

## Occurrence and coenology of halophilous species *Taraxacum bessarabicum* (Hornem.) Hand.-Mazz. (sect. Piesis) in Slovakia

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Abstract: We studied historical and recent occurrence of halophilous dandelion *Taraxacum bessarabicum* (Hornem.) Hand.-Mazz. in Slovakia. Herbarium specimens from 16 public herbaria were revised and field research during 2010–2015 was carried out. In total, circa 60 localities were recorded, 29 sites are documented by herbarium vouchers and 31 sites were excerpted only from the literature and unpublished data. Only five locations were confirmed recently, therefore we suggest keep the listing of the species on the IUCN category EN (endangered). Concerning the phytosociological approach, four recent locations of *T. bessarabicum* were found in saline vegetation of the alliance *Puccinellion limosae*, whereas its past frequent occurrence in the alliance *Juncion gerardii* was failed to confirm. Synanthropic occurrence was observed in Košice along gravel roadsides, between panels and on the edges of parking places and footpaths in stands close to vegetation of alliance *Dauco-Melilotion*. Distribution map of the historical and recent distribution of the species is given.

Keywords: *Taraxacum bessarabicum*, habitats, coenology, distribution, Slovakia.

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## Introduction

*Taraxacum* WIGG. (*Asteraceae*, *Cichorieae*) is a taxonomically complicated genus actually divided into ca. 55 sections (KIRSCHNER & ŠTĚPÁNEK 1997) with about 2800 accepted species (ŠTĚPÁNEK & KIRSCHNER 2012) while new taxa are still being described (OLLGAARD 2015; VAŠUT & MAJESKÝ 2015).

The ecologically well selected group of the genus *Taraxacum* comprises of halophytic and subhalophytic species preferring slightly to strongly disturbed saline meadows and pastures. From coastal communities were described the section *Piesis* (DC.) A.J. RICHARDS ex KIRSCHNER et ŠTĚPÁNEK (syn. sect. *Leptocephala* Soest). Species of the section are usually diploid sexuals and small plants which flower in the (late) summer or autumn (KIRSCHNER & ŠTĚPÁNEK 1998).

*Taraxacum bessarabicum* (HORNEM.) HAND.-MAZZ is an autogamic species distributed in the Pannonian Lowland (Czech Republic, Austria, Hungary, Slovakia) over south Ukraine and south-east Russia to the southern parts of central Siberia, on Altai Mts., to Mongolia and north-west China. Isolated occurrences are in France (Auvergne), Bulgaria, Anatolia, Transcaucasia, Syria, north Iran, Middle Asia and in Afghanistan. In North Africa it is distributed in Libya, in South Africa secondary occurrence is known (KIRSCHNER et al. 2007+; KIRSCHNER et al. 2011).

According to KIRSCHNER et al. (2011) the species is small, 5–20 cm high and usually slim. Leaves tend slant up, nearly bald, shiny, mid-green to pale yellowish green, narrow; leaf blade is linear-elliptic to close lanceolate, 10–18 cm long, almost undivided to deeply divided, sparsely to (less often) ± densely dentate or dissected. Petiole 4–6 cm long, narrow, unwinged, pale green to pinkish. Scapes are ± arachnoid throughout, rarely with bracteoles below capitulum. Capitulum small, 1–2 cm in diameter, light yellow; involucre narrow, almost cylindrical. Number of outer bracts 14–21, linear-lanceolate, roof-organized, inner bracts adpressed, on the apex with small cornicula, with green central line and pale pinkish margin. Ligules of margin flowers shallow grooved, outside with reddish line, ligules of central flowers markedly grooved, on the apex with small reddish teeth. Stigmas yellow. Pollen grains present, ± regular size. Achenes pale greyish, pappus pale pinkish-brown. Main flowering period is from July to September (DOSTÁL & ČERVENKA 1992; KIRSCHNER & ŠTĚPÁNEK 1998). Plants may vary in size and shape of leaves blade (Fig. 1) as a reaction on ecological and light conditions without taxonomical importance (KIRSCHNER et al. 2011).

Karyology:  $2n = 16$ , district Podunajská nížina Lowland (06), Kamenín /8177b/ (DVOŘÁK & DADÁKOVÁ in LÖVE et al. 1978; DVOŘÁK 1979), Močenok [= Sládečkovce], Síky /7773d/ (KOCHJAROVÁ 1992; KIRSCHNER et al. 1994), Tvrdošovce, ruderalised grassland around a small pond in Tvrdošovce /7974a/ (KIRSCHNER et al. 1994); Košická kotlina Basin (07), Košice, under the road bridge on the road to Prešov, opposite to Magnesite Plant /7293d/; district Stredné Pohornádie (18), Košice-Ľahanovce, Pri Hrušove street, Želiarska street 36 and Hlinkova street, near the road viaduct above the railway track /7293a, b/ (MIKOLÁŠ & MIHOKOVÁ 1993).



**Fig. 1. Variability of leaves from all present micro-localities from Košice (leg. DUDÁŠ 2015 KO).**

According to new Red list of ferns and flowering plants of Slovakia (ELIÁŠ et al. 2015) the species is evaluated in Slovakia in the category “endangered” (EN); as endangered (“stark gefährdet”) is evaluated also in Austria (KÄSTNER & FISCHER 2008). In the Czech Republic is critically endangered – C1t/§1 (GRULICH 2012).

The paper provides a detailed distribution of *Taraxacum bessarabicum* in Slovakia, including historical as well as recently confirmed locations. Coenotic affinity of the species is also completed and discussed.

## Material and methods

### Data collection and processing

The study was carried out during the years 2010–2015 in Slovakia. We revised herbarium sheets to determine the species distribution and field research was also conducted. Data concerning the distribution of the species were obtained from 16 herbaria (BP, BRA, BRNU, BRNM, GM, KO, LTM, MOP, NI, OLM, PMK, PR, PRA, PRC, SAV and SLO). Herbarium abbreviations are according to THIERS (2015) and VOZÁROVÁ & SUTORÝ (2001). A list of localities was compiled according to the directives of Flóra Slovenska VI/1 (cf. GOLIAŠOVÁ & MICHALKOVÁ 2012). Each location found/confirmed not more than 25 years ago was considered as recent (ELIÁŠ et al. 2015), the other locations are considered as historical. Published and unpublished data were obtained from database stored in the Department of Taxonomy of Higher Plants, Institute of Botany in Bratislava. Results of this study are presented on the dot map designed by program ArcGis, version 9.2. The grid on the map follows that described by NIKLFELD (1971). Map of occurrence in Košice (Fig. 4) was created using Google Maps.

Phytosociological relevés were sampled according to the Zürich-Montpellier approach using the adapted nine-grade Braun-Blanquet’s scale (BARKMAN et al. 1964) and stored in the TURBOWIN database (HENNEKENS & SCHAMINÉE 2001). Nomenclature of flowering plants follows MARHOLD & HINDÁK (1998). Names of syntaxa are according to cited references. The phytogeographical division of Slovakia is in accordance with work of J. FUTÁK (FUTÁK 1980).

## Results

### Distribution

The results of the study confirmed, that *Taraxacum bessarabicum* occurs only in the SW and SE part of the country in four phytogeographical districts of *Pannonicum*: Podunajská nížina Lowland, Východoslovenská nížina Lowland, Burda Hills and Košická kotlina Basin on the border of the *Carpathicum* (Košice, Ťahanovce village). In total, we recorded 29 sites documented by herbarium vouchers and 31 localities excerpted only from the literature and unpublished data (Fig. 3). Although some of these data could be a mistake, we can conclude that the species have occurred in more than 50 locations in Slovakia, of which

only five have been recently confirmed. Based on those data the inclusion of species in IUCN category EN (endangered) in the Red list of fern and flowering plants of Slovakia is correct.

The list of localities of *Taraxacum bessarabicum* in Slovakia [numbers of phytogeographical regions according to FUTÁK (1980)]:

#### **Pannonicum.**

**District 1. Burda Hills:** Kamenica nad Hronom (Futák 1949 SLO). – Chľaba [Helemba], on loess (V. Nábělek 1942).

**District 6. Podunajská nížina Lowland:** Klížska Nemá (Krippelová & Špániková 1962 SAV). – Tôň, swamps (Fr. Nábělek 1949 SAV; Futák 1949 SLO). – Veľké Kosihy, saline soil (Májovský 1963 SLO; Svobodová & Řehořek 1992). – Zlatná na Ostrove (Weber 1935 OLM; Weber 1936 PR) = Zlatná, pasture behind the village (Krippelová et soc. 1971 NI). – Zlatná na Ostrove, Pavol farmstead, saline soil (Krist 1940; Klokner 1965 PMK). – Nová Stráž (Weber 1933 PR). – Komárno, exercising ground (Krist 1940; Futák 1949 ined.; Krippelová & Špániková 1962 SAV). – Komárno, saline soil (Futák 1949 SAV). = Komárno, saline soil near station (Smejkal 1951 BRNU; Tenarček 1957 BRNM). – Chotín (Futák et Magic 1948 SLO). – Hurbanovo [*Ó-gyalla*], wet meadows near Žitava river [Zsitva] (Gáyer 1916). – Trnovec nad Váhom, Mešterík farmstead (Weber 1934 OLM). – Hájske, saline pastures [Kepežd] (Krist 1936 BRNU, 1940). – Trnovec nad Váhom, Sík farmstead (Weber 1936 BRA). = Šafa, farmstead Sík, in the direction of the Hájske village (Krist 1937 BRNU, 1940). = Močenok [Sládečkovce] (Grulich, Kirschner et Štěpánek 1986 PRA). = Močenok [Sládečkovce], Siky farmstead, 2n=16 (Kochjarová et soc. 1988 SLO). = Sík farmstead, in the direction of Močenok village (Weber 1935 OLM; Krist 1937 BRNU) = Močenok, farmstead Siky, around the panel road (MATUŠICOVÁ & ČERNUŠÁKOVÁ 2005; Eliáš jun. et Duchoň 2010 NI; Eliáš jun. 2015 NI). – Poľný Kesov, field near village (Svobodová 1968 NI; Svobodová 1982). – Poľný Kesov, meadow near Cabajský potok stream W from village (Svobodová 1972). – Dražovce, meadows (Scheffer 1927). – between villages of Jatov and Tvrdošovce (Krist 1940). – Horný Jatov and Dolný Jatov, saline soils (Krist 1937). – Dolný Jatov [U. Jatto] (Knapp 1865). – Tvrdošovce [Tardosked] (Grulich, Kirschner et Štěpánek 1986 PRA) = Tvrdošovce, ruderalised lawn near fishpond together with sect. *Palustris* (Grulich et al. 1986 PRA). – Tvrdošovce, saline soil and wet meadow (Krist 1936 BRNU, 1940; Kusák 1988 OLM; Vozárová 1994 BRA). – Tvrdošovce, saline soils near Ráčzovo jazierko Lake in the village (Svobodová & Řehořek 1992; Eliáš jun. 2013, 2015 NI). – Palárikovo [Slovenský Meder], salty meadows NW from the village (Krist 1940). – Palárikovo [Slovenský Meder], Bačala farmstead (Weber 1934 PR, 1935 OLM, 1936 BRA; Krist 1936 BRNU, 1940). – Palárikovo [Slovenský Meder], Malé Čiky farmstead (Weber 1934, 1935 PR). = Šurany, saline soil near gamekeeper's lodge Čiastka (Krist 1937 BRNU; 1940). – Palárikovo [Slovenský Meder], Okomáň farmstead (Weber 1935 PR). – Palárikovo [Slovenský Meder], Veľké

Čiky farmstead (Weber 1934 OLM). = Tvrdošovce, saline soil in Veľké Čiky farmstead [Nagy Csik] (Jirásek 1936 PRC; Unar 1965 BRNU). = Palárikovo [Slovenský Meder], saline meadow near road to Tvrdošovce village (Weber 1934 PR). – Palárikovo, saline pastures near statue of St. Wendel SE from the village (Futák 1949 ined.). – Komjatice, saline pastures [szík] near Ružový Dvor farmstead (Vlach 1934 PRC, Krist 1940). = Komjatice, saline soil (Weber 1936 BRA). – Vráble (Futák, Hejná et Ružička 1949 SLO). – Nitra, Čierny vŕšok farmstead, saline soil (Dostál 1955 PRC). – Pribeta, saline soil near railway station (Futák 1949 ined.). – Búč, W roadside to Kravany nad Dunajom [Karva] (Krist 1941; Vicherek 1964b). – Diva, Párizs völgy valley (Krist 1940). = Diva, pastures near village at Paríž stream (Eliáš jun. 2013, 2015 NI). – Ľubá [Libád], Teknyös völgy valley (Krist 1940). – Iža, saline soil near Bokroš farmstead (Klokner 1958 PMK, 1985). – between Iža and Virthova pusta site (Futák 1949 ined.). – Kravany nad Dunajom [Karva], Mária farmstead (Krist 1940). – Čenkov (Hodoval 1976 BRA). = Mužla, saline [szík] meadows (Jirásek 1938 ined.; Krist 1940). – Kamenín [Kamendín], saline meadows (Weber 1933 OLM; Krist 1935 BRNU, 1940; Fr. Nábělek 1936 SAV, BRA; Jedlička 1937 GM; Deyl 1938 BP; Futák 1948 SLO; Skřivánek 1948 BRNM; Deyl 1977 OLM) = Kamenín Nature Reserve, Dolné lúky saline soil (Jasenák 1974 LTM; Svobodová & Řehořek 1985). – Kamenný Most [Köhid Gyarmath] (Feichtinger 1899; Chrtek & Žertová 1958 PRC; Chrtek 1958 PRC; Májovský 1965 SLO; Hodoval 1976 BRA). = Štúrovo, Kamenný Most [Kamenné Ďarmoty] (Krist 1935 BRNU, 1940). = Kamenný Most, Čistiny Nature Reserve (Svobodová & Řehořek 1988). – Bíňa, alluvium – Nána, alluvium (both Holubičková & Kropáčová 1958).

**District 7. Košická kotlina Basin:** Košice, Ťahanovce village, on several places around the Magnezitárska street (from NW to SE) near Želiarska bus stop, in lanw; near Zberné suroviny salvage, in ruderalized lawn and between panels; near crossing of railway track to old Magnesite plant, on gravel; near Magnezitárska bus stop, around pylon of high voltage in ruderalized lawn; along the road W from Magnezitárska bus stop; lateral small south street opposite to Magnezitárska bus stop, on gravel near road (Mikoláš & Mihoková 1993; all Dudáš 2015 KO; Fig. 2). – Košice, Hlinkova and Rampová streets (Mikoláš & Mihoková 1993). – Košice, Rampová Street (Mikoláš 1995 MOP). – Košice, under railway station (Mikoláš 1993 MOP). – Košice, near bus stop “Pri Hati”, ruderalized lawn (Dudáš 2014, 2015 KO). – Košice, Pri Hati street, ruderalized lawn under overpass to bridge over the railway track (Dudáš 2015 KO).

**District 8. Východoslovenská nížina Lowland:** Strážne, ca. 3 km W from village on the bank of Veľká Krčava oxbow – Somotor, E from village – Šamudovce, W from village – Veľký Kamenec, S from village – Veľké Raškovce, ca 1 km NW from village – Malčice, ca 2 km E from village (all data Vicherek 1964a). – Malčice, Biednica site, saline meadows (Májovský et al. 1974). – Novosad, S from village – Malé Raškovce – Slavkovce, saline soil – Zemplínske Kopčany, Kopčianske slanisko Nature Reserve, saline soil – Soľ, mineral spring – Kuzmice, Slaný jarok mineral spring (all data Vicherek 1973; Maťaš & Mochnacký 1983).



HERBARIUM Matej Dudáš

*Taraxacum bessarabicum*

Slovensko, stredné Pohornádie (okr. 18),  
Košice, Magnezitárska ulica, okraj  
parkoviska pred areálom firmy, okolo stĺpu  
vysokého napätia, viac ako desiatka  
jedincov  
48°44'56.7"N 21°15'55.5"E  
7293d 11.8.2015 M. Dudáš

**Fig. 2.** Herbarium specimen of *Taraxacum bessarabicum* sampled in Magnezitárska street, Košice, Eastern Slovakia, deposited in KO (revised by J. Štěpánek, 2015).

### Coenology

Because the current presence of *Taraxacum bessarabicum* is rare in Slovakia, assessment of its phytosociological affinity of the species is limited. We sampled four relevés with the species on four recent sites, they are presented below:

**Relevé 1.** Diva, saline pastures grazed by livestock, in the valley south of the village under the stables, 16 m<sup>2</sup>, E<sub>1</sub> 80%, 120 m a. s. l., 47°51'57.23" N, 18°34'17.12" E, 9. 5. 2010, D. Dít ě, Z. Melečková & P. Eliáš jun.

E<sub>1</sub>: *Puccinellia distans* 4, *Taraxacum bessarabicum* 2a, *Tripolium pannonicum* 2b, *Juncus gerardii* 1, *Dichodon viscidum* +.

**Relevé 2.** Tvrdošovce, depression in pastures, extensively grazed by sheep, near the Ráczo vo jazierko pond, 16 m<sup>2</sup>, E<sub>1</sub> 90%, 110 m a. s. l., 48° 5'45.08" N, 18° 3'5.00" E, 25. 9. 2014, P. Eliáš jun.

*Puccinellia distans* 3, *Artemisia santonicum* subsp. *patens* 2b, *Tripolium pannonicum* 2b, *Festuca pseudovina* 2a, *Juncus compressus* 1, *Lotus tenuis* 1, *Taraxacum bessarabicum* 1, *Agrostis stolonifera* +, *Bupleurum tenuissimum* +, *Calamagrostis epigejos* +, *Carex distans* +, *Elytrigia repens* +, *Festuca arundinacea* +, *Lactuca saligna* +, *Melilotus macrorrhizus* +, *Poa angustifolia* +, *Podospermum canum* +.

**Relevé 3.** Močenok, Siky farmstead, saline pastures grazed by sheep, 16 m<sup>2</sup>, E<sub>0</sub> 10%, E<sub>1</sub> 95%, E<sub>Tot</sub> 95%, 116 m a. s. l., 48°13'18.42" N, 17°53'51.68" E, 24. 9. 2010, D. Dítě, Z. Melečková, P. Eliáš jun. & D. Galvánek.

E<sub>1</sub>: *Trifolium bonanii* 3, *Pulegium vulgare* 2b, *Agrostis stolonifera* 2a, *Cynodon dactylon* 2a, *Pulicaria vulgaris* 2a, *Hordeum geniculatum* 1, *Juncus compressus* 1, *Lolium perenne* 1, *Plantago lanceolata* 1, *Echinochloa crus-galli* +, *Festuca pseudovina* +, *Leontodon autumnalis* +, *Lotus tenuis* +, *Plantago major* subsp. *winteri* +, *Poa pratensis* +, *Taraxacum bessarabicum* +, *Taraxacum* sect. *Ruderalia* +, *Trifolium repens* +.

E<sub>0</sub>: *Amblystegium humile* 2a.

**Relevé 4.** Košice, Ťahanovce village, Magnezitárska Street, on gravel on roadside near crossing of railway, 16 m<sup>2</sup>, E<sub>1</sub> 85 %, 223 a. s. l., 48°45'04.4" N, 21°15'42.3" E, 11. 8. 2015, M. Dudáš & J. Fabianová.

E<sub>1</sub>: *Taraxacum bessarabicum* 3, *Puccinellia distans* 2m, *Stenactis annua* 1, *Atriplex tatarica* 1, *Cichorium intybus* 1, *Achillea collina* +, *Artemisia vulgaris* +, *Artemisia absinthium* +, *Solidago canadensis* +, *Senecio jacobea* r, *Melilotus albus* r.

As showed our data, the species is recently present in stands of the association *Puccinellietum limosae* SOÓ 1933 (alliance *Puccinellion limosae* SOÓ 1933, class *Festuco-Puccinellietea* SOÓ ex VICHÉREK 1973). Relevé 1 represents strongly overgrazed and species-poor stand of this association. There is no doubt that intensive grazing is an appropriate management for survival of *Taraxacum bessarabicum*; it reached relatively high cover (to 10%). In contrast, relevé 2 is considerably degraded stage of *Puccinellietum limosae*. Stand passes gradually into the vegetation of the alliance *Festucion pseudovinae* SOÓ 1933 due to changes in the hydrological regime and the absence of long-term grazing in the past. The cover of *Taraxacum bessarabicum* is lower by a half compared to the previous relevé. The species had the lowest cover in saline grasslands intensively grazed by sheep near Močenok (relevé 3) where a typical mosaic of different halophytic and sub-halophytic vegetation is developed. The stand of relevé 3 is in a shallow depression flooded longer in spring. It has a strong transitional character; moderate soil salinity indicates species of several alliances like *Puccinellion limosae* and *Festucion pseudovinae*. Low salt and high nutrient accumulation indicate species of *Potentillion anserinae* R. Tx. 1947 and



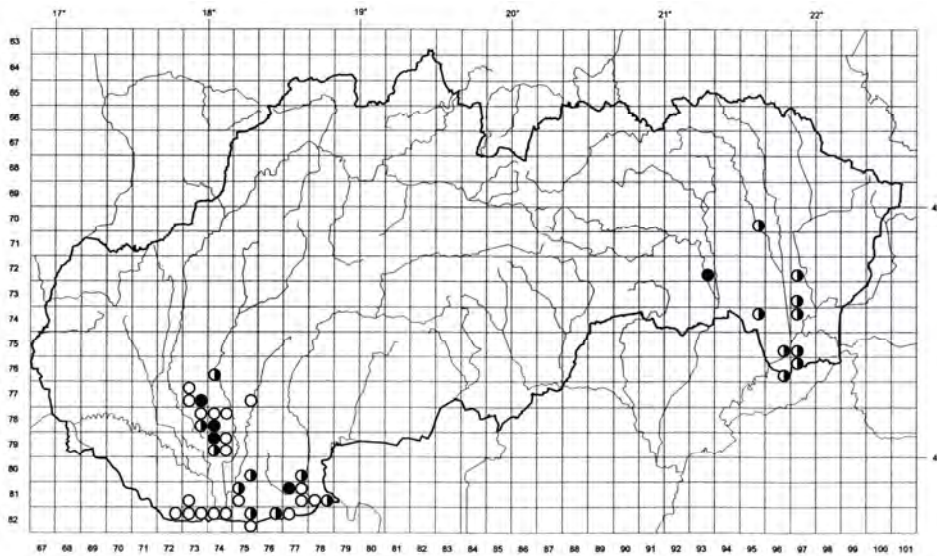
*Verbenion supinae* SLAVNÍČ 1951 (especially from association *Pulicario vulgaris-Menthetum pulegii* SLAVNÍČ 1951). In addition, coenologically indifferent species of trampled, disturbed areas are present. Therefore, this relevé is not determinable to a particular syntaxon. The ecological circumstances for *Taraxacum bessarabicum* are optimal thanks to the low disturbance and the surrounding semi-natural vegetation. Relevé 4 represents ruderal vegetation with a predominance of biennial and perennial species close to stands of alliance *Dauco carotae-Melilotion albae* GÖRS 1966. Open patches and the low level of species competition allow the long term survival of *T. bessarabicum* here. The ability of species to survive in this type of habitat creates a presumption that the number of such secondary localities may rise in the future.

## Discussion

*Taraxacum bessarabicum* is a relatively easily determinable and also a rare species of the Slovak flora. In rare cases it can be confused with plants belonging to the *Taraxacum* sect. *Palustris* or *Taraxacum* sect. *Ruderalia* which can grow together.

As our study shows the distribution of *T. bessarabicum* in the territory of Slovakia is concentrated to the southwestern and south-eastern parts of the country. In the Košická kotlina Basin the occurrence of the species is situated only in southern border of the *Carpaticum* (the Košice settlement). DOSTÁL & ČERVENKA (1992) mentioned its occurrence also in the Záhorská nížina Lowland, however, no herbarium specimens or literature data were found during our study and current occurrence was also not confirmed there. We can conclude that *T. bessarabicum* was referred mistakenly in this area. Although also some other literature data might be incorrect (e. g. V. NÁBĚLEK mentioned the species from loess soil where it does not grow), they mostly overlap and complement the sites documented by herbarium collections, respectively (Fig. 3).

KNAPP (1865) was one of the first botanists who reported the species from Slovakia. He found it in the surrounding of Jatov settlement. Later PANTOCSEK (1898) mentioned *T. bessarabicum* as a typical species of saline habitats of former Nitra Comitatus (the data was probably taken from work of KNAPP) and FEICHTINGER (1899) published it from surrounding of Kamenný Most village. Most data have gathered in the period between the world wars. As a top effort can be considered the work of Moravian botanist V. KRIST who provided the most comprehensive overview of saline habitats in SW Slovakia that time (KRIST 1940). The author mentioned also *Taraxacum bessarabicum* from this area while he pointed out 16 exact locations of the species in the text, but 31 dots in his distribution map (KRIST l. c., p. 25). The reason for this disproportion is not known, but it is possible that the author drawn more dots on the map for some larger localities mentioned in the text. Later VICHEREK (1964a, b, 1973) confirmed the occurrence of the species in SW Slovakia but also indicates new locations in SE Slovakia. Several data from SW Slovakia published also SVOBODOVÁ (1972, 1982) and SVOBODOVÁ & ŘEHOŘEK (1985, 1988, 1992).



**Fig. 3. Distribution of *Taraxacum bessarabicum* in Slovakia: ○ – historical localities, ● – recently confirmed localities, ⊙ – supplemental literature data (not documented by herbarium specimen).**

We confirmed only four sites from a large number of sites in SW Slovakia. *T. bessarabicum* has survived in three relatively well preserved saline habitats managed as pastures (Močenok, Tvrdšovce – two micro-populations, Diva), other locations were probably destroyed during massive land reclamation practices in the seventies and eighties of the 20th century (SÁDOVSKÝ et al. 2004). However, thanks to the re-introduction of grazing (within the implementation of the project LIFE10 NAT/SK/083 from 2013) in several locations of natural halophytic vegetation in SW Slovakia we observed positive changes in the floristic composition. The continuous trampling of domestic animals promotes the re-establishment of species with low competition ability therefore re-discovery of *T. bessarabicum* cannot be excluded.

Occurrence in Východoslovenská nížina Lowland was not confirmed during our field research. No records were discovered also during the Floristic course in Trebišov (cf. MÁRTONFI et al. 2014). Occurrence in saline soils in Nature Reserve Kopčianske slanisko and Slavkovské slanisko was not confirmed for a long time. However, while occurrence of *T. bessarabicum* can be still expected in the first locality (occasional grazing is still present here), degradation processes has forwarded on the second one very rapidly and its re-appearance here is already unlikely. Others localities were destroyed and changed to agriculture fields. Reports of occurrence from mineral springs near village of Kuzmice (Slaný jarok spring) and village of Sol' (mineral springs) were not confirmed as well. We also monitored the mineral spring near Ladmovce village, but the terrain was modified and the species has never been known here. We expect that the species can be

rediscovered on the banks of Krčava oxbow or in close field roads around the oxbow, where are still good conditions for its survival.

In East Slovakia the species was recently confirmed only in the border of Košická kotlina Basin and the Stredné Pohornádie Region in the city of Košice. The first finding of *T. bessarabicum* in Košice was found by V. MIKOLÁŠ in 1987. Comparing with the distribution of summarized work of MIKOLÁŠ & MIHOKOVÁ (1993), the main occurrence is concentrated north of an abandoned Magnesite plant along the Magnezitárska Street (Fig. 4). The present distribution of the species is located between the bus stops “Zeliarska” and “Magnezitárska” in several micro-populations. Isolated micro-populations are located near the bus stop “Pri Hati” along the footpath in ruderalized lawn and near the road bridge over railway track. The occurrence of the species is connected partly with the influence of prevailing northern winds bringing magnesite pollution from magnesite plant. All of these locations represent synanthropic habitats strongly affected by industrialisation and constructions.

The species naturally grows in halophilous meadows and lawns, near salt sources and periodically water-logging depressions, generally on disrupt places; on clay wet, always salt alkaline soils (KIRSCHNER et al. 2011). It was found the most frequently in alliances *Puccinellion limosae* (class *Festuco-Puccinellietea*) and *Juncion gerardii* WENDELBERGER 1943 [class *Scorzonero-Juncetea gerardii* (VICHEREK 1973) GOLUB et al. 2001] in Slovakia (VICHEREK 1973; DÍTĚ et al. 2014a; MELEČKOVÁ et al. 2014). In the first case it is a constant species of the associations *Puccinellietum limosae* and *Hordeetum hystricis* WENDELBERGER 1950. In the *Scorzonero-Juncetea gerardii* it is a characteristic species of the class and it occurs in each association of the class, the most frequently in the association *Agrostio-Caricetum distantis* SOÓ 1939, where it is a constant species. It figures as a constant species of the association *Scorzonero parviflorae-Juncetum gerardii* as well, which is recently missing in Slovakia. In addition, it also occurs sporadically in the association *Caricetum divisae* SLAVNÍČ 1948 (MELEČKOVÁ et al. l. c.). In the past, *T. bessarabicum* was found in stands of the association *Cyperetum pannonicum* SLAVNÍČ 1948 included in the class *Crypsietea aculeatae* VICHEREK 1973 (VICHEREK 1964b, 1973), however, this association is extinct now in Slovakia (DÍTĚ et al. 2014b).

As showed our research, *Taraxacum bessarabicum* occurs recently mainly in species-poor perennial halophytic plant communities of the association *Puccinellietum limosae*. But character of stand recorded in relevé 3 suggests that the species might enter also to other types of semi-natural periodical wetland vegetation. In the future, it could be found e. g. in association *Pulicario vulgaris-Menthetum pulegioides* (alliance *Verbenion supinae*) which occupy soils rich with basic ions and nitrates, sometimes slightly saline (VALACHOVIČ 2001; ŠUMBEROVÁ & HRIVNÁK 2011, 2013; BORHIDI et al. 2012). It thus appears that the survival of the species depends more in habitat disturbance than soil salinity. The recent records in southeast Slovakia confirm that it can be also expected at the edges of salted roads in the future as it is well known for other halophytes e. g. *Puccinellia distans* (ŠERÁ 2008; KŘENOVÁ et al. 2012). Relevé 4 sampled in this habitat clearly shows this possibility. *T. bessarabicum* occurs here in vegetation close to alliance *Dauco-Mellilotion* (class *Artemisietea vulgaris* LOHMEYER et al.

ex von ROCHOW 1951) developed on shallow soils with a high content of gravel, which are dry and poor in nutrients. Stands form the initial stages of succession on anthropogenic substrates and spread extensively during the 20th century due to the development of road and railway network, building construction etc. In Slovakia they are found abundantly in lowland and hilly areas (LÁNIKOVÁ 2009; JAROLÍMEK et al. 1997). Occurrence of *T. bessarabicum* in this vegetation type at locality in the Košice settlement is caused by high secondary concentrations of magnesium in the soil from a near abandoned magnesium factory, what some halophytic species probably used as a substitute for the lack of Na and lower soil salinity.

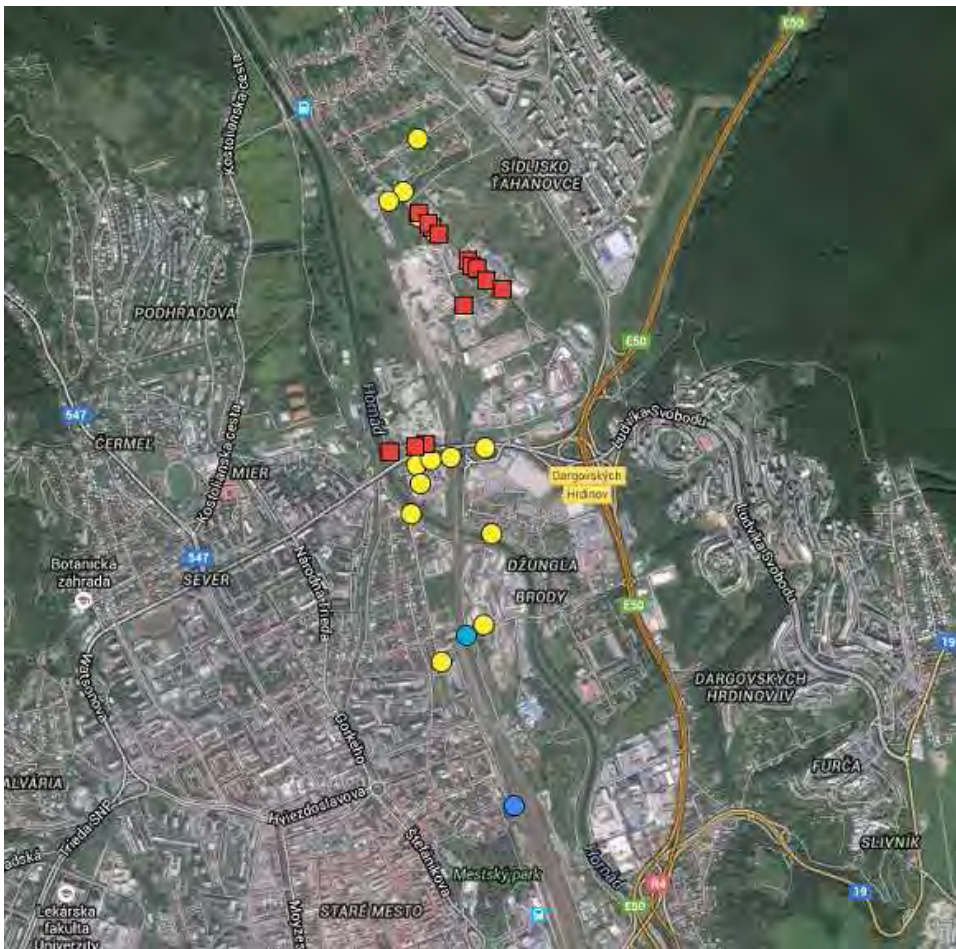


Fig. 4. Distribution of *Taraxacum bessarabicum* in northern part of Košice city and Ťahanovce village, Slovakia. Yellow rings – literary data according to MIKOLÁŠ & MIHOVÁ. Blue rings – old herbarium specimens (MIKOLÁŠ 1993, 1995 MOP). Red squares – current status of distribution in years 2014–2015 (DUDÁŠ 2014, 2015 KO).

In other countries of Central Europe the halophytic vegetation is well preserved especially in Hungary. The species is mentioned there within vegetation of the class *Festuco-Puccinellietea* SOÓ 1968 em. BORHIDI 2003, the alliance *Puccinellion peisonis* (Wendelbg. 1943 corr. Soó 1947) BORHIDI 2003. Significant *T. bessarabicum* presence was recorded especially in the association *Lepidio crassifolii-Puccinellietum limosae* SOÓ (1947) 1957. This stands represent relatively strongly salinised solonchak meadows, where the maximum salt content is near the soil surface (BORHIDI et al. 2012). In addition to this type of vegetation *T. bessarabicum* is stated also in the class *Scorzonero-Juncetea gerardii* (VICHEREK 1973) GOLUB et al. 2001, alliance *Scorzonero-Juncion gerardii* (WENDELBG. 1943) VICHEREK 1973. Here, *T. bessarabicum* is one of the constant species of associations *Taraxaco bessarabicae-Caricetum distantis* WENDELBG. 1943 and *Loto-Potentilletum anserinae* VICHEREK 1973 (BORHIDI et al. l. c.). The species is reported from these same types of vegetation also from Austria (WENDELBERGER 1950; MUCINA 1993) while in the Czech Republic it was recorded also in stands of the association *Heleochoëtum schoenoidis* TOPA 1939, class *Crypsietea aculeatae* VICHEREK 1973 (ŠUMBEROVÁ 2007). It is obvious that *T. bessarabicum* has no specific phytosociological affinity and it occupies different types of halophytic vegetation where traditional management, such as extensive grazing and mowing, play quite a substantial role in their vegetation dynamics (MELEČKOVÁ et al. 2014).

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