HACQUETIA 10/2 • 2011, 171–181

DOI: 10.2478/v10028-011-0009-3

BECKMANNIA ERUCIFORMIS (L.) HOST IN SLOVAKIA – DISTRIBUTION, ECOLOGY AND COENOTIC AFFINITY

Dedicated to the memory of Ján Bogoly (1951 – 2011)

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Abstract

The historical and recent distribution, ecology and phytosociology of perennial grass *Beckmannia eruciformis* was studied in Slovakia between 2002 and 2010. Altogether 22 natural and two secondary sites with presence of the species were found from published sources, herbaria and field research. Localities of its native occurrence have been concentrated in Eastern Slovakia (Východoslovenská nížina Lowland from the settlement of Streda nad Bodrogom to the villages of Pribeník and Biel). Secondary sites were found in Western Slovakia (Podunajská nížina Lowland; the surroundings of Sládkovičovo town and Jaslovské Bohunice village). The relatively massive reduction of *Beckmannia eruciformis* localities was recorded in the seventies and eighties of the last century; it was related to massive land reclamation and alterations in the water regime of river alluvia. Recently only seven localities were found. Permanent occurrence was confirmed only in two localities (Malý Horeš, Strážne). In those cases *Beckmannia eruciformis* has created relatively large populations including some thousands of individuals. All other recent occurrences were temporary (Streda nad Bodrogom, Keresztúr farmstead, Horešské lúky Nature Reserve, Veľký Horeš, Pribeník). Moreover, they were relatively poor in the number in individuals and are acutely threatened by anthropogenic changes of environmental conditions. According to our results and by applying the IUCN criteria, we propose to modify the threat category of the species from critically endangered (CR) to endangered (EN) in Slovakia. Occurrence of the association *Beckmannietum eruciformis* and the alliance *Beckmannion eruciformis*, was also not confirmed for Slovakia during our research. We believe that the association was not present in the past either. Recently, *Beckmannia eruciformis* was found in the stands of *Oenanthion aquaticae* (*Phragmito-Magnocaricetea*) and *Potentillion anserinae* (*Molinio-Arrhenatheretea*) in two localities (Malý Horeš, Strážne) during our study. The species composition of the mentioned alliances is fundamentally influenced by the ecological conditions of sites, mainly by water regime during the vegetation period. According to our knowledge, the most favourable conditions for *Beckmannia eruciformis* are the following: short-term and low floods in the spring, decrease of the water table at the beginning of summer and relatively high level of groundwater during next part of vegetation period. On the contrary, the species may not appear on the site in case of unfavourable weather conditions (dry years).
Key words: Východoslovenská nížina Lowland, endangered species, marshland vegetation, phytosociology.

Izvleček

Preteklo in današnjo razširjenost, ekologijo in fitocenologijo večletne trave *Beckmannia eruciformis* na Slovaškem smo preučevali med letoma 2002 in 2010. V objavljenih virih, herbarijih in s terenskimi raziskavami smo našli 22 naravnih in dve drugotni rastišči. Mesta naravnih rastišč so skoncentrirana v zahodnem delu Slovaške (Východoslovenská nížina od naselja Streda nad Bodrogom do vasi Pribeník in Biel). Sekundarna rastišča smo našli v zahodnem delu Slovaške (Podunajská nížina; okolica mesta Sládkovičovo in vasi Jaslovské Bohunice). Razmeroma množično upadanje nahajališč vrste *Beckmannia eruciformis* se je začelo v sedemdesetih in osemdesetih letih prejšnjega stoletja in je bilo povezano z velikimi izsuševanji in spremembami vodnega režima ob rečnih naplavinah. V zadnjem času smo našli samo še sedem rastišč. Stalno pojavljanje smo potrdili samo na dveh rastiščih (Malý Horeš, Strážne). V teh primerih se vrsta *Beckmannia eruciformis* pojavlja v razmeroma

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velikih populacijah z nekaj tisoč osebki. Vsa druga nahajališča so prehodna (Streda nad Bodrogom, farma Keresztúr, naravni rezervat Horešské lúky, Veľký Horeš, Pribeník). Poleg tega so tukaj populacije maloštevilne in so ogrožene zaradi človekovega spreminjanja rastiščnih razmer. V skladu z našimi rezultati in uporabo meril IUCN predlagamo spremembo kategorije od kritično ogrožene (CR) v ogroženo vrsto na Slovaškem. Pojavljana sestojev asociacije *Beckmannietum eruciformis* in zveze *Beckmannion eruciformis* na Slovaškem pa nismo potrdili. Menimo, da asociacija tudi v preteklosti ni bila prisotna. Vrsto *Beckmannia eruciformis* smo v naši raziskavi našli v sestojih zvez *Oenanthion aquaticae* (*Phragmito-Magnocaricetea*) in *Potentillion anserinae* (*Molinio-Arrhenatheretea*) na dveh rastiščih (Malý Horeš, Strážne). Na vrstno sestavo omenjenih zvez vplivajo ekološke razmere na rastiščih, predvsem vodni režim med vegetacijskim obdobjem. Najbolj ugodne razmere za vrsto *Beckmannia eruciformis* so: kratkotrajne in nizke poplave spomladi, upad podtalnice v začetku poletje in razmeroma visok nivo talne vode v naslednjem delu vegetacijske dobe. Nasprotno pa se vrsta ne pojavlja na rastišču, če so vremenske razmere neugodne (sušna leta).
Ključne besede: Východoslovenská nižine, redke vrste, močvirska vegetacija, fitocenološka analiza.

1. INTRODUCTION

Beckmannia eruciformis (L.) Host is an Eurasian continental species with a wide distribution range in Europe and Asia, from Italy, the Balkan Peninsula, Central and north-eastern Europe to Western and Middle Asia, the Caucasus and western and eastern Siberia (Tzvelev 1983, Holub 1999). Within Central Europe the species has been recorded only from south-eastern Slovakia, north-eastern Poland and northern and eastern Hungary (Soó 1964, Holub 1999, Frey & Paszko 2000, Csiky 2004, Penksza 2009). It occurs in wetlands, meadows and pastures on salt affected soils, on the banks as well as in secondary habitats like field depressions and drainage canals along roads. The species requires muddy, loamy to clayey, alkaline, slightly saline soils that are generally wet and/or flooded in the spring, but dry in summer (Dostál & Červenka 1992, Holub 1999).

From the taxonomical point of view, *Beckmannia eruciformis* belongs to tribe *Aveneae*, subtribe *Alopecurinae* (Soreng et al. 2007, Gillespie et al. 2008) and it is usually divided into two subspecies. The nominate subsp. *eruciformis* is laxly caespitose, with creeping rhizomes, and the basal internodes of stems are tuberous. It is distributed throughout most of the range of the species. By contrast, subsp. *borealis* Tzvelev is densely caespitose, without creeping rhizomes, and the basal internodes of stems are not tuberous. It occupies north-eastern parts of the distribution range in the Northern European region of the former USSR, Siberia, and the Far East (Tzvelev 1973, 1983, Tutin 1980).

Beckmannia eruciformis was always known as a rare species of the Slovak flora (Holub 1999). In terms of threat and rarity, Feráková et al. (2001) classified it as critically endangered (CR). The species is also included in the Red book of vascular plants of the Czech Republic and Slovakia (Čeřovský et al. 1999) and it is protected by law as well. Although occurrence of the species and its coenotic affinity was mentioned in several works (Hejný 1960, Vicherek 1964, 1973, Holub 1999, Zlacká 2005), more accurate historical and current data are lacking.

The aims of our paper were:

a) to process the detailed occurrence of *Beckmannia eruciformis* in Slovakia,
b) to analyze the coenotic and ecological conditions of *Beckmannia eruciformis* in Slovakia.

2. MATERIAL AND METHODS

The study was carried out during the years 2002–2010. The data concerning the distribution of the species were processed from herbaria BP, BRA, BRNM, BRNU, KO, NI, PR, PRC, SAV, SLO and from the Database of vascular plants deposed in the Institute of Botany, Slovak Academy of Sciences in Bratislava. All data on the occurrence of *Beckmannia eruciformis* were divided into three groups: the first includes all the historical data from the literature and herbaria to year 1975, the second group includes data from literature and herbaria for the period of intensive reclamation and drainage projects in the years 1975 – 1999, the third group includes current relevant data found during our research as well as published in the literature after 2000. Herbarium vouchers collected during field research are stored in herbarium NI. The mentioned herbarium acronyms are according to Vozárová & Sutorý (2001). The

results of this study are presented on the distribution map. Coordinates of historical localities were taken from Google Earth; coordinates of recent localities were obtained during field research using GPS equipment Garmin CS 60 in the WGS 84 system. A list of localities was compiled according to directives of the Flóra Slovenska VI/1 (cf. Goliašová & Šípošová 2008).

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 relevés were classified by divisive polythetic analysis using the TWINSPAN program (Hill & Šmilauer 2005). Names of syntaxa are according to Molnár & Borhidi (2003). The nomenclature of flowering plants is according to Marhold et al. (1998) and Oťahelová et al. (2001). The phytogeographical division of Slovakia follows Futák (1980).

3. RESULTS

Historical and recent occurrence of *Beckmannia eruciformis* in Slovakia

Altogether, 24 localities of *B. eruciformis* were confirmed in Slovakia (Figure 1 and List of localities), but two of them have secondary origin. All native localities were situated in south-eastern Slovakia, in the Východoslovenská nížina Lowland within a relatively small area (ca 200 km^2) between the settlements of Streda nad Bodrogom and Biel. Secondary localities were found in south-western Slovakia, in the Podunajská nížina Lowland (Sládkovičovo, Jaslovské Bohunice). One herbarium specimen from Kačín hill in the Malé Karpaty Mts. (western Slovakia) is deposed in the herbarium of the National Museum in Prague (Peyl 1887 PR). The location of the site is not precise on the herbarium label, thus the origin of *Beckmannia eruciformis* there is questionable.

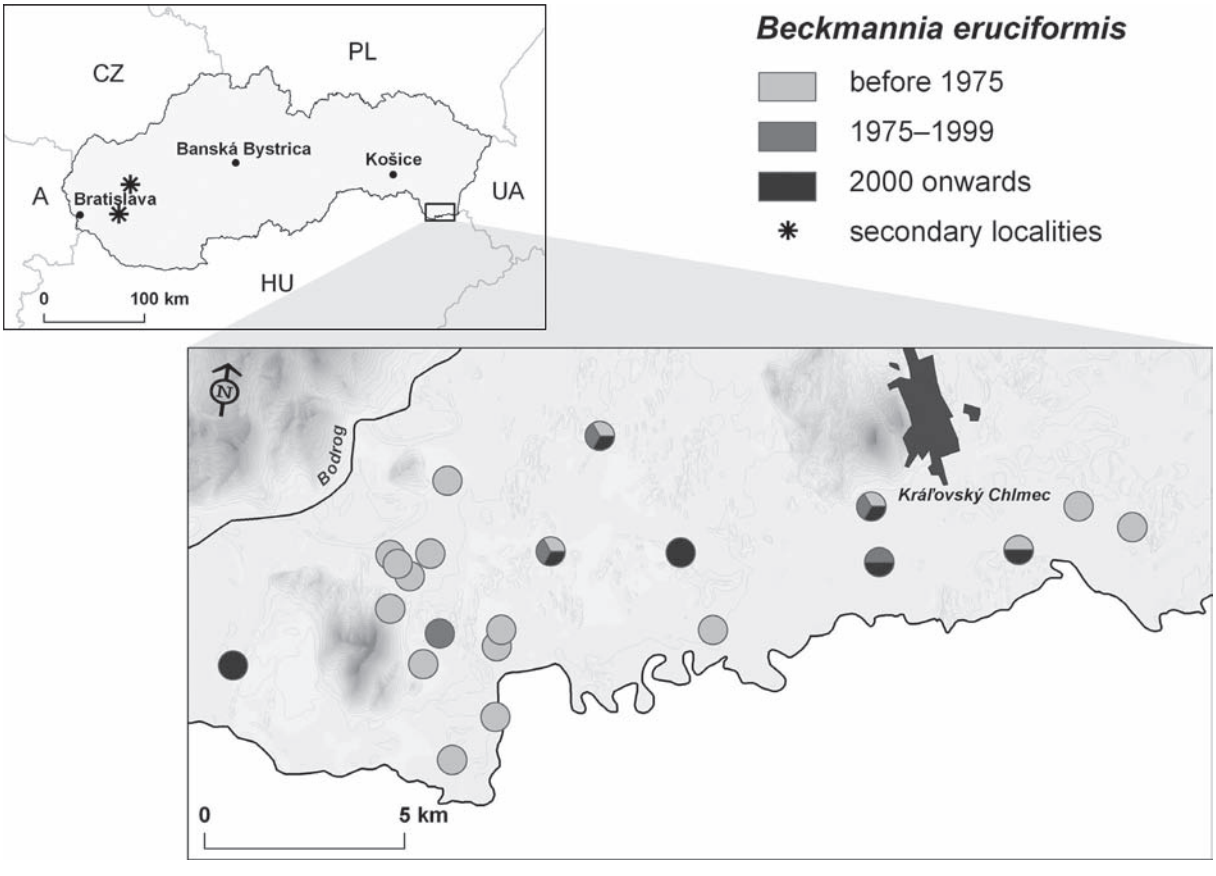

Figure 1: Historical and recent distribution of *Beckmannia eruciformis* in Slovakia.
Slika 1: Zgodovinska in današnja razširjenost vrsta *Beckmannia eruciformis* na Slovaškem.

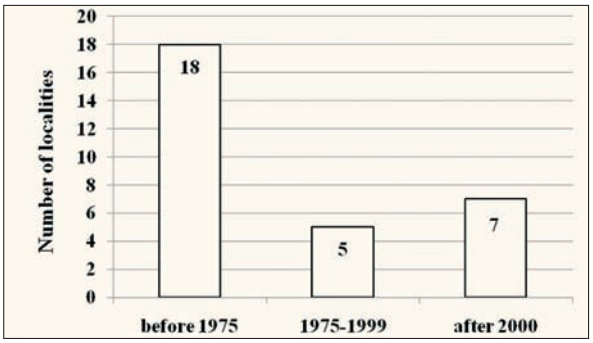

Figure 2: Comparison of the number of native *Beckmannia eruciformis* localities in Slovakia in different time periods.

Slika 2: Primerjava števila naravnih rastišč vrste *Beckmannia eruciformis* na Slovaškem v različnih časovnih obdobjih.

Comparing the number of localities in different time periods, a strong decrease was recorded in the seventies and eighties of the last century – approximately 80% of localities were destroyed (Figure 2). Since then the number of sites was more or less stable until now; ca 30% of all localities still exist. However, the presence has remained only temporary in most of the localities (they were usually ploughed again after subsidence of the groundwater – Streda nad Bodrogom, Keresztúr farmstead, Horešské lúky Nature Reserve, Veľký Horeš, Pribeník). Long-term, stable occurrence of *Beckmannia eruciformis* was found only on two sites (Onča farmstead, Strážne).

List of localities: *Pannonicum*: **Podunajská nížina Lowland.** Sládkovičovo (Potůček 1966). – Jaslovské Bohunice, Červeník highway rest area (Feráková 1990 SAV, 1991). **Východoslovenská nížina Lowland.** Streda nad Bodrogom, field depression (Zlacká 2005 NI). – Keresztúr farmstead (Staněk 1947 BRNU, BRNM; Hejný 1960; Bogoly 1994; Zlacká 2005). – Somotor (Margittai 1925 BRNU, 1926 BP, Margittai 1929; Holub 1999). – Somotor, around the train stop (Hejný 1960). – Somotor, west from the train stop (Šourek 1954 PR). – Somotor, Veľké pole site [Hosszú mező] (Kiss 1939). = Somotor, SW, pastures on the northern foothill of the Tarbucka Hill (Vicherek 1962 BRNU, 1964, 1973; Šmarda 1965). – Somotor, meadows right from the road to Veľký Kamenec (Černoch 1954 BRNM; Pokluda 1960 BRNM). – Somotor, roadside canal along the road to Veľký Kamenec (Pokluda 1960 BRNM). – Veľký Kamenec (Margittai 1929). – Veľký Kamenec, meadow ca 1 km north-east from the village (Nevrlý 1973 BRNM, 1975 PR, BRNU, BRNM, 1976 BRNM). – Veľký Kamenec, south from the village, roadside canal along road to Pácin (Vicherek 1962 BRNU, 1964, 1973). – Veľký Kamenec, around Veľká Karčava – Veľký Kamenec, east from the village in rice fields (both data Hejný 1960). – Veľký Kamenec, around Južný Radský kanál canal (Májovský 1964 SLO). – Strážne, swamp and meadow near the former train stop (Hejný 1960; Vicherek 1964; Bogoly 1985, 1994; Holub 1999; Zlacká 2005 NI; Eliáš jun., Dítě et Šuvada 2009 NI). – Veľký Horeš NW, field depression (Balla 2006 in verb.). – Veľký Horeš, wet meadows south from the village (Záborský 1960 SLO). – Malý Horeš, Horešské lúky Nature Reserve (Šomšák 1963; Májovský 1964 SLO; Bogoly 1985; Zlacká 2005 NI). – Malý Horeš, Onča farmstead (Řepka 1994 BRNM; Bogoly 1994; Zlacká et Dítě 2005 NI; Eliáš jun., Dítě et Šuvada 2009 NI). – Pribeník (Hejný 1960; Holub 1999, Zlacká 2005). – Dobrá (Hejný 1960; Holub 1999). – Biel, near Viničný vrch Hill [Szőlő révész] (Staněk 1947 BRNM, BRNU).

General data (not mapped): *Pannonicum*: Východoslovenská nížina Lowland (Novák 1954).

Erroneous data: *Carpaticum:* Malé Karpaty Mts. Bratislava, Kačín Hill (Peyl 1887 PR).

Coenotic affinity and recent stage of *Beckmannia eruciformis* populations

Strážne, swamp and meadow near the former train stop

Large population, including thousands of individuals covering an area of approximately 1.5 ha in a periodically flooded shallow depression on the edge of mowed meadows, was found in 2009. It was a part of a broad grassland complex, represented by lowland wet meadows, marshes and extensively overgrazed sub-halophytic pastures. Stands on this site are considered as marshland vegetation of shallow water, classified into alliance *Oenanthion aquaticae* (Table 1, rels. 1–7) within the class *Phragmito-Magnocaricetea*. Habitats with permanently stagnating water on the soil surface are indicated by the presence of several real aquatic plants (rels. 1–4), while typical marshland species (rels. 5–7) indicate eutrophic habitats with shallow water drying out during the summer. The cover of *Beckmannia eruciformis* had low to medium values (1–40 %).

Malý Horeš, Onča farmstead

The largest recent population in Slovakia included some thousands of individuals in 2009.

Figure 3: A part of *Beckmannia eruciformis* stand near Strážne (Photo: Pavol Eliáš jun.).
Slika 3: Del sestoja vrste *Beckmannia eruciformis* pri vasi Strážne. Foto: Pavol Eliáš mlajši.

Figure 4: Ruderalized stand of *Beckmannia eruciformis* in Onča farmstead near the Malý Horeš village (Photo: Daniel Dítě).
Slika 4: Ruderaliziran sestoj vrste *Beckmannia eruciformis* na farmi Onča pri vasi Malý Horeš. Foto: Daniel Dítě.

Figure 5: Typical inflorescence of *Beckmannia eruciformis* (Photo: Daniel Dítě).

Slika 5: Značilno socvetje vrste *Beckmannia eruciformis*. Foto: Daniel Dítě.

It was located on the eastern edge of the village, between the road and the Krčavský kanál channel. The vegetation was developed in a shallow inundation at the edge of drained pastures covering an area of approximately 0.5 ha. A dense population of *Beckmannia eruciformis* occurred there with a high cover reaching up to 70%. We consider that those stands belong to the meadow vegetation of *Potentillion anserinae* alliance. *Agrostis stolonifera* and *Beckmannia eruciformis* dominated in the stands at the site. *Glyceria fluitans* agg., *Ranunculus repens* and *Rorippa austriaca* reached also higher cover values. The drainage, however, caused changes in the vegetation structure – some atypical and ruderal species were recorded here (Table 1, rels. 8–10).

Veľký Horeš, Horešské lúky Nature Reserve

Residual and temporary occurrences in Horešské lúky Nature Reserve and the surrounding area were confirmed in 2005. A few tens to hundreds of individuals were recorded ca 100 m west of the border of the nature reserve. Since then, the presence here has not been confirmed (Balla in verb.).

Streda nad Bodrogom, field depression

This relatively small locality was found in 2005 (Zlacká 2005 NI). Some hundreds of individuals grew on the field edge and they occupied an area of ca 0.3 ha. The locality was destroyed (ploughed up) in the following year. It is not excluded that the species will re-appear if there are favourable moisture rates again.

Veľký Horeš, NE from the village

This temporary locality was reported in 2006. Some thousands of individuals occupied a shallow depression in an abandoned field (Balla in verb.). The depression was not cultivated only in wet years, when it was flooded, but it was used as arable land in years with low precipitation.

Keresztúr farmstead

A small temporary site as in the above mentioned case. Some of hundreds individuals were found on extensively managed wet pastures in 2005. It was not confirmed later.

Pribeník

The site was mentioned by Zlacká (2005). It is a single population in Slovakia without exact population size and location, therefore further research and mapping is needed. As in the previous case, the locality was not confirmed in recent years.

4. DISCUSSION

Historical and recent occurrence of *Beckmannia eruciformis* in Slovakia

The native *Beckmannia eruciformis* occurrence in Slovakia amounted to only localities in a small part of the Východoslovenská nížina Lowland phytogeographical district where the species extends from Hungary. The area is restricted to the settlements of Hrušov, Somotor, Veľký Kamenec, Strážne, Malý Horeš, Pribeník and Dobrá (Holub 1999). As we found, 22 localities of the species

were recorded here in total (Figure 1). The first three above-mentioned localities of the species on the territory of Slovakia were published by Margittai (1929) and Kiss (1939). But most sites were discovered in the fifties and sixties of the last century. The increase in the number of sites was related to the experimental cultivation of rice because *Beckmannia eruciformis* occurred as a weed in these stands (Hejný 1960). Moreover, higher intensity of botanical research in the area (Vicherek 1964, 1973) is also connected with the expanding frequency of the species. However, many suitable habitats disappeared due to massive land reclamation and drainage in the seventies and eighties (Holub 1999) and the number of *Beckmannia eruciformis* localities decreased rapidly (Figure 2). For example, Bogoly (1994) recorded only 3 locations in a very detailed floristic survey of the southern part of Východoslovenská nížina Lowland. By contrast, the occurrence of the species in some localities – particularly in cases where there were only a few individuals – was not constant, it mostly depends on the weather during a particular year, especially on the amount of rainfall at the beginning of the vegetation period. In dry years, the species was surviving in a sterile stage and it might have been overlooked on site. During the last 35 years, the number of sites has remained relatively stable (Figure 2) although many of them were only temporary. This is also because of the existence of so-called "temporary fields" in this region of Slovakia related to the wide occurrence of heavy gleyed soils. A specific feature of this soil category is that in terms of their physical properties the fields can be ploughed annually, but in order to protect their production potential and stability they require to be periodically used as pastures (Mati 2000). If this pasture is transformed again to field, *Beckmannia eruciformis* will usually disappear.

Two secondary sites were also found in the Podunajská nížina Lowland (south-western Slovakia). First Potůček (1966) mentioned the occurrence of *B. eruciformis* near the settlement of Sládkovičovo as a result of its experimental cultivation in farm breeding, and much later (Feráková 1991) found the species at a roadside canal near the highway parking place named Červeník. Neither of the localities was not confirmed during our research. It should be noted that Holub (1999) considered all findings from south-western Slovakia as an alien species *Beckmannia syzigachne*. As shown by our revision of the available herbarium material, this argument is false, and *B. syzigachne* has not yet been found in Slovakia (Gojdičová et al. 2002).

Finally, we found an old herbarium specimen of the species from the Kačín hill in the Malé Karpaty Mts. in south-western Slovakia (Peyl 1887 PR). We consider this as a mistake that arose in the processing of herbarium material (confusion of herbarium labels). Native occurrence of the species is extremely unlikely here.

Ecology and coenotic affinity

According to several authors (Bodrogközy 1965, Bodrogközy & Györffy 1970, Borhidi 2003), *Beckmannia eruciformis* is considered as characteristic species of alliance *Beckmannion eruciformis* Soó 1933. The vegetation is characterized by the presence of typical meadow species such as *Agrostis stolonifera*, *Beckmannia eruciformis*, *Mentha pulegium, Inula britannica, Alopecurus pratensis, Eleocharis palustris, E. uniglumis, Trifolium fragiferum, Lotus tenuis, Rorippa kerneri, Polygonum aviculare, Pulicaria vulgaris, Trifolium repens, Alopecurus geniculatus, A. aequalis, Glyceria fluitans* agg. and *Tripolium pannonicum* (arranged by frequency, cf. Soó 1930). There are several species which are absent in the phytosociological material obtained recently in Slovakia (Table 1). By contrast to stands in Hungary, stands with *Beckmannia eruciformis* in Slovakia contained several marshland and real aquatic species (Table 1, rels. 1–7) or meadow species (rels. 8–10), which are not typical for the above mentioned vegetation. For this reason, we classified the vegetation mainly to the *Oenanthion aquaticae* (*Phragmito-Magnocaricetea*) and marginally to *Potentillion anserinae* (*Molinio-Arrhenatheretea*) alliances. Recently, vegetation of *Beckmannion eruciformis* is not occurring in the territory of Slovakia.

According to Holub (1999), the occurrence of alliance *Beckmannion eruciformis* is centred in Hungary and the incidence in Slovakia is only marginal. However, the alliance was included in the recently published checklist of Slovak plant communities (Jarolímek & Šibík, 2008). Mucina (1989) pointed out that the community is missing in Slovakia. According to the preliminary analysis of so far available data from the Pannonian Plain, the occurrence of the alliance *Beckmannion eruciformis* is limited to eastern Hungary and the Romanian part of Pannonia (Dítě et al. 2011 in prep.). In Slovakia, the alliance is still not con-

firmed today, and very likely it did not occur even in the past, though Vicherek (1973) mentioned it in his survey of halophytic vegetation of former Czechoslovakia. In our opinion, the phytosociological relevés published by Vicherek can be identified with the association *Potentillion anserinae* (class *Molinio-Arrhenatheretea*). Similarly, two relevés were published as vegetation of *Beckmannion eruciformis* by Zlacká (2005). However, both represented the stands of class *Phragmito-Magnocaricetea* and alliance *Oenathion aquaticae*.

These findings are similar to those mentioned by several authors in the past. For example Oťahelová et al. (1985) included a part of *Beckmannia eruciformis* stands on the site in the alliance *Oenanthion aquaticae*, because *Beckmannia eruciformis* as a sociable species behaved synecologically, syngenetically and structurally as a member of alliance *Oenanthion aquaticae* on the edge of his distribution range (cf. Oťahelová et al. l. c.). At the same site, Zlacká (2005) recorded also a species requiring higher levels of water, for example *Butomus umbellatus*. Recently Oťahelová et al. (2001) also mentioned the presence of *Beckmannia eruciformis* in association *Glycerietum aquaticae* Hueck 1931. The species would still survive around the village of Strážne in stands of *Phragmito-Magnocaricetea*, which are more or less similar to those recorded by the above mentioned authors. According to Holub (1999) some Slovak occurrences of *Beckmannia eruciformis* stands are syntaxonomically close rather to subhalophytic facies of class *Phragmito-Magnocaricetea*. Moreover, the species survives in the mosaic of remnant stands in periodically flooded field depressions of class *Isoëto-Nanojuncetea* similarly as *Schoenoplectus supinus* – other rare species of Slovak flora (Zlacká et al. 2006).

For completeness, we believe that *Beckmannia eruciformis* could be accidentally present outside Slovakia in relatively narrow and deep grooves on strongly saline soils as a component of the association *Pholiuro pannonici-Plantaginetum tenuiflorae* Wendelberger 1943. In Slovakia, the occurrence of the species in this vegetation is not known either historically or currently (see Dítě et al. 2010).

5. CONCLUSIONS

The notable reduction of *Beckmannia eruciformis* occurrence was caused by massive hydromelioration adjustments and abandonment of the experimental rice cultivation in the Východoslovenská nížina Lowland in the nineteen-seventies and eighties – more than two thirds of localities have vanished. However, a relatively stable trend in the number of localities as well as in the abundance of local populations has been detected in the last 35 years – the species has survived now in two permanent, large populations and in five temporary populations. Based on our results, we propose to change the IUCN category of the species from critically endangered (CR) to EN B2a, b(iii), c(iii, iv) (endangered) in Slovakia.

Recently, vegetation with presence of *Beckmannia eruciformis* belongs to the *Oenanthion aquaticae* (*Phragmito-Magnocaricetea*) and *Potentillion anserinae* (*Molinio-Arrhenatheretea*) alliances. Species composition strongly depends on the length and period of flooding during the year, where mainly marshland as well as real aquatic species and species of eutrophic wet habitats have been recorded.

6. ACKNOWLEDGEMENTS

We are grateful to Miloš Balla (Administration of Protected Landscape Area Latorica, Trebišov) for versatile, long-term assistance in the field and Helena Oťaheľová (Institute of Botany, Bratislava) for their critical comments on the manuscript. We also thank Anna Petrášová (Matej Bel University, Banská Bystrica) for bryophytes determination and Dušan Senko (Institute of Botany, Bratislava) for the map processing. The study was supported by grants VEGA No. 1/0814/09 and 2/0030/09.

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Received 28. 4. 2011
Revision received 23. 8. 2011
Accepted 25. 8. 2011

Table 1: Phytosociological table of communities with *Beckmannia eruciformis* currently recorded in Slovakia.
Tabela 1: Fitocenološka tabela združb z vrsto *Beckmannia eruciformis,* trenutno popisanih na Slovaškem.

*	Relevé number	1	2	3	4	5	6	7	8	9	10
	Relevé area ($m^{2)}$	16	16	16	16	16	16	16	16	16	16
	cover E_1 (%)	60	60	70	70	90	90	95	90	90	95
	cover E_0 (%)	0	0	0	0	0	10	1	0	0	0
	Vegetation of shallow water (*Oenanthion aquaticae*)										
PM	*Eleocharis palustris*	+	+	a	a	a	3	3	1	.	.
LE	*Salvinia natans*	a	a	b	a	1	.	1	.	.	.
PM	*Alisma plantago-aquatica*	+	1	+	+	.	a	.	.	.	.
PM	*Oenanthe aquatica*	1	+	.	.	1	1	1	.	.	.
PM	*Lycopus europaeus*	.	+	.	.	1	+	.	.	.	.
	Vegetation of shallow water (*Oenanthion aquaticae*) of aquatic habitats										
LE	*Lemna minor*	.	+	r	+	.	.	.	.	.	.
LE	*Hydrocharis morsus-ranae*	.	+	1	1	.	.	.	.	.	.
	Vegetation of shallow water (*Oenanthion aquaticae*) of eutrophic habitats										
PM	*Sparganium erectum*	.	.	.	.	1	1	1	.	.	.
PM	*Rorippa amphibia*	.	.	.	.	1	.	r	.	.	.
BI	*Bidens frondosus*	.	.	.	.	+	.	1	.	.	.
MA	*Rorippa sylvestris*	.	.	.	.	+	.	+	.	+	.
MA	*Gratiola officinalis*	.	.	.	+	+	1	.	.	.	.
	Veronica scutellata	.	.	.	.	+	1	.	.	.	.
PM	*Carex riparia*	.	.	.	+	.	1	b	.	.	.
BI	*Alopecurus aequalis*	r	.	.	.	.	a	1	.	.	.
	Eurhynchium praelongum	.	.	.	.	.	a	1	.	.	.
BI	*Persicaria hydropiper*	.	.	.	.	.	a	+	.	.	.
PM	*Alisma lanceolatum*	.	.	.	.	.	+	r	+	.	.
	Meadow vegetation (*Potentillion anserinae*)										
MA	*Rorippa austriaca*	.	.	.	.	.	.	.	1	a	1
	Other species										
	Beckmannia eruciformis	3	a	a	1	3	b	b	4	4	4
PM	*Glyceria fluitans* agg.	1	a	a	a	a	1	a	.	1	1
MA	*Agrostis stolonifera*	.	.	1	+	3	b	3	b	b	3
	Rumex stenophyllus	.	+	+	.	+	+	+	.	1	.
	Cirsium arvense	.	.	+	+	+	+	.	.	+	+
PM	*Galium palustre*	.	.	.	.	+	+	.	+	.	+
PM, MA	*Lythrum salicaria*	.	.	.	r	.	.	+	.	+	1

* BI – *Bidentetea tripartitae;* LE – *Lemnetea;* MA – *Molinio-Arrhenatheretea;* PM – *Phragmito-Magnocaricetea*

Species recorded in one relevé only: *Alopecurus pratensis* 1 (7); *Ambrosia artemisiifolia* r (10); *Cardamine parviflora* 1 (6); *Carex vulpina* 1 (6); *Convonvulus arvensis* r (9); *Dactylis glomerata* + (10); *Elatine alsinastrum* + (6); *Epilobium tetragonum* r (7); *Inula britannica* + (6); *Peplis portula* 1 (6); *Plantago major* 1 (6); *Potentilla reptans* + (6); *Rumex crispus* + (10); *R. palustris* + (8); *Scutellaria galericulata* + (7); *Senecio erraticus* + (6); *Taraxacum* sect. *Ruderalia* + (7); *Trifolium repens* + (6); *Xanthium strumarium* r (10).

Localities of relevés No:
1.–4. Strážne, meadow near the former train stop, 48° 23' 08.20", 21° 51' 17.60", 102 m a. s. l., water level 30 cm, 31. 7. 2010. **5–7.** Strážne, meadow near the former train stop, 48° 23' 07.40", 21° 51' 20.70", 102 m a. s. l., water level 10–20 cm, 7. 7. 2009. **8–10.** Malý Horeš, Onča farmstead, shallow and ruderalized inundation on the edge of drained pastures, 48° 23' 34.70", 21° 57' 41.60", 104 m a. s. l., no water level, 8. 7. 2009.