

# NEW LOCALITIES OF SOME RARE FEN BRYOPHYTE SPECIES IN BELARUS

## Nové lokality vzácných slatinných mechorostů v Bělorusku



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### Abstract:

Bryophyte species occurring in calcium-rich fens are endangered and retreating in all European countries, including those in Northern Europe, because of fen degradation in intensively exploited landscapes. During our field investigation of mires in northwestern Belarus in July 2017, we discovered new localities of some rare fen bryophyte species. They are included as endangered in the Red Book of Belarus (*Cinclidium stygium*, *Drepanocladus lycopodioides* and *Meesia triquetra*) or have been retreating in the last decades (*Hamatocaulis vernicosus*, *Helodium blandowii*, *Paludella squarrosa*, *Scorpidium cossonii* and *S. scorpioides*). Knowledge about their recent distribution is a prerequisite for their active protection by nature conservation authorities.



### Key words:

endangered bryophytes, calcium-rich fens, mires, red-list species, glacial relicts.

## **INTRODUCTION**

Groundwater-dependent calcium-rich sedge-moss fens (minerotrophic mires) are a unique type of habitat supporting a large number of specialized and relict species (Amon et al. 2002, Jiménez-Alfaro et al. 2012, Horsáková et al. 2018). These fens thus represent islands with high biodiversity in agricultural landscapes. Throughout Europe, the area of calcium-rich fens has decreased substantially, and in the last decades they have become rare and endangered. The main reasons are the severe consequences of human activities such as drainage, groundwater abstraction, fertilization and cessation of traditional land use (van Diggelen et al. 2006, Seer & Schrautzer 2014). Moreover, they are amongst the 10% of the most threatened European habitats (Janssen et al. 2016). In connection with the retreat of fens, some bryophytes associated with this type of habitat have become rare and endangered, and many species are therefore listed in Red Books and Red Lists (Hodgetts 2015). Moreover, some of these fen species are currently rare and endangered not only in Western and Central Europe, but they are also retreating in the (sub-) boreal zone (e.g. *Hamatocaulis vernicosus* and *Meesia triquetra*; Hodgetts 2015, Rehell & Virtanen 2016) and in Eastern Europe (Maslovsky 2005, Rykovsky et al. 2015). The possible reasons in the case of bryophytes include not only direct habitat destruction (e.g. by drainage or peat extraction), but also an absence of management, eutrophication and subsequent expansion of competitively stronger herbs or *Sphagnum* spp. (Kooijman 2012, Hájek et al. 2015).

Although there is still a rather large number of existing fens in Belarus, some fen bryophyte species are listed in the country's Red Book. The majority of Belarusian calcium-rich fens occur in the NW part of Belarus. Szafnagel (1908) was the first to gather and publish extensive distributional data on fen bryophytes in the region. Some of Szafnagel's localities were verified in 1980–1990 by Rykovsky & Maslovsky (2004). Considering that mires occur in large areas of NW Belarus, the existing knowledge about the distribution of rare fen bryophytes is definitely not sufficient, though it is important for nature conservancy planning. Therefore, the aim of this paper is to contribute to the knowledge about the distribution of relic fen bryophytes in NW Belarus.

## **METHODS**

Our study area focuses on the NW part of Belarus, where most currently existing Belarusian calcium-rich fens occur (Fig. 1). In July 2017 we visited fen sites that we pre-selected based on an examination of aerial photos, distributional data on endangered fen vascular plants such as *Liparis loeselii* or *Saxifraga hirculus* (Vozniachuk et al. 2012, Dubovik et al. 2015) and other sources, including our own unpublished data. At each

site we recorded at least one vegetation-plot record of bryophytes and vascular plants using a plot size of 16 m<sup>2</sup> and collected all bryophytes for proper identification under a microscope. We focused on the best-developed sedge-moss fen vegetation. We measured water conductivity and water pH directly at microsites well supplied with groundwater in the central parts of the plots using a digital portable multimeter (HACH HQ40d). In addition, we recorded their accurate geographic coordinates using a Garmin 60CSx GPS receiver with an accuracy of < 15 m. Few bryophyte specimens were also collected outside the vegetation plots in their close vicinity. In such cases we report water chemistry measurements and coordinates from the nearby vegetation plots.

## RESULTS AND DISCUSSION

We discovered some new localities of fen bryophyte species that are currently considered endangered or rapidly disappearing. In some cases we verified certain old records of Szafnagel (1908). All specimens are stored in the herbarium of Masaryk University (BRNU).



**Obr. 1.** Rozmístění studovaných slatiňů v Bělorusku  
**Fig. 1.** Distribution of fens studied in Belarus

***Cinclidium stygium* Sw.** (Fig. 13)

- Miadel district (Narochansky NP), ca 800 m N of Novoselki, fen on the W bank of Svirnishche lake; 54°52'26.0"N, 26°22'02.7"E, 148 m a.s.l., 15. 7. 2017, water pH 6.69, conductivity 280  $\mu\text{S}\cdot\text{cm}^{-1}$ , field number BY 2/17.
- Postavy district, fen near the Cherveniy river, ca 2.6 km SW of Popovtsy village, 4.3 km W of Bolshie Shvakshy lake, 54°58'50.9"N, 26°29'39.2"E, 172 m a.s.l., 16. 7. 2017, water pH 7.03, conductivity 288  $\mu\text{S}\cdot\text{cm}^{-1}$ , field number BY 4/17.
- Smorgon district, SE of Valeykovichy, W bank of Mertvov lake, 54°35'10.9"N, 26°16'03.8"E, 137 m a.s.l., 20. 7. 2017, water pH 7.1, conductivity 345  $\mu\text{S}\cdot\text{cm}^{-1}$ , field number BY 20/17.

This very rare species was included in the 4<sup>th</sup> edition of the Red Book of Belarus (Rykovsky et al. 2015) as endangered (EN). Only five localities had been recorded in Belarus before our investigation, to which we have contributed three new sites.

***Drepanocladus lycopodioides* (Brid.) Warnst.** (Fig. 14)

- Miadel district, Chistets fen, ca 1.2 km SE of Stakhovtsy village, small fen in the mire forest; 54°46'02.7"N, 26°47'09.2"E, 166 m a.s.l., 20. 7.2017, water pH 6.6, conductivity 177  $\mu\text{S}\cdot\text{cm}^{-1}$ , field number BY 100/17.

This generally rare species is categorized as endangered (EN) in the 4<sup>th</sup> edition of the Red Book of Belarus (Rykovsky et al. 2015). Altogether 11 localities of this species had been recorded in the country before our investigation, out of which two populations have probably gone extinct. In the region of the new locality reported here, this species was recorded already by Szafnagel (1908). This species is very rare in the whole of temperate Europe (Peterka et al. 2017).

***Hamatocaulis vernicosus* (Mitt.) Hedenäs**

- Miadel district (Narochansky NP), ca 800 m N of Novoselki, fen on the W bank of Svirnishche lake; 54°52'26.0"N, 26°22'02.7"E, 148 m a.s.l., 15. 7. 2017, water pH 6.69, conductivity 280  $\mu\text{S}\cdot\text{cm}^{-1}$ , field number BY 2/17.
- Miadel district, Chistets fen, ca 1.8 km SE of Stakhovtsy village; 54°45'37.7"N, 26°47'00.0"E, 161 m a.s.l., 20. 7. 2017, water pH 6.8, conductivity 287  $\mu\text{S}\cdot\text{cm}^{-1}$ , field numbers BY 18+19/17.
- Polotsk district, ca 4 km S of Dretun, fen on the right bank of Trosnitsa river; 55°39'20.6"N, 29°12'03.8"E, 136 m a.s.l., 17. 7. 2017, water pH 6, conductivity 77  $\mu\text{S}\cdot\text{cm}^{-1}$ , field number BY 7/17.
- Smorgon district, SE of Valeykovichy, W bank of Mertvov lake; 54°35'08.6"N, 26°15'55.79"E, 137 m a.s.l., 20. 7. 2017, water pH 7.1, conductivity 345  $\mu\text{S}\cdot\text{cm}^{-1}$ , field number BY 21/17.
- Mosty district, ca 450 m SE of Slizhi Podgrebelnye; 53°20'08.7"N, 24°59'33.8"E, 116 m a.s.l., 22. 7. 2017, water pH 5.9, conductivity 117  $\mu\text{S}\cdot\text{cm}^{-1}$ , field number BY 24/17.

*Hamatocaulis vernicosus* is included in the additional list of near-threatened species deserving precautionary protection of the Red Book of Belarus (Rykovsky et al. 2015). It had been quite frequent in the country, but recently the number of existing localities has been decreasing rapidly because of fen deterioration. Altogether 33 localities of this species had

been recorded in Belarus before our investigation. We have found four new sites and verified one site after almost 120 years (Mertvoe lake, Szafnagel 1908).

***Helodium blandowii* (F. Weber & D. Mohr) Warnst.**

- Verhnedvinsk district, left bank of Pizhevka river, 4.6 km E of Strelkovskoe lake; 55°55'55.2"N, 28°18'09.7"E, 131 m a.s.l., 18. 7. 2017, water pH 5.82, conductivity 60.2  $\mu\text{S}\cdot\text{cm}^{-1}$ , field numbers BY 11+12/17.
- Miadel district, Chistets fen, ca 1.6 km SE of Stakhovtsy village; 54°45'40.1"N, 26°46'54.7"E, 161 m a.s.l., 20. 7. 2017, water pH 7, conductivity 268  $\mu\text{S}\cdot\text{cm}^{-1}$ , field number BY 19/17.
- Smorgon district, SE of Valeykovich, W bank of Mertvoe lake; 54°35'08.6"N, 26°15'55.79"E, 137 m a.s.l., 20. 7. 2017, water pH 7.1, conductivity 345  $\mu\text{S}\cdot\text{cm}^{-1}$ , field number BY 21/17.
- Karelitchi district, ca 8 km N of Mir, terrestrialized lake margin, ca 300 m NE from the Miranka village; 53°31'19.3"N, 26°26'26.8"E, 139 m a.s.l., 21. 7. 2017, water pH 6.26, conductivity 154  $\mu\text{S}\cdot\text{cm}^{-1}$ , out of relevé;
- Pruzhany district, Boloto Dikoe (Belovezhskaya Pushcha NP), ca 1.4 km NNW of Zalesie village; 52°44'38.5"N, 24°17'12.9"E, 158 m a.s.l., 22. 7. 2017, water pH 6.5, conductivity 180  $\mu\text{S}\cdot\text{cm}^{-1}$ , BY 27/17.

This species is rare in temperate Europe. Altogether 18 localities had been recorded in Belarus before our investigation (Rykovsky & Maslovsky 2004). We discovered five new localities in NW Belarus.

***Meesia triquetra* (Richter) Aongstr.**

- Postavy district, fen near the Cherveniy river, ca 2.6 km SW of Popovtsy village, 4.3 km W of Bolshie Shvakshty lake; 54°58'50.9"N, 26°29'39.2"E, 172 m a.s.l., 16. 7. 2017, water pH 7.03, conductivity 288  $\mu\text{S}\cdot\text{cm}^{-1}$ , field number BY 04/17.
- Miadel district, Chistets fen, ca 1.8 km SE of Stakhovtsy village; 54°45'37.7"N, 26°47'00.0"E, 161 m a.s.l., 20. 7. 2017, water pH 6.8, conductivity 287  $\mu\text{S}\cdot\text{cm}^{-1}$ , out of relevé.
- Pruzhany district, Boloto Dikoe (Belovezhskaya Pushcha NP), ca 1.4 km NNW of Zalesie village; 52°44'38.5"N, 24°17'12.9"E, 158 m a.s.l., 22. 7. 2017, water pH 6.5, conductivity 180  $\mu\text{S}\cdot\text{cm}^{-1}$ , BY 27/17.

This rare species was included as endangered (EN) in the 4<sup>th</sup> edition of the Red Book of Belarus (Rykovsky et al. 2015). Altogether 15 localities of this species had been recorded in Belarus before our investigation, but most of them represent only literature reports without available herbarium specimens (Rykovsky & Maslovsky 2004). The new localities reported here are located in the same regions from which the literature data come.

***Paludella squarrosa* (Hedw.) Brid.**

- Smorgon district, SE of Valeykovich, W bank of Mertvoe lake; 54°35'08.6"N, 26°15'55.79"E, 137 m a.s.l., 20. 7. 2017, water pH 6.3, conductivity 267  $\mu\text{S}\cdot\text{cm}^{-1}$ , field number BY 21/17.

This species is rare and its distribution in Belarus is shrinking rapidly under the influence of agricultural melioration. Ten localities of this species had been recorded in Belarus before our investigation (Rykovsky & Maslovsky 2004).

### ***Scorpidium cossonii* (Schimp.) Hedenäs**

- Miadel district (Narochansky NP), ca 800 m N of Novoselki, fen on the W bank of Svirnishche lake; 54°52'23.6"N, 26°21'58.9"E, 148 m a.s.l., 15. 7. 2017, water pH 6.8, conductivity 425  $\mu\text{S.cm}^{-1}$ , field number BY 1/17.
- Postavy district, fen near the Cherveniy river, ca 2.6 km SW of Popovtsy village, 4.3 km W of Bolshie Shvakshty lake; 54°58'50.9"N, 26°29'39.2"E, 172 m a.s.l., 16. 7. 2017, water pH 7.03, conductivity 288  $\mu\text{S.cm}^{-1}$ , field number BY 4/17.
- Miadel district, Chistets fen, ca 1.8 km SE of Stakhovtsy village; 54°45'37.7"N, 26°47'00.0"E, 161 m a.s.l., 20. 7. 2017, water pH 6.8, conductivity 287  $\mu\text{S.cm}^{-1}$ , BY 18/17.

This species has a geographically constrained distribution in Belarus, being mainly confined to its NW part. It is still relatively common in the Miadel district, but the localities reported here are new. Like other fen bryophytes, *Scorpidium cossonii* is expected to lose part of its distribution due to the degradation of wetlands expected to continue in the near future, as exemplified by its recent displacement by more generalist brown mosses or late-successional *Sphagnum* species in some Central-European regions (Hájek et al. 2015).

### ***Scorpidium scorpioides* (Hedw.) Limpr.**

- Miadel district, Chistets fen, ca 1.2 km SE of Stakhovtsy village, small fen in the mire forest; 54°46'02.7"N, 26°47'09.2"E, 166 m a.s.l., 20. 7. 2017, water pH 6.6, conductivity 177  $\mu\text{S.cm}^{-1}$ , field number BY 100/17.
- Postavy district, fen near the Cherveniy river, ca 2.6 km SW of Popovtsy village, 4.3 km W of Bolshie Shvakshty lake; 54°58'50.9"N, 26°29'39.2"E, 172 m a.s.l., 16. 7. 2017, water pH 7.03, conductivity 288  $\mu\text{S.cm}^{-1}$ , field number BY 4/17.

This species used to be more frequent in the country, but now it is declining rapidly because of fen deterioration. Besides 11 localities of this species recorded in Belarus before our investigation, we found two new sites. One of them (the river Cherveniy) is located in the region from which three other localities have recently been known (Maslovsky, pers. herb.).

It is interesting that this species is very rare in Belarus considering its large number of existing localities and local abundance in neighbouring Latvia (pers. observ., Rykovsky & Maslovsky 2004). All sites of this species in Belarus are concentrated in the NW part of the country, and the SE margin of its distribution in Eastern Europe is situated in the central part of Belarus (Maslovsky 2017). The more continental climate in Belarus, causing seasonal water table declines, could be an explanation. Vegetation of the alliance *Stygio-Caricion limosae*, where the species usually dominates, is sensitive to even small declines in water level (Peterka et al. 2018).

## **SOUHRN**

Mechorosty vápnitých slatinišť jsou ohrožené a ustupující ve všech evropských zemích, včetně severní Evropy, a to z důvodu degradace

slatinišť v intenzivně využívané krajině. Během expedice na slatiniště severozápadního Běloruska v červenci 2017 jsme objevili nové lokality vzácných slatiništních mechorostů, které jsou zahrnuté v Červené knize Běloruska jako ohrožené (*Cinclidium stygium*, *Drepanocladus lycopodioides*, *Meesia triquetra*) nebo v posledních dekádách ustupují (*Hamatocaulis vernicosus*, *Helodium blandowii*, *Paludella squarrosa*, *Scorpidium cossonii*, *S. scorpioides*). Znalost jejich rozšíření je nezbytná pro jejich aktivní ochranu.

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## Obrázky k článku „New localities of some rare fen bryophyte species in Belarus“



**Obr. 13.** Klečenka bahenní (*Cinclidium stygium*) je druhem boreálních slatinišť. Ve střední Evropě je vzácným reliktem. Z Běloruska bylo doposud známo jen pět jeho lokalit. Další tři lokality jsou publikovány v rámci tohoto článku. Foto P. Hájková

**Fig. 13.** *Cinclidium stygium* is a species of boreal extremely rich fens, This moss is rare and relic in temperate regions such as Central Europe. It is rare even in Belarus, where only five localities have been known. The paper reports three additional sites. Photo by P. Hájková



**Obr. 14.** Srpnatka plavuňovitá (*Drepanocladus lycopodioides*) je nyní v celé Evropě vzácný druh. Roste na vápnitých slatiništích, na kterých sezónně poklesá hladina vody. Autoři objevili jeho novou lokalitu na slatiništi Čistec v Bělorusku. Foto P. Hájková

**Fig. 14.** *Drepanocladus lycopodioides* is a recently rare species in the whole Europe, occurring in calcareous fens with a seasonally fluctuating water table. Authors found its new locality in the Chistets fen (Miadel district, Belarus). Photo by P. Hájková



**Obr. 15.** Vápnité slatiniště na západním břehu Mrtvého jezera v Bělorusku patří k vzácnému typu boreokontinentálních vápnitých slatinišť, jejichž produktivita není limitována nedostatkem fosforu, ale dusíku (svaz *Saxifraga hirculi-Tomentypnion nitentis*). Byly zde nalezeny druhy *Hamatocaulis vernicosus*, *Cinclidium stygium*, *Paludella squarrosa* a *Helodium blandowii*. Foto P. Hájková

**Fig. 15.** Calcareous fen at the western bank of the Mertvoe lake (Smorgon district, Belarus) belongs to the rare type of topogenic, boreo-continental brown-moss fens whose productivity is limited by nitrogen rather than phosphorus (the *Saxifraga hirculi-Tomentypnion nitentis* alliance). *Hamatocaulis vernicosus*, *Cinclidium stygium*, *Paludella squarrosa* and *Helodium blandowii* have been reported from this fen. Photo by P. Hájková



**Obr. 16.** Nejznámější běloruská údolní slatiniště se nacházejí v Berezinské biosférické rezervaci. Vyskytují se zde vzácné druhy mechů jako *Hamatocaulis vernicosus*, *Helodium blandowii* a *Sphagnum obtusum*. Foto P. Hájková

**Fig. 16.** The best known percolation fens of Belarus are located in the Berezinsky Biosphere Reserve. Rare moss species such as *Hamatocaulis vernicosus*, *Helodium blandowii* or *Sphagnum obtusum* still occur in these fens. Photo by P. Hájková