UNIVERSITY OF BELGRADE
FACULTY OF BIOLOGY

Studentski trg 16
11000 BELGRADE
Republic of SERBIA
Tel: +381 11 2186 635
Fax: +381 11 2638 500
E-mail: dekanat@bio.bg.ac.rs

Aneta Sabovljević
University of Belgrade, Faculty of Biology
Department of Plant physiology, Takovska 43
11000 Belgrade, Serbia

Review of the PhD thesis

Eliška Vicherova: The ecology of peatland bryophytes – adaptations and competition in alkaline fens

The PhD thesis of the candidate Eliška Vicherova is devoted to adaptations and competitions of selected peatland bryophytes (*Sphagnum* or non-sphagnaceous mosses) in alkaline fens. The author studied the most important eco-physiological mechanisms in investigated species, as ion compartmentalization, cell-wall cation binding properties, phosphorus and iron uptake, as well as plant-plant communication in order to elucidate the reasons behind the diverse reactions of peatland bryophytes to calcium.

The thesis includes a general introduction that presents well supported review of the contemporary literature outlining peatland habitats and bryophyte survival along the gradient of calcium availability (i.e. reaction on Ca^{2+} availability and pH). Very clear review on peatland bryophytes interactions and competitions among species that are crucial for the survival of individuals in plant communities is presented in the introduction part. At the end of the introduction, the author clearly outlined the main aims of the study. The candidate demonstrated an ability to put forward testable hypoteses. The following four chapters represent results of the PhD thesis, which contain three published peer-review papers in international journals and one unsubmited manuscript, all of them well written and presented. Chapters 6 and 7 are general conclusions (in English and Czech).

According to the results presented in this thesis, calcium toxicity in calcifugous bryophytes is caused by insufficient control over the balance of intracellular Ca^{2+} uptake/efflux. Additionally, potassium availability does promote expansion of calcifugous bryophytes to an alkaline environment. Interestingly, it was shown that moderate calcium concentrations promote desiccation tolerance of *Sphagnum* species, probably through protection of cell componentes (i.e. membranes), which facilitates these species survival in calcareous fens. Calcicole and calcifuge species differ in plasma membrane Ca^{2+} channels and therefore calcicoles evolved specific adaptations that enable stable cytosolic Ca^{2+} level even in an alkaline environment. At the end of this study, the author represents the first evidence of bryophyte communication through volatile organic compounds. Interactions are crucial for the survival of individuals in certain habitats and this ability can be used during short unfavorable periods (e.g. when the environmental conditions favour expansion of *Sphagnum* at the expense of non-sphagnaceous mosses).

I would like to state that the submitted thesis is well written and is based on papers with significant quality. Therefore, I fully recommend the thesis to be accepted for defence.

Belgrade, 8th October, 2020

Aneta Sabovljević

Questions:

1. *Hamatocaulis vernicosus,* red-listed species, is a weak competitor in nature, similarly to other rare plant species that are generally considered to be weak competitors. As you stated in the results, nutrient availability changed competitive relations between this moss species and other non-sphagnaceous mosses in the calcareous solutions during experimentations. Under increased nitrogen and phosphorus concentrations, *H. vernicosus* was the strongest competitor in solutions representing moderately rich, rich and calcareous fens. How could you explain this Ca^{2+} tolerance pattern and change in competitive abilities in *H. vernicosus*?

2. *Sphagnum* species, as the main and dominant species in the bogs, are very important because they control important processes through water retention. According to literature, *Sphagnum* species are able to develop desiccation tolerance, which enables them to survive severe desiccation. You have investigated the combined effect of desiccation and calcium in the laboratory experiments. Is desiccation tolerance in *Sphagnum* affected by calcium and how? How could you explain the fact that in the laboratory experiments combined effect of desiccation and calcium is not always harmful as it is in the fens where desiccation and calcium uptake do restrict *Sphagnum* survival?

3. In your dissertation you have investigated plant-plant volatile organic compounds (VOC) interactions in the bryophytes and this was the first evidence in non vascular plants. According to your results, bryophytes are able to communicate through VOCs and they can adjust their growth to avoid competitive exclusion. You have tested the changes in VOCs emission in response to light quality. Far-red light did not induce production of new VOCs nor change the total amount of VOCs produced, which is in contrast with the response of vascular plants. Can you explain the difference in response of vascular plants and bryophytes to low R/FR ratios? Since bryophytes and vascular plants differ in their ecological strategies, do you think that VOCs have slightly different roles in biotic and abiotic stress tolerance in bryophytes when compared to vascular plants?