

## ***Ventanata dubia* (Leers) Coss. (Poaceae) in Slovakia: Distribution, habitat affinities and threats**

**Pavol Eliáš Jr.**

Institute of Plant and Environmental Sciences, Slovak University of Agriculture, A. Hlinku 2, SK-94976  
Nitra, Slovakia, pavol.elias.jun@gmail.com

---

Eliáš P. Jr. (2022): *Ventanata dubia* (Leers) Coss. (Poaceae) in Slovakia: Distribution, habitat affinities and threats. – Thaiszia – J. Bot. 32 (1): 001-015.

*Abstract:* This paper presents data on the distribution of *Ventanata dubia* in Slovakia. I recorded the species in 145 quadrants of the Central European mapping grid. The majority of these records occurred in the Pannonian region, especially in the phytogeographical districts of Podunajská nížina, Burda and Ipeľsko-rimavská brázda Region of southern Slovakia. In the Carpathian region, the species has a scattered to rare distribution pattern and is only found in the area associated with the pre-Carpathian flora, especially in the Štiavnické vrchy Mountains. *Ventanata dubia* most often occupies dry grassland habitats, but also frequently occurs in human-modified habitats (quarries, unpaved roads through agricultural fields and grasslands, vineyards). It rarely occurs on forest edges or in open forests. The grass was recorded on loessal, saline, quartzite, and limestone soils, but most often on shallow soils with high basalt (volcanic) rock content. At present, it is among the less threatened plant species of the Slovak flora (NT).

*Keywords:* central Europe, grasses, mapping, occurrence.

---

### **Introduction**

Annual grasses typically exhibit r-selected life-history strategies which allow them to tolerate grazing in natural habitats better compared to perennial K-selected grass species (Díaz et al. 2006). Annual grass species can also more quickly colonize newly created open habitats, often associated with more recent (secondary) range

expansion (Oka 1983; da Silveira Pontes et al. 2015; Király & Hohla 2015; Mesterházy et al. 2021). After being introduced into a new region, such plant species often become invasive; causing serious problems such as reducing native species biodiversity, altered community composition and structure, ecosystem modification, and altered disturbance (e.g., fire) regimes (Linder et al. 2018; Kerns et al. 2020).

*Ventenata dubia* (Leers) Coss. (syn. *Avena dubia* Leers) is an example of the kind of annual grass described above. The species is widely distributed across Eurasia, from North Africa (Algeria, Morocco); southwestern and southern Europe (Portugal, Spain, France, Italy); across North-western (Belgium, now extinct), Central (Germany, Austria, Czech Republic, Slovakia, Hungary), South-eastern (former Yugoslavia, Albania, Bulgaria, Romania, Moldova, Greece) and Eastern Europe (Ukraine, South European Russia); to the Caucasus Region (Azerbaijan, Armenia, Georgia), Turkey, Kazakhstan and Iran (Prokudin et al. 1977; Hamzeh'ee et al. 2008; Denchev & Denchev 2018; Clayton et al. 2018; Alomran et al. 2019; POWO 2021). *Ventenata dubia* has spread secondarily in Europe as well as in East Asia. In Europe, it was found as a casual alien in Great Britain (Copping 1987), Denmark (Skipper et al. 2020), Switzerland (Conert 1994), Poland (Frey & Pazsko 1998) and Finland (Kalleinen 2002 as cited in Lampinen & Laiho 2021), and was recently introduced into Japan (Koba et al. 2005). However, *V. dubia* has become invasive with severe ecological consequences and high economic costs in western North America, where the grass is raising concerns as it rapidly spreads into multiple native plant communities in the United States and Canada (Novak et al. 2015; Alomran et al. 2019; Pervukhina-Smith et al. 2020; Ridder et al. 2022).

The recent occurrences and geographic distribution of *V. dubia* in Slovakia is not well known. Dostál & Červenka (1992) mentioned its presence in lowlands; the lower Carpathian Mountains (Biele Kapaty Mts., Tribeč Mts.), the area surrounding of Piešťany and Nové Mesto nad Váhom (W Slovakia), and the upper portion of the Nitra River. The lack of occurrence and distribution data for this grass means that it is considered to be very rare in Slovakia (Feráková et al. 2001). Unfortunately, recent research has not explicitly assessed the status of this species (Biela 2010; Turis et al. 2014). This study was conducted to fill this knowledge gap concerning the distribution of *V. dubia* in Slovakia. In addition, these data can be used to characterize the range of habitats the grass occurs in and to assess threats (conservation status) of the species.

## Material and Methods

The distribution of *V. dubia* in Slovakia was ascertained using revised herbarium specimens from 20 herbarium collections (BP, BRA, BRNM, BRNU, herbarium of the Protected Landscape Area Ponitrie, KO, LTM, MMI, NI, OLM, PMK, PRC, PR, SAV, SLO, SMBB, VT, W, ZAM, ZV and the USDA-ARS EBCL herbarium), published manuscripts (using the floristic data file of the Department of Taxonomy of Higher Plants of the Botanical Institute of the Slovak Academy of Sciences in Bratislava), and the webpage Virtual Herbaria (<https://herbarium.univie.ac.at/database/collections.htm>).

Acronyms of herbaria are given according to the work of Thiers (2022+); and in the case of regional herbaria, according to Vozárová & Sutorý (2001). A list of localities is provided as an appendix to this paper. In the appendix, citations up to the year 1952 are presented according to Futák & Domin (1960), research published after 1952 are presented in an abbreviated form. Data for a single locality are arranged chronologically. The current names of municipalities are given according to Majtán (1998); the original names on herbarium labels that are different from the above are given in brackets. The map was processed in Corel Draw using the map grid described by Niklfeld (1971).

The nomenclature of higher plant taxa coincides with that of Marhold et al. (2007). Herbarium and literature data are arranged according to phytogeographical districts published by Futák (1984). Data on habitat type and elevation were obtained from herbarium labels, and publications/manuscript notes, respectively. The risk assessment of *V. dubia* in Slovakia is based on IUCN rules (2012). A 24-year interval was used to present the data.

## Results and Discussion

### Distribution

*Ventenata dubia* was recorded in 145 quadrants of the Central European mapping network (Fig. 1). These records indicate that the centre of the distribution of the grass in Slovakia occurs in the eastern part of the Podunajská nížina lowland, in the Burda hills district, and in the western part of the Ipel'sko-rimavská brázda region. Similar to other thermophilic plant species, *V. dubia* probably spread northward into Slovakia from southern refugia, through the Danube Valley, during times of favourable climate following the last glacial period (Krippel 1986). This dispersal pathway was reported for *Scorzonera purpurea*, which migrated from South-eastern Europe, along the Danube River Valley, to the west and northwest (Meindl et al. 2016). *Ventenata dubia* spread northward along the tributaries of the Danube, especially the rivers Ipel' and Hron, and now occurs in the areas adjacent to the lower Carpathian Mountains. Within those regions, *V. dubia* was common in the Štiavnické vrchy Mountains: it was recorded in 16 quadrants. The species apparently spread into this region, from the south and the west, where it found suitable habitats and climatic conditions (especially southern rocky slopes with sparse vegetation cover). Hlavaček (1985) reported *V. dubia* from various localities in this region, and the results presented in the current study confirm this previous finding.

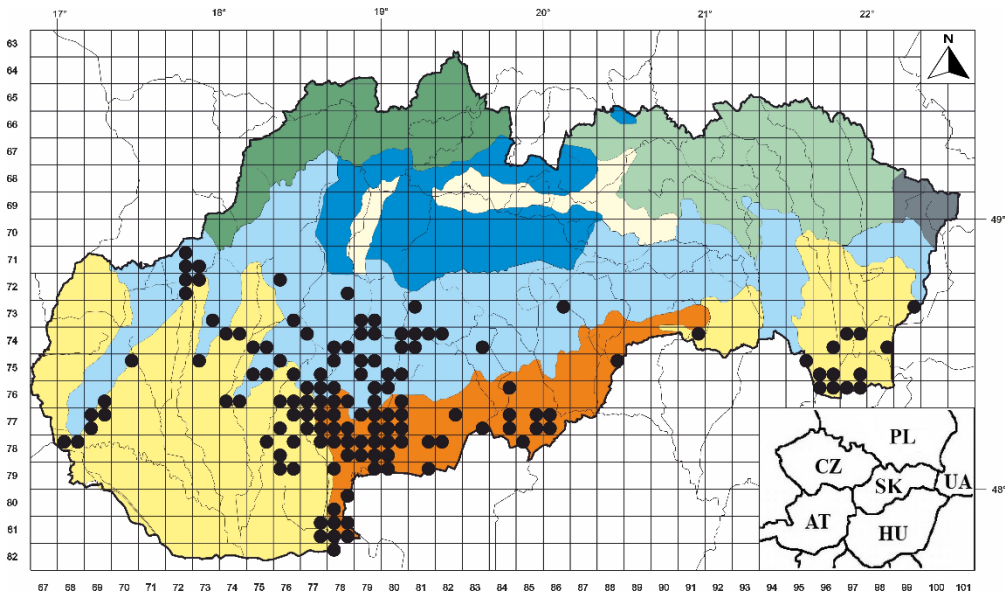
*Ventenata dubia* apparently spread from the Hron River Valley to neighbouring phytogeographical units (Pohronský Inovec Mts., Vtáčnik Mts., Kremnické vrchy Mts., Poľana Mts.), but it occurs only rarely in these units and may not persist in some localities in this region (see Futák 1943). Similarly, *V. dubia* may have spread northward in eastern Slovakia along the Bodrog and Tisa Rivers.

*Ventenata dubia* most often inhabits lowlands and low-elevation hilly areas (approximately 70% of all localities), and it was found only rarely at higher elevations (> 500 m) (Fig. 2). In Slovakia, the highest elevation the grass was previously reported

in 650 m, at Banská Štiavnica, Kremenisko, in the Štiavnické vrchy Mountains (J. Švec 1939 LTM). Cserey (1897) reported it from the same region, from the Paradajz Hill at an elevation of approximately 900 m, but this report is now considered doubtful (Hlavaček 1985). Sutorý (1996) described a similar elevational distribution for *V. dubia* in the Czech Republic; likewise, the maximum elevation of the grass in the Czech Republic was reported to be 600 m above sea level.

### Habitats

During the examination of herbarium sheets, as well as assessment of the relevant literature, I also recorded the habitat types *V. dubia*. Although about one-third of the *V. dubia* occurrence data did not contain such information, other data supplemented by field research allow me to conclude that this species is most closely associated with dry grassland habitats (Fig. 3) mostly of the *Festuco-Brometea* class Br.-Bl. et Tx. 1944 (Škodová et al. 2014). In addition, it is relatively common in human-modified habitats such as quarries, roads through agricultural fields, and vineyards (~27% of occurrences). It rarely occurs on forest edges or in open forests (~14% of occurrences). These results largely confirm previously reported habitat type data for *V. dubia*, both in its native range and areas into which the grass has more recently expanded its range (Prokudin et al. 1977; Dostál & Červenka 1992; Conert 1994; Crins 2007; Novak et al. 2015; Alomran et al. 2019; Pervukhina-Smith et al. 2020). The presence of *V. dubia* in forests and forest edges indicates that the species is not only a heliophyte, but it is also a helioscophyte. These properties also explain the successful and rapid spread of the grass into certain forest communities in western North America (Tortorelli et al. 2020).



**Fig. 1** The distribution of *Ventenata dubia* in Slovakia. The yellow and orange areas represent the thermophilic phytogeographical districts of the Pannonian region and the other colours represent the mountain areas of the Carpathian region (Futák 1984).

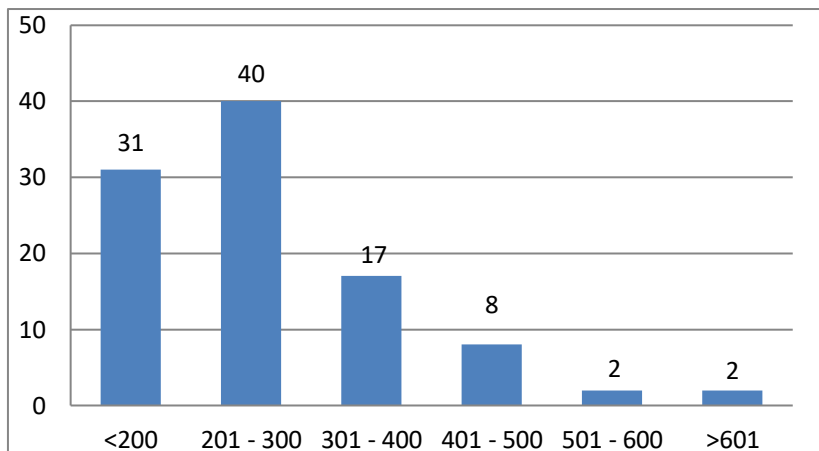
Data analysis and field research also reveals that the species occupies various soil substrates. *Ventenata dubia* was reported on loessal, saline, quartzite, and limestone soils, but most often on shallow soils with high basalt (volcanic) rock content. The occurrence of the species on salt steppes in SW and SE Slovakia is a new finding of this study. *Ventenata dubia* is considered to be a glycophyte in Central Europe – a species that does not tolerate soils with high salt content (Jurko 1990; Borhidi 1995; Chytrý et al. 2018). However, a similar result was reported for *V. dubia* in Hungary, where the species was reported from several localities in the Hortobágy region (SE Hungary) (Lukács et al. 2017; Deák et al. 2019). The Hortobágy region is the largest area containing inland saline vegetation in Central Europe (Molnár & Borhidi 2003; Eliáš et al. 2021). The grass cannot be considered a true halophyte, but it does appear to be a salt-tolerant plant which occurs mainly in non-saline soils.

### Threat

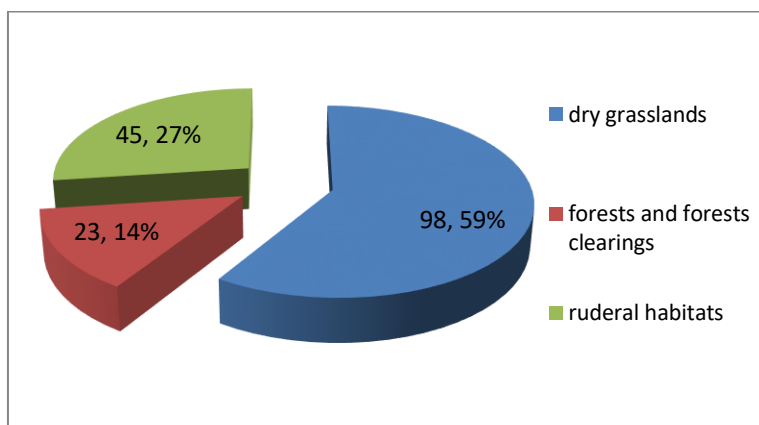
The results of this study reveal that *V. dubia* is a relatively common species of the Slovak flora. The number of reported localities increased over time, and the maximum number of reports occurred in the 1951 – 1975 time period (Fig. 4). At this time, intensive floristic research was conducted in southern Slovakia (Chrtek 1961; Hendrych & Chrtek 1964; Neuhäuslová-Novotná & Neuhäusl 1966; Smejkal & Vicherek 1970), and many specimens were deposited in herbaria. There was a noticeable decline in reports of the species following the 1951 – 1975 time period. This is most likely explained by a decline in research interest in the southern part of Slovakia. This lack of data led to the inclusion of *V. dubia* on the Red List, in the EN (endangered) category, in the 1990s (Feráková et al. 2001). However, when attention was focused on this region once again (David 1988, 1994; David & Vozárová 1990; Biela 2010), the number of localities within which the grass was reported increased greatly. Because of this recent data, the status of *V. dubia* was changed to the NT category (near threatened) for both the Carpathian Region (Turis et al. 2014) and for all of Slovakia (Eliáš et al. 2015). This change in status is also confirmed by this study. If the number of localities with *V. dubia* from the last two time periods are totalled, the presence of the grass has been confirmed in 63 new sites, since 1991. These 63 sites are almost equal to the number of localities in which the species was reported during the 1951 – 1975 time period (72 localities).

However, it is also true that several sites where the grass has been reported have disappeared and some populations have become extirpated. For example, the species apparently no longer occurs in the Biele Karpaty Mountains (Mertanová & Smatanová 2006; Škodová 2007), where J. L. Holuby listed several localities in the vicinity of Nové Mesto nad Váhom (Holuby 1888). Based on the results of this study, the threat status of the species in Slovakia is accurate, and does not need to be changed.

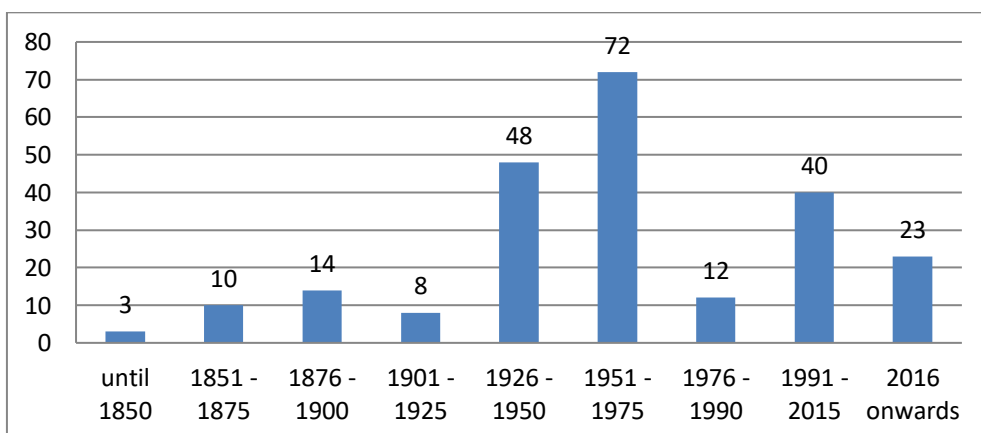
The situation is similar for other countries of Central and Southern Europe. In Hungary, *V. dubia* is relatively common, especially in the northern and eastern parts



**Fig. 2** The distribution of *Ventena dubia* in Slovakia at various elevations. The x-axis represents elevation intervals in metres, and the y-axis represents the percent of localities for each elevation interval.



**Fig. 3** Main habitat types of *Ventenata dubia* in Slovakia.



**Fig. 4** The number of *Ventenata dubia* localities reported across different time periods in Slovakia.

of the country (Bartha et al. 2015). The grass is not classified as a rare species in Hungary (Király 2007). It is not classified as an endangered species in Italy either (Orsenigo et al. 2021). The species was placed in the "G+ = lower risk" category in Germany (Bundesamt für Naturschutz 2018; Uebeler et al. 2008). *Ventenata dubia* is also regionally rare in Romania (Dragulescu 1996), but the species was not included in the Red Book for Romania (Dihoru & Negrean 2009). On the other hand, the grass is considered very rare in some countries - it is classified as critically endangered in Austria (Niklfeld & Schratt-Ehrendorfer 1999), Croatia (Nikolić & Topić 2004), and the Czech Republic (Grulich 2012). Taken together, the information presented here concerning the status of *V. dubia* in Slovakia points to the importance of comprehensive and current plant surveys to accurately assess the conservation status of this grass in its native range.

## Acknowledgement

I am indebted to the Curators of the herbaria that were visited; they provided the opportunity to examine the specimens used in this study. Special thanks to René Sforza (Montpellier, France) for excerpting data from the USDA-ARS EBCL herbarium, Pavol Mered'a jun. (Bratislava, Slovakia) for specimens delivery from the SAV herbarium and Stephen J. Novak (Boise, Idaho, USA) for valuable comments and language revision of the earlier version of the manuscript. The study was funded by the Slovak Grant Agency for Science VEGA (grant project No. 1/0359/22).

## References

- Alomran M., Newcombe G. & Prather T. (2019): *Ventenata dubia's* native range and consideration of plant pathogens for biological control. – *Invasive Plant Sci. Manag.* 12(4): 242–245. doi:10.1017/inp.2019.24
- Bartha D., Király G., Schmidt D., Tiborc 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.
- Biela M. (2010): Nálezy chránených a ohrozených druhov cievnatých rastlín v okolí Novej Dediny. – *Acta Mus. Tekovensis (Levice)* 8: 7–29.
- Borhidi A. (1995): Social behaviour types, the naturalness and relative indicator values of the higher plants in the Hungarian flora. – *Acta Bot. Hung.* 39: 97–181.
- Bundesamt für Naturschutz (eds.) (2018): *Rote Liste gefährdeter Tiere, Pflanzen und Pilze Deutschlands. Band 7: Pflanzen*. – Bundesamt für Naturschutz, Bonn.
- Clayton W. D., Govaerts R., Harman K. T., Williamson H. & Vorontsova M. (2018): *Ventenata dubia* (Leers) Coss. & Durieu. – In: *World checklist of Poaceae*. – Royal Botanic Gardens, Kew. [http://wcsp.science.kew.org/namedetail.do?name\\_id=449601](http://wcsp.science.kew.org/namedetail.do?name_id=449601) [Accessed 26 October 2021].
- Conert H. J. (1994): Gramineae. — In: Conert H. J., Hamann U., Schultze-Motel W. & Wagenitz G. (eds): *G. Hegi, Illustrierte Flora von Mitteleuropa, 3rd edn., 1(3)*, p. 1–560. – Blackwell & Parey, Hamburg & Berlin.
- Copping A. (1987): Aliens and adventives. *Ventenata dubia* (Leers) FW Schultz in Grays Chalk Quarry, Essex, 1986. – *BSBI News* 45: 24–25.

- Crins W. J. (2007). *Ventenata*. – In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 22+ vols. Vol. 24, p. 684. – New York and Oxford.
- Cserey A. (1897): Selmeczbánya vidéke növénytani tekintetben - Selmeczbánya monográfiája, 3. füzet, 121 pp.
- da Silveira Pontes, L., Maire, V., Schellberg, J. et al. (2015): Grass strategies and grassland community responses to environmental drivers: a review. – *Agron. Sustain. Dev.* 35, 1297–1318. <https://doi.org/10.1007/s13593-015-0314-1>
- David S. (1988): Květena Kusé hory (Kurta hegy) u Levic. – *Vlastivedný spravodaj Tekovského múzea v Leviciach* 12: 29–38.
- David S. (2004): Vegetační poměry NPR Horšianská dolina (Ipeľská pahorkatina, JZ Slovensko). – *Acta Mus. Tekovensis (Levice)* 5: 11–27.
- David S. & Vozárová M. (1990): Výskyt ohrozených a vzácných druhů vyšších rostlin flóry Slovenska v okolí Mochovců. – *Biológia* 45: 441–450.
- Deák B., Török P., Tóthmérész B., Radócz Sz., Lukács K. & Valkó O. (2019): A közép-tiszavidéki halmok flórakutatásának új eredményei. – *Kitaibelia* 24: 94–105.
- Denchev T. T. & Denchev C. M. (2018): Two new smut fungi on *Ventenata* (Poaceae): *Tilletia elizabethae* from Slovakia and *T. ventenatae* from Turkey. – *Willdenowia* 48(2): 177–183. <https://doi.org/10.3372/wi.48.48201>
- Díaz S., Lavorel S., McIntyre S., Falczuk V., Casanoves F., Milchunas D. G., Skarpe C., Rusch G., Sternberg M., Noy-Meir I., Landsberg J., Zhang W., Clark H. & Campbell B. D. (2006): Plant trait responses to grazing – a global synthesis. – *Glob. Chang. Biol.* 12: 1–29. doi:10.1111/j.1365-2486.2006.01288.x
- Dihoru Ghe. & Negrean G. (2009): Cartea rosie a plantelor vasculare din Romania. – Editura Academiei Romane, Bucuresti, 630 pp.
- Dostál J. & Červenka M. (1992): Velký klíč na určovanie vyšších rastlín II. – SPN, Bratislava. 1567 pp.
- Dragulescu C. (1996): Die Rote Liste der Kormophyten im Hermannstädter Kreis (Siebenbürgen) – *Stapfia* 45: 171–180.
- 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. <https://doi.org/10.1515/biolog-2015-0018>
- Eliáš P. jun., Dítě D. & Dítě Z. (2021): Halophytic Vegetation in the Pannonian Basin: Origin, Syntaxonomy, Threat, and Conservation. – In: Grigore M. N. (ed.): *Handbook of Halophytes: From Molecules to Ecosystems towards Biosaline Agriculture*, p. 287–324. – Springer International Publishing, Cham.
- Feráková V., Maglocký Š. & Marhold K. (2001): Červený zoznam papraďorastov a semenných rastlín Slovenska (december 2001). – *Ochr. Prír., Banská Bystrica*, 20 (Suppl.): 48–81.
- Futák J. (1943): Kremnické hory (štúdia geobotanicko-floristická). – Matica Slovenská, Turčiansky Sv. Martin, 112 pp.
- Futák J. (1984): Fytogeografické členenie Slovenska. – In: Bertová, L. (ed.): *Flóra Slovenska*. IV/1, p. 418–419. – Veda, Bratislava.
- Futák J. & Domin K. (1960): Bibliografia k flóre ČSR do r. 1952. – Vyd. Slov. Akad. Vied, Bratislava, 883 pp.
- Frey L. & Paszko B. (1998): *Ventenata dubia* (Poaceae) – a rare ephemerophyte in Poland. – *Fragm. Florist. Geobot. Pol.* 5: 15–20.
- Grulich V. (2012): Red List of vascular plants of the Czech Republic: 3rd edition. – *Preslia* 84: 631–645.



- Hamzeh'ee B., Ghahremaninejad F., Bidar Lord M. & Attar F. (2008): *Ventenata* Koeler, a new genus (Gramineae: Pooideae) record for Iran. – Iranian J. Bot. 14: 105–107.
- Hendrych R. & Chrtek J. (1964): Ad districtum oppidi Modrý Kameň in Slovacia additamenta florographica. – Acta Univ. Carol. Biol. 1964: 1–59.
- Hlavaček A. (1985): Flóra CHKO Štiavnické vrchy. – Ústredie štátnej ochrany prírody, Bratislava, 775 pp.
- Holuby J. L. (1888): Flora des Trencsiner Comitatus. – Trencsénvárm, Természettud. Egl. Évk., 152 + XIX pp.
- Chrtek J. (1961): Bemerkungen zur Flora der Umgebung von Šahy und Krupina. – Acta Univ. Carol., Biologica, Praha, 1961/I: 3–39.
- Chytrý M., Tichý L., Dřevojan P., Sádlo J. & Zelený D. (2018): Ellenberg-type indicator values for the Czech flora. – Preslia 90: 83–103.
- IUCN (2012): IUCN Red List categories and criteria: version 3.1. 2nd ed. – IUCN Species Survival Commission, IUCN, Gland, Switzerland and Cambridge, iv+32 pp.
- Jurko A. (1990): Ekologické a socioekonomické hodnotenie vegetácie. – Príroda, Bratislava, 200 pp.
- Kerns B. K., Tortorelli C., Day M. A., Nietupski T., Barros A. M. G., Kim J. B. & Krawchuk M. A. (2020): Invasive grasses: A new perfect storm for forested ecosystems? – For. Ecol. Manag. 463: 117985. <https://doi.org/10.1016/j.foreco.2020.117985>.
- Király G. (ed.) 2007. Vörös Lista. A magyarországi edényes flora veszélyeztetett fajai. – Saját kiadás, Sopron. 73 pp.
- Király G. & Hohla M. (2015): New stage of the invasion: *Sporobolus vaginiflorus* (Poaceae) reached Hungary. Studia Bot. Hung. 46(2): 149–155.  
DOI : 10.17110/StudBot.2015.46.2.149
- Koba H., Katsuyama T. & Shoji K. (2005): *Ventenata dubia* (Leers) Coss. (Gramineae), newly introduced to Japan. – Bull. Kanagawa Pref. Mus., Nat. Sci. 34: 61–63.
- Krippel E. (1986): Postglaciálny vývoj vegetácie Slovenska. – VEDA, Bratislava, 312 pp.
- Lampinen R. & Laiho E. (2021). Finnish Floristic Database (Finnish Museum of Natural History Collections). Version 1.41. – Finnish Biodiversity Information Facility. Occurrence dataset. <https://doi.org/10.15468/kasmwk> accessed via GBIF.org [Accessed 26 October 2021]
- Linder H P., Lehmann C. E. R., Archibald S., Osborne C. P. & Richardson D. M. (2018): Global grass (Poaceae) success underpinned by traits facilitating colonization, persistence and habitat transformation. – Biol. Rev. Camb. Philos. Soc. 93(2): 1125–1144. <https://doi.org/10.1111/brv.12388>
- Lukács B., Gulyás G., Horváth D., Hódör I., Schmotzer A., Sramkó G., Takács A. & Molnár A. (2017): Florisztikai adatok a Tiszántúl középső részéről. – Kitaibelia 22: 317–357.
- Meindl C., Brune V., Listl D., Poschlod P. & Reisch Ch. (2016): Survival and postglacial immigration of the steppe plant *Scorzonera purpurea* to Central Europe. – Plant Syst. Evol. 302: 971–984. <https://doi.org/10.1007/s00606-016-1311-9>
- Majtán M. (1998): Názvy obcí Slovenskej republiky. Vývin v rokoch 1773 – 1997. – Veda, Bratislava, 600 pp.
- Marhold K., Mártonfi P., Meredá P. & Mráz P. (eds.) (2007): Chromosome number survey of the ferns and flowering plants of Slovakia. – VEDA, Bratislava, 649 pp.
- Mertanová S. & Smatanová J. (eds) (2006): Floristický kurz Pruské 2003. Zborník výsledkov Floristického kurzu SBS a ČBS Pruské, 29. 6. – 5. 7. 2003. – Bull. Slov. Bot. Spoloč., Bratislava, 28, suppl. 1(12): 1–120.
- Mesterházy A., Wirth T., Schmidt D. & Csiky J. (2021): Spreading along the railways: morphology and invasion success of *Vulpia ciliata* in Hungary. – Kitaibelia 26(2): 145–156.

- Molnár Z. & Borhidi A. (2003): Hungarian alkali vegetation: Origins, landscape history, syntaxonomy, conservation. – *Phytocoenologia* 33: 377–408.
- Neuhäuslová-Novotná Z. & Neuhäusl R. (1966). Fytocenotické poznámky ke květeně okolí Levic. – *Acta Rer. Natur. Mus. Nat. Slov. (Bratislava)* 12(1): 93–110.
- Niklfeld H. (1971): Bericht über die Kartierung der Flora Mitteleuropas. – *Taxon* 20: 545–571.
- Niklfeld H. & Schratt-Ehrendorfer L. (1999): Rote Liste gefährdeter Farn- und Blütenpflanzen (Pteridophyta und Spermatophyta) Österreichs. 2. Fassung. – In: Niklfeld, H. (eds.): Rote Listen gefährdeter Pflanzen Österreichs. 2. Auflage. Grüne Reihe des Bundesministeriums für Umwelt, Jugend und Familie, Band 10, p. 33–152. – Graz, Austria Medien Service.
- Nikolić T. & Topić J. (eds.) (2004): Vascular flora. – In: Čivić K., Hršak V., Maričević A., Radović J., Rajčić A., Štefan A., Štrbenac A. & Topić R. (2004): Red list of threatened plants and animals of Croatia. – State Institute for Nature Protection, Zagreb, 693 pp.
- Novak S. J., Cristofaro M., Maguire D. & Sforza R. F. H. (2015): The invasive grass *Ventenata (Ventenata dubia)*: a new threat for Nevada. [http://agri.nv.gov/uploadedFiles/agrinvgov/Content/Plant/Noxious\\_Weeds/Documents/Novak%20et%20al.%20Nevada%20Weed%20Management%20Association%20Conference%202015.pdf](http://agri.nv.gov/uploadedFiles/agrinvgov/Content/Plant/Noxious_Weeds/Documents/Novak%20et%20al.%20Nevada%20Weed%20Management%20Association%20Conference%202015.pdf) [Accessed 27 October 2021].
- Oka H. I. (1983): Life-history characteristics and colonizing success in plants. – *Amer. Zool.* 23: 99–109.
- Orsenigo S., Fenu G., Gargano D., Montagnani C., Abeli T., Alessandrini A., Bacchetta G., Bartolucci F., Carta A., Castello M., Cogoni D., Conti F., Domina G., Foggi B., Gennai M., Gigante D., Iberite M., Peruzzi L., Pinna M. S., Prosser F., Santangelo A., Selvaggi A., Stinca A., Villani M., Wagensommer R. P., Tartaglini N., Duprè E., Blasi C. & Rossi G. (2021): Red List of threatened vascular plants in Italy. – *Plant Biosyst.* 155(2): 310–335. <https://doi.org/10.1080/11263504.2020.1739165>
- Pervukhina-Smith I., Sforza R. F. H., Cristofaro M., Smith J. F. & Novak S. J. (2020): Genetic analysis of invasive populations of *Ventenata dubia* (Poaceae): an assessment of propagule pressure and pattern of range expansion in the Western United States. – *Biol. Invasions* 22: 3575–3592. <https://doi.org/10.1007/s10530-020-02341-2>
- POWO (2021): Plants of the World Online. – Facilitated by the Royal Botanic Gardens, Kew. <http://www.plantsoftheworldonline.org/> [Accessed 24 October 2021].
- Prokudin Yu. N., Vovk A. G., Petrova O. A., Ermolenko E. D. & Vernichenko Yu. V. (1977): Zlaki Ukrainy. – *Naukova dumka, Kiev.* 519 p.
- Ridder L. W., Morris L. R., Day M. A. & Kerns B. K. (2022): *Ventenata (Ventenata dubia)* Response to Grazing and Prescribed Fire on the Pacific Northwest Bunchgrass Prairie. – *Rangel. Ecol. Manag.* 80: 1–9. <https://doi.org/10.1016/j.rama.2021.09.003>
- Skipper L., Calabuig I., Møller J., Wenøe Breddam D. & Skovgaard Mathorne J. (2020): National checklist of all species occurring in Denmark. Version 9.3. Miljøstyrelsen / The Danish Environmental Protection Agency. – Checklist dataset <https://doi.org/10.15468/bpmaze> [Accessed 27 October 2021]
- Smejkal M. & Vicherek J. (1970): Doplnky ke květeně Šah na jižním Slovensku. – *Zpr. Čs. Bot. Společ.* 5: 49–52.
- Sutorý K. (1996): Die Verbreitung der Art *Ventenata dubia* (Leers) Cosson auf dem Gebiet der Tschechischen Republik. – *Acta Mus. Moraviae, Sci. nat.* 80 (1995): 87–94.
- Škodová I. (ed.) (2007): Flóra a vegetácia Bielych Karpát: zborník výsledkov z projektu MVTŠ 2000-2001. – Slovenská botanická spoločnosť pri SAV, Bratislava, 178 pp.

- Škodová I., Janišová M., Dúbravková D. & Ujházy K. (2014): *Festuco-Brometea*. – In: Hegedúšová Vantarová K. & Škodová I. (eds): Rastlinné spoločenstvá Slovenska. 5. Travinnó-bylinná vegetácia, p. 35–146. – Veda, Bratislava.
- Thiers B. (2021+): 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/> [Accessed 21 October 2021].
- Tortorelli C., Krawchuk M. & Kerns B. (2020): Expanding the invasion footprint: *Ventenata dubia* and relationships to wildfire, environment, and plant communities in the Blue Mountains of the Inland Northwest, USA. – *Appl. Veg. Sci.* 23: 562–574. <https://doi.org/10.1111/avsc.12511>
- Turis P., Kliment J., Feráková V., Dítě D., Eliáš P., Hrivnák R., Košťál J., Šuvada R., Mráz P. & Bernátová D. (2014): Red List of vascular plants of the Carpathian part of Slovakia. – *Thaiszia – J. Bot.* 24(1): 35–87.
- Uebeler M., Ehmke W., Nawrath S., König A. & Wittig R. (2008): Ergebnisse der Floristischen Kartierung im Hohen Taunus. – *Geobot. Kolloq.* 21: 23–42.
- Vozárová M. & Sutorý K. (2001): Index herbariorum Reipublicae bohemicae et Reipublicae slovacae. – *Bull. Slov. Bot. Spoločn. (Bratislava), Suppl.* 7, 95 pp.

Received: November 3<sup>rd</sup> 2021

Revised: January 4<sup>th</sup> 2022

Accepted: January 27<sup>th</sup> 2022

## Appendix

List of localities with occurrence of *Ventenata dubia* in Slovakia. The records are arranged according to the phytogeographical division of Slovakia (Futák 1984).

### *Pannonicum*

**1. Burda hills:** Kováčovské [Ďarmotské] kopce (Domin 1936 ined.; M. Deyl 1951 PR). – Kamenica nad Hronom, NW, unpaved road to Skaly hill, 185 m (Eliáš jun. 2014 NI). – Kováčov [Kováčspatak], Skaly hill [Sziklás], path edge, 200–300 m (Boros 1939 BP; Kárpáti 1939 BP) – Chľaba, dry grasslands upper the Veľká dolina valey, 220 m (Eliáš jun. 2020 NI). **2. Ipľsko rimavská brázda region:** Levice, Kalvária site, 208 m (Jirásek 1936 PRC). – Levice, Staré Levice site, vineyards and field edges (Krist, Sborn. Přírodov klubu Brno, 1937/1936: 51). – Levice, Vápnik [Šíklóš] hill, grasslands, 180 m (Krist 1935 BRNU, l. c.). – Levice, Kusá hora hill, 205–225 m (Vozárová 1984 LTM; David 1984 LTM, 1988; David & Vozárová, *Biológia* 45: 442, 1990; Eliáš jun. 2016 NI; Sforza & Novak 2016 USDA-ARS EBCL herbarium). – Levice, Malé Krškany [Levice], Veľké drevo hill, ruderal sites, 259 m (Jirásek 1936 PRC). – Levice, Malé Krškany, clover field, 195 m (Osvažilová 1956 NI). – Kalinčiakovo, in the old vineyard, 200 m (Jos. Dostál 1968 PR). – Sikenička [Sikeničky, Ďarmotky], sub-ruderal place, Šarkáň site, 200 m (Jos. Dostál 1960 PR). – Bajtava, field edge, 198 m. – Leľa [Léled], field edge, 128 m (both data Domin 1936 ined.). – Nová Dedina, Opatová, meadows and roads edges, 280–304 m (Smetanová 2010 LTM). – Gondovo, NE, grasslands, 240 m (M. Biela 2008 LTM). – Horša, Horšianska dolina valley (David, *Acta Mus. Tekoviensis* 5: 25, 2004). – Horša, sunny slopes in abandoned stone pit N from the village, 211 m (Májovský 1967 SLO). – between Žemberovce and Jalakšová,

meadows, 250–280 m (Osvačilová 1957 NI; Jos. Dostál 1967 PR). – between Hontianska Vrbica [Ďarmoty] and Santovka [Santov], forest clearing and forest, 230 m (Osvačilová 1956 NI; Jos. Dostál 1966 PR). – Trhyňa, near the village, 200 m (Soják 1959 PR). – Trhyňa [Trgyňa], in the old vineyard, 200 m (Jos. Dostál 1967 PR). – Pastovce, on the hills (Ferd. Weber 1936 PR). – Jabloňovce, quarry north direction from the village, 320–340 m (Košťál & Vadel 2015 herb. S-CHKO Ponitrie, Bull. Slov. Bot. Spoločn. 38: 90, 2016; Eliáš jun. 2016 NI; Sforza & Novak 2016 USDA-ARS EBCL herbarium). – Hontianske Nemce, dry slopes upper the train stop, 290 m – Hontianske Nemce, Pivnica farmstead, circa 3 km W from the village, field edge, 310 m (both data Vicherek 1968 BRNU; Smejkal & Vicherek, Zpr. Čs. Bot. Společ. 5: 51, 1970). – Dvorníky, grasslands in elevation point 303.6 m, 250 m (Čvančara 1975 BRNM; Sutorý 1975 BRNM). – Horné Túrovce, sunny hill near stone pit, 200 m (Weber 1960 BRA; J. Dvořák 1962 BRA; Manica 1962 ZV). – Dolné Semerovce, Zlatá site, abandoned vineyards, 195 m (Eliáš jun. 2015 NI). – Dolné Semerovce, near Dolný Osláš hill, 140 m (Eliáš jun. 2015 NI). – Slatina [Szalatnya] (Kitaibel 1803: 232; Reuss sine data in Domin ined.). – Plášťovce, Babica hill, dry grasslands, 260–280 m (Eliáš jun. 2014, 2017 NI). – Plášťovce, Čierny hrad [Čongrád] hill (sine coll. sine data PR; Weber 1961 BRA, BRNM). – Plášťovce, Šípka hill, dry slopes, 260–270 m (sine coll. sine data PR; Weber 1930 OLM, 1960 BRA; Černoch 1961 BRNM; Smejkal et Vicherek 1968 BP, BRA, BRNM, BRNU, PR, PRC, SAV, SLO; Skřivánek 1968 BRNM; Vicherek 1968 BRA, BRNU). – Plášťovce, Terno hill, southwestern slopes, 240 m (Eliáš jun. 2015 NI; Eliáš et al., Bull. Slov. Bot. Spoločn. 39/2: 164, 2017). – Horné Rykynčice, Churchoť, 250 m (Greštiak 1963 ZV). – Horné Rykynčice, Sanda hill, SW rocky slopes, 320 m – Medovarce, Pod závozom site, 200–240 m – Medovarce, SW slopes of elevation point 341.6 m, 280 m (all data Eliáš jun. 2014 NI). – Domaníky, sunny slopes upper the road to Dudince (Valenta 1999 BRA). – Domaníky, Krupinská planina Plane, on the south-east slopes situated above the village and the public road 250–700 m SWW from the church in the village, rocky and grassy areas, 200 m (Daníhelka, K. Chytrý, M. Chytrý & Prokešová 2020 BRNU). – Uňatín (Chrtek, Acta Univ. Carol., Biol., p. 34, 1961; Hlavaček, Flóra CHKO Štiavnické vrchy, p. 581–582, 1985). – Čabradský Vrbovok, Horné Tále hill, sunny slopes, 360 m (Eliáš jun. 2015 NI). – Čabradský Vrbovok, near the ruins of the Čabrad' castle, andesitic soil, 340 m (Chrtek & Šourková 1975 PR). – Šahy, Veľký vrch hill [Magas hegy], 230 m (Weber 1934 BRNM; Eliáš jun. 2013 NI). – Šahy, NW edge of forest near Veľký vrch hill [Magas hegy], 200 m (Šourek 1957 PR). – Horné Túrovce, in dry sites upper village (Ferd. Weber 1937 PR). – Šahy NW, Plieška hill, pastures, 200 m (Chrtek sen. 1957 PRC). – Šahy, Šomoš hill, in *Quercus* forest, 190 m (Černoch 1954 BRNM). – Šahy, abandoned pastures in foothill of Drieňok (Šomoš) hill, 185 m (Eliáš jun. 2016 NI; Sforza & Novak 2016 USDA-ARS EBCL herbarium). – Šahy, Olvár farmstead, foreststeppe, 220 m (Chrtek sen. 1957 PRC). – Ipeľské Predmostie [Hídvég] (sine coll. 1934 PR). – Vinica, Stráž hill [Őrhegy], steppe vegetation, 300 m (Černoch 1954 BRNM). = Nkyje, Stráž hill [Erhegy], southern slopes, 300 m (Šourek 1954 PR). – Vinica, Kohút hill [Nyergeshegy], dry open oak forest (Hynšt 1952 OLM). – Príbelce (Hallonová 1980 SMBB). – Malé Dálovce, ravine – Pinciná, dry meadows (both data Svobodová 1962 NI). – between Slovenské Ďarmoty and Sklabiná, field edges – Sklabiná, loes hills east from the village (both Domin 1933 ined.). – Závada, SW from Lučenec town, pastures 1,5 km N from the village (Skalický 1983 PRC). – Mučín [Mučiná] (Vojtuň 1966 KO). – Málinec, Hámor farmstead, southern slope upper the settlement, 450 m (Kühn, Práce Obor. Bot. Zool. Brno, 1976: 49). – Filákovo [Füle] (Theuber 1944 BP). – Čakanovce, unpaved road SW from the settlement, 320 m. – Večelkov, gravel road in eastern slope of the Borievka hill, 360 m. – Večelkov, Dunivá hora hill, bottom of abandoned stone pit, 580 m. – Stará Bašta NW, pastures and unpaved road towards to Pustý hrad site, 300–400 m. – Gemerský Jablonec, Vodokáš farmstead, grasslands, 240 m (all data

Eliáš jun. 2015 NI). – Hajnáčka, field road between Zabodské hill and Roháč hill, 350 m (Černochoch 1954 BRNM). – Hajnáčka [Ajnácskő], Roháč [Ragasalyia] hill, grasslands, 500 m (Vrabélyi 1865 BP; Švestka 1933 BP, BRA, BRNM, BRNU, NI, OLM, PR, PRC, SLO, ZV, 1937f: 267). – Ragačské kopce, Hajnáčka, at the southern edge of the forest on Zaboda hill [Zabodakő], 400 m – Hajnáčka, near the rural road, 400 m (both Šourek 1954 PR). – Hajnáčka [Ajnácskő], Plešivec hill [Szárko], oak forest (Hulják 1941: 38). – Tachty, elevation point 406.1 m SW from the village, 400 m (Eliáš jun. 2015 NI). – Jesenské, Fušom [Fuson] hill, forest clearing, 362 m (Unarová & Unar 1935 BRNM). **3. Slovenský kras karst:** Kečovo, near the Domica cave (Futák in Hendrych & Chrtek, Acta Univ. Carol. Biol. 1964: 1–59, 1964; Virók et al., A Gömör–Tornai-karszt flórája. Enumeráció / Flóra Gemersko-turnianskeho krasu. Enumerácia. Aggteleki Nemzeti Park Igazgatóság. Jósvalfő, p. 832, 2016). **5. Devínska Kobyla hills:** Bratislava, Devínska Kobyla hill, southern slopes, 250 m (Ptačovský 1928 SLO; Krist 1938 BRNU; E. Králik 1997 SLO). – Bratislava, part Dúbravka, Hlavy hill, 270 m (Valenta 1970 BRA). – Bratislava, part Dúbravka, Dúbravská Hlavica hill (E. Králik 1997 SLO; Valenta 1998 BRA, Ondrášek & Valenta, Bull. Slov. Bot. Spoločn. 21: 87, 1999). – Bratislava, part Dúbravka, Quercus forest opposite to Švamperíky site [Schwabenberg], 340 m (Valenta 1939 BRA). – Bratislava, part Dúbravka, slopes of Devínska Kobyla Hill, open forest (K. Ptačovský 1928 SAV). – Bratislava, part Patrónka, meadow (Schidlay 1931 BRA). **6. Podunajská nížina lowland:** Bratislava [Pressburg], along train lines to Vienna (Fuchs 1859 SLO). – Bratislava [Pozsony, Pressburg] (Eschfaeler 1879 BRNU; Brančík sine data BP). – Bratislava, Dynamitka site (V. Nábělek 1936 BRA, SAV). – Svätý Jur [S. Georgium], near train lines (Bolla 1845 SLO, 1856a: 7). – Myslenice [Grinaviae], fields (Holuby 1916 PRC). – Pezinok [Bazinium], fields and dry grasslands (Holuby 1900 NI, 1920 PRC; Zoznam rastlín cievnatých okolia Pezinského, SAV, Bratislava, 1956). – Pezinok, Panholský háj [Bahnwald], field edges (Holuby 1919 PRC). – Modra, fields (Mergl 1895 SAV, SLO; Holuby 1914 BRA). – Boleráz, field edges (E. Králik 1978 SLO). – Nové Mesto nad Váhom [Waagneustadt] (Keller, 1867: 212). – Beckov, fallows (Holuby 1888a: 150). – Tovarníky [Tavarnok]. – Bašovce [Bassoc]. – Nitrianska Streda [Nyitraszerdahely] (all data Scheffer 1927: 278). – Beša, hill opposite to train stop, 180 m (Valenta 2001 BRA). – Jesenské, grasslands near the train stop, 205 m (Eliáš jun. 2013 NI). – Mochovce, Dobrica hill, dry grassland, 300 m (Eliáš jun. 2016 NI; Sforza & Novak 2016 USDA-ARS EBCL herbarium). – Nový Tekov, Újhegy hunter house, 117 m (Osvačilová 1957 NI). – Plavé Vozokany, abandoned terraced vineyards southeast of the village, the northernmost tip, 213 m (Eliáš jun. 2020 NI). – Machulince, clay pit west from the village, 256 m (Eliáš sen. 2015 NI). – Čifáre, forest edge E from the village (Kvapilík 1929 OLM). – Malé Kozmálovce, Plešovica hill, dry slopes, 275 m (Eliáš jun. 2020 NI). – Kozárovce, Skala hill, 230–237 m (Domin 1936 ined.; David 1984 LTM; Vozárová 1984 LTM; David & Vozárová, Biológia 45: 442, 1990). – between Psiare and Kozárovce, around road. – Kozárovce, train stop (both data Domin 1936 ined.). – Mlyňany Arboretum (F. Nábělek 1953 SAV). – Malé Vozokany, road edge, 176 m (Pospíšil 1955 BRNM). – Volkovce, part Olichov, field limits and edges of currant plantation, 240 m (Valenta 1998 BRA). – Máriańska Čalád', Mariánske hory hills, clearing in oak forest, 190–250 m (Domin 1930 ined.; Domin & Krajina 1936 PRC). – Kamenín, Kamenínske slanisko Nature Reserve, saline grasslands, 111 m. – Kamenný Most, Čistiny Nature Reserve, saline grasslands, 110 m (both data Eliáš jun. 2016 NI). – Mužla, Belianske kopce hills [Hegyfarok] (Hejná 1951 SLO). – Štúrovo (V. Nábělek 1937 BRA, SAV). **7. Košická kotlina basin:** Žarnov [Zsarnó] (Thaisz 1912 BP). **8. Východoslovenská nížina lowland:** Luhyňa, road edge, 125 m (J. Dvořák 1960 BRA). – Černochoch, pastures (Májovský 1961 SLO). – Veľká Bara, Piliš hill, southern slopes, 180 m (Černochoch 1963 BRNM). – Veľká Bara, 160 m (Sforza & Novak 2019 USDA-ARS EBCL herbarium). – Borša [Borsi] (Margittai 1927 BP). – Viničky [Seleška], Irma site

[Irmatelep], ruderal site in vineyards, 150 m (Jos. Dostál 1952 PRC). – Viničky, forest edge, 130–180 m (Domin & Sillinger 1932 PRC; J. Dvořák 1960 BRA, BRNM). – Ladmovce, hills upper the village (Májovský 1960 SLO). – Streda nad Bodrogom, Roháč hill, vineyard edge (Májovský 1963 SLO). – Somotor [Szomotor], Tarbucka hill (Margittai 1938 BP). – Tarbucka hill, vineyards edge E from elevation point 161 m (Májovský 1963 SLO). – between Veľký Kamenec and Strážne (Májovský 1960 SLO). – Markovce, 200 m (Margittai 1937 BP). – Sirník, 140 m. – Malčice, E from the village, 110 m (both data Sforza & Novak 2016 USDA-ARS EBCL herbarium). – Zemplínske Kopčany, Kopčianske slanisko Nature Reserve, unpaved road, 101 m (Eliáš jun. 2014 NI). – Malý Horeš, Horešské lúky grasslands, 130 m (Eliáš jun. & D. Dítě 2014 NI). – Kráľovský Chlmec, Veľký kopec hill, rural road in vineyards, 130 m (Eliáš jun. & Galvánek 2019 NI). – Kapušianske Kľačany, loess-sandy hill near the village (Májovský 1963 SLO).

### ***Carpaticum***

**9. Biele Karpaty Mts.:** Bzince pod Javorinou (Holuby 1865j: 352, 1870 BP). – Zemianske Podhradie, 300 – 350 m (Holuby sine data PR, 1869 VT). – Zemianske Podhradie [Ns. Podhragy], fallows and oak forests (Holuby 1865 BP, BRA, 1866, 1869, 1870, 1872, 1876 BP, 1867 BRA, 1866, 1887 BRNU, 1869, 1882 PRC, sine data PR). – Zemianske Podhradie, forest named Lovichovec (Holuby 1867 BRA). – Zemianske Podhradie, Budišiná hill (Holuby 1879: 238). – Bošáca, Bošácka dolina valley, in oak forests (Holuby 1869 BP, 1896 BRNU, 1899 PRC). – Bošáca, Dubová farmstead, forest (Holuby 1896 BRA). **10. Malé Karpaty Mts.:** Bratislava [Pozsony], Kamzík hill [Zerge-hegy] (Degen 1913 BP; Gáyer 1917a: 40). – Bratislava, part Lamač, suny slopes, 225–300 m (Krist 1938 BRNU; J. Dvořák 1961 BRA, BRNM). – Bratislava, part Lamač, Plánky [Polanky], 200 m (Valenta 1938 BRA). – Vinosady, rocky slopes upper the village, 240 m (J. Dvořák 1978 BRA). – Čachtice (Keller l. c.). **11. Považský Inovec Mts.:** Jalšové, Janovo hill, around forest roads (Domin 1931a: 150). – Lipovník, slopes north from the village (Řehořek 1962 BRNU). **12. Tribeč Mts.:** Nitra, S slopes of Zobor [Zubor] hill, forest edge. – Dolné Štitáre, S slopes of Žibrica hill (both data Kvapilík 1930 OLM). – Nitrianske Hrnčiarovce, forest edge (Svobodová 1985 ined.). – Ladice, a small quarry near a cherry orchard, 260 m (Dúbravková & Košťál, Hacquetia 11/2: 255, 2012). – Jelenec [Ghymes], sunny slopes of the castle hill (Rechinger 1927 W, O). – Kostoľany pod Tribečom, Jedliny site (Svobodová 1975 NI). – Veľčice, Veľčické cery site, 240 m (Eliáš, Rosalia 2: 62, 1985). – Krnča, Jahodište, in stream valley, 250 m (Štěpánková et Štech in Ambros (ed.), Florist. Kurz Partizánske, Rosalia, special issue, p. 137, 1996). – Nitrianska Streda, Hrdovická hill, dry grasslands and oak forest (Eliáš, Pam. Prír. 15/6: 35, 1984, Rosalia 3: 48, 1986, Rosalia 5: 82, 1988). **13. Strážovské vrchy Mts.:** Uhrovské Podhradie, Kňazhinove lúky meadows, 600 m. – Malé Kršteňany, Veľký vrch hill, steppic vegetation near the peak, 390 m (both data Hrouda in Ambros l. c.). **14a. Pohronský Inovec Mts.:** Machulince, andesite rocks above the road to Obyce village, 280 m (Eliáš sen., Bull. Slov. Bot. Spoločn. 49, Suppl. 1: 49, 2018). – Hronský Beňadik, Klíča hill, southern slopes, 320–350 m (Krist 1938 BRNU; Valenta 1938 BRA). – Tekovské Nemce (Svobodová 1974 NI). – Horné Hámre, Majer farmstead, meadows. – Horné Hámre, Šajbovci farmstead, trench (both data Magic 1948 SLO). **14b. Vtáčnik Mts.:** Rudica, Kozárova lúka site, Bridove štále farmstead (Lančaričová 1997 ined.). – Žiar nad Hronom [Svätý Kríž], upper the village (Jos. Podpěra 1948 BRNU). – Handlová, Kňazov kopec hill [Pfaffenberg], stone pit (Unzeitig 1938 BRNU). **14c. Kremnické vrchy Mts.:** Ihráčska dolina valley, Pitelovský mlyn site, 300 m (Domin 1920 ined.). – between Zvolen and Kováčová (Frey 1872: 353). – Zvolen, S slopes of Veľká Stráž hill upper the Hron river, 325 m, 350–400 m (Manica 1963, 1966 ZV). **14d. Poľana Mts.:** Dolná Mičiná [Vičiná], meadows (Hrabětová 1958 BRNU; Ponert 1958 PR). – Vígľaš, slopes upper the village (Futák 1947 SLO). **14e. Štiavnické vrchy Mts.:** Hronský

Beňadik, in valley about 1.2 km ESE from the train stop, southern forest-steppe slopes (Trávníček 1995 OL). – Hronský Beňadik, cca 1,5 km E from the village, meadow, 350 m. – Hronský Beňadik, Čiapkovská dolina, unpaved forest road, 400 m. – Kozárovce, E from the village, rural road, 200 m (all data Kusák 1994 OLM). – Rybník, dry grasslands near the chapel upper the vineyards, 260 m (Eliáš jun. 2017 NI). – Čajkov, vineyards and andesitic rocks upper the village, 190–200 m, 240–320 m (Svobodová 1957 NI; Osvačilová 1958 NI, PRC; Neuhäuslová-Novotná & Neuhäusl, Acta Rer. Natur. Mus. Nat. Slov. Bratislava 12/1: 108, 1966). – Nová Dedina, Beňov vrch hill (Neuhäuslová-Novotná & Neuhäusl l. c.). – Nová Dedina-Gondovo, Nad vinicami site, shallow soils in volcanic rocks (Neuhäuslová-Novotná & Neuhäusl l. c.; Biela 2010). – Nová Dedina-Gondovo, Šándorky site, edge of rural road passing pastures (Biela 2010). – Nová Dedina-Gondovo, N from the village, dry grassland near the St. Cyril and Method chapel, 250 m (Eliáš jun. 2016 NI; Sforza & Novak 2016 USDA-ARS EBCL herbarium). – Nová Dedina-Gondovo, Vtáčniky site, shooting range, grasslands, 250 m (Eliáš jun. 2016 NI). – Nová Dedina, meadows between the vineyards at the statue of St. Urban, 255 m (Eliáš jun. 2018 NI). – Devičany (Neuhäuslová-Novotná & Neuhäusl l. c.). – Pukanec, southern slopes of Hampoch hill, 400 m (Hlavaček 1980 BRA, Zborník II, XXI TOP, p. 15, 1986). – Brehy, pastures around Obecný potok stream, 230 m (Domin 1920 ined.). – Brehy, Kališný vrch [Laštok] hill (Hynšt 1952 OLM). – Žarnovica, Sokola vrch Hill, andesites, dry grasslands, SW slopes, 350–400 m (Manica 1964 ZV). – Vyhne, dry slopes near spa (Kitaibel in Gombocz 1945: 884; Hlavaček l. c.). – Horné Opatovce, Bralo hill, forest, 250–400 m (Manica 1962 ZV). – Súdoce, dry SW slopes of Žarnový vrch hill upper Súdovský potok stream, 295 m (Eliáš jun. 2021 NI). – Ladzany, Nad Verepcom site [Verepec], dry grasslands, 330 m (Jos. Dostál 1952 PRC). – Prenčov (Kmeť 1876 BRA). – Hronská Breznica, Demjan hill, dry ESE slopes, 610 m (Eliáš jun. 2020 NI). – Hontianske Nemce, Rakovec, Pusté vinice site, grasslands in southern slopes, 250 m (Hlavaček 1955 SAV, SLO). – Hontianske Nemce, Dianiš hill, dry slopes, 270 m (Eliáš jun. 2015 NI; Sforza & Novak 2016 USDA-ARS EBCL herbarium). – Banská Belá, dry grassland, ca 510 m (Eliáš jun. 2021 NI). – Banská Štiavnica (Kmeť 1876 BRA; Hlavaček l. c.). – Banská Štiavnica, Kremenisko, rocky slopes, 650 m (J. Švec 1939 LTM). – Široké Lúky farmstead, Hanisberg hill (Chrtek l. c.; Hlavaček l. c.). – Babiná, pastures NW from the train stop (Chrtek sen. 1959 PRC, l. c.). – Zvolen [Altsohl] (Freyn 1870 PRC, 1872: 353). – Kamenný Kríž farmstead (Chrtek l. c.; Hlavaček l. c.). – Podhorie, dry grasslands (Šuvada 2019 ined.). **14f. Javorie region:** Bzovík (Chrtek 1: 34; Hlavaček l. c.). – Bzovská Lehôtka, road edge to Krupina (Chrtek sen. 1959 PRC). – Zvolen, souther rocky slope upper the water reservoir and Strážnica Hill, 320 m (Manica 1965 ZV). – Zvolenská Slatina, sunny slopes near the water reservoir (Manica 1962 BRA). – Michalková, N margin of the village, grasslands – Kráľová, SE rocky slopes of elevation point 676 m near Dúbrava farmstead (both data Kaplan in Benčaťová & Ujházy, Floristický kurz Zvolen 1997, Zvolen, p. 51, 1998). **15. Slovenské rudohorie region:** Revúca [Velká Revúce] (Reuss 1853: 467). **20. Vihorlatské vrchy Mts.:** Vyšné Nemecké, Močidlá, in stone pit near goalkeeper house (Májovský 1982 SLO).

**Doubtful data:** **14e. Štiavnické vrchy Mts.:** Banská Štiavnica, Paradajz hill, 900 m (Cserey 1897: 70; Hlavaček l. c.).

