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THE CONFIRMED OCCURRENCE AND CURRENT PHYTOSOCIOLOGICAL STATUS OF *CYPERUS PANNONICUS* IN VOJVODINA (NORTHERN SERBIA)

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During the investigation of the halophytic vegetation in Vojvodina (northern Serbia) in 2012 the occurrence of *Cyperus pannonicus* Jacq. was confirmed. The species with a relatively large population create stands of association *Cyperetum pannonici* Wendelberger 1943 on the shore of a small saline lake called Medura, east of the village Riđica.

Key words: endangered species, halophytes, saline lakes

INTRODUCTION

Cyperus pannonicus Jacq. [Syn.: *Acorellus pannonicus* (Jacq.) Palla; *Chlorocyperus pannonicus* (Jacq.) Rikli; *Cyperus tataricus* Less.; *Juncellus pannonicus* (Jacq.) C. B. Clarke; *Pycreus pannonicus* (Jacq.) P. Beauv. ex Rchb] is a caespitose, usually leafless annual or perennial species with a large area in Eurasia. In Europe it is known from the central and south--eastern parts: Austria, Slovakia, Hungary, Albania, Bulgaria, countries of

the former Yugoslavia, Romania (DeFilipps 1980). Its area expands to the east across the southern parts of Russia, Caucasus and Western Siberia into central Asia as far as northern China (Schulze-Motel 1980).

In central Europe it grows only in the Pannonian Lowland and in the Transylvanian Basin. Its northern border of areal goes through southern Slovakia where it is now extinct (Eliáš jun. *et al*. 2003). In Austria it is known only from the vicinity of Neusiedler See (Wendelberger 1943, Fischer *et al*. 2005). The most abundant is in Hungary around Balaton Lake, Kiskunság and mainly in the Tiszántúl region (Király 2009). It was reported from Romania as well (Şerbănescu & Nyárády 1966).

Distribution in Serbia

According to the literature and herbarium data *Cyperus pannonicus* has cca 30 records within 26 UTM squares (Fig. 1), mostly in lowland regions of Vojvodina and central Serbia. It has been recently confirmed on only six localities (Riđica, Gaj-Šumarak, Aleksandrovac, Bresničić, Suva Česma and Lalinac).

Bačka: CS 90 **Subotica** (Slavnić 1943: 401); DS00 **Palić** ["Palics"] (Prodán 1915: 202); **Palić Lake** ["Palicsi tó"] (Prodán 1914: 103; 1915: 202; Slavnić 1939); **Krvavo Lake** ["Vértó"] (Sturc 1997: 91; *Sturc, J. 16--Sep-1956* Zrnić 2001: 71); **Slano Lake** ["Sóstó"] (Prodán 1914: 103; 1915: 202; Sturc 1973: 126; Kojić 1986: 290; *Šturc 1956, 1959* Zrnić 1993: 256, 262; Sturc 1997: 91); **Ludaško Lake** [Ludastó] (Prodán 1914: 103; Slavnić 1939; Rafajlović & Seleši 1957: 36); DS11 **Horgoš** (Slavnić 1943: 401); DS20 **Martonoš** (*Slavnić, Ž. pers. comm*., Budak 1998: 17); CR59 **Riđica** (Budak 1998: 17); CR48 **Gakovo** ["Gádor"] (Prodán 1915: 202); DR28 **Senta** (*Slavnić, Ž. pers. comm*., Budak 1998: 17); DR26 **Čik River** ["Csikér"], here and there on the dried saline River bed (Kovács 1929: 51); DR25 **Bečej** ["Óbecse"]: Arpad Park (extinct) ["Árpádliget"]; south of the city ["Alsó rét"]; the vicinity of Bečej ["Irizset" and "Szilvás puszta"] (Kovács 1929: 51); DR31 **Vilovo** ["Tündéres"] (Prodán 1915: 202).

Banat: DS30 **Novi Kneževac** ass. *Acorelletum pannonici* Soó (1939) 1947 subass. *pycretosum flavescenti* (Knežević 1983: 86); DR38 **Čoka** (Slavnić 1943: 401); DR57 **Kikinda** (Slavnić 1943: 401); DR72 **Banatski Despotovac**: Deračka bara pond (Slavnić 1939; Knežević 1994: 12); DR71 **Tomaševac** (*pers. comm. D. Savić* Vukojičić 1997; Tomović *et al*. 2007: 68); EQ06-EQ16 **Gaj-Šumarak** (Tomović *et al*. 2007: 68); EQ16-EQ26 **Dubovac-Bela Crkva**: in the ponds along the Danube (*Kitaibel, P. 19-Jun-1800*, Sturc 1989: 331).

Srem: DR11 **Petrovaradin** ["Peterwardein", subn. *Scirpus pannonicus* L.] (Godra 1872: 293).

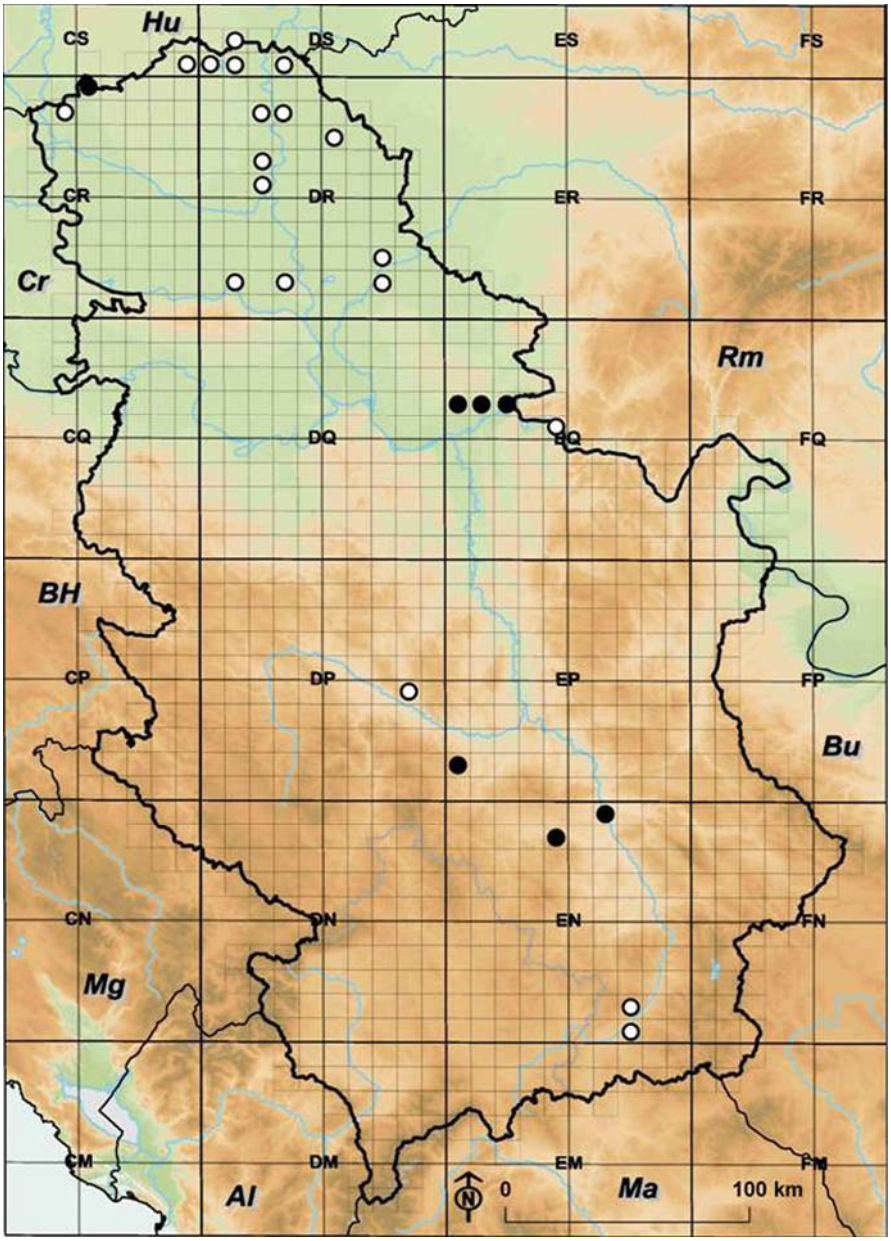

Fig. 1. - Records from 1800 to 1998 (○) and recently confirmed records (after the year 2000) (●) of *Cyperus pannonicus* in Serbia.

Pomoravlje: EQ45 Veliko Gradište: **Vinci**, Požežena Sands (*Pančić J.* [18]86, BEOU; Vukojičić 1997; Tomović *et al*. 2007: 68); **Šumadija**: DP84 Kraljevo: **Vitanovac** (Pančić 1856: 586; 1874: 701; Adamović 1904: 24 ap. Vukojičić 1997), **Slatina** (*Pančić J.* Aug-[1]852 BEOU; Vukojičić 1997;

Adamović 1904: 24 ap. Vukojičić 1997). **Central Serbia**: EP01 **Aleksandrovac** (Slavnić 1940: 67; Zlatković *et al*. 2005: 17); EN48 Prokuplje: **Bresničić** and **Suva Česma** salt-marshes (Zlatković *et al*. 2005: 17; Tomović *et al*. 2007: 68); EN69 Niš: Lalinac saltmarsh (Zlatković *et al*. 2005: 17). **South Serbia**: EN70 **Bujanovac** (subn. *Acorellus pannonicus* Palla, *Slavnić, Ž.* Jul-1939, BEO; Slavnić 1940: 67); EN71 **Vranje** (Slavnić 1940: 67).

General data: all over Bačka and Banat, ass. *Cyperetum pannonici* (Soó 1933) Wendelberger 1943 (Slavnić 1948: 87); Bačka and Banat (Slavnić 1953: 52); Banat (Serbia?): "in locis subsalsis depressis planitici, inprimis arenosis" (Heuffel 1858: 215); Subotica Sand (Obradović & Boža 1986: 122); Srem ["Syrmien"] (Rumy 1842: 52 ap. Schulzer *et al*. 1866: 81); in northern lowland areas of Serbia (Janković 1976: 159).

Recently, *Cyperus pannonicus* has become rare throughout central Europe. This is reflected by its threat category on the Red Lists of the concerned countries: the species is critically endangered (CR) in Austria (Niklfeld & Schratt-Ehrendorfer 1999), strictly protected by law ("Sl. Glasnik RS" 5/10) and critically endangered – endangered (CR-EN) in Serbia (Tomović *et al*. 2007), and probably exctinct (EX?) in Slovakia (Feráková *et al*. 2001). In Hungary, it is evaluated as near threatened (NT) according to Király (2007); however, its occurrence is also sporadic.

MATERIAL AND METHODS

The phytosociological relevés were sampled according to the Zürich-Montpellier approach using the adapted nine-grade Braun-Blanquet scale (Barkmann *et al*. 1964). All relevés were stored in the TURBOVEG database (Hennekens & Schaminée 2001). The names of communities that are not mentioned in that work are presented with the name(s) of the author(s) of the description. Nomenclature follows Tutin *et al*. (1968-1980, 1993). Distribution of the species in Serbia is given on a map with 10 ×10 *km* UTM grid system (Lampinen 2001). The map was created by the program ArcGis, version 9.2.

RESULTS

In 2012 during the field observation of localities with halophytic vegetation in the northern part of Bačka (Serbia) the occurrence of *Cyperus pannonicus* was confirmed (Fig. 2). A relatively large population was found on the western bank of saline Medura Lake situated in the middle of the intensively used fields ca. 2 *km* east of the village of **Riđica**

(N45°59'28.2"; E19°07'57.1"). *Cyperus pannonicus* covers an area around 500 m^2. The major part of the population grows in a narrow, 1-4 *m* wide belt, and several separated micropopulations on the SW banks of the dried up lakebed accompanied by other therophytes typical of saline lakes of the Pannonian Lowland. Some individuals were found on the edges of the unpaved rural road leading tightly besides the SW margins of the lake.

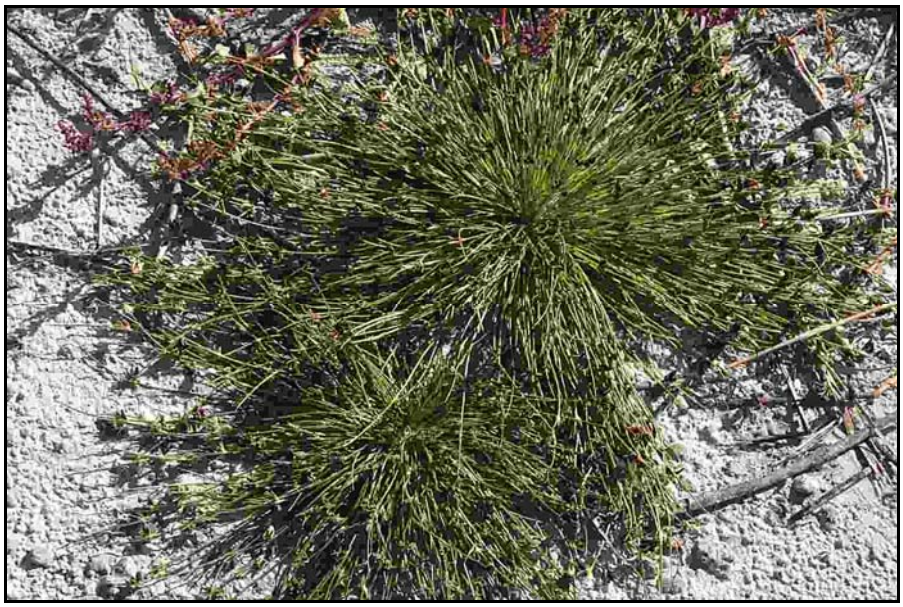

Fig. 2. - *Cyperus pannonicus* in bare bottom of Lake Medura near Riđica village.

Concerning the vegetation where the species occurs, the following phytosociological relevés were recorded:

Relevé 1, 30th August, 2012, Lake Medura, Riđica village, (N45°59'28.2"; E19°07'57.1"), W bank of the saline lake, sampled area 8 m^2, 92 *m a.s.l.*, E_0: 0 %, E_1: 70 % (sampled by D. Dítě, Z. Melečková):

E_1: *Cyperus pannonicus* 4, *Chenopodium chenopodioides* 1, *Scirpus maritimus* agg. +, *Puccinellia distans* subsp. *limosa* +.

Relevé 2, 30th August, 2012, next to the previous site, Lake Medura, Riđica village, sampled area 7 m^2, 92 *m a.s.l.*, E_0: 0 %, E_1: 30 % (sampled by D. Dítě, Z. Melečková):

E_1: *Cyperus pannonicus* 2a, *Chenopodium chenopodioides* 1, *Puccinellia distans* subsp. *limosa* 1, *Suaeda pannonica* 1, *Scirpus maritimus* agg. +, *Crypsis aculeata* +.

According to the species composition these stands are assigned to the class *Crypsidetea aculeatae* Vicherek 1973, alliance *Cypero-Spergularion*

salinae Slavnić 1948, association *Cyperetum pannonici* Wendelberger 1943 (Fig. 3).

Fig. 3. - Association *Cyperetum panonici* Wendelberger 1943 in Lake Medura near Riđica village.

In late-summer of the year 2012 the bottom of Lake Medura (about 5 *ha*) was completely dried up, as it had been a favorable habitat for the development of the salt pan vegetation. There are more types of vegetation patches on the bottom of the lake dominated by species such as *Chenopodium chenopodioides* and *Crypsis aculeata*; large areas were covered with their communities as well: *Atriplici prostratae-Chenopodietum crassifolii* Slavnić 1948 corr. Gutermann & Mucina 1993 and *Crypsidetum aculeatae* Wenzl 1934. Smaller surfaces were covered with *Suaeda pannonica*, but its homogenous community was not typically developed, rather, it was growing together with *Chenopodium chenopodioides* which indicated a higher accumulation of nitrogen originating probably from the runoff of the surrounding intensively used fields. The soils of the outer parts of the lakebed are sandy and the centre of the lake bottom is more clayey covered with red algae.

There is another small shallow saline lake 6 *km* SW of Riđica, next to the village Kruševlje. Its area is around 3,5 *ha*, and in 2012 it was also completely dried up. Compared to Medura Lake, the soil has only sandy fractions and the flora is poorer. The bottom of the Kruševlje saline pond is covered only with *Crypsidetum aculeatae*, and in the margins of the lake

there are stands of *Scirpus maritimus* agg. Around the lake in the contact zone with the fields there are rich stands of *Atriplex littoralis*.

Both lakes (Medura and Kruševlje) originate from the former meanders of the Plazović (Kígyós) River and they are typical examples of the Pannonian salt lake vegetation characteristic of the sand ridge area of the Duna-Tisza interfluve, continuing from the Hungarian Kiskunság region. They represent an important refuge of the disappearing halophytic flora and today they are among the last fragments of valuable habitats in the agricultural landscape in Vojvodina.

For comparison, we also included a coenotic characteristic of a small population of *C. pannonicus* from a similar habitat type in the Hungarian upper Bácska region. This site represents the closest locality, situated ca 20 *km* NE of the stands of Riđica. It was recorded in 2009 near the town of Bácsalmás in the bottom of the saline Sós-tó Lake with poor vegetation cover. The vegetation is documented by the relevé below:

Relevé 3, 14th August, 2009, Lake Sós-tó, Bácsalmás town, (N46°05'49.4"; E19°19'52.7"), Hungary, W bank of salt lake, sampled area 16 m^2, 116 *m a.s.l.*, E_0: 0 %, E_1: 10 % (sampled by D. Dítě, P. Eliáš jun., R. Šuvada):

E_1: *Cyperus pannonicus* 1, *Puccinellia distans* subsp. *limosa* 1, *Suaeda pannonica* 1.

This stand has a rather slightly developed vegetation, and according to the floristical composition can be classified in the alliance of *Cypero-Spergularion salinae*.

DISCUSSION

On the occurrence of *Cyperus pannonicus* from this part of Vojvodina there is only one record originating probably from the middle of the 1980s (Budak 1986, published 1998). Today in Serbia three big saline lakes (Slano Kopovo, Rusanda and Okanj) and three small ones (Medura, Kruševlje and Čokanska Arenda) have preserved. Another important finding is *Suaeda pannonica* in Medura Lake – a critically endangered species in Serbia which is confirmed for the first time in this locality (noted with a question mark in the Red Data Book of flora of Serbia, Boža 1999). This emphasizes the importance of saline lakes as biodiversity centres in the Pannonian Lowland. Many of the former saline lakes, as well as almost all other localities with *Cyperus pannonicus,* were irreversibily desalinized (Palićko, Krvavo Lake and Ostrovo) or degraded (Baranda Lakes, Slano Lake).

The association *Cyperetum pannonici* is a characteristic community in the Ponto-Pannonian region (Wendelberger 1950, Vicherek 1973). Data are available from Slovakia (Vicherek 1973), Austria (Wendelberger 1943, 1950, Mucina 1993), Hungary (Molnár & Borhidi 2003), Romania (Pop 2002) and Serbia (Slavnić 1948, Knežević 1983, Zlatković *et al*. 2005, Kojić *et al*. 1998). Vicherek (1973) outlines a possible occurrence of this synataxon in Bulgaria and Ukraine, although in national vegetation surveys it is not listed at all (Solomakha 1996, Tzonev *et al*. 2008).

Stands of the association are connected to the lakeshores and depressions on salt-affected wet sandy soils which are inundated periodically but for longer periods of time. The vegetation typically forms short one-layered stands with high abundance of *Cyperus pannonicus*, while continuous mono-dominant stands of the species on large, ecologically favourable conditions are quite unusual. In the natural stands, apart from the dominant species other annual halophytes with a higher frequency typical of the alliance *Cypero-Spergularion salinae* (*Suaeda pannonica, Chenopodium chenopodioides*) grow; some perennials are also abundant (*Puccinellia distans* aggr., *Aster tripolium* subsp. *pannonicus*). *Cyperus pannonicus* is a rather facultative halophyte: it does not require high salt content in the soil but it does tolerate higher salinity levels as well. The species composition of its communities depends on the amounts of salts.

On the higher degrees of salinity, as in the case of Medura Lake, the stands are species-poor and obligate halophytes prevail: *Puccinellia distans* subsp. *limosa*, *Crypsis aculeata, Suaeda pannonica*. Soils with lesser amounts of soluble salts host more species and apart from obligate halophytes there are also facultative halophytes (for example *Lotus tenuis*), and even glycophytic species from the class *Isoëto-Nanojuncetea* such as *Agrostis stolonifera, Cyperus fuscus, Chenopodium glaucum, Juncus bufonius*. Stands of that kind are recently known from the gravel-bottomed saline lake Warmsee from the Austrian Seewinkel (Dítě, Eliáš jun., Melečková ined.).

CONCLUSIONS

The data about the presence of *Cyperus pannonicus* in the vicinity of Riđica in Vojvodina (northern Serbia) contributes to the knowledge about recent distribution of this species in the southern part of the Pannonian Lowland. The phytosociological relevés recorded in Lake Medura document the community of *Cyperetum pannonici*. In connection with this community, *Suaeda pannonica* (a critically endangered species in Serbia) was confirmed for the first time in this locality. The saline Lakes Medura

and Kruševlje are important biodiversity centres and fragments of the rare halophytic flora in the intensively used agricultural landscape.

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ПОТВРДА ПРИСУСТВА *CYPERUS PANNONICUS* У ВОЈВОДИНИ (СЕВЕРНА СРБИЈА) И ЊЕГОВ САДАШЊИ ФИТОЦЕНОЛОШКИ СТАТУС

ДАНИЈЕЛ ДИТЕ, ЗУЗАНА МЕЛЕЧКОВА, РАНКО ПЕРИЋ, ПАВОЛ ЕЛИАШ МЛ.

РЕЗИМЕ

Приликом истраживања халофитске вегетације у Војводини (северна Србија) 2012. године потврђено је присуство *Cyperus pannonicus* Jacq. Врста расте на обали малог сланог језера званог Медура источно од Рибице где гради релативно велику популацију у оквиру заједнице *Cyperetum pannonici* Wendelberger.