The most species-rich plant communities in the Czech Republic and Slovakia (with new world records)

Druhově nejbohatší rostlinná společenstva České republiky a Slovenska (s novými světovými rekordy)

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Dedicated to the memory of Leoš Klimeš (1960–2007)

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We provide an inventory of the sites and vegetation types in the Czech Republic and Slovakia that contain the highest numbers of vascular plant species in small areas of up to 625 m^2. The highest numbers of species were recorded in semi-natural grasslands, in which we report four new world records for fine-scale species richness: 17 species of vascular plants in 0.0044 m^2 in a mountain meadow in the Krkonoše Mts, 52 and 63 species in 0.25 and 0.5 m^2, respectively, in the Kopanecké lúky meadows in the Slovak Paradise (Slovenský raj), and 109 species in 16 m^2 in the Porážky meadows in the White Carpathians (Bílé Karpaty). The previous world record of 43 species in 0.1 m^2 was equalled in the Čertoryje meadows in the White Carpathians, however, the previous record referred to shoot presence while the new record considers only the species rooted in the plot. We interpreted and corrected the data from the Czech Republic that Wilson et al. (2012) used to compile a list of world records and provide an updated list. The updated list contains five world records from the Czech Republic and two from Slovakia. The most species-rich grasslands and forests in the Czech Republic and Slovakia are concentrated in regions with base-rich soils in the Western Carpathians, especially in the flysch zone in SE Moravia and the Czech-Slovak borderland, and in limestone and volcanic areas in central Slovakia. The richest types of non-forest vegetation include semi-dry base-rich meadows (*Bromion erecti* and *Cirsio-Brachypodion pinnati*), base-rich pastures and mesic meadows (*Cynosurion cristati* and *Arrhenatherion elatioris*), *Nardus stricta* grasslands (*Violion caninae* and *Nardo strictae-Agrostion tenuis*) and some wet meadows and natural subalpine grasslands. A special type of species-rich herbaceous to open woodland vegetation develops as successional stages on gravel accumulations in Carpathian rivers after severe flooding. The maximum counts of vascular plant species in non-forest vegetation in the Czech Republic and Slovakia are 7 species/0.0009 m^2, 11/0.0011 m^2, 12/0.004 m^2, 17/0.0044 m^2, 23/0.01 m^2, 37/0.04 m^2, 43/0.1 m^2, 52/0.25 m^2, 63/0.5 m^2, 82/1 m^2, 88/4 m^2, 109/16 m^2, 116/25 m^2, 131/49 m^2 and 133/100 m^2. While the maximum counts for plots smaller than 0.5 m^2 are from various regions and probably mainly depend on appropriate management, the maximum counts for plots larger than 0.5 m^2 are for two areas only, the south-eastern part of the White Carpathians and Kopanecké lúky meadows, suggesting the importance of regionally specific landscape processes for high species richness at such scales. Czech and Slovak forest vegetation is much poorer than grasslands, reaching maxima of 100, 109 and 118 species in plots of 100, 400 and 500 m^2, which are considerably smaller than global maxima for temperate forests. Most of the species-rich sites occur on base-rich soils, in habitats with intermediate values of environmental factors, are subject to low-intensity management or natural disturbance, occur in landscapes with large areas of natural and semi-natural vegetation and probably have a long historical continuity.

K e y w o r d s: alpha diversity, base-rich forests, fine-scale species richness, meadows, relevés, semi-natural grasslands, vegetation database, vegetation plots, Western Carpathians, White Carpathians

Introduction

Sites with a concentration of unusually high numbers of plant species have always attracted the attention of ecologists. They are important from the conservation viewpoint, because appropriate management can ensure protection of a considerable portion of regional biodiversity. They are also of great interest to theoretical ecologists, as they provide unique systems for exploring the mechanisms that contribute to fine-scale species coexistence and the maintenance of high species diversity. Comparative studies of sites and vegetation types with extremely high species richness are needed to obtain a better insight into these mechanisms. However, there is no systematic information on the exact location and characteristics of high-richness sites. Although ecological literature abounds with studies of species richness patterns and their environmental correlates, the focus is usually on mean species numbers, whereas data on the regionally most species-rich sites and vegetation types are extremely scarce.

Very high numbers of plant species found in small areas (≤ 1 ha) have traditionally been reported in three types of ecosystem: tropical rainforests (Whitmore et al. 1985, Gentry & Dodson 1987, Duivenvoorden 1994), mediterranean-type vegetation (Naveh & Whittaker 1979) and temperate grasslands (Zobel 1992). In a recent global review, Wilson et al. (2012) revealed that record numbers of vascular plant species in plots of 100 m^2 and larger are all from tropical rainforests, while those for smaller plots are all from temperate grasslands. In addition to pointing out the vegetation formations that are probably globally richest at a fine scale, this study also helped ecologists realize which values of species richness can be considered unusually high at different spatial scales by summarizing the maximum species counts reported for various plot sizes.

Although maximum values of fine-scale plant species richness are published, most of the records only contain the number of species, plot size, a rough indication of the location and assignment to broad vegetation types (Wilson et al. 2012). This precludes any deeper analysis that might improve our understanding of the determinants of high species-richness. Therefore, there is an obvious need for systematic documentation of high-richness sites, which would enable us to describe their geographical distribution, identify their vegetation types and compare their environmental, landscape and historical context.

The Czech Republic and Slovakia are of special interest for fine-scale diversity studies, because five of the 18 world-record species-richness values reported by Wilson et al. (2012) were recorded in the Čertoryje meadows in the White Carpathians, a mountain range in the borderland between these two countries. Very high species richness is also known to occur at other White Carpathian meadow sites (Merunková et al. 2012) and in similar grasslands at the fringes of the Carpathians in Romanian Transylvania (Dengler et al. 2012, Turtureanu et al. 2014) and western Ukraine (Roleček et al. 2014). Therefore, it is highly likely that other species-rich sites will be found, especially in the Carpathians and their foothills.

This study aims to: (i) locate and document the sites in the Czech Republic and Slovakia with the highest counts of vascular plant species in small plots, separately for

non-forest and forest vegetation, (ii) identify vegetation types and environmental factors associated with these species-rich sites, (iii) characterize the geographical distribution of the species-rich sites and (iv) put the high-richness phenomena at the Czech and Slovak sites into a regional and global context.

Methods

We searched for species-rich plots in the national vegetation-plot databases of the Czech Republic (Chytrý & Rafajová 2003, GIVD code EU-CZ-001, http://www.sci.muni.cz/botany/vegsci/dbase.php) and Slovakia (Šibík 2012, EU-SK-001, http://ibot.sav.sk/cdf/) and in the forest typology databases of both countries (Zouhar 2012, EU-CZ-002; Vladovič et al. 2011). In total, these databases contain approximately 151,000 vegetation plots from the Czech Republic and 56,000 from Slovakia. Although vegetation-plot databases may provide partly biased estimates of the mean species richness (Chytrý 2001), they are an excellent source of information on regionally maximum species counts, because many field botanists tend to search for unusually species-rich sites and document them with vegetation-plot records. We also reviewed regional literature and asked several field botanists for additional information on sites with species-rich vegetation. Based on this preliminary search we visited several sites where high species richness was reported and sampled accurately measured plots.

In central Europe, non-forest vegetation is traditionally sampled in plots ranging in size between 1 and 100 m^2, and forest vegetation in plots of 100 m^2 and larger (Chytrý & Otýpková 2003). There are also many records of the species composition in grassland plots smaller than 1 m^2, obtained mainly from management experiments or specialized ecological studies. However, there are no centralized national or regional databases collecting the data from these very small plots, and primary data from such plots are hardly ever published. Therefore only a small proportion of such fine-scale records was available to us.

Of the data obtained from all sources, we selected the plots with the highest numbers of vascular plant species in particular plot sizes from 0.0009 m^2 (3 × 3 cm) to 100 m^2 for non-forest vegetation and from 100 m^2 to 625 m^2 for forests, separately for each of the two countries. Scrub data were available for a broad range of plot sizes and were therefore compared with both non-forest and forest vegetation, depending on plot size. Larger plots were available for some forest sites, but none of them contained more species than the richest plots of the size up to 625 m^2. We also selected several plots with species numbers close to the record values provided they were from other localities than the richest plots of the same size. After careful screening of all the richest plots, few of them were excluded as doubtful (with likely incorrect indication of plot size or with several obvious species misidentifications).

A serious problem when compiling species richness data from multiple sources is that the method and accuracy of measuring plot size is often unknown. Most of the plots recorded in the field by our team were measured exactly with a tape-line or a cord and their boundaries were marked with a cord during sampling. However, phytosociological sample plots are often measured less accurately by pace counting and only the four corners are marked when sampled. In this study we also considered data from plots measured

with low accuracy or those for which the measuring method was unknown. Where known, we indicate the measurement method for the richest plots in the plot data in Appendix 1.

Species recorded repeatedly in two or more vegetation layers of the same plot were counted only once. Bryophytes and lichens were not considered in the species counts, but if their records were available, they were included in the plot species lists. Vascular plant taxonomy and nomenclature follows Danihelka et al. (2012) and Marhold & Hindák (1998), the latter source for species of the Slovak flora not included in the former. Names of bryophytes and lichens follow Kučera et al. (2012) and Guttová et al. (2013), respectively. Phytosociological units (syntaxa) were identified and named in accordance with the latest national monographs: Chytrý (2007–2013) for the Czech Republic, Kliment & Valachovič (2007) and Hegedüšová Vantarová & Škodová (2014) for grassland vegetation of Slovakia. Nomenclature of forest and scrub syntaxa of Slovakia follows in most cases Jarolímek et al. (2008). Computer expert systems based on the Cocktail method (Chytrý 2007–2013, Hegedüšová Vantarová & Škodová 2014) were partly used for identifying syntaxa.

Results and discussion

The highest numbers of vascular plant species recorded in vegetation plots of different sizes in the Czech Republic and Slovakia are shown in Fig. 1 (plot sizes up to 1 m^2) and Fig. 2 (plot sizes 1–625 m^2) and listed in Tables 1 and 3 and Appendix 1, separately for non-forest and forest vegetation and different regions. Although grasslands are usually sampled in plots of up to 100 m^2 and forests in plots of 100 m^2 or larger, the richest forest plots contain much fewer species than the richest grassland plots.

Sites with most species-rich plots under 1 m^2 in size

For very small plots, the richest sites were recorded in different types of wet to semi-dry grasslands and in different regions of the Czech Republic and Slovakia. They were close to the world records reported by Wilson et al. (2012) but maximum counts from three sites were higher than these records: in a mountain meadow near Malá Úpa in the Krkonoše Mts (Fig. 3) 17 species were recorded in a plot of 0.0044 m^2 (6.7 × 6.7 cm); in base-rich mountain grassland in the Kopanecké lúky meadows near the village of Vernár, Slovak Paradise National Park (Fig. 4), 52 and 63 species were recorded in plots of 0.25 and 0.5 m^2, respectively; in a mesic meadow near Žítková in the White Carpathians, 45 species were recorded in 0.25 m^2, which is less than at the Kopanecké lúky, but still more than the previous world record of 44 species reported for this plot size by Wilson et al. (2012) based on data of Klimeš et al. (2001) from the Čertoryje meadows, also in the White Carpathians. Our new count of 43 species in a plot of 0.1 m^2 in the Čertoryje meadows equalled the world record from a Transylvanian semi-dry grassland (Dengler et al. 2012, Wilson et al. 2012). However, the Transylvanian species count refers to shoot presence, whereas in the White Carpathians only species rooted in the plot were counted, which indicates that the White Carpathian grassland was probably richer.

It is important to note that identification of the species-richest plots smaller than 1 m^2 is strongly limited by data availability, because species lists for such plots were collected

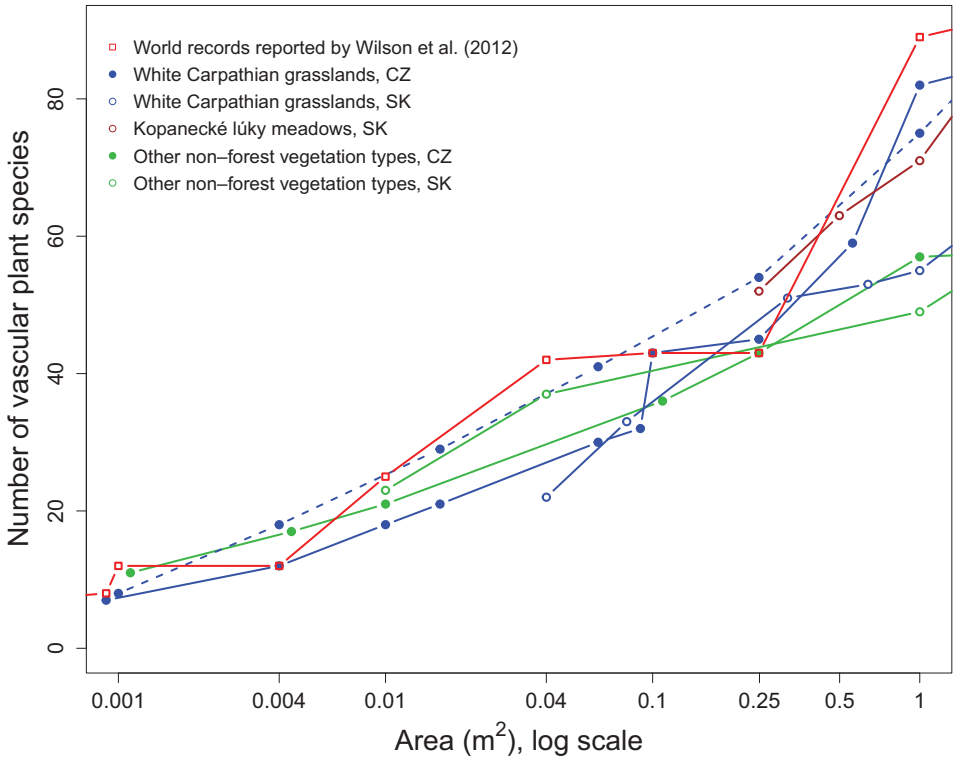

Fig. 1. – Maximum counts of vascular plant species recorded in vegetation plots ≤ 1 m^2 in the Czech Republic (full circles) and Slovakia (open circles), compared with the world records reported by Wilson et al. (2012). Lines connect the maximum values for particular areas and vegetation types. The blue dashed line for the White Carpathians represents the maximum possible values recorded by Klimeš et al. (2001) at the Čertoryje site (line c in Table 2). The world-record values reported erroneously by Wilson et al. (2012) and attributed to Klimeš et al. (2001) are corrected according to Klimeš et al. (2001).

at a small number of sites, are not stored in collective databases and usually also not published. Three new world records and one equalled world record reported here are based on a limited data set, suggesting that higher counts than the currently known global maxima reported by Wilson et al. (2012) may be relatively common at this fine scale. Even a great sampling effort at randomly selected sites may increase the probability of finding record counts. This can be illustrated by the case of the new world record reported here from Krkonoše mountain meadow, mown once a year in June and fertilized once in approximately five years (Herben et al. 1993). At this site species frequency was recorded each year from 1985 to 2012 in four plots of 50 × 50 cm located within an area of ca. 7 × 7 m. Each plot was divided into a grid of 15 × 15 squares of 3.3 × 3.3 cm. In total, there were 24,975 records in the grid squares, 4 of which contained a maximum count of 11 species. When aggregated to squares of 6.7 × 6.7 cm, a maximum of 17 species (the world record) was found in only 1 of 5439 records. In aggregated squares of 10 × 10 cm a maximum of 19 species was found in 6 of 2200 records, and in the entire plots of 50 × 50 cm a maximum of 37 species was recorded three times, in different plots and different years, while the mean

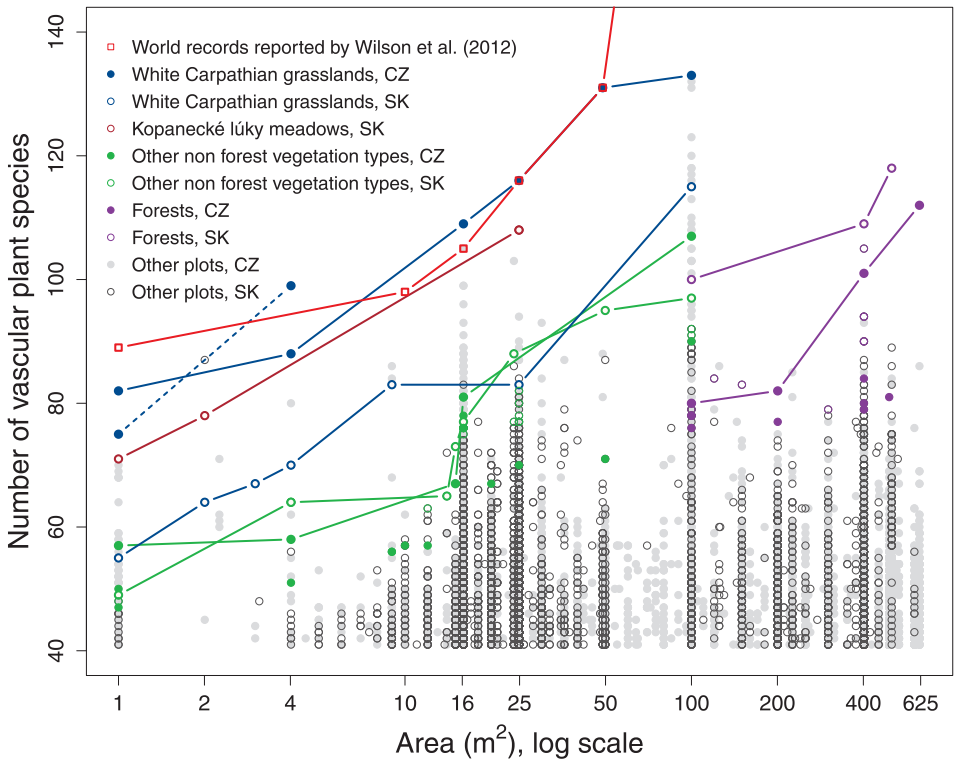

Fig. 2. – Maximum counts of vascular plant species recorded in vegetation plots ≥ 1 m^2 in the Czech Republic and Slovakia, compared with the world records reported by Wilson et al. (2012). World records for tropical rainforests are situated above the graph area. Isolated coloured points refer to the near-to-record vegetation plots reported in Appendix 1. Grey or open black points represent plots with lower species counts or rich plots from the sites in which the richest plots were recorded. See Fig. 1 for explanation of other details.

over all years and all four plots was 30.4 species. Other record counts for small plots also originate from high-intensity sampling. For example, the Czech record of 21 species in a 0.01-m^2 plot from the Železné hory Mts (Appendix 1, plot 3) was the only one of 34,800 plot records. This intensive sampling was carried out as part of a detailed experimental study targeting the effects of traditional management by mowing and landscape eutrophication on wet meadow plant communities (Klimešová et al. 2011, Janeček et al. 2013). The Czech record for an area outside the White Carpathians of 43 species rooted in a 0.25-m^2 plot in an intermittently wet meadow near Ohrazení in southern Bohemia (see Lepš 2014 for experiment description) was also recorded only once in a 20-year data set from three replicated experimental plots, each comprising a grid of 25 cells of 10 × 10 cm, mown once a year in June and not fertilized (plots with other experimental treatments were always less species-rich). Also the world record of 12 species (one more than in the Krkonoše meadow) for a plot size of 0.001 m^2 reported by Wilson et al. (2012) is based on high-intensive fine-scale grid sampling of the alvar grasslands on the Swedish island of Öland (van der Maarel & Sykes 1993).

Table 1. – Most species-rich plots in the Czech and Slovak parts of the White Carpathian Mts. The vegetation in all the plots corresponds to the association *Brachypodio pinnati-Molinietum arundinaceae* (alliance *Bromion erecti*) except for plot 9, where it corresponds to the association *Anthoxantho odorati-Agrostietum tenuis* (alliance *Cynosurion cristati/Arrhenatherion elatioris*). In plots 1–12 and 17–25, × means species presence; in other plots plant covers on the Braun-Blanquet scale are given.

	Czech Republic																Slovakia										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Acer campestre juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	r	.
Acer pseudoplatanus juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	r	.	.	.	.	.	.	.	.	.	.	.	.
Achillea millefolium agg.	.	.	×	×	×	×	.	×	×	×	×	×	+	+	+	r	×	×	×	×	×	×	×	×	×	+	+
Agrimonia eupatoria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Agrostis capillaris	.	.	.	×	.	.	.	×	.	×	×	×	2	.	r	+	×	×	×	×	×	×	×	×	×	2	1
Agrostis vinealis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.
Ajuga genevensis	.	.	.	.	.	.	.	.	.	×	×	.	+	.	+	r	.	.	.	.	.	.	.	.	.	r	.
Ajuga reptans	.	.	.	.	.	.	.	.	.	×	×	×	+	+	+	+	×	.	×	×	×	×	×	×	×	+	+
Alchemilla glaucescens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Alchemilla sp.	.	.	.	.	.	.	.	.	×	.	×	.	+	.	.	.	.	×	×	×	×	×	×	×	×	r	+
Alchemilla xanthochlora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Allium carinatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.
Allium scorodoprasum	.	.	.	.	.	.	.	.	.	.	×	.	+	.	.	.	.	.	.	.	.	×	×	×	×	.	.
Anacamptis pyramidalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.
Anemone sylvestris	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anthericum ramosum	.	.	×	.	.	.	×	.	.	.	×	+	+	+	+	.	.	.	.	.	.	.	.	.	+	.
Anthoxanthum odoratum	.	.	.	×	.	.	.	×	×	×	×	+	+	+	+	.	.	×	×	×	×	×	×	×	2	+
Anthriscus sylvestris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r
Anthyllis vulneraria	.	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aquilegia vulgaris	.	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Arabis hirsuta	×	.	.	.	.	.	.	.	.	×	×	.	+	.	.	+	.	.	.	.	.	.	.	.	.	r	r
Arrhenatherum elatius	.	.	.	.	.	.	×	×	×	×	×	×	+	+	+	+	.	×	×	×	×	×	×	×	×	.	1
Asarum europaeum	.	.	.	.	.	.	.	.	.	.	×	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asperula cynanchica	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	×	.	.
Asperula tinctoria	.	.	×	.	.	.	.	×	.	.	×	×	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Astragalus danicus	.	.	.	.	.	.	.	×	.	.	.	×	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Astrantia major	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Avenula pubescens	.	.	.	.	.	.	.	.	.	.	×	×	+	+	+	+	.	.	.	.	.	.	.	.	+	+	
Betonica officinalis	.	.	.	.	.	.	.	×	.	×	×	×	1	+	+	+	×	.	×	×	×	×	×	×	1	1	
Betula pendula juv.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Brachypodium pinnatum	×	×	.	×	×	×	×	×	×	×	×	×	2	+	+	1	×	×	×	×	×	×	×	×	3	1	
Briza media	.	.	.	×	×	.	.	.	×	×	×	×	+	+	+	+	×	.	×	×	×	×	×	×	2	+	
Bromus erectus	×	×	×	×	×	×	.	×	.	×	×	×	1	2	2	3	.	×	×	×	×	×	×	×	3	2	
Bupleurum falcatum	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	
Calamagrostis arundinacea	.	.	.	.	.	.	.	.	.	.	×	×	2	+	+	1	.	.	.	.	.	.	.	.	.	.	
Calamagrostis epigejos	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
Campanula glomerata	.	.	.	.	.	.	.	.	×	×	×	×	+	+	+	+	.	.	×	×	×	×	×	×	1	+	
Campanula patula	.	.	.	.	.	.	.	.	×	.	×	+	r	+	.	.	.	.	.	.	.	×	×	×	.	+	
Campanula persicifolia	.	.	.	.	.	.	.	.	.	×	×	+	+	+	+	.	.	×	×	×	×	×	×	×	.	+	
Campanula rapunculoides	.	.	.	.	.	.	.	.	.	×	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
Carex acuta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Carex caryophyllea	.	×	.	×	×	×	.	.	×	×	.	×	+	+	+	+	.	.	.	.	.	.	.	.	.	1	+
Carex flacca	.	.	×	.	×	×	.	.	×	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	1	+
Carex michelii	.	.	.	.	.	.	.	.	.	.	.	×	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Carex montana	.	.	.	.	×	×	×	.	.	×	×	×	2	4	4	1	.	×	×	×	×	×	×	×	×	2	1
Carex pallescens	.	.	.	.	.	.	.	.	×	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	×	.	+
Carex panicea	.	.	×	.	.	×	.	.	×	.	.	×	.	.	.	+	.	.	.	.	.	.	.	.	.	1	.
Carex tomentosa	.	×	.	.	.	.	×	×	.	.	×	×	+	+	+	+	.	.	.	.	.	.	.	.	.	+	+

	Czech Republic																Slovakia										
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Carlina acaulis	.	.	.	.	.	.	.	.	×	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	×	+	+
Carlina vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carpinus betulus juv.	.	.	.	.	.	.	.	.	×	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	×	+	.
Carum carvi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×	×	×	×	.	.
Centaurea phrygia agg.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Centaurea jacea	.	.	.	.	×	×	.	.	×	.	.	×	.	r	+	+	.	.	.	.	×	×	×	×	×	+	+
Centaurea scabiosa	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Centaurea stenolepis	.	.	.	.	.	.	.	.	.	.	×	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurium erythraea	.	.	.	.	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium holosteoides subsp. *triviale*	.	.	.	.	.	.	.	.	.	×	×	×	r	.	.	+	×	×	×	×	×	×	×	×	.	.	+
Chaerophyllum aromaticum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Chamaecytisus supinus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Chamaecytisus virescens	.	.	.	.	.	.	.	.	.	×	.	×	+	r	+	+	.	.	.	.	.	.	.	.	.	.	.
Cirsium arvense	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	+
Cirsium canum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Cirsium pannonicum	×	×	.	.	×	×	×	×	.	×	×	×	1	1	1	1	×	.	.	.	×	×	×	×	×	2	+
Cirsium vulgare	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Clematis recta	.	.	.	.	.	.	.	.	.	×	×	×	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Coeloglossum viride	.	.	.	.	.	.	.	.	.	.	.	.	.	r	r	.	.	.	.	.	.	.	.	.	.	.	.
Colchicum autumnale	.	.	.	.	.	.	.	.	.	.	×	.	1	r	+	+	.	.	.	.	.	.	.	.	×	.	+
Convallaria majalis	.	.	.	.	.	.	.	.	.	.	×	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cornus sanguinea juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r
Crataegus monogyna (shrub)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
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Crataegus sp. juv.	.	.	.	.	.	.	.	.	.	.	×	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Crepis biennis	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	r	+
Crepis praemorsa	.	.	×	×	×	×	×	×	.	.	.	×	+	+	+	+	.	.	.	.	.	.	.	.	.	.	+
Cruciata verna	.	.	.	.	.	.	.	×	×	×	×	×	1	+	+	+	×	×	×	×	×	×	×	×	×	+	+
Cynosurus cristatus	.	.	.	.	.	.	.	.	.	.	×	.	+	.	.	.	.	.	×	×	×	×	×	×	×	.	+
Cytisus nigricans	.	.	.	.	.	.	.	.	.	.	.	.	.	r	+	.	.	.	.	.	.	.	.	.	.	.	.
Dactylis glomerata	.	×	.	.	×	.	×	.	.	×	×	×	+	+	+	+	×	×	×	×	×	×	×	×	×	1	+
Danthonia alpina	.	×	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	1	.
Danthonia decumbens	.	.	.	×	×	×	.	.	×	.	.	×	+	+	+	+	.	.	×	×	×	×	×	×	×	+	.
Deschampsia cespitosa	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	r	.	×	.	.	.	.	×	×	×	.	.
Dianthus carthusianorum	.	.	.	.	.	.	.	.	.	×	.	+	.	.	.	r	.	.	×	×	×	×	×	×	×	.	+
Dorycnium germanicum	.	.	.	.	.	.	.	×	.	.	.	×	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Equisetum arvense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	×	×	×	×	×	×	×	×	×	+	+
Equisetum telmateia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×	×	×	×	.	1
Erysimum odoratum	.	.	.	.	.	.	.	.	.	.	×	.	+	.	.	r	.	.	.	.	.	.	.	.	.	.	.
Euonymus europaeus juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r
Euphorbia cyparissias	×	.	.	.	.	.	.	.	.	.	.	×	.	r	+	+	.	.	.	.	.	.	.	.	.	+	+
Euphorbia waldsteinii	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphrasia stricta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×	×	×	×	.	.
Festuca ovina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×	×	×	×	×	×	×	.	.
Festuca pratensis	.	.	.	.	.	.	.	.	×	×	×	×	+	+	+	+	.	×	×	×	×	×	×	×	×	+	+
Festuca rubra	.	.	.	.	.	.	.	×	×	×	×	×	+	+	r	+	×	×	×	×	×	×	×	×	×	2	1
Festuca rupicola	.	.	.	.	.	.	×	×	×	×	×	×	2	1	1	+	.	.	.	.	.	.	.	.	×	1	+
Filipendula vulgaris	.	.	.	.	×	×	×	×	×	×	×	×	1	+	+	+	×	×	×	×	×	×	×	×	×	2	+
Fragaria vesca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Fragaria viridis	.	.	×	.	.	.	×	.	.	.	.	×	.	+	+	+	.	×	×	×	×	×	×	×	×	.	.
Galium album	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r
Galium aparine	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r
Galium boreale	.	.	.	.	.	.	.	.	.	×	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.

	Czech Republic																Slovakia										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Galium pumilum	.	.	.	.	.	.	.	×	.	.	.	.	.	r	r	r	.	.	.	.	.	.	.	.	.	.	.
Galium verum	.	.	.	.	.	.	×	×	.	×	.	×	.	.	r	+	.	×	.	.	.	×	×	×	×	1	2
Genista tinctoria	.	.	.	.	.	.	.	.	.	.	×	×	+	+	+	+	.	.	.	.	.	.	.	.	.	1	.
Geranium sanguineum	.	.	.	.	.	.	.	.	.	.	×	.	2	+	+	+	.	.	.	.	.	×	×	×	×	.	.
Gladiolus imbricatus	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gymnadenia conopsea	.	.	.	.	×	.	.	.	.	.	.	.	.	+	+	+	.	.	×	×	×	×	×	×	×	+	.
Helianthemum grandiflorum subsp. *obscurum*	.	.	×	.	×	×	×	×	.	×	.	×	+	1	+	+	.	.	×	×	×	×	×	×	×	1	+
Heracleum sphondylium	.	.	.	.	.	.	.	.	.	.	×	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Hieracium bauhini	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Hieracium lachenalii	.	.	.	.	.	.	.	.	.	.	.	.	.	+	r	.	.	.	.	.	.	.	.	.	.	.	.
Holcus lanatus	.	.	.	.	.	×	.	.	.	.	.	.	.	.	r	+	.	.	×	×	×	×	×	×	×	.	+
Hypericum maculatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×	×	.	+
Hypericum perforatum	.	.	.	.	.	.	.	.	.	.	×	.	+	+	+	+	.	.	.	.	.	.	.	.	.	.	r
Hypochaeris maculata	.	.	×	.	.	×	.	.	.	.	.	×	1	+	+	+	.	.	.	.	.	.	.	.	.	+	.
Inula ensifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	r	+	.	.	.	.	.	.	.	.	.	.	.	.
Inula hirta	.	.	.	.	×	×	.	.	.	.	.	×	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Inula salicina	.	.	.	.	.	.	×	×	.	×	.	×	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Iris variegata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.
Knautia kitaibelii	.	.	.	.	.	.	.	.	×	×	×	×	+	+	+	+	×	.	×	×	×	×	×	×	×	r	+
Koeleria macrantha	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Koeleria pyramidata	.	.	.	.	×	×	.	.	×	.	.	×	.	+	+	.	.	.	.	.	.	.	.	.	.	1	.
Laserpitium latifolium	.	.	.	.	.	.	.	.	.	.	×	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lathyrus latifolius	.	.	.	.	.	.	.	.	.	.	×	.	+	+	+	+	.	.	.	.	.	.	.	.	.	.	+
Lathyrus niger	.	.	.	.	.	.	.	.	.	.	×	×	+	+	+	+	.	.	.	.	.	.	.	.	.	.	r
Lathyrus pratensis	.	.	.	.	.	.	.	.	.	.	×	.	+	.	.	+	.	×	.	.	.	×	×	×	×	+	+
Leontodon hispidus	.	×	×	×	×	.	.	×	×	×	×	×	+	1	1	+	×	×	×	×	×	×	×	×	×	1	+
Leucanthemum ircutianum et *vulgare*	.	.	.	.	.	.	.	.	×	×	×	×	+	+	+	+	.	.	×	×	×	×	×	×	×	+	+
Leucanthemum margaritae	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Ligustrum vulgare juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	+
Lilium martagon	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linum catharticum	.	×	×	×	×	×	×	×	.	×	×	×	+	+	+	+	.	.	×	×	.	.	.	.	.	+	+
Linum flavum	.	.	.	.	.	.	.	.	.	.	.	.	.	r	r	.	.	.	.	.	.	.	.	.	.	.	.
Listera ovata	.	.	.	.	.	.	.	.	.	.	×	.	r	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Lotus corniculatus	.	.	.	.	.	.	.	.	.	.	×	×	+	+	+	+	×	×	×	×	×	×	×	×	×	+	+
Luzula campestris	.	.	.	.	.	.	.	×	×	×	×	.	+	r	+	+	×	×	×	×	×	×	×	×	×	1	+
Lysimachia vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Malus sp. juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	r
Medicago falcata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Medicago lupulina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.
Melampyrum cristatum	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Melampyrum nemorosum	.	.	.	.	.	.	.	×	.	.	×	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Molinia arundinacea	×	.	.	×	×	×	×	.	.	×	×	×	1	1	2	2	.	.	.	.	.	.	.	.	.	.	.
Myosotis arvensis	.	.	.	.	.	.	.	.	.	×	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Nardus stricta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×	×	×	×	×	×	×	.	.
Ononis spinosa	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Ophioglossum vulgatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Orchis mascula	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.
Orchis ustulata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Pedicularis exaltata	.	.	.	.	.	.	.	.	.	.	×	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Peucedanum cervaria	.	.	.	.	.	.	.	.	.	×	×	×	+	+	+	+	.	.	.	.	.	.	.	.	.	.	+
Phleum phleoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Phleum pratense	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.

	Czech Republic																Slovakia										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Picris hieracioides	.	.	×	.	.	.	.	.	.	.	.	.	.	r	r	.	.	.	.	.	.	.	.	.	.	.	.
Pilosella officinarum	.	.	×	.	.	.	.	.	.	.	.	.	.	r	r	.	.	.	.	.	.	.	.	.	.	.	.
Pimpinella saxifraga	.	.	.	.	.	.	.	.	×	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	+	r
Plantago lanceolata	.	.	.	×	×	×	×	×	×	.	×	×	+	+	+	+	×	×	×	×	×	×	×	×	×	1	+
Plantago media	.	.	.	.	×	×	×	.	.	×	×	×	+	+	+	+	.	.	.	.	.	.	.	.	.	+	+
Platanthera bifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Poa pratensis agg.	.	.	.	.	.	.	×	×	.	×	.	.	+	.	.	+	.	.	.	.	.	.	.	.	×	.	+
Polygala comosa	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Polygala major	.	.	.	.	.	.	.	.	.	.	.	×	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Polygala vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×	.	.
Potentilla alba	×	×	×	.	.	.	×	.	×	×	×	1	1	1	1	.	×	×	×	×	×	×	×	×	1	1
Potentilla erecta	.	.	.	×	.	.	.	.	.	×	×	+	+	+	+	.	.	×	×	×	×	×	×	×	.	+
Potentilla heptaphylla	.	.	×	×	×	×	×	.	×	×	×	×	+	+	+	+	.	.	.	×	×	.	.	.	+	+
Potentilla reptans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Primula veris	.	.	.	.	×	×	.	.	×	×	×	×	1	+	+	+	×	.	×	×	×	×	×	×	×	1	+
Prunella grandiflora	.	.	.	×	×	×	×	×	.	.	×	×	1	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Prunella ×*dissecta*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.
Prunella vulgaris	.	.	.	.	.	.	×	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+
Prunus cerasus juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.
Prunus sp. juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r
Prunus spinosa juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Pulmonaria angustifolia	.	.	.	.	.	.	.	.	.	×	.	×	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Pulmonaria mollis	.	.	.	.	.	.	.	.	.	×	.	×	1	+	+	+	.	.	×	×	×	×	×	×	×	.	+
Pyrus pyraster juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	r	.	.	.	.	.	.	.	.	.	.	.	.
Pyrus sp. juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r
Quercus petraea juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	+	+	.	.	.	.	.	.	.	.	×	r	r
Quercus robur juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	+	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculus acris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×	×	.	+
Ranunculus auricomus agg.	.	.	.	.	.	.	.	.	.	.	×	.	+	.	.	r	.	.	.	.	.	.	.	.	.	.	.
Ranunculus bulbosus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×	×	×	×	.	.
Ranunculus polyanthemos	.	.	.	.	×	×	×	×	×	×	×	×	+	+	+	+	×	×	×	×	×	×	×	×	×	+	+
Rhamnus cathartica juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	r	.	.	.	.	.	.	.	.	.	.	.	r
Rhinanthus alectorolophus	.	.	.	.	.	.	.	.	.	.	.	.	.	r	+	.	.	.	.	.	.	.	.	.	.	.	.
Rhinanthus minor	.	.	.	.	.	.	.	.	.	.	.	×	.	+	+	+	.	.	.	.	.	.	.	×	×	.	.
Rosa canina agg. juv.	.	.	.	.	.	.	.	.	.	.	.	×	.	+	+	+	.	.	.	.	.	.	.	.	×	+	+
Rosa gallica	.	.	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rubus caesius	.	.	.	.	.	.	.	.	.	.	.	.	.	r	+	.	.	.	.	.	.	.	.	.	.	.	.
Rumex acetosa	.	.	.	.	.	.	.	.	×	.	×	×	+	r	r	+	×	×	×	×	×	×	×	×	×	+	+
Salvia pratensis	.	.	.	.	×	×	×	.	×	×	×	×	+	+	+	+	.	.	×	×	×	×	×	×	×	1	+
Sambucus nigra juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r
Sanguisorba minor	.	.	.	.	.	.	×	.	×	.	.	.	.	.	.	.	.	.	×	×	×	×	×	×	×	.	+
Sanguisorba officinalis	.	.	.	.	.	.	.	×	.	×	×	×	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Scabiosa ochroleuca	.	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Scorzonera hispanica	.	.	.	.	.	.	.	.	.	.	×	.	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Scorzonera purpurea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Securigera varia	.	.	.	.	.	.	×	.	×	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Sedum sexangulare	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×	.	.
Senecio jacobaea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r
Serratula tinctoria	.	.	.	×	.	.	×	×	.	.	×	×	1	+	+	+	.	.	.	.	.	.	.	.	.	.	r
Silene nutans	.	.	.	×	.	.	.	×	.	.	×	.	r	.	.	r	.	.	.	.	.	.	.	.	.	.	.
Silene vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Stellaria graminea	.	.	.	.	.	.	.	.	.	.	×	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Symphytum tuberosum	.	.	.	.	.	.	.	.	.	.	×	×	+	+	+	+	.	×	.	.	.	×	×	×	×	.	+
Tanacetum corymbosum	.	.	.	.	.	.	×	.	.	×	×	×	+	+	+	+	.	×	.	×	×	×	×	×	×	+	+

	Czech Republic																Slovakia										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Taraxacum sect. *Taraxacum*	.	.	.	.	.	.	×	.	.	×	.	×	+	r	r	+	.	×	.	.	.	.	×	×	×	r	+
Teucrium chamaedrys	.	×	.	.	×	×	×	.	.	.	.	×	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.
Thalictrum simplex	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.
Thesium linophyllon	.	.	×	.	.	.	×	.	.	×	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	1	.
Thymus pulegioides	.	.	.	×	.	×	.	.	×	.	.	×	.	+	+	.	.	.	×	×	×	×	×	×	×	+	+
Tilia cordata juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	r	.	.	.	.	.	.	.	.	.	.	.	.
Tragopogon orientalis	.	.	.	.	.	.	.	.	×	.	.	.	+	+	+	+	.	×	×	×	×	×	×	×	×	+	+
Traunsteinera globosa	.	.	.	.	.	.	.	.	.	.	×	.	r	+	+	.	.	.	.	.	.	.	.	.	.	.	r
Trifolium alpestre	.	.	.	.	.	.	.	.	.	.	.	.	+	r	+	+	.	×	.	.	.	×	×	×	×	+	+
Trifolium campestre	.	.	.	.	.	.	.	×	.	×	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Trifolium dubium	.	.	.	.	.	.	.	.	.	.	.	×	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.
Trifolium medium	.	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Trifolium montanum	.	.	.	.	.	.	.	×	×	.	.	×	+	+	+	+	.	×	×	×	×	×	×	×	×	1	+
Trifolium ochroleucon	.	.	.	.	.	.	.	×	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium pratense	.	.	.	.	.	.	.	.	.	.	.	×	+	+	+	+	×	×	×	×	×	×	×	×	×	.	+
Trifolium repens	.	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	×	×	×	×	×	×	×	.	+
Trifolium rubens	.	.	.	.	.	.	.	.	.	.	×	×	+	+	+	+	.	.	.	.	.	.	.	.	×	+	+
Trisetum flavescens	.	.	×	.	.	.	.	×	×	×	×	×	2	r	r	+	.	.	×	×	×	×	×	×	×	1	+
Valeriana stolonifera	.	.	.	.	.	.	.	.	.	.	×	.	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Veronica arvensis	.	.	.	.	.	.	.	.	.	×	.	×	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.
Veronica chamaedrys agg.	.	.	.	.	.	.	.	×	×	×	×	×	+	r	r	+	.	.	.	.	.	.	.	.	.	.	+
Veronica officinalis	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Veronica orchidea	.	.	.	.	.	.	.	.	.	.	.	.	.	r	r	.	.	.	.	.	.	.	.	.	.	.	.
Veronica spicata	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.
Veronica teucrium	.	.	.	.	×	×	×	.	.	.	.	×	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.
Viburnum opulus juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	r
Vicia angustifolia	.	.	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vicia cracca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Vicia hirsuta	.	.	.	.	.	.	.	.	.	×	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.
Vicia sepium	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vicia tenuifolia	.	.	.	.	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vicia tetrasperma	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r
Vincetoxicum hirundinaria	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Viola canina	.	.	.	.	.	.	.	.	.	.	×	×	+	.	r	+	.	.	×	×	×	×	×	×	×	+	+
Viola hirta	.	×	×	×	×	×	×	×	×	×	×	×	+	1	1	+	.	×	.	.	×	×	×	×	×	+	+
Viola riviniana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.

Bryophytes (only recorded in plots 1, 8, 16 and 26): 1: *Brachythecium glareosum* ×, *Homalothecium lutescens* ×, *Plagiomnium affine* ×; 8: *Brachythecium rutabulum* ×, *Plagiomnium affine* ×; 16: *Abietinella abietina* 1, *Brachythecium glareosum* +, *Brachythecium rivulare* r, *Brachythecium rutabulum* 1, *Campyliadelphus chrysophyllus* +, *Chiloscyphus cuspidatus* +, *Ctenidium molluscum* r, *Fissidens dubius* 1, *Homalothecium lutescens* 1, *Hypnum cupressiforme* +, *Oxyrrhynchium hians* +, *Plagiomnium affine* 2, *Rhytidiadelphus squarrosus* 1, *Thuidium delicatulum* +; 26: *Brachythecium salebrosum* +, *Calliergonella cuspidata* +, *Fissidens taxifolius* +, *Hypnum cupressiforme* +, *Plagiomnium rostratum* +, *Plagiomnium* sp. +, *Thuidium assimile* +.

Czech Republic: (1) **7 species / 0.0009 m²** – Čertoryje National Nature Reserve near Kněždub, 17°24'50"E, 48°51'20"N (measured by GPS), altitude 395 m, aspect S, slope 6°, covers: herb layer 60%, moss layer 25%, plot size measured with a tape measure, 11 June 2008, M. Chytrý & Z. Preislerová, plot ID 457713. – (2) **12 species / 0.004 m²** – Čertoryje, 17°24'54.1"E, 48°51'08.1"N (read from www.mapy.cz), altitude 382 m, aspect SW, plot size measured with a metal ring, June 1998, M. Dančák (data used in Klimeš et al. 2001), plot ID 959016. – (3) **18 (20?) species / 0.01 m²** – Čertoryje (Klimeš 1997: Table 1, plot m3), plot ID 957016. The structure of Table 1 in Klimeš (1997) is broken; after correction for shifted cells in the rows, we counted 20 species (listed in Table 1 of the current paper), however, Klimeš gives a count of 18 species, which we consider is the correct count. – (4) **21 species / 0.015625 m² (Czech record)** – Čertoryje, 17°24'54.1"E, 48°51'08.1"N

(read from www.mapy.cz), altitude 382 m, aspect SW, plot size measured with a metal ring, June 1998, T. Kučera (data used by Klimeš et al. 2001), plot ID 959031. – (5–6) **2 × 30 species / 0.0625 m² (Czech records)** – Čertoryje, 17°24'54.1"E, 48°51'08.1"N (read from www.mapy.cz), altitude 382 m, aspect SW, plot size measured with a cord, June 1998, M. Dančák and I. Jongepierová, respectively (data used by Klimeš et al. 2001), plot IDs 959018, 959004. – (7) **32 (34?) species / 0.09 m² (Czech record)** – Čertoryje (Klimeš 1997: Table 1, plot v2), plot ID 957015. The structure of Table 1 in Klimeš (1997) is broken; after correction for shifted cells in the rows, we counted 34 species (listed in Table 1 of the current paper), however, Klimeš gives a count of 32 species, which we consider is the correct count. – (8) **43 species / 0.1 m² (equalled world record and new world record for rooted species only)** – Čertoryje, 17°24'41.3"E, 48°51'30.9"N (measured by GPS), altitude 387 m, aspect SW, slope 2°, plot size measured with a cord, 10 June 2014, M. Chytrý, P. Dřevojan & K. Fajmon, bryophytes identified by M. Táborská, plot ID 955007. – (9) **45 species / 0.25 m² (Czech record)** – Hutě Nature Reserve near Žítková, 17°54'25.9"E, 48°59'30.5"N (measured by GPS), altitude 469 m, aspect W, slope 10°, covers: herb layer 90%, moss layer 70%, plot size measured with a cord, 10 June 2008, K. Fajmon, plot ID 957018. – (10) **59 species / 0.56 m² (Czech record)** – Čertoryje, 17°25'00.5"E, 48°51'22.4"N (read from www.mapy.cz), covers: herb layer 85%, moss layer 50%, 1999, J. Němec & M. Perný (data used in Klimeš et al. 2013), plot ID 957001. – (11) **82 species / 1 m² (Czech record)** – Porážky National Nature Reserve near Slavkov, 17°37'23.0"E, 48°53'19.7"N (measured by GPS), altitude 574 m, aspect N, slope 1°, cover herb layer 98%, plot size measured with a cord, 10 June 2014, P. Hájková & M. Hájek, plot ID EU-CZ-001-487693. – (12) **88 species / 4 m² (Czech record)** – Čertoryje, 1998, L. Klimeš, plot size measured with a cord (data used in Klimeš et al. 2001), plot ID 959014. – (13) **109 species / 16 m² (world record)** – Porážky, same site as plot 11, plot size measured with a cord, 10 June 2014, P. Hájková & M. Hájek, plot ID EU-CZ-001-487694. – (14–15) **116 and 131 species / 25 and 49 m² (world records)** – Čertoryje, 17°24'39"E, 48°51'26"N (read from www.mapy.cz), altitude 400 m, aspect W, slope 4°, cover herb layer 85%, plot size measured with a cord, 10 June 2000, Z. Preislerová (reported by Wilson et al. 2012), plot IDs 457724, 457725. – (16) **133 species / 100 m² (Czech record)** – Čertoryje, 17°24'50"E, 48°51'20"N (measured by GPS), altitude 395 m, aspect S, slope 6°, covers: herb layer 65%, moss layer 50%, plot size measured with a cord, 11 June 2008, M. Chytrý & Z. Preislerová, plot ID 457714.

Slovakia: (17–25) **22, 33, 51, 53, 55, 64, 67, 70 and 83 species / 0.04, 0.08, 0.32, 0.64, 1, 2, 3, 4 and 9 m²** – Nebrová Nature Reserve near Červený Kameň, 18°07'24.1"E, 49°07'13"N (coordinates measured by GPS), regularly mown and irregularly grazed grassland, altitude 530 m, aspect SW, slope 7°, plot size measured with a metal frame of 1×1 m with a grid of 20×20 cm, records for plots larger than 1 m² were aggregated from the contiguous 1-m²-plot records, 10 July 1993, I. Škodová, plot IDs EU-SK-001-714700–08. – (26) **83 species / 25 m²** – Bučkova jama Nature Reserve near Vrbovce, 17°26'18"E, 48°49'14"N (coordinates read from a 1 : 50,000 map), altitude 548 m, aspect S, slope 5°, covers: herb layer 100%, moss layer 0%, plot size measured by pace counting, 10 June 1999 (Škodová in Škodová et al. 2011: Table 2, plot 11), plot ID EU-SK-001-714286. – (27) **115 species / 100 m² (Slovak record)** – Nebrová Nature Reserve near Červený Kameň, 18°07'23.7"E, 49°07'13.7"N, altitude 529 m, aspect SE, slope 5°, covers: herb layer 80%, moss layer 30%, plot size measured with a cord, 10 June 2009, K. Merunková & Z. Preislerová, plot ID 457719.

In addition to high sampling intensity, probability of finding extremely high numbers of species in small plots also depends on the researchers' training, especially their ability to identify tiny juvenile individuals (Klimeš et al. 2001). This is important particularly in small plots, because the probability that a species is represented only by a juvenile individual usually decreases with plot size. Researchers' skills usually increase during the early years of sampling experimental or monitoring plots (Appendix S1 in Lepš 2014).

It is important to note that at sites of long-term ecological experiments, some plots can become richer due to experimental manipulations. In this study we included data from sites where experimental treatment was the same as usual management (e.g. mowing, grazing or abandoment), but we disregarded any experimental plots in which species numbers were manipulated directly, e.g. by sowing or removal of particular species. For example, one mown unfertilized plot of 0.25 m² at the Ohrazení experimental site where the dominant grass *Molinia caerulea* was selectively removed contained 44 species, which would be the Czech record outside the White Carpathians, but this was not included in the overview of records.

White Carpathian grasslands: a classical hotspot of fine-scale species richness

Grasslands in the White Carpathian Mts (Bílé Karpaty), located in the flysch zone of the Outer Western Carpathians at the border between the Czech Republic and Slovakia, have long been known for their high species richness (Sillinger 1929), but a systematic study of this phenomenon started only in the past two decades with the work of Leoš Klimeš (Klimeš 1997, 2008, Klimeš et al. 2001). In their overview of species-richness world records, Wilson et al. (2012) reported global maxima for five plot sizes (0.004, 0.25, 16, 25 and 49 m^2, corresponding to 13, 44, 105, 116 and 131 species, respectively) from a single grassland site, the Čertoryje meadows in the south-western part of the White Carpathians in the Czech Republic (Fig. 5). The first two of these counts were ascribed to Klimeš et al. (2001), who actually did not report such values in their paper (see below), while the latter three were based on unpublished data by Z. Preislerová (referred to under her maiden name Z. Otýpková in Wilson et al. 2012; see also Merunková et al. 2012). Full vegetation-plot records related to these counts are included in the current paper.

Based on our search and new data collected in the field, we have identified several remarkably high species counts in the White Carpathians in addition to those published by Wilson et al. (2012). They include a new world record of 109 species in 16 m^2 in the Porážky meadows (Fig. 6), an equalled world record of 43 species in 0.1 m^2 (which is an absolute world record for rooted species only) in the Čertoryje meadows, and three other counts higher than those in Wilson et al. (2012): 44 species in 0.25 m^2 in the Hutě meadows near Žítková, 51 species in 0.32 m^2 in the Nebrová meadows near Červený Kameň and 59 species in 0.56 m^2 at Čertoryje. However, none of these latter three counts are world records, because we recorded even higher values in the Kopanecké lúky meadows in the Slovak Paradise (see below).

The newly obtained record species counts indicate that Čertoryje is not the only site with extremely high local species richness. To some extent, the high number of record counts reported from the Čertoryje meadows can be due to intensive botanical and ecological research conducted at this site by several individuals and teams since the late 1980s (Klimeš 1995, 1997, 1999, 2003, Klimeš et al. 2001, 2013, Bravencová 2003, Jongepierová 2008, de Bello et al. 2012, Merunková et al. 2012, Mitchley et al. 2012, Klimešová et al. 2013, Mudrák et al. 2013, Dvořáková et al. 2014). Other meadow areas in the White Carpathians have received much less attention and therefore it is likely that new record counts may be recorded there, for example in the extensive meadow areas near the villages of Suchov and Vápenky, including the Přední louky meadows (where 132 species in 100 m^2 were recorded, i.e. just one species less than the maximum value of 133 species recorded for this plot size in Čertoryje), Porážky meadows (in addition to the above-mentioned world record for 16 m^2, a remarkable count of 82 species in 1 m^2 was recorded there), Dolnoněmčanské louky meadows (105 species for 16 m^2, equal to the old world record from Čertoryje). Other high species counts are reported for the Jazevčí meadows near Javorník and Dubiny meadows near Březová. Historically, also Miliovy louky meadows near Blatnička, Hájová meadows near Lipov and meadows on Lesná hill-top near Strání were among the richest sites, but all of them are now depauperated after heavy applications of fertilizers in the 1970–1980s.

Fig. 3. – Mountain meadow near Malá Úpa, Krkonoše Mts, with flowering *Geranium sylvaticum*, *Leontodon hispidus*, *Ranunculus acris* and *Trifolium pratense* (*Sileno vulgaris-Nardetum strictae*, *Nardo strictae-Agrostion tenuis*), a world-record site with 17 species of vascular plants in an area of 0.0044 m^2. Photo by V. Hadincová, 2004.

Fig. 4. – Kopanecké lúky meadows, the Slovak Paradise (Slovenský raj) National Park, grassland of the association *Anthoxantho odorati-Agrostietum tenuis* (*Cynosurion cristati/Arrhenatherion elatioris*), a world-record site with 52 and 63 species in areas of 0.25 and 0.5 m^2, respectively. Photo by T. Dražil, 2006.

Fig. 5. – Čertoryje meadows, White Carpathians, with *Bromus erectus* and *Anacamptis pyramidalis* (*Brachypodio pinnati-Molinietum arundinaceae, Bromion erecti/Cirsio-Brachypodion pinnati*), a world-record site with 43, 116 and 131 species in areas of 0.1, 25 and 49 m^2, respectively. Photo by M. Chytrý, 2014.

Fig. 6. – Porážky meadows, White Carpathians, with *Pedicularis exaltata* (*Brachypodio pinnati-Molinietum arundinaceae, Bromion erecti/Cirsio-Brachypodion pinnati*), a world-record site with 109 species in an area of 16 m^2. Photo by P. Hájková, 2014.

Nearly all the extremely high species counts from the White Carpathians were recorded in grasslands belonging to the phytosociological association *Brachypodio pinnati-Molinietum arundinaceae*, which is transitional between the alliances *Bromion erecti* and *Cirsio-Brachypodion pinnati* (Chytrý et al. 2007, Illyés et al. 2007, Škodová et al. 2008, 2011, Hegedüšová Vantarová & Škodová 2014). In most cases these are polydominant stands with the graminoids *Brachypodium pinnatum*, *Bromus erectus*, *Carex montana*, *Festuca rupicola* and *Molinia arundinacea*, in places also *Calamagrostis arundinacea*, and numerous broad-leaved herbaceous plants including species of meadow steppes (*Cirsio-Brachypodion pinnati* alliance), productive mesic meadows (*Arrhenatherion elatioris* alliance), low-productive intermittently wet meadows (*Molinion caeruleae* alliance) and herbaceous forest-edge vegetation (*Geranion sanguinei* alliance). They occur at altitudes of approximately 350–600 m (Čertoryje is at the lower limit and Porážky at the upper limit of this range). They develop on Carpathian flysch, a sedimentary sequence of alternating sandstones and claystones of Lower Tertiary age, which give rise to deep soils with a pH (H_2O) of mostly 6.5–7.0. As claystones and the heavy soils that develop from them impede drainage, these soils are considered to vary considerably in moisture content both in space and time, which would enable drought-adapted and moisture-demanding species to co-occur (Chytrý et al. 2007, Škodová et al. 2008, 2011, Hegedüšová Vantarová & Škodová 2014).

White Carpathians seem to have a continual Holocene history of open land created and maintained by prehistoric agriculture, but exactly when the present-day pattern of wooded grassland and forest distribution appeared is unknown. In the 11–13th century, after the fall of the Great Moravian Empire, the region became a poorly settled borderland between the Czech and Hungarian kingdoms. Since the 14th century, towns in the adjacent lowlands bought grasslands in the mountains and used them for hay making late in the season. New villages appearing in the foothills, for example Kněždub close to the Čertoryje meadows, also utilized distant meadows. Late mowing, except in some dry years, without fertilization, drainage or irrigation, and with occasional autumn grazing, was the prevailing form of management of these meadows (Jongepierová 2008) that are currently the most species-rich. This historical management persisted up to the second half of the 20th century, when socialistic collective farms ploughed, heavily grazed, applied fertilizer or abandoned many of these grasslands. High species richness persisted in some abandoned grasslands or in the few meadows where fertilizer was not applied and heavy machines were not used for mowing. In the 1980s and 1990s, abandoned grasslands encroached by shrubs and tall grasses were restored and then scythed by volunteers attending summer camps (Porážky, Čertoryje). Today these sites and other valuable grasslands are regularly mown by land tenants using tractor-driven mowers or, on landslides, grass trimmers, usually in mid-summer (Jongepierová 2008). In the last decade, mowing has temporally been diversified between June and September in grasslands whose management is fully funded by nature conservancy authorities. In addition, selected strips of grassland are temporarily left unmown to support insect populations, but competitively strong grasses, such as *Calamagrostis epigejos* and *Molinia arundinacea,* tend to spread into such places, lowering the local species richness of plants.

Although most of the species-rich grasslands in the White Carpathians belong to the association *Brachypodio-Molinietum*, those in the Hutě Nature Reserve near Žítková in the central part of the mountain range are more mesic. According to the Czech phytosociological

system (Chytrý 2007–2013), they belong to the association *Anthoxantho odorati-Agrostietum tenuis* (alliance *Cynosurion cristati/Arrhenatherion elatioris*), but they contain a group of calcicolous dry-grassland species and not many acidophytes. In the Slovak phytosociological system (Hegedüšová Vantarová & Škodová 2014) they belong to the *Anthyllido vulnerariae-Trifolietum montani* or even to the *Brachypodio pinnati-Molinietum arundinaceae* association, which is delimited more broadly in Slovakia than in the Czech Republic. The grassland patches with the richest plant communities were traditionally scythed in summer and moderately grazed by small numbers of cattle, goats, horses or sheep in autumn. After a short break in the 1980s, they have been regularly scythed or mown by a small lath mower (MF-70 type) since 1991, with no applications of fertilizer and only occasional autumn grazing.

Interpretation of some previously published species counts from the White Carpathians

There is some uncertainty in the literature about the highest species counts recorded in the Čertoryje meadows, especially the interpretation of the data published by Klimeš et al. (2001). In this methodological study five botanists sampled vascular plant species in seven non-overlapping plots of different sizes ranging from 0.001 to 4 m^2, located at one of the most species-rich spots in the Čertoryje meadows. As they worked independently, combined records of individual researchers for each plot may have contained more species than actually present because of the misidentifications of tiny non-flowering individuals of some species. For example, *Asperula tinctoria* was recorded and correctly identified by four researchers, whereas the fifth one misidentified it as *A. cynanchica*, which would cause a false increase in the total count in the combined data by one species. Klimeš et al. (2001: Table 2) reported species counts for individual researchers and combined data for all the researchers, but they emphasized that those counts were for uncorrected data. Surprisingly, Klimeš (2008) reported the same combined values as if they were actual species counts. We therefore re-examined the original data used by the late Leoš Klimeš for preparing the first paper (Klimeš et al. 2001). Actually, the species counts that he reported as uncorrected in that paper had already been corrected for obvious species misidentifications, therefore they were quite realistic. He further used another, rather conservative correction of the combined data, in which he excluded all the species recorded in a particular plot by a single researcher (singletons) or by only two researchers (doubletons), provided he did not confirm the presence of these species in the plots after sampling. In Table 2 of the present paper, we summarize species counts recorded in the Čertoryje meadows by Klimeš et al. (2001) depending on the different ways in which the data were combined or corrected. Counts reported in lines (a) and (c) are those published by Klimeš et al. (2001). Actual species counts for individual plot sizes can be close to the values reported in line (c) and are shown as dashed curves in Figs. 1 and 2. If these values were valid, they would include four additional world records of 18, 29, 54 and 99 species in 0.004, 0.016, 0.25 and 4 m^2, respectively. However, until these counts are confirmed by individual researchers or groups of researchers sampling the same plot at the same time, we adopt a conservative approach and do not include them in the list of world records.

Table 2. – Species counts recorded by five researchers in seven plots of different sizes in the Čertoryje meadows and based on different ways of combining and correcting the data. The counts were obtained from unpublished original data of Klimeš et al. (2001).

Plot size (m^2)	0.001	0.004	0.016	0.0625	0.25	1	4
(a) Maximum number of species recorded by a single researcher (uncorrected data)	5	12	21	30	43	67	88
(b) Number of species in the combined uncorrected data	8	18	31	41	57	77	103
(c) Number of species in the combined data after removing obvious misidentifications	8	18	29	41	54	75	99
(d) Number of species in combined data after removing non-confirmed singletons and doubletons	4	11	19	32	40	68	85

Another source of error concerns the paper by Wilson et al. (2012), who published two world-record species counts (13 species in 0.004 m^2 and 44 in 0.25 m^2) referring to Klimeš et al. (2001). However, Klimeš et al. (2001) actually reported 12 and 43 species for these plot sizes, respectively, as maxima counted by single researchers. None of these values would be world records, because the same values were reported for smaller plots from the limestone grassland on the Swedish island of Öland (van der Maarel & Sykes 1993) and for Transylvanian semi-dry grasslands (Dengler et al. 2012), respectively.

A further remarkable species count recorded for Čertoryje referred to the late Leoš Klimeš and published recently (Jongepier 2013) is 109 species in a plot of 20 m^2. This would be a global maximum for this plot size and is realistic, given the counts of 105 and 116 species recorded in plots of 16 and 25 m^2 at Čertoryje and 109 species in a plot of 16 m^2 at Porážky (Table 1). However, L. Klimeš counted species in his field notebook directly after sampling (J.W. Jongepier, personal communication) and never published this record, not even in his later book chapter reporting the maxima of species richness in the White Carpathians (Klimeš 2008). As the species list of this record was not found and we cannot check it for possible repeated records of the same species, which commonly occur in field notebooks, we have not included this count in our summary.

Kopanecké lúky meadows in the Slovak Paradise: a new world-record site

In addition to the species-rich White Carpathian localities, another site with world-record and near-world-record species counts was discovered in the Kopanecké lúky meadows (Kopanec meadows, also called Vernárske lúky, Vernár meadows) near the village of Vernár in the Slovak Paradise (Slovenský raj) National Park situated in the central part of the Western Carpathians, Slovakia (Fig. 4). The species counts from a series of nested plots sampled at this site in the year 2000 include world records of 52 and 63 species in areas of 0.25 and 0.5 m^2, respectively, and other remarkably high counts of 71, 78 and 108 species in plots of 1, 2 and 25 m^2, respectively (Table 3).

The Kopanecké lúky meadows extend over an area of approximately 34 ha on slopes of various aspects with an inclination of 0–30° at altitudes of 900–1186 m. In the karst region of the Slovak Paradise, these meadows occur in a specific geological setting on a tectonic fault between two limestone nappes, in which non-limestone sediments occur, such as Lower Triassic shales, fine-grained sandstones and marlstones. Their relatively easy weathering has resulted in the gentle topography of this area and deep soils.

Table 3. – Species records for a 25-m^2 plot in the Kopanecké lúky meadows, the Slovak Paradise (Slovenský raj) National Park (*Anthoxantho odorati-Agrostietum tenuis* grassland), including a nested plot of 1 × 2 m divided into eight subplots of 0.5 × 0.5 m. The column with cover values contains the data from the 25 m^2 plot. Species occurrences are given for the smallest plots of 0.25 m^2 and species counts for plots of 0.5, 1 and 2 m^2 are stepwise cumulative species counts based on the data from the smallest plots. Maximum counts of vascular plant species are 52 in an area of 0.25 m^2, 63 in 0.5 m^2, 71 in 1 m^2, 78 in 2 m^2 and 108 in 25 m^2. Only species rooted in the plots were recorded. Locality: Vernár, Hlaváčova dolina, 150 m E of the Javorinka saddle, above a fen, 20°16'35.3"E, 48°53'25.0"N (read from Google Earth), altitude 1050 m, aspect E, slope 10°, covers: herb layer 95%, moss layer 5%, litter 10%, plot sizes measured with a frame, 2 July 2000, V. Šefferová, T. Dražil, A. Leskovjanská & J. Šeffer. Cover in the 25-m^2 plot was recorded using the nine-degree Braun-Blanquet scale. × = presence; dot = absence. Two varieties of *Leontodon hispidus* were counted as a single species. Plot IDs 958001–958015.

		Cover	Occurrence							
No. of species in 0.25 m^2			47	49	47	52	52	51	48	47
No. of species in 0.5 m^2				62		60		63		59
No. of species in 1 m^2						71				71
No. of species in 2 m^2										78
No. of species in 25 m^2		108								
1	*Brachypodium pinnatum*	4	×	×	×	×	×	×	×	×
2	*Festuca ovina*	3	×	×	×	×	×	×	×	×
3	*Achillea millefolium* agg.	2b	×	×	×	×	×	×	×	×
4	*Arabidopsis halleri* subsp. *halleri*	2b	.	×	.	×	.	×	×	×
5	*Carum carvi*	2b	×	×	×	×	×	×	×	×
6	*Cruciata verna*	2b	×	×	×	×	.	×	×	×
7	*Phyteuma orbiculare*	2b	×	×	×	.	×	×	×	×
8	*Sanguisorba minor*	2b	×	×	×	×	×	.	×	×
9	*Vicia cracca*	2b	×	×	×	.	×	×	×	×
10	*Agrostis capillaris*	2a	×	×	×	×	×	×	×	×
11	*Alchemilla monticola*	2a	×	×	×	×	×	×	×	×
12	*Carex caryophyllea*	2a	×	×	×	×	×	×	×	×
13	*Plantago media*	2a	×	×	×	×	×	×	×	×
14	*Thymus pulegioides*	2a	×	×	×	×	×	×	×	×
15	*Trifolium repens*	2a	×	×	×	×	×	×	×	×
16	*Leontodon hispidus* var. *hispidus*	2a	×	×	×	×	×	×	.	×
	Leontodon hispidus var. *glabratus*	2m	.	×	.	.	×	×	.	×
17	*Pimpinella saxifraga*	2a	×	×	×	×	×	×	.	.
18	*Briza media*	2m	×	×	×	×	×	×	×	×
19	*Campanula persicifolia*	2m	×	×	×	×	×	×	×	×
20	*Carex panicea*	2m	×	×	×	×	×	×	×	×
21	*Lotus corniculatus*	2m	×	×	×	×	×	×	×	×
22	*Pilosella bauhini*	2m	×	×	×	×	×	×	×	×
23	*Prunella vulgaris*	2m	×	×	×	×	×	×	×	×
24	*Ranunculus polyanthemos*	2m	×	×	×	×	×	×	×	×
25	*Anthoxanthum odoratum*	2m	.	×	×	×	×	×	×	×
26	*Crepis mollis*	2m	×	×	×	×	×	×	×	.
27	*Festuca pratensis*	2m	×	×	.	×	×	×	×	×
28	*Festuca rubra*	2m	×	×	×	×	×	.	×	×
29	*Plantago lanceolata*	2m	×	×	×	×	×	×	×	.
30	*Taraxacum* sect. *Taraxacum*	2m	×	×	×	×	×	×	.	×
31	*Trifolium montanum*	2m	×	×	×	×	.	×	×	×
32	*Trifolium pratense*	2m	.	×	×	×	×	×	×	×
33	*Centaurea erdneri*	2m	.	×	.	×	×	×	×	×
34	*Lathyrus pratensis*	2m	.	×	×	×	×	.	×	×

		Cover	Occurrence							
No. of species in 0.25 m^2			47	49	47	52	52	51	48	47
No. of species in 0.5 m^2				62		60		63		59
No. of species in 1 m^2						71				71
No. of species in 2 m^2										78
No. of species in 25 m^2		108								
35	*Pilosella officinarum*	2m	.	.	×	×	×	×	×	×
36	*Pimpinella major*	2m	×	×	×	×	.	×	×	.
37	*Tanacetum corymbosum*	2m	.	×	.	×	×	×	×	×
38	*Veronica officinalis*	2m	.	.	×	×	×	×	×	×
39	*Carex alba*	2m	×	.	×	×	×	.	×	.
40	*Carex ornithopoda*	1	×	×	×	×	×	×	×	.
41	*Rumex acetosa*	1	.	×	.	×	×	×	×	×
42	*Euphrasia officinalis* subsp. *rostkoviana*	1	.	×	.	×	×	×	×	×
43	*Anthyllis vulneraria*	1	×	×	.	×	.	×	×	.
44	*Dianthus carthusianorum*	1	×	×	.	.	×	×	×	.
45	*Tragopogon orientalis*	1	×	.	.	×	.	×	×	×
46	*Veronica chamaedrys*	1	.	×	×	×	.	×	.	×
47	*Campanula glomerata*	1	×	.	×	.	.	×	.	×
48	*Leucanthemum vulgare*	1	×	.	×	×	.	.	.	×
49	*Luzula luzuloides*	1	.	×	.	.	×	.	×	×
50	*Ajuga reptans*	1	×	.	.	.	×	.	×	.
51	*Dactylis glomerata*	1	×	.	.	×	.	.	.	×
52	*Fragaria vesca*	1	.	×	.	.	.	×	.	×
53	*Potentilla aurea*	1	.	×	.	.	×	×	.	.
54	*Calamagrostis varia*	1	×	.	.	.	.	×	.	.
55	*Carex flacca*	1	.	×	.	.	.	.	.	×
56	*Carex tomentosa*	1	.	.	.	.	×	×	.	.
57	*Linum catharticum*	1	×	.	×	.	.	.	.	.
58	*Phleum pratense*	1	.	.	.	.	.	×	.	×
59	*Carlina acaulis*	1	.	.	.	.	.	.	.	.
60	*Scabiosa lucida*	1	.	.	.	.	.	.	.	.
61	*Viola rupestris*	+	×	×	×	×	×	.	.	.
62	*Phleum phleoides*	+	×	.	×	×	×	.	.	.
63	*Pilosella cymosa*	+	.	.	.	×	×	×	.	×
64	*Coeloglossum viride*	+	×	.	.	×	.	.	.	×
65	*Polygala amara*	+	×	.	.	.	×	×	.	.
66	*Colchicum autumnale*	+	.	.	×	.	.	.	×	.
67	*Centaurea scabiosa*	+	×	.	.	.	×	.	.	.
68	*Crocus heuffelianus*	+	.	.	×	.	×	.	.	.
69	*Galium album*	+	.	.	.	.	×	×	.	.
70	*Gymnadenia conopsea*	+	.	.	×	.	×	.	.	.
71	*Rhinanthus major*	+	.	.	×	×	.	.	.	.
72	*Stellaria graminea*	+	.	×	×	.	.	.	.	.
73	*Alchemilla crinita*	+	.	.	.	.	.	.	×	.
74	*Luzula campestris*	+	.	×	.	.	.	.	.	.
75	*Ophioglossum vulgatum*	+	.	.	.	.	.	.	×	.
76	*Thesium alpinum*	+	.	.	.	.	×	.	.	.
77	*Acinos alpinus*	+	.	.	.	.	.	.	.	.
78	*Aquilegia vulgaris*	+	.	.	.	.	.	.	.	.
79	*Arabidopsis arenosa*	+	.	.	.	.	.	.	.	.
80	*Arenaria serpyllifolia*	+	.	.	.	.	.	.	.	.
81	*Astrantia major*	+	.	.	.	.	.	.	.	.
82	*Carduus glaucinus*	+	.	.	.	.	.	.	.	.

		Cover	Occurrence							
No. of species in 0.25 m^2			47	49	47	52	52	51	48	47
No. of species in 0.5 m^2				62		60		63		59
No. of species in 1 m^2						71				71
No. of species in 2 m^2										78
No. of species in 25 m^2		108								
83	*Carex pallescens*	+	.	.	.	.	.	.	.	.
84	*Festuca pallens*	+	.	.	.	.	.	.	.	.
85	*Galium pumilum*	+	.	.	.	.	.	.	.	.
86	*Heracleum sphondylium*	+	.	.	.	.	.	.	.	.
87	*Hypericum maculatum*	+	.	.	.	.	.	.	.	.
88	*Knautia arvensis*	+	.	.	.	.	.	.	.	.
89	*Lilium bulbiferum*	+	.	.	.	.	.	.	.	.
90	*Medicago lupulina*	+	.	.	.	.	.	.	.	.
91	*Poa pratensis*	+	.	.	.	.	.	.	.	.
92	*Potentilla erecta*	+	.	.	.	.	.	.	.	.
93	*Primula elatior*	+	.	.	.	.	.	.	.	.
94	*Salvia verticillata*	+	.	.	.	.	.	.	.	.
95	*Silene nemoralis*	+	.	.	.	.	.	.	.	.
96	*Allium oleraceum*	r	×	.	.	.	.	.	.	.
97	*Carex digitata*	r	.	.	.	.	.	.	×	.
98	*Cerastium holosteoides*	r	.	.	.	×	.	.	.	.
99	*Sanguisorba officinalis*	r	.	.	.	×	.	.	.	.
100	*Antennaria dioica*	r	.	.	.	.	.	.	.	.
101	*Geum rivale*	r	.	.	.	.	.	.	.	.
102	*Hieracium murorum*	r	.	.	.	.	.	.	.	.
103	*Listera ovata*	r	.	.	.	.	.	.	.	.
104	*Polygonatum verticillatum*	r	.	.	.	.	.	.	.	.
105	*Ranunculus acris*	r	.	.	.	.	.	.	.	.
106	*Sorbus aria* juv.	r	.	.	.	.	.	.	.	.
107	*Trollius altissimus*	r	.	.	.	.	.	.	.	.
108	*Verbascum lychnitis*	r	.	.	.	.	.	.	.	.

Based on a palaeoecological analysis of a spring fen in the Kopanecké lúky meadows, Hájek et al. (2011) dated the deforestation of this site to the High Medieval (1268–1387 AD). This corresponds to the time of the Wallachian colonization when many open calcareous fens appeared in the Western Carpathians (Hájková et al. 2012). However, the site is located only 10 km from the southern Spiš region, an area with abundant prehistoric settlements founded since the Neolithic (Soják 2000). Long-term persistence of mesic and semi-dry grasslands over the entire Holocene was suggested for the adjacent Poprad basin, where pollen types of *Alchemilla*, *Filipendula*, *Pimpinella major*, *Potentilla* and *Rumex acetosa* were recorded even for pre-Neolithic times (see Figure S2D in Hájková et al. 2015). Open patches in the local *Picea* and *Corylus* forests may have been maintained by large herbivores, as suggested by the continuous presence of coprophilous fungi and ruderal plant species in the sedimentary sequence. The assembly of plant communities in the Kopanecké lúky meadows might have further been enriched by species from the herb layer of adjacent calcicolous beech forests, which also tend to be species-rich.

Up to 1969 the Kopanecké lúky meadows were cut for hay once a year by private farmers from the village of Vernár, with occasional aftermath grazing. Like other

extremely species-rich grasslands in the Carpathians (Hájková et al. 2011, Roleček et al. 2014) these grasslands are located far from the village, which is an obstacle to intensive management involving the application of fertilizer and frequent mowing. Babai & Molnár (2014) decribed an analogous system of fertilized, species-poor meadows near villages and unfertilized, species-rich meadows distant from villages in the Romanian Eastern Carpathians.

In 1970 the Kopanecké lúky meadows were taken over by a cooperative farm and converted into pastures where up to 400 sheep were grazed in the 1970s. In the 1980s the area was abandoned; a part of it was afforested while in other parts trees and shrubs encroached spontaneously. In the 1990s nature conservation management was introduced, including restoration of some abandoned areas (although 18 ha of the original area of 52 ha were left as woodland) and mowing with no grazing and no fertilizer application. The site sampled in 2000 was abandoned (with irregular cattle grazing) in the 1970s and mown once in 1999. Currently some parts of these meadows are cut once a year, others at intervals of approximately five years.

The species composition of the Kopanecké lúky meadows is similar to that recorded in the White Carpathian grasslands. Although about 60–70% of species growing there also commonly occur in the White Carpathian grasslands, there are some remarkable differences. Kopanecké lúky meadows do not harbour a group of *Molinion caeruleae* species including *Galium boreale*, *Molinia arundinacea* and *Serratula tinctoria*, which are typical of the *Brachypodio pinnati-Molinietum arundinaceae* grasslands in the White Carpathians. However, these species are also absent from some grasslands in the White Carpathians, for example from the species-rich *Anthoxantho odorati-Agrostietum capillaris* grasslands in the Hutě meadows near Žítková. Some dry-grassland species such as *Bromus erectus*, *Carex michelii*, *Festuca rupicola* and *Koeleria* spp. are also absent from the Kopanecké lúky meadows. On the other hand, the Kopanecké lúky meadows contain a group of montane species which are rare (e.g., *Carex ornithopoda*, *Crepis mollis* and *Phyteuma orbiculare*) or missing (e.g., *Calamagrostis varia*, *Potentilla aurea* and *Scabiosa lucida*) in the White Carpathians. In terms of the phytosociological classification, this vegetation is perhaps closest to the association *Anthoxantho odorati-Agrostietum tenuis*, but at the same time it is rich in species of the alliance *Bromion erecti* (Hegedüšová Vantarová & Škodová 2014). A comparison of the species composition in the Kopanecké lúky meadows at the end of the period of regular mowing (Smiešková 1970) and after the period of abandonment (Dražil 2004) indicates an expansion of competitive grasses such as *Brachypodium pinnatum* (in drier places), *Calamagrostis arundinacea* (in wetter places) and *C. varia*. Regular mowing tends to result in the spread of thermophilous species of the alliance *Bromion erecti* (Dražil, unpubl. observation).

Other species-rich non-forest vegetation types

Other species-rich grasslands in the Czech Republic (Appendix 1, Fig. 7), assessed in areas larger than 0.5 m^2, were considerably poorer than the richest meadows in the White Carpathians. They were concentrated in the Carpathian flysch zone, partly in a dry area in the Central Moravian Carpathians (Středomoravské Karpaty) in southern Moravia, at altitudes of 220–340 m and partly in the higher and precipitation-richer area north of the White Carpathians, namely in the Hostýnské vrchy Mts, Vsetínské vrchy Mts, and the area

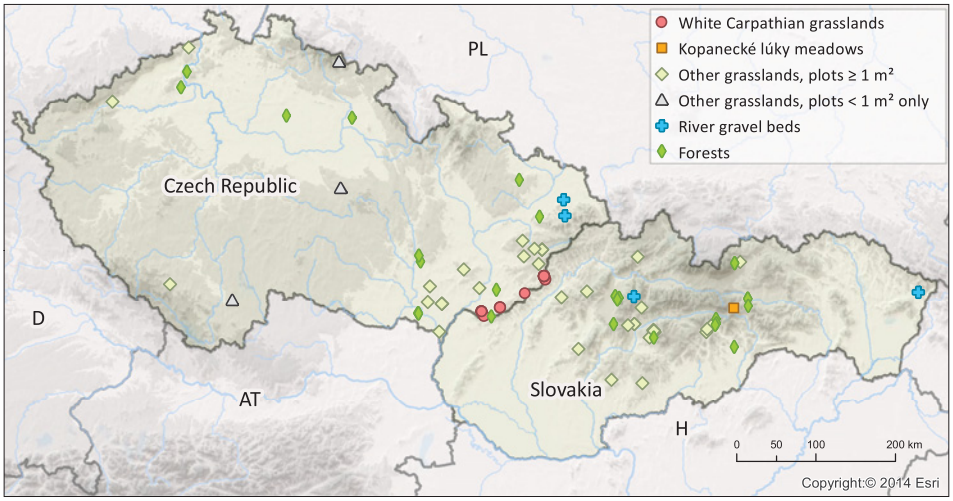

Fig. 7. – Distribution of the richest and next-to-richest vegetation plots in the Czech Republic and Slovakia (see Tables 1 and 3 and Appendix 1).

between these mountain ranges and the White Carpathians, at altitudes of 400–500 m. In the Central Moravian Carpathians, the species-rich vegetation is represented by semi-dry, occasionally mown continental grasslands of the *Cirsio-Brachypodion pinnati* alliance (especially the association *Polygalo majoris-Brachypodietum pinnati*), while in the area north of the White Carpathians, species-rich grasslands include a broader range of types, particularly semi-dry meadows of the association *Scabioso ochroleucae-Brachypodietum pinnati* (*Cirsio-Brachypodion pinnati*) and base-rich pastures of the association *Anthoxantho odorati-Agrostietum tenuis* (*Cynosurion cristati/Arrhenatherion elatioris*), but also some types of mesic meadows (*Arrhenatherion elatioris*) and wet meadows (*Calthion palustris*).

For areas of the Czech Republic outside the Carpathian flysch zone, some isolated records of species-rich mesic to intermittently wet grasslands exist from the 1950s to 1970s, namely for the Šumava Mts, Krušné hory Mts and their foothills, and the Morava river floodplain, but in contrast to the Carpathian grasslands, there are no recent records of comparably high species richness at these sites. Record or near-record species counts in grasslands for areas outside the Carpathians were only recorded in plots smaller than 0.5 m^2.

In Slovakia, the most species-rich non-forest vegetation types other than those in the White Carpathians and Kopanecké lúky meadows are semi-dry to mesic mown meadows and pastures on limestone or volcanic bedrock at altitudes of ca. 400–1100 m in central Slovakia, mainly in the Starohorské vrchy Mts, Poľana Mts, Štiavnické vrchy Mts and Muránska planina Mts (Appendix 1). Some of these grasslands are very similar in species composition to the White Carpathian grasslands and are classified in the same association, *Brachypodio pinnati-Molinietum arundinaceae* (*Bromion erecti*). Other grasslands belong to different types of semi-dry mown meadows of the alliance *Cirsio-Brachypodion pinnati*

(association *Carici albae-Brometum monocladi*), mesic *Arrhenatherion elatioris* meadows and oligotrophic short grasslands of *Violion caninae*.

Species-rich grasslands also occur in the (sub)alpine belt on limestone mountain groups such as the Belianske Tatry and Veľká Fatra Mts. These tall-herb grasslands, belonging to the alliances *Calamagrostion arundinaceae*, *Astero alpini-Seslerion calcariae* and *Seslerion tatrae*, tend to occur at sites protected from winter frosts by a thick cover of snow, which melts early in spring. At some sites they may also be periodically disturbed by avalanches. Vegetation at such sites often includes several thermophilous species nowadays more typical of lower altitudes, some of which may be of relict origin, either from the warmer periods of the Middle Holocene (Ložek 1972, Šibík et al. 2004) or the Late Glacial or Early Holocene forest-steppes.

In general, species-rich grasslands occur mainly on semi-dry to mesic soils, sometimes on intermittently wet soils (the alliances *Molinion caeruleae* and *Deschampsion cespitosae* or the association *Scirpo-Cirsietum cani* of the *Calthion palustris* alliance), but rarely on constantly wet soils. Nevertheless, high species richness is typical of successionally transitional communities between fens and wet grasslands of the alliance *Calthion palustris* (Hájková & Hájek 2003); for example, there are some fen species, such as *Carex flava*, *Epipactis palustris* and *Triglochin palustris*, co-existing with species of mesic grasslands, which otherwise avoid fens (e.g. *Carex pallescens*, *Glechoma hederacea* and *Phleum pratense*), in the species-rich wet meadow at the Dubcová site (Hostýnské vrchy Mts, Appendix 1, plot 13). The ongoing process of generalists spreading into fen grasslands due to eutrophication and hydrological deterioration was also described from the pre-Alps of Switzerland (Bergamini et al. 2009), where it resulted in a temporary increase in species richness, but the resulting communities were of lower conservation value than the previous successional stage.

In addition to grasslands, exceptionally species-rich plant communities were recorded on gravel accumulations along Carpathian streams, including the Ostravice and Čeladenka in the north-eastern Czech Republic, Ľubochnianka in central Slovakia and Ulička in north-eastern Slovakia (Appendix 1, plots 16, 18, 48 and 63). These communities are unstable early successional stages following habitat disturbance by flooding. Unlike species-rich grasslands, high species richness in this habitat is transitory, confined to the early successional stages and declines with habitat age. Occassional strong floods create new gravel accumulations in river channels, which are quickly colonized by plants established from propagules transported there mainly by water and wind. These plants include species of riparian zones, forest herbs, woody plants, grassland species and species of ruderal habitats, many of which are not native, which makes this vegetation difficult to assign to units of the phytosociological system. Studies of permanent plots on river gravel bars created by a strong flood in north-eastern Czech Republic revealed that one-year-old gravel bars are very rich in species, with a maximum of 67 species in 15 m^2, but in the next year their species richness declines. The richest 15-m^2 plot contained 33 species two months after the flood, 67 species after one year and only 14 species after two years (Kalníková 2012). However, in some places high species richness may also occur in mid-successional stages dominated by *Salix elaeagnos*, such as on a gravel accumulation in the Ľubochnianka river in the Veľká Fatra Mts, where 100 species were recorded in an area of 100 m^2 (Appendix 1, plot 63).

Patterns in species richness in small vs large grassland plots

Our data indicate that for very small plots (< 0.5 m^2) high species richness is not associated with specific areas (Fig. 1). In contrast, for larger plots (> 0.5 m^2) there is a striking difference between the extremely rich grasslands in the White Carpathians and Kopanecké lúky meadows on the one hand and the regionally richest grasslands in all the other areas on the other hand (Fig. 2).

A possible explanation is that in very small areas, species richness is controlled mainly by plant size, which imposes a limit on the number of plant individuals that can co-occur within a plot, and by local interspecific interactions. If there is a factor limiting plant size and preventing asymmetric competition, for example mowing, and at the same time the species pool of habitat-adapted species is not too small in the surrounding landscape, high species richness in very small plots can occur at various sites and in various types of grassland, even on acidic soils such as at the record-holding sites in the Krkonoše, Železné hory and Poľana Mts and in southern Bohemia (Appendix 1, plots 1–3, 5, 25 and 26). In contrast, in larger plots in which geometric constraints on plant size and hence on numbers of plant individuals are no longer significant drivers of local species richness, other factors may become more important. One such factor could be differences in species pools between regions, but no differences in the grassland species pool size were found between the White Carpathians and adjacent regions, where there are grasslands with lower local species richness (Michalcová et al. 2014). However, it is very difficult to use species pool size as an explanation of local species richness, because of the uncertainty and potential circularity of the assignment of species to the species-pool of particular plant communities. Probably more important regional factors could be historical and recent dispersal processes at the landscape scale, which can be efficient in some areas and less efficient in others. Several causes and mechanisms possibly responsible for the high species richness in the White Carpathian grasslands at the scales of 1–100 m^2 were proposed in recent comparative studies (Hájková et al. 2011, Merunková et al. 2012, Michalcová et al. 2014), however, more research is needed for a better understanding of the phenomena of regional patterns in species richness in plots of 1–100 m^2.

The most species-rich forests

The species-richest forest plots were poorer than the richest non-forest plots. There were 80, 82, 101 and 112 species in 100, 200, 400 and 625-m^2 plots, respectively, in the Czech Republic, whereas in the richest plots in Slovakia there were 100, 109 and 118 species in 100, 400 and 500 m^2 plots, respectively. These plots were sampled in various areas in the eastern Czech Republic and northern and central Slovakia (Fig. 7). A common feature of the richest and close-to-richest forest plots was their occurrence on limestone or other base-rich rocks, e.g. calcareous sandstone, marlstone, calcareous flysch, loess, basalt or serpentine. However, they included very different forest types such as floodplain forests (*Alnion incanae* and *Salicion elaeagno-daphnoidis*), mesic oak-hornbeam forests (*Carpinion betuli*), calcicolous beech forests (*Fagion sylvaticae* and *Sorbo torminalis-Fagion sylvaticae*), mixed deciduous scree-slope forests (*Tilio platyphylli-Acerion*), thermophilous oak forests (*Quercion pubescenti-petraeae* and *Quercion petraeae*), pine forests on limestone outcrops (*Pulsatillo slavicae-Pinion sylvestris*) and Carpathian high-mountain *Abies alba* forests. They also included some types of *Corylus avellana*

scrub in central Slovakia, which ranged in altitude from about 200 m to more than 1100 m. The richness of some *Pinus mugo* stands on limestone in the subalpine belt in the Western Carpathians was also close to that of the richest forests. Some of these forests and shrublands have an open canopy due to the effect of drought on canopy trees or due to rugged topography with rock outcrops and steep slopes. Such forests can contain both light-demanding and shade-tolerant species within single plots. However, this is not the case of all the species-rich forest and scrub types.

Environmental and biogeographical context of the Czech and Slovak species-rich vegetation

If we consider species-richness in areas larger than 0.5 m^2, several common features of the most species-rich grasslands and forests in the Czech Republic and Slovakia can be identified:

(i) They all occur on base-rich soils, typically over easily weathered calcareous sediments, limestone or base-rich volcanic rocks. Although we do not have measured pH values for all the species-rich sites, the available values are between 5.5 and 8. This is the range suitable for calcicolous species, which strongly predominate over calcifuge species in the central European flora, a phenomenon likely to be due to past evolutionary processes and extinction bottlenecks (Pärtel 2002, Chytrý et al. 2003, Ewald 2003). Sites with a soil pH > 5 thus have larger species pools and often also greater fine-scale species richness than more acidic sites. Species richness in temperate forests of eastern North America is also known to increase with soil cation content (Peet et al. 2014).

(ii) None of the species-rich plant communities occur where environmental conditions are extreme. They occur on semi-dry, mesic or intermittently wet soils, but not on soils that are very dry or constantly water-saturated. They do not develop on soils extremely poor in nutrients. In grasslands, they also do not occur where the nutrient status of the soils is high, which would favour strong competitors. They never occur on saline soils. In the high mountains, they are confined to relatively warm sites that in winter are protected by a covering of snow. This indicates that species-rich vegetation mainly occurs at sites with intermediate values of all the important environmental factors (Merunková et al. 2012, Reitalu et al. 2014). Many species have an optimum in such environments or can tolerate them, therefore species pools for such sites tend to be the largest. This observation accords with the concept of environmental favourableness (e.g. Peet et al. 2014).

(iii) Species-rich vegetation types are typically favoured by low-intensity management or natural disturbances. Grasslands are usually regularly mown for hay or moderately grazed, but receive a limited input of fertilizers. This regime of regular disturbance of intermediate intensity maintains high species richness by reducing asymmetric competition and preventing the decline of competitively poor species (Huston 1979). Klimeš et al. (2013) reported that already one year after the cessation of mowing of the White Carpathian meadows there is a decline in species richness due to the spread of competitively strong grasses, although this effect is less pronounced at low-productive sites. Riverine herbaceous and woody vegetation is regularly disturbed by floods, and species-rich stands develop especially as post-disturbance successional stages on river gravel beds. Species-rich vegetation in the alpine and subalpine belt can be disturbed by avalanches (Šibík et al. 2015). Species-rich forests usually have a natural or near-natural tree and shrub layer composition, with no signs of past plantations or other types of intensive

forestry management, but in recent history some of them may have been influenced by traditional management such as coppicing or livestock grazing.

(iv) Most of the species-rich sites occur in landscapes with prevailing semi-natural or natural vegetation and large areas occupied by the same vegetation type as the target species-rich vegetation. Large areas of semi-natural or natural grasslands or forests can act as reservoirs of rich species pools of these vegetation types, as predicted by the Theory of Island Biogeography (MacArthur & Wilson 1967). It was demonstrated that the proportion of natural or semi-natural habitats in the landscape positively influences the number of species in Slovak grasslands at the plot scale (Janišová et al. 2014), although the size of the grassland species pool in the landscape does not differ between the White Carpathians and adjacent regions that lack species-rich grasslands (Michalcová et al. 2014). An interaction of both these factors is probably important: for the development of a large regional species pool in a local community, crucial factors are those promoting dispersal, including species population size, landscape structure without distinct dispersal barriers and long-term persistence of habitats. Unless surrounded by similar (semi-)natural habitats, a local community may be poor, i.e. 'incomplete' (Pärtel et al. 2013), despite its large regional species pool. In this context, it is interesting to note that some of the richest forest plots occur very close to the richest grassland sites of Čertoryje and Kopanecké lúky (Fig. 7).

(v) Most of the species-rich sites and vegetation types tend to be relatively stable over centuries or even millennia. This is obviously true of subalpine and forest communities, but also of many types of semi-natural grasslands. For example, the region with species-rich grasslands in the south-eastern Czech Republic, including lower altitudes in the White Carpathians, has been settled by humans continuously since the Neolithic (Hájková et al. 2011) and grasslands have existed there throughout the Holocene (Kuneš et al. 2015). Prehistoric farmers probably used these grasslands for low-intensity livestock grazing, and since the Iron Age also for hay making (Hejcman et al. 2013), thus preserving this habitat, suppressing asymmetric competition and enabling the gradual accumulation of many plant species. At the mid-altitudes in the central Western Carpathians, however, most grasslands date back only to the High Medieval or early Modern Period. Their young age is probably responsible for a lower representation of ecological specialists in these grasslands than in those in the White Carpathians (Fajmonová et al. 2013). However, the species-richest site in the Kopanecké lúky meadows is exceptional in that it is located in a region with a long history of open habitats, which may have facilitated the assembly of a large regional pool of grassland species. In addition, both the White Carpathian grasslands and the Kopanecké lúky meadows were subjected to low-intensity management in the Medieval and modern times, including the period of agriculture intensification in the 1950s–1980s, during which many species-rich grasslands in eastern-central Europe were destroyed.

(vi) Most species-rich sites occur in the Carpathians, both in the flysch zone and the central mountain ranges, while only few of them occur in the Bohemian Massif (western and central part of the Czech Republic where acidic metamorphic and granitoid rocks prevail). This pattern probably results partly from a widespread occurrence of base-rich soils in the Carpathians, as opposed to the predominantly acidic Bohemian Massif, and partly from the longer persistence of low-intensity management practices in the Carpathians.

In spite of these similarities, the high species richness in the Czech and Slovak grasslands and forests occurs in different vegetation types. Many of the richest grasslands, including those in the White Carpathians, are semi-dry grasslands belonging to the alliances *Cirsio-Brachypodion pinnati* and *Bromion erecti*. Species-rich grasslands in Transylvania (Dengler et al. 2012, Turtureanu et al. 2014), in the Carpathian foothills in western Ukraine (Roleček et al. 2014) and poorer but still relatively rich eastern Austrian grasslands in the Vienna Woods (Willner et al. 2013) and Styria (Steinbuch 1995) belong to the same vegetation types. Nevertheless, very high values of fine-scale species richness were also recorded in more mesic types of grassland. The most species-rich forests and shrublands also include many different types that occur from lowlands to high mountains, from floodplains to dry rocky slopes and include both broad-leaved deciduous and coniferous forests. These data indicate that high species richness in forests is not specific to certain community types, which is in agreement with other records of high species richness in temperate forests in northern Eurasia and North America (Chytrý et al. 2012, Peet et al. 2014).

Czech and Slovak species-rich vegetation in a broader geographical context

Our data summary supports the assumption that global hot spots of fine-scale species richness occur in some types of temperate semi-natural grasslands in eastern-central and eastern Europe and in natural steppes in eastern Europe (Table 4). Occurrence of high species richness in the Central Chernozem steppes in the Kursk region of western Russia, namely the Kazatskaya steppe, has been known for several decades: Alekhin (Russian sources from the 1930s, cited in Vasilevich 2009) reported 77 vascular plant species in 1 m^2 and 110 species in 100 m^2 for this region, Lysenko (2007) 87 species in 1 m^2, Semeniuk & Gudina (Russian sources from the 1980s, cited in van der Maarel & Titlyanova 1989) 88 species in 1 m^2 and 130 species in 100 m^2. Zobel (1992) reported 88 and 143 species in 1 and 100 m^2, respectively, from dry steppes, without mentioning the region. All these records require critical evaluation, as they are poorly documented and most of them are based on old sources.

High-quality data are available for species-rich grasslands in Estonia and the Carpathian region. Sammul et al. (2003) reported 76 species in 1 m^2 in the Laelatu wooded meadows in Estonia, which are also extremely rich at scales below 1 m^2 (Kull & Zobel 1991). Further species-rich semi-dry grasslands were recently discovered in the peri-Carpathian region, namely the Fânaţele Clujului grassland near Cluj-Napoca in the Transylvanian Basin, Romania (Dengler et al. 2012, Turtureanu et al. 2014), and the Dzyurkach grassland near Chernivtsi in western Ukraine (Roleček et al. 2014). Grasslands at both these sites are very similar to the White Carpathian grasslands in their species composition and belong either to the same or a closely related phytosociological association (Roleček et al. 2014). At the Romanian site 79, 98 and 127 species were recorded in areas of 1, 10 and 100 m^2, respectively, and at the Ukrainian site up to 90 species in 9 m^2. The counts for 9 and 10 m^2 are the current world records for these plot sizes, however, we believe that at the Czech or Slovak sites higher counts for these plots could be recorded in the future, because plots of these sizes were rarely sampled and the lines connecting the highest counts from smaller and larger plots for the White Carpathian grasslands are greater than the world records (Fig. 2, Table 4).

Table 4. – Updated table of world records of species richness in plots smaller than 100 m^2. [1]A record of 13 species in 0.004 m^2 reported in Wilson et al. (2012), with reference to Klimeš et al. (2001) was removed, because Klimeš et al. (2001) actually reported 12 species. [2] New world record published here. [3] Equalled world record (and new world record for species rooted in the plot) published here. [4] New world record published after 2012. [5] Reported in Wilson et al. (2012) as Otýpková (unpubl.), full species list first published here.

Area (m^2)	Richness	Method	Habitat	Country	Reference
0.000001	3	Shoot	Dry, sandy grassland	Germany	Dengler in Wilson et al. (2012)
0.000009	3	Shoot	Dry, sandy grassland	Germany	Dengler in Wilson et al. (2012)
0.0001	5	Shoot	Dry, sandy grassland	Germany	Dengler in Wilson et al. (2012)
0.0009	8	Rooted	Mountain grassland	Argentina	Cantero in Wilson et al. (2012)
0.001	12	Shoot	Limestone grassland	Sweden	van der Maarel & Sykes (1993)[1]
0.0044	17	Rooted	Mountain grassland	Czech Rep.	Herben et al. (this paper)[2]
0.01	25	Rooted	Wooded meadow	Estonia	Kull & Zobel (1991)
0.04	42	Rooted	Wooded meadow	Estonia	Kull & Zobel (1991)
0.1	43	Shoot	Semi-dry basiphilous grassland	Romania	Dengler et al. (2012)
0.1	43	Rooted	Semi-dry basiphilous grassland	Czech Rep.	Chytrý et al. (this paper)[3]
0.25	52	Rooted	Mountain limestone grassland	Slovakia	Šefferová et al. (this paper)[2]
0.5	63	Rooted	Mountain limestone grassland	Slovakia	Šefferová et al. (this paper)[2]
1	89	Rooted	Mountain grassland	Argentina	Cantero et al. (1999)
9	90	Rooted	Semi-dry basiphilous grassland	Ukraine	Roleček et al. (2014)[4]
10	98	Shoot	Semi-dry basiphilous grassland	Romania	Dengler et al. (2012)
16	109	Rooted	Semi-dry basiphilous grassland	Czech Rep.	Hájek & Hájková (this paper)[2]
25	116	Rooted	Semi-dry basiphilous grassland	Czech Rep.	Preislerová (this paper)[5]
49	131	Rooted	Semi-dry basiphilous grassland	Czech Rep.	Preislerová (this paper)[5]

Unlike grasslands, the richest Czech and Slovak forest sites with maxima of 100–118 species in 100–500 m^2 significantly lag behind the global maxima of species richness, which are recorded in tropical rainforests (Wilson et al. 2012). For example, Whitmore et al. (1985) reported 233 species in 100 m^2 in a Costa Rican lowland rainforest. Some extra-European temperate forests and shrublands are also much richer than the richest Czech and Slovak forests. Peet et al. (2014) reported 129 species in 100 m^2 and 146 species in 400 m^2 in frequently disturbed riparian woodlands and scrub of *Alnus serrulata* in the Blue Ridge Mts (southern Appalachians), which they considered as probably the richest woody plant community in temperate North America; however, about one third of these species were aliens (Brown & Peet 2003). Chytrý et al. (2012) reported 114 (all native) species in 100 m^2 in a *Betula pendula-Pinus sylvestris* forest in the northern Altai Mts in southern Siberia and Palmer et al. (2003) found 109 species in a plot of the same size in an oak woodland in north-eastern Oklahoma.

Conclusions

This study is the first inventory of the most species-rich sites and vegetation types in the Czech Republic and Slovakia and provides a baseline for further studies of the phenomenon of very high fine-scale plant species richness in central Europe. It reveals that regional hot spots of fine-scale species richness are found in semi-dry, mesic or intermittently wet semi-natural grasslands subject to low-intensity management. World records for species richness for particular plot sizes were recorded for some of these grasslands,

especially those near Malá Úpa in the Krkonoše Mts, the Čertoryje and Porážky meadows in the White Carpathians and the Kopanecké lúky meadows in the Slovak Paradise. Our records of 17, 52, 63 and 109 species in 0.0044, 0.25, 0.5 and 16 m^2, respectively, exceed the global maxima cited by Wilson et al. (2012). Unlike grasslands, forests in the Czech Republic and Slovakia are much poorer than tropical rainforests and also significantly poorer than the richest temperate forests. For both grasslands and forests, the most species-rich sites tend to occur mainly on base-rich soils, in habitats with intermediate values of most of the relevant environmental factors and levels of disturbance, subject to low-intensity management and occurring in landscapes preserving large areas of natural or semi-natural vegetation with a long historical continuity. Such sites are mainly in the Carpathian Mts and their foothills and we believe that further research will discover more sites with very high fine-scale species richness in this region, not only in the Czech Republic and Slovakia, but also elsewhere. Future collections of such data and increasing knowledge of the geographical and ecological context of extremely species-rich plant communities is indispensable for deepening our still incomplete understanding of the species-richness phenomena.

See www.preslia.cz for Electronic Appendix 1

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Souhrn

Článek shrnuje současný stav znalostí a základní data o druhově nejbohatších rostlinných společenstvech České republiky a Slovenska, sestavený na základě údajů z vegetačních databází, rešerše literatury a vlastního terénního průzkumu. Druhové bohatství bylo posuzováno jako počet druhů cévnatých rostlin v plochách o velikosti do 100 m^2 u nelesní vegetace a 100–625 m^2 u lesní vegetace.

České a slovenské rekordy, zvlášť pro nelesní a lesní vegetaci, jsou uvedeny na obr. 1 a 2, v tab. 1 a 3 a appendixu 1. Na velmi malých plochách (< 0,5 m^2) byly největší počty druhů zaznamenány na vlhkých, mezických i suchých loukách a pastvinách v různých oblastech Česka a Slovenska. Pro tyto malé plochy je k dispozici omezené množství údajů, z nichž většina pochází z managementových pokusů nebo speciálního monitoringu na několika málo lokalitách. Zjištění maximálních hodnot zde do značné míry závisí na počtu opakování, jak ukazuje rekordní hodnota 17 druhů na ploše 0,0044 m^2 (6,7 × 6,7 cm) na louce u Malé Úpy v Krkonoších, která byla zaznamenána v jediném z 5439 pozorování získaných při monitoringu vegetace v jemné síti po dobu 28 let. Výskyt největších počtů druhů v několika různých oblastech i vegetačních typech však naznačuje, že na těchto malých plochách jsou pro koexistenci velkého počtu druhů důležité hlavně lokální faktory, které vylučují výskyt velkých rostlin a omezují asymetrickou konkurenci, zejména pravidelná seč.

Naproti tomu na plochách větších než 0,5 m^2 se výrazně oddělily extrémně druhově bohaté louky jihozápadní části Bílých Karpat a Kopanecké (= Vernárské) lúky u Vernáru ve Slovenském ráji od všech ostatních

regionálně nejbohatších luk, které byly vždy výrazně chudší. To naznačuje význam regionálních faktorů, snad částečně souvisejících s dobrým šířením lučních druhů v krajině, které přispívají k velkému lokálnímu druhovému bohatství ve dvou nejbohatších oblastech. Zatímco mimořádné druhové bohatství bělokarpatských luk je známé dlouhou dobu a bylo mu věnováno několik studií, velké druhové bohatství Kopaneckých lúk je poprvé popsáno v tomto článku. Louky Bílých Karpat a Kopanecké lúky jsou si podobné druhovou skladbou s výrazným zastoupením druhů suchých trávníků a mezofilních luk. Druhově bohaté bělokarpatské louky v nadmořských výškách 350–600 m však obsahují více druhů suchých trávníků a většina z nich patří do asociace *Brachypodio pinnati-Molinietum arundinaceae*, zatímco Kopanecké lúky ve výšce 1050 m mají více mezofilních a horských druhů a patří spíš do asociace *Anthoxantho odorati-Agrostietum tenuis*. Ostatní druhově bohaté trávníky mají také vesměs charakter širokolistých suchých trávníků svazů *Cirsio-Brachypodion pinnati* a *Bromion erecti*, bazifilních pastvin asociace *Anthoxantho odorati-Agrostietum tenuis*, smilkových trávníků svazů *Violion caninae* a *Nardo strictae-Agrostion tenuis* a mezofilních luk svazu *Arrhenatherion elatioris*. Vyskytují se hlavně v oblastech s bázemi bohatými horninami v Karpatech, zejména ve flyšové zóně na jihovýchodní Moravě a na vápencích a vulkanitech středního Slovenska. Na vlhkých loukách se velké počty druhů na malé ploše nacházejí vzácně, zejména na střídavě vlhkých půdách nebo ve společenstvech procházejících sukcesními změnami. Některé druhově bohaté trávníky se nacházejí i v subalpínském stupni Belianských Tater a Veľké Fatry.

Zvláštním typem druhově bohatých nelesních společenstev jsou štěrkové náplavy karpatských řek, kde může v raných sukcesních stadiích po narušení silnou povodní dojít k přirozenému nahromadění velkého množství druhů s různými ekologickými nároky. V další sukcesi někdy převládnou konkurenčně silné druhy, které způsobí ochuzení této vegetace, někdy se však velké druhové bohatství udržuje i ve středních sukcesních stadiích se *Salix elaeagnos*.

Druhově nejbohatší lesy Česka a Slovenska patří z fytocenologického hlediska k různým společenstvům od lužních lesů přes dubohabřiny, vápnomilné bučiny, suťové lesy, teplomilné doubravy a vápencové bory po karpatské vysokohorské jedliny. Druhově velmi bohaté jsou i některé lískové křoviny středního Slovenska. Společným znakem všech těchto společenstev je výskyt v oblastech s bazickými horninami, zejména na vápencích. Stejně jako v případě nelesní vegetace se nejbohatší lesy nacházejí spíš v Karpatech než v Českém masivu.

Obecně se česká a slovenská rostlinná společenstva, která jsou mimořádně druhově bohatá na plochách větších než 0.5 m^2, vyznačují těmito společnými rysy: (i) nevyskytují se na stanovištích s extrémními hodnotami faktorů prostředí, jako jsou velmi suché, zamokřené, kyselé nebo živinami chudé půdy, u travinné vegetace i půdy živinami velmi bohaté a u lesů husté porosty s omezeným přístupem světla do bylinného patra; (ii) jsou ovlivňovány pravidelnými přirozenými disturbancemi nebo extenzivně obhospodařovány, v případě trávníků nejčastěji sečeny jednou do roka bez hnojení nebo s omezeným hnojením, v případě lesů v minulosti využívány jako výmladkové nebo pastevní lesy bez zavádění stanovištně nepůvodních druhů dřevin; (iii) nacházejí se v krajinách s velkým podílem přirozené a polopřirozené vegetace, často jsou součástí rozsáhlých ploch se stejným typem vegetace (luk, lesů), což možná podporuje šíření mnoha druhů v krajinném měřítku; (iv) jde o společenstva, která se v dané krajině s velkou pravděpodobností vyskytují bez velkých změn po staletí až tisíciletí a jejichž dlouhá existence umožnila jak přežití světlomilných druhů z období starého holocénu, tak postupnou imigraci mnoha druhů adaptovaných na daná stanoviště.

Ve srovnání s nedávno publikovaným seznamem světových rekordů druhového bohatství rostlinných společenstev pro různě velké plochy (Wilson et al. 2012), který obsahoval pět rekordních hodnot z luk na lokalitě Čertoryje v Bílých Karpatech, jsme zjistili nové světové rekordy: 17 druhů na ploše 0,0044 m^2 na horské louce u Malé Úpy, 52 a 63 druhů na 0,25 a 0,5 m^2 na Kopaneckých lúkách a 109 druhů na 16 m^2 na loukách na lokalitě Porážky v Bílých Karpatech. Světový rekord 43 druhů na 0,1 m^2, dříve udávaný z Transylvánie, jsme vyrovnali na Čertoryjích, transylvánský údaj však zahrnoval i druhy do plochy přesahující svými stonky a listy, zatímco údaj z Čertoryjí se vztahuje pouze k druhům kořenícím v dané ploše. Současně jsme zjistili, že u dvou světových rekordů, které Wilson et al. (2012) uvádějí z Čertoryjí, tito autoři udělali chybu při přepisu počtu druhů a ve skutečnosti o světové rekordy nešlo. Nejbohatší lesní společenstva Česka a Slovenska jsou výrazně chudší než nejbohatší tropické a subtropické lesy a mají výrazně méně druhů i ve srovnání s druhově nejbohatšími temperátními a hemiboreálními lesy známými z jihovýchodu USA a jižní Sibiře. Aktualizovaná tabulka světových rekordů zahrnuje jeden údaj z Krkonoš, čtyři z české strany Bílých Karpat a dva z Kopaneckých lúk ve Slovenském ráji.

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Appendix 1. – Most species-rich vegetation plots from the Czech Republic and Slovakia except for the plots from the White Carpathian grasslands and Kopanecké lúky meadows, which are presented in Tables 1 and 3. Species composition is listed for record sites only; full data on all plots are available in Electronic Appendix 1. Plot data included in the national vegetation databases are referred with GIVD codes and database numbers. Unless indicated otherwise, species occurrences were recorded in the herb layer and species covers estimated using the Braun-Blanquet scale.

Non-forest vegetation, Czech Republic

(1) **11 species / 0.0011 m^2 (3.3 × 3.3 cm) (Czech record)** – Mountain meadow (*Sileno vulgaris-Nardetum strictae*, *Nardo strictae-Agrostion tenuis*), Krkonoše Mts, Malá Úpa, near Jana chalet, 15°47'41.6"E, 50°41'25.2"N (coordinates read from www.mapy.cz), altitude 880 m, aspect ESE, slope 10°, Upper Proterozoic mica-schist, plot size measured with a wooden recording grid with steel rods. This number of species was recorded in four plots at this site in different years; the species list shows only one of these record counts, 1993, T. Herben et al., plot ID 961001.

1. *Agrostis capillaris*
2. *Anemone nemorosa*
3. *Anthoxanthum odoratum*
4. *Arabidopsis halleri*
5. *Campanula rotundifolia*
6. *Festuca rubra*
7. *Geranium sylvaticum*
8. *Lathyrus pratensis*
9. *Ranunculus acris*
10. *Trifolium repens*
11. *Veronica chamaedrys*

(2) **17 species / 0.0044 m^2 (6.7 × 6.7 cm) (world record)** – Site identical to (1), sampled in 1987, T. Herben et al., plot ID 961013.

1. *Agrostis capillaris*
2. *Anemone nemorosa*
3. *Anthoxanthum odoratum*
4. *Avenella flexuosa*
5. *Bistorta officinalis*
6. *Campanula rotundifolia*
7. *Carex pilulifera*
8. *Festuca rubra*

9. *Holcus mollis*
10. *Hypericum maculatum*
11. *Luzula* sp.
12. *Nardus stricta*
13. *Poa pratensis*
14. *Ranunculus acris*
15. *Trifolium repens*
16. *Veronica chamaedrys*
17. *Veronica officinalis*

(3) **21 species / 0.01 m² (10 × 10 cm) (Czech record)** – Wet meadow (*Caricion canescenti-nigrae*), Železné hory Mts, Buchtovka Nature Monument near Trhová Kamenice, 15°48°47.1"E, 49°46'25.1"N (coordinates measured with Google Earth), altitude 544 m, slope 0°, Quaternary sediments, plot size measured with a wooden frame with a 10 × 10 cm metal grid, 2011, Š. Jirásková (data used in Janeček et al. 2013), plot ID 962001.

1. *Agrostis canina*
2. *Anemone nemorosa*
3. *Briza media*
4. *Cardamine pratensis*
5. *Carex nigra*
6. *Carex rostrata*
7. *Comarum palustre*
8. *Epilobium palustre*
9. *Eriophorum angustifolium*
10. *Festuca rubra*
11. *Filipendula ulmaria*
12. *Galium palustre*
13. *Galium uliginosum*
14. *Holcus lanatus*
15. *Lythrum salicaria*
16. *Poa trivialis*
17. *Ranunculus acris*
18. *Rumex acetosa*
19. *Scutellaria galericulata*
20. *Valeriana dioica*
21. *Viola palustris*

(4) **36 species / 0.1089 m² (33 × 33 cm) (Czech record outside the White Carpathians)** – Mesic to slightly dry grassland grazed by cattle for decades (*Anthoxantho odorati-Agrostietum tenuis*, *Cynosurion cristati/Arrhenatherion elatioris*), eastern Moravia, Vsetínské vrchy Mts, Huslenky, Losový Nature Reserve, 18°05'39.5"E, 49°19'03.9"N (coordinates read from Google Maps in which the larger (5 × 5 m) experimental plots are clearly visible on remote-sensing images), altitude 551 m, aspect SSE, slope 24°, calcareous flysch claystone, soil pH ($CaCl_2$) 5.0, plant-available (Mehlich 3) phosphorus 9.8 $mg \cdot kg^{-1}$, potassium 347 $mg \cdot kg^{-1}$, calcium 2045 $mg \cdot kg^{-1}$, magnesium 204 $mg \cdot kg^{-1}$, organic carbon 35.2 $g \cdot kg^{-1}$, total nitrogen 3.0 $g \cdot kg^{-1}$, herb layer cover 99%, species covers estimated in percentages, plot size measured with a tape measure and fixed for monitoring, 22 May 2009, J. Mládek, field no. Losovy 6/3D/2009, plot ID 957010.

1.	*Agrimonia eupatoria*	1	19.	*Leontodon hispidus*	1
2.	*Agrostis capillaris*	2	20.	*Leucanthemum vulgare*	1
3.	*Alchemilla monticola*	1	21.	*Linum catharticum*	1
4.	*Anthoxanthum odoratum*	1	22.	*Lotus corniculatus*	1
5.	*Brachypodium pinnatum*	1	23.	*Luzula campestris*	1
6.	*Briza media*	1	24.	*Orchis ustulata*	3
7.	*Campanula patula*	1	25.	*Pilosella bauhini*	3
8.	*Carex caryophyllea*	1	26.	*Pimpinella saxifraga*	1
9.	*Carex tomentosa*	1	27.	*Plantago lanceolata*	5
10.	*Centaurea jacea*	1	28.	*Plantago media*	7
11.	*Convolvulus arvensis*	1	29.	*Polygala comosa*	1
12.	*Cruciata verna*	1	30.	*Ranunculus polyanthemos*	5
13.	*Dactylis glomerata*	1	31.	*Rosa canina* agg. juv.	7
14.	*Festuca pratensis*	1	32.	*Thymus pulegioides*	1
15.	*Festuca rubra*	1	33.	*Trifolium medium*	2
16.	*Fragaria viridis*	2	34.	*Trifolium repens*	2
17.	*Galium verum*	2	35.	*Veronica chamaedrys*	1
18.	*Hypochaeris radicata*	3	36.	*Viola hirta*	1

(5) **43 species / 0.25 m² (Czech record outside the White Carpathians)** – Intermittently wet meadow (*Molinion caeruleae*), southern Bohemia, Ohrazení, meadow surrounded by forest ca. 1.2 km NE of the village, 14°35'33.9"E, 48°57'11.3"N (coordinates read from www.mapy.cz), altitude 515 m, slope 0°, paragneiss, soil pH (KCl) 4.0, herb layer cover 96%, plot size measured with a wooden frame with a grid, June 2001, J. Lepš et al., plot ID 962002.

1. *Achillea ptarmica*
2. *Angelica sylvestris*
3. *Anthoxanthum odoratum*
4. *Briza media*
5. *Cardamine pratensis*
6. *Carex hartmanii*
7. *Carex nigra*
8. *Carex pallescens*
9. *Carex panicea*
10. *Carex pilulifera*
11. *Carex pulicaris*
12. *Carex umbrosa*
13. *Centaurea jacea*
14. *Cerastium holosteoides*
15. *Cirsium palustre*
16. *Cynosurus cristatus*
17. *Danthonia decumbens*
18. *Festuca ovina*
19. *Festuca pratensis*
20. *Festuca rubra*
21. *Galium boreale*
22. *Galium uliginosum*
23. *Holcus lanatus*
24. *Juncus effusus*
25. *Lathyrus pratensis*
26. *Luzula multiflora*
27. *Lysimachia vulgaris*
28. *Molinia caerulea*
29. *Myosotis nemorosa*
30. *Nardus stricta*
31. *Plantago lanceolata*
32. *Potentilla erecta*
33. *Prunella vulgaris*
34. *Ranunculus acris*
35. *Ranunculus auricomus* agg.
36. *Ranunculus nemorosus*
37. *Rumex acetosa*
38. *Sanguisorba officinalis*
39. *Scirpus sylvaticus*
40. *Scorzonera humilis*
41. *Selinum carvifolia*
42. *Tephroseris crispa*
43. *Valeriana dioica*

(6) **57 species / 1 m^2 (Czech record outside the White Carpathians)** – Site and methods identical to (4), 18 June 2006, M. Dančák, field no. Losovy 3D/2006, plot ID 957011.

1.	*Acer pseudoplatanus* juv.	1
2.	*Achillea millefolium*	2
3.	*Agrimonia eupatoria*	2
4.	*Agrostis capillaris*	15
5.	*Alchemilla monticola*	1
6.	*Anthoxanthum odoratum*	6
7.	*Betula pendula* juv.	4
8.	*Brachypodium pinnatum*	14
9.	*Briza media*	1
10.	*Campanula patula*	1
11.	*Carex caryophyllea*	1
12.	*Carex flacca*	1
13.	*Carex pallescens*	3
14.	*Carex tomentosa*	7
15.	*Carum carvi*	1
16.	*Centaurea jacea*	4
17.	*Cruciata verna*	2
18.	*Cuscuta epithymum*	1
19.	*Dactylis glomerata*	1
20.	*Danthonia decumbens*	1
21.	*Euphorbia cyparissias*	1
22.	*Euphrasia officinalis* subsp. *rostkoviana*	1
23.	*Festuca pratensis*	1
24.	*Festuca rubra*	1
25.	*Fragaria viridis*	5
26.	*Galium verum*	4
27.	*Leontodon hispidus*	8
28.	*Leucanthemum vulgare*	1
29.	*Linum catharticum*	1
30.	*Lotus corniculatus*	1
31.	*Luzula campestris*	1
32.	*Ononis spinosa*	1
33.	*Orchis ustulata*	1
34.	*Pilosella bauhini*	1
35.	*Pimpinella saxifraga*	1
36.	*Plantago lanceolata*	5
37.	*Plantago media*	5
38.	*Platanthera bifolia*	1
39.	*Poa pratensis*	7
40.	*Polygala comosa*	1
41.	*Populus tremula* juv.	1
42.	*Potentilla erecta*	3
43.	*Potentilla reptans*	1
44.	*Ranunculus polyanthemos*	1
45.	*Rosa canina* agg. juv.	1
46.	*Rumex acetosa*	1
47.	*Sanguisorba minor*	1
48.	*Securigera varia*	1
49.	*Taraxacum* sect. *Taraxacum*	1
50.	*Thymus pulegioides*	1
51.	*Trifolium dubium*	1
52.	*Trifolium medium*	14
53.	*Trifolium pratense*	1
54.	*Trisetum flavescens*	11
55.	*Veronica chamaedrys*	1
56.	*Viola canina*	1
57.	*Viola hirta*	1

(7) **57 species / 1 m² (Czech record outside the White Carpathians)** – Near (4), 18°05'38.7"E, 49°19'03.7"N (read from Google Maps), experimental plot managed by sheep grazing and spring burning of litter since 2006 in a traditional cattle pasture, pH ($CaCl_2$) 5.8, plant-available (Mehlich 3) phosphorus 10.1 mg·kg^{-1}, potassium 229 mg·kg^{-1}, calcium 3339 mg·kg^{-1}, magnesium 219 mg·kg^{-1}, organic carbon 34.1 g·kg^{-1} and total nitrogen 3.4 g·kg^{-1}, plot size measured with a tape measure and fixed for monitoring, 26 May 2008, J. Mládek, database number 443, field no. Losovy 3A/2008, plot ID 957012. The species composition is very similar to (6), which is from the same site, therefore species list for this site is only included in Electronic Appendix 1.

(8) **50 species / 1 m²** – Semi-dry grassland (*Scabioso ochroleucae-Brachypodietum pinnati*, *Cirsio-Brachypodion pinnati*), southern Moravia, Lísky, Oulehla Nature Reserve, 17°12'37.3"E, 49°10'15.5"N (measured by GPS, accuracy 3 m), altitude 311 m, aspect S, slope 11°, calcareous flysch sediments, pH (H_2O) 7.7, covers: herb layer 85%, moss layer 90%, plot size measured with a cord, 27 May 2008, K. Merunková & Z. Preislerová, field no. 6/Da, plot ID 457717.

(9) **47 species / 1 m²** – Semi-dry grassland (*Polygalo majoris-Brachypodietum pinnati*, *Cirsio-Brachypodion pinnati*), southern Moravia, Čejkovice, Špidláky Nature Reserve, 16°57'27.5"E, 48°55'01.4"N (measured by GPS, accuracy 5 m), altitude 224 m, aspect N, slope 29°, calcareous Tertiary sediments, pH (H_2O) 7.1, plot size measured with a cord, covers: herb layer 95%, moss layer 15%, 23 May 2008, K. Merunková, Z. Preislerová, M. Chytrý & J. Dvořáková, field no. 2/Da, plot ID 457715.

(10) **58 species / 4 m² (Czech record outside the White Carpathians)** – Semi-dry grassland (*Polygalo majoris-Brachypodietum pinnati*, *Cirsio-Brachypodion pinnati*), southern Moravia, Čejč, Čejčský Špidlák site, 16°57'44"E, 48°54'55"N (read a posteriori from a digital map), altitude 225 m, aspect N, slope 8°, calcareous Tertiary sediments, cover herb layer 95%, plot size measured with a cord, 1 July 2000, Z. Preislerová, field no. 20/2m, plot ID 956012.

(11) **51 species / 4 m²** – Flooded alluvial meadow (*Lathyro palustris-Gratioletum officinalis*, *Deschampsion cespitosae*), southern Moravia, Morava river floodplain, preciser location not indicated, flat terrain, covers not reported, 1961, Balátová-Tuláčková (1969, Table 2, relevé 2), plot ID EU-CZ-001-438331.

(12) **56 species / 9 m²** – Mesic to slightly dry meadow (*Pastinaco sativae-Arrhenatheretum elatioris*, *Arrhenatherion elatioris*), irregularly mown, eastern Moravia, Lidečko, near a stream 0.4 km NE of Lidečko-Ves railway station, 18°03'28"E, 49°12'40"N (read a posteriori from a digital map by the author), altitude 460 m, aspect WSW, slope 10°, Tertiary clay sediments, covers: herb layer 90%, moss layer 20%, plot size measured by pace counting, 28 July 2003, Z. Preislerová, plot ID EU-CZ-001-440143.

(13) **56 species / 9 m²** – Wet meadow (*Cirsietum rivularis*, *Calthion palustris*), Hostýnské vrchy Mts, Kateřinice, Dubcová Nature Reserve, 17°52'33"E, 49°22'59"N (measured by GPS), altitude 490 m, aspect E, slope 1°, flysch claystone and sandstone, covers: herb layer 90%, moss layer 80%, plot size measured with a tape measure, 4 June 2002, Z. Fajmonová, M. Hájek & P. Hájková, plot ID EU-CZ-001-478764.

(14) **57 species / 10 m²** – Wet meadow (*Angelico sylvestris-Cirsietum palustris*, *Calthion palustris*), Děčínské stěny Hills, meadows in the village of Sněžník, 14°05'17"E, 50°47'25"N (estimated a posteriori from description of the locality), altitude 595 m, flat terrain, crystalline slate, covers: herb layer 98%, moss layer 5%, 14 March 1975 (the March date is probably an error in the original publication), Balátová-Tuláčková (1997, Table 6, relevé 16), plot ID EU-CZ-001-407423.

(15) **57 species / 12 m²** – Intermittently wet meadow (*Scirpo sylvatici-Cirsietum cani*, *Calthion palustris*), NW Bohemia, Vernéřov, meadow near small stream at Vernéřov–Kadaň crossroads, 13°13'40"E, 50°24'00"N (estimated a posteriori from description of the locality), altitude 335 m, flat terrain, Quaternary sediments, covers: herb layer 95%, moss layer 1%, 18 July 1975, Balátová-Tuláčková (1981, Table 18, relevé 3), plot ID EU-CZ-001-406857.

(16) **67 species / 15 m² (Czech record outside the White Carpathians)** – One-year old accumulation of acidic flysch sandstone gravel in a river channel, NW Moravia, Nová Dědina, Čeladenka river, 18°21'29.0"E, 49°34'02.4"N (measured by GPS, accuracy 2 m), altitude 375 m, flat terrain, covers: herb layer 30%, moss layer 2%, plot size measured with a cord, 11 August 2011, Kalníková (2012, Table 26, relevé 518703), plot ID EU-CZ-001-518703.

1.	*Agrostis stolonifera*	+	35.	*Lycopus europaeus*	r
2.	*Alchemilla* sp.	r	36.	*Lysimachia nummularia*	r
3.	*Alliaria petiolata*	r	37.	*Mentha longifolia*	+
4.	*Alnus glutinosa* juv.	r	38.	*Moehringia trinervia*	r
5.	*Alnus incana* juv.	+	39.	*Myosotis palustris* agg.	+
6.	*Anthriscus sylvestris*	r	40.	*Persicaria mitis*	2a
7.	*Betula pendula* juv.	1	41.	*Persicaria hydropiper*	+
8.	*Brachypodium sylvaticum*	r	42.	*Plantago major*	r
9.	*Cardamine flexuosa*	+	43.	*Poa annua*	+
10.	*Carex* sp.	+	44.	*Poa compressa*	r
11.	*Centaurea jacea*	r	45.	*Poa nemoralis*	r
12.	*Chaerophyllum aromaticum*	r	46.	*Populus* sp. juv.	+
13.	*Dactylis glomerata*	r	47.	*Rubus* sp. juv.	r
14.	*Daucus carota*	r	48.	*Rumex obtusifolius*	r
15.	*Deschampsia cespitosa*	r	49.	*Sagina procumbens*	r
16.	*Epilobium adenocaulon*	+	50.	*Salix euxina* juv.	+
17.	*Epilobium montanum*	+	51.	*Scrophularia nodosa*	r
18.	*Equisetum arvense*	r	52.	*Solanum lycopersicum*	+
19.	*Erigeron annuus*	+	53.	*Solidago canadensis*	1
20.	*Eupatorium cannabinum*	r	54.	*Stachys sylvatica*	+
21.	*Euphorbia cyparissias*	r	55.	*Stellaria alsine*	+
22.	*Festuca gigantea*	+	56.	*Stellaria media*	2m
23.	*Fragaria vesca*	r	57.	*Tanacetum vulgare*	r
24.	*Galeopsis tetrahit*	r	58.	*Taraxacum* sect. *Taraxacum*	r
25.	*Galium odoratum*	r	59.	*Trifolium repens*	r
26.	*Galium* sp.	r	60.	*Tussilago farfara*	r
27.	*Geranium robertianum*	r	61.	*Ulmus* sp. juv.	r
28.	*Geum rivale*	r	62.	*Urtica dioica*	1
29.	*Glechoma hederacea*	+	63.	*Veronica arvensis*	+
30.	*Holcus lanatus*	r	64.	*Veronica beccabunga*	r
31.	*Hypericum maculatum*	+	65.	*Veronica chamaedrys*	r
32.	*Impatiens glandulifera*	r	66.	*Veronica serpyllifolia*	r
33.	*Impatiens noli-tangere*	r	67.	*Vicia cracca*	r
34.	*Impatiens parviflora*	1			

Moss layer: *Bryum argenteum* +, *Bryum klinggraeffii* 1, *Bryum* sp. +, *Ceratodon purpureus* 1, *Funaria hygrometrica* 1

(17) **81 species / 16 m² (Czech record outside the White Carpathians)** – Semi-dry grassland (*Anthoxantho odorati-Agrostietum tenuis*, *Cynosurion cristati/Arrhenatherion elatioris*), Vsetínské vrchy Mts, Vsetín, Nepřejov, W slope of Lysá hill above the village, 18°00'30"E, 49°19'25"N (estimated a posteriori from description of the locality), altitude 400 m, aspect S, slope 10°, layer covers not indicated, 3 July 1949, Pospíšil (1957, p. 130, relevé 3), plot ID EU-CZ-001-423123.

1.	*Achillea millefolium*	+	16.	*Carex montana*	2
2.	*Agrostis capillaris*	+	17.	*Carlina acaulis*	r
3.	*Ajuga reptans*	+	18.	*Carum carvi*	+
4.	*Alchemilla xanthochlora*	+	19.	*Centaurea jacea*	1
5.	*Antennaria dioica*	+	20.	*Centaurea scabiosa*	2
6.	*Anthoxanthum odoratum*	1	21.	*Cerastium holosteoides*	+
7.	*Anthyllis vulneraria*	+	22.	*Cirsium pannonicum*	+
8.	*Aquilegia vulgaris*	+	23.	*Cruciata verna*	+
9.	*Arrhenatherum elatius*	1	24.	*Dactylis glomerata*	1
10.	*Betonica officinalis*	2	25.	*Dactylorhiza sambucina*	+
11.	*Brachypodium pinnatum*	1	26.	*Deschampsia cespitosa*	1
12.	*Briza media*	+	27.	*Dianthus deltoides*	+
13.	*Campanula glomerata*	2	28.	*Festuca rubra*	1
14.	*Campanula persicifolia*	+	29.	*Filipendula vulgaris*	2
15.	*Carex caryophyllea*	+	30.	*Galium pumilum*	+

31.	*Galium verum*	1	56.	*Polygala vulgaris*	+
32.	*Genista tinctoria*	+	57.	*Potentilla erecta*	+
33.	*Geranium sanguineum*	1	58.	*Potentilla heptaphylla*	+
34.	*Gymnadenia conopsea*	+	59.	*Potentilla recta*	r
35.	*Helianthemum grandiflorum* subsp. *obscurum*	+	60.	*Primula elatior*	+
			61.	*Prunella laciniata*	+
36.	*Hypericum maculatum*	+	62.	*Prunella vulgaris*	+
37.	*Hypochaeris maculata*	2	63.	*Ranunculus acris*	+
38.	*Inula salicina*	+	64.	*Rhinanthus minor*	+
39.	*Knautia arvensis*	+	65.	*Salvia verticillata*	+
40.	*Koeleria pyramidata*	+	66.	*Sanguisorba minor*	1
41.	*Leontodon hispidus*	+	67.	*Sedum sexangulare*	+
42.	*Leucanthemum vulgare*	1	68.	*Senecio jacobaea*	+
43.	*Linum catharticum*	+	69.	*Stellaria graminea*	+
44.	*Lotus corniculatus*	+	70.	*Thymus pulegioides*	3
45.	*Luzula campestris*	r	71.	*Tragopogon orientalis*	+
46.	*Medicago lupulina*	1	72.	*Trifolium alpestre*	+
47.	*Melampyrum nemorosum*	+	73.	*Trifolium medium*	2
48.	*Nardus stricta*	2	74.	*Trifolium montanum*	1
49.	*Ononis spinosa*	+	75.	*Trifolium ochroleucon*	+
50.	*Orchis morio*	+	76.	*Trifolium pratense*	+
51.	*Pilosella bauhini*	+	77.	*Trifolium repens*	+
52.	*Pilosella officinarum*	r	78.	*Trisetum flavescens*	1
53.	*Plantago lanceolata*	+	79.	*Veronica officinalis*	+
54.	*Plantago media*	+	80.	*Veronica teucrium*	+
55.	*Platanthera bifolia*	+	81.	*Viola canina*	+

Moss layer: *Abietinella abietina* 1, *Campyliadelphus chrysophyllus* 1, *Entodon concinnus* +, *Fissidens dubius* +, *Homalothecium lutescens* 1, *Hylocomium splendens* +, *Pseudoscleropodium purum* 1, *Rhytidiadelphus triquetrus* +, *Thuidium assimile* +, *Weissia controversa* +

(18) **78 species / 16 m²** – One-year old accumulation of acidic sandstone gravel in a river channel, NW Moravia, Frýdek-Místek, left bank of the Ostravice river 1 km NW from the railway station, 18°20'35.7"E, 49°41'05.9"N (measured by GPS), altitude 281 m, aspect SW, slope 1°, covers: herb layer 25%, moss layer not sampled, plot size measured with a cord, 25 June 2011, Kalníková in Eremiášová & Kalníková (2011), plot ID EU-CZ-001-120492.

(19) **76 species / 16 m²** – Semi-dry grassland (*Polygalo majoris-Brachypodietum pinnati*, *Cirsio-Brachypodion pinnati*), southern Moravia, Horní Bojanovice, Tabulka hill 2 km SW of the village, 16°48'00"E, 48°55'40"N (estimated a posteriori from description of the locality), altitude 275 m, aspect W, slope 30°, calcareous sandstone covered by loess, covers: herb layer 100%, moss layer 5%, date not indicated, Vicherek in Vicherek & Unar (1971, Table 54, relevé 8), plot ID EU-CZ-001-403344.

(20) **67 species / 20 m²** – *Nardus stricta* grassland (*Violion caninae*), Šumava Mts, meadows S of Lštění, 13°52'38"E, 49°03'47"N (estimated a posteriori from description of the locality), altitude 840 m, aspect S, slope 2°, gneiss, soil pH 4.8, covers: herb layer 75%, moss layer 80%, 9 July 1956, Moravec (1965, Table 43, relevé 46), plot ID EU-CZ-001-403814.

(21) **70 species / 25 m²** – Intermittently wet floodplain meadow (*Molinietum caeruleae*, *Molinion caeruleae*), southern Moravia, Břeclav, Dyje river floodplain SSE of Lány chateau, 6.3 km SSE of Břeclav square, 16°55'43"E, 48°42'31"N (estimated a posteriori from description of the locality), altitude 154 m, flat terrain, lower part of a small elevation of acidic sand, covers: herb layer 95%, moss layer 10%, plot size measured by pace counting, 2 June 1995, Šumberová in Vicherek et al. (2000, Table 10, relevé 8), plot ID EU-CZ-001-445235.

(22) **71 species / 50 m²** – Semi-dry meadow with *Arrhenatherum elatius* and *Brachypodium pinnatum* (*Scabioso ochroleucae-Brachypodietum pinnati*, *Cirsio-Brachypodion pinnati*), Jasenná, by dirt road NNW of the village, 17°53'24"E, 49°16'03"N (estimated a posteriori from description of the locality), altitude 465 m, aspect SW, slope 20°, flysch claystone, pH (H_2O) 7.1, covers: herb layer 100%, moss layer 5%, date not indicated, Dubová in Dubová & Unar (1986, Table 1, relevé 6), plot ID EU-CZ-001-407936.

(23) **107 species / 100 m² (Czech record outside the White Carpathians)** – Semi-dry grassland (*Polygalo majoris-Brachypodietum pinnati*, *Cirsio-Brachypodion pinnati*), formerly mown, now abandoned meadow, southern Moravia, Bošovice, Visengrunty Nature Reserve, 16°49'39.9"E, 49°02'42.3"N (measured by GPS, accuracy 3 m), altitude 332 m, aspect N, slope 18°, Tertiary calcareous flysch sediments covered with loess, covers: shrub layer 4%, herb layer 75%, moss layer 85%, pH (H_2O) 7.6, plot size measured with a cord, 2 June 2008, K. Merunková, Z. Preislerová & J. Dvořáková, field no. 18/Db, plot ID EU-CZ-001-457718.

1.	*Achillea millefolium* agg.	+	54.	*Knautia* × *posoniensis*	+
2.	*Agrimonia eupatoria*	r	55.	*Koeleria macrantha*	+
3.	*Anemone sylvestris*	1	56.	*Koeleria pyramidata*	1
4.	*Anthoxanthum odoratum*	+	57.	*Lathyrus latifolius*	+
5.	*Arrhenatherum elatius*	1	58.	*Lathyrus tuberosus*	+
6.	*Asperula tinctoria*	+	59.	*Leontodon hispidus*	+
7.	*Aster amellus*	+	60.	*Leucanthemum vulgare*	+
8.	*Avenula pubescens*	+	61.	*Ligustrum vulgare* juv.	+
9.	*Betonica officinalis*	+	62.	*Linum catharticum*	+
10.	*Brachypodium pinnatum*	2b	63.	*Lotus borbasii*	1
11.	*Briza media*	+	64.	*Lotus corniculatus*	+
12.	*Bromus inermis*	+	65.	*Medicago lupulina*	+
13.	*Bupleurum falcatum*	+	66.	*Melampyrum arvense*	+
14.	*Calamagrostis epigejos*	+	67.	*Onobrychis arenaria*	+
15.	*Campanula glomerata*	+	68.	*Picris hieracioides*	+
16.	*Campanula rapunculoides*	+	69.	*Pilosella densiflora*	+
17.	*Campanula rotundifolia*	+	70.	*Pilosella officinarum*	+
18.	*Carex caryophyllea*	+	71.	*Pimpinella saxifraga*	+
19.	*Carex humilis*	+	72.	*Plantago lanceolata*	+
20.	*Carex montana*	1	73.	*Plantago media*	+
21.	*Carlina acaulis*	+	74.	*Poa pratensis*	+
22.	*Carlina biebersteinii*	+	75.	*Polygala major*	+
23.	*Centaurea jacea*	+	76.	*Potentilla alba*	+
24.	*Centaurea scabiosa*	+	77.	*Potentilla heptaphylla*	+
25.	*Cerastium arvense*	r	78.	*Primula veris*	r
26.	*Chamaecytisus ratisbonensis*	2a	79.	*Prunella grandiflora*	+
27.	*Cirsium pannonicum*	+	80.	*Prunus avium* juv.	+
28.	*Cornus sanguinea* juv.	+	81.	*Prunus spinosa* juv.	+
29.	*Crataegus monogyna* juv.	+	82.	*Pyrus* sp. juv.	+
30.	*Crepis biennis*	+	83.	*Ranunculus polyanthemos*	+
31.	*Crepis praemorsa*	+	84.	*Rhamnus cathartica* juv.	+
32.	*Dactylis glomerata*	+	85.	*Robinia pseudoacacia* juv.	+
33.	*Daucus carota*	+	86.	*Rosa gallica* juv.	+
34.	*Elymus hispidus*	+	87.	*Rosa* sp. juv.	+
35.	*Euphorbia cyparissias*	+	88.	*Salvia pratensis*	+
36.	*Euphorbia epithymoides*	r	89.	*Sanguisorba minor*	+
37.	*Euphorbia virgata*	+	90.	*Scabiosa canescens*	+
38.	*Falcaria vulgaris*	+	91.	*Scabiosa ochroleuca*	+
39.	*Festuca pratensis*	+	92.	*Securigera varia*	r
40.	*Festuca rubra*	+	93.	*Serratula tinctoria*	+
41.	*Festuca rupicola*	1	94.	*Silene nutans*	+
42.	*Filipendula vulgaris*	+	95.	*Stachys recta*	+
43.	*Fragaria vesca*	+	96.	*Stipa pennata*	+
44.	*Fragaria viridis*	+	97.	*Tanacetum corymbosum*	+
45.	*Fraxinus excelsior* juv.	+	98.	*Tephroseris integrifolia*	+
46.	*Galium album*	+	99.	*Thesium linophyllon*	+
47.	*Galium glaucum*	+	100.	*Thymus glabrescens*	1
48.	*Galium verum*	+	101.	*Trifolium alpestre*	+
49.	*Geum urbanum*	+	102.	*Trifolium montanum*	+
50.	*Glechoma hederacea*	r	103.	*Tussilago farfara*	+
51.	*Inula ensifolia*	+	104.	*Veronica chamaedrys*	+
52.	*Juglans regia* (shrub layer)	+	105.	*Vincetoxicum hirundinaria*	r
	Juglans regia juv.	1	106.	*Viola ambigua*	+
53.	*Knautia kitaibelii*	1	107.	*Viola hirta*	+

(24) **90 species / 100 m²** – Semi-dry mown meadow (*Polygalo majoris-Brachypodietum pinnati*, *Cirsio-Brachypodion pinnati*), southern Moravia, Čejkovice, Špidláky Nature Reserve, 16°57'27.5"E, 48°55'01.4"N (measured by GPS, accuracy 6 m), altitude 224 m, aspect N, slope 29°, calcareous Tertiary sediments, pH (H_2O) 7.1, covers: herb layer 90%, moss layer 10%, plot size measured with a cord, 23 May 2008, K. Merunková, Z. Preislerová, M. Chytrý & J. Dvořáková, field no. 2/Db, plot ID 457716.

Non-forest vegetation, Slovakia

(25) **23 species / 0.01 m² (Slovak record)** – Mesic oligotrophic pasture (*Festuco rupicolae-Nardetum strictae*, *Violion caninae*), Poľana Mts, Povrazník, SW slopes of Mt Jaseňový, pasture extensively grazed by sheep or cattle (control plot of a management experiment), 19°22'00.8"E, 48°42'10.1"N (read from Google Earth), altitude 710 m, aspect SW, slope 15°, volcanic bedrock (rhyodacite), plot size measured with a metal frame, 2 June 2011, K. Ujházy, plot ID 957002.

1. *Agrostis capillaris*
2. *Anthoxanthum odoratum*
3. *Briza media*
4. *Cerastium holosteoides*
5. *Cynosurus cristatus*
6. *Euphrasia officinalis* subsp. *rostkoviana*
7. *Festuca rubra*
8. *Genista pilosa*
9. *Helianthemum grandiflorum* subsp. *obscurum*
10. *Leontodon hispidus*
11. *Lotus corniculatus*
12. *Luzula campestris*
13. *Nardus stricta*
14. *Pilosella officinarum*
15. *Pimpinella saxifraga*
16. *Plantago lanceolata*
17. *Ranunculus acris*
18. *Ranunculus bulbosus*
19. *Stellaria graminea*
20. *Trifolium ochroleucon*
21. *Trifolium repens*
22. *Viola canina*
23. *Viola hirta*

Moss layer: *Brachythecium* sp.

(26) **37 species / 0.04 m² (Slovak record)** – Site identical to (25) but grazing abandoned since 2009, mulched in September as part of management experiment, 19°22'00.8"E, 48°42'09.8"N (read from Google Earth), plot size measured with a metal frame, 17 June 2010, M. Janišová & D. Galvánek, plot ID 957004.

1. *Achillea millefolium*
2. *Agrostis capillaris*
3. *Avenula praeusta*
4. *Briza media*
5. *Carex caryophyllea*
6. *Carex panicea*
7. *Carex pilulifera*
8. *Centaurea erdneri*
9. *Cerastium holosteoides*
10. *Cruciata verna*
11. *Danthonia decumbens*
12. *Euphrasia officinalis* subsp. *rostkoviana*
13. *Festuca ovina*
14. *Festuca rubra*
15. *Genista pilosa*
16. *Helianthemum grandiflorum* subsp. *obscurum*
17. *Hypericum perforatum*
18. *Leontodon hispidus*
19. *Luzula campestris*
20. *Nardus stricta*
21. *Pilosella lactucella*
22. *Pilosella officinarum*
23. *Pimpinella saxifraga*
24. *Plantago lanceolata*
25. *Plantago media*
26. *Poa angustifolia*
27. *Potentilla erecta*
28. *Potentilla heptaphylla*
29. *Ranunculus acris*
30. *Ranunculus bulbosus*
31. *Rumex acetosa*
32. *Thymus pulegioides*
33. *Trifolium montanum*
34. *Trifolium ochroleucon*
35. *Trifolium pratense*
36. *Trifolium repens*
37. *Viola canina*

Moss layer: *Abietinella abietina*, *Climacium dendroides*, *Plagiomnium affine*, *Plagiomnium undulatum*, *Thuidium delicatulum*

(27) **49 species / 1 m² (Slovak record outside the White Carpathians and Kopanecké lúky)** – Semi-dry mown meadow (*Carici albae-Brometum monocladi*, *Bromion erecti*), Starohorské vrchy Mts, Banská Bystrica, Jakub Protected Site, grasslands on slopes E of the village, 19°08'34.0"E, 48°45'57.6"N (measured by GPS,

accuracy 3 m), altitude 411 m, aspect N, slope 22°, limestone, soil pH (H_2O) 7.7, covers: herb layer 55%, moss layer 50%, plot size measured with a cord, 25 June 2009, Z. Preislerová & K. Merunková, field no. 79/Da, plot ID 457721.

1.	*Acer campestre* juv.	r	26.	*Hippocrepis comosa*	+
2.	*Anthericum ramosum*	2a	27.	*Hypochaeris maculata*	+
3.	*Anthyllis vulneraria*	+	28.	*Knautia kitaibelii*	+
4.	*Avenula pubescens*	+	29.	*Leontodon hispidus* var. *hispidus*	+
5.	*Brachypodium pinnatum*	+	30.	*Leucanthemum ircutianum*	+
6.	*Briza media*	+	31.	*Linum catharticum*	+
7.	*Bromus monocladus*	+	32.	*Lotus corniculatus*	+
8.	*Buphthalmum salicifolium*	+	33.	*Luzula campestris*	r
9.	*Carex alba*	r	34.	*Ononis spinosa*	+
10.	*Carex caryophyllea*	+	35.	*Phyteuma orbiculare*	r
11.	*Carex digitata*	r	36.	*Pimpinella saxifraga*	+
12.	*Carex panicea*	2b	37.	*Plantago lanceolata*	+
13.	*Carlina acaulis*	2a	38.	*Plantago media*	+
14.	*Carlina vulgaris*	+	39.	*Potentilla heptaphylla*	+
15.	*Carpinus betulus* juv.	+	40.	*Primula veris*	+
16.	*Centaurea scabiosa*	1	41.	*Quercus petraea* juv.	r
17.	*Cruciata verna*	+	42.	*Ranunculus auricomus* agg.	+
18.	*Cuscuta epithymum*	r	43.	*Salvia pratensis*	+
19.	*Dianthus carthusianorum*	+	44.	*Sanguisorba minor*	+
20.	*Euphrasia officinalis* subsp. *rostkoviana*	r	45.	*Tanacetum corymbosum*	+
21.	*Festuca rupicola*	+	46.	*Thesium linophyllon*	+
22.	*Galium pumilum*	r	47.	*Thymus pulegioides*	+
23.	*Genista pilosa*	+	48.	*Tragopogon orientalis*	+
24.	*Globularia bisnagarica*	+	49.	*Trifolium montanum*	+
25.	*Helianthemum grandiflorum* subsp. *obscurum*	+			

(28) **48 species / 1 m²** – Mesic grassland (*Anthoxantho odorati-Agrostietum tenuis*, *Cynosurion cristati/Arrhenatherion elatioris*), Kysucká vrchovina Mts, Zázrivá-Plešivá, occasionally grazed hay meadow close to the settlement, abandoned in 2001 as a part of management experiment, 19°11'15.0"E, 49°16'13.5"N (read from Google Earth), altitude 761 m, aspect SW, slope 2°, Klippen Belt limestone, plot size measured with a tape measure, 21 June 2001, D. Galvánek, plot ID 957006.

(29) **64 species / 4 m² (Slovak record outside the White Carpathians and Kopanecké lúky)** – Mesic oligotrophic pasture (*Festuco rupicolae-Nardetum strictae*, *Violion caninae*), Poľana Mts, Povrazník, locality identical to plot (25), pasture extensively grazed by sheep, since 2009 also regularly mown with a scythe as part of management experiment, 19°22'00.7"E, 48°42'09. 9"N (read from Google Earth), altitude 710 m, aspect SW, slope 15°, volcanic bedrock (rhyodacite), covers: herb layer 87%, moss layer 25%, species covers estimated in percentages, plot size measured with a cord, 1 June 2011, K. Ujházy, plot ID 957005.

1.	*Achillea millefolium*	3	16.	*Cynosurus cristatus*	1
2.	*Agrostis capillaris*	1	17.	*Danthonia decumbens*	2
3.	*Alchemilla* sp.	3	18.	*Dianthus deltoides*	1
4.	*Anthoxanthum odoratum*	10	19.	*Euphrasia stricta*	1
5.	*Briza media*	3	20.	*Euphrasia officinalis* subsp. *rostkoviana*	2
6.	*Campanula patula*	1	21.	*Festuca ovina*	7
7.	*Cardamine pratensis*	1	22.	*Festuca pratensis*	1
8.	*Carex caryophyllea*	8	23.	*Festuca rubra*	5
9.	*Carex pallescens*	1	24.	*Festuca rupicola*	1
10.	*Carex panicea*	3	25.	*Genista pilosa*	15
11.	*Carex pilulifera*	6	26.	*Helianthemum grandiflorum* subsp. *obscurum*	5
12.	*Carlina vulgaris*	1	27.	*Hypericum perforatum*	1
13.	*Centaurea erdneri*	5	28.	*Hypochaeris radicata*	1
14.	*Cerastium holosteoides*	1	29.	*Juniperus communis* juv.	1
15.	*Cruciata verna*	2			

30.	*Knautia arvensis*	1	48.	*Ranunculus acris*	1
31.	*Leontodon hispidus*	2	49.	*Ranunculus bulbosus*	1
32.	*Leucanthemum vulgare*	1	50.	*Ranunculus polyanthemos*	1
33.	*Lotus corniculatus*	1	51.	*Rumex acetosa*	1
34.	*Luzula campestris*	2	52.	*Rumex acetosella*	1
35.	*Nardus stricta*	12	53.	*Sanguisorba minor*	1
36.	*Pilosella lactucella*	1	54.	*Scorzoneroides autumnalis*	1
37.	*Pilosella officinarum*	10	55.	*Stellaria graminea*	1
38.	*Pimpinella saxifraga*	5	56.	*Taraxacum* sect. *Taraxacum*	1
39.	*Plantago lanceolata*	2	57.	*Thymus pulegioides*	8
40.	*Plantago media*	1	58.	*Trifolium ochroleucon*	4
41.	*Poa angustifolia*	1	59.	*Trifolium pratense*	1
42.	*Polygala comosa*	1	60.	*Trifolium repens*	1
43.	*Polygala vulgaris*	4	61.	*Veronica chamaedrys*	1
44.	*Potentilla erecta*	2	62.	*Veronica officinalis*	1
45.	*Potentilla heptaphylla*	1	63.	*Viola canina*	5
46.	*Prunella vulgaris*	1	64.	*Viola hirta*	1
47.	*Prunella ×intermedia*	1			

Moss layer: *Abietinella abietina* 10, *Brachythecium albicans* 1, *Brachythecium* sp. 1, *Bryum caespiticium* 1, *Ceratodon purpureus* 2, *Climacium dendroides* 2, *Dicranum bonjeanii* 1, *Plagiomnium affine* 5, *Pleuridium acuminatum* 1, *Pleurozium schreberi* 1, *Rhytidiadelphus triquetrus* 1, *Thuidium delicatulum* 10

(30) **64 species / 4 m² (Slovak record outside the White Carpathians and Kopanecké lúky)** – Locality identical to the previous plot but grazing abandoned since 2009 as part of management experiment, 19°22'00.6"E, 48°42'09.5"N (measured by GPS), altitude 700 m, aspect SW, plot size measured with a cord, 17 June 2010, K. Ujházy, M. Janišová & D. Galvánek, plot ID 957003.

(31) **63 species / 12 m²** – Herbaceous vegetation at forest edge (*Geranio-Trifolietum alpestris*, *Geranion sanguinei*), Slovenský kras (Slovak Karst), Plešivská planina Plateau, Ostré vŕšky Hills, forest edge west of the field station, 20°25'00"E, 48°36'53"N (coordinates added later from a map), altitude 650 m, aspect E, slope 5°, herb layer cover 100%, 11 July 1984, Háberová et al. (1985), plot ID EU-SK-001-900295.

(32) **65 species / 14 m² (Slovak record outside the White Carpathians and Kopanecké lúky)** – Mesic meadow (*Crepido mollis-Agrostietum capillaris*, *Polygono bistortae-Trisetion flavescentis*), Muránska planina Mts, Eštókovo, 20°02'10.5"E, 48°46'41.4"N (measured by GPS, accuracy 2.5 m), altitude 1075 m, aspect WNW, slope 1°, limestone, covers: herb layer 92%, moss layer 30%, plot size measured by pace counting, 15 July 2005, field no. 34/05, K. Ujházy, plot ID EU-SK-001-736172.

(33) **73 species / 15 m² (Slovak record outside the White Carpathians and Kopanecké lúky)** –
Semi-dry grassland (*Salvio verticillatae-Festucetum rupicolae*, *Bromion erecti*), Poľana Mts, Hrochoť, NE of the village, 19°18'59.9"E, 48°39'44.7"N (read from 1:10 000 orthophoto, accuracy 10 m), altitude 635 m, aspect SSW, slope 25°, andesite breccia/conglomerate, covers: herb layer 80%, moss layer 30%, species covers estimated using the Zlatník scale (Zlatník 1978), plot size measured by pace counting, 18 June 1998, K. Ujházy, field no. 16, plot ID EU-SK-001-736850.

1.	*Achillea millefolium* agg.	1	13.	*Carex caryophyllea*	–2
2.	*Achillea nobilis*	1	14.	*Centaurea phrygia* agg.	+
3.	*Agrimonia eupatoria*	–	15.	*Centaurea scabiosa*	+
4.	*Allium* sp.	–	16.	*Cerastium holosteoides*	+
5.	*Anthoxanthum odoratum*	1	17.	*Clinopodium vulgare*	–
6.	*Anthyllis vulneraria*	–	18.	*Daucus carota*	+
7.	*Arrhenatherum elatius*	1	19.	*Dianthus carthusianorum*	1
8.	*Artemisia vulgaris*	–	20.	*Euphorbia cyparissias*	1
9.	*Astragalus glycyphyllos*	+	21.	*Festuca pratensis*	+
10.	*Briza media*	+	22.	*Festuca rupicola*	+2
11.	*Bromus hordeaceus*	–	23.	*Fragaria viridis*	+
12.	*Campanula rotundifolia*	–	24.	*Galium album*	+

25.	*Galium verum*	–	50.	*Rhinanthus minor*	–
26.	*Hypericum perforatum*	+	51.	*Rosa canina* agg. juv.	–
27.	*Knautia arvensis*	+	52.	*Salvia pratensis*	–
28.	*Koeleria macrantha*	1	53.	*Salvia verticillata*	1
29.	*Leontodon hispidus*	+	54.	*Sanguisorba minor*	1
30.	*Leucanthemum vulgare* agg.	1	55.	*Securigera varia*	+
31.	*Linum catharticum*	1	56.	*Sedum sexangulare*	1
32.	*Lotus corniculatus*	–2	57.	*Tanacetum corymbosum*	–
33.	*Luzula campestris* agg.	1	58.	*Taraxacum* sp.	1
34.	*Myosotis arvensis*	–	59.	*Thymus pulegioides*	–3
35.	*Origanum vulgare*	–	60.	*Tragopogon orientalis*	+
36.	*Picris hieracioides*	–	61.	*Trifolium dubium*	–2
37.	*Pilosella bauhini*	–	62.	*Trifolium montanum*	1
38.	*Pilosella officinarum*	–2	63.	*Trifolium ochroleucon*	+
39.	*Pimpinella saxifraga*	+	64.	*Trifolium pratense*	+
40.	*Plantago lanceolata*	1	65.	*Trisetum flavescens*	+
41.	*Plantago media*	1	66.	*Turritis glabra*	–
42.	*Poa angustifolia*	+2	67.	*Verbascum chaixii* subsp. *austriacum*	–
43.	*Potentilla argentea*	+	68.	*Veronica arvensis*	+
44.	*Potentilla collina*	1	69.	*Veronica spicata*	1
45.	*Potentilla recta*	–	70.	*Veronica teucrium*	–
46.	*Prunella laciniata*	–2	71.	*Vicia cracca*	+
47.	*Prunus spinosa* juv.	–	72.	*Viola hirta*	1
48.	*Pulmonaria mollis*	–	73.	*Viscaria vulgaris*	+
49.	*Ranunculus bulbosus*	1			

Moss layer: *Abietinella abietina* 2, *Brachythecium salebrosum* 1, *Cladonia* sp. +, *Fissidens* sp. +, *Plagiomnium rostratum* +

(34) **77 species / 16 m² (Slovak record outside the White Carpathians and Kopanecké lúky)** – *Festuca tatrae-Calamagrostis varia* alpine grassland (*Festucetum tatrae* Szafer et al. 1923 corr. 1927, *Astero alpini-Seslerion calcariae*), Belianske Tatry Mts, Dolina Siedmich prameňov valley, 20°16'20"E, 49°13'25"N, altitude 1600 m, aspect SE, slope 50°, limestone, covers: herb layer 50%, moss layer 20%, 7 July 1956, Šmarda et al. (1971: Table 9, relevé 20), plot ID EU-SK-001-632528.

1.	*Acer pseudoplatanus* (shrub layer)	+	24.	*Convallaria majalis*	1
2.	*Achillea millefolium* subsp. *sudetica*	+	25.	*Cystopteris fragilis*	+
3.	*Actaea europaea*	+	26.	*Daphne mezereum*	+
4.	*Anthyllis vulneraria* subsp. *alpestris*	1	27.	*Dianthus praecox*	+
5.	*Aquilegia vulgaris*	+	28.	*Digitalis grandiflora*	1
6.	*Arabidopsis arenosa*	+	29.	*Epilobium angustifolium*	1
7.	*Arabis hirsuta*	+	30.	*Erysimum hungaricum*	+
8.	*Asplenium ruta-muraria*	+	31.	*Festuca carpatica*	1
9.	*Asplenium viride*	+	32.	*Festuca tatrae*	3
10.	*Bellidiastrum michelii*	1	33.	*Fragaria vesca*	+
11.	*Botrychium lunaria*	+	34.	*Galium anisophyllon*	+
12.	*Bupleurum longifolium*	+	35.	*Galium intermedium*	+
13.	*Bupleurum ranunculoides*	+	36.	*Gymnadenia odoratissima*	+
14.	*Calamagrostis varia*	2	37.	*Helianthemum grandiflorum* subsp. *grandiflorum*	1
15.	*Campanula glomerata* subsp. *elliptica*	+			
16.	*Campanula persicifolia*	+	38.	*Heracleum sphondylium*	+
17.	*Campanula rapunculoides*	+	39.	*Hieracium bifidum*	1
18.	*Carduus glaucinus*	1	40.	*Hylotelephium argutum*	+
19.	*Carex ornithopoda*	+	41.	*Hypericum maculatum*	+
20.	*Carex sempervirens*	+	42.	*Jovibarba hirta*	1
21.	*Carlina acaulis*	+	43.	*Kernera saxatilis*	+
22.	*Centaurea montana* subsp. *mollis*	1	44.	*Larix decidua* (shrub layer)	+
23.	*Cirsium erisithales*	+	45.	*Laserpitium latifolium*	+

46.	*Lathyrus pratensis*	+	62.	*Polygala amara* subsp. *brachyptera*	1
47.	*Leucanthemum rotundifolium*	1	63.	*Primula auricula*	+
48.	*Libanotis pyrenaica*	1	64.	*Pyrethrum clusii*	+
49.	*Lilium martagon*	+	65.	*Rosa pendulina*	+
50.	*Linum catharticum*	+	66.	*Rubus saxatilis*	+
51.	*Lotus corniculatus*	+	67.	*Salix caprea* (shrub layer)	+
52.	*Luzula luzuloides* subsp. *luzuloides*	1	68.	*Saxifraga paniculata*	1
53.	*Origanum vulgare*	1	69.	*Scabiosa lucida*	1
54.	*Phleum hirsutum*	+	70.	*Sesleria tatrae*	1
55.	*Phyteuma orbiculare*	1	71.	*Silene nemoralis*	+
56.	*Phyteuma spicatum*	+	72.	*Solidago virgaurea* subsp. *minuta*	+
57.	*Picea abies* (shrub layer)	+	73.	*Sorbus aucuparia* (shrub layer)	+
58.	*Pimpinella saxifraga*	1	74.	*Thesium alpinum*	+
59.	*Platanthera bifolia*	+	75.	*Thymus pulcherrimus*	1
60.	*Pleurospermum austriacum*	+	76.	*Veronica chamaedrys*	+
61.	*Poa nemoralis*	1	77.	*Veronica fruticans*	+

Moss layer: *Anomodon viticulosus* 1, *Bryum argenteum* +, *Cladonia pocillum* +, *Ctenidium molluscum* +, *Didymodon fallax* +, *Ditrichum flexicaule* +, *Encalypta vulgaris* +, *Homalothecium lutescens* 1, *Homalothecium philippeanum* +, *Hygrohypnum luridum* +, *Hypnum vaucheri* +, *Rhytidium rugosum* 1, *Schistidium apocarpum* 1, *Sciuro-hypnum reflexum* +, *Solorina saccata* +, *Thuidium assimile* +, *Tortella tortuosa* 2

(35) **76 species / 16 m²** – Mesic calciphilous meadow (*Lilio bulbiferi-Arrhenatheretum elatioris*, *Arrhenatherion elatioris*), Muránska planina Mts, Muráň, Hrdzavá dolina, Nižný Kostelec, small forest meadow, mown once annually, 20°00'55.2"E, 48°45'06.2"N (measured by a GPS), altitude 830 m, aspect NNE, slope 10°, carbonate rock (limestone and/or dolomite), covers: herb layer 95%, moss layer 35%, 24 June 2004, E. Uhliarová, field no. 35/04, plot ID EU-SK-001-755412.

(36) **76 species / 16 m²** – Mesic grassland (*Anthoxantho odorati-Agrostietum tenuis*, *Cynosurion cristati/Arrhenatherion elatioris*), Muránska planina Mts, Tisovec, Voniaca, near hunting hut, 19°57'33.2"E, 48°42'18.7"N (coordinates measured by GPS), altitude 1014 m, aspect W, slope 5°, covers: herb layer 95%, moss layer 60%, plot size measured by pace counting, 16 June 2003, R. Hrivnák, J. Kliment, J. Kochjarová & P. Šmarda, plot ID EU-SK-001-738759.

(37) **76 species / 16 m²** – Mountain meadow (*Crepido mollis-Agrostietum capillaris*, *Polygono bistortae-Trisetion flavescentis*), Muránska planina Mts, Tisovec, Dížďovnica, upper part of meadow near hiking trail, 19°58'01.8"E, 48°43'39.3"N (coordinates measured by GPS), altitude 1162 m, aspect SW, slope 3°, covers: herb layer 98%, moss layer 40%, plot size measured by pace counting, 17 June 2003, R. Hrivnák, J. Kliment & J. Kochjarová, plot ID EU-SK-001-738760.

(38) **75 species / 16 m²** – Short mesic pasture (*Anthoxantho odorati-Agrostietum tenuis*, *Cynosurion cristati/Arrhenatherion elatioris*), Poľana Mts, Povrazník, 700 m NW of the village church, between field and forest, 19°21'27.8"E, 48°43'12.3"N (read from 1:10 000 orthophoto, accuracy ca. 10 m), altitude 657 m, aspect WNW, slope 7°, epiclastic andesite breccia and/or conglomerate, covers: herb layer 80%, moss layer 70%, plot size measured by pace counting, 24 June 1999, K. Ujházy, field no. 33/a, plot ID EU-SK-001-736062.

(39) **77 species / 18 m² (Slovak record outside the White Carpathians and Kopanecké lúky meadows)** – Mesic limestone grassland (*Carici albae-Brometum monocladi*, *Cirsio-Brachypodion pinnati*), Muránska planina Mts, Muráň, Nižný Kostelec, Hrdzavá dolina Nature Reserve, 20°00'51.1"E, 48°45'11.5"N (measured by GPS, accuracy 3.5 m), altitude 854 m, aspect SSW, slope 15°, limestone, covers: herb layer 95%, moss layer 35%, plot size measured by pace counting, 24 June 2004, K. Ujházy, field no. 36/04, plot ID EU-SK-001-736150.

(40) **88 species / 24 m² (Slovak record outside the White Carpathians and Kopanecké lúky meadows)** – Tall subalpine grassland (*Sileno vulgaris-Calamagrostietum arundinaceae*, *Calamagrostion arundinaceae*), Veľká Fatra Mts, S slope of the Zvolen mountain group, 19°13'21"E, 48°53'22"N (coordinates read from a map), altitude 1390 m, aspect SSE, slope 45°, marl limestone, covers: herb layer 90%, moss layer 1%, species covers estimated using an ordinal scale 1–9, plot size measured with a tape measure, 13 July 1990, Kliment (1995, Table 2, relevé 15), plot ID EU-SK-001-630833.

1.	*Acer pseudoplatanus* juv.	3
2.	*Achillea millefolium* subsp. *sudetica*	2
3.	*Aegopodium podagraria*	1
4.	*Agrostis capillaris*	3
5.	*Ajuga reptans*	2
6.	*Alchemilla glaucescens*	2
7.	*Anthoxanthum alpinum*	2
8.	*Anthyllis vulneraria* subsp. *alpestris*	2
9.	*Arabis hirsuta*	2
10.	*Asarum europaeum*	2
11.	*Astrantia major*	2
12.	*Brachypodium pinnatum*	2
13.	*Briza media*	5
14.	*Bupleurum longifolium* subsp. *vapincense*	3
15.	*Calamagrostis arundinacea*	7
16.	*Campanula elliptica*	5
17.	*Campanula serrata*	2
18.	*Carduus personata*	2
19.	*Carex flacca*	2
20.	*Carlina acaulis*	3
21.	*Centaurea montana* subsp. *mollis*	3
22.	*Cerastium holosteoides*	2
23.	*Cirsium erisithales*	3
24.	*Conioselinum tataricum*	2
25.	*Convallaria majalis*	3
26.	*Cruciata verna*	3
27.	*Dactylis glomerata* subsp. *slovenica*	2
28.	*Delphinium elatum*	3
29.	*Dianthus carthusianorum* subsp. *latifolius*	3
30.	*Digitalis grandiflora*	3
31.	*Euphorbia amygdaloides*	2
32.	*Euphorbia epithymoides*	2
33.	*Festuca rubra*	2
34.	*Fragaria vesca*	2
35.	*Galium album*	2
36.	*Galium anisophyllon*	3
37.	*Gentianella lutescens*	2
38.	*Geranium sylvaticum*	3
39.	*Gymnadenia conopsea*	2
40.	*Heracleum sphondylium* subsp. *trachycarpum*	2
41.	*Hesperis matronalis* subsp. *nivea*	2
42.	*Hieracium bifidum*	2
43.	*Hieracium murorum*	2
44.	*Hieracium prenanthoides*	3
45.	*Hylotelephium argutum*	3
46.	*Hypericum hirsutum*	2
47.	*Hypericum maculatum*	2
48.	*Hypochaeris maculata*	1
49.	*Jovibarba hirta* subsp. *glabrescens*	2
50.	*Knautia kitaibelii*	1
51.	*Knautia maxima*	5
52.	*Lathyrus vernus*	2
53.	*Leontodon hispidus* var. *hispidus*	6
54.	*Leucanthemum margaritae*	3
55.	*Lilium martagon*	1
56.	*Linum catharticum*	4
57.	*Linum extraaxillare*	3
58.	*Lotus corniculatus*	2
59.	*Luzula luzuloides* subsp. *rubella*	2
60.	*Phleum hirsutum*	3
61.	*Phyteuma orbiculare*	2
62.	*Pimpinella major* subsp. *rubra*	6
63.	*Plantago media*	2
64.	*Poa alpina*	3
65.	*Poa nemoralis*	5
66.	*Polygala amara* subsp. *brachyptera*	2
67.	*Polygonatum verticillatum*	1
68.	*Potentilla thuringiaca*	3
69.	*Primula elatior*	2
70.	*Pyrethrum clusii*	2
71.	*Ranunculus nemorosus*	3
72.	*Ranunculus platanifolius*	2
73.	*Rubus saxatilis*	3
74.	*Rumex arifolius*	2
75.	*Saxifraga paniculata*	5
76.	*Silene vulgaris* subsp. *vulgaris*	3
77.	*Stellaria graminea*	1
78.	*Thesium alpinum*	3
79.	*Thymus alpestris*	3
80.	*Tragopogon orientalis*	2
81.	*Traunsteinera globosa*	1
82.	*Trifolium montanum*	2
83.	*Trifolium pratense*	2
84.	*Trifolium repens*	2
85.	*Veronica chamaedrys*	2
86.	*Vicia oreophila*	5
87.	*Vicia sepium*	2
88.	*Viola lutea* subsp. *sudetica*	1

Moss layer: *Tortella tortuosa* 2

(41) **77 species / 24 m²** – Mesic grassland (*Anthoxantho odorati-Agrostietum tenuis*, *Cynosurion cristati/Arrhenatherion elatioris*), Tríbeč Mts, Radobica, above the settlement U Košovských, 18°29'55"E, 48°34'36.5"N (read a posteriori from a map), altitude 543 m, aspect NNE, slope 15°, Triassic dolomite, covers: herb layer 80%, moss layer 45%, plot size measured by pace counting, 28 June 2004, J. Smatanová & M. Janišová, plot ID EU-SK-001-752535.

(42) **84 species / 25 m²** – Mown meadow (*Carici albae-Brometum monocladi*, *Cirsio-Brachypodion pinnati*), Muránska planina Mts, Muráň, NW of the village, Nižný Kostelec, 20°00'40.1"E, 48°45'13.5"N (read a posteriori from a map), altitude 872 m, aspect SE, slope 20°, covers: herb layer 80%, moss layer 45%, 6 July 1998, R. Hrivnák, D. Blanár & J. Vlčko, plot ID EU-SK-001-738761.

(43) 82 species / 25 m² – Semi-dry grassland (*Brachypodio pinnati-Molinietum arundinaceae*, *Bromion erecti*), formerly mown meadow, now abandoned, Rajecká kotlina Basin, Fačkov, NE of the village, 18°36'27.3"E, 49°00'25.0"N (measured by GPS), altitude 620 m, aspect W, slope 12°, limestone, covers: herb layer 95%, moss layer 35%, plot size measured by pace counting, 9 August 2012, M. Janišová, A. Dobošová & M. Zajac, plot ID 960001.

(44) **80 species / 25 m²** – Subalpine tall-forb grassland (*Aconito firmi-Digitaletum grandiflorae* Hadač et al. 1969, *Adenostylion alliariae*), Belianske Tatry Mts, Dolina Siedmich prameňov cirque, Ovčí žľab valley, 20°16'24"E, 49°13'22"N (coordinates added later from a map), altitude 1420 m, aspect ESE, slope 31°, limestone, covers: herb layer 60%, moss layer 20%, 30 July 1956, Hadač et al. (1969, p. 93, relevé no. 83), plot ID EU-SK-001-629531.

(45) **78 species / 25 m²** – Semi-dry grassland (*Lilio bulbiferi-Arrhenatheretum elatioris*, *Arrhenatherion elatioris*), Starohorské vrchy Mts, Podkonice, Pleše, 19°14'11"E, 48°49'14"N (measured by GPS, accuracy 6 m), altitude 948 m, aspect SSW, slope 25°, covers: herb layer 90%, moss layer not indicated, limestone, plot size measured by pace counting, 28 June 2005, Uhliarová & Janišová in Janišová et al. (2010, Table 2, relevé 74), plot ID EU-SK-001-755367.

(46) **77 species / 25 m²** – Semi-dry grassland (*Lilio bulbiferi-Arrhenatheretum elatioris*, *Arrhenatherion elatioris*), Starohorské vrchy Mts, ridge between Riečka and Tajov villages, 19°04'16"E, 48°45'19"N (added later from a map), altitude 540 m, aspect N, slope 5°, covers: herb layer 98%, moss layer 75%, plot size measured by pace counting, 28 July 2001, Janišová in Janišová et al. (2010, Table 2, relevé 113), plot ID EU-SK-001-752587.

(47) **77 species / 25 m²** – Mesic mountain meadow (*Polygono bistortae-Trisetion flavescentis*), Veľká Fatra Mts, Ružomberok, Malinô brdo, E edge of Malá mulda, 19°15'20"E, 49°03'09"N, altitude 1010 m, aspect N, slope 20°, covers: herb layer 100%, moss layer 5%, plot size measured by pace counting, 17 July 1988, J. Kliment, field code 23/88, plot ID EU-SK-001-725216.

(48) **95 species / 50 m² (Slovak record outside the White Carpathians and Kopanecké lúky)** – Open herbaceous vegetation (*Melilotetum albo-officinalis*, *Dauco carotae-Melilotion*) on river gravel bar, Bukovské vrchy Mts, small island in the Ulička stream, 22°22'11"E, 49°00'57"N (coordinates added a posteriori from a map), altitude 275 m, flat terrain, covers: shrub layer 2%, herb layer 30%, moss layer not indicated, 6 August 1990, Hadač & Terray (1997, Table 1, relevé 445), plot ID EU-SK-001-621002.

1.	*Achillea millefolium*	+	23.	*Echium vulgare*	+
2.	*Agrostis capillaris*	1	24.	*Epilobium adenocaulon*	1
3.	*Agrostis stolonifera*	1	25.	*Epilobium hirsutum*	+
4.	*Angelica sylvestris*	+	26.	*Equisetum arvense*	+
5.	*Arctium lappa*	+	27.	*Erigeron annuus* agg.	+
6.	*Artemisia vulgaris*	1	28.	*Eupatorium cannabinum*	+
7.	*Astragalus glycyphyllos*	+	29.	*Euphorbia cyparissias*	1
8.	*Barbarea vulgaris*	1	30.	*Galeopsis pubescens*	1
9.	*Brachypodium sylvaticum*	+	31.	*Galeopsis speciosa*	+
10.	*Calystegia sepium*	+	32.	*Galinsoga quadriradiata*	+
11.	*Campanula patula*	+	33.	*Galium album*	+
12.	*Campanula trachelium*	+	34.	*Galium aparine*	+
13.	*Cardamine flexuosa*	+	35.	*Galium odoratum*	1
14.	*Carduus personata*	+	36.	*Geranium robertianum*	1
15.	*Centaurea jacea*	1	37.	*Hypericum humifusum*	+
16.	*Cerastium holosteoides*	1	38.	*Hypochaeris radicata*	1
17.	*Cichorium intybus*	+	39.	*Impatiens noli-tangere*	+
18.	*Circaea lutetiana*	+	40.	*Juncus articulatus*	+
19.	*Cirsium palustre*	+	41.	*Lapsana communis*	+
20.	*Cruciata verna*	1	42.	*Lathyrus pratensis*	+
21.	*Daucus carota*	1	43.	*Leontodon hispidus* var. *glabratus*	+
22.	*Deschampsia cespitosa*	1	44.	*Leucanthemum ircutianum*	+

45.	*Lotus corniculatus*	1	71.	*Salix euxina* (shrub layer)	1
46.	*Lychnis flos-cuculi*	+	72.	*Salix purpurea* (shrub layer)	1
47.	*Lycopus europaeus*	1	73.	*Saponaria officinalis*	+
48.	*Melilotus albus*	4	74.	*Scleranthus annuus*	1
49.	*Mentha arvensis*	+	75.	*Scutellaria galericulata*	+
50.	*Mentha longifolia*	1	76.	*Sedum sexangulare*	+
51.	*Moehringia trinervia*	+	77.	*Silene dioica*	1
52.	*Mycelis muralis*	+	78.	*Silene latifolia* subsp. *alba*	1
53.	*Myosotis nemorosa*	1	79.	*Stachys sylvatica*	1
54.	*Myosoton aquaticum*	1	80.	*Stellaria media*	1
55.	*Ononis arvensis*	+	81.	*Tanacetum vulgare*	+
56.	*Oxalis stricta*	1	82.	*Taraxacum* sect. *Taraxacum*	+
57.	*Persicaria hydropiper*	+	83.	*Torilis japonica*	+
58.	*Plantago lanceolata*	1	84.	*Trifolium dubium*	+
59.	*Plantago major*	1	85.	*Trifolium pratense*	1
60.	*Poa annua*	1	86.	*Trifolium repens*	1
61.	*Poa compressa*	+	87.	*Tripleurospermum inodorum*	1
62.	*Poa trivialis*	1	88.	*Tussilago farfara*	2
63.	*Potentilla anserina*	1	89.	*Urtica dioica*	+
64.	*Potentilla reptans*	+	90.	*Verbascum densiflorum*	+
65.	*Prunella vulgaris*	1	91.	*Verbascum nigrum*	+
66.	*Ranunculus acris*	+	92.	*Veronica beccabunga*	+
67.	*Ranunculus repens*	+	93.	*Veronica chamaedrys*	+
68.	*Rubus idaeus*	+	94.	*Veronica officinalis*	+
69.	*Rumex conglomeratus*	+	95.	*Viola tricolor*	+
70.	*Rumex obtusifolius*	+			

(49) **97 species / 100 m^2 (Slovak grassland record outside the White Carpathians and Kopanecké lúky)** – Semi-dry mown meadow (*Onobrychido viciifoliae-Brometum erecti*, *Bromion erecti*), Strážovské vrchy Mts, Malé Košecké podhradie, Lukavica, 18°18'56.4"E, 48°57'51.7"N (measured by GPS, accuracy 5 m), altitude 396 m, aspect SW, slope 21°, deep soil on calcareous shale, pH (H_2O) 7.7, covers: shrub layer 1%, herb layer 70%, moss layer 55%, plot size measured with a cord, 16 June 2009, K. Merunková & Z. Preislerová, field no. 71/Db, plot ID 457720.

1.	*Acer campestre* juv.	r	24.	*Centaurea scabiosa*	+
2.	*Achillea millefolium* agg.	+	25.	*Cirsium pannonicum*	+
3.	*Agrimonia eupatoria*	+	26.	*Convolvulus arvensis*	+
4.	*Ajuga genevensis*	+	27.	*Cornus sanguinea* juv.	r
5.	*Allium oleraceum*	+	28.	*Crataegus* sp. juv.	r
6.	*Anthericum ramosum*	+	29.	*Crepis biennis*	r
7.	*Anthoxanthum odoratum*	+	30.	*Cruciata verna*	+
8.	*Arabis hirsuta*	+	31.	*Dactylis glomerata*	+
9.	*Arrhenatherum elatius*	+	32.	*Daucus carota*	+
10.	*Asperula cynanchica*	+	33.	*Dorycnium herbaceum*	+
11.	*Asperula tinctoria*	+	34.	*Euphorbia cyparissias*	+
12.	*Aster amellus*	+	35.	*Euphorbia esula*	+
13.	*Avenula pubescens*	r	36.	*Festuca pratensis*	+
14.	*Betonica officinalis*	+	37.	*Festuca rubra*	+
15.	*Brachypodium pinnatum*	2a	38.	*Festuca rupicola*	+
16.	*Briza media*	+	39.	*Filipendula vulgaris*	+
17.	*Bromus erectus*	+	40.	*Fragaria viridis*	+
18.	*Campanula rapunculoides*	r	41.	*Galium album*	r
19.	*Carex caryophyllea*	1	42.	*Galium verum*	+
20.	*Carex michelii*	+	43.	*Hippocrepis comosa*	+
21.	*Carex montana*	1	44.	*Hypericum perforatum*	+
22.	*Carex tomentosa*	+	45.	*Inula ensifolia*	+
23.	*Carlina acaulis*	+	46.	*Inula salicina*	1

47. *Juglans regia* (shrub layer) +
Juglans regia juv. +
48. *Knautia kitaibelii* 2a
49. *Lathyrus latifolius* +
50. *Lathyrus tuberosus* +
51. *Leontodon hispidus* var. *glabratus* et var. *hispidus* +
52. *Leucanthemum vulgare* r
53. *Ligustrum vulgare* juv. r
54. *Linum catharticum* +
55. *Lotus corniculatus* 1
56. *Medicago falcata* +
57. *Medicago lupulina* +
58. *Microthlaspi perfoliatum* r
59. *Muscari comosum* +
60. *Onobrychis viciifolia* +
61. *Picris hieracioides* +
62. *Pilosella bauhini* 2a
63. *Pimpinella saxifraga* +
64. *Plantago media* +
65. *Platanthera chlorantha* +
66. *Poa pratensis* +
67. *Polygala comosa* +
68. *Potentilla heptaphylla* +
69. *Primula veris* r
70. *Prunella laciniata* +
71. *Prunus domestica* juv. +
72. *Prunus spinosa* juv. +
73. *Quercus petraea* juv. +
74. *Ranunculus bulbosus* +
75. *Ranunculus polyanthemos* +
76. *Robinia pseudoacacia* (shrub layer) +
Robinia pseudoacacia juv. +
77. *Rosa* sp. juv. +
78. *Salvia pratensis* 1
79. *Salvia verticillata* +
80. *Sanguisorba minor* +
81. *Secale cereale* r
82. *Securigera varia* +
83. *Sedum sexangulare* +
84. *Tanacetum corymbosum* +
85. *Taraxacum* sect. *Taraxacum* +
86. *Teucrium chamaedrys* 2m
87. *Tragopogon orientalis* +
88. *Trifolium alpestre* +
89. *Trifolium montanum* +
90. *Trifolium repens* r
91. *Trifolium rubens* +
92. *Trisetum flavescens* +
93. *Veronica chamaedrys* +
94. *Veronica teucrium* +
95. *Vicia cracca* r
96. *Vincetoxicum hirundinaria* +
97. *Viola hirta* +

(50) **92 species / 100 m²** – Semi-dry abandoned meadow (*Scabioso ochroleucae-Brachypodietum pinnati*, *Cirsio-Brachypodion pinnati*), Štiavnické vrchy Mts, Beluj, SW of the village, 18°53'03.1"E, 48°20'49.5"N (measured by GPS, accuracy 4 m), altitude 470 m, aspect E, slope 17°, volcanic bedrock, pH (H_2O) 6.3, covers: shrub layer 5%, herb layer 65%, moss layer 0%, plot size measured with a cord, 1 July 2009, K. Merunková & Z. Preislerová, field no. 88/Db, plot ID 457723.

(51) **91 species / 100 m²** – Semi-dry mown meadow (*Carici albae-Brometum monocladi*, *Bromion erecti*), Starohorské vrchy Mts, Banská Bystrica, Jakub Protected Site, grasslands on slopes E of the village, 19°08'34.0"E, 48°45'57.6"N (measured by GPS, accuracy 3 m), altitude 411 m, aspect N, slope 22°, limestone, pH (H_2O) 7.7, covers: herb layer 55%, moss layer 50%, plot size measured with a cord, 25 June 2009, K. Merunková & Z. Preislerová, field no. 79/Db, plot ID 457722.

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(52) **80 species / 100 m² (Czech forest record)** – *Carpinus betulus-Tilia cordata* mesic forest (*Primulo veris-Carpinetum betuli*, *Carpinion betuli*), Moravian Karst (Moravský kras), Říčka valley 1.4 km NNE of Muchova cabin, 16°43'16.3"E, 49°13'56.5"N (measured by GPS, accuracy 5 m), altitude 320 m, aspect ENE, slope 29°, limestone, soil pH (KCl) 7, pH ($CaCl_2$) 6.6, covers: tree layer 60%, shrub layer 10%, herb layer 50%, moss layer 5% (species not recorded), plot size measured with a cord, 16 July 2009, I. Axmanová & M. Vymazalová, plot ID EU-CZ-001-183169.

1. *Acer campestre* (tree layer) 1
Acer campestre juv. +
2. *Acer platanoides* (tree layer) +
Acer platanoides juv. +
3. *Acer pseudoplatanus* juv. r
4. *Anemone nemorosa* +
5. *Asplenium trichomanes* +
6. *Brachypodium sylvaticum* 2m
7. *Bromus benekenii* r
8. *Bupleurum falcatum* +
9. *Calamagrostis arundinacea* +
10. *Campanula persicifolia* +
11. *Campanula rapunculoides* +
12. *Campanula rotundifolia* r

13.	*Campanula trachelium*	r	46.	*Lilium martagon*	+
14.	*Carex digitata*	1	47.	*Lonicera xylosteum* juv.	+
15.	*Carex michelii*	1	48.	*Melampyrum nemorosum*	+
16.	*Carex muricata* agg.	+	49.	*Melica nutans*	1
17.	*Carpinus betulus* (tree layer)	3	50.	*Melittis melissophyllum*	r
	Carpinus betulus (shrub layer)	+	51.	*Mercurialis perennis*	+
	Carpinus betulus juv.	r	52.	*Myosotis sylvatica*	r
18.	*Cephalanthera longifolia*	r	53.	*Neottia nidus-avis*	r
19.	*Clinopodium vulgare*	r	54.	*Peucedanum cervaria*	r
20.	*Convallaria majalis*	2a	55.	*Pilosella officinarum*	+
21.	*Cornus mas* (shrub layer)	1	56.	*Pimpinella major*	+
22.	*Corylus avellana* (shrub layer)	+	57.	*Poa nemoralis*	1
	Corylus avellana juv.	r	58.	*Poa pratensis*	+
23.	*Crataegus* sp. juv.	r	59.	*Polygonatum odoratum*	+
24.	*Dactylis polygama*	+	60.	*Polypodium vulgare*	2m
25.	*Daphne mezereum*	r	61.	*Primula veris*	1
26.	*Digitalis grandiflora*	+	62.	*Pulmonaria mollis*	+
27.	*Euonymus verrucosus* (shrub layer)	1	63.	*Quercus petraea* agg. juv.	+
	Euonymus verrucosus juv.	+	64.	*Ranunculus bulbosus*	+
28.	*Euphorbia cyparissias*	+	65.	*Rhamnus cathartica* juv.	+
29.	*Euphorbia dulcis*	r	66.	*Rosa* sp. juv.	r
30.	*Fagus sylvatica* juv.	+	67.	*Securigera varia*	r
31.	*Fourraea alpina*	+	68.	*Silene nutans*	+
32.	*Fragaria vesca*	+	69.	*Sorbus aucuparia* juv.	r
33.	*Fraxinus excelsior* juv.	+	70.	*Sorbus torminalis* (tree layer)	2m
34.	*Galium album*	+		*Sorbus torminalis* juv.	+
35.	*Galium sylvaticum*	r	71.	*Stellaria holostea*	+
36.	*Genista tinctoria*	r	72.	*Tanacetum corymbosum*	+
37.	*Glechoma hirsuta*	+	73.	*Taraxacum* sect. *Taraxacum*	r
38.	*Hepatica nobilis*	1	74.	*Teucrium chamaedrys*	+
39.	*Hieracium murorum*	+	75.	*Tilia cordata* (tree layer)	2b
40.	*Hieracium sabaudum*	r		*Tilia cordata* (shrub layer)	1
41.	*Hylotelephium maximum*	+	76.	*Veronica vindobonensis*	1
42.	*Hypericum montanum*	r	77.	*Vicia pisiformis*	r
43.	*Lathyrus niger*	r	78.	*Vincetoxicum hirundinaria*	+
44.	*Lathyrus vernus*	+	79.	*Viola hirta*	+
45.	*Ligustrum vulgare* juv.	+	80.	*Viola mirabilis*	+

(53) **78 species / 100 m^2** – Thermophilous *Quercus pubescens* forest (*Lathyro collini-Quercetum pubescentis*, *Quercion pubescenti-petraeae*), České středohoří Mts, Vchynice, SW slope of Mt Ovčín, 120 m SW of the hill top, 14°00'12.9"E, 50°30'15.8"N (measured by GPS, accuracy 12 m), altitude 411 m, aspect WSW, slope 27°, basalt, soil pH 6.7, covers: tree layer 70%, shrub layer 10 %, herb layer 55%, moss layer not recorded, 18 July 2010, Mazák (2011, Table 5, relevé 71), plot ID EU-CZ-001-518226.

(54) **76 species / 100 m^2** – *Quercus robur* forest (*Melico pictae-Quercetum roboris*, *Quercion petraeae*), White Carpathians (Bílé Karpaty), Javorník nad Veličkou, Machová Nature Reserve, 17°31'13"E, 48°49'21"N (read from www.mapy.cz), altitude 425, aspect WSW, slope 3°, flysch sediments, covers: tree layer 65%, shrub layer 0%, herb layer 50%, moss layer 1%, plot size measured with a cord, 18 June 2006, Fajmon (2006, Table 5, relevé 21), plot ID EU-CZ-001-282108.

(55) **82 species / 200 m^2 (Czech forest record)** – *Quercus petraea* forest (*Melico pictae-Quercetum roboris*, *Quercion petraeae*), White Carpathians (Bílé Karpaty), Vlčnov, Kovářův žleb Nature Reserve, 17°34'42"E, 49°01'15"N, altitude 270 m, aspect E, slope 5°, flysch claystone and sandstone, covers: tree layer 70%, shrub layer 5%, herb layer 50%, moss layer not recorded, 6 August 2007, M. Hájek & P. Hájková, plot ID EU-CZ-001-487163.

1.	*Agrimonia eupatoria*	+	43.	*Hieracium umbellatum*	+
2.	*Agrostis capillaris*	+	44.	*Hypericum perforatum*	+
3.	*Aster amellus*	r	45.	*Impatiens parviflora*	+
4.	*Astragalus glycyphyllos*	+	46.	*Knautia arvensis*	+
5.	*Betonica officinalis*	1	47.	*Ligustrum vulgare* (shrub layer)	+
6.	*Brachypodium pinnatum*	1		*Ligustrum vulgare* juv.	+
7.	*Brachypodium sylvaticum*	+	48.	*Lithospermum officinale*	2a
8.	*Bromus erectus*	+	49.	*Loranthus europaeus* (mistletoe)	+
9.	*Bupleurum falcatum*	+	50.	*Medicago falcata*	r
10.	*Calamagrostis arundinacea*	+	51.	*Melampyrum nemorosum*	+
11.	*Campanula glomerata*	+	52.	*Melica nutans*	+
12.	*Campanula persicifolia*	r	53.	*Peucedanum cervaria*	1
13.	*Campanula rapunculoides*	+	54.	*Pimpinella saxifraga*	+
14.	*Carex caryophyllea*	+	55.	*Plantago major*	+
15.	*Carex montana*	2a	56.	*Poa nemoralis*	+
16.	*Carex muricata*	+	57.	*Poa pratensis*	+
17.	*Carex spicata*	+	58.	*Polygonatum multiflorum*	+
18.	*Carex sylvatica*	+	59.	*Potentilla alba*	+
19.	*Carpinus betulus* (tree layer)	+	60.	*Prunella laciniata*	+
	Carpinus betulus (shrub layer)	1	61.	*Prunus avium* (tree layer)	1
	Carpinus betulus juv.	1		*Prunus avium* juv.	+
20.	*Centaurea jacea*	r	62.	*Prunus spinosa* juv.	+
21.	*Cephalanthera damasonium*	+	63.	*Pulmonaria mollis*	+
22.	*Chamaecytisus virescens*	+	64.	*Pyrus pyraster* (shrub layer)	1
23.	*Clematis vitalba*	+		*Pyrus pyraster* juv.	+
24.	*Clinopodium vulgare*	+	65.	*Quercus petraea* (tree layer)	4
25.	*Cornus sanguinea* (shrub layer)	+		*Quercus petraea* juv.	2a
	Cornus sanguinea juv.	+	66.	*Ranunculus polyanthemos*	+
26.	*Crataegus monogyna* juv.	1	67.	*Rosa canina* juv.	+
27.	*Crepis biennis*	r	68.	*Salvia pratensis*	+
28.	*Dactylis polygama*	+	69.	*Sanguisorba officinalis*	+
29.	*Euphorbia cyparissias*	+	70.	*Securigera varia*	r
30.	*Euphorbia virgata*	+	71.	*Senecio nemorensis* agg.	+
31.	*Festuca heterophylla*	+	72.	*Silene nutans*	+
32.	*Festuca rubra*	+	73.	*Solidago virgaurea*	1
33.	*Festuca rupicola*	1	74.	*Sorbus torminalis* juv.	+
34.	*Filipendula vulgaris*	+	75.	*Tanacetum corymbosum*	+
35.	*Fragaria moschata*	+	76.	*Taraxacum* sect. *Taraxacum*	+
36.	*Fragaria vesca*	+	77.	*Tilia cordata* (shrub layer)	1
37.	*Fragaria viridis*	+		*Tilia cordata* juv.	+
38.	*Frangula alnus* juv.	+	78.	*Trifolium alpestre*	+
39.	*Fraxinus excelsior* juv.	+	79.	*Veronica vindobonensis*	+
40.	*Galium verum*	+	80.	*Viburnum lantana* juv.	+
41.	*Geum urbanum*	+	81.	*Vincetoxicum hirundinaria*	+
42.	*Glechoma hederacea*	+	82.	*Viola hirta*	+

(56) **77 species / 200 m²** – *Fagus sylvatica-Carpinus betulus* forest (*Cephalanthero damasonii-Fagetum sylvaticae*, *Sorbo-Fagion sylvaticae*), Moravian Karst (Moravský kras), between Babice nad Svitavou and Kanice, 16°42'03"E, 49°16'34"N (coordinates of the centre of the forest compartment indicated in the original field protocol), altitude 420 m, slope 2°, rendzina on limestone, covers: tree layer 80%, shrub layer 8%, herb layer 90%, moss layer 20%, 30 June 1959, J. Lazebníček, plot ID EU-CZ-002-195493.

(57) **101 species / 400 m² (Czech forest record)** – Thermophilous *Quercus pubescens* forest with openings containing dry grassland species (*Lithospermo purpurocaerulei-Quercetum pubescentis*, *Quercion pubescenti-petraeae*), southern Moravia, Milovice, Milovická stráň Nature Reserve 1.5 km S of the village, 16°41'53"E, 48°50'43"N (read a posteriori from a map), altitude 248 m, aspect WSW, slope 16°, calcareous flysch sandstone with loess cover, covers: tree layer 40%, shrub layer 6%, herb layer 55%, moss layer not recorded, plot size measured with a cord, 27 June 2001, Z. Preislerová, plot ID EU-CZ-001-482105.

1. *Achillea pannonica* +
2. *Acinos arvensis* r
3. *Adonis vernalis* +
4. *Ajuga genevensis* r
5. *Alliaria petiolata* r
6. *Arabis hirsuta* r
7. *Arenaria martrinii* r
8. *Asparagus officinalis* +
9. *Asperula cynanchica* r
10. *Astragalus onobrychis* +
11. *Betonica officinalis* r
12. *Brachypodium pinnatum* 2b
13. *Bromus inermis* +
14. *Buglossoides purpurocaerulea* +
15. *Bupleurum falcatum* +
16. *Campanula glomerata* +
17. *Campanula persicifolia* +
18. *Carex humilis* 1
19. *Carex michelii* +
20. *Carex montana* +
21. *Clinopodium vulgare* +
22. *Convallaria majalis* +
23. *Cornus mas* (shrub layer) 1
    Cornus mas juv. +
24. *Crataegus monogyna* (shrub layer) +
    Crataegus monogyna juv. +
25. *Cuscuta* sp. r
26. *Cytisus nigricans* +
27. *Dactylis polygama* +
28. *Dictamnus albus* 1
29. *Dorycnium germanicum* +
30. *Elymus hispidus* +
31. *Eryngium campestre* +
32. *Euonymus verrucosus* juv. 1
33. *Euphorbia cyparissias* +
34. *Euphorbia epithymoides* r
35. *Falcaria vulgaris* +
36. *Fallopia dumetorum* r
37. *Festuca ovina* r
38. *Festuca pulchra* r
39. *Festuca rupicola* 2a
40. *Festuca valesiaca* +
41. *Fragaria moschata* +
42. *Fragaria viridis* +
43. *Fraxinus excelsior* (tree layer) +
    Fraxinus excelsior (shrub layer) +
44. *Galatella linosyris* +
45. *Galium album* r
46. *Galium glaucum* +
47. *Geum urbanum* +
48. *Helianthemum grandiflorum* subsp. *obscurum* +
49. *Hieracium lachenalii* r
50. *Hieracium sabaudum* r
51. *Hylotelephium maximum* +
52. *Hypericum perforatum* +
53. *Inula conyzae* +
54. *Inula ensifolia* 2a
55. *Inula hirta* r
56. *Isopyrum thalictroides* r
57. *Koeleria macrantha* r
58. *Lathyrus niger* +
59. *Lepidium campestre* +
60. *Ligustrum vulgare* (shrub layer) 1
    Ligustrum vulgare juv. 1
61. *Medicago falcata* +
62. *Melampyrum cristatum* +
63. *Melica nutans* agg. +
64. *Melica transsilvanica* +
65. *Melittis melissophyllum* +
66. *Microthlaspi perfoliatum* r
67. *Muscari comosum* +
68. *Peucedanum alsaticum* +
69. *Peucedanum cervaria* 1
70. *Pimpinella saxifraga* +
71. *Poa nemoralis* +
72. *Poa pratensis* +
73. *Potentilla incana* r
74. *Prunus mahaleb* (shrub layer) +
75. *Pulmonaria officinalis* r
76. *Quercus petraea* (tree layer) 1
    Quercus petraea juv. r
77. *Quercus pubescens* (tree layer) 2b
    Quercus pubescens (shrub layer) +
    Quercus pubescens juv. +
78. *Robinia pseudoacacia* (tree layer) +
    Robinia pseudoacacia juv. +
79. *Rosa canina* agg. (shrub layer) +
80. *Rosa* sp. juv. +
81. *Salvia pratensis* +
82. *Scabiosa ochroleuca* r
83. *Scorzonera austriaca* r
84. *Securigera varia* +
85. *Silene nutans* +
86. *Sorbus aucuparia* (tree layer) +
87. *Sorbus torminalis* (tree layer) +
    Sorbus torminalis juv. +
88. *Stachys recta* +
89. *Stipa capillata* +
90. *Stipa pulcherrima* +
91. *Tanacetum corymbosum* +
92. *Teucrium chamaedrys* 1
93. *Thymus praecox* +
94. *Trifolium alpestre* +
95. *Ulmus glabra* (shrub layer) r
96. *Veronica chamaedrys* +
97. *Veronica spicata* r
98. *Veronica teucrium* +
99. *Viburnum lantana* (shrub layer) 2a
    Viburnum lantana juv. 1
100. *Vincetoxicum hirundinaria* +
101. *Viola ambigua* +

(58) **84 species / 400 m²** – *Fraxinus excelsior-Acer pseudoplatanus* floodplain forest (*Stellario nemorum-Alnetum glutinosae*, *Alnion incanae*), northern Moravia, Lesní Albrechtice, right bank of the Moravice river north of the meander Papírenský splav, 17°50'10"E, 49°50'00"N, altitude 300 m, flat terrain, Quaternary sediments, covers: tree layer 90%, shrub layer 3%, herb layer 90%, moss layer 5%, 17 August 1981, Sedláčková (1992: Table 4, relevé 37), plot ID EU-CZ-001-416141.

(59) **80 species / 400 m²** – *Tilia cordata-Quercus robur* forest (*Stellario holosteae-Carpinetum betuli*, *Carpinion betuli*), northern Moravia, Životice near Nový Jičín, below a forest road 0.5 km SE of the top of Mt Jedle (544 m), 18°03'58"E, 49°33'46"N, altitude 480 m, aspect SSE, slope 10°, flysch sandstone, covers: tree layer 90%, shrub layer 10%, herb layer 90%, moss layer 5%, 16 May 1989, Sedláčková (1996, Table 1, relevé 13), plot ID EU-CZ-001-425932.

(60) **79 species / 400 m²** – *Quercus robur* forest (*Melico pictae-Quercetum roboris*, *Quercion petraeae*), eastern Bohemia, Rožďalovice, forest east of the village, 15°11'53"E, 50°18'01"N (coordinates of the centre of the forest compartment indicated in the original field protocol), altitude 215 m, slope 1°, calcareous claystone, covers: tree layer 95%, shrub layer 10%, herb layer 100%, moss layer 1%, 1 October 1962, J. Buršík, plot ID EU-CZ-002-242307.

(61) **81 species / 490 m²** – *Quercus* forest (*Pruno padi-Fraxinetum excelsioris, Alnion incanae*), eastern Bohemia, Libřice, Kaltouz forest W of the village, 15°56'25"E, 50°17'03"N (coordinates of the centre of the forest compartment indicated in the original field protocol), altitude 490 m, flat terrain, Turonian marlstone, soil with slight gley formation, covers: tree layer 65%, shrub layer 80%, herb layer 90%, moss layer 10%, 2 July 1953, A. Zlatník, plot ID EU-CZ-002-263200.

(62) **112 species / 625 m² (Czech forest record)** – Thermophilous oak forest (*Lithospermo purpurocaerulei-Quercetum pubescentis*, *Quercion pubescenti-petraeae*), southern Moravia, Milovice, Milovická stráň Nature Reserve 1.5 km S of the village, 16°41'53"E, 48°50'43"N (read a posteriori from a digital map), altitude 248 m, aspect WSW, slope 16°, calcareous flysch sandstone with loess cover, covers: tree layer 45%, shrub layer 7%, herb layer 60%, moss layer not recorded, plot size measured with a cord, 27 June 2001, Z. Preislerová, plot ID 956004.

1.	*Achillea pannonica*	+	27.	*Cuscuta* sp.	r
2.	*Acinos arvensis*	r	28.	*Cytisus nigricans*	+
3.	*Adonis vernalis*	+	29.	*Dactylis polygama*	+
4.	*Ajuga genevensis*	r	30.	*Dictamnus albus*	1
5.	*Alliaria petiolata*	r	31.	*Dorycnium germanicum*	+
6.	*Arabis hirsuta*	r	32.	*Elymus hispidus*	+
7.	*Arenaria martrinii*	r	33.	*Eryngium campestre*	+
8.	*Asparagus officinalis*	+	34.	*Erysimum diffusum* agg.	r
9.	*Asperula cynanchica*	r	35.	*Euonymus verrucosus* juv.	1
10.	*Astragalus onobrychis*	+	36.	*Euphorbia cyparissias*	+
11.	*Betonica officinalis*	r	37.	*Euphorbia epithymoides*	r
12.	*Brachypodium pinnatum*	3	38.	*Falcaria vulgaris*	+
13.	*Bromus inermis*	+	39.	*Fallopia dumetorum*	r
14.	*Buglossoides purpurocaerulea*	+	40.	*Festuca ovina*	1
15.	*Bupleurum falcatum*	+	41.	*Festuca pulchra*	r
16.	*Campanula glomerata*	+	42.	*Festuca rupicola*	r
17.	*Campanula persicifolia*	+	43.	*Festuca valesiaca*	r
18.	*Campanula trachelium*	r	44.	*Fragaria moschata*	+
19.	*Carex humilis*	1	45.	*Fragaria viridis*	+
20.	*Carex michelii*	+	46.	*Fraxinus excelsior* (tree layer)	1
21.	*Carex montana*	+		*Fraxinus excelsior* (shrub layer)	+
22.	*Clinopodium vulgare*	+	47.	*Galatella linosyris*	+
23.	*Convallaria majalis*	+	48.	*Galium album*	+
24.	*Cornus mas* (shrub layer)	1	49.	*Galium glaucum*	+
	Cornus mas juv.	+	50.	*Geum urbanum*	+
25.	*Crataegus laevigata* (shrub layer)	+	51.	*Helianthemum grandiflorum*	
26.	*Crataegus monogyna* (shrub layer)	+		subsp. *obscurum*	r
	Crataegus monogyna juv.	+	52.	*Hesperis sylvestris*	r

53. *Hieracium lachenalii* r
54. *Hieracium sabaudum* r
55. *Hylotelephium maximum* +
56. *Hypericum perforatum* r
57. *Inula conyzae* r
58. *Inula ensifolia* 1
59. *Inula hirta* +
60. *Inula salicina* +
61. *Isopyrum thalictroides* r
62. *Koeleria macrantha* r
63. *Lathyrus niger* +
64. *Lepidium campestre* r
65. *Ligustrum vulgare* (shrub layer) +
    Ligustrum vulgare juv. 1
66. *Lonicera xylosteum* (shrub layer) r
67. *Medicago falcata* +
68. *Melampyrum cristatum* +
69. *Melica nutans* +
70. *Melica transsilvanica* +
71. *Melittis melissophyllum* +
72. *Microthlaspi perfoliatum* r
73. *Muscari comosum* +
74. *Peucedanum alsaticum* +
75. *Peucedanum cervaria* +
76. *Pimpinella saxifraga* +
77. *Plantago media* +
78. *Poa nemoralis* +
79. *Poa pratensis* +
80. *Polygonatum multiflorum* +
81. *Potentilla incana* r
82. *Primula veris* +
83. *Prunus mahaleb* (shrub layer) +
84. *Pulmonaria officinalis* r
85. *Quercus petraea* (tree layer) 1
    Quercus petraea juv. +
86. *Quercus pubescens* (tree layer) 2b
    Quercus pubescens (shrub layer) +
    Quercus pubescens juv. +
87. *Robinia pseudoacacia* (tree layer) +
    Robinia pseudoacacia juv. +
88. *Rosa canina* agg. (shrub layer) +
    Rosa canina agg. juv. +
89. *Salvia pratensis* +
90. *Scabiosa ochroleuca* r
91. *Scorzonera austriaca* r
92. *Securigera varia* +
93. *Silene nutans* +
94. *Sorbus aucuparia* (tree layer) +
    Sorbus aucuparia (shrub layer) +
95. *Sorbus torminalis* (tree layer) +
    Sorbus torminalis juv. +
96. *Stachys recta* +
97. *Stipa capillata* +
98. *Stipa pulcherrima* +
99. *Tanacetum corymbosum* +
100. *Taraxacum* sect. *Taraxacum* r
101. *Teucrium chamaedrys* +
102. *Thymus praecox* r
103. *Tilia cordata* (shrub layer) r
104. *Trifolium alpestre* +
105. *Turritis glabra* r
106. *Ulmus glabra* (shrub layer) +
    Ulmus glabra juv. +
107. *Veronica chamaedrys* +
108. *Veronica spicata* r
109. *Veronica teucrium* +
110. *Viburnum lantana* (shrub layer) 1
    Viburnum lantana juv. 1
111. *Vincetoxicum hirundinaria* +
112. *Viola ambigua* +

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(63) **100 species / 100 m² (Slovak forest record)** – Riparian willow woodland with *Salix elaeagnos* (*Salicetum elaeagno-purpureae*, *Salicion elaeagno-daphnoidis*), Veľká Fatra Mts, Ľubochňa, Ľubochnianska dolina valley, Vyšný tajch, right bank side of the Ľubochnianka stream, 19°08'19.4"E, 48°58'07.8"N (measured by GPS, accuracy 10 m), altitude 774 m, aspect NNE, slope 2°, limestone, covers: tree layer 65%, shrub layer 1%, herb layer 90%, moss layer 25%, bryophytes not recorded, plot size measured by pace counting, 29 July 2014, R. Hrivnák, J. Kliment, M. Slezák & J. Nechaj, plot ID EU-SK-001-738799.

1. *Abies alba* juv. r
2. *Acer pseudoplatanus* juv. +
3. *Aconitum variegatum* 1
4. *Actaea spicata* +
5. *Aegopodium podagraria* +
6. *Ajuga reptans* +
7. *Alliaria petiolata* +
8. *Allium ursinum* +
9. *Alnus incana* juv. +
10. *Angelica sylvestris* +
11. *Anthriscus nitidus* 2b
12. *Asarum europaeum* +
13. *Astrantia major* +
14. *Brachypodium sylvaticum* 2b
15. *Calamagrostis varia* +
16. *Caltha palustris* +
17. *Campanula trachelium* +
18. *Cardamine amara* +
19. *Cardamine impatiens* +
20. *Carex sylvatica* +
21. *Chaerophyllum aromaticum* +
22. *Chaerophyllum hirsutum* 2a

23.	*Chrysosplenium alternifolium*	+	63.	*Myosotis palustris* agg.	+
24.	*Cirsium oleraceum*	1	64.	*Orobanche flava*	+
25.	*Coeloglossum viride*	r	65.	*Oxalis acetosella*	+
26.	*Colchicum autumnale*	r	66.	*Paris quadrifolia*	+
27.	*Cortusa matthioli*	+	67.	*Petasites hybridus*	3
28.	*Crepis paludosa*	1	68.	*Petasites kablikianus*	3
29.	*Cruciata verna*	+	69.	*Phyteuma spicatum*	+
30.	*Dactylis glomerata*	+	70.	*Picea abies* (tree layer)	2a
31.	*Daphne mezereum*	1		*Picea abies* juv.	+
32.	*Dentaria bulbifera*	r	71.	*Pimpinella major*	+
33.	*Elymus caninus*	+	72.	*Pleurospermum austriacum*	1
34.	*Epilobium tetragonum*	+	73.	*Poa trivialis*	+
35.	*Epipactis helleborine*	r	74.	*Polygonatum verticillatum*	+
36.	*Equisetum arvense*	+	75.	*Primula elatior*	+
37.	*Eupatorium cannabinum*	1	76.	*Pulmonaria obscura*	+
38.	*Fagus sylvatica* (shrub layer)	+	77.	*Ranunculus lanuginosus*	+
39.	*Festuca gigantea*	+	78.	*Ranunculus platanifolius*	+
40.	*Filipendula ulmaria*	+	79.	*Ranunculus repens*	+
41.	*Fragaria vesca*	+	80.	*Ribes uva-crispa*	+
42.	*Fraxinus excelsior* juv.	+	81.	*Rosa canina* agg. juv.	r
43.	*Galeobdolon luteum*	+	82.	*Rubus idaeus*	+
44.	*Galeopsis pubescens*	+	83.	*Rumex obtusifolius*	+
45.	*Galeopsis speciosa*	+	84.	*Salix elaeagnos* (tree layer)	4
46.	*Galium aparine*	+		*Salix elaeagnos* (shrub layer)	+
47.	*Galium odoratum*	1		*Salix elaeagnos* juv.	+
48.	*Geranium phaeum*	+	85.	*Salvia glutinosa*	+
49.	*Geranium robertianum*	+	86.	*Senecio ovatus*	1
50.	*Geum urbanum*	+	87.	*Silene dioica*	+
51.	*Heracleum sphondylium*	+	88.	*Stachys sylvatica*	1
52.	*Hesperis matronalis* subsp. *nivea*	+	89.	*Stellaria nemorum*	1
53.	*Lamium maculatum*	+	90.	*Symphytum tuberosum*	r
54.	*Lapsana communis*	+	91.	*Tanacetum corymbosum*	r
55.	*Listera ovata*	+	92.	*Telekia speciosa*	2a
56.	*Lonicera xylosteum* (shrub layer)	+	93.	*Trollius altissimus*	+
	Lonicera xylosteum juv.	+	94.	*Urtica dioica*	+
57.	*Maianthemum bifolium*	r	95.	*Valeriana excelsa* subsp. *sambucifolia*	+
58.	*Malus sylvestris* juv.	r	96.	*Valeriana simplicifolia*	r
59.	*Mentha longifolia*	+	97.	*Veronica beccabunga*	1
60.	*Mercurialis perennis*	+	98.	*Veronica chamaedrys*	+
61.	*Milium effusum*	+	99.	*Vicia sepium*	+
62.	*Mycelis muralis*	+	100.	*Viola biflora*	+

(64) **92 species / 100 m²** – Limestone pine forest (*Carici humilis-Pinetum*, *Pulsatillo slavicae-Pinion sylvestris*), Slovenský raj National Park, Hrabušice, Mt Ihrík, above cliffs near Gackova diera abyss, 20°25'38"E, 48°57'16"N, altitude 630 m, aspect SSW, slope 23°, limestone, covers: tree layer 40%, shrub layer 30%, herb layer 80%, moss layer 30%, plot size visually estimated, 10 August 1973, J. Uhlířová, plot ID EU-SK-001-797521.

(65) **79 species / 100 m²** – *Corylus avellana* scrub (*Prenantho purpurei-Coryletum avellanae* (Kulczyński 1928) Kliment et Jarolímek 2012, *Corylo-Populion tremulae*), Poľana Mts, Hrochoť, Mt Kruhy, 19°21'48.9"E, 48°39'48.4"N (read from 1:10 000 orthophoto, accuracy ca. 10 m), altitude 880 m, aspect N, slope 12°, andesite, covers: total cover 100%, tree layer 10%, shrub layer 95%, herb layer 70%, plot size measured by pace counting, 4 August 1998, K. Ujházy & M. Ujházyová, field no. 77L, plot ID EU-SK-001-736733.

(66) **78 species / 100 m²** – *Abies alba* forest (*Piceo-Abietetum albae* Szafer et al. 1923, *Abietion albae*), Belianske Tatry Mts, Dolina Siedmich prameňov cirque, on the right bank of the stream Hlboký potok, 20°16'54"E, 49°13'05"N (coordinates added a posteriori from www.atlas.cz), altitude 1140 m, aspect E, slope

20°, limestone, soil pH 6.4–7.3, covers: not reported for tree and shrub layers, herb layer 100%, moss layer not recorded, 6 July 1957, Šmarda et al. (1971: Table 20, relevé 113), plot ID EU-SK-001-632575.

(67) **78 species / 100 m²** – Montane *Corylus avellana* scrub (*Prenantho purpurei-Coryletum avellanae* (Kulczyński 1928) Kliment et Jarolímek 2012, *Corylo-Populion tremulae*), Dolný Turček, upper part of slope above railway, near NE edge of large hazel scrub, 18°54'33.7"E, 48°45'52.6"N (measured by GPS, accuracy 5 m), altitude 700 m, aspect N, slope 15°, andesite, covers: tree layer 3%, shrub layer 90%, herb layer 75%, moss layer 1%, plot size measured by pace counting, 22 June 2011, K. Ujházy & J. Kliment in Kliment & Jarolímek (2012: Table 1, relevé 2), plot ID EU-SK-001-736433.

(68) **84 species / 120 m²** – *Abies alba-Larix decidua-Picea abies* forest (*Calamagrostio arundinaceae-Abietetum*, *Abietion albae*), Belianske Tatry Mts, Dolina Siedmich prameňov cirque, on mid-slope above the stream Hlboký potok, 20°16'55"E, 49°13'10"N (read a posteriori from www.atlas.cz), altitude 1135 m, aspect SE, slope 31°, limestone, soil pH 6.9, covers: tree layer 70%, herb layer 80%, moss layer 45%, 29 July 1956, Hadač et al. (1969, page 301, relevé 79), plot ID EU-SK-001-629668.

(69) **83 species / 150 m²** – *Tilia platyphyllos-Acer pseudoplatanus* scree-slope forest (*Cynancho-Tilietum platyphyllis*, *Tilio platyphylli-Acerion*), Veľká Fatra Mts, Mt Pekárová, steep slope below the lowest part of rocky hilltop, 18°58'18"E, 48°57'35"N (read a posteriori from 1: 25 000 map), altitude 950 m, aspect S, slope 40°, limestone, covers: tree layer 70%, shrub layer 10%, herb layer 50%, moss layer 5%, plot size visually estimated, 14 September 1993, Uhlířová et al. (1999, Table 1, relevé 1), plot ID EU-SK-001-605462.

(70) **79 species / 300 m²** – *Fagus sylvatica-Abies alba-Larix decidua* forest (*Clematido alpinae-Fagetum*, *Fagion sylvaticae*), Slovenský raj National Park, NW hillside of Mt Holý kameň (1105 m), 20°25'55"E, 48°54'00"N (coordinates added later), altitude 1020 m, aspect WNW, slope 35°, limestone/dolomite, covers: tree layer 70%, shrub layer 10%, herb layer 60%, moss layer 20%, plot size visually estimated, 13 August 1973, Uhlířová-Šimeková in Pitoniak et al. (1978, Table 9, relevé 17), plot ID EU-SK-001-634610.

(71) **109 species / 400 m² (Slovak forest record)** – Relict oak forest with *Fagus sylvatica* and *Pinus sylvestris* (*Quercion pubescenti-petraeae*), Veľká Fatra Mts, Blatnica, Tlstá Nature Reserve, limestone terrace above Vápenná valley NW of Mažarná cave, 18°57'21.0"E, 48°56'26.9"N (measured by GPS, accuracy 5 m), 860 m, aspect SW, slope 20°, limestone, covers: tree layer 75%, shrub layer 1%, herb layer 85%, moss layer 5%, 40 × 10 m, plot size measured by pace counting, 14 August 2014, D. Bernátová, J. Kliment & D. Blanár, bryophytes and lichens identified by A. Petrášová and A. Košuthová, respectively, plot ID EU-SK-001-795603.

1.	*Abies alba* (tree layer)	1	20.	*Campanula cochleariifolia*	+
	Abies alba (shrub layer)	r	21.	*Campanula persicifolia*	+
	Abies alba juv.	r	22.	*Campanula rapunculoides*	+
2.	*Acer pseudoplatanus* (tree layer)	1	23.	*Campanula serrata*	+
	Acer pseudoplatanus (shrub layer)	+	24.	*Carex alba*	+
3.	*Achillea distans*	+	25.	*Carex digitata*	r
4.	*Ajuga reptans*	+	26.	*Carex flacca*	+
5.	*Allium ochroleucum*	+	27.	*Carex humilis*	3
6.	*Amelanchier ovalis*	+	28.	*Cephalanthera damasonium*	r
7.	*Anthericum ramosum*	+	29.	*Cirsium erisithales*	+
8.	*Aquilegia vulgaris*	r	30.	*Cirsium pannonicum*	+
9.	*Asperula tinctoria*	1	31.	*Clematis alpina*	r
10.	*Asplenium ruta-muraria*	+	32.	*Convallaria majalis*	+
11.	*Asplenium trichomanes*	r	33.	*Coronilla coronata*	+
12.	*Berberis vulgaris*	r	34.	*Cotoneaster tomentosus*	+
13.	*Brachypodium pinnatum*	2a	35.	*Crataegus* sp. juv.	+
14.	*Brachypodium sylvaticum*	r	36.	*Crepis alpestris*	+
15.	*Briza media*	+	37.	*Cytisus nigricans*	+
16.	*Bromus monocladus*	2a	38.	*Daphne mezereum*	r
17.	*Buphthalmum salicifolium*	+	39.	*Digitalis grandiflora*	+
18.	*Bupleurum falcatum*	+	40.	*Epipactis helleborine*	+
19.	*Calamagrostis varia*	3	41.	*Euphorbia amygdaloides*	+

42.	*Euphorbia cyparissias*	+
43.	*Fagus sylvatica* (tree layer)	2b
	Fagus sylvatica juv.	+
44.	*Festuca amethystina*	2a
45.	*Fragaria vesca*	+
46.	*Galium album*	+
47.	*Galium anisophyllon*	+
48.	*Galium boreale*	+
49.	*Galium intermedium*	+
50.	*Genista pilosa*	+
51.	*Gentianella fatrae*	r
52.	*Geranium sanguineum*	+
53.	*Globularia cordifolia*	+
54.	*Helianthemum grandiflorum* subsp. *obscurum*	+
55.	*Hieracium murorum*	+
56.	*Hippocrepis comosa*	+
57.	*Inula ensifolia*	+
58.	*Jovibarba globifera*	+
59.	*Kernera saxatilis*	r
60.	*Knautia kitaibelii*	r
61.	*Laserpitium latifolium*	+
62.	*Leontodon incanus*	+
63.	*Libanotis pyrenaica*	+
64.	*Lilium martagon*	r
65.	*Linum catharticum*	+
66.	*Lotus corniculatus*	+
67.	*Maianthemum bifolium*	+
68.	*Melampyrum sylvaticum*	+
69.	*Melica ciliata*	+
70.	*Melica nutans*	+
71.	*Melittis melissophyllum*	+
72.	*Mercurialis perennis*	+
73.	*Mycelis muralis*	+
74.	*Origanum vulgare*	+
75.	*Peucedanum cervaria*	+
76.	*Phyteuma orbiculare*	r
77.	*Picea abies* (shrub layer)	r
	Picea abies juv.	r
78.	*Pilosella bauhini*	+
79.	*Pimpinella major*	+
80.	*Pinus sylvestris* (tree layer)	2a
	Pinus sylvestris juv.	r
81.	*Poa stiriaca*	+
82.	*Polygonatum odoratum*	+
83.	*Prenanthes purpurea*	+
84.	*Primula auricula*	r
85.	*Pulsatilla slavica*	+
86.	*Quercus petraea* agg. (tree layer)	4
	Quercus petraea agg. juv.	+
87.	*Ranunculus nemorosus*	+
88.	*Ranunculus platanifolius*	r
89.	*Rosa canina* juv.	+
90.	*Rosa spinosissima*	+
91.	*Scabiosa ochroleuca*	r
92.	*Securigera varia*	+
93.	*Sedum album*	+
94.	*Senecio ovatus*	+
95.	*Senecio umbrosus*	+
96.	*Sesleria caerulea*	1
97.	*Solidago virgaurea*	+
98.	*Sorbus aria* (tree layer)	1
	Sorbus aria juv.	1
99.	*Sorbus aucuparia* juv.	r
100.	*Tanacetum corymbosum*	r
101.	*Teucrium chamaedrys*	1
102.	*Teucrium montanum*	+
103.	*Thesium alpinum*	+
104.	*Thymus pulcherrimus* subsp. *sudeticus*	+
105.	*Vaccinium vitis-idaea*	+
106.	*Viburnum lantana* juv.	r
107.	*Vincetoxicum hirundinaria*	2a
108.	*Viola collina*	+
109.	*Viscum album* (mistletoe)	+

Moss layer: *Cladonia chlorophaea* +, *Cladonia fimbriata* +, *Cladonia macilenta* +, *Collema fuscovirens* +, *Ctenidium molluscum* +, *Dicranum scoparium* +, *Fissidens dubius* +, *Homalothecium sericeum* +, *Hypnum cupressiforme* 1, *Peltigera rufescens* +, *Pohlia nutans* +, *Pseudoleskeella catenulata* +, *Rhytidium rugosum* +, *Schistidium apocarpum* +, *Tortella tortuosa* 1

(72) **105 species / 400 m²** – Dry rock-outcrop oak-lime forest (*Seslerio-Quercetum*, *Tilio platyphylli-Acerion*), Slovenský raj National Park, Hrabušice, Prielom Hornádu Nature Reserve, Mt Ihrík, slopes above the Hornád river valley, 20°25'41.9"E, 48°57'16.8"N (measured by GPS, accuracy 7 m), altitude 633 m, aspect SSE, slope 38°, limestone, covers: tree layer 85%, shrub layer 70%, herb layer 25%, moss layer 40%, plot size measured by pace counting, 6 August 2013, D. Blanár, plot ID EU-SK-001-795604.

(73) **94 species / 400 m²** – *Quercus pubescens* forest on a rocky slope (*Lithospermo purpurocaerulei-Quercetum pubescentis*, *Quercion pubescenti-petraeae*), Jelšavský kras (Jelšava Karst), Šivetice, Mt Muteň ESE of 466.0 elevation point, N of the village, 20°16'28.2"E, 48°35'37.0"N (measured by GPS, accuracy 4 m), altitude 378 m, aspect SEE, slope 33°, dolomite and crystalline limestone, covers: tree layer 65%, shrub layer 55%, herb layer 40%, moss layer 3%, plot size measured by pace counting, 30 July 2014, D. Blanár, plot ID EU-SK-001-795607.

(74) **94 species / 400 m²** – Rock-outcrop oak-lime-ash forest (*Seslerio-Quercetum* variant with *Galium odoratum*, *Tilio platyphylli-Acerion*), low unmanaged stand with multi-stemmed lime trees, Muránska planina Mts, Muráň, Cigánka Nature Reserve, SE-facing slopes of Muráň castle hill, ca. 150 m below the castle, 20°03'41.8"E, 48°45'35.3"N (measured by GPS, accuracy 2 m), altitude 876 m, aspect ESE, slope 30°, limestone, covers: tree layer 70%, shrub layer 7%, herb layer 65%, moss layer 20%, bare rock 40%, plot size measured by pace counting, 29 May 2008, Ujházy in Kliment et al. (2010, Table 1, relevé 60), field no. 7/08, plot ID EU-SK-001-736254.

(75) **90 species / 400 m²** – Rock-outcrop oak-lime-ash forest (*Seslerio-Quercetum*, *Tilio platyphylli-Acerion*), formerly coppiced, Muránska planina Mts, Muráň, Šiance National Nature Reserve, ESE of Mt Šance summit (1041.5 m), 20°04'33.4"E, 48°46'15.7"N (measured by GPS, accuracy 8 m), altitude 990 m, aspect S, slope 50°, limestone, covers: tree layer 70%, shrub layer 30%, herb layer 70%, moss layer 30%, plot size measured by pace counting, 10 July 2012, D. Blanár, plot ID EU-SK-001-795610.

(76) **90 species / 400 m²** – *Picea abies-Pinus sylvestris* forest (*Astero bellidiastri-Pinetum sylvestris*, *Pulsatillo slavicae-Pinion sylvestris*), Muránska planina Mts, Zlatno, crest of Mt Lopušná, Havranie rocks, 20°04'11.5"E, 48°48'11.8"N (measured by GPS, accuracy 10 m), altitude 1085 m, aspect ESE, slope 30°, redzina on limestone, covers: tree layer 60%, shrub layer 2%, herb layer 95%, plot size measured with Vertex (circular plot), 19 May 2010, F. Máliš, plot ID EU-SK-001-778156.

(77) **118 species / 500 m² (Slovak forest record)** – *Acer pseudoplatanus-Fagus sylvatica-Picea abies* forest (*Cortuso-Fagetum*, *Fagion sylvaticae*), Veľká Fatra Mts, Blatnica, alluvium of the stream Gaderský potok, 18°57'09.8"E, 48°56'52.7"N (measured by GPS, accuracy 2 m), altitude 551 m, aspect WSW, slope 1°, fluvisol on limestone/dolomite fluvial gravel deposits, covers: tree layer 80%, shrub layer 5 %, herb layer 80%, moss layer 5%, species covers estimated using the Zlatník scale (Zlatník 1978), plot size measured by pace counting, 19 July 2007, M. Ujházyová & K. Ujházy, field no. 74 V, plot ID EU-SK-001-736844.

1.	*Abies alba* juv.	+
2.	*Acer pseudoplatanus* (tree layer)	–4
	Acer pseudoplatanus juv.	1
3.	*Aconitum lycoctonum*	–
4.	*Aconitum variegatum*	+
5.	*Aegopodium podagraria*	1
6.	*Ajuga reptans*	+
7.	*Allium ursinum*	1
8.	*Angelica sylvestris*	–
9.	*Anthriscus nitidus*	+
10.	*Anthriscus sylvestris*	–
11.	*Arctium nemorosum*	+
12.	*Aruncus dioicus*	–
13.	*Asarum europaeum*	+2
14.	*Astrantia major*	+
15.	*Berberis vulgaris* (shrub layer)	+
16.	*Brachypodium sylvaticum*	–3
17.	*Bromus benekenii*	–
18.	*Caltha palustris*	–
19.	*Campanula latifolia*	–
20.	*Campanula rapunculoides*	+
21.	*Campanula trachelium*	+
22.	*Carduus personata*	–
23.	*Carex alba*	–2
24.	*Carex digitata*	1
25.	*Carex sylvatica*	–
26.	*Chaerophyllum aromaticum*	1
27.	*Chaerophyllum hirsutum*	+
28.	*Cirsium erisithales*	–
29.	*Cirsium oleraceum*	1
30.	*Clematis alpina*	–
31.	*Clinopodium vulgare*	–
32.	*Cornus sanguinea* (shrub layer)	–
33.	*Cortusa matthioli*	–
34.	*Corylus avellana* (shrub layer)	1
	Corylus avellana juv.	+
35.	*Crataegus* sp. (shrub layer)	–
36.	*Crepis paludosa*	+
37.	*Cystopteris fragilis*	–
38.	*Dactylis glomerata*	+
39.	*Daphne mezereum* juv.	+
40.	*Deschampsia cespitosa*	–
41.	*Dryopteris filix-mas*	+
42.	*Elymus caninus*	–
43.	*Epilobium montanum*	–
44.	*Epipactis helleborine*	+
45.	*Equisetum arvense*	+
46.	*Euonymus europaeus* (shrub layer)	–
47.	*Eupatorium cannabinum*	1
48.	*Fagus sylvatica* (tree layer)	–2
	Fagus sylvatica (shrub layer)	+
	Fagus sylvatica juv.	+
49.	*Filipendula ulmaria*	–
50.	*Fragaria vesca*	+
51.	*Fraxinus excelsior* (shrub layer)	–2
	Fraxinus excelsior juv.	1
52.	*Fraxinus americana* or *pennsylvanica* (tree layer)	+
	Fraxinus americana or *pennsylvanica* (shrub layer)	+

53. *Galeobdolon luteum* 1
54. *Galeopsis speciosa* –
55. *Galium intermedium* +
56. *Galium odoratum* +
57. *Geranium phaeum* 1
58. *Geranium robertianum* +
59. *Glechoma hederacea* 1
60. *Hacquetia epipactis* +
61. *Heracleum sphondylium* +
62. *Hieracium murorum* –
63. *Hypericum hirsutum* +
64. *Hypericum perforatum* –
65. *Impatiens noli-tangere* –
66. *Lapsana communis* –
67. *Listera ovata* +
68. *Lonicera xylosteum* (shrub layer) +
69. *Lunaria rediviva* –
70. *Maianthemum bifolium* +
71. *Melampyrum sylvaticum* +
72. *Melica nutans* –
73. *Mentha longifolia* +
74. *Mercurialis perennis* 1
75. *Monotropa hypopitys* +
76. *Mycelis muralis* –
77. *Orobanche flava* –
78. *Oxalis acetosella* –2
79. *Paris quadrifolia* +
80. *Petasites hybridus* +3
81. *Phyteuma spicatum* –
82. *Picea abies* (tree layer) –3
    Picea abies (shrub layer) +
    Picea abies juv. +
83. *Platanthera bifolia* +
84. *Poa nemoralis* –
85. *Polygonatum multiflorum* –
86. *Prenanthes purpurea* +
87. *Primula elatior* 1
88. *Primula vulgaris* –
89. *Prunella vulgaris* +
90. *Prunus spinosa* (shrub layer) –
91. *Pseudorchis albida* +
92. *Pulmonaria obscura* 1
93. *Ranunculus auricomus* agg. +
94. *Ranunculus lanuginosus* +
95. *Ranunculus repens* –
96. *Ribes uva-crispa* (shrub layer) +
97. *Rosa canina* agg. (shrub layer) +
98. *Rubus idaeus* +
99. *Salvia glutinosa* –2
100. *Sambucus nigra* (shrub layer) –
101. *Sanicula europaea* +
102. *Senecio germanicus* –
103. *Senecio ovatus* +
104. *Sorbus aria* (shrub layer) –
105. *Sorbus aucuparia* juv. –
106. *Stachys sylvatica* 1
107. *Stellaria nemorum* 1
108. *Symphytum tuberosum* +
109. *Taraxacum* sp. –
110. *Thalictrum aquilegiifolium* –
111. *Tilia platyphyllos* (shrub layer) –
112. *Tussilago farfara* +
113. *Ulmus glabra* (shrub layer) +
    Ulmus glabra juv. +
114. *Urtica dioica* –
115. *Valeriana excelsa* subsp. *sambucifolia* +
116. *Viburnum opulus* (shrub layer) –
117. *Viola biflora* 1
118. *Viola reichenbachiana* 1

Moss layer: *Plagiomnium affine* +, *Plagiomnium undulatum* 1, *Rhytidiadelphus triquetrus* +