

Taraxacum* sect. *Erythrosperma* in Slovakia. Part II. Notes on distribution and ecology of *Taraxacum danubium

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Abstract: *Taraxacum danubium* is xerothermic species of *Taraxacum* sect. *Erythrosperma* occurring in Central Europe with the highest frequency in southeastern Czechia, northeastern Austria and southwestern Slovakia. Since its description in 1970 from Devínska Kobyla Hills in Slovakia the species was documented from numerous localities across the country, however overall study on the species distribution in Slovakia was still lacking. Thus in this paper, we present a detailed survey on its chorology in Slovakia based on our long-term field observation and data excerpted from herbarium specimens with commentary on the distribution (over 60 localities in Slovakia) and biology of the species. Western Slovakia seems to be a centre of its distribution, while towards east the number of populations rapidly decreases. Karyology and ecology are discussed. The full list of locations and distribution map are presented.

Keywords: lesser dandelions, occurrence, Central Europe, xerothermic habitats, chorology.

Introduction

The genus *Taraxacum* Wigg. is taxonomically very complicated genus divided into ca. 60 sections, which represent systematic groups or supposed phylogenetic lines and at the same an important taxonomic structure of the genus. In Central Europe, ca. 10 sections are known with more than ca 300 species, of which only five (*T. bessarabicum*, *T. erythrospermum*, *T. linearisquameum*, *T. pienicum* and *T. serotinum*) are sexual (Trávníček et al. 2010). One such section present in the central European region, is a group of xerothermic taxa *Taraxacum* sect. *Erythrosperma* (H. Lindb.) Dahlst. (lesser dandelions). The section accommodates only one diploid sexual species (*T. erythrospermum* Andr.) and approximately 150-200 polyploid apomictic species (Doll 1973; Vašut 2003; Euro+Med 2006–2019).

In Slovakia, the genus *Taraxacum* is represented by nine sections, namely the sect. *Alpestris*, *Alpina*, *Dioszegia*, *Erythrocarpa*, *Erythrosperma*, *Hamata*, *Palustria*, *Piesis*, and *Taraxacum*. The sect. *Erythrosperma* is the second most frequent group of dandelions in Slovakia. Although sect. *Palustria* is species richer than the sect. *Erythrosperma*, the wet habitats where the species typically occur, are less frequent than xerothermous habitats. The sect. *Erythrosperma* would require a detailed survey and taxonomic study within the region of Slovakia as such work is still missing, and although lesser dandelions were studied by several authors, these studies merely focused either on small areas (e.g. Richards 1970; Šuvada 2010; Dudáš 2014) or particular species (Schmid et al. 2004; Vašut & Trávníček 2004; Vašut et al. 2005; Vašut & Majeský 2015; Kirschner et al. 2019). The only published list of species is the one of Kirschner & Štěpánek (1995), which is however outdated. This list mentions ca. 15 species for Slovakia, however due to ongoing research this number will increase in future as several well definable but still undescribed apomictic taxa are known from Slovakia (Dudáš and Vašut, unpublished data).

In this paper, which represents the second part of the miniseries dealing with the distribution of *Taraxacum* sect. *Erythrosperma* in Slovakia (Dudáš 2019), we want to introduce one of the three most common apomictic species of the section, *Taraxacum danubium* A. J. Richards. The paper summarizes the present knowledge on the distribution, biology and ecology of the species.

Taraxacum danubium is Central-European species occurring in eastern Austria, Czechia (here in Bohemia and Moravia) (Vašut 2003), East Germany (Saxony) (Uhlemann 2003), southern Poland (Wolanin & Musiał 2018), northern Hungary and Slovakia (Šuvada 2010; Trávníček et al. 2010). The species was described from Devínska Kobyla Hills near Bratislava (SW Slovakia), the author also mentioned two other localities in western Slovakia, i.e. Sedliská site (near Hlohovec town, Podunajská nížina Lowland) and Kováčovské kopce Hills (Kamenica nad Hronom village, Burda Hills) (Richards 1970). The holotype specimen is accessible from the homepage of The Oxford University Herbaria, Great Britain (see References).

Materials and Methods

The study was carried out during the years 1999–2019. The distribution is based on our field observations as well as on research of herbarium specimens from the following public herbaria collections in Slovakia (BRA, KO, NI, SAV, SLO), Czechia (BRNM, BRNU, MMI, OL, OLM, PR, PRA, PRC), Richards' type collection deposited in Great Britain (OXF) and from private herbarium collection of Jaroslav Zámečník (Hradec Králové, Czechia) and Zdeněk Kaplan (Průhonice, Czechia). Abbreviations of public herbaria follow Thiers (2020+). Herbarium documents from our field course are deposited in KO (M. Dudáš, R. Šuvada; specimens are fully digitalized and available upon request) and in OL (R. J. Vašut, Ľ. Majeský, M. Dudáš). A list of revised specimens and literary records are provided in Appendix 1. The map was designed in the program ArcGis, version 9.2. The mapping grid follows the grid template described by Niklfeld (1971). The taxonomy and nomenclature of *Taraxacum* follow Kirschner and Štěpánek (1995) & Vašut (2003). Names of syntaxa follow Jarolímek et al. (2008).

Results and discussion

Distribution in Slovakia

Taraxacum danubium A. J. Richards, Acta Fac. Rer. Nat. Univ. Comen. ser. bot., 18: 108, 1970 [syn. *T. austriacum* var. *danubium* (A. J. Richards) R. Doll Feddes Repert. 84: 21, 1973.] is one of the most common species of the section *Erythrosperma* in the western part of Slovakia. However, it is by far not as common as *T. erythrospermum* or *T. parnassicum* (Dudáš, unpublished data). Especially, the species is common on blown sands of the Záhorská nížina lowland and limestone rocky sites in the Biele Karpaty Mts. and Strážovské vrchy Mts. Towards the east, the species is gradually vanishing and becoming rare. The main distribution range of *T. danubium* thus lies in western Slovakia.

We recorded the presence of species in 19 phytogeographic districts and subdistricts (out of 31). Most of them are situated in the area of the Carpathian flora (*Carpathicum*) (over 33 sites in 12 districts) while less in the area of the Pannonian flora (*Pannonicum*) (over 30 sites in 7 districts) as showing distribution map (Fig. 1.).

Within the *Pannonicum* (Záhorská nížina lowland, Podunajská nížina lowland and Devínska Kobyla Hills) the species shows preferences for the warmest regions with sandy soils. The most of localities are present at lower altitudes (130–250 m). Within the *Carpathicum* the species is growing in higher altitudes (250–920 m). Here it usually occurs on limestone and dolomite rocky outcrops, on touristic sightseeing points, hilltops and castle hillsides (mainly Strážovské vrchy Mts. and Biele Karpaty Mts. less in the Tematínske kopce Mts. and Tribeč Mts.). The abundant occurrence on calcareous rocky sightseeing points between Trenčianske Teplice town and villages of Omšenie and Dolná Poruba, over valley of Teplička River in the Strážovské vrchy Mts. was found. In southern and southeastern parts of Slovakia the number of localities rapidly decreases, and known populations are consisting of a few

individuals only. Surprisingly, in the Slovenský kras Mts., an ideal area with many suitable habitats, only five recent populations were discovered. We thus expect to find further new localities in future here.

The overall minimum altitude of ca. 130 m reaches the species in Kopáč Island near Danube River (*Pannonicum*, Podunajská nížina lowland; herbarium specimen deposited at herbarium SLO). The maximum recorded altitude (910–920 m) reaches the species on the top of Chmeľová hill in the Biele Karpaty Mts. (*Carpaticum*) on a small limestone ridge. The localities of the species in Poland are situated in low hill area between 200–360 m (Wolanin & Musiał 2018). In Czechia, localities in Moravia are situated in the lowlands and hills (between 180–500 m), and altitudinal maximum reaches the species in the Sedlo hill (České středohoří Mts.) with 720 m (Vašut 2003; Kirschner et al. 2010). In Hungary and Austria, the distribution prevails in lowlands and low hilly areas; however, it seems that the species occurs only sparsely in Hungary (e.g., Šuvada 2010; herbarium specimens in KO, BRNM, BP and OL). From our survey as well as based on data from Vašut (2003) the region delimited by cities of Bratislava – Wien – Znojmo – Hodonín – Trenčín – Nitra – Bratislava represents the centre of distribution of *T. danubium*.

Differentiation from other taxa

Although *T. danubium* is a very remarkable species (Fig. 2), it is not always easily distinguishable from other species of section *Erythrosperma*. Its typical leaf-shape with patent and narrow lateral lobes, which are usually swollen at apex, and terminal lobes triangular (of outer leaves) or trilobate (of inner leaves) with swollen drop-like apex is very characteristic (Fig. 2A). Achenes are dark brownish-red with body densely spinulose. Pollen is present; the length of irregular grains varies between 17–43 µm.

Not well-developed plants can sometimes be confused with other taxa (Tab. 1). Similar leaf shape can sometimes be seen in diploid *T. erythrospermum* (which usually has very narrow lateral lobes, strongly toothed lateral margin of lobes and distinct tunica of dried leaves at the base of leaf-rosette). Also young plants of *T. parnassicum* resemble the leaf pattern of juvenile *T. danubium*, and these two taxa can be thus confused. However, the presence of pollen and a more regular width of inner bracts (for *T. danubium*) are safety features for distinguishing these two species. Other similar species is *Taraxacum persicum*, a rare species known from southern and eastern Slovakia (Chľaba, Soví hrad hill, Viniansky hrad castle), which is differing by narrower lateral lobes (mostly lacking the characteristic drop-like apex) and by absence of pollen (Kirschner & Štěpánek unpublished data).

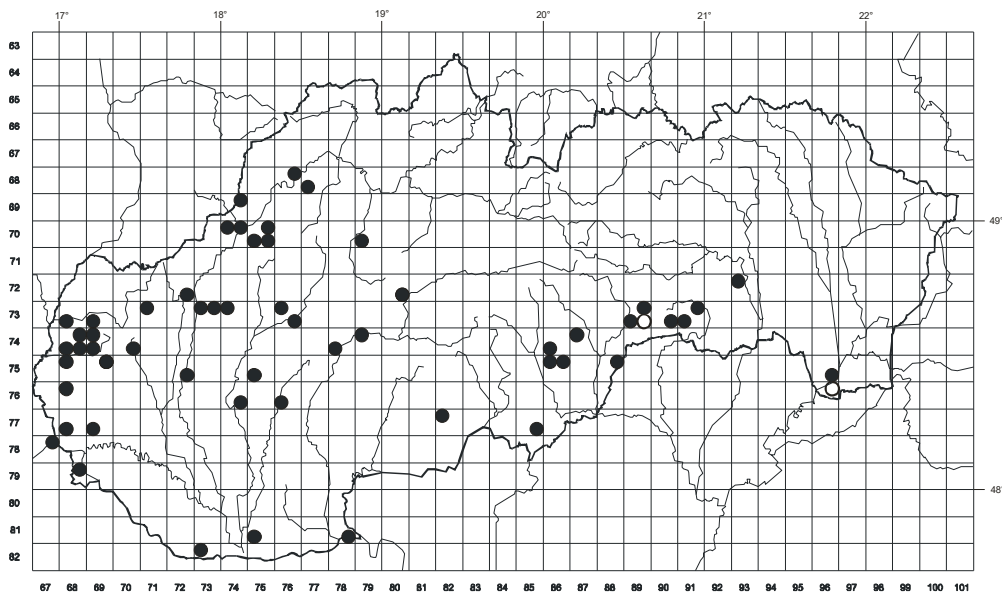


Fig. 1 Distribution map of *Taraxacum danubium* in Slovakia (black circle). *T. cf. danubium* (white circle) is also presented.

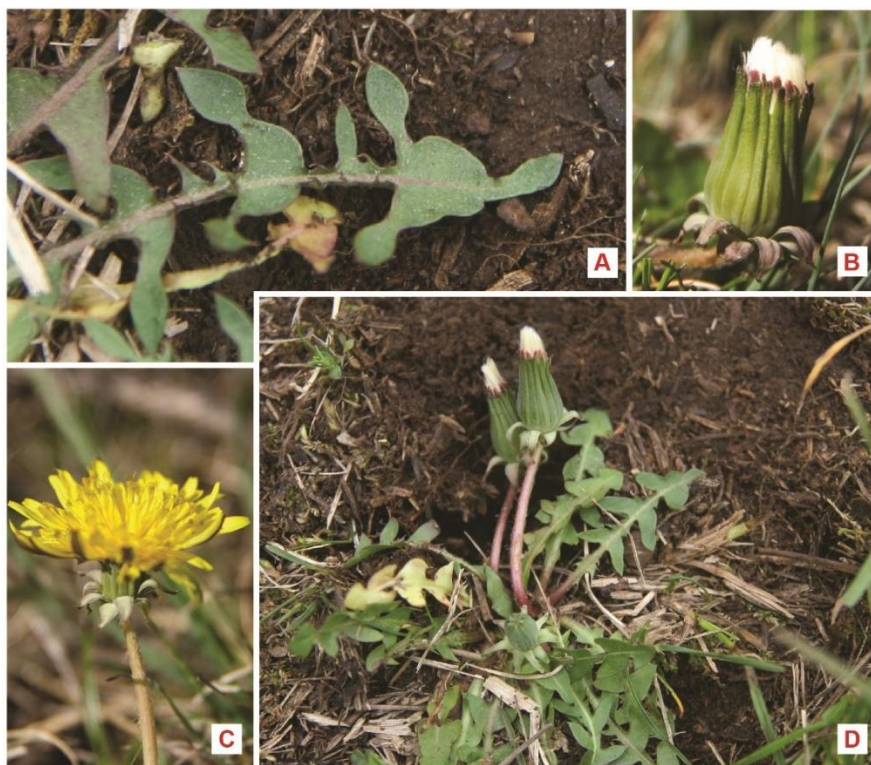


Fig. 2 *Taraxacum danubium*, leaf shape (A), inflorescence after blossoming (B), inflorescence (C) and habitus (D) (orig. by M. Dudáš)

Tab. 1 Main differences among *T. danubium* and other similar microspecies.

Character	<i>T. danubium</i>	<i>T. persicum</i>	<i>T. parnassicum</i>	<i>T. arcuatum</i>	<i>T. erythrosperrum</i>
Pollen	present, irregular size	absent	absent	present, irregular size	present, regular size (rare irregular)
Outer involucrel phyllaries	regularly arcuate-recurved	regularly arcuate-recurved	erect to subspreading, recurved at apex (star-like)	adpressed to erect	usually adpressed
Terminal lobe	trilobate with a short, obtuse tip ; on outer leaves triangular and obtuse (rounded)	triangular to trilobed, acute to (lingulate-) mucronate	triangular and acute or shortly trilobate with a short, subacute tip	triangular to trilobate with a short, obtuse tip	regular and triangular (outer leaves) to trilobate and linear (inner leaves); mostly obtuse
Lateral lobes	(3-)4(-6) pairs triangular, sometimes hamate (outer leaves), usually obtuse to rounded, abruptly narrowed at apex ended with drop-like tip	(3-) 5-6 pairs triangular to deltoid, usually entire, acute to acuminate	4-7 pairs regular, slightly recurved, with distal margin convex and entire; acute	4-7 (mostly 5) regularly opposite recurved, subacute, distal margin convex and entire, usually with a solitary tooth on its proximal margin	3-5 pairs very variable in size and shape, mostly narrow, linear, obtuse at apex and often distinctly denticulate
Achenes	deep dark brownish-red (3.0-) 3.2-3.5(-3.8) mm long, cone cylindrical to subcylindrical 0.7-0.8(-1.0) mm long	deep brownish-red (purplish) to deep brown, 3.5-4.1 mm long, cone cylindrical to subcylindrical 0.8-1.1 mm long	dark red (immature brick red), (3.0-) 3.5-4.0 mm, cone 0.7-1.0 mm	red (reddish-brown), 3.1-3.7 mm; cone 0.7-0.9 mm	red, small, (2.5-) 3.2-3.0 mm long, cone 0.6-0.8 mm long.
Other distinct character	drop-like tips at apex of lateral lobes	sometimes lingulate tip at terminal lobe	connate inner involucrel phyllaries	tunica of dried leaves at base of the leaf-rossette	tunica of dried leaves at base of the leaf-rossette; plants with numerous small capitula, V-shaped at their base

Karyology

T. danubium is a triploid species with chromosome number $2n = 24$. First chromosome counts were reported by Richards (1970, pp. 85-87) from three sites in western Slovakia: (1) Devínska Kobyla Hills (*locus classicus*), (2) Kováčovské kopce Mts. and (3) Soroš, Sedliská Nature Reserve near Hlohovec town. The same triploid chromosome number was also reported by Vašut (2007, p. 570) from Chotínske piesky Nature Reserve. Vašut (2003) also counted $2n = 24$ from Moravia (Bzenec). Triploid level $2n \sim 3x$ (determined by flow cytometry) was detected for plants from Krásnohorské Podhradie village in Slovenský kras Mts. (Šuvada 2010) and Kašvár Nature Reserve in Východoslovenská nížina Lowland (Dudáš 2014), both from eastern Slovakia.

Ecology and habitats

Taraxacum danubium belongs to the most xerothermophilic species of the section *Erythrosperma* growing on calcareous and sandy dry soils (Trávníček et al. 2010). Our results show that *T. danubium* in Slovakia prefers mostly limestone's grassy hillsides, rocky outcrops on sightseeing points and castle hills (alliance *Festucion valesiaca* and *Alyso alyssoidis-Sedion albi*) and sandy dunes (alliance *Festucion vaginata*). Less frequently it grows on lightly trampled sites along tourist paths, on dry pastures (alliance *Cynosurion cristati*), in light shrubberies (alliance *Prunion spinosae*) and open oak, pine and birch forests of the alliance *Quercion pubescentis-petraeae* and *Pinetum sylvestris*. The occurrence of *T. danubium* is always accompanied by other species from the section *Erythrosperma*, especially by *T. erythrospermum*, *T. cristatum*, sometimes *T. prunicolor* and *T. parnassicum*.

Threats and conservation status

Taraxacum danubium is not endangered in Slovakia. The number of localities and the number of individuals in populations in Slovakia suggests the species is not threatened in near future. Moreover, numerous localities occur in protected areas. Furthermore, many localities represent touristic hotspots, and a high number of tourists provide regular disturbance of soil, which is profitable for the species as a weak competitor (similar also to other species of the section *Erythrosperma*). Therefore the species is not included into the Red List of endangered species in Slovakia (Turis et al. 2014; Eliáš et al. 2015).

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Appendix 1

List of revised herbarium specimens and literary records.

For herbarium specimens the collector, year of collection and herbarium acronym are given and evidence number of specimen is also given if exists. Records are arranged following the phytogeographical division of Slovakia by Futák (1980) and assigned to the quadrants of the CEBA grid template (Central European Basic Area, Niklfeld 1971). Locality information was translated into English but in some instances place names are given in the original language in parentheses. References for published records are listed in References chapter and are given in an abridged form including authors, year and the page of a particular *Taraxacum danubium* record. Abbreviation: N (north), S (south), W (west), E (east) and its combinations.

Pannonicum

(*Matricum*) **1. Burda Hills:** Kováčovské kopce Hills, between villages of Kamenica and Kováčov [Slovakia austr.: colles Kováčovské kopce: in decliv. fruticosis inter pag. Kamenice et Kováčov] (J. Dostál 1950 PRC #402202). – Kováčovské kopce Hills (Májovský 1969 SLO; Richards 1970:

86, 2n = 24). **2. Ipeľsko-rimavská brázda Region:** Modrý Kameň, hill Pavlov hrb [Slovakia: in colle Pavlov vrch (c. 495) situ septent. ab opp. Modrý Kameň] (Hendrych 1961 PRC #402201). – Hajnáčka, xerothermic slopes of the volcanic castle hill Hajnáčka, 296 m (Majeský 2009 OL; Vašut 2009 OL). – Drienčany, W, pasture, 256 m (Šuvada 2007 KO #30720). – Drienčany village, karst meadows above the village, 236 m (Majeský 2008 OL). – Drienčany village, xerothermic vegetation around an abandoned stone-pit behind the village in north-west direction, 236 m (Majeský 2008 OL). – Budikovany, rocky slopes, Skalica hill (Kliment 1977 SAV). **3. Slovenský kras Mts.:** Kameňany, Valetínka hill, small abandoned stone-pit on SW foothill, 299 m (Dudáš 2015 photodocumented). – Slovenský kras, Domicca cave (Kláštorský 1936 PR). – Krásnohorské Podhradie, Krásna Hôrka castle, hillside, scattered, 448 m (Šuvada 2007, 2008 KO #30691; Majeský 2009 OL; Dudáš 2016 OL). – Rožňava, Krásnohorské Podhradie, xerothermic grasses near the castle (Vašut & Vašutová 2004 OL; Vašut 2008 OL). – Jovice, Dievčenská skala rock, scattered, 660 m (Dudáš 2018 KO #34659). – Jabloňov nad Turňou, Soroška (Michálek 1965 BRA #87, *T. cf. danubium*). – Hrhov, Okrúhle hill, pine forest, 219 m (Šuvada 2007 KO #30721). – Zádiel, along paths on calcareous rocks above the Zádiel valley [*locus classicus T. slovacum*] (Vašut & Vašutová 2004 OL). – Turňa nad Bodvou, xerothermic grasses on rocky slopes and along paths near the castle ruins (Vašut & Vašutová 2004 OL; *T. cf. danubium!*). – Jasov, castle Jasovský hrad, hilltop (Dudáš 2019 photodocumented).

(*Eupannonicum*) **4. Záhorská nížina Lowland:** Studienka (Futák 1973 SAV). – Studienka, sands in the Rudava valley, 2 km SW from the village, 175 m (Kaplan 1995 herb. Kaplan #95/54). – Studienka, sandy road in pinewood east of the village, 197 m (Vašut 2001 OL, 2008 OL). – Studienka, xerothermic grasses on sands, 1 km SSW from village, 206 m (Vašut 2008 OL). – Studienka, xerothermic grasses on sands, E of village, ca. 200 m (Vašut 2008 OL). – Malacky, along road from Malacky to Studienka, near bridge over the highway, ca. 180 m (Vašut 2001 OL). – Plavecký Mikuláš, xerothermic grasses on sands, 3,5 SW of village (Vašut 2008 OL). – forest edge between Šaštín and Borský Mikuláš villages (Slavoňovský 1961 BRNU #492255). – Borský Mikuláš town, a sandy road in pinewood, near the Ruženica hill, 250 m (Majeský 2008 OL). – Gbely, xerothermic grasses in pine-wood between villages Šaštín–Stráže and Borský Mikuláš, 180 m (Vašut 2001 OL). – Borský Mikuláš, Ruženice (281 m), xerothermic grasses on sands, 250 m (Vašut 2008 OL). – Lakšárska Nová Ves, sandy sites (Kirschner 1984 PRC #402196, 402197, *Tarax.* Exs. no. 400-404). – Lakšárska Nová Ves, around forest road in pine forest, on sand, ca. 2674 m W from middle of village and ca. 1014 m NE from Šišulákovci settlement, 205 m (Zámečník 2009 herb. Zámečník). – Veľké Leváre, xerothermic vegetation on sand, ca. 488 m SW from Závod train station, 153 m (Zámečník 2009 herb. Zámečník). – Závod, Abrod, dry meadows (Skřivánek 1953 BRNM). – Borský Svätý Jur, dry lawn in village, ca. 639 m WNW from middle of cemetery on western part of village, 174 m (Zámečník 2012 herb. Zámečník). – Borský Sv. Jur, xerothermic grasses on sands, 2 km SE of village, 170 m (Vašut 2001 OL). **5. Devínska Kobyla Hills:** Devínska Kobyla (Májovský 1955 SLO; Excursion 1955 SLO; Malý 1994 BRNU #662897). – Devín, Devínska Kobyla, *locus classicus*, 292 m (Richards 1968 OXF; Šuvada 2008 KO #30692). – Devínska Kobyla, northern hillside (Kothajová 1989 SAV). – Devínska Kobyla, grassy hillside, ca. 200 m (Futák 1960 SAV). – Devínska Kobyla, over stalls of collective farm (former JRD) (Májovský 1969 SLO). – Devínska Kobyla, SW hillside (Feráková 1997: 137). – Devínska Kobyla, under railway near Vápenka (=Štokeraevská vápenka) site (Fabranská 1955 SLO). **6. Podunajská nížina Lowland:** Kopáč Island, dry slopes over gravel-pit (Králik 1985 SLO; Uhereková Šmelková & Ružičková 2012: 91). – Šúr (Futák 1942 SLO). – Hlohovec, Soroš, Nature Reserve Sedliská, along paths, scattered, ca. 235 m (Richards & Májovský 1968 OXF, #54692, holotypus, 2n = 24; Vozárová

1979: 75; Dudáš 2017 KO #34010, 34011, 34014). – Hlohovec, hillsides over road 3 km NE from village (Sutorý 1986 BRNM #379140). – Komárno, Velké Kosihy, Derhídia, 1,7 km ENE of village (Grulich 1987 MMI). – Chotín, parking place (Šuvada 2008 KO #30693). – Chotín, Chotínske piesky site, 139 m (Šuvada 2008 KO #30694). – Chotín (Hetény), semirudeal grasses on sands near the parking place in the vicinity of the Nature Reserve (Vašut 2003 OL). – Arboretum Mlyňany (Fr. Nábělek 1954 SAV). **8. Východoslovenská nížina Lowland:** Ladmovce, Šomoš hill, Kašvár Nature Reserve, along field road, limestone, 140 m (Dudáš 2012 KO #31077, Dudáš 2015, 2016 OL, Dudáš 2019 KO #34836, BRNU #671052). – Velký Kamenec SW, settlement, eastern slopes of Tarbucka hill (Malý 1992 BRNU, *T. cf. danubium*).

Carpaticum

(*Praecarpaticum*) **10. Malé Karpaty Mts.:** Plavecký Štvrtok town, a sandy road in pinewood near the town, 171 m (Majeský 2008 OL). – Plavecký Štvrtok, along pathways in pine-wood, 1,5 km SE of village, 160 m (Vašut 2008 OL). – Plavecký Štvrtok, along road from Malacky to Plavecký Štvrtok (Vašut 2001 OL). – Studienka village, a sandy road in pinewood east of the village, 197 m (Majeský 2008 OL). – Plavecké Podhradie, Plavecký castle (Bertová 1976 SAV, *T. aff. danubium*). – Plavecké Podhradie, limestone rocks, ca 200 m (Futák 1962 SAV). – Plavecké Podhradie, near cemetery (Letz 1992 SAV). – Sološnica, Malý Raštún hill, limestone rocks, 451 m (Fr. Černoch 1957 BRNM #399901, *T. cf. danubium*; Zámečník 2013 herb. Zámečník). – Smolenice near Trnava, woodes and meadows near castle ruins [in silvis et pratis circum arcem Smolenice prope opp. Trnava] (M. Deyl 1962 PR). – Brezová pod Bradlom, slopes near road to Hradište (Králik 1969 SLO). – Čachtické kopce Mts., Čachtice castle, [together with *T. cristatum*, *T. parnassicum* and *T. erythrospermum*] (Eliáš jun. 2009 NI, rev. M. Dudáš). – Čachtice, castle ruins (F. Weber 1924 OLM). – Čachtice (s. coll. 1932 PR). – Čachtice, xerothermic grasses on rocky slopes in the vicinity of the castle ruins (Vašut 2008 OL). – Višňové village, xerothermic vegetation on the hill above the village, around the ruins of the Čachtice castle, 346 m (Majeský 2008 OL). **11. Považský Inovec Mts.:** Lúka village NEE, xerothermic slopes on limestone, east of the village, scattered, ca 220-222 m (Majeský 2009 OL; Dudáš 2017 KO #34018). – Tematínske kopce Mts., Lúka village, Tematín castle, xerothermous lawn under southern wall, frequent, 570 m (Dudáš 2017 KO #34015, 34020). – Tematín (Skřivánek 1947 BRNM #571488). – Topoľčany, Podhradie, xerothermic slopes near the castle ruins, 730 m (Majeský 2009 OL; Vašut 2009 OL). **12. Tribeč Mts.:** Zobor hill, western slope, between *Pinus nigra*, on limestone (Kusák 1982 OLM #159951). – Zobor, Hrnčiarovce, Nitra, southern slopes (Kvapilík 1930 OLM). – Zobor hill (Tetera 1995 PRC #402189, *T. cf. danubium*). – between the Cross and cave Svoradova jaskyňa (Kerényi-Nagy et al. 2008: 109; Dudáš 2019 not.). – cave Svoradova jaskyňa, near entry, in *Prunus spinosa*, scattered, 355 m (Dudáš 2017 KO #34019, *T. cf. danubium*). – Jelenec, steppe meadow SE from castle, ca 490 m (Kováčiková & Fabianková 1974 SAV). **13. Strážovské and Súľovské vrchy Mts.:** Záskanie, limestone sightseeing point near the cave Vápencová jaskyňa, 834 m (Dudáš 2018 KO #35173). – Dubnica nad Váhom, in the grass on the dike lining the Váh River, 227 m (Majeský 2017 OL). – Košecké Podhradie, Košecký hrad castle, rocks on the top of the castle hill, 450 m (Dudáš 2018 KO #35177). – Trenčianske Teplice, Sokolovica, sightseeing point, limestone, ca 620 m (Dudáš 2017 KO #34141). – Omšenie, Starý háj (= Langáč), sightseeing point, between limestone rocks, 620 m (Dudáš 2017 KO #34143). – Omšenie, Baba hill, rocks on the top, limestone, small meadow, 668 m (Dudáš 2017 KO #34012). – Omšenie, Bartošovica, sightseeing point, between limestone rocks, 694 m (Dudáš 2017 KO #34017). – Dolná Poruba, Sľopský vrch hill (= Vlčanská hill), tourist path on the top near the Cross, 789 m (Dudáš 2018 KO #35174). – Partizánske, Hradište, xerothermic grasses near the church of St. Barnabas,

235 m (Vašut & Vašutová 2004 OL). – Oslany (= Oslievany), Veľký vrch hill, dolomite (J. Futák 1960 SAV). **14b. Vtáčnik Mts.:** Revištské Podhradie, xerothermic grasses near the castle ruins (Vašut & Vašutová 2004 OL). **14e. Štiavnické vrchy Mts.:** Šášovské Podhradie, xerothermic grasses near the castle ruins (Vašut & Vašutová 2004 OL). **14d. Poľana Mts.:** Banská Bystrica, Urpínska lesostep, xerothermic meadow (Dudáš 2019 KO #34934). **15. Slovenské rudohorie Mts.:** Hrušovo village, xerothermic vegetation around an abandoned stone-pit, ca 1 km in front of the village from the south, 258 m (Majeský 2013 OL). – Hrušovo village, karst meadows above the village, 270 m (Majeský 2013 OL). **18. Stredné Pohornádie Valley:** Košice, Hradová hill, path in birch forest over shooting gallery, rare, 333 m (Dudáš 2015 OL). (*Intracarpaticum*) **25. Turčianska kotlina Basin:** Mošovce, pastures in E outskirts (Vašut 2003 OL). (*Beschidicum occidentale*) **27a. Severné Biele Karpaty Mts.:** Dolná Súča, Mt. Krasín, abandoned stone pit NNW from the village, 356 m (Dudáš 2018 KO #35175). – Dolná Súča, Mt. Krasín, rocks on the top, 514 m (Dudáš 2018 KO #35178). – Dolná Súča, Mt. Krasín, middle belt in field road at southern foothill, 387-420 m (Dudáš 2018 KO #35176). – Vršatské Podhradie, Chmeľová hill, small top ridge, tens of plants, 910-920 m (Dudáš 2017 KO #34013). **27b. Javorníky Mts.:** Udiča, Klapý hill, near yellow tourist path over spring, edge of light oak forest, scattered, ca. 520 m (Dudáš 2017 KO #34016).

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