6TH EUROCC VILNIUS WORKSHOP ON USING HPC

Abstract book

January 22, 2026

Vilnius, Lithuania

Published by Vilnius University Press

https://doi.org/10.15388/EUROCC.2026.6

eISSN 2669-0233

Vilnius University Proceedings

Hyperspectral fluorescence imaging of desiccation tolerant desert moss *Syntrichia caninervis*: tracking the rapid recovery of photosynthetic machinery during rehydration

Lena Golubewa[1,2], Yaraslau Padrez[1,3], Andrius Gelžinis[1,2], Kipras Mažeika[4], Augustas Vaitkevičius[4,5], Simona Streckaitė[1], Jevgenij Chmeliov[1,2], Vilius Čirgelis[1], Chunhong Yang[6], Leonas Valkūnas[1], Bruno Robert[7]

[1]*Department of Molecular Compound Physics, Center for Physical Sciences and Technology, Vilnius, Lithuania*

[2]*Institute of Chemical Physics, Faculty of Physics, Vilnius University, Vilnius, Lithuania*

[3]*Neuroscience Research Center, College of Medicine, Jiaxing University, Jiaxing, China*

[4]*Institute of Photonics and Nanotechnology, Faculty of Physics, Vilnius University, Vilnius, Lithuania*

[5]*Department of Optoelectronics, Center for Physical Sciences and Technology, Vilnius, Lithuania*

[6]*Institute of Botany, Chinese Academy of Sciences, Beijing-100093, China*

[7]*Université Paris-Saclay, CEA, CNRS, Institute for Integrative Biology of the Cell, Gif-sur-Yvette, France*

E-mail: lena.golubewa@ftmc.lt

Syntrichia caninervis (*S. caninervis*) is one of the dominant species in moss crusts. It is characterized by remarkable tolerance to extreme environmental conditions [1]. The mechanisms of the rapid (from seconds to minutes) recovery of its photosynthetic function gain a lot of interest. Hyperspectral imaging of the moss leaves in dehydrated and rehydrated state may shed light on the specificity of the pigment redistribution in the leaf cells upon recovery. In the present study, hyperspectral imaging of *S. caninervis* was performed at the micro- and macroscopic scales. To reveal the spatial heterogeneity in spectral characteristics over the leaf area in dehydrated and rehydrated leaf cells of *S. caninervis* and identify the patterns of spectral features within the leaf, image segmentation based on the corresponding spectral datasets was performed. Hyperspectral image segmentation was done by *k*-means clustering. The number of clusters was determined based on the combination of three segmentation quality metrics. Significant spectral heterogeneity was revealed in both dehydrated and rehydrated moss samples at the micro- and macroscopic levels. Both dehydrated and rehydrated moss samples show fluorescence in the 530-650 nm range, with dehydrated samples exhibiting significantly higher relative intensity and variance in the fluorescence peak position than rehydrated moss leaves, probably resulting from partially disassembled pigments, e.g. carotenoids. The intensity ratio I_{685}/I_{740} varies in both the dehydrated and rehydrated samples, but is much lower in the dehydrated sample, indicating the dominance of photosystem (PS) I. However, the fluorescence emission peaks related to PSII (685 nm) are also present and more pronounced in the edge clusters, probably indicating the contact of these areas with humid air and the onset of PSII recovery. The gradual shift of the peak from 690 nm to 707 nm when moving the outer segments towards the inner parts of the dehydrated moss leaf could refer to different phases of PSII recovery.

REFERENCES

[1] X. Li, W. Bai, Q. Yang, et al. The Extremotolerant Desert Moss Syntrichia Caninervis Is a Promising Pioneer Plant for Colonizing Extraterrestrial Environments, *Innov.* **5**, 100657 (2024).