

# REVISION OF HISTORICAL AND CURRENT DISTRIBUTION OF *PHOLIURUS PANNONICUS* (HOST.) TRIN. IN SLOVAKIA

Pavol ELIÁŠ jun.<sup>1</sup>, Daniel DÍTĚ<sup>2</sup>, Vít GRULICH<sup>3</sup> & Róbert ŠUVADA<sup>4</sup>

## Abstract

Historical and current occurrence of the obligate halophyte *Pholiurus pannonicus* was studied in Slovakia during the period 2003–2009. The species had been occurring in the Podunajská nížina Lowland and the Východoslovenská nížina Lowland; 30 localities were found in total. Recently the number of localities has decreased markedly and the species was confirmed only in the Podunajská nížina Lowland. We documented only seven localities during the study. Therefore, we confirmed that *Pholiurus pannonicus* belongs to the critically endangered plants of Slovak flora.

**Key words:** *Pholiurus pannonicus*, halophytes, distribution, Slovakia.

## Izveleček

Preučili smo pojavljanje obligatne halofitske vrste *Pholiurus pannonicus* v Podunajski nížini in Východoslovenski nížini v letih od 2003 do 2009. Vrsta se je pojavljala. Našli smo 30 rastišč. V zadnjem času se je število rastišč močno zmanjšalo in jih najdemo samo še v Podunajski nížini. Med raziskavo smo dokumentirali le sedem nahajališč. Vrsta *Pholiurus pannonicus* zato sodi med kritično ogrožene vrste flore Slovaške.

**Ključne besede:** *Pholiurus pannonicus*, halofiti, razširjenost, Slovaška.

## 1. INTRODUCTION

*Pholiurus pannonicus* (Host) Trin. (Poaceae, Figure 1) belongs to the group of vanishing obligate halophytic plants in Central Europe. It is included in the Red Lists of endangered taxa in Austria and Slovakia (Niklfeld & Schratt-Ehrendorfer 1999, Feráková et al. 2001). This species occurs from central and south-eastern Europe to Siberia, former Soviet Middle Asia, the Caucasus and Western Asia. A small isolated distribution area was also found in west and north-west Spain (Conert 1998, Figure 2). In Central Europe it is spread from the Pannonian Lowland and countries of former Yugoslavia (Croatia, Serbia, Macedonia) to Ukraine

and Romania. In some Central European countries (Poland, Czech Republic) and in Australia *Ph. pannonicus* was found as an alien species occupying waste and ruderal areas out of saline soils (Řehořek & Maglocký 1999, Clayton et al. 2006).

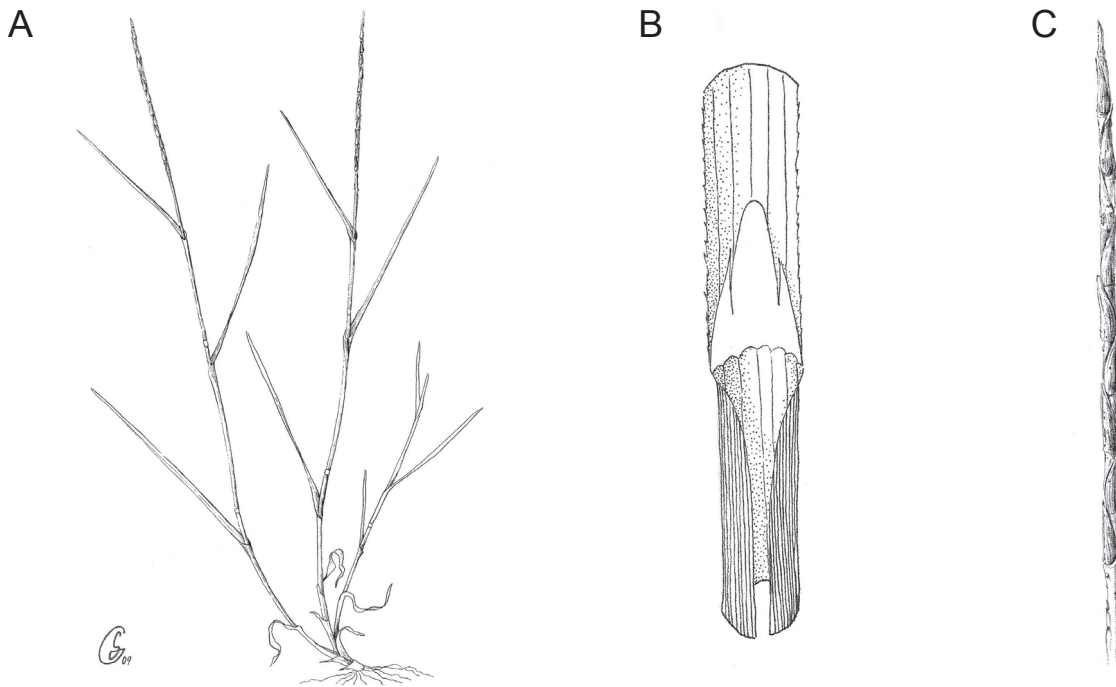
The species prefers solonetz soils and occupies especially shallow depressions and narrow ditches in alkali steppes, which are submerged for a relatively long time. On those micro-habitats the community of *Pholiuro pannonici-Plantaginetum tenuiflorae* Wendelberger 1943 [syn. *Plantagini tenuiflorae-Pholiuretum pannonicum* (Soó 1933) Wendelberger 1943; *Puccinellietum limosae plantaginetosum tenuiflorae* Soó 1933] usually has been created in the Pannonian Lowland. The

<sup>1</sup> Department of Botany, Slovak University of Agriculture, Tr. A. Hlinku 2, SK-949 76 Nitra, Slovakia, pelias@afnet.uniag.sk

<sup>2</sup> Institute of Botany, Slovak Academy of Sciences, Dúbravská cesta 14, SK-845 23, Bratislava, Slovakia, daniel.dite@savba.sk

<sup>3</sup> Institute of Botany and Zoology, Masaryk University, Kotlářská 2, CZ-61137 Brno, Czech Republic, grulich@sci.muni.cz

<sup>4</sup> Administration of the Slovenský kras National Park, Hámosiho 188, SK-049 51, Brzotín, Slovakia, robert.suvada@sopsr.sk



**Figure 1:** *Pholiurus pannonicus*: A – habit of the plant, B – leaf-sheath with the ligula, C – inflorescence in detail (orig. P. Čepček).

**Slika 1:** *Pholiurus pannonicus*: A – izgled rastline, B – listna nožnica z listno kožico, C – socvetje (orig. P. Čepček).



**Figure 2:** Distribution area of *Pholiurus pannonicus* (after Conert 1998).

**Slika 2:** Razširjenost vrste *Pholiurus pannonicus* (po Conert 1998).

community is still widely dispersed in some parts of Hungary (e.g. the Hortobágy National Park), but in adjacent countries it is not so common. It has been found to be very rare in Austria around the Neusiedler See, where the community reaches the western border of range (Wendelberger 1950, Mucina 1993). Distribution in Romania is very scattered; Popescu (2005) mentioned occurrence of the community only from the districts Oltenia, Dobrogea and Muntenia. The association was recorded in northern Serbia as well, (the Vojvodina region, Slavnić 1948, Knežević 1994, Ivezić et al. 1995). In Slovakia, the association occurred only in the Podunajská nížina Lowland and Východoslovenská nížina Lowland (Vicherek 1973), but it is presently extinct (Dítě et al. ined.).

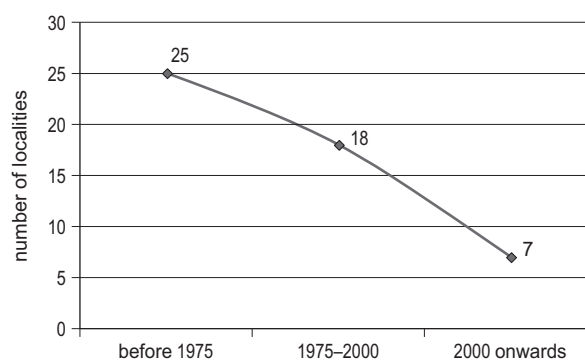
The paper is aimed at clarifying the historical and present distribution of *Pholiurus pannonicus* in Slovakia.

## 2. MATERIAL AND METHODS

The study was carried out during the period 2003–2009 in the Podunajská nížina Lowland and Východoslovenská nížina Lowland. The historical data concerning the distribution of the species were achieved from herbaria BP, BRA, BRNU, BRNM, LTM, MMI, MZ, NI, KO, OLM, PMK, PR, PRC, SAV, SLO and ZV. The active floristic survey was carried out to confirm recent localities of the species. Herbarium specimens collected during this research are stored in herbarium NI. Herbarium abbreviations are according to Holmgren et al. (1990) and Vozárová & Sutorý (2001). Results of this study are presented on the point map. The map was designed by program ArcGis, version 9.2. Coordinates of historical localities were taken from Google Earth. Coordinates of recent localities were obtained during field research using GPS equipment Garmin CS 60. The abbreviations of works published before 1956 are cited following Futák & Domin (1960), and the nomenclature of flowering plants follows Marhold & Hindák (1998). Phytogeographical divisions follow Futák (1980).

## 3. RESULTS

Our results showed that large changes in land use have caused the disappearance of up to 70 % of the sites of the species in Slovakia (Figure 3).



**Figure 3:** Decline trend in the number of *Pholiurus pannonicus* sites in Slovakia.

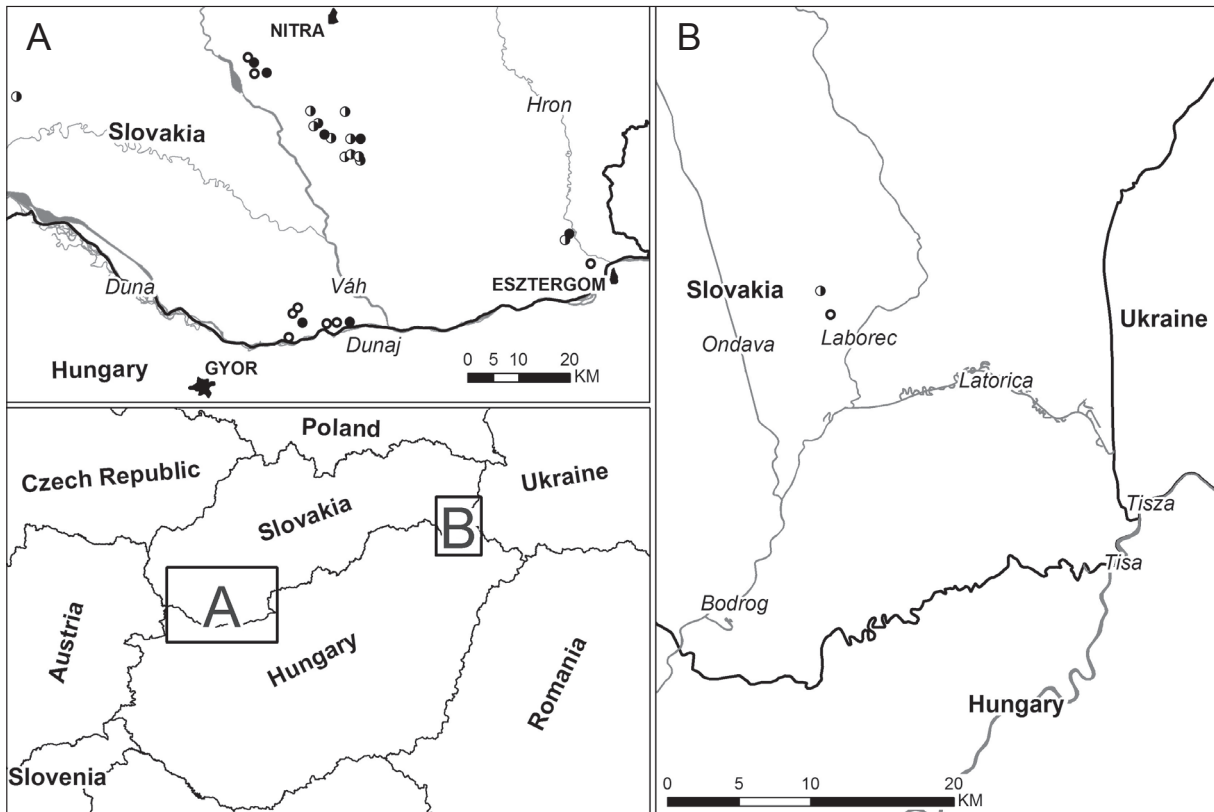
**Slika 3:** Upadanje števila nahajališč vrste *Pholiurus pannonicus* na Slovaškem.

*Pholiurus pannonicus* is now nearly extinct in this area. However, before 1975, the species was found at 30 sites in two main areas: the Podunajská nížina Lowland and the Východoslovenská nížina Lowland (Figure 3, 4). We also found questionable data from this period. Hrabětová (1952 BRNU) collected a herbarium voucher on the locality of Štúrovo, but there is no suitable habitat in the close surroundings of this town. Surely it was only an inaccurate localization of some saline sites situated north from the town of Štúrovo (in the vicinity of Nána, Kamenný Most or Kamenín).

Intensive land reclamation has caused a decrease in the number of localities since the 1970s. Therefore, the existence of 13 sites was documented during the period 1975–2000 in both lowland regions. Recently (after 2000), the species has been found on seven sites only in the Podunajská nížina Lowland. Occurrence of the species in the Východoslovenská nížina Lowland was not confirmed, since all former localities were destroyed by land reclamation that caused the soil desalination. It should be noted that the plants are subtle and inconspicuous and they can be easily overlooked in the field. It is therefore possible that a few of the localities in south-west Slovakia could be re-found in the future. Below is the list of sites of existing populations:

### Veľké Kosihy, Mostová Nature Reserve

Occurrence of *P. pannonicus* was restricted to a few square metres in the south-east part of the Nature Reserve in 2008. The small scale population included only a few tens of individuals. It has survived in ruts of the rural road.



**Figure 4:** Distribution of *Pholiurus pannonicus* in Slovakia: A – Podunajská nížina Lowland, B – Východoslovenská nížina Lowland, ○ – before 1975, ◐ – 1975–2000, ● – after 2000 (orig. R. Šuvada).

**Slika 4:** Razširjenost vrste *Pholiurus pannonicus* na Slovaškem: A – Podunajska nižina, Vzhodnoslovaška nižina, ○ – pred letom 1975, ◐ – med letoma 1975 in 2000, ● – po letu 2000 (orig. R. Šuvada).

#### Tvrdošovec, NW from the railway station

The second largest population in Slovakia, *Pholiurus pannonicus* occupied two small micro-sites in a deep rut of the rural road in 2008. The total area was not larger than 10 m<sup>2</sup> and the population size was around 100 individuals. In 2009, several hundred plants were recorded in the same place as well as in shallow depressions of a rural road ca 100 metres south-east. The total area of the population was around 50–100 m<sup>2</sup>. It is obvious that the size of populations is closely related to suitable habitat conditions.

#### Močenok, Siky farmstead

The species occurred in a fragment of the *Pholiuro pannonicum-Plantaginetum tenuiflorae* community, which was developed in a small shallow depression at the edge of a Lucerne field in May 2005. In the next year the site was ploughed and the species has not been confirmed here from this time. It is possible, that the species could appear again in favourable conditions.

#### Hájske, Michalova jama site

The locality is very close to the previous one and was confirmed in 2002 (Sádovský 2003). The species was growing in small depressions in degraded saline habitat among arable land and a stand of *Phragmites communis*. The population contained about some tens of individuals.

#### Šurany, Okomáň farmstead

The third largest local population in Slovakia had covered an area ca 10 m<sup>2</sup> and contained several hundreds of individuals in 2004. The species was growing in some shallow depressions and the vegetation cover represented the last fragments of *Pholiuro pannonicum-Plantaginetum tenuiflorae* in Slovakia. Human disturbance (mainly land reclamations), however, is leading to rapid degradation processes on the site. We found only a few *Pholiurus* plants in remains of native communities in 2008. Most of those communities were replaced by vegetation with dominance of *Festuca pseudovina*.



### Komárno, part Nová Stráž, fragment of a depression east from the village

The largest Slovak population, on locality which was ploughed and drained out in the 1970s. Then the locality was abandoned to its fate and covered by secondary saline vegetation. The occurrence of *P. pannonicus* was restricted to the lowest part of the site in 2003 and the species occupied an area of ca 300 m<sup>2</sup>. This depression was covered by a secondary plant community with dominance of *Tripolium pannonicum*. Population of the species was relatively large and included a few thousand individuals. The same situation was confirmed in 2009.

### Kamenín, the Kamenínske slanisko Nature Reserve

The species occurrence was restricted to an area of only 1 m<sup>2</sup>, in a small pit surrounded by degraded vegetation with dominance of *Festuca pseudovina* and *Galatella punctata*. The number of individuals was not more than 30. If the necessary steps are not performed in the near future (e.g. excavation of deep grooves to maintain the micro-sites with fluctuating water level), the species will entirely disappear from the site.

## 4. DISCUSSION

*Pholiurus pannonicus* is considered as a phytoecologically important border element of the Slovak flora (Řehořek & Maglocký 1999). The species was first documented by Sándor Feichtinger (herbarium voucher from year 1861 deposited in BP, see Appendix). Detailed distribution of the species has not yet been published, although three older works have minimally carried much valuable data. Krist (1940) elaborated distribution of the species in the Podunajská nížina Lowland. He found 22 localities between the towns of Nitra and Nové Zámky and in the surroundings of Komárno, but did not mention any localities of saline habitats around Štúrovo. Approximately fifty years later Dostál (1989) and Dostál & Červenka (1992) pointed out the distribution of *P. pannonicus* correctly, but very briefly. The most recent work was performed by Řehořek & Maglocký (1999). They attempted to describe detailed species distribution, but their data were also incomplete. The authors did not mention historical localities, and recent sites were described only generally. Some data were also published in several phytosociological and floristic studies (e.g.

Vicherek 1964, Vicherek 1973, Svobodová 1989, Řehořek & Svobodová 1992, Bogoly 1994 etc.).

Our results showed that the species was relatively frequent in the past; we have found 30 localities in total at present (see Figure 4). This number of localities corresponds with data given by Krist (1940). The saline habitats were well-preserved by traditional use (grazing, mowing) and markedly disturbed only locally, for example by soil mining for brick production (Klika & Vlach 1937, Krist 1940, Šmarda 1952, Krippelová 1964).

The relatively positive situation had changed in the 1970s. The rapid decrease of *Pholiurus* sites started due to land reclamation, afforestation and transformation of saline habitats to arable land (Sádovský et al. 2004b, Fehér 2007). Similar changes in land use resulted in extinction of the species in NW Hungary near Győr (Schmidt 2007) and in north-west Austria (Kästner & Fischer 2008). In Slovakia, the number of localities also decreased markedly. Only 13 sites were confirmed in the period 1975–2000. Occurrence of *Pholiurus pannonicus* was restricted to secondary habitats, where the species has survived usually in wet tracks of rural roads and small depressions (Svobodová 1989, Svobodová & Řehořek 1992). A current survey of saline habitat fragments has brought similar cheerless results – only seven localities have been found since 2000 and occurrence of *P. pannonicus* was not confirmed on the Východoslovenská nížina Lowland. That means a ca 70 % reduction of occurrence in the species in Slovakia. Therefore, the inclusion of *Pholiurus pannonicus* to critically endangered species of Slovak flora was correct (Feráková et al. 2001).

We suppose that the survival of the species in Slovakia will depend on active human preservation. Fortunately, the species can be easily cultivated in *ex situ* conditions (Řehořek & Maglocký 1999), which could be used for support of the natural populations.

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## 7. APPENDIX:

List of localities of *Pholiurus pannonicus* in Slovakia (localities were arranged in direction west – east).

### Distr. 6. Podunajská nížina Lowland:

Bratislava, part Vajnory, margin of football playground N from the Čierna Voda settlement (Trávníček 1988 OL; Trávníček 1996). – Okoličná na Ostrove, Ekelský dvor farmstead – Okoličná na Ostrove (both data Šmarda 1951 BRNM). – Velké Kosihy, saline meadows near village (Dvořák 1963 BRA, PR). – Velké Kosihy, NE = Velké Kosihy, the Mostové Nature Reserve (Vicherek 1973; Grulich 1987 MMI; Eliáš jun., Dítě et Šuvada 2008 NI). – Zlatná na Ostrove, E (Weber 1934 BRA, PR, Valenta 1938 BRA; Kavka 1950 BRA, PR; Šourek 1950 PR; Černoch 1956 BRNM). – Zlatná na Ostrove, Pavel farmstead (Krist 1940). – Komárno, part Nová Stráž (Krist 1938 BRNU; Weber 1934 PR; Krist 1940; Dvořák 1966 OLM; Eliáš jun., Dítě et Sádovský 2003 NI; Eliáš jun. 2009 NI). – Hájske, W from the village (Vicherek 1973). – Hájske, S from the village (Krist 1937 BRNU; Valenta 1937 BRA; Krist 1940; Grulich 1988 MMI). = Hájske, Michalova jama (Sádovský 2003: 252). – Hájske, Mešterik farmstead (Weber 1935 BRA). – Močenok, Siky farmstead (Krist 1937 BRNU; Valenta 1937 BRA; Krist 1940; Grulich 1988 MMI; Svobodová & Řehořek 1992; Eliáš jun. 2005 NI) = Močenok, W from the village (Vicherek 1973) = Šala, Siky farmstead (Weber 1935 PR). – Velká Dolina, Čierny Vřšok farmstead (Grulich 1988 MMI). – Rastislavice, S from the village (Vicherek 1973) = Komjatice, Ružový dvor farmstead (Grulich 1988 MMI). – Dolný Jatov, S from the village (Vicherek 1973). = Jatov, S mar-

gin of the village (Grulich 1988 MMI). – Jatov, E from the railway stop (Grulich 1988 MMI). – Tvrdošovce (Scheffer 1923 BRA, BRNU; Weber 1935 PR – the site is probably identical with some of next ones). – Tvrdošovce, near railway station (Krist 1940). = Tvrdošovce NW (Krist 1936 BRNU; Grulich 1988 MMI; Svobodová 1989; Chytrý 1994 BRNU; Eliáš jun. 2008 NI). – Tvrdošovce, the Ráczove jazierko pool (Grulich 1988 MMI). – Tvrdošovce, Bačala farmstead (Krist 1936 BRA, BRNM, BRNU, NI, OLM, PR, PRC, ZV; Krist 1940). – Palárikovo, salt pastures near railway station (Krist 1940; Dvořák 1952 BRA, BRNM; Součková 1952 BRNM; Dostál 1968 PR). – Palárikovo, Velké Čiky farmstead (Grulich 1988 MMI). – Palárikovo, Malé Čiky farmstead (Weber 1935 BRA, PR; Grulich 1988 MMI). – Šurany, Čiastka gamekeeper's house (Krist 1940; Grulich 1988 MMI). – Šurany, Okomáň farmstead (Weber 1935 BRA, PR; Grulich 1987, 1988 MMI; Svobodová 1989; Řehořek et Maglocký 1999; Eliáš jun. et Sádovský 2004 NI; Eliáš jun., Dítě et Šuvada 2008 NI). – Kamenín, site Alsó rétek = Kamenín, S = the Kamenínske slanisko Nature Reserve (Feichtinger 1861 BP; Domin et Jirásek 1936 PRC, Vicherek 1973, Svobodová 1989; Řehořek et Maglocký 1999; Eliáš jun. 2008 NI). – Kamenný Most, Čistiny Nature Reserve (Feichtinger 1861 BP, SLO; Feichtinger 1899: 366; Domin 1933v: 247; Vicherek 1973; Žíla et Svobodová 1986 NI; Svobodová 1989). – Nána (Feichtinger 1899: 366; Domin 1933v: 247).

### Distr. 8. Východoslovenská nížina Lowland:

Malčice, 2 km E from the village (Vicherek 1963 BRNU; Vicherek 1964: 556, 1973). = Malčice, rural road near the Kopčianske slanisko Nature Reserve (Nevrlý 1975 BRNU, PR). = Zemplínske Kopčany, Kopčianske slanisko Nature Reserve (Humeňanský 1984; Grulich 1988 MMI; Bogoly 1994). – Velké Raškovce, 1.5 km NW from the village (Kühn 1962 BRNU; Vicherek 1963 BRNU; Vicherek 1964: 556; Križo 1968 BRA; Vicherek 1973).

Doubtful data (not mapped): Štúrovo (Hrabětová 1952 BRNU).

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