

Communication

Revision of the distribution of *Ranunculus illyricus* in Slovakia after four decades

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Received: 1 February 2024. Accepted: 19 April 2024. Published online: 6 June 2024.

Abstract

Pariláková M., Miháliková T., Dudáš M., 2024: Revision of the distribution of *Ranunculus illyricus* in Slovakia after four decades. – *Botanica*, 30(0): 81–90. <https://doi.org/10.35513/Botlit.2024.2.4>

Ranunculus illyricus is a typical xerothermic plant. The main part of its northern distribution area lies in the territory of Slovakia. Based on an intensive field study and the revision of herbarium specimens in central European herbaria, we prepared an updated distribution map of *Ranunculus illyricus* in Slovakia. The species was recorded in Slovakia in 16 phytogeographical districts situated in the area of the Pannonian and nine in the area of the Carpathian flora, respectively. The species is continuously widespread in southern parts of the country; towards the east, the number of populations significantly decreases, but the populations are often numerous. Based on the distributional data, the inclusion of *Ranunculus illyricus* into the near threatened (NT) category in the current Red List of Flowering Plants in Slovakia is correct.

Keywords: Central Europe, near threatened species, Ranunculaceae, xerothermic species.

INTRODUCTION

With the expansion in quantity and different types of biodiversity data being collected, there is a need to find ways to combine these sources to provide summaries of species' potential and realised distributions in space and time (Isaac et al., 2020). Regarding biodiversity, attention is frequently focused on specific taxonomic groups or species of conservation concern, e.g. red-listed or alien species.

The genus *Ranunculus* L. is cosmopolitan and the largest member of the family *Ranunculaceae* Juss. It comprises almost 600 species in temperate to arc-

tic zones (Tamura, 1995). Thirty-six species are reported from the territory of Slovakia (Futák, 1982), of which 21 species are listed in the current Red List (Eliáš et al., 2015).

Ranunculus illyricus L. (Ranunculaceae, subgen. *Ranunculastrum* (DC.) Spach., sect. *Xiphocoma* (Stev.) Ovcz., *Grumosa* group) is a typical xerothermic species. Within the threat categories (IUCN, 2001), it is classified as near threatened in Slovakia (NT; Eliáš et al., 2015). For example, it is classified as highly endangered in the Czech Republic (C2b; Grulich, 2012), protected but not endangered in Hungary (Király, 2007) and critically endangered in

Poland (CR; Mirek et al., 2006). Its distribution in Slovakia was published 40 years ago for the last time (Futák, 1982), and at present, several records from further geographical regions have been found.

This research is a continuation of a more comprehensive study aimed at revising the distribution of selected threatened *Ranunculus* species in Slovakia (Dítě et al., 2021; Eliáš et al., 2021; Dudáš et al., 2023). The main aim of this research was to collect all available records on *Ranunculus illyricus* and to update its overall distribution in Slovakia.

MATERIALS AND METHODS

A revision of herbarium specimens in the Central European public herbaria (BP, BRA, BRNM, BRNU, DE, EGR, HLO, HNTS, HUM, KO, LTM, MMI, MOP, MPS, NI, OLM, PMK, PR, PRC, RBM, SAV, SLO, SNV, TM, VSM, ZAM, ZV) and the private herbarium of Richard Hrivnák, accompanied by intensive field research, was carried out in the years 2018–2023. The herbarium acronyms follow Thiers (2023), and small local museum collections were unified according to Vozárová and Sutory (2001). Floristic records were also obtained from the JACQ – Virtual herbaria database (www.jacq.org), published literature sources (www.fotonet.sk) and relevant unpublished works or manuscripts (mainly stored at the Institute of Botany, Plant Science and Biodiversity Centre, Slovak Academy of Sciences, Bratislava, Slovakia). All these data sources were used to prepare the distribution map of the species in the programme ArcGis, version 9.2. All historical and recent records were arranged according to the phytogeographical affiliation proposed by Futák (1984) and assigned to the grid cells of the Central European Flora Mapping grid template (Niklfeld, 1971; Jasičová & Zahradníková, 1976). Nomenclature of plants and higher syntaxa follows Marhold et al. (2007) and Mucina et al. (2016), respectively.

A list of individual localities taken from herbarium specimens includes the collector's name, the year of collection and the herbarium acronym in parentheses. References for published records are given in the abbreviated form, i.e. they comprise the publication's author, journal abbreviation and volume, page with *Ranunculus illyricus* record and year of publication. For unpublished field records, the year of finding is

followed by the name(s) of the author(s). Locality notes were translated, with a few exceptions where historical names of localities are given in their original form, indicated by parentheses (see Appendix).

RESULTS AND DISCUSSION

Distribution

Altogether, we revised over 325 herbarium specimens (excluding duplicates) and collected many published and unpublished records unsupported by herbarium specimens (see Appendix). *Ranunculus illyricus* was recorded in Slovakia in 16 phytogeographical districts (of 31 in total). Of those, seven are situated in the area of the Pannonian flora (*Pannonicum*), eight in the area of the West-Carpathian flora (*Carpaticum occidentale*) and a single one in the East-Carpathian flora (*Carpaticum orientale*). As shown on the distribution map (Fig. 1), the species is coherently widespread in southern parts of the country.

As Futák (1982) has mentioned, the species reaches the northern limit of its range in Slovakia. Based on isolated localities in Bohemia (Křisa, 1988) in Moravia in the Bílé Karpaty Mts (Jongepier & Jongepierová, 2004), in Małopolska Upland in southern Poland (Dembicz & Kozub, 2015) and Sweden (Jonsell, 2001), it can be stated that a part of the northern limit of the natural distribution area of the species lies in Slovakia. The northern limit of its range in the territory of Slovakia is formed approximately by the line territorial administrative towns Skalica–Hlohovec–Nitra (Mt. Žibrica)–Hronský Beňadik–Levice–Dudince–Modrý Kameň with isolated occurrences in Hajnáčka village, area of the Slovak Karst (Zádiel), the Zemplínske vrchy Mts and single locality in the Vihorlat Mts (forest-steppe Mt. Senderov and Recreation centre Hôrka) and Brekov Castle Hill (cf. Futák, 1982). In Hungary, the situation is similar; the species is widespread in the hills of northwestern and northern parts of the territory, and towards the east, the number of localities decreases noticeably (Bartha et al., 2015).

The first map of distribution in Slovakia has been published by Hendrych & Chrtek (1964: 44; map 21). It shows four demarcated regions – the Záhorská Lowland, the southeastern part of the Danubian Lowland with the adjacent western part of the Southern Slovak

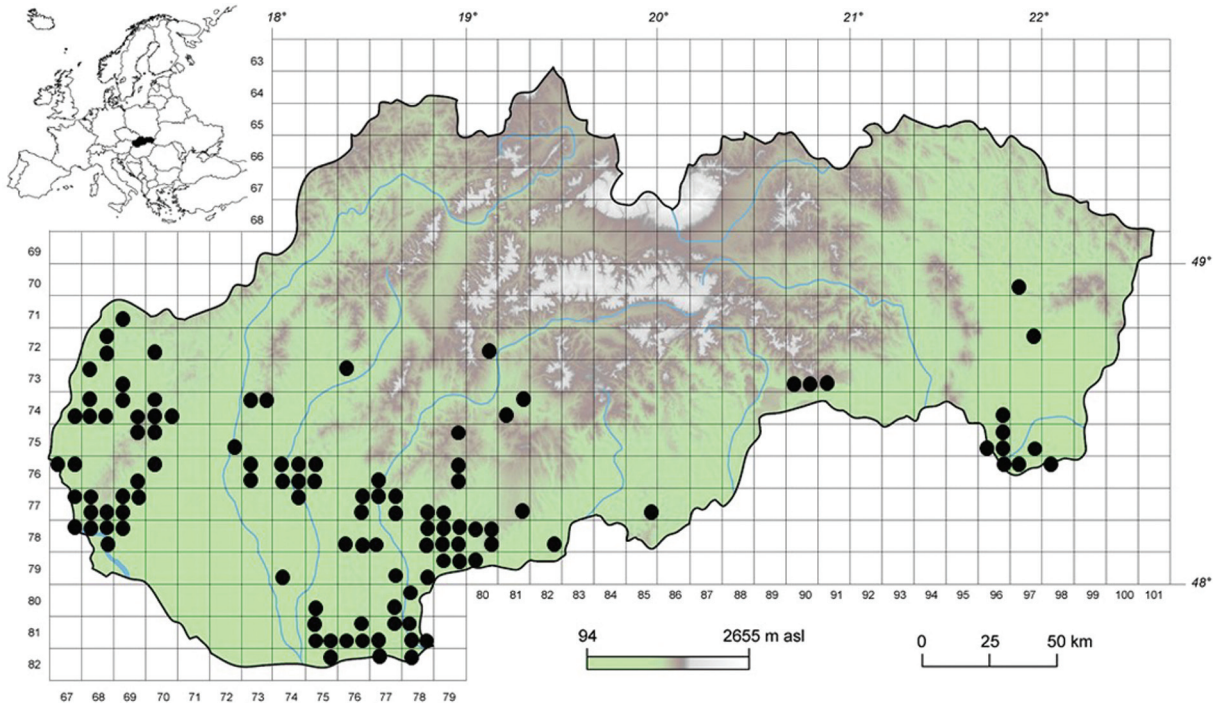


Fig. 1. An updated distribution map of *Ranunculus illyricus* in Slovakia.

Basin, Slovak Karst and southern part of the Eastern Slovak Lowland. Later, Futák (1982: 172; map 26) published the updated map with included supplements from Považský Inovec Mts, several localities from southern Slovakia and the Slovenské stredohorie Mts and the isolated single occurrence near the village of Hajnáčka in the southern part of the territory. Numerous populations were recorded in southwestern Slovakia, as shown on the updated map (Fig. 1). The number of localities decreases towards the east, and many of these populations are numerous in terms of number of individuals.

Although there are not many locations in eastern Slovakia, they are often rich in the number of individuals, although they may not bloom yearly. Holuby (1920) has noticed that the species remains in the vegetative phase when spring is dry and produces only basal leaves. We According to Jonsell (2001) in very dry sites with a dense sward only basal leaves are produced, and they soon die off. Achenes develop regularly, but the species is also spread by means of the tuber-like roots, both locally and over a distance. We also observed this fact in several localities in eastern Slovakia after a dry spring, e.g. in the Zemné Hradisko Nature Reserve, around Ladmovce village and in the Recreation Centre Hôrka.

The reason is the annual developmental cycle of *Ranunculus illyricus*, with particular emphasis on producing underground tuber clusters that serve as a vegetative propagation. Kocot et al. (2022) have indicated that the efficiency of vegetative propagation can be higher than that of generative propagation. Moreover, vegetatively reproduced individuals bloomed in the first year after emergence, whereas the first plant of generative origin was observed to bloom only after three years.

Habitats

Ranunculus illyricus (Fig. 2) requires dry soils within acidic and basic substrates such as acidic sands on the Záhorská Lowland, basic sands on the Eastern Slovak Lowland, volcanic (e.g. the vicinity of Hajnáčka village) and calcareous substrates (e.g. Devínska Kobyla Mts) in southern and southeastern parts of the territory of Slovakia. It grows in lowlands and hilly areas to the altitude ca. 500 m above sea level in grassy (xerothermic) steppe vegetation, steppe-oak forests and on overgrowing sandy dunes in the alliances *Festucion valesiaca* Klika 1931, *Festucion pseudodalmatica* (Klika 1955) Michalko



Fig. 2. *Ranunculus illyricus* in a dry grassland. Photo by M. Dudáš.

1957, *Asplenio-Festucetum glaucae* Zólyomi 1936, *Festucion vaginatae* Rapaics ex Soó 1929, less frequently also in pastures, in forests of the class *Robinietaea* Jurko ex Hadač et Sofron 1980 and on margins of abandoned vineyards. The species grows in the association *Ranunculo illyrici-Festucetum valesiacae* Klika 1931 on the Devínska Kobyla Mts (Miškovic & Dúbravcová, 2004).

Threats

The species is listed in regional Red Books, e.g. in Poland (Kaźmierczakowa & Towpasz, 2014) as well as in Red Lists, for example, in the Czech Republic (Grulich, 2012), Hungary (Király, 2007) and Poland (Mirek et al., 2006). In Slovakia, it is classified as near

threatened (NT, Eliáš et al., 2015). This category is correct, considering the number of locations, the state of the populations, and the long-term trend.

ACKNOWLEDGEMENTS

We thank Lenka Mártonfiová for the proofreading of the English text.

Author contribution. MD conceived the ideas, writing and overall design. MD, TM and MP collected and analysed distribution data. TM created the map and co-edited the manuscript. All authors read and approved the final manuscript.

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APPENDIX

List of *Ranunculus illyricus* localities

For herbarium specimens, the collector, year of collection and herbarium acronym are given; herbarium codes follow Thiers (2023). References for published records from sources not listed in the References chapter are provided in an abridged form, including the page of a particular *Ranunculus illyricus* 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 (1984) and assigned to the grid cells 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.

PANNONICUM

Matricum. 1. Burda Mts.: Kamenica nad Hronom, pastures at the railway station (Futák 1947 SLO; Žertová 1952 PR; Futák 1961 SAV; Šmiták 1988 BRNM). – Kamenica nad Hronom, hillsides and range over village (Holubičková & Kropáčová, Veg. pom. okr. Štúrovo, p. 50–52, 1958; Kmeťová & Peniašteková 1983 SAV; Dudáš 2023 KO). – Kamenica nad Hronom, Skala, 280 m (Domin 1929 ined.; Smejkal 1962 BRNU; Dudáš 2023 ined.). – Kováčovské hills, andesite rocks under stone-pit near road, Hill 397, forest edge (Klika 1935 PR). – Kováčovské hills, Burda, forest and slopes (Domin, Zborn Mus. v Bratislave 23: 215, 1931; Klika, Beih. B. C. 58: 448, 1938; Opluštilová 1946 SLO; Bagin 2015 www.fotonet.sk, ID 123519). – Kováčov, railway stop, dry meadows, 200 m (s. coll. 1956 SAV). – Kováčov, valley of Kováčovský potok, 130–200 m (Domin 1929 PRC; Domin, l. c., 1931; Klášterský & M. Deyl –1933 PR; Dudáš 2023 ined.). – Kováčovské hills, Kováčov, hunting house, grassy place (Zahradníková & Porubská 1966 SAV). – from Kováčov towards Chľaba along the railway, 135 m (Šmarda 1948 BRNM). – Chľaba [Helemba], steppe (Skřivánek 1948 BRNM; Staněk 1951 BRNM).

Common data: Burda (Krist 1933 BRNU; Klika 1937 PR; Horváthová 1991 BRA). – Kováčovské hills (Pulchart 1934 BRNM; Hrabětová 1950 BRNU; Grebenščikov 1955 SAV; Rozkošná 1967 BRNM; Fabianková 1973 SAV; Klokner 1974 PMK; Hodoval 1981 BRA).

2. Ipeľsko-rimavská brázda Region: Pavlová [Garampáld], hill 288,8 near Hlboký majer, oak forest (Barina 2003 BP). – Zalaba (Kristóf 1967, 1968 LTM). – Ipeľský Sokolec, vineyards, 160 m (Švec 1964 LTM). – Santovka, road ditch (Valentíková 1970 LTM). – Demandice, slopes between vineyards, 170 m (Švec 1965 LTM). – Šahy, [settlement] Mačkáš. – Dolné Semerovce. – Dudince, travertine nearby a spa (all data Chrtek, Acta Univ. Carol. Biol. 1: 28, 1961; s. coll. 1950 BRA). – Hontianske Moravce, steppe slopes over vineyards, Jeruzalem, 170 m (Švec 1964 LTM). – Vyškovce nad Ipľom, sandy dunes with White agate, 118–130 m (David 1984 LTM). – Dudince, spa Rímske kúpele, travertine, 150 m (Smetanová 2019 LTM). – Dudince, steppe, 170 m (Greštiak 1963 ZV). – Slatina (Kristóf 1964 LTM). – Šahy, Merovce, pasture, 230 m (Šourková & Chrtek 1970 PRC). – Ďarmotské kopce, settlement Nový Svet, *Festucetum valesiacae* (Májovský 1962 SLO). – Ďarmotské kopce, Hegyfarok towards Kétiho hora (261) (Domin 1929 ined.). – Ďarmotské kopce, Hill 228 (Krist 1934 BRNU). – road to Šahy (Májovský 1951 SLO). – Šahy, Vinica, dry meadows over vineyards, 300 m (Futák 1952 SLO; Švec 1948, 1963 LTM). – Šahy, Kalvária, steppe slope, 220 m (Švec 1947, 1963 LTM). – Šahy, road to Handáš, 160 m (Švec 1964 LTM). – Šahy, Hradisko, grassy places, 300 m (Chrtek, Křísa & Slavíková 1966 PRC). – Horné Turovce, steppe slopes west and south from stone-pit, Hill 211, 170–200 m (Chrtek, Preslia 30: 80, 1958; Manica 1962 ZV). – Šahy, the slope on the eastern part towards Tešmák (Švec, 1948 LTM; Chrtek, l. c., 1958). – Šahy, NE, Kerek hill. – settlement Lipovec. – meadows at forest road between Hill 271 and settlement Pusty Olvar. – Hill Močar (all Chrtek, l. c. 1958). – Tešmak, cemetery, dune, 135 m (Eliáš jun. 2018 NI; Eliáš jun. in Eliáš jun. (ed.) Bull. Slov. Bot. Spoločn. 40/2: 183, 2018). – Tešmak, Kopasz hill, steppe slope between vineyards, 170 m (Švec 1964 LTM). – Tešmak, Holý vrch, east from hill 324 (Drieňok), xerophilic grassy vegetation (Ptáčková 1993 OLM). – Tešmak, Veľký vrch (282 m), margin of oak forest, *Inulo oculus-christi-Festucetum pseudodalmaticae*,

280 m (David 1993 LTM; Urbanová 1993 ZAM). – Tešmak, east of hill Drienok, volcanic, 324 m (Vozárová 1993 BRA). – Plášťovce, Lomoc, rocky steppe, 270 m (Švec 1955 LTM). – Plášťovce, Biela skala, southern slopes (excursion 1955 SLO). – Plášťovce, hill Terno, top (Eliáš jun. 2015 NI). – Plášťovce, behind hunting cottage (excursion 1955 SLO). – Plášťovce, forest-steppe, 150–190 m (Hrivnák 2013 herb. Hrivnák; Smetanová 2015 LTM). – Plášťovce, Šípka (Weber 1932 BRNM; Eliáš jun. 2013 NI). – Plášťovce, Bende, volcanic steppe, 250–300 m (Chrtek, l. c., 1958; Smetanová 2015 LTM). – Plášťovce, Čongrád, 332 m, forest steppe on andesite, 250–332 m (Smetanová 2001 LTM). – Plášťovce, Čierny hrad, 290 m (Eliáš jun. 2012 NI). – Plášťovce, Brezovo, 368 m, forest steppe on andesite, 200–340 m (Smetanová 202012 LTM). – Plášťovce, Tulipánka, forest steppe on andesite, 200–270 m (Smetanová 2012 LTM). – Plášťovce, Veľký Lišinec, rocky slopes, 270 m (Švec 1954 LTM). – Plášťovce, over vineyards, 300 m (Vozárová 1994 BRA). – Plášťovce (Májovský & Jurko, *Biológia* 11: 133, 1956). – Vinica (Nekyje), hillside over vineyards (Futák 1951 unpublished). – Ipeľské Šahy, Rykynčice, hill Nad hájom, andesite, *Festucetum valesiaca* and *F. pseudodalmatica* (Domin 1932 PRC; Domin & Sillinger 1932 PRC). – Modrý Kameň, Hill 406 (Hendrych 1961 PRC; Hendrych & Chrtek, *Acta Univ. Carol. Biol.* 1: 43, 1964). – Kováčovce, hill Hradište (Hrivnák 1991 herb. Hrivnák). – Hajnáčka, 280 m (Hendrych, *Acta Univ. Carol.* 2: 163, 1967).

Common data: Šahovské kopce (Novák, *Ochrana* 2: 310, 1954).

3. Slovak Karst: Hrhov (Šuvada 2005 www.fotonet.sk, ID 10829). – Dvorníky-Včeláre, Hradisko (334 m), NE part, grassland, 237 m (Dúbravková-Micháľková et al., *Hacquetia* 7/2: 139, 2008; Dudáš & Pariřáková 2022 ined.). – Turňa nad Bodvou, karst over the castle Turniansky hrad (Májovský & Michalko 1950 SLO). – Turňa nad Bodvou, Turniansky hradný vrch [Torna, Várhegy] (Hulják 1907 BP; J. Dostál 1933 PRC; Klika 1937 PR; Siroki 1943 DE; Suza, *Práce mor. akad. věd, přír.* 22/6: 202, 1950; J. Dvořák 1977 BRA; Sitášová 1988 VSM; Urvichiarová 1988 RBM). – Zádielský kameň, forest (Kláštorský & M. Deyl 1933 PR). – Dvorníky, Nagy Várád (Klika 1937 PR).

Eupannonicum. 4. Záhorská Lowland: Skalica, Šibenica, steppe (Sillinger 1927 PR, PRC). – Sobotište (Bránik 1872 BP). – Holíč [Holics], Cunin [Czunin] (Krzisch, *Oester. Bot. Zeit.* 7: 31, 1853). – Moravské Pole, between Čáry and Kúty (Domin 1931 PRC). – Gbely (Weber 1930 BRA). – Kúty, sands in a pine forest north of the railway station (Domin 1931 ined.). – between Hasprunka and Veľké Leváre (Krippel 1958 SAV). – between Moravský Svätý Ján and Veľké Leváre (Degen et al., *Magy. Bot. Lapok* 22: 83, 1923; Valenta 1936 BRA). – Veľké Leváre, Abrod, meadows 2.5 km north of the village (Č. Deyl 1979 OLM). – Závod, dry grassland near the railway station, 150 m (Grulich 1983 MMI; Lustyk 1992 BRNM). – Borský Mikuláš [Borský Sv. Mikuláš], railway embankment (Klika 1931 PR). – Lakšárska Nová Ves, the meadow in the forest north of the village, 210 m (Ružička 1954 SAV). – Lakšárska Nová Ves, towards Bratislava (Kmeťová & Gajarský 1968 SAV). – Studienka, northern part, abandoned place (Májeková & Zaliberová, *Bull. Slov. Bot. Spoločn.* 28: 92, 2006). – Stupava, sands (Futák 1948 ined.; Gajarský 1961 SAV). – Devínske jazero (Degen et al., *Magy. Bot. Lapok* 22: 83, 1923). – Malacky, Uhorská Ves (Matz ex Knapp, *Oester. Bot. Z.* 14: 305, 1864). – Devínske Jazero, old dam of the Morava River (Zaliberová 1992 BRA).

5. Devínska Kobyla Mts.: Devín, oak-hornbeam forest (Májovský & Krippel 1959 SLO). – Devín [Devényi], behind cemetery (Mergl 1903 SAV; Ptačovský 1929 SAV). – Devín, limestone (F.A. Novák 1922 PRC). – Devínska Nová Ves (Holuby 1857 SLO; V. Nábělek 1936 SAV; Skřivánek 1948 BRA; Kmeťová 1972 SAV). – Devínska Kobyla, U Duba, towards Červený kríž along yellow tourist path (Vartíková 1978 SLO). – Dúbravská Hlavica, Hadie údolie and PP Devínska lesostep (Ondrášek & Valenta, *Bull. Slov. Bot. Spoločn.* 21: 87, 1999). – Štokeravská vápenka, hillside (Ondrášek 1981 SLO). – Devínska Kobyla, NE hillside (Záborský 1975 SLO). – Devínska Kobyla, Fialkové údolie (Feráková 1977 SLO). – Šibeničník (Martinec 1931 PR). – Devínska Kobyla, hilltop, 514 m (Baeumler, *Verh. Z. B. Ges. Wien* 59: 315, 1909; J. Dvořák 1947 BRNU; Skřivánek 1948 OLM). – Devínska Kobyla, rocks under castle (Novák, *Preslia* 2: 72, 1922). – Karlova Ves, beginning of Líšcie údolie near Juventa, meadow, 180 m (Ondrášek in Dítě (ed.), *Bull. Slov. Bot. Spoločn.* 28: 280, 2006).

Common data: Devínska Kobyla, forest and steppe, 400 - 514 m (Kláštorský & M. Deyl 1935 PR; Krist 1937 BRNU; s. coll. 1946 NI; Dvořák 1947 BRNM; Knebllová 1948 PRC; Skřivánek 1948 BRNM; Kaleta, *Acta Rer. Natur. Mus. Nat. Slov.*, Bratislava 14/1: 41–55, 1968; Hodoval 1971 BRA; Kmeťová 1972 SAV; Č. Deyl 1978

OLM; Feráková, Acta Fac. Rer. Natur. Univ. Bot. 35: 28, 1988; Suda 1995 PRC).

6. Danubian Lowland: Bratislava, over the railway station [in limes ad stationem ferroviae] (Skalický 1964 PRC; Skalický & Belicová Zpr. Českoslov. Bot. Spol. 1/2: 121, 1966). – Bratislava, Hlboká cesta (Richter, Correspond. Ver. Nat. Presb. 2: 105, 1863). – Bratislava, Dynamitka [Dynamitfabrik], near the road behind the tunnel towards Šinweg (Mergl 1907 SAV; Ptačovský 1923 SAV). – field road on the eastern hillside from Vajnorská cesta to railway station Dynamitka (Kvapilík 1948 OLM). – Grinava [Grynava], field (Holuby 1910 PR, 1910, 1919 PRC; Zigmundík 1913 BRA). – Svätý Jur, Šúr [Szt. György] (Szénert 1879, 1883 BP; Weber 1932 OLM; Nábělek 1941 SAV; Futák & Turianská 1942 SLO; Berta 1956 SLO; Dočolomanský 1956 BRA; Viktorin 1961 BRA). – Vajnory, fields near Šurský kanál (Feráková 1971 SLO). – Svätý Jur, Šúr, Panónsky háj (Ptačovský 1938 SAV). – Sokolníky, Malý Bahorec, northern slope, 180 m (Bleho 1980 BRNU). – Sasinkovo, grove Dureš (Ješko 1967 BRA, HLO). – Rumanová, felled site opposite to Rišňovce (Ješko 1964 BRA, HLO; Feráková et al., Acta Fac. Rer. natur. Univ. Comen., ser. bot. 16: 65, 1970). – Lužianky, road ditch (Ďurková 2001 NI). – Nitra, Kalvária, assoc. *Fest. vall.-Ran. Ill.*, 200 m (Knapp, Oesterr. Bot. Z. 29: 69, 1879; Suza 1928 BRNU; Suza et al., Sborn. Prír. Odb. Muz. Brat. 109, 1931; Švec, 1946 LTM; Šutovský s. dato NI; Vojtuň 1964 KO; Klokner 1974 PMK; Möllerová 1978 PRC; Svobodová 1980 NI). – Nitra, monastery (Vlácky 1925 PRC; Klika 1927 PR). – Pohranice pri Nitre, dry pastures (Grebenščikov 1954 SAV; Mokráň 2017 www.fotonet.sk, ID 137848). – Chotín (Osvačilová 1960 NI; s. coll. 2022 PRC). – Chotín, cemetery (Klokner 1965 PMK). – Chotín, Chotínske piesky Nature reserve (Sluková 1979 OLM). – Hurbanovo, 115 m (Körössyová 1963 BRA). – Veľká Kamenná Pustatina east from Hurbanovo (Chrtek et al., Preslia 44: 62, 1972). – Šrobárová, slopes NW (Chrtek et al., l. c.). – Bajč, *Robinia* forest, 117 m (Osvačilová 1954 NI). – Palárikovo, saline site, 160 m (Mencl 1952 PRC). – Svätý Peter, *Robinia* forest, 180 m (Osvačilová 1954 NI). – Marcelová, dry grassland north from the village, sand (Klokner 1970 PMK; Klokner, Acta Rer. Natur. Mus. Nat. Slov. Bratislava 20: 75, 1974). – Modrany, Nový les, forest, 210 m (Chrtek, Křisa & Slavíková 1970 PRC; Chrtek et al., l. c.). – Modrany, Chrbát, forest (Klokner 1970 PMK; Klokner, l. c., 1974). – Búč, Jurský Chlm, W part (Eliáš jun. 2013 NI). – Čenkov [Czenkov], sands (Krist 1938 BRNU; Skřivánek 1948, 1950 BRNM; Černoch 1950 BRNM; D. Novák 1950 BRNM; Šmarda 1950 BRNM; Kavka 1950 BRA; Májovský 1955 SLO; Pokluda 1959 BRNM). – Čenkovský les, 105 - 115 m (Hlavaček 1957 SAV; Chrtek, Křisa & Slavíková 1970 PRC). – Štúrovo [Párkán] (Roubal 1931 SLO). – Nová Vieska (Popovič 1960 SAV). – Gbelce, Drieňová hora (Klokner 1970 PMK; Skalická 1976 PRC). – Gbelce, pasture on loess south of the village, 200 m (Futák 1953 SAV; Osvačilová 1955 NI). – Mochovce (Suza, Práce mor. přír. spol. 17/11: 5, 1945). – Levice, Baračka, SW, oak forest (Futák 1952 ined.). – Kozárovce, Zani hill, andesite, forest, 300 m (Kláštorský & M. Deyl 1933 PR). – Kozárovská brána site (Májovský & Jurko, Acta Fac. Rerum Nat. Univ. Comen., Bot. 2/7: 288, 1958). – Kozárovce (Suza, Práce mor. přír. spol. 17/11: 5, 1945; Kupčok, Biol. práce 2/9: 9, 1956). – Kozárovce, Slovenská brána (Futák, Prír. zborn 2: 30, 1947). – Čifáre, Podkamenie, rocky xerothermic slope, oak forest with *Festuca pseudodalmatica*, andesite, 205 m (David 1983, 1985 LTM; David & Vozárová, Biológia 45/5: 44, 1990). – Beša, mown meadows, 156–180 m (Smetanová 2002 LTM; Fehér & Končeková in Dítě (ed.), Bull. Slov. Bot. Spoločn. 28: 275, 2006). – Beša, xerotherm hills over football pitch (Eliáš jun. 2017 NI). – Bardoňovo, SE, pasture on the edge of oak forest (Futák, Sborn. Pr. Ochr. Prír. Záp.-slov. Kraja, p. 46, 1962). – Rybník nad Hronom, meadow (Suza, Práce mor. přír. spol. 17/11: 5, 1945; Ižoldová 1974 LTM). – Malé Kozmálovce, Pipiška, xerotherm on the top, andesite, 238 m (David 1984 LTM; David & Vozárová, l. c., 1990). – Kozmálovské pahorky, Dobroca, eastern tophill slope in White agate forest, 320 m (David 1982 LTM). – Kozmálovské vřšky, Skala, 237 m (Betinová 2004 LTM). – Podlužany, xerothermic slope near church and cemetery, andesite, 190–210 m (Smetanová 2008 LTM). – Levice, Kusá hora, 200 m (Kupčok 1904 BP; Futák, Čsl. bot. listy 1: 69, 1948; Červenák 1974 LTM; David 1982, 1989 LTM; Nižňanská 1993 SNV). – Tekovské Lužany, dry meadow (Futák 1952 SLO). – Vozokany nad Hronom (Nižňanská 1993 SNV). – Tekovská Nová Ves (Suza, Práce mor. přír. spol. 17/11: 5, 1945). – Bíňa, Lapó hill, 200 m (Krist 1935 BRNU). – Kamenín, left side of river Hron, dry meadow over Órdöngös völgy, south, 280 m (Futák 1958 SAV). – Kamenín, Dolné lúky [Alsó rétek], saline site (Jasenák 1976 LTM). – Kamenín, saline site Kamenínske slanisko (Tomášiková 2012, 2015 www.fotonet.sk, ID 91446, 123503). – Kamenín [Kamendín], 125 m (Valenta 1931 BRA).

Common data: Nitra (Garaj 1968 NI). – Presburg (Schneller 1858 BRA).

8. Eastern Slovak Lowland: Zemplínska Širava, Hôrka, hillock over Rybárska koliba, 132 m (Dudáš & Májevková 2021 KO, SAV). – Novosad, hillock east from village, field road, 110 m (Dudáš 2016 KO; Dudáš in Eliáš jun (ed.), Bull. Slov. Bot. Spoločn. 38/2: 295, 2016). – Zemplínske Jastrabie, Cintorínska street, edge of the cemetery, 117 m, introduced during construction earthworks with limestone (Dudáš 2022 KO). – Černochoch, slopes over village, 250 m (J. Dvořák 1964 BRNU; Futák & Magic 1964 SAV). – Černochovská hegyalja (= hill area), Borša, stepposis declibus (Domin & Sillinger 1932 PRC). – Borša, waterworks (Májovský 1959 ined.). – Ladmovce, Dlhá hora [Hosszú hegy] (Margittai, Bot. Köz. 30/1–4: 52, 1933; Kiss, Bot. Köz. 36/5–6: 214, 1939). – Ladmovce, Baba, limestone, 160 m (Futák 1953 ined.; Černoch 1963 BRNM). – Ladmovce, Šomoš, northern slope, limestone, 200 m (Záborský 1959 ined.; Dudáš 2016 ined.). – Ladmovce, xerothermic vegetation along the road between the cemetery and river port, 102 m (Dudáš 2022 KO). – Viničky, a hill in the field towards hill Baba (Futák 1964 ined.). – Slovenské Nové Mesto, a plateau between Borsz hegy (268) and Hegyköz (194 m), dry meadows (Domin 1932 ined.). – Somotor, hill Vřšok (Májovský 1957 ined.). – Nature Reserve Tajba, the road from a roadhouse (Malý 1987 BRNU). – Veľký Kamenec [V. Kövesd], Tarbucka [Tarbuczka], sands, 140–250 m (Margittai, Sborn. Přír. Kl. Košic 2: 89, 1935; M. Deyl 1938 PR; Černoch 1963 BRNM; Vojtuň 1975 KO; Osbornová 1985 PRC; Malý 1998, 2003 BRNU; Zlacká in Dítě (ed.), Bull. Slov. Bot. Spoločn. 28: 283, 2006; Dudáš, Pariřáková & Kerbčárová 2022 KO). – Veľký Kamenec, 160 m (Zlacká in Dítě (ed.), l. c.). – Veľký Horeš (L. Dostál s. dato MPS). – Malý Horeš, Horešské lúky, SKUEV0030, sandy dunes (Sitášová, Nat. Carpat. 57: 35, 2016). – Malý Horeš, Nature reserve Poniklecová lúčka, 130 m (Zlacká in Dítě (ed.), l. c.). – Svätušie [Plešany], Kráľovské kopce hills, andesite, White agate forest, 150 m (Hadinec & Křisa 1981 PRC). – Kráľovský Chlmec, field road towards Holý vrch near Plešany, 140 m (Černoch 1963 BRNM). – Kráľovský Chlmec [Királyhelmece], White agate forest, cemetery and sandy pastures (Margittai, Bot. Köz. 26/5–6: 94, 1929; Margittai 1927 BP, BRNU, PRC; Klášterský 1936 PR, BP). – Kráľovský Chlmec, Hill 222, White agate forest, 150–200 m, andesite (Hadinec & Křisa 1981 PRC). – Pribeník [Perbeník] (Májovský & Michalko 1950 SLO; Nábělek 1950 SAV).

CARPATICUM OCCIDENTALE

***Praecarpaticum*. 10. Malé Karpaty Mts.:** Bratislava, edge of cereal field under Krpáč, NE from Dúbravka (Feráková 1973 SLO). – Dúbravka, Dlhé Diely (Vartíková 1977 SLO). – forests south from Dúbravka (Bertová 1965 BRA). – Bratislava, Podháj street, Klanec hill (Hodálová et al., Bull. Slov. Bot. Spoločn. 21: 95, 1999). – between Karlova Ves and Lamač (Valenta 1933 BRA). – Lamač (Holuby 1857 SLO; Schidlay 1936 SAV; Horváthová 1962 BRA). – Rača [Račišdorf], Kriegerov rybník (Mikeš 1935 PRC). – Rača, [Ratschdorf], pasture (Lumnitzer, Fl. Pos. 230, 1791). – Rača [Račišdorf], towards Vajnorsky airport (Mikeš, Kvet. okr. Bratis. p. 114, 1938). – between Limbach and Pezinok (Šípošová & Peniašteková 1986 SAV). – Pezinok [Bazinium], meadows and pastures (Holuby 1914, 1916, 1919 PRC, 1914 BRA, 1918 BRNM, PR; Holuby, Magy. Bot. Lapok 15: 228, 1916; Holuby, Přír. 14: 77, 1919; excursion 1955 SLO). – Pezinok [St. Georgium], grassland, villa Pálffyán (Holuby 1915 PRC). – Kučišdorf, abandoned vineyards, Široká (Holuby, Přír. 14: 78, 1919). – Pezinok, Taubingerova lúka meadow (Holuby, Přír. 14: 78, 1919). – Plavecký Mikuláš, dry grasslands (Ptačovský 1928 SAV). – between Plavecký Mikuláš and Ostrý Kameň (Mikeš, Kvet. okr. Bratislavy, p. 82, 1938). – Jablonica, pine-oak forest Skripík (Nevole, Práce mor. přír. spol. 6/5: 111, 1931; Nevole 1930 BRNU). – Plavecké Podhradie, rocks over cemetery (Eliáš jun. 2016 NI). – Plavecké Podhradie (Skřivánek 1951 BRNM). – Smolenice [Szmolány], dry meadows, 250–300 m (Scheffer 1922 BP, BRNU; Nevole 1928 BRNU; Mikeš, Kvet. okr. Bratis., p. 46, 1938). – between Smolenice– Buková [Biksard] and Rozbehy (Suza, Práce mor. přír. spol., 2/2: 4, 1948). – Rozbehy, Korlátka (Nevole, Práce mor. přír. spol. 6/5: 108, 1931). – Brezovské kopce hills near Dubová (Novák, Ochrana 2: 352, 1954). – Lošonec near Smolenice (Jasičová 1961 SAV). – Trstínsko–Bukovské kopce hills, Holý vrch hill, dolomite (Medovič, Sborn. Slov. Nár. Múz., přír. vedy 5: 81, 1959).

Common data: Malé Karpaty, common (Černý 1924 BRA).

11. Považský Inovec Mts.: Považský Inovec Mts, Moravany, valley Striebornica (Vavro 1981 HLO). – Hlohovec, Soroš, bus stop (Feráková 1966 SLO). – Hlohovec, ŠPR Sedlisko Reserve, 280 m (Feráková et al., Ochr.

přír. 9: 139, 1966; Sutorý 1986 BRNM). – Nitrianska Blatnica, Biela skala, rocky rib with forest steppe, ca 500 m (Králik in Dítě (ed.) Bull. Slov. Bot. Spoločn. 28: 278, 2006).

12. Tribeč Mts.: Between Nitra and Dražovce, roadside (Vlach, Věda přír. 10: 273, 1929). – Hill 220 at road Nitra–Dražovce (Suza et al., Sborn. Přír. Odb. Muz. Brat. 112, 1931). – Pleška (Vlach, l. c.). – Lupka (Osvačilová 1955 NI; Plesník, Zborn. Pedag. fak. Nitra, přír. vedy 24: 19, 1976). – Nitra, Mt. Plieška (Kvapilík 1929 OLM; Suza, Věst. Král. Čes. Společ. N. 22: 22, 1939). – Zobor, hilltop (Klika 1929 PR; Kvapilík 1929 OLM; M. Deyl 1935 PR; Futák 1943 SLO; Dvořák 1948 BRNU; Nábělek & Hejná 1949 SLO; Danko 1954 NI; Hlaváčková 1954 NI; Gábriš s. dato NI; Pechočiak 1954 NI; Uňatinský 1954 NI; Nedasová 1964 BRA; Lizoň 1964 BRA; Michálek 1964 BRA; Zábojník 2018 www.fotonet.sk, ID 145166; Villaris 2009 www.nahuby.sk, ID 152837). – Zobor, Zoborská lesostep, 480 m (Osvačilová 1961 PRC; Plesník l. c.; Duchoň 2010 www.fotonet.sk, ID 54779). – Zobor, limestone rocky slope over Cave of Saint Svorad, *Festucetum valesiacaе*, 530 m (Vlach, l. c.; Futák 1965 SAV). – Nitrianske Hrnčiarovce, S part of forest (Ďurica 1954 NI). – Žibrica, western rocky ridge, 500 m (Suza et al., Sborn. Přír. Odb. Muz. Brat. 113, 1931; Zahradníková 1968 SAV; Plesník l. c.). – Žirany, Vápeník, rocky steppe on the eastern slope, 500 m (Čáp 1986 BRNM; Bagin 2019 www.fotonet.sk, ID 158022).

Common data: Nitra, Zoborské vrchy Mts (Vavro 1974 HLO; Klokner 1974 PMK).

13. Strážovské vrchy Mts.: Skačany, 320 m (Kližanová 1964 BRA).

14d. Poľana Mts.: Urpín (Tmák 1870 SLO).

14e. Štiavnické vrchy Mts.: Psiare (Suza, Práce mor. přír. spol. 17/11: 5, 1945). – Psiare, Krivín, the xerothermic slope on the left bank of the River Hron, 300 m (David 1985 LTM). – Kamenný Chotár, site Ladia, forest-steppe and xerothermic hillsides, frequent, 240 – 290 m, (Králik in Eliáš (ed.), Bull. Slov. Bot. Spoločn. 45/2: 202, 2023). – Banská Štiavnica, Teplá, Ferdinandova štôľňa, forest margin (Hlavaček 1936 PRC). – Banská Štiavnica, meadow towards Teplá, 650 m (Švec 1947 LTM). – Teplá, Mikulášova šachta (Kupčok, Biol. Pr. SAV 2/9: 9, 1956; Hlavaček, Fl. CHKO Štiav. vrchy, p. 415, 1985). – Teplá (Suza, Práce mor. přír. spol. 17/11: 5, 1945). – Krnišov, pod Teplíčkami, on reefs (Kmet' 1876 BRA). – Súdovce, the valley of Súdovský potok, xerothermic slopes in the northern part of the valley, 280 - 320 m (Králik in Eliáš jun. (ed.) Bull. Slov. Bot. Spoločn. 41/2: 242, 2019). – Banská Štiavnica (Hlavaček, Fl. CHKO Štiav. vrchy, p. 415, 1985). – Prenčov (Hlavaček, Fl. CHKO Štiav. vrchy, p. 415, 1985).

14f. Javorie Mts.: Dobrá Niva, Kráľová (Neuhäuslová-Novotná Acta Rer. Natur. Mus. Nat. Slov., Bratislava 12/1: 90, 1966). – Vígľaš, rocks over village (Májovský & Jurko, Acta Fac. Rerum Nat. Univ. Comen., Bot. 2/7: 288, 1958).

20. Vihorlat Mts.: Vinné, Senderov, steppe slopes, andesite (Staněk 1950 BRNM).

Beschidicum orientale. 30c. Nízke Beskydy hill area: Brekov, 200 m (Ambrová 1964 BRA).

Common data (not mapped): Bratislava [Pressburg, Pešburg, Poszony, Požoň, Poson] (Resely s. dato BP; Bothár s. dato NI; Černý s. dato PRC; Ptačovský s. dato PRC; Holuby 1855 BP; Schneller 1858 PR; 1868 BRA; Wiesbauer 1864 BRNU; Bäumlér 1904 BP). – Bratislava, sunny places (Frantová, Přír. sborn. 2: 176, 1947). – Bratislava, Kalvarianberger (Tauscher 1869 BP). – Ziegelöfen (Endlicher, Fl. Pos. p. 411, 1830). – Nitra [Nitruer comitat, Sobotyit] (Bránik 1875 BP). – Zvolen (Randušková 1963 BRA).

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