Desiccation tolerance of fen bryophytes

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Introduction

Many rich fen bryophyte species decreased considerably during last 50 years especially because of habitat destruction such as fen drainage, acidification or eutrophication. Knowing about their biology may help to improve their protection and habitat management.
This poster shows the desiccation tolerance of fen mosses.

Materials and methods

Studied species
The experiment was carried out in the common garden with eight moss species, representing a wide range of microhabitats occurring at rich fens: *Aulacomnium palustre* (Ap), *Bryum pseudotriquetrum* (Bp), *Calliergonella cuspidata* (Cc), *Campylium stellatum* (Cs), *Climacium dendroides* (Cd), *Hamatocaulis vernicosus* (Hv), *Plagiomnium elatum* (Pe) and *Tomentypnum nitens* (Tn).

Sampling and fragments growing
The moss specimens were collected from three localities to avoid potential random influences such as decreased vitality, damage during the transport or genotypes with unusual drought tolerance. The mosses were brought to the experiment site, divided in three groups representing three replications. Every repetition contained all studied species from all localities (Fig. 1). Every repetition was kept on a separate table to avoid any possible interaction. Five stems from each species and locality were placed into a perforated plastic pot and left dry out naturally at the temperature of 18 °C and 12 h light period. After every two weeks, one set of plastic pots per repetition (45 stems of every species) was put into a glass container and grown in a stable water level for five weeks. Five weeks after rewetting, the number of living stems was counted. The moss plant was considered alive when it had at least one green branch capable of continuing the growth.

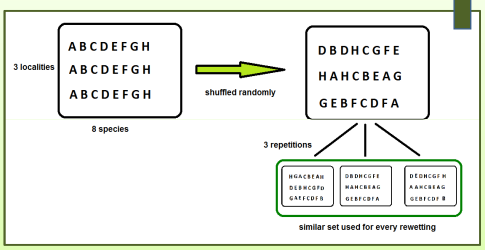

Fig. 1 The desiccation experiment arrangement

Results

The reaction of studied species to the increasing time of desiccation is shown in the summarizing graph (Fig. 2). It shows the average proportion of stems, which were able to resume their growth after 0-20 weeks of drought. *Climacium dendroides* tolerated best the absence of water, while *Campylium stellatum* was the most sensitive species.
Hummock species *Aulacomnium palustre, Climacium dendroides* and *Tomentypnum nitens* generally tolerated the desiccation better and some stems (>10 %) were able to resume growth even after 20 weeks of drought.

Tab. 1 GLM – desiccation tolerance results. The decreasing ability to resume growth after increasing period of drought differed significantly among tested species.

	Df	F	p
species	7	11,831	<0,001
time	1	548,729	<0,001
species *time	7	3,200	0,024
Error	776		

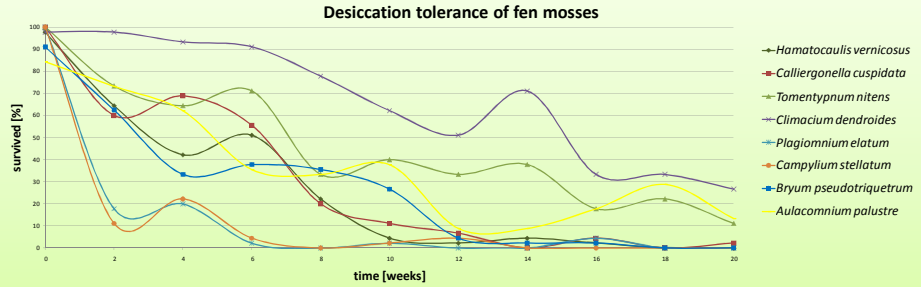

Fig. 2 The desiccation tolerance of fen mosses

Three groups of mosses can be differentiated after the first 10 weeks. The best desiccation tolerance was shown by *Climacium dendroides*, while *Campylium stellatum* and *Plagiomnium elatum* showed an extremely low tolerance. The remaining species demonstrated a decreasing but still remarkable drought tolerance. The situation changed rapidly after 10 weeks. The probability of regenerating after 10 weeks of continuous drought was less than 10% in all studied species except for *Tomentypnum nitens* and *Climacium dendroides*. The limited ability to resume growth after 16 weeks of desiccation was observed in three species – *Aulacomnium palustre*, *Tomentypnum nitens* and *Climacium dendroides*.

Tab. 2 The multiple comparison of the regenerating ability between studied species (Tukey HSD). The red marked pairs differ significantly at p = 0.05.

species	Hv	Cc	Tn	Cd	Pe	Cs	Bp
Cc	0,999696						
Tn	0,000032	0,000032					
Cd	0,000032	0,000032	0,005528				
Pe	0,004062	0,000551	0,000032	0,000032			
Cs	0,002296	0,000299	0,000032	0,000032	1,000000		
Bp	1,000000	0,999749	0,000032	0,000032	0,003852	0,002172	
Ap	0,004836	0,027019	0,186418	0,000032	0,000032	0,000032	0,005096

The differences/similarities in desiccation tolerance between some species pairs is quite remarkable. Probably the most interesting is the high similarity between the reaction of the vulnerable *Hamatocaulis vernicosus* and the common *Calliergonella cuspidata*. Unlike *H. vernicosus*, *C. cuspidata* is also able to grow in hummocks and lawns, so its higher desiccation tolerance was expected. This could be affected by the local population adaptation, because all species were sampled in fens.

Conclusion

The desiccation tolerance of studied fen bryophytes seems to be quite remarkable, especially in hummock species. Some of their stems were able to survive even 20 weeks of constant drought. On the other hand, even two weeks of dry period caused a significant mortality in all species.
When the drought period appears repeatedly, it may pose even greater harm because of the exhaustion of moss energy reserves and damage of cells. This might be why the population vitality is so significantly determined by the groundwater level. Even if the locality is partially wet for most of the year, the unavailability of water following the decrease of water level causes repeated desiccation of the mosses which leads to both vitality and competitive ability decrease of the sensitive mosses.


Hamatocaulis vernicosus

Acknowledgments

We are grateful to Jan Kučera and Pavel Kúr for help with this project. We would also like to thank the Grant Agency of the Czech Academy of Sciences (project no. IAA601410703) and the Nature Conservation Agency of the Czech Republic. The research was performed within the scope of long-term research funding of University of South Bohemia (GAJU 138/2010/P).