

The current distribution and status of community *Puccinellietum limosae* in Slovakia

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Abstract: Community *Puccinellietum limosae*, characteristic by dominant occurrence of *Puccinellia* species, has developed on flat plots of alkali soils. Twelve localities with this community were documented by phytosociological relevés in Slovakia until 1970s. During field survey of Slovak saline habitats in 2003 – 2008 we found no typical vegetation of this association. Plants of *Puccinellia distans* agg. occur frequently on all remains of saline habitats, but they are fixed on different plant communities, which are also often modified and degraded. Vegetation most similar to association *Puccinellietum limosae* was found on damaged (tilth and subsequently abandoned) salt meadows on two localities near the villages of Kráľová nad Váhom and Nová Stráž. Management to preserve or improve these saline habitats is lacking, therefore the habitats are changing gradually and ruderal species are invading there from surrounding agricultural fields. We may conclude that association *Puccinellietum limosae* is critically endangered in Slovakia now.

Keywords: *Puccinellia distans* agg., *Puccinellietum limosae*, saline habitats, Slovakia.

Introduction

Saline habitats with typical alkali vegetation covered a relatively large area in Slovakia, with the largest localities in the Podunajská nížina Lowland (8300 ha documented until 1970s; OSVAČILOVÁ & SVOBODOVÁ 1961). Smaller area of saline biotopes was found in the Východoslovenská nížina Lowland (VICHEREK 1964) and the Záhorská nížina Lowland (KRIST 1940). Strong reduction of saline sites during last 30-40 years resulted in ca. 500 ha of actual alkali vegetation estimated in the Podunajská nížina Lowland (SÁDOVSKÝ et al. 2004), only fragments with species-poor vegetation in two natural reserves in the Východoslovenská nížina Lowland (Kopčianske slanisko and Slavkovské slanisko), and even extinction of saline communities in the Záhorská nížina Lowland (DÍTĚ & ELIÁŠ jun. ined.). Devastation of saline soils resulted also to the regression of typical saline plant communities. Besides the summary work by VICHEREK (1973), there are only a few works devoted to saline plant communities in Slovakia which are useful for our knowledge of their distribution, species structure and ecological requirements.

The association *Puccinellietum limosae* SOÓ 1933 is classified within the alliance *Puccinellion limosae* SOÓ 1933 and class *Festuco-Puccinellietea* SOÓ ex VICHEREK 1973. It is represented by sparse vegetation, often with discontinuous canopy, with dominance of either *Puccinellia limosa* (e.g. in relevés by VICHEREK 1973) or *P. distans* (e.g. ŠUMBEROVÁ et al. 2007). These two species from the genus *Puccinellia* have often been misidentified by various botanists (see MORAVCOVÁ et al. 2001); therefore in this paper we prefer to use provisional name *P. distans* agg. Further obligate halophytes, such as *Artemisia santonicum*, *Plantago maritima*, *Tripolium pannonicum* or *Spergularia media*, are often present in the association. It is a species-poor community with 5 – 15 species, developed in flat parts of saline habitats without sharp depressions. Soils are heavy, clayey and very saline. The stands are wet during the year, except in the summer when the surface becomes to dry heavily, hardens and then fissures to polygons (cf. ŠUMBEROVÁ et al. 2007).

Puccinellietum limosae was a rather abundant community in Slovakia in the past (Fig. 1). KRIST (1940) reported it from most Slovak saline habitats. It is documented by relevés from the Podunajská nížina Lowland on localities Kamenín, Zlatná na Ostrove, Tvrdošovce, Palárikovo, Rastislavice, and Hájske as well as from the Východoslovenská nížina Lowland on locality Malčice (VICHEREK 1973). ŠMARDA (1935) published a relevé from Palárikovo and KLIKA & VLACH (1937) from Komárno, Nová Stráž, Komjatice, Kamenín and Dolný Jatov.

The aim of this paper is to present the current status and distribution of the association *Puccinellietum limosae* in Slovakia. We compare published vegetation data about this typical saline community with new data which we gathered during the survey of Slovak saline habitats.

Material and methods

The study was carried out in 2003–2008. Localities of *Puccinellietum limosae* were found in the field according to published data (KLIKA & VLACH 1937, KRIST 1940, ŠMARDÁ 1952, VICHÉREK 1973). The phytosociological relevés were sampled according to the Zürich-Montpellier approach using 9-grade Braun-Blanquet scale (BARKMAN et al. 1964). All relevés were stored in the database using the TURBOVEG software (HENNEKENS 1996). The relevés were classified by divisive polythetic analysis using program TWINSpan (HILL 1979). Nomenclature of flowering plants follows MARHOLD & HINDÁK (1998) and the names of syntaxa are according to MOLNÁR & BORHIDI (2003).

Results

During the surveys of Slovak saline habitats we recorded populations of *P. distans* agg. in various saline communities. Plants of *Puccinellia* occurred almost on all remains of remarkably degraded salt meadows. Although we were not able to identify plants to either *P. distans* or *P. limosa* (therefore they are indicated as *P. distans* agg., Tab. 1), we estimate that the latter taxon is much less frequent as the former one. In most cases, the cover of *Puccinellia* does not reach more than 5% (max. 15%) per relevé (DÍTĚ, ELIÁŠ jun., SÁDOVSKÝ & ŠUVADA, ined.). Slightly higher cover was recorded in fragments of associations *Camphorosmetum annuae* (Tab. 1, relevés no. 1 – 4) and *Artemisio santonici-Festucetum pseudovinae* (Tab. 1, relevés no. 5 – 7).

Relatively large cover (>15%, twice even more than 50%) of *P. distans* agg. was observed on salt marshes, which were damaged (tilth) in the past. Saline habitats on localities near Kráľová nad Váhom, Nová Stráž and Pavol farmstead (Fig. 1) were left abandoned after tilth (Tab. 1, relevés no. 8 – 14). During subsequent succession, artificial and modified communities have formed there, e.g. on salt meadow near Nová Stráž with cover of *Tripolium pannonicum* about 80%. Among all currently recorded relevés, these communities most resemble association *Puccinellietum limosae*.

In contrast to typical *Puccinellietum limosae*, communities recorded during our study are developed on places remarkably degraded by human activities. According to the shape of relief in localities with remains of saline habitats, we may assume that current saline habitats had contained highest level of soil salt concentration also before their devastation. High salt concentration in the soil was not lowered during agricultural intervention. Hence, the salt places have remained to be not utilizable by agriculture in spite of the nearby fields which are regularly managed by conventional agriculture. Presence of several ruderal species in relevés is a result of their spread from neighbouring fields.

Tab. 1. Recent phytosociological relevés from Slovakia with cover of *Puccinellia distans* agg. more than 15%.

Number of relevé	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Area of relevé m ²	2	2	1	1	4	8	16	16	16	16	16	16	16	16
cover E1 %	30	25	60	30	65	75	70	60	85	95	85	75	85	65
cover E0 %	0	0	10	0	0	0	0	0	0	0	0	60	0	0
Number of species	4	3	3	3	5	9	12	7	5	8	5	9	4	5
<i>Puccinellia distans</i> agg.	b	b	3	3	b	b	3	b	3	b	4	b	4	3
<i>Tripolium pannonicum</i>	.	.	.	.	.	1	1	3	5	5	3	4	4	4
<i>Camphorosma annua</i>	3	b	b	a	.	.	.	.	.	.	.	.	.	.
<i>Artemisia santonicum</i>	.	.	+	1	a	1	b	.	.	.	.	.	.	.
<i>Festuca pseudovina</i>	.	.	.	.	3	3	a	.	.	.	.	.	.	.
<i>Juncus compressus</i>	.	.	.	.	.	1	+	.	.	.	.	.	.	.
<i>Cerastium dubium</i>	r	.	.	.	1	+	1	.	.	.	1	+	+	.
<i>Matricaria recutita</i>	.	.	.	.	a	.	r	.	.	.	+	1	.	1
<i>Atriplex littoralis</i>	.	.	.	.	.	1	1	.	.	.	.	.	.	.
<i>Spergularia media</i>	.	.	.	.	.	a	a	.	.	.	.	.	.	.
<i>Taraxacum</i> sect. <i>Ruderalia</i>	.	.	.	.	.	.	.	.	.	1	+	+	.	r
<i>Daucus carota</i>	.	.	.	.	.	.	.	+	.	+	.	.	.	.
<i>Ranunculus sardous</i>	.	.	.	.	.	.	.	.	.	1	.	1	.	.
<i>Spergularia salina</i>	.	.	.	.	.	.	.	.	b	.	.	.	.	r
<i>Plantago maritima</i>	.	r	.	.	.	.	.	1	.	.	.	.	.	.

Taxa recorded in one relevé only: *Atriplex prostrata* + (8), *Atriplex tatarica* + (9), *Calamagrostis epigejos* r (10), *Carex stenophylla* + (7), *Cirsium arvense* + (8), *Cuscuta* sp. + (8), *Cynodon dactylon* r (1), *Elytrigia repens* + (7), *Epilobium tetragonum* r (12), *Galium aparine* + (6), *Lamium purpureum* + (7), *Lepidium perfoliatum* r (12), *Myosurus minimus* 1 (12), *Phragmites australis* r (13), *Plantago major* + (10), *Poa pratensis* 1 (9), *Sonchus arvensis* r (10).

Localities of relevés:

1. Tvrdošovce, north from the settlement, rutted rural road, 18°02'09.09"; 48°06'09.42", 109 a. s. l., 12. 5. 2005. 2., 3. Bokrošské slanisko Nature Reserve, west edge of the site, margin of depression, 18°15'14.08"; 47°44'57.30", 106 a. s. l., 1. 10. 2006. 4. PR Mostové, degraded remains of salt pan, 17°54'08.50"; 47°46'21.10", 115 a. s. l., 12. 5. 2005. 5. Močenok, Siky farmstead, depression in the most salinated part of pasture, 17°53'52.02"; 48°13'13.37", 115 a. s. l., 9. 5. 2004. 6., 7. Tvrdošovce, saline site in the settlement, 18°03'11.52"; 48°05'45.30", 108 a. s. l., 8. 5. 2004. 8. Komárno, Pavol site, abandoned ploughed area, 18°0'01".40; 47°46'23.80", 106 a. s. l., 17. 9. 2007. 9., 11., 13., 14., Kráľová nad Váhom, Juhásove slance site, depression, 17°52'49.07"; 48°13'54.58", 115 a. s. l., 15. 9. 2003. 10. 12., Nová Stráž, Komárňanské slanisko site, depression in ploughed and abandoned part, 18°04'29.00"; 47°46'09.59", 105. a. s. l., 13. 9. 2003.

Note: relevés 1 – 4 was published in Dítě et al. (2008).

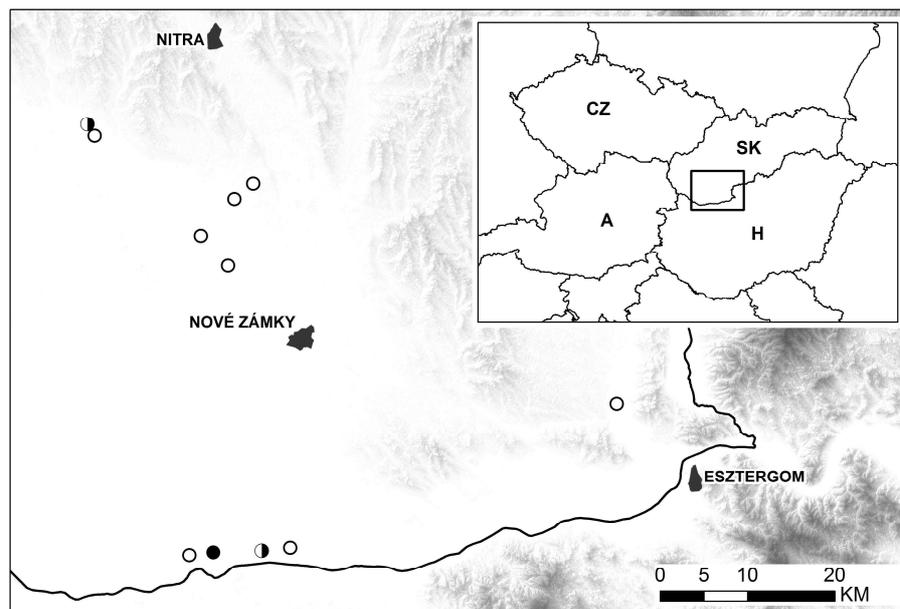


Fig. 1. Map of localities with occurrence of association *Puccinellietum limosae* in Podunajská nížina Lowland, Slovakia. ● – recent localities; ◐ – recent localities reported in literature; ○ – extinct localities reported in literature.

Discussion

Saline vegetation of the association *Puccinellietum limosae* has been known from Slovakian part of Pannonian Lowland for decades. KLIKA & VLACH (1937) observed that *Puccinellietum limosae* spreads to places with higher salt concentration, and when compared to association *Camphorosmetum annuae*, its optimum is on somewhat elevated places. Vegetation with *Camphorosma annua* is then often surrounded by *Puccinellietum limosae*, which requires less salt soils. KRIST (1940) stated that vegetation with dominance of *Puccinellia limosa* often occurs on degraded salt meadows and he regarded its presence as a result of intensive grazing and trampling. Interestingly, ŠMARDKA (1952) observed vegetation of the community *Puccinellietum limosae* on "salt eyes" and he regarded it as a vicariant of association *Camphorosmetum annuae*. He noted that both associations have almost the same accessory species. He regarded *Puccinellietum limosae* as early succession stage in mosaic of ecological and vegetation micro-sites on salt meadows. Thus it grows on places with highest salt concentration, similar to *Camphorosmetum annuae*. KRIPPELOVÁ (1965) indicates that on Slovak alkali meadows *Puccinellia distans* grows always together with *Festuca pseudovina* and that the two species have similar

ecological demands, especially tolerance to drought and to broad range of salt concentration in soil. She observed *P. distans* in all relevés of association *Artemisio santonici-Festucetum pseudovinae* SOÓ in MÁTHÉ 1933 corr. BORHIDI 1996. This vegetation, according to her model of saline habitats zonation, surrounds vegetation of “salt eyes” of the association *Camphorosmetum annuae*.

VICHEREK (1973) described variation of community in five subassociations: *Puccinellietum limosae typicum*, *Puccinellietum limosae spergularietosum marginatae*, *Puccinellietum limosae artemisietosum salinae*, *Puccinellietum limosae juncetosum gerardii* and *Puccinellietum limosae hordeetosum hystricis*. The latter is a synonym of association *Hordeetum hystricis* WENDELBG. 1943. In our opinion, remaining subassociations reflect only various ecological conditions and seasonal fluctuation structures and do not deserve higher rank. We dispensed to distinguish those subassociations.

The most recent relevés of the association *Puccinellietum limosae* were published from Natural Reserve Mostové near Velké Kosihy (ZLÍNSKA 2003). In our view it was vegetation of *Artemisio santonici-Festucetum pseudovinae*, which was influenced by heavy machines (tractor roads). Nevertheless, this vegetation represents partially ruderalized, changed and species-enriched communities, which arise on disturbed places only temporarily. Therefore, we assume to not consider these communities as association *Puccinellietum limosae*, according to comparison with historical relevés from Slovakia. On the contrary, vegetation sampled during our research (Tab. 1, relevés no. 8 – 14), regardless of its secondary origin should be considered as community *Puccinellietum limosae*.

Vegetation of the association *Puccinellietum limosae* is characterized by presence of *Puccinellia* species with dominance more than 15% (but in most cases more than >50%) and by constant presence of *Tripolium pannonicum* (dominance up to 50%), *Plantago maritima*, *Chamomilla recutita*, *Cerastium dubium* and *Taraxacum bessarabicum* (KLIKA & VLACH 1937, VICHEREK 1973). We have not found some accompanying species presently, which is probably related to the secondary origin of the vegetation studied in 2003-2008. Recent species composition of the community is associated with changes of ecological conditions, mainly with dewatering and damage of vegetation cover, following by fragmentation and extinction of some typical halophytes.

In the case of the Pavol farmstead near Komárno, the vegetation cover was ploughed out in 2003 and then abandoned. Destroyed areas have been gradually colonized by ruderal vegetation, whereas halophytes spread only to the most saline plots in places of former salt pans (“salt eyes”). The vegetation cover of salt pans was close to *Puccinellietum limosae* rather by floristic composition than vegetation structure. On native undamaged saline habitats the vegetation structure is rather uniform and continual, while in the salt pans of the Pavol farmstead vegetation of *Puccinellietum limosae* occurs only in insulated fragments and some places are still without vegetation cover. Succession of vegetation on this locality is a subject of an ongoing research (ELIÁŠ jun. & DÍTĚ ined.).

It is reasonable to predict that the occurrence of the community *Puccinellietum limosae* is temporary in Slovakia, with respect to negative changes of vegetation on remaining localities, i.e. absence of nature conservation management, invasion of ruderal and weedy species from surrounding fields, application of fertilizers and herbicides application etc. Urgent nature conservation management steps are needed, because if currently we considered the association as critically endangered in Slovakia, than it could be missing or extinct in the near future.

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