

## ***Achillea ptarmica* (Asteraceae), a scarce and less known species of the Slovak flora**

**MATEJ DUDÁŠ<sup>1</sup>, JIŘÍ DANIELKA<sup>2,3</sup> & PAVOL ELIÁŠ JUN.<sup>4</sup>**

<sup>1</sup>Institute of Biology & Ecology, Faculty of Science, P. J. Šafárik University, Mánesova 23, SK-041 54, Košice, Slovakia; dudas.mato@gmail.com

<sup>2</sup>Department of Botany and Zoology, Masaryk University, Kotlářská 2, CZ-611 37, Brno, Czech Republic; daniel@sci.muni.cz

<sup>3</sup>Institute of Botany, The Czech Academy of Sciences, Zámek 1, CZ-252 43, Brno, Czech Republic

<sup>4</sup>Department of Botany, Slovak University of Agriculture, Tr. A. Hlinku 2, SK-949 76, Nitra, Slovakia; pavol.elias.jun@gmail.com

---

Dudáš M., Danielka J. & Eliáš P. jun. (2017): *Achillea ptarmica* (Asteraceae), a scarce and less known species of the Slovak flora.  
– Thaiszia – J. Bot. 27 (2): 95-109. – ISSN 1210-0420.

**Abstract:** The distribution of *Achillea ptarmica* in Slovakia was studied using herbarium specimens deposited in 22 public herbaria. The herbarium studies were supplemented with targeted field search. The species has been recorded in 28 phytogeographical districts and sub-districts but most of the records are concentrated in the Záhoršská nížina lowland in western Slovakia, in the Slovenské stredohorie Mts. in central Slovakia and in the Slovenské rudohorie Mts. in eastern Slovakia. While most of the occurrences once recorded in the Pannonian part of the country vanished, many new populations were recently found in the Carpathians. Our results show that the evaluation of the species as near threatened (NT) in the recent version of the Slovak Red List is correct.

**Keywords:** *Compositae*, distribution, garden escape, ornamental plants, phytogeography, Slovakia, sneezewort.

---

### **Introduction**

The genus *Achillea*, naturally distributed in Eurasia, northern Africa and North America, includes about 130 perennial allogamous species. Its members occur in various habitats including semideserts, sea coasts, moist meadows, alpine

grasslands, rocks fissures and ruderal sites (Guo et al. 2004; DANIHELKA 2004). The genus was traditionally divided in five sections but recent phylogenetic studies have shown that also the western Mediterranean genera *Otanthus* and *Leucocyclus* have to be merged with *Achillea*, the former as a section of its own (EHRENDORFER & GUO 2005). The same authors also considerably restricted the traditionally broadly circumscribed and heterogeneous *A.* sect. *Ptarmica* by separating the plants of mountain habitats of central and southern Europe as *A.* sect. *Anthemoideae*. In its recent narrow and more natural circumscription *A.* sect. *Ptarmica* includes about 10 species mainly of humid and moderately dry lowland habitats in the temperate zone of Eurasia (MEUSEL & JÄGER 1992; EHRENDORFER & GUO 2006), with only one species distributed also in the boreal zone of North America (TROCK 2006). Of those only *A. ptarmica* and *A. salicifolia* occur in central Europe, the latter being restricted to the easternmost part of Germany and Polish Silesia.

*Achillea ptarmica* L., Sp. Pl. 2: 898 (1753) [= *Ptarmica vulgaris* DC. Prodr. 6: 23, 1838] is the only species of *Achillea* sect. *Ptarmica* native to Slovakia. Its distribution range includes most of Europe, reaching as far as France and the British Isles in the west, Scandinavia and the Saint Petersburg area in the north, the western bank of the Odra River in Poland and northern Ukraine in the east, as well as northern Italy, Slovenia, Serbia and Romania in the south and south-east. It has become naturalized in Canada, the United States (including Alaska), Australia and Tasmania; it was also recorded in Iceland (MEUSEL & JÄGER 1992; CSURCHES & EDWARDS 1998; DANIHELKA 2004; TROCK 2006).

*Achillea ptarmica* is a perennial herb with a creeping rhizome. Stem (20–)30–100 cm tall, erect, terete, simple or rarely branched above. Leaves simple, sessile, not divided or rarely pinnatifoliated, linear to linear-lanceolate, 3–7 cm × 2.5–6 mm, margin 1–2× serrate. Flower heads in a corymbous panicle, 5–36(–49) in number, ± 15 mm in diameter. Involucrum bowl-shaped to hemispheric, 3–4.6 mm long; involucral bracts narrowly ovate, with brown membranous margin, loosely tomentose. Ray flowers (5–)8(–13), ligule broadly elliptic, 2.8–5.0 × 2.2–4.6 mm, shallowly 3-toothed at the tip. Disc flowers numerous, tubular, small, yellow. Achenes cuneate in outline, 1.5–2 × 0.8–1.0 mm. Flowering time from July to September (DANIHELKA 2004). The species is diploid with  $2n = 18$ ; the only count from Slovakia (HINDÁKOVÁ in MÁJOVSKÝ et al. 1974) corresponds to about 70 counts from other parts of the species's range currently registered in the Chromosome Counts Database (RICE et al. 2015).

*Achillea ptarmica* was used in folk medicine and also as a magical plant (FUTÁK 1946; DOSTÁL 1989; HANELT 2001). It has been sometimes cultivated as an ornamental, more frequently in double- and semi-double-flowered cultivars (Fig. 1; DOSTÁL 1989; THORNTON-WOOD 2000), usually referred to as *flore pleno*, and it is also available in some garden shops. The species easily escapes from cultivation. For this reason, it is often very difficult to distinguish between indigenous populations and those derived from garden escapes.



**Fig. 1.** Plants with normal, semi double-flowered and double-flowered capitula (photographed by M. Dudáš).

JÁVORKA (1924–1925) reported the occurrence of *Achillea ptarmica* in the present Slovakia only for the former counties of Túróc (Turčianska župa), Zólyom (Zvolenská ž.), Nógrád (Novohradská ž.) and Gömör (Gemerská ž.). DOSTÁL (1958) knew it only from the surroundings of the town of Malacky in westernmost Slovakia. HENDRYCH (1963) was the first to summarize the species' records from the country in a map (p. 11), listing only ten localities in central and eastern Slovakia. Later ŠPÁNIKOVÁ (1971) added a further four localities from eastern Slovakia from the south-western part of the Košická kotlina Basin.

*Achillea ptarmica* is included in the local Red Lists of vascular plants of the Morava River floodplain (OŤAHEĽOVÁ et al. 1997) and of the Volovské vrchy Mts. (MRÁZ & MIKOLÁŠ 1996). In the latest version of the Slovak Red List (ELIÁŠ et al. 2015) the species is evaluated as near threatened (NT). It is generally considered rare in Slovakia but no recent comprehensive information on its distribution exists. The purpose of this study is to summarize the records of *A. ptarmica* in the country and to reassess its conservation status, based on exact information.

## Materials and methods

The study and field research was done mainly in the years 2013–2016. As the source of species' records we used herbarium specimens, published and unpublished studies on flora and vegetation, and unpublished field notes. We used specimens from 22 public Slovak, Czech, Hungarian and Austrian herbaria, including BP, BRA, BRNM, BRNU, GM, HUM, KO, LTM, MOP, MP, MPS, NI, OLM, PR, PRC, SAV, SLO, SMBB, SNV, TNP, TYM and W, while in many other Czech and Slovak herbaria no specimens from Slovakia were found. Herbarium codes follow THIERS (2017). The map was designed in the program ArcGis, version 9.2. The mapping grid follows the traditionally used CEBA (Central European Basic Area) grid template described by NIKLFELD (1971), divided into quadrants of  $5 \times 3$  arc minutes (corresponding to approximately  $5.5 \times 5.9$  km). A list of revised specimens and other records is provided in Appendix 1. The information on habitat type was extracted from herbarium labels and supplemented by field observations. Taxonomy and nomenclature of vascular plants follow MARHOLD & HINDÁK (1998).

## Results and discussion

### Distribution in Slovakia

Altogether we have seen 93 herbarium specimens (apart from duplicates) and collected further at least 58 published and unpublished records not supported by herbarium specimens. A full list of records is given in Appendix 1. All herbarium specimens were identified correctly. Compared to the other *Achillea* species found in Slovakia, *A. ptarmica* is a distinct and the easiest to identify species of the genus: the usually undivided linear-lanceolate leaves toothed on the margin and large flower heads are particularly diagnostic.

*Achillea ptarmica* has been found in Slovakia altogether in 28 phytogeographic districts. Of those seven are situated in the area of the Pannonian flora (*Pannonicum*) and twenty-one in the area of the Carpathian flora (*Carpaticum*).

As shown in Fig. 2, most of the species' localities are concentrated in three parts of the country. The first and in the same time the smallest area is situated in the west in the Záhorská nížina lowland of the area of the Pannonian flora. *Achillea ptarmica* occurs there in the surroundings of the town of Malacky, in the floodplain of the Morava River and at several places along streams and on the shores of fishponds. Its occurrence has been documented there since the 1920s; the earliest specimens were collected mainly by S. Staněk. From these sites *A. ptarmica* may have spread downstream to the localities along the Danube River in the Podunajská nížina lowland near the city of Bratislava and near the towns of Kolárovo and Moča.

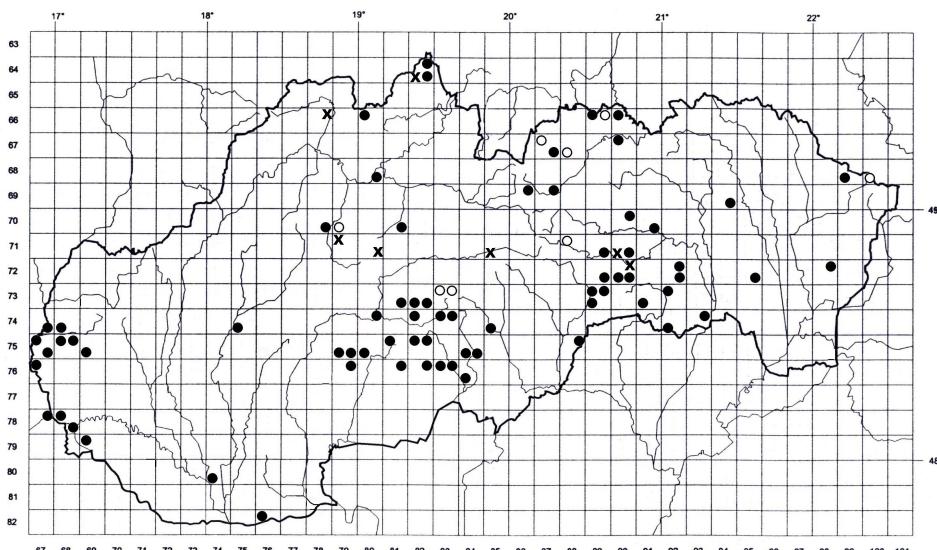


Fig. 2. Distribution of *Achillea ptarmica* in Slovakia: ● – plants with normal flowers (70 occupied quadrants), ○ – only semi double- and double-flowered plants (8 occupied quadrants), x – plants escaped from cultivation (7 occupied quadrants).

The second and largest compact distribution area of *Achillea ptarmica* is situated in central Slovakia. It includes mainly the southern and north-eastern parts of the Slovenské stredohorie phytogeographic district of the area of the Carpathian flora (sub-districts Štiavnické vrchy Mts., Javorie Mts., and Poľana Mts.). The earliest species' record from the country also originated from this area: P. Kitaibel found *A. ptarmica* near the town of Banská Bystrica as soon as in 1804 (KANITZ 1863). However, only a few records have been collected since then, and HLAVAČEK (1985), for instance, regarded the species in the Štiavnické vrchy Mts. as very rare. As shown by our study, *A. ptarmica* is found in the Javorie Mts. and Poľana Mts. at numerous sites, and new populations are still being found, for example, in the surroundings of the Detva town (Fig. 2, Appendix 1). The species' occurrences continue towards the south to the Ipel'sko-rimavská brázda phytogeographic district at the northern edge of the area of the Pannonian flora, where a few localities have been known since the 1860s (e.g. FÁBRY 1867).

The third, also a rather compact distribution patch of *Achillea ptarmica* is situated in eastern Slovakia in the eastern part of the Slovenské rudoohorie phytogeographic district. Most of the populations were discovered around the town of Gelnica about 15 years ago (MRÁZ & MRÁZOVÁ 2003). The earliest gathering of *A. ptarmica* from this area is that by L. de Thaisz from 1908. Unfortunately, the locality information on its label says only Abaúj-Torna Megye. Kassa [= Košice]. It may have been collected in the alluvium of the Vrbica stream or in wet meadows on Kamenný Hrb Hill ( $48^{\circ}45'10''N$ ,  $21^{\circ}9'46''E$ ) about 8 km north-west of the city. At the latter site the species forms a large and vital population consisting of hundreds of flowering and thousands of sterile plants, as confirmed by our field observations (DUDÁŠ 2015). Among plants with normal flowers, three double-flowered plants were found.

*Achillea ptarmica* is present also in the adjacent area of the Pannonian flora, i.e. in the Slovenský kras karst, the Košická kotlina Basin and in the Borsod-Abaúj-Zemplén county in north-eastern Hungary (BARTHA et al. 2015; VIRÓK et al. 2016). While the presence of *A. ptarmica* at its former Slovak localities in this area has not been confirmed recently (R. Šuvada in verb. and our field research), it is still present in the adjacent Hungarian territory (SOMLYAY & LÖKÖS 1999; SIMON 2006; SZÚCS & BARINA 2007; R. Šuvada in verb.).

From easternmost Slovakia only five records of *Achillea ptarmica* exist, most of them from the Carpathians. Three of these records are recent. The populations near the village of Dargov and in the Ruské sedlo pass consist of a small number of individuals, while the largest population in the Pod Ruským Nature Reserve harbours dozens of flowering plants, as observed in 2015. Actually, the number of plants at the latter site may be even larger because the meadow was freshly mown during the site inspection. In general, *A. ptarmica* is rare in the Eastern Carpathians, and KRÍCSFALUSI & BUDNIKOV (2007) classified *A. ptarmica* as vulnerable (VU) in the Red List of the Ukrainian Carpathians.

The situation in north-western and northern Slovakia is not very different. *Achillea ptarmica* occurs there as scattered (13 quadrants occupied by plants with normal or double flowers). With the only exception being those in ruderal habitats, it is difficult to assess the origin of these populations. Even some of those found in wet meadows may have been founded by plants escaped from cultivation, e.g. self-sown or from garden waste brought to the place, or they may represent direct relics of cultivation in abandoned settlements. Frequent cultivation of double-flowered plants is reported, for instance, by DOSTÁL (1989) for the whole of the former Czechoslovakia. In a local study, MIGRA (1983) listed *A. ptarmica* as a frequently cultivated ornamental plant, which had been able to escape into suitable habitats around former villages and settlements and to persist there for decades. The occurrence in the Gaderská valley was reported by FÁBRY (1880: 51) and repeatedly cited by later authors but it has not been confirmed ever since (KLIMENT & BERNÁTOVÁ 1996). However, it is also possible that some populations are indigenous because *A. ptarmica* is rather frequent in south-eastern Poland (ZAJĄC & ZAJĄC 2001).

The considerations about the status (indigenous versus introduced) concern more or less the majority of *Achillea ptarmica* populations in the country. Slovakia is situated close to the eastern limits of its total distribution range, where the species is becoming progressively rare towards the east. A comparison is possible, for instance, with the distribution pattern in the Czech Republic, where *A. ptarmica* is widespread at middle and higher altitudes of Bohemia, much less so in the Moravian part of the Bohemian massif and rare to scarce in eastern Moravia, where it is somewhat more frequent only in the Carpathians. Some of the populations at lower altitudes of central and southern Moravia may represent temporary outposts (spread along streams and rivers) and even more frequently garden escapes. Among 1214 revised herbarium specimens from the Czech Republic the share of double-flowered and semi double-flowered plants was about 5.5%, and the frequency of such plants increased towards the east. The share of double-flowered plants among the specimens from Slovakia was even higher, namely 11%. This suggests that also the proportion of populations established by plants escaped from cultivation is larger in Slovakia than in the Czech Republic. However, at least plants with semi double-flowers may probably arise in nature by spontaneous mutations and co-occur with plants bearing normal flowers, while some double-flowered cultivars are not true-breeding (MACLACHLAN et al. s.a.). Not all double-flowered plants are therefore necessarily garden escapes and, vice versa, also plants with normal flowers may be progeny of garden escapes or relics of cultivation for ornamental or medicinal purposes. Consequently, there is no clear-cut decision, and status of many populations will always remain uncertain.

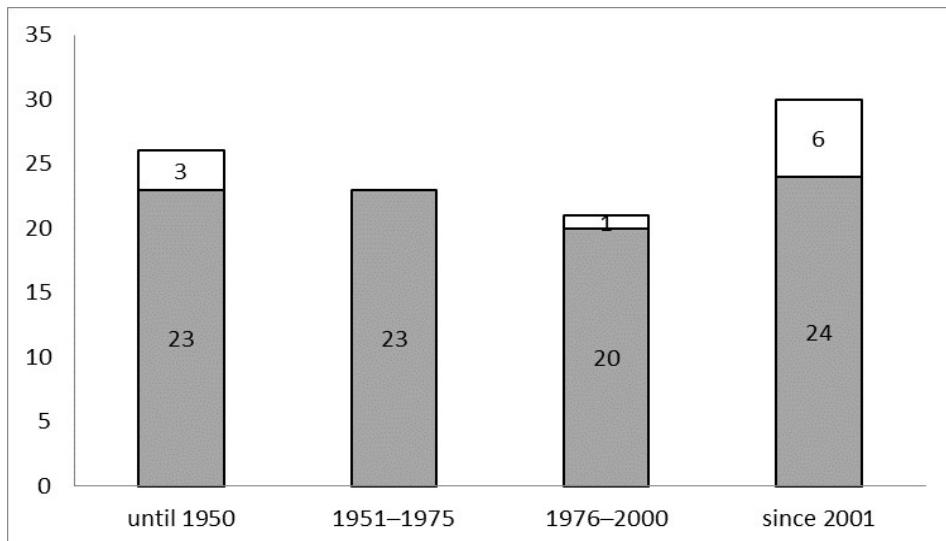
## Habitats

*Achillea ptarmica* requires non calcareous and permanently wet soils. It occurs mainly in wet meadows of the alliance *Calthion palustris*, less frequently also in meadows of the alliance *Molinion caeruleae*, which are wet in spring but mesic

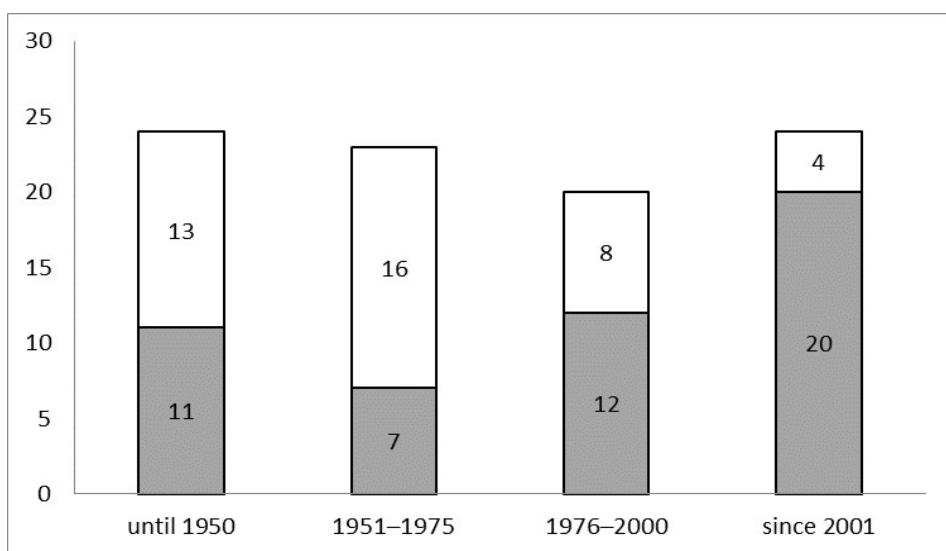
in summer, and perhaps also in alluvial meadows of the alliance *Deschampsion cespitosae*. Apart from wet and fen meadows it is also found around springs, on streamsides and along ditches, in shrubberies and openings of alluvial forests, as well as in various types of humid ruderal habitats. The most frequently co-occurring species are *Agrostis canina*, *Anthoxanthum odoratum*, *Betonica officinalis*, *Briza media*, *Carex flava*, *C. hirta*, *C. nigra*, *C. panicea*, *Cirsium palustre*, *Dactylorhiza majalis*, *Deschampsia cespitosa*, *Filipendula ulmaria*, *Lysimachia vulgaris*, *Molinia caerulea*, *Potentilla erecta*, *Ranunculus acris*, *R. flammula*, *Sanguisorba officinalis*, *Selinum carvifolia*, *Serratula tinctoria* and *Succisa pratensis*.

#### Threats and conservation status

An attempt to analyse the changes in the distribution of *Achillea ptarmica* in time is shown in Fig. 3. Keeping in mind the history of the research into the flora of Slovakia, the graph has to be interpreted with caution. Because of general scarcity (and local decline), the species was included already into the first version of the Slovak Red List (MAGLOCKÝ 1983), and it has remained red-listed ever since (MAGLOCKÝ & FERÁKOVÁ 1993; FERÁKOVÁ et al. 2001; ELIÁŠ et al. 2015). The slight increase in the number of records and occupied quadrants since 2001 may be best explained by more intense research, particularly due to habitat mapping for the Natura 2000 network (ŠEFFEROVÁ STANOVÁ et al. 2015). Thus, can we still consider *A. ptarmica* an endangered species? Fig. 4 offers a response. While the number of occupied quadrants in the Carpathians increased twice, the number of occupied quadrants in the Pannonian area has fallen by two thirds when compared with the situation until 1950. The reasons are well known. The lowlands of Slovakia have turned into intensively managed agricultural landscape since the end of the 19th century (e.g. ŠPÁNIKOVÁ 1982, 1985; KUBALOVÁ 2003; ŠEFFEROVÁ STANOVÁ 2015). River regulations, drainage and conversion of lowland meadows and pastures to arable land were the main causes for *A. ptarmica* habitat loss in the Pannonian area, particularly in the phytogeographic districts of the Podunajská nížina lowland, the Slovenský kras karst and the Košická kotlina Basin. In these areas we failed to confirm the presence of *A. ptarmica* at any of the previously reported sites (see Appendix 1). The Záhorská nížina lowland is the only part of the area of the Pannonian flora where *A. ptarmica* has survived until now. It occurs there mainly in alluvial meadows along the Morava River, which were not managed intensively in the past due to their position in the border zone with restricted access until the late 1980s (ŠEFFER & STANOVÁ 1999). However, this habitat is currently under threat by spread of invasive plant species (UHERČÍKOVÁ 1997; JAROLÍMEK et al. 1999). For these reasons, we believe that the classification of *A. ptarmica* as near threatened (NT) in the latest Slovak Red List of ferns and flowering plants (ELIÁŠ et al. 2015) is correct. The decline of *A. ptarmica* was observed also in other countries of Central Europe, therefore it is considered near threatened in Hungary (KIRÁLY 2007) and endangered (EN) in Austria (NIKLFELD & SCHRATT-EHRENDORFER 1999).



**Fig. 3.** Frequency of *Achillea ptarmica* in four different time periods in Slovakia. Numbers of occupied quadrants of the CEBA grid template are given separately for plants with normal flowers (grey) and for semi double-flowered and double-flowered plants (white).



**Fig. 4.** Frequency of *Achillea ptarmica* expressed as numbers of occupied quadrants of the CEBA grid template in four different time periods in the area of the Carpathian (grey) and Pannonian (white) flora. Only records of plants with normally developed flowers from non-ruderal (natural and semi-natural) habitats are included.

## Acknowledgements

We are grateful to the curators of herbaria cited above for the access to the collections and to P. Potocký (Zvolen), M. Nižnanská and P. Chromý (Spišská Nová Ves), R. Šuvada (Rožňava), M. Jasík (Banská Bystrica), A. Šimková (Trebišov) and E. Sitášová (Košice) for the information about the occurrence of *A. ptarmica*. We are also indebted to K. Hegedűšová (Martin) and P. Mereda (Bratislava) for the access to the Central database of phytosociological relevés and card files of plant records deposited at the Institute of Botany of the Slovak Academy of Sciences (Bratislava). We further thank P. Mártonfi for comments on an earlier version of the manuscript and two anonymous reviewers for their useful suggestions. The study was supported by grant VVGS-PF-2015-471 (MD) and grant VEGA no. 1/0083/16 (PE). The participation of JD was supported by the long-term research development project no. RVO 67985939 from the Academy of Sciences of the Czech Republic.

## References

- BARTHA D., KIRÁLY G., SCHMIDT D., TIBORCZ V., BARINA Z., CSIKY J., JAKAB G., LESKU B., SCHMOTZER A., VIDÉKI R., VOJTKÓ A. & ZÓLYOMI SZ. (eds) (2015): *Atlas florae Hungariae*. – University of West Hungary Press, Sopron, 329 pp.
- CSURCHES S. & EDWARDS R. (1998): Potential environmental weeds in Australia. – Queensland Department of Natural Resources, Land Protection, Locked Bag 40, Coorparoo Delivery Centre Qld 4151, 202 pp.
- DANIELSKA J. (2004): *Achillea* L. – řebříček. – In: SLAVÍK B. & ŠTĚPÁNKOVÁ J. (eds): Květena České republiky, vol. 7, p. 187–215. – Academia, Praha.
- DOSTÁL J. (1958): Klíč k úplné květeně ČSR. Ed. 2. – Nakladatelství Československé akademie věd, Praha, 982 pp.
- DOSTÁL J. (1989): Nová květena ČSSR. – Academia, Praha, 1548 pp.
- DUDÁŠ M. (2015): Masový výskyt rebríčka bertrámového (*Achillea ptarmica*) nedaleko Jahodnej (Volovské vrchy). – Natura Carpat. 56: 59–62.
- EHRENDORFER F. & GUO Y.-P. (2005): Changes in the circumscription of the genus *Achillea* (*Compositae-Anthemideae*) and its subdivision. – Willdenowia 35: 49–54.
- EHRENDORFER F. & GUO Y.-P. (2006): Multidisciplinary studies on *Achillea* sensu lato (*Compositae-Anthemideae*): new data on systematics and phylogeography. – Willdenowia 36: 69–87.
- ELIÁŠ P. jun., DÍTĚ D., KLIMENT J., HRIVNÁK R. & FERÁKOVÁ V. (2015): Red list of ferns and flowering plants of Slovakia, 5th edition (October 2014). – Biologia 70: 218–228.
- FÁBRY J. (1867): Gömör megye viránya. – In: HUNFALVY J. (ed.): Gömör és Kishont törvényesen egyesült vármegyének leírása, p. LXXIX–XCIII. – Budapest.
- FÁBRY J. (1880): Két kirándulás Turócmegyében. – Magyar Növényt. Lapok 4: 50–55.
- FERÁKOVÁ V., MAGLOCKÝ Š. & MARHOLD K. (2001): Červený zoznam papraďorastov a semenných rastlín Slovenska (December 2001). – In: BALÁŽ D., MARHOLD K. & URBAN P. (eds): Červený zoznam rastlín a živočíchov Slovenska. – Ochr. Prír. 20 (Suppl.): 48–81.
- FUTÁK J. (ed.) (1946): Slovenský herbár. Vol. 1. – Spolok sv. Vojtechu v Trnave, Trnava, 415 pp.
- FUTÁK J. (1980): Fytogeografické členenie / Phytogeographical division (1: 1 000 000). – In: MAZÚR E. (ed.): *Atlas Slovenskej socialistickej republiky*. – Slovenské pedagogické nakladatelstvo, Bratislava.

- GUO Y.-P., EHRENDORFER H. & SAMUEL R. (2004): Phylogeny and systematics of *Achillea* (Asteraceae-Anthemideae) inferred from nrITS and plastid trnL-F DNA sequences. – Taxon 53: 657–672.
- HANELT P. (2001): Mansfeld's encyclopedia of agricultural and horticultural crops. – Springer, Berlin, Heidelberg & New York, 3649 pp.
- HENDRYCH R. (1963): Ad floram dicionis oppidi Šafárikovo in Slovacia materies critica. – Biol. Práce Slov. Akad. Vied 9/6: 1–63.
- HLAVAČEK A. (1985): Flóra CHKO Štiavnické vrchy. – Ústredie štátnej ochrany prírody, Bratislava, 775 pp.
- JAROLÍMEK I., OŽAHEĽOVÁ H., BANÁSOVÁ V. & ZALIBEROVÁ M. (1999): Invázne druhy rastlín pozdĺž slovenského úseku rieky Moravy. – In: ELIÁŠ P. (ed.): Invázie a invázne organizmy II, p. 148–157. – SEKOS, Bratislava.
- JÁVORKA S. (1924–1925): Magyar flóra (Flora hungarica). – Budapest, 1307 pp.
- KANITZ A. (1863): Reliquiae Kitaibeliana. V. Kitaibelli: Iter arvense anno 1804 susceptum. – Verh. Zool.-Bot. Ges. Wien, Abh. 13: 92–107.
- KIRÁLY G. (ed.) (2007): Vörös Lista. A magyarországi edényes flóra veszélyeztetett fajai. – Sopron, 73 pp.
- KLIMENT J. & BERNÁTOVÁ D. (1996): Nesprávne a pochybné floristické údaje z Veľkej Fatry – predbežný zoznam. – Bull. Slov. Bot. Spoločn. 18: 52–61.
- KRÍCSFALUSY V. & BUDNIKOV G. (2007): Threatened vascular plants in the Ukrainian Carpathians: current status, distribution and conservation. – Thaiszia – J. Bot. 17: 11–32.
- KUBALOVÁ S. (2003): Zhodnotenie súčasného stavu vegetácie slatinných biotopov v okolí Dolného Baru (okr. Dunajská Streda). – Biosozologia 1: 44–51.
- MACLACHLAN W., GILL S., DUTKY E., BALGE R. & KLICK S. (s.a.): Production of yarrows as cut flowers. – Fact sheet 685, University of Maryland (URL: <http://www.growingforyou.com/images/Yarrow.pdf>).
- MÁJOVSKÝ J. et al. (1974): Index of chromosome numbers of Slovakian flora (Part 3). – Acta Fac. Rer. Natur. Univ. Comen. – Bot. 22: 1–20.
- MAGLOCKÝ Š. (1983): Zoznam vyhynutých, endemických a ohrozených taxónov vyšších rastlín flóry Slovenska. – Biológia (Bratislava) 38: 825–852.
- MAGLOCKÝ Š. & FERÁKOVÁ V. (1993): Red list of ferns and flowering plants (Pteridophyta and Spermatophyta) of the flora of Slovakia (the second draft). – Biológia (Bratislava) 48: 361–385.
- MARHOLD K. & HINDÁK F. (eds) (1998): Zoznam nižších a vyšších rastlín Slovenska. – Veda, Bratislava, 688 pp.
- MRÁZ P. & MIKOLÁŠ V. (1996): Regionálny červený zoznam vzácnych a ohrozených druhov cievnatých rastlín Volovských vrchov. – Bull. Slov. Bot. Spoločn. 18: 164–173.
- MRÁZ P. & MRÁZOVÁ V. (eds) (2003): 39. floristický kurz Slovenskej botanickej spoločnosti a Českej botanickej spoločnosti v Gelnici (2000). – Bull. Slov. Bot. Spoločn. 25, Suppl. 9: 1–140.
- MEUSEL H. & JÄGER E. J. (eds) (1992): Vergleichende Chorologie der zentraleuropäischen Flora. Vol. 3. – Gustav Fischer, Jena, Stuttgart & New York, 688 pp.
- MIGRA V. (1983): Floristické pomery masívu Babej hory (Oravské Beskydy), 2. časť. – Oravské Múz. 2: 44–71.
- NIKLFELD H. (1971): Bericht über die Kartierung der Flora Mitteleuropas. – Taxon 20: 545–571.
- NIKLFELD H. & SCHRATT-EHRENDORFER L. (1997): Rote Liste gefährdeter Farn- und Blütenpflanzen (Pteridophyta und Spermatophyta) Österreichs. 2. Fassung. – In: NIKLFELD H. (ed.): Rote Listen Gefährdeter Pflanzen Österreichs. 2. neu bearbeitete Auflage, p. 33–129. – Bundesministerium für Umwelt, Jugend und Familie, Graz.

- OŤAHEĽOVÁ H., BANÁSOVÁ V., JAROLÍMEK I. & ZALIBEROVÁ M. (1997): Red list of plants of the Morava river floodplain (Slovakia). – Bull. Slov. Bot. Spoločn. 19: 107–113.
- RICE A., GLICK L., ABADI S., EINHORN M., KOPELMAN N. M., SALMAN-MINKOV A., MAYZEL J., CHAY O. & MAYROSE I. (2015): The Chromosome Counts Database (CCDB) – a community resource of plant chromosome numbers. – New Phytol. 206: 19–26.
- ŠEPPER J. & STANOVÁ V. (eds) (1999): Aluválne lúky rieky Moravy – význam, obnova a manažment. – DAPHNE – Centrum pre aplikovanú ekológiu, Bratislava, 187 pp.
- ŠEFFEROVÁ STANOVÁ V. (ed.) (2015): Manažmentové modely pre údržbu, ochranu a obnovu mokraďových biotopov. – Štátnej ochrany prírody Slovenskej republiky, Banská Bystrica, 300 pp.
- ŠEFFEROVÁ STANOVÁ V., GALVÁNKOVÁ J. & RIZMAN I. (eds) (2015): Monitoring rastlín a biotopov európskeho významu v Slovenskej republike. Výsledky a hodnotenie za roky 2013–2015. – Štátnej ochrany prírody Slovenskej republiky, Banská Bystrica.
- SIMON T. (2006): A Zempléni-hegység botanikai értékei. – Fol. Hist.-Nat. Mus. Matr. 30: 407–414.
- SOMLYAY L & LÖKÖS L. (1999): Florisztikai és taxonómiai kutatások a Tornense területén. – Kitaibelia 4: 17–23.
- SZÜCS P. & BARINA Z. (2007): Az *Achillea ptarmica* L. előfordulása Komáromnál. – Fl. Pannonica 5: 194.
- ŠPÁNIKOVÁ A. (1971): Fytocenologická štúdia lúk juhozápadnej časti Košickej kotliny. – Biol. Pr. Slov. Akad. Vied 17/2: 1–103.
- ŠPÁNIKOVÁ A. (1982): Vegetácia Východoslovenskej a Záhorskej nížiny. – Acta Bot. Slov. Ser. A (Tax., Geobot.) 6: 125–291.
- ŠPÁNIKOVÁ A. (1985): Vegetačné pomery južnej časti Východoslovenskej nížiny. – Acta Bot. Slov. Ser. A (Tax., Geobot.) 8: 1–189.
- THIERS B. (2017): Index Herbariorum: A global directory of public herbaria and associated staff. – New York Botanical Garden's Virtual Herbarium, New York. <http://sweetgum.nybg.org/ih/>
- THORNTON-WOOD S. P. (2000): *Achillea*. – In: CULLEN J. et al. (eds): European Garden Flora 6: 607–612. – Cambridge University Press, Cambridge.
- TROCK D. K. (2006): *Achillea*. – In: Flora of North America Editorial Committee (eds): Flora of North America north of Mexico 19: 492–494. – Oxford University Press, New York & Oxford.
- UHERČÍKOVÁ E. (1997): *Aster novi-belgii* agg. v lužných lesoch inundácie Moravy a Dunaja. – In: ELIÁŠ P. (ed.): Invázie a invázne organizmy. pp. 129–135. – SEKOS, Bratislava.
- VIRÓK V., FARKAS R., FARKAS T., ŠUVADA R. & VOJTKÓ A. (2016). A Gömör-Tornai-karszt flórája – Enumeráció. Flóra Gemersko-turnianskeho krasu – Enumerácia. – ANP füzetek 14: 1–200 & suppl., Aggteleki Nemzeti Park Igazgatóság, Jósvafő.
- ZAJĄC A. & ZAJĄC M. (eds) (2001): Atlas rozmieszczenia roślin naczyniowych w Polsce. Distribution Atlas of Vascular Plants in Poland. – Pracownia Chorologii Komputerowej Instytutu Botaniki Uniwersytetu Jagiellońskiego, Kraków, XII + 716 pp.

## **Appendix 1. List of revised herbarium specimens, published and unpublished records**

For herbarium specimens the collector, year of collection and herbarium are given; herbarium codes follow THIERS (2017). References for published records from sources not listed in References chapter are given in an abridged form including the page of a particular *Achillea ptarmica* record. For unpublished field records the year is given, followed by the name(s) of its author(s). Records are arranged following the phytogeographical division of Slovakia by FUTÁK (1980) and assigned to the quadrants of the CEBA grid template (for its description see NIKLFELD 1971). Locality information was translated into English but in some instances place names are given in the original language in parentheses. Abbreviation: rkm – river km.

### **Plants with normal flowers**

**Pannonicum.** 2. Ipeľsko-rimavská brázda Region: **7683b.** Tomášovce ("Tamásiharasztt, Sosoni mellett, Nográg"; J. Fábry 1851 BRA). **7684c.** Fabiánka, wet meadows ("nedves, raocsáros réteken, Fábjánka", Kunszt, Magyar Növényt. Lapok 2: 27, 1878). **7584c.** Kalinovo, Slatinský stream (Hrvnák et al., Bull. Slov. Bot. Spoločn. 27: 132, 2005). – Mineral spring south-west of Kalinovo (Svobodová, Acta Fytotech. Univ. Agricult. 16: 175, 1967). – Breznička, Červeň settlement, alluvium of left tributary of Ipeľ River (Hrvnák et al. I. c.). **7584d.** Poltár, Šťavica stream, fen meadow (S. Staněk 1948 BRNM). – Zelené, Ipeľ River, hill with spot height 215 (S. Staněk 1948 BRNM). – Poltár-Zelené, gravel pits along road Zelené–Uhorské (S. David 1986 LTM). – Meadows on left side of Ipeľ River opposite to Zelené train stop (Svobodová I. c.). **3. Slovenský Kras Karst:** **7588b.** Silická Plateau, chalet Domica, wet places (F. Dvořák 1967 BRNU). – Domica, near sinkhole south-west of the cave (V. Nábělek 1936 SAV; Hendrych 1963: 10). **7389c.** Jovice, Jovické rašelinisko Nature Reserve (Rozložník & Karasová, Chránená krajinná oblast – Biosférická rezervácia Slovenský kras. Martin, 1994: 427). – Jovice, alluvium of Čremošná stream (Balátová-Tuláčková & Háberová, Tüxenia 16: 227–250, 1996). **7389a.** Krásnohorské Podhradie, Nirjéš settlement ("Nyirjes"; Geyer sec. Fábry 1867: LXXXVII). **7389b.** Krásnohorské Podhradie (Špániková 1971: 42). – Krásnohorské Podhradie, wet meadow near the Gypsy settlement (J. Hadinec et al. 1978 MP). **4. Záhorská nížina Lowland:** **7467d, 7468c.** Abrod (E. Bosáčková 1963 BRA; Bosáčková, Pr. Štúd. Čs. Ochr. Prír. 2: 51, 1970; J. Dvořák 1976 BRA; ex herb. V. Hodoval 1978 BRA; M. Peňašteková 1991 SAV; Stanová & Viceníková, Biodiverzita Abrodu – stav, zmeny, obnova. Bratislava, 2003: 104). **7567a.** Alluvium of the Morava River, rkm 35–36, below the dam (D. Vorlíčková 1993 SAV). – Morava, Gajary (J. Malý 2002 BRNU). – Gajary-Kopanica, meadow behind river embankment (Hegedűšová & Škodová, Bull. Slov. Bot. Spoločn. 26: 79, 2004). **7567c.** Alluvium of Morava River, rkm 42–43, ruderal site (D. Vorlíčková 1994 SAV). – Gajary, "V Studénkách" (S. Staněk 1945 BRNM). – Suchohrad, Karlov Dvor (V. Feráková 1964 SLO). **7467d.** Gajary, Sinferský bridge, meadow (S. Staněk 1945 BRNM). **7667a.** Jakubov, meadows from Grófsky bridge towards Feldský bridge, Šmolzie (M. Ružička 1951 SAV). **7568a.** Červený kríž, roadside Malacky–Studienka ("Hasprunka", V. Valenta 1937 BRA). – Studienka, Červený kríž gamekeeper's house, marsh on roadside towards Malacky (V. Valenta 1938 BRA). **7568b.** Malacky: Rohrbach, fen meadow Rybník (S. Staněk 1922 BRNU). – Meadow Rybník between Rohožník ("Rohrbach") and Bor villages ("Búr"; J. Bílý 1922 BRNM; S. Staněk 1922 BRNM; S. Staněk 1946 BRNM). – Meadows near Malacky and Zohor towns (J. Bílý 1922 OLM). **7568c.** Malacky, Malina stream (T. Kripelová 1972 SAV). **5. Devínska Kobyla Hills:** **7867b.** Devín, castle (V. Nábělek 1936 BRA). **6. Podunajská nížina Lowland:** **7868d.** Bratislava, Petržalka, right bank of Danube River (V. Knebllová

1951 PR). – Bratislava, Petržalka, "Staré lúky" site (F. Kvapilík 1935 OLM). **7969a.** Podunajské Biskupice, gamekeeper's house Borové Na Pieskoch, embankment of Danube River (E. Kmeťová & L. Bertová 1986 SAV). **7475c.** Solčany (s. coll. 1964 TYM). **8074c.** Meadows between towns of Kolárovo and Nové Zámky (Osvaldová & Svobodová, Floristicko-fytocenologický výskum Nitrianskeho kraja. Záverečná správa. Vysoká škola poľnohospodárska v Nitre, 1961). **8276a.** Moča (Osvaldová & Svobodová I. c.). **7. Košická kotlina Basin:** **7391d.** Meadows between Drienovec stream and Bodva River (Špániková I. c.; in 2015 not confirmed, M. Dudáš). **7392a.** Paňovce, Rudnícky stream, "Malé lúky" site (Špániková I. c.). **7492d.** Nižný Láneč ("Alsó Lánc"), wet meadow (S. Staněk 1947 BRNM). – Vyšný Láneč ("Felső Lánc"), fen meadow (S. Staněk 1947 BRNM). – Perín-Chym (S. Staněk 1947 BRNM). **7493b.** Grajčiar, alluvium of Brežnenský stream east of the hill with spot hight 192 (Špániková I. c.). **8. Východoslovenská nížina Lowland:** **7298b.** Úbrež, fen meadow (S. Staněk 1947 BRNM).

**Carpathicum.** **10. Malé Karpaty Mts.:** **7868a.** Lamač (ex herb. V. Nábělek 1936 BRA). **7569b.** Plavecké Podhradie, meadow below Vápenná hill (J. Malý 1984 BRNU). **14c.** **Kremnické vrchy Mts.:** **7280a.** Kordíky, meadows north of the village (J. Kochjarová in Benčačová & Ujházy, Floristický kurz Zvolen 1997. Zvolen, 1998: 13). **7480b.** Zvolen, bank of Hron River (Futák, Kremnické hory. Turčiansky Sv. Martin, 1943: 97). – Zvolen (Kupčok, Biol. Pr. Slov. Akad. Vied 2/9: 47, 1956). **14d. Poľana Mts.:** **7381d.** Očová, Andrášová forest, wet meadows mainly on Kollárka hill (D. Magic 1963 SAV). – Očová (J. Májovský 1970 SLO). – Očová, wet meadows (J. Májovský et al., Acta Fac. Rer. Natur. Univ. Comen. – Bot. 22: 2, 1974, 2n = 18). **7382c.** Dúbravy, gamekeeper's house Bujačie (K. Sutorý 1984 BRNM). – Dúbravy, Iviny, confluence of Hradný and Mačinová streams (Janišová et al., Bull. Slov. Bot. Spoločn., Suppl. 13: 26, 2004). **7382d.** Detva, Kostolná, Horná Chrapková Nature Reserve, wetlands and wet meadows (Janišová et al. I. c.; in 2015 not confirmed, M. Dudáš). **7482a.** Dúbravy, Hradné lúky meadows (2015 P. Potocký). – Dúbravy, depression on right bank of Hradná stream (Jasík & Dítě, Bull. Slov. Bot. Spoločn. 39/1: 75, 2017). **14e. Štiavnické vrchy Mts.:** **7579a.** Banská Štiavnica, Paradajz (Cserey 1897: 2: 26 sec. Hlavaček 1985: 35). **7579c.** Sitno (I. Klášterský 1933 PR). **7579d.** Svätý Anton, Štiavnica stream ("Antol", Cserey 1892/1893: 1: 51 sec. Hlavaček 1985: 35). **7580c.** Banský Studenec, Holý vrch, shores of the water reservoir (S. David 1985 LTM). – Holý vrch, pastures (Ružičková, Zborník I. XXI. TOP-u, Počúvadlo, 1985: 11). – Babiná, Holý vrch Nature Reserve (M. Fekiač 2010 <http://www.fotonet.sk/>, ID 51067; P. Kolárik 2013 <http://www.fotonet.sk/>, ID 98297; 2016 M. Jasík). – Banský Studenec, Gajdošovo, Bystrá valley, meadows and pastures (I. Háberová in Benčačová & Ujházy I. c.). – Babiná, Gajdošovo Nature Reserve (2016 M. Jasík). **14f. Javorie Mts.:** **7581a.** Zaježová, Struhárňa, Lipový hill, meadows (K. Šumberová & E. Uhliarová in Benčačová & Ujházy I. c.). **7681b.** Lešť, military training area (2015 P. Potocký). **7582a.** Stará Huta (2015 P. Potocký). **7582b.** Ábelová, Mojžišov hill, meadows. – Budiná, between settlements Svatošovo and Durášovci, meadow. – Budiná, Sihla, roadside (all records Hrvnák et al. I. c.). **7682b.** Polichno, Trnkošovo hill, abandoned meadows (Slezák et al., Bull. Slov. Bot. Spoločn. 32: 60, 2010). **7683a.** Praha, Vŕšok hill, abandoned meadows (Slezák et al. I. c.). **15. Slovenské rudoohorie Mts.:** **7584d.** Poltár, confluence of Uhorskiansky stream and Ipel' River (Foltínová & Miadok, Zprávy Českoslov. Bot. Společn. 9: 62, 1974). **7483b.** Detvianska Huta, settlements Čechánky-Nový svet, Nad Pálenicou, Žabica and Lučovka (2015 P. Potocký). **7484a.** Látky-Mláky, Habáňovo Nature Reserve, fen meadow (I. Turisová & E. Martincová 1995 SMBB; Hrvnák et al., Ochr. Prír. 23: 165, 2004; M. Dudáš 2015 KO). –

Mláky, fen below Bykov hill (Beracko. Master thesis, 1972). – Ďubákovo (Cvachová & Hrvnák, Chrán. Úz. Slov. 53: 8, 2002). **7485c.** Kokava nad Rimavicou-Hámor, right bank of Rimavica stream (A. Hallonová SMMB 1981). **7189d.** Zahájnice, wet meadow (2015 M. Nižňanská & P. Chromý). **7289d.** Úhorná, Hekerová hill, Krivské meadows (1995 M. Nižňanská; in 2016 not confirmed, M. Dudáš). **7190d.** Mníšek nad Hnilcom, right bank of Hnilec River, floodplain forest and wet meadows (P. Špryňar in Mráz & Mrázová Bull. Slov. Bot. Spoločn. 25, Suppl. 9, 2003: 40). **7290c.** Smolník, stream alluvium and spring site (Ľ. Halada & S. David in Mráz & Mrázová I. c.). **7290d.** Smolník, wet meadow and mires below the road Smolník–Štós (P. Špryňar in Mráz & Mrázová I. c.). – Smolník, next to the waterworks (2013 M. Nižňanská) **7292b.** Košice, below Jahodná (A. Vojtúň 1971 KO; V. Mikoláš 1999 KO; V. Mikoláš 2001 KO). – Košice, Jahodná, Kamenný Hrb hill, meadow (Šmídt, Florografické pomery územia Košického lesa. Master thesis PF UPJŠ Košice, 1973; M. Dudáš 2014 KO; M. Dudáš 2015 SAV; M. Dudáš 2016 KO). – Meadows towards Jahodná (I. Šmídt 1969 SNV; Šmídt, Zborn. Východoslov. Múz. 16: 93, 1975). – Košický forest, meadow (I. Šmídt 1972 SNV). **7292d.** Košice, Mlynky, Vrbica stream (I. Šmídt 2000 KO). – Košice, streamside ("Kassa", Z. Siroki 1942 BP). – Košice ("Kassa"; L. de Thaisz 1908 BRA). **16. Muránska planina Plain:** **7286c.** Muráň (Hazslinszky, Éjszaki Magyarhon viránya, Kassa, 1864: 243). **18. Stredné Pohornádie Mts.:** **7091d.** Kluknava, Štefanská Huta, Záhorie valley, streamside (B. Trávníček in Mráz & Mrázová I. c.). **19. Slanské vrchy Mts.:** **7295d.** Forest meadows near the road Košice–Sečovce (K. Domin 1919 ined.). – Dargov, wet meadow (2015 A. Šimková & M. Balla). **22. Nízke Tatry Mts.:** **7081d.** Liptovská Lužná ("Luzsna"; G. Lengyel 1928 BP). **24. Pieniny Mts.:** **6689a.** Stráňany (V. Grulich in Mártonfi, Flóra okresu Stará Ľubovňa. Košice & Stará Ľubovňa, 1992: 37). **25. Turčianska kotlina Basin:** **7078d.** Polieriecka valley in Turiec ("polerjekai volgybe", Fábry, Mag. Növenyi Lapok 4: 54, 1880). **6880d.** Krpelany, channel of Váh River, bank of an oxbow (Hrvnák & Kochjarová, Bull. Slov. Bot. Spoločn. 30: 274, 2008). **26b. Spišské kotliny Basins:** **6986b.** Štrba, alluvium of Červená voda stream (2016 M. Jasík). **7090b.** Dreveník (J. Šmarda 1957 TNP). **6987b.** Poprad (J. Jedlička 1937 GM). **28. Západné Beskydy Mts.:** **6577b.** Klokočov, settlement Hrubý Buk (E. Hettenbergerová 2004 BRNU). **6680a.** Nová Bystrica, settlement Šudovci, left bank of stream, pasture (K. Sutory 1975 BRNM). **6482b.** Oravská Polhora, Borsučia valley, gamekeeper's house Borsučie (V. Migra 1976 SLO). **6482d.** Gamekeeper's house Roveň (Migra, Master thesis, 1977; Migra 1983: 45). **29. Spišské vrchy Mts.:** **6690a.** Hraničné, Eliášovka stream (J. Sádlo in Mártonfi (ed.) I. c.). **6790a.** Jakubany, Jakubianka stream (Zaliberová & Májeková, Bull. Slov. Bot. Spoločn. 36: 104, 2013). **30c. Nízke Beskydy Mts.:** **6995d.** Valkov, Suchý stream (K. Domin 1921 ined.). **31. Bukovské vrchy Mts.:** **68100c.** Ruské (J. Májovský 1981 SLO; V. Mikoláš 1994 MOP). – Ruské, wet meadows towards Veľká Poľana settlement (Ľ. Dostál 1985 HUM; Dostál, Zborn. Východoslov. Múz. 26: 29, 1985). – Pod Ruským Nature Reserve, wet meadows (Dostál, Zborn. Východoslov. Múz. 27: 37, 1986; J. Hadač 1991 HUM; M. Dudáš 2015 KO).

#### Specimens and records with imprecise locality information

**14c. Kremnické vrchy Mts./14d. Poľana Mts.:** Near Banská Bystrica ("Ad Neosolinum"; Kitaibel sec. Kanitz, Verh. Zool.-Bot. Ges. Wien, Abh. 13: 97, 1863). **23c. Belianske Tatry Mts.:** Tatranská kotlina (J. Dostál 1952 PRC). – Belianske Tatry (J. Hadač 1955 MP). **30c. Nízke Beskydy Mts.:** Nízke Beskydy (double-flowered plants, Ľ. Dostál 1980 MPS).

### **Double-flowered and semi-double-flowered plants**

**Carpaticum.** 14b. Vtáčnik Mts.: 7477b. Ostrý Grúň (K. Sutorý 1977 BRNM). **14d.** Poľana Mts./**15. Slovenské rudohorie Mts.**: 7383a+b. Sihla, Kamenistá valley, 2 sites (2016 M. Jasík). **15. Slovenské rudohorie Mts.**: 7190d. Mníšek nad Hnilcom, pastures, garden escape (V. Grulich in Mráz & Mrázová I. c.). **7290b.** Mníšek nad Hnilcom, ruderal sites (waste ground), escaped plants (J. Kochjarová in Mráz & Mrázová I. c.). **17. Slovenský raj Paradise:** **7188a.** Stratená (E. Mitske 1968 SNV). **21c. Veľká Fatra Mts.**: 7079c. Blatnica, Gaderská valley, next to castle (Fábry, Magyar Növenyt. Lapok 4: 51, 1880). **22. Nízke Tatry Mts.**: 7180d. Špania Dolina, streamside east of the village (2015 A. Schmotzer & J. Táborská). **7185c.** Závadka nad Hronom, waste ground (Kochjarová et al., Reussia 1, Suppl. 1: 104, 2004; R. Hrvnák & D. Blanár 2001 SAV). **23c. Belianske Tatry Mts.**: **6787a.** Ždiar, Monkova cottage (K. Domin 1937 PRC). – Ždiar, between Pod Príslopom pass and Strednica pass (V. Mikoláš 2006 W). **25. Turčianska kotlina Basin:** **7179a.** Háj, wetland Konopiská, garden escape (Bernátová et al., Bull. Slov. Bot. Spoločn. 39/2: 205, 2017). **28. Západné Beskydy Mts.**: **6678b.** Krásno nad Kysucou, Sýkorovci settlement, roadside, garden escape (M. Eliášová 2013 NI). **6482c.** Sihelné, on heap of soil, gravel and ash, probably garden escape (Medvecká et al., Thaiszia 19: 126, 2009). **29. Spišské vrchy Mts.**: **6788c.** Lendak (K. Domin 1935 ined.). **6689b.** Litmanová, Veľký Lipník stream, garden escape (M. Dudáš 2015 KO). **31. Bukovské vrchy Mts.**: **68100c.** Ruské, former village (V. Mikoláš 1994 KO). – Ruské, Ruské pass, below big curve (M. Valachovič 1999 SAV).

### **Cultivated plants**

**6. Podunajská nížina Lowland:** **7676c.** Arboretum Mlyňany (F. Nábělek 1956 SAV). **18. Stredné Pohornádie Mts.**: 7192a. Ružín, Ružínka (V. Mikoláš 1997 MOP).

### **Doubtful records**

**6. Podunajská nížina Lowland** **7968b.** Jarovce, island in Danube River, gravel bank (Jurko, Pôdne ekologické pomery a lesné spoločenstvá Podunajskej nížiny. Bratislava, 1958: 219). **22. Nízke Tatry Mts.** Liptovské hole, Dereše (Sekera 1969 SNV) – probably a labelling mistake.

Received: June 13<sup>th</sup> 2017  
Revised: November 6<sup>th</sup> 2017  
Accepted: November 8<sup>th</sup> 2017