heathland and scrub vegetation of the Podyjí/Thayatal National Park]. – Thayensia 5: 11–84.

Grulich V. (1996): Ohrožené druhy rostlin v Národním parku Podyjí [Threatened species of vascular plants in the Podyjí National Park]. – Příroda 6: 39–59.
Grulich V. (1997): Atlas rozšíření cévnatých rostlin Národního parku Podyjí. Verbreitungsatlas der Gefäßpflanzen im Nationalpark Podyjí/Thayatal. – Masarykova univerzita, Brno.
Grulich V. & Chytrý M. (1993): Botanische Untersuchungen im Nationalpark Podyjí (Thayatal) und im grenznahen Österreich. – Verh. Zool.-Bot. Ges. Österr. 130: 1–31.
Gruna B. & Reiter A. (1996): Výzkum lokality Ledové sluje u Vranova nad Dyjí (NP Podyjí) [Investigation of the locality "Ledové sluje" [Ice caves] near Vranov nad Dyjí (Podyjí National Park)]. Příroda 3: 1–163.
Himmelbaur W. & Stumme E. (1923): Die Vegetationsverhältnisse von Retz und Znaim. – Abh. Zool.-Bot. Ges. Wien 14/2: 1–146.
Kovanda M. (1996): Observations on Sorbus in Southwest Moravia (Czech Republic) and adjacent Austria I. – Verh. Zool.-Bot. Ges. Österr. 133: 347–369.
Kubešová S. (2003a): Bryoflora in block fields in south-western Moravian river valleys. – Acta Mus. Morav., Sci. Biol., 88: 81–94.
Kubešová S. (2003b): Mechorosty skal na jihozápadní Moravě [Bryophytes of rocks in south-western Moravia]. – Čas. Slezsk. Muz., Ser. A, 52: 273–280.
Kubešová S. (2005): Diversity of bryophytes on treeless cliffs and talus slopes in a forested central European landscape. – J. Bryol. 27: 35–46.
Oborny A. (1879): Die Flora des Znaimer Kreises. – Verh. Naturforsch. Ver. Brünn 17: 105–304.
Sedláková I. & Chytrý M. (1999): Regeneration patterns in a Central European dry heathland: effects of burning, sod-cutting and cutting. – Pl. Ecol. 143: 77–87.
Tichý L. (1998): Dlohodobá teplotní měření na lokalitě Sloní hřbet (NP Podyjí) ve vztahu ke struktuře a fenologickým projevům vegetačního krytu [Long term temperature measurements at the locality of Sloní hřbet, Podyjí National Park, in relation to the structure and phenological development of vegetation]. – Thayensia 1: 67–81.
Tichý L. (1999): Predictive modeling of the potential natural vegetation pattern in the Podyjí National Park, Czech Republic. – Folia Geobot. 34: 243–252.
Tichý L. (1999): Teplotní poměry a vegetace na lokalitě Sloní hřbet v Národním parku Podyjí [Temperature and vegetation pattern at the Sloní hřbet Ridge, Podyjí National Park]. – Preslia 70 (1998): 289–301.
Zelený D. & Chytrý M. (2007): Environmental control of vegetation pattern in deep river valleys of the Bohemian Massif. – Preslia 79: 205–222.

**Appendix 1.** Selected species of vascular plants in the heathlands near Popice and Havraníky

*Agrimonia eupatoria*
*Agrostis vinealis*
*Achillea collina*
*A. setacea*
*Allium flavum*
*Anthriscus cerefolium*
subsp. *trichosperma*
*Arabidopsis thaliana*
*Aristolochia clematitis*
*Armeria vulgaris*
*Arrhenatherum elatius*
*Artemisia campestris*
*Asparagus officinalis*
*Asperula cynanchica*
*Aster linosyris*
*Avenella flexuosa*
*Avenula pratensis*
*Berteroa incana*
*Biscutella laevigata*
subsp. *varia*
*Bromus tectorum*
*Calluna vulgaris*
*Cardaria draba*
*Carex humilis*
*C. supina*
*Carlina vulgaris*
*Centaurea stoebe*
*Cerastium glutinosum*
*Chamaecytisus ratisbonensis*
*Chondrilla juncea*
*Conium maculatum*
*Cotoneaster integerrimus*
*Cytisus procumbens*
*C. scoparius*
*Danthonia decumbens*
*Dianthus carthusianorum*
*D. deltoides*
*Echium vulgare*
*Elytrigia intermedia*
*Erodium cicutarium*
*Euphorbia cyparissias*
*E. waldsteinii*
*Festuca ovina*
*F. pallens*
*F. pseudovina*
*F. valesiaca*
*Ficaria calthifolia*
*Filago arvensis*
*F. minima*
*Filipendula vulgaris*
*Fragaria viridis*
*Frangula alnus*
*Gagea bohemica*
*G. pusilla*
*G. villosa*
*Galium valdepilosum*
*Genista pilosa*
*G. sagittalis*
*Helichrysum arenarium*
*Hieracium echioides*
*H. umbellatum*
*Hypochaeris maculata*
*H. radicata*
*Inula britannica*
*Iris pumila*
*Jasione montana*
*Jovibarba globifera*
*Koeleria macrantha*
*Linaria genistifolia*
*Luzula campestris*
*Lychnis viscaria*
*Melampyrum arvense*
*Melica transsilvanica*
*Mercurialis annua*
*Myosotis ramosissima*
*M. stricta*
*Nardus stricta*
*Odontites vernus*
subsp. *serotinus*
*Onopordon acanthium*
*Orthantha lutea*
*Petrorhagia prolifera*
*Phleum phleoides*
*Picris hieracioides*
*Plantago media*

*Poa bulbosa*
*Polygonatum odoratum*
*Potentilla arenaria*
*Prunus fruticosa*
*Pseudolysimachion spicatum*
*Pulsatilla grandis*
*Ranunculus bulbosus*
*Rhinanthus minor*
*Rosa gallica*
*R. jundzilii*
*R. rubiginosa*
*R. spinosissima*
*Rumex acetosella*
*Salvia nemorosa*
*S. pratensis*
*Sanguisorba minor*
*Saxifraga bulbifera*
*S. granulata*
*Scabiosa canescens*
*S. ochroleuca*
*Scleranthus perennis*
*S. polycarpos*
*Scorzonera cana*
*S. acre*
*S. reflexum*
*S. sexangulare*
*Senecio jacobaea*
*Seseli annuum*
*S. hippomarathrum*
*S. osseum*
*Silene otites*
*Sisymbrium altissimum*
*Stachys recta*
*Stipa capillata*
*S. pennata*
*Taraxacum* sect. *Erythrosperma*
*Teucrium chamaedrys*
*Thlaspi perfoliatum*
*Thymus praecox*
*Trifolium alpestre*
*T. arvense*
*T. campestre*
*T. montanum*
*T. retusum*
*Valerianella locusta*
*Verbascum lychnitis*
*V. phoeniceum*
*Veronica dillenii*
*V. prostrata*
*V. triphyllos*
*V. verna*
*V. vindobonensis*
*Vicia pannonica*
subsp. *striata*
*Vincetoxicum hirundinaria*
*Viola canina*

**Appendix 2.** Selected species of vascular plants in the Dyje valley near Hardegg

*Abies alba*
*Acer campestre*
*Aconitum anthora*
*Adoxa moschatellina*
*Agrostis vinealis*
*Achillea nobilis*
*A. pannonica*
*Ajuga genevensis*
*Allium flavum*
*Allium senescens* subsp. *montanum*
*Alnus glutinosa*
*Alyssum alyssoides*
*Anemone ranunculoides*
*A. sylvestris*
*Anthemis tinctoria*
*Anthericum ramosum*
*Arabis brassica*
*Artemisia campestris*
*Asarum europaeum*
*Asparagus officinalis*
*Asperula cynanchica*
*Asplenium ruta-muraria*
*A. septentrionale*
*Aster amellus*
*A. linosyris*
*Aurinia saxatilis*

*Avenella flexuosa*
*Batrachium fluitans*
*Berberis vulgaris*
*Brachypodium pinnatum*
*Bromus benekenii*
*Buphthalmum salicifolium*
*Bupleurum falcatum*
*Calamagrostis arundinacea*
*Campanula persicifolia*
*Cardaminopsis arenosa*
*Carex brizoides*
*C. buekii*
*C. flacca*
*C. humilis*
*C. michelii*
*C. montana*
*C. pilosa*
*C. supina*
*Carpinus betulus*
*Centaurea scabiosa*
*C. stoebe*
*C. triumfettii*
*C. pumilum*
*C. semidecandrum*
*Chamaecytisus ratisbonensis*
*Clematis recta*
*Convallaria majalis*
*Corallorhiza trifida*
*Cornus mas*
*Corydalis solida*
*Cotoneaster integerrimus*
*Crepis praemorsa*
*Cyclamen purpurascens*
*Cypripedium calceolus*
*Dactylis polygama*
*Daphne mezereum*
*Dentaria bulbifera*
*Dictamnus albus*
*Echium vulgare*
*Eryngium campestre*
*Euonymus europaea*
*E. verrucosa*
*Euphorbia angulata*
*E. cyparissias*
*E. dulcis*
*E. epithymoides*
*Fagus sylvatica*
*Festuca ovina*
*F. pallens*
*F. valesiaca*
*Gagea bohemica*
*G. minima*
*Galanthus nivalis*
*Galeopsis speciosa*
*Galium glaucum*
*G. odoratum*
*G. sylvaticum*
*G. valdepilosum*
*Genista germanica*
*G. pilosa*
*Gentiana cruciata*
*Geranium phaeum*
*G. sanguineum*
*Glechoma hirsuta*
*Helianthemum grandiflorum* subsp. *obscurum*
*Hepatica nobilis*
*Hesperis sylvestris*
*Hieracium echioides*
*H. umbellatum*
*Hierochloë australis*
*Hypericum montanum*
*Hypochaeris maculata*
*Inula conyzae*
*I. salicina*
*I. ensifolia*
*Inula ensifolia* × *I. germanica*
*I. hirta*
*I. oculus-christi*
*Iris variegata*
*Isopyrum thalictroides*
*Juniperus communis*
*Knautia drymeia*
*Lactuca quercina*
*L. viminea*
*Lappula squarrosa*
*Lathyrus vernus*
*Libanotis pyrenaica*
*Ligustrum vulgare*
*Lilium martagon*
*Linaria genistifolia*
*Lonicera xylosteum*

*Loranthus europaeus*
*Luzula divulgata*
*L. luzuloides*
*Lychnis viscaria*
*Maianthemum bifolium*
*Medicago falcata*
*Melampyrum nemorosum*
*Melica ciliata*
*M. picta*
*M. uniflora*
*Melittis melissophyllum*
*Mercurialis perennis*
*Milium effusum*
*Minuartia fastigiata*
*Neottia nidus-avis*
*Omphalodes scorpioides*
*Orchis militaris*
*O. purpurea*
*Origanum vulgare*
*Orobanche lutea*
*Phalaris arundinacea*
*Phleum phleoides*
*Phyteuma spicatum*
*Pinus sylvestris*
*Poa bulbosa*
*P. nemoralis*
*Polygala major*
*Polygonatum multiflorum*
*P. odoratum*
*Potentilla arenaria*
*P. recta*
*Primula elatior*
*P. veris*
*Prunus fruticosa*
*P. mahaleb*
*Pseudolysimachion spicatum*
*Pulsatilla grandis*
*P. pratensis* subsp. *bohemica*
*Quercus petraea*
*Qu. robur*
*Ranunculus bulbosus*
*Rumex acetosella*
*R. aquaticus*
*Salix fragilis*
*Salvia glutinosa*
*S. pratensis*
*Sanicula europaea*
*Saxifraga tridactylites*
*Scabiosa ochroleuca*
*Scleranthus perennis*
*Scrophularia umbrosa*
*Sedum album*
*S. reflexum*
*Senecio germanicus*
*Seseli osseum*
*Sesleria caerulea*
*Silene nutans*
*Sisymbrium strictissimum*
*Sorbus aria* agg.
*S. hardeggensis*
*S. torminalis*
*Stachys recta*
*Stellaria holostea*
*S. nemorum*
*Stipa capillata*
*S. dasyphylla*
*Stipa pennata*
*Stipa pulcherrima*
*Symphytum tuberosum*
*Tanacetum corymbosum*
*Taxus baccata*
*Teucrium chamaedrys*
*Thesium linophyllon*
*Thlaspi caerulescens*
*Th. perfoliatum*
*Thymus praecox*
*Tilia cordata*
*T. platyphyllos*
*Trifolium alpestre*
*T. montanum*
*Ulmus glabra*
*U. laevis*
*Vaccinium myrtillus*
*V. chaixii* subsp. *austriacum*
*Verbascum nigrum*
*Veronica dillenii*
*V. praecox*
*Veronica prostrata*
*V. teucrium*
*V. vindobonensis*
*Viburnum lantana*
*Vicia sylvatica*

*V. tenuifolia*
*Vincetoxicum hirundinaria*
*Viola mirabilis*
*V. tricolor sub*sp. *saxatilis*
*Viscum album* subsp. *austriacum*

**Appendix 3.** Vascular plants species recorded on the ridge of Ledové sluje

*Abies alba*
*Acer campestre*
*A. platanoides*
*A. pseudoplatanus*
*Achillea collina*
*A. distans* s. lat.
*A. millefolium*
*Aconitum anthora*
*Actaea spicata*
*Adoxa moschatellina*
*Aegopodium podagraria*
*Agrostis capillaris*
*A. gigantea*
*A. stolonifera*
*Ajuga genevensis*
*A. reptans*
*Alchemilla gracilis*
*Alliaria petiolata*
*Allium flavum*
*A. oleraceum*
*A. senescens* subsp. *montanum*
*Alnus glutinosa*
*Alopecurus aequalis*
*A. pratensis*
*Anchusa officinalis*
*Anemone nemorosa*
*A. ranunculoides*
*Angelica sylvestris*
*Anthemis tinctoria*
*Anthericum ramosum*
*Anthoxanthum odoratum*
*Anthriscus sylvestris*
*Apera spica-venti*
*Arabidopsis thaliana*
*Arabis glabra*
*A. pauciflora*
*A. turrita*
*Arctium lappa*
*A. minus*
*A. tomentosum*
*Arenaria serpyllifolia*
*Arrhenatherum elatius*
*Artemisia absinthium*
*A. vulgaris*
*Asarum europaeum*
*Asplenium septentrionale*
*A. trichomanes*
*Astragalus glycyphyllos*
*Astrantia major*
*Athyrium filix-femina*
*Atropa bella-donna*
*Aurinia saxatile*
*Avenella flexuosa*
*Avenochloa pubescens*
*Ballota nigra*
*Batrachium fluitans*
*Berteroa incana*
*Betonica officinalis*
*Betula pendula*
*Brachypodium pinnatum*
*B. sylvaticum*
*Briza media*
*Bromus benekenii*
*B. hordeaceus* subsp. *hordeaceus*
*B. inermis*
*B. tectorum*
*Bupleurum falcatum*
*Calamagrostis arundinacea*
*C. epigeios*
*Calluna vulgaris*
*Caltha palustris*
*Calystegia sepium*
*Campanula glomerata*
*C. patula*
*C. persicifolia*
*C. rapunculoides*
*C. rotundifolia*
*C. trachelium*

*Capsella bursa-pastoris*
*Cardamine amara*
*C. impatiens*
*C. pratensis*
*Cardaminopsis arenosa*
*Cardaria draba*
*Carduus acanthoides*
*C. crispus*
*Carex acutiformis*
*C. brizoides*
*C. buekii*
*C. cespitosa*
*C. curvata*
*C. digitata*
*C. gracilis*
*C. hartmanii*
*C. hirta*
*C. michelii*
*C. muricata* s. str.
*C. ovalis*
*C. pallescens*
*C. pediformis*
*C. pilosa*
*C. remota*
*C. spicata*
*C. sylvatica*
*C. vesicaria*
*C. ×vratislaviensis* (= *C. acuta* × *C. buekii*)
*Carlina acaulis*
*Carpinus betulus*
*Centaurea jacea*
*C. triumfettii*
*Centaurium erythraea*
*Cerastium arvense*
*C. glutinosum*
*C. holosteoides*
*Chaerophyllum aromaticum*
*C. temulum*
*Chamaecytisus supinus*
*Chelidonium majus*
*Chenopodium album*
*C. hybridum*
*Chrysosplenium alternifolium*
*Cichorium intybus*
*Cimicifuga europaea*
*Circaea lutetiana*
*Cirsium arvense*
*C. canum*
*C. oleraceum*
*C. palustre*
*C. vulgare*
*Clinopodium vulgare*
*Conium maculatum*
*Convallaria majalis*
*Convolvulus arvensis*
*Conyza canadensis*
*Cornus mas*
*C. sanguinea*
*Corydalis intermedia*
*C. solida*
*Corylus avellana*
*Cotoneaster integerrimus*
*Crataegus laevigata*
*C. monogyna*
*Crepis biennis*
*C. paludosa*
*Cruciata laevipes*
*Cuscuta europaea*
*Cyclamen purpurascens*
*Cynosurus cristatus*
*Cystopteris fragilis*
*Cytisus nigricans*
*Dactylis glomerata*
*D. polygama*
*Dactylorhiza majalis*
*Daphne mezereum*
*Daucus carota*
*Dentaria bulbifera*
*D. enneaphyllos*
*Deschampsia caespitosa*
*Descurainia sophia*
*Dianthus carthusianorum*
*D. deltoides*
*Digitalis grandiflora*
*Dryopteris carthusiana*
*D. dilatata*
*D. filix-mas*
*Echium vulgare*
*Elymus caninus*
*Elytrigia intermedia*
*E. repens*

*Epilobium angustifolium*
*E. ciliatum*
*E. montanum*
*Equisetum arvense*
*E. palustre*
*E. pratense*
*Erigeron annuus*
*Erophila verna*
*Eryngium campestre*
*Euonymus europaea*
*E. verrucosa*
*Eupatorium cannabinum*
*Euphorbia cyparissias*
*E. dulcis*
*E. esula*
*E. polychroma*
*Fagus sylvatica*
*Falcaria vulgaris*
*Fallopia convolvulus*
*F. dumetorum*
*Festuca gigantea*
*F. firmula*
*F. ovina*
*F. pallens*
*F. pratensis*
*F. rubra*
*Ficaria verna* subsp. *bulbifera*
*Filago arvensis*
*Filipendula ulmaria*
*F. vulgaris*
*Fragaria moschata*
*F. vesca*
*Fraxinus excelsior*
*Fumaria schleicheri*
*Gagea lutea*
*G. minima*
*Galanthus nivalis*
*Galeobdolon montanum*
*Galeopsis pubescens*
*Galium album*
*G. aparine*
*G. glaucum*
*G. odoratum*
*G. pumilum*
*G. sylvaticum*
*G. uliginosum*
*G. valdepilosum*
*G. verum*
*Genista germanica*
*G. pilosa*
*G. tinctoria*
*Geranium columbinum*
*G. divaricatum*
*G. pratense*
*G. pusillum*
*G. robertianum*
*G. sanguineum*
*Geum urbanum*
*Glechoma hederacea*
*G. hirsuta*
*Glyceria maxima*
*Gnaphalium sylvaticum*
*Gymnocarpium dryopteris*
*Hedera helix*
*Helianthemum grandiflorum* subsp. *obscurum*
*Hepatica nobilis*
*Heracleum sphondylium*
*Herniaria glabra*
*Hesperis sylvestris*
*Hieracium bifidum*
*H. lachenalii*
*H laevigatum*
*H. murorum*
*H. pilosella*
*H. sabaudum*
*Holcus lanatus*
*Humulus lupulus*
*Hylotelephium maximum*
*Hypericum hirsutum*
*H. montanum*
*H. perforatum*
*Hypochaeris radicata*
*Impatiens noli-tangere*
*I. parviflora*
*Inula conyza*
*Iris variegata*
*Isopyrum thalictroides*
*Jasione montana*
*Juncus bufonius*
*J. conglomeratus*

*J. effusus*
*J. tenuis*
*Juniperus communis*
*Knautia arvensis*
*Lactuca quercina*
*L. serriola*
*Lamium album*
*L. maculatum*
*L. purpureum*
*Lapsana communis*
*Larix europaea*
*Lathraea squamaria*
*Lathyrus niger*
*L. pratensis*
*L. vernus*
*Lemna minor*
*Leontodon autumnalis*
*L. hispidus*
*Leucanthemum ircutianum*
*Libanotis pyrenaica*
*Ligustrum vulgare*
*Lilium martagon*
*Linaria genistifolia*
*L. vulgaris*
*Lithospermum arvense*
*L. purpurocaeruleum*
*Lolium perenne*
*Lonicera xylosteum*
*Lotus corniculatus*
*Lupinus polyphyllus*
*Luzula campestris*
*L. divulgata*
*L. luzuloides*
*Lychnis flos-cuculi*
*L. viscaria*
*Lycopus europaeus*
*Lysimachia nummularia*
*L. vulgaris*
*Lythrum salicaria*
*Maianthemum bifolium*
*Matricaria discoidea*
*Medicago falcata*
*M. lupulina*
*Melampyrum nemorosum*
*M. pratense*
*Melica nutans*
*M. picta*
*M. uniflora*
*Mentha longifolia*
*Mercurialis perennis*
*Milium effusum*
*Moehringia trinervia*
*Molinia caerulea*
*Mycelis muralis*
*Myosotis arvensis*
*M. laxiflora*
*M. ramosissima*
*M. sylvatica*
*M. stricta*
*Myosoton aquaticum*
*Neottia nidus-avis*
*Neslia paniculata*
*Oenothera biennis*
*Omphalodes scorpioides*
*Origanum vulgare*
*Oxalis acetosella*
*Papaver confine*
*P. rhoeas*
*Paris quadrifolia*
*Persicaria amphibia*
*P. hydropiper*
*P. lapathifolia*
*Phalaris arundinacea*
*Phleum phleoides*
*P. pratense*
*Phragmites australis*
*Phyteuma spicatum*
*Picea abies*
*Pimpinella major*
*P. saxifraga*
*Pinus sylvestris*
*Plantago lanceolata*
*P. major*
*Poa angustifolia*
*P. annua*
*P. bulbosa*
*P. compressa*
*P. nemoralis*
*P. palustris*
*P. pratensis*
*P. trivialis*
*Polygonatum multiflorum*

*P. odoratum*
*Polygonum aviculare*
*Polypodium vulgare*
*Populus alba*
*P. tremula*
*Potentilla anserina*
*P. arenaria*
*P. argentea*
*P. erecta*
*P. reptans*
*P. tabernaemontani*
*Prenanthes purpurea*
*Primula elatior*
*P. veris*
*Prunella vulgaris*
*Prunus mahaleb*
*P. spinosa*
*Pseudolysimachion maritimum*
*Pulmonaria officinalis* agg.
*Pyrethrum corymbosum*
*Pyrus communis*
*Quercus petraea*
*Ranunculus acris*
*R. auricomus* agg.
*R. bulbosus*
*R. repens*
*Reynoutria japonica*
*Rhamnus cathartica*
*Ribes alpinum*
*R. uva-crispa*
*Rorippa sylvestris*
*Rosa canina*
*R. gallica*
*R. pendulina*
*Rubus caesius*
*R. fruticosus* agg.
*R. idaeus*
*R. saxatilis*
*Rumex acetosa*
*R. acetosella*
*R. aquaticus*
*R. conglomeratus*
*R. crispus*
*R. obtusifolius*
*Sagina procumbens*
*Salix alba*
*S. caprea*
*S. cinerea*
*S. fragilis*
*S. purpurea*
*S. rosmarinifolia*
*S. triandra*
*Salvia glutinosa*
*S. pratensis*
*Sambucus ebulus*
*S. nigra*
*S. racemosa*
*Sanguisorba minor*
*S. officinalis*
*Sanicula europaea*
*Saxifraga granulata*
*Scirpus sylvaticus*
*Scleranthus annuus*
*S. perennis*
*Scrophularia nodosa*
*S. umbrosa*
*Securigera varia*
*Sedum acre*
*S. sexangulare*
*S. reflexum*
*Senecio erraticus*
*S. germanicus*
*S. viscosus*
*S. vulgaris*
*Seseli osseum*
*Silene dioica*
*S. latifolia* subsp. *alba*
*S. nutans*
*S. vulgaris*
*Solidago gigantea*
*S. virgaurea*
*Sonchus arvensis*
*S. oleraceus*
*Sorbus aria*
*S. aucuparia*
*S. torminalis*
*Spergularia rubra*
*Stachys recta*
*S. sylvatica*
*Staphylea pinnata*
*Stellaria graminea*
*S. holostea*

*S. media*
*S. nemorum*
*Symphytum officinale*
*S. tuberosum*
*Tanacetum vulgare*
*Taraxacum* sect. *Erythrosperma*
*T.* sect. *Ruderalia*
*Tephroseris crispa*
*Teucrium chamaedrys*
*Thesium linophyllon*
*Thlaspi arvense*
*T. caerulescens*
*Thymus pulegioides*
*Tilia cordata*
*T. platyphyllos*
*Torilis japonica*
*Tragopogon orientalis*
*Trifolium alpestre*
*T. arvense*
*T. aureum*
*T. dubium*
*T. hybridum*
*T. medium*
*T. pratense*
*T. repens*
*Tussilago farfara*
*Typha latifolia*
*Ulmus glabra*
*Urtica dioica*
*Vaccinium myrtillus*
*Valeriana excelsa* subsp. *sambucifolia*
*Valerianella locusta*
*Verbascum chaixii* subsp. *austriacum*
*V. nigrum*
*V. phlomoides*
*Veronica anagallis-aquatica*
*V. arvensis*
*V. chamaedrys*
*V. dillenii*
*V. officinalis*
*V. sublobata*
*V. vindobonensis*
*Viburnum opulus*
*Vicia cracca*
*V. hirsuta*
*V. pisiformis*
*V. sepium*
*V. tenuifolia*
*V. tetrasperma*
*V. villosa* subsp. *villosa*
*Vincetoxicum hirundinaria*
*Viola arvensis*
*V. mirabilis*
*V. reichenbachiana*
*V. tricolor* subsp. *saxatilis*
*V.* ×*scabra* (= *V. hirta* × *V. odorata*)
*Viscum album* subsp. *abietis*
*V. album* subsp. *austriacum*

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