Contributions to the distribution and ecology of Carex hordeistichos Vill. in the Czech Republic and Slovakia

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Abstract: Current and historical occurrence as well as habitat requirements of Carex hordeistichos in the Czech Republic and Slovakia are presented. The study is based on the revision of herbarium specimens from 25 herbaria and a field survey carried out during 2004-2009. Altogether, 195 sites were documented in the Czech Republic, exclusively in the Moravia region. Recent occurrence was confirmed at only four localities (2% of sites), therefore the status of threat was confirmed – the species is critically endangered. In Slovakia, 184 localities of the species were recorded in total; 34 sites were found in period 1975-1999 and 35 sites were confirmed recently (19% of sites recorded), but only 6 in the Pannonia (3% of sites). The number of localities was stable over the last 35 years, therefore, we re-evaluated the IUCN status of C. hordeistichos in Slovakia. The species is now assessed in the category vulnerable – VU. Results of the study are summarised in the maps of historical and actual species distribution.

Carex hordeistichos usually occurred in various wet grassland communities and it had no well-defined coenotic relationships. On the basis of our knowledge, we consider C. hordeistichos as a facultative halophyte.

Key words: facultative halophytes, occurrence, IUCN criteria, rare species

1. Introduction

Carex hordeistichos Vill. is a species with the European Centre of range. It occurs in Spain, France, Italy, Germany, Central and Eastern Europe (the Czech Republic, Slovakia, Hungary, Romania, Bulgaria) and in the countries of former Yugoslavia. The range extends south into northern Africa and eastward to southern Russia, the Caucasus, in Asia Minor, Iraq and Iran (Meusel et al. 1965; Schulze-Motel 1980).

Occurrence of C. hordeistichos in Europe is characterized by Chater (1980) as “in most of the territory is very rare”. The species is absent in Scandinavia, the British Isles, the Benelux and also in some Mediterranean countries such as Portugal or Greece (Muller 1999). In Spain, it occurs only very rarely (Luceño 1994); in France, it is included in Red Book (Olivier et al. 1995) and is protected by law (Danton & Baffray 1995). In Germany, the species is considered one of the most endangered plant species (Korneck et al. 1996). Muller (1999) believes that in central Europe, the species probably occurs more commonly but current data are missing. In fact, the species is also relatively rare in this area.

In Austria, the species grows only in the Burgenland Region, the Lower Austria and in Vienna, while in the Carinthia Region, it is now extinct (Fischer et al. 2005); it belongs to the critically endangered species of Austrian flora (Niklfield & Schratt-Ehrendorfer 1999). Similarly, it is rare in Ukraine (Krečetovič 1940), but it is not included in the protected plants (Shelyag-Sosonko 1996). In Hungary, C. hordeistichos occurs scattered all over the territory (Sós 1973), but it was included in the latest version of Red list in the category NT (near threatened) (Király 2007). The species is evaluated as critically endangered (C1) in the Czech Republic (Procházka 2001), in Slovakia, it is included in IUCN category EN – endangered (Feráková et al. 2001); the species is also protected by law in both countries.

In view of the foregoing contributions, the paper is aimed to obtain historical and current occurrence and ecology of Carex hordeistichos in the Czech Republic and Slovakia.

2. Material and methods

Carex hordeistichos is a perennial tussock sedge up to 10-30 cm high. The stems are prostrate to ascending,
thick, smooth, and blunt triangular. The basal leaf sheaths are yellow-brown to black and fibrous. The leaves are 3 to 5 mm wide, stiff, leathery. Male spikelets usually two or three, are close together, but away from female ones. Female spikelets three to four. Utricles are ovoid to oblong, 8-12 mm long, in distinct rows, surface is sparcely pubescent (Chater 1980; Schulze-Motel 1980). The species is very often confused with Carex secalina Wahlenb. C. secalina is characteristic especially for glabrous utricles 5-7 mm long, not in distinct rows (Grulich & Řepka 2002).

The research was undertaken in years 2004-2009. We designed the distribution by studying the herbarium specimens from the herbaria BP, BBZ, BRA, BRNM, BRNU, CB, KO, LTM, MMI, MZ, NI, NJM, OL, OLM, PMK, PR, PRC, ROZ, SAS, SLO, TM, TMM, VM, VYM, ZV, data from the Central Database of phytosociological relevés (CDF) deposited in Institute of Botany (Hegedušová 2007), literature data as well as our field research. Data published from South Moravia can be used only in a limited extent, as we found in the herbaria frequent confusions with a very similar species C. secalina, both species grow here sympatrically. Some unpublished data from the territory of Slovakia were also obtained from database of vascular plants stored at the Department of taxonomy of vascular plants, Institute of Botany, Bratislava. Older literature is cited in abbreviated form following Futák & Domin (1960). Nomenclature of taxa according to Marhold & Hindák (1998), syntaxa nomenclature is not according to a single source, thus the name of each syntaxonomic unit includes the name of the author. Phytogeographical division of the Czech Republic is according to Skalický (1988), in Slovakia, it followed Futák (1984). Herbarium abbreviations are according to Holmgren et al. (1990) and Vozárová & Sutorý (2001). Categories of threat were determined according to the methodology of IUCN (2001).

3. Results and discussion

3.1. Distribution of Carex hordeistichos in the Czech Republic

In the Czech Republic, C. hordeistichos was recorded at 195 sites in total (Fig. 1, Appendix 1, see http://www.brc.amu.edu.pl). 37 locations were found in period 1975-1999 and the species was recently confirmed at

![Fig. 1. Historical and current distribution of Carex hordeistichos in the Czech Republic](image-url)
A marked decrease in numbers of localities was found during our study due to massive land reclamation (Fig. 2). The occurrence of the species is limited to the Pannonian Thermophyticum and Carpathian Mesophyticum in the Southeast and southern Moravia, the isolated site was located near Olomouc in Central Moravia. The species is very rare in south-west Moravia (the Znojemsko-brněnská pahorkatina Hills); only six sites are known here. Most sites were recorded in the central part of South Moravia in the territory between settlements of Drnholec, Brno, Bučovice and Břeclav; these sites are located in the Dyjsko-svratecký úval Region, the Bučovická a Hustopečská pahorkatina Hills, Pavlovské kopce Area and Milovicko-valtická pahorkatina Hills. The second isolated distribution area is located in southeast Moravia in the territory between settlements of Uherské Hradiště, Luhačovice, Valašské Klobouky and Strážnice. The center of species occurrence lies there in forest and steppe areas of the Bílé Karpaty Mts, where the species spread to the Dolnomoravský úval Region and Zlinské vrchy Mts. It is documented from lowland to submountain areas (cf. Skalický 1988). The minimum altitude site is located between villages of Lednice and Červená Nová Ves (157 m above sea level); maximum altitude was recorded in 650 m a. s. l. at the Lesná Hill near the village Horní Němčí.

Distribution of *C. hordeistichos* was summarized for the first time by Podpíra (1930) in Moravia. A detailed grid map for Bílé Karpaty Mts. was published much later by Jongepier & Pechanec (2006). Čelakovský (1867) mentioned *C. hordeistichos* occurrence also from Bohemia (Budyně nad Ohří), but the information was confused with *C. secalina* and was somewhat later corrected by himself (Čelakovský 1871). In addition, several Bohemian vouchers come from a culture in botanical gardens: Prague, Botanic Garden, leg. Vogl 1852 PR; a specimen located in Prague [no exact location], leg. Gintl 1856 PRC is probably of the same origin.

### 3.2. Distribution of *Carex hordeistichos* in Slovakia

The species occurs scattered and rarely only in some parts of the territory of Slovakia from the foothills to lowlands. Overall, 184 sites were found in our study. 34 locations were recorded in period 1975-1999 and the species was confirmed at 35 sites recently (Fig. 3, Appendix 2, see http://www.brc.amu.edu.pl). The number of localities was stable during last 35 years (Fig. 2). Most data in the Pannonia are from the Danube Lowland and the Ipeľsko-Rimavská brázda Region. However, a large reduction of localities influenced by agricultural land use was recorded – from 58 sites known in the past only six are found presently (9% of sites). Overall, in the Carpathian region 126 sites were documented, of which 30 are current (23% of sites). The sites are located especially in the Turčianska Basin and basins under the Tatras. Populations are often small in number of individuals (see e.g. Bernátová *et al*. 2006), micro-populations contain only one or two plants in extreme cases (e.g. in the Turčická Valley at 710 m a.s.l.). The minimum altitude of *C. hordeistichos* occurrence was found in Tvrdošovce (109 m a.s.l.), maximum altitude was recorded near Fačkov (Strážovské vrchy Mts.) approximately in 1000 m a.s.l.
Most detailed data on the occurrence of *C. hordeistichos* in Slovakia was published by Dostál & Červenka (1992): lowlands, middle and lower Považie Basin, Bánovce nad Bebravou, Ponitrie Region, middle and lower Pohronie Region, Hostice (Rimavská Sobota district), around town of Rožňava, as well as rarely in Liptov, Turiec and Spiš regions. Based on our data, we can conclude that the extension of the above is inaccurate and incomplete.

### 3.3. Ecology and coenotic relationships

Very little information is available about *Carex hordeistichos* habitat (Muller 1999). The species occurs in the salt marshes, in salinised edges of pastures and fields, field roads (Schulze-Motel 1980; Muller 1999; Řepka 2007), it also grows in wet grasslands, in ditches, (Dostál & Červenka 1992) and along watercourses (also regulated). Several authors considered the species as obligate halophyte (Krist 1940; Šmarda 1961), respectively, for species preferring saline habitats (Wendelberger 1950; Schulze-Motel 1980; Oberdorfer 1990). Some authors (Guinocet & de Vilmorin 1973; Oberdorfer 1990) regarded it as characteristic species of halophytic association *Juncion geradii* Wendelberger 1943 [pseudonym *Agropyro-Rumicion crispí* Nordhagen 1940; syn. *Scorzonero-Juncion gerardii* (Wendelberger 1943) Vicherek 1973] which includes halophytic and sub-halophytic communities physiognomic close to moist ruderal vegetation, pasture and meadows (Šumberová et al. 2007). Other authors (Mucina 1993; Šumberová et al. 2007) included it not to a distinctive taxa of association of *Juncion geradii* Wendelberger 1943.

From Western Europe, the association *Carici hordeistichi-Trifolietum fragiferi* is known from this alliance, which has been described in Spain (Rivas-Godoy & Borja-Carbonell 1961) and was recorded also in France (Mony & Muller 2005). From this alliance, the species was still referred in association *Dactylo-Festucetum* Tx. 50 (syn. *Potentillo-Festucetum* Nordh. 1940) (Muller 1999). Mucina (1993) included it among the diagnostic species of the *Scorzonero-Juncetalia gerardii* Vicherek 1973 and *Potentillo-Polygonetalia* R. Tx. 1947. Oberdofer (1983) mentioned it in the association *Junco compressi-Trifolietum repentis* Eggler 1933 (the alliance *Plantaginio-Prunellion* Eliáš 1980).

The analysis of occurrence in recent sites showed that the species had no well-defined coenotic affinities. Only a small proportion of sites was related to halophilic or sub-halophilic communities of the alliance of *Juncion gerardii* Wendelberger 1943 in the Czech Republic and Slovakia. Except for the above mentioned alliance of *Plantaginio-Prunellion* Eliáš 1980, we recorded the species, for example, in vegetation of *Cynosurion cristati* Tüxen 1947 and *Deschampsion cespitosae* Horvatić 1930. It was also found in communities of *Caricion davallianae* Klika 1934 alliance and, occasionally, on forest roads in contact with vegetation of the alliance of *Cirsio-Brachypodion pinnati* Hadač et Klika ex Klika 1951.

The results of our study showed that *C. hordeistichos* cannot be considered as obligate halophyte. Most of
historical and current sites were found outside the salted soil. Plants of *C. hordeistichos* found in saline habitats occupied here less salted sites and they avoided excessively highly salted soils. Most sites were recorded on rural roads and sites often strongly affected by anthropic disturbances; however, it also grew in fens with a high content of bases (Watzka 1997; Hájek 1998). The same conclusion was also reached by Mony & Muller (2005); the authors studied the relationship of *C. hordeistichos* and halophytic communities in Lorraine, France. Species was absent in typical halophilic community with the dominance of *Juncus gerardii* and *Salicornia europaea*, and it was most often recorded in grassland communities (18 out of 21 analysed sites). They also found a negative correlation between the occurrence of the species and increasing soil salinity. Therefore, the authors considered the species as a plant only slightly tolerating increased salt content in soil.

4. Final remarks

The results of the study showed that the inclusion of the species in the critically endangered (CR A2a, c) category is justified in the Czech Republic. The occurrence of the species was strongly reduced, approximately 98% of the sites disappeared or were not recently verified (Fig. 1, 2, Appendix 1). On the other hand, in Slovakia, the inclusion of *C. hordeistichos* in IUCN category EN is overestimated. Although the occurrence of the species was significantly reduced in the Pannonia (91% of sites were not confirmed recently), the species is still present and relatively abundant in the Carpathians (23% of sites still exist or new sites were found) and the reduction of occurrence was not found since 1975 (Fig. 2, 3, Appendix 2). Therefore, we evaluated the species in the IUCN category vulnerable – VU A2c+B2b(iii, iv).

We found that *C. hordeistichos* had no well-defined coenotic relationships; the species usually occurred in various wet grassland communities, often disturbed by human activities and ruderalised (rural roads, field edges, pastures). The species does not prefer the saline habitats and could be regarded only as a facultative halophyte.

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References


Appendix 1. List of localities of Carex hordeistichos in the Czech Republic

Appendix 2. List of localities of Carex hordeistichos in Slovakia


3. Silícká planina, moist places north-west from Borzová near road to Plešivec (Chrtek et Žertová 1956 PRC).


**Questionable data:** **21b.** the Fatranský Kriváň Hill (Trapl 1924 PRC).

**General data:** the Záhorská nížina Lowland, salt habitats (Novák 1954). – Bošácka dolina Valley, stream gravel (Holuby 1878 PR). – the Trenčianska župa County (Rochel s. a. BP).