

## ***Triglochin maritima* – rediscovered in southern Slovakia**

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Abstract: North of the town Štúrovo near Diva settlement a rare halophyte, *Triglochin maritima* was found. It grows in stands of the association *Puccinellietum limosae* which occupies the lowest-lying shallow depressions. The site is intensively grazed by cattle, semi-ruderalized stands of the alliance *Potentillion anserinae* prevail. Although the area is known as an interesting site of inland salt marsh vegetation, the species was not confirmed more than 40 years in the entire Podunajská nížina Lowland. While in the inner basins of the Western Carpathians it has several recent localities in fen vegetation (*Caricion davallianae*), in the Slovak part of the Pannonian bioregion it is the single locality.

Keywords: inland salt marshes, *Puccinellion limosae*, grazing, rare species.

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### **Introduction**

Sea arrow-grass (*Triglochin maritima* L.) is an Eurasian species with boreal-oceanic circumpolar distribution (cf. MAGLOCKÝ & HOLOTOVÁ 1999). In Europe it has continuous occurrence along the Atlantic seacoast from the British Isles and Scandinavia to the Baltic Sea. Several sites are in Iceland, smaller areas are in NW part of the Iberian Peninsula, the French Riviera, Sicily and Croatia. Inland occurrences are mostly in Spain, France, Italy, Austria, Slovakia, Hungary, Romania, Bulgaria, Moldavia and Ukraine. Elsewhere it has rather disjunct area.

In Russia it is known from Siberia to Ural, on the south at the Caspian Sea to Turkey. It is also reported from Asia, North and South America (cf. HULTÉN 1964).

In the Western Carpathians *Triglochin maritima* is a glacial relic species (DÍTĚ et al. 2018). In Slovakia it is relatively rare, its main distribution with the majority of occurrences is in the inner basins of the Western Carpathians: Liptovská, Popradská and Hornádska kotlina. It occurs sporadically in the Turčianska kotlina, Horehronie, Slovenský raj, Pieniny, Šarišská vrchovina and Nízke Beskydy regions. In the recent past, 18 sites were confirmed from the 44 known localities (DÍTĚ & PUKAJOVÁ 2004).

In southern Slovakia, the species was published from 8 localities of lowland saline habitats: Poľný Kesov, Hájske, Búč, Mužla, Diva and Štúrovo. The most recently documented sites are Poľný Kesov (Svobodová 1972 NI) and Kamenínske slanisko (Šula 1974 OLM, Jasenák 1976 LTM). From the following years it was only mentioned in several publications from sites Čistiny and Kamenínske slanisko (SVOBODOVÁ & ŘEHOŘEK 1985, 1988; DAVID 1996). DÍTĚ & PUKAJOVÁ (l. c.) and MELEČKOVÁ et al. (2013) consider the species in the Pannonian part of Slovakia extinct. In the latest Red List of Slovakia (ELIÁŠ et al. 2015) *T. maritima* is included among the category vulnerable species (VU).

Detailed distribution in Slovakia and coenological studies of *Triglochin maritima* provided DÍTĚ & PUKAJOVÁ (2004). According to these authors it is recently concentrated in fens of northern Slovakia. It grows in plant communities of the *Caricion davallianae* alliance, in the association *Caricetum davallianae*, often together with the extremely rare *Schoenus ferrugineus*. *T. maritima* creates with *Centaureum litorale* subsp. *uliginosum*, *Glaux maritima*, *Plantago maritima*, *Schoenoplectus tabernaemontani* and *Trichophorum pumilum* a very specific plant assemblage, *Glaux-Trichophoretum pumili* (DÍTĚ et al. 2007). This association is known only from mineral springs of the Popradská and Hornádska kotlina basins (MELEČKOVÁ et al. 2014; DÍTĚ et al. 2015a). The species was published from Baldovce (Hornádska kotlina) by DÍTĚ et al. (2017) in other vegetation, relative to the association *Scorzonero-Juncetum gerardii* (alliance *Juncion gerardii*) which is the single known occurrence in the Western Carpathians in this vegetation type.

From southern Slovakia, all historical occurrences refer to inland salt marshes, primarily in the vegetation of the alliance *Juncion gerardii*, association *Scorzonero parviflorae-Juncetum gerardii* (VICHÉREK 1973; SVOBODOVÁ & ŘEHOŘEK 1985, 1988; MAGLOCKÝ & HOLOTOVÁ 1999). Phytosociological material of this association with the presence of *T. maritima* was published from localities near Hájske, Kamenný Most and Diva settlements (VICHÉREK l. c.). Our contribution aims to provide information on the rediscovery of *Triglochin maritima* in southern Slovakia.

## Material and methods

Phytogeographical division is used according to FUTÁK (1984). Taxonomy and names of flowering plants follow MARHOLD & HINDÁK (1998), names of syntaxa

follow JAROLÍMEK et al. (2008); if the syntaxon is not published in this work, we include it with the authors' abbreviations and the year of description. Herbarium acronyms are according to VOZÁROVÁ & SUTORÝ (2001). Phytosociological relevés were sampled according to the Zürich-Montpellier approach (BARKMAN et al. 1964) using the adapted nine-grade Braun-Blanquet's scale (WESTHOFF & VAN DER MAAREL 1978). A grid map was created in ArcGis, vers. 9.2. according to the methodology published by NIKLFELD (1971).

## Results

During the field survey of saline vegetation north of the town Štúrovo was found *Triglochin maritima* on a pasture near the settlement Diva on the right side of the Paríž stream (Fig. 1, 2). The vegetation is characterized by the following phytosociological relevé:

Pohronská pahorkatina, Diva, intensively grazed saline vegetation by cattle, 117 m, N 47°51'57.0", E 18°34'09.8", 16 m<sup>2</sup>, E<sub>1</sub>: 85%, 8. 7. 2017.

E<sub>1</sub>: *Puccinellia distans* agg. 4, *Juncus gerardii* 2a, *Trifolium bonanii* 2a, ***Triglochin maritima* 2a**, *Festuca arundinacea* 1, *Tripolium pannonicum* 1, *Plantago major* +, *Taraxacum bessarabicum* +.

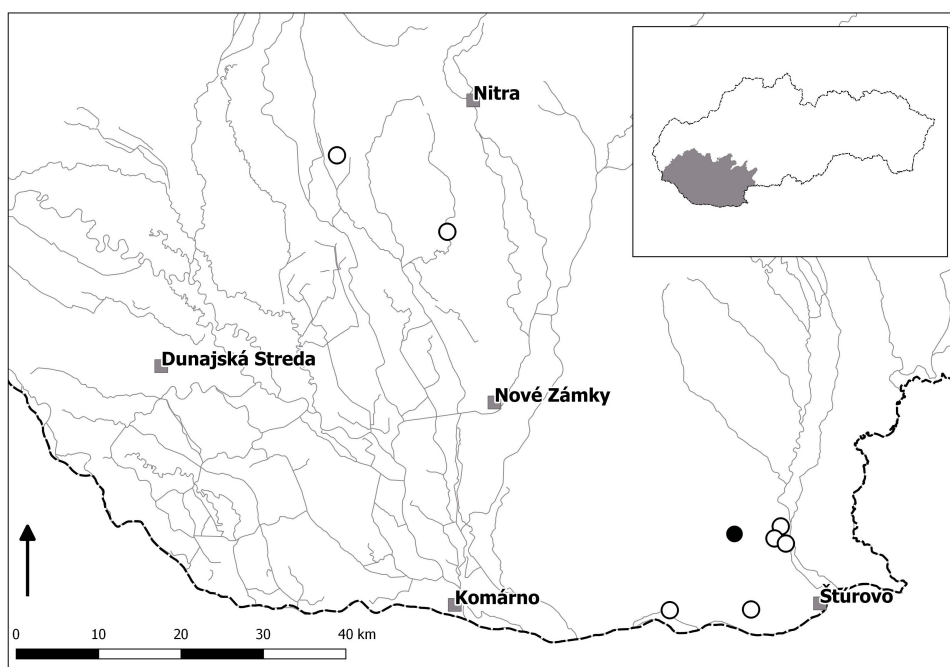


Fig. 1. Occurrence of *Triglochin maritima* in the Podunajská nížina Lowland: ○ – historical localities, ● – localities confirmed in 2017.

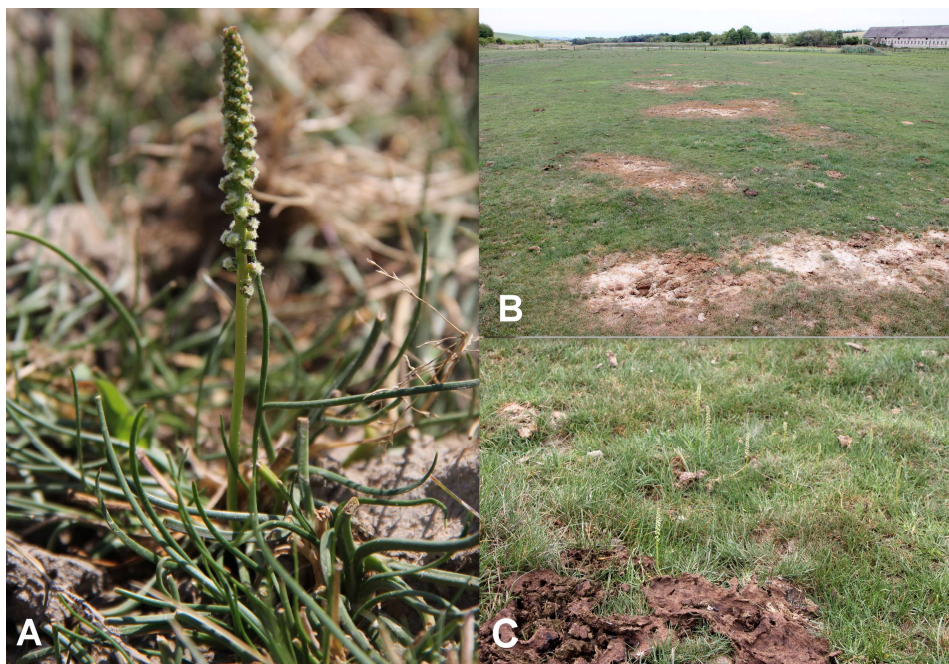


Fig. 2. *Triglochin maritima* in Diva settlement north of the town Štúrovo. A – flowering specimen, B – whitish “blind-szik” patches with increased soil salinity on the pasture where association *Puccinellietum limosae* grows, C – detailed capture of the vegetation of *T. maritima*.

Based on the dominance of *Puccinellia distans* agg. and the presence of *Tripolium pannonicum* we assign this vegetation into the association *Puccinellietum limosae* (alliance *Puccinellion limosae*, class *Festuco-Puccinellietea*). These stands occupy the lowest-lying shallow depressions, their area is about 40 x 150 m within the fenced pasture. *T. maritima* was found only in the central part of the depression on small, 25 m<sup>2</sup> area. There are rich populations of two rare halophytes, *Taraxacum bessarabicum* (thousands of individuals) and *Tripolium pannonicum*.

Except species recorded in the enclosed relevé, no other obligate halophytes were found. On the SE part of the pasture around a small, degraded spring *Schoenoplectus tabernaemontani* is abundant. Ruderalized stands of the alliance *Potentillion anserinae* R. Tx. 1947 prevail, the most common is *Festuco arundinaceae-Althaeetum officinalis* Neuhäuslová-Novotná 1968. On the contact zones with the saline depression, stands of *Loto-Potentilletum anserinae* Vicherek 1973 are developed. On the moister areas with longer flooding period, plant community of *Rumici crisp- Agrostietum stoloniferae* Moor 1958 is typical.

Halophytic vegetation on the site Diva is rather secondary, it has developed after water regulations and it was ploughed several times. In the beginning of the

2000s, there were known only poor stands of *Puccinellia distans* agg. growing in blind-szik areas (patches with the highest soil salinity). In the following years, those stands were extending over the whole depression thanks to the regular intensive grazing. The whole area (5 ha) is grazed by 40 cattle. In years with higher precipitation, these places are inundated several times. The drenched soil is trampled by the cattle which create suitable micro-habitats for *Puccinellia distans* agg. and other halophytes (e.g. *Taraxacum bessarabicum*). For this reason, *T. maritima* could have been out of attention for a long time, supposing that it was surviving there in a minimum population size. During our visit, several flowering plants were just grazed by the cattle. The height of fertile plants reached max. 15 cm, sterile plants were impossible to determine in the dense stands.

## Discussion

The first remark of inland salt marshes and *Triglochin maritima* in Diva (Paríž river valley) provided KRIST (1940) who referred them as the part of vast saline habitats expanding north of the town Štúrovo. He described the habitat of *T. maritima* as saline wet meadows; on places with the highest soil salinity no vegetation cover was present and poor stands of *Puccinellia distans* were developed. Except the obligate halophytes recorded in our relevé he reports *Plantago maritima* (KRIST l. c.), among facultative halophytes *Taraxacum bessarabicum*, *Achillea aspleniifolia* and *Podospermum canum* and mesic species common for pastures like *Cichorium intybus*, *Daucus carota*, *Pastinaca sativa*, on the channel banks *Eleocharis palustris*, *Schoenoplectus lacustris* and *Bolboschoenus maritimus*. All these plants except *Achillea aspleniifolia* are recently present there (DUDÁŠ et al. 2016).

The single source regarding vegetation characteristics of the area are five coenological relevés sampled by VICHÉREK (1973; Tab. 11, rel. no. 6-10). There dominated *Scorzonera parviflora*, *Juncus gerardii* and *Triglochin maritima* (cover between 15-25%), lower cover values reached *Plantago maritima*, *Tripolium pannonicum*, *Taraxacum bessarabicum*, *Puccinellia distans*, *Trifolium bonanii*. The author classified these stands within the alliance *Juncion gerardii*, association *Scorzonero parviflorae-Juncetum gerardii*. We have not confirmed this salt marsh community, recently it is not known either in south Slovakia (MELEČKOVÁ et al. 2014; DÍTĚ et al. 2017). Association where *T. maritima* has its coenological optimum, is in the whole Pannonian bioregion rare and threatened, the most wide-spread is in the Seewinkel (Fertő) area. The nearest, similar vegetation is known in NW Hungary, Győr (DÍTĚ et al. 2015b). In southern Morava all of the published sites are vanished (ŠUMBEROVÁ et al. 2007). In the newest edition of the Czech Red List (GRULICH 2012) the species is categorized as RE (Regionally Extinct).

Despite the long-term survey of saline habitats of the Pannonian bioregion we did not record *T. maritima* in the vegetation of *Puccinellietum limosae*. Species-

poor initial stands with *T. maritima* and dominance of *Puccinellia* genus is typical for maritime salt marshes especially in western and northern Europe, e.g. ADAM (1981); BAKKER et al. (1993); NORDHAGEN (1954); NYGAARD & LAWESSON (1998). Such vegetation we surveyed in southern Sweden and in the Arctic Norway (Dítě D. & Dítě Z. 2015, 2016, ined.). Beyond the Pannonian border we recorded it in poor secondary vegetation of *Puccinellietum limosae* in abandoned salt mines of Ocna Sibiului (Transylvanian basin, Romania). Since the vegetation composition is very similar to the discovered site in Slovakia, we enclose a relevé below.

Romania, Ocna Sibiului, abandoned salt mines, outside of the fenced area of the spa, shallow water-logged depression, heavily salinized, grazed by goat, 394 m, N 45°52'08.2", E 24°03'48.9", 16 m<sup>2</sup>, E<sub>1</sub>: 45%, 22. 7. 2011.

E<sub>1</sub>: *Puccinellia distans* agg. 2b, ***Triglochin maritima* 2b**, *Tripolium pannonicum* 1.

Outside of the relevé plot, *Salicornia prostrata*, *Plantago maritima*, *Juncus gerardii* and *Lotus tenuis* were frequent. Such vegetation from the very similar habitat type was discovered from abandoned salt mines in western Ukraine (WOCH & TRZCINSKA-TACIK 2015) where *T. maritima* was recorded in typical stands of *Puccinellietum limosae*.

The ability to colonize pioneer habitats is evidenced by the fact that *Triglochin maritima* occupies places around highly mineralized springs with new travertine formations in several localities of northern Slovakia (e.g. Stankovany, Sliačske travertíny, Bešeňová, Sivá brada). In such stands it can be the sole species (cf. DÍTĚ & PUKAJOVÁ 2004).

The rediscovered site in Diva completes the knowledge about the vegetation niche of *Triglochin maritima* in the Pannonian bioregion. Within inland salt habitats besides the most typical vegetation (*Juncion gerardii*) it is a component of the alliance *Puccinellion limosae* as well.

Grazing is evidently a promoting factor for establishing/surviving of halophytes like *T. maritima*. Although the site Diva is a relatively well-explored locality of halophytic vegetation, the species was not found there more than 40 years. This applies for the entire Podunajská nížina Lowland where it is missing nowadays. On the closest historical sites (Čistiny and Kamenínske slanisko Nature Reserves), the grazing was re-introduced within the project LIFE+ and thanks to restoration activities from 2014 several rare species of saline habitats (*Carex divisa*, *Trifolium retusum*, *T. angulatum*) were found again. Rediscovery of salt marsh species like *Triglochin maritima* or *Scorzonera parviflora* on that site is still some way off.

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