

Report of a thesis

submitted at the Faculty of Science, University of South Bohemia

☒ supervisor's report
☐ bachelor thesis

☐ opponent's report
☒ master thesis

Author: Anežka Míšková

Thesis Title: Comparison of photophysiological characteristics of two strains of the cyanobacterium *Trichodesmium* in relation to nitrogen fixation

Study program: Biophysics

Year of submission: 2022

Supervisor: Meri Eichner

Workplace: Centre Algatech, Institute of Microbiology CAS

Contact e-mail: eichner@alga.cz

Scientific/professional quality:

☒ excellent ☐ very good ☐ average ☐ below average ☐ unsatisfactory

Factual errors:

☒ almost none ☐ a reasonable number ☐ frequent minor errors ☐ serious

Results:

☒ original ☐ original and adopted ☐ non-trivial compilation ☐ cited from the literature
☐ copied

Extent of the work:

☐ large ☒ standard ☐ sufficient ☐ insufficient

Graphic, linguistic and formal quality:

☐ excellent ☒ very good ☐ average ☐ below average ☐ unsatisfactory

Typographic errors:

☒ almost none ☐ a reasonable number ☐ numerous

Overall quality of the thesis:

☒ excellent ☐ very good ☐ average ☐ below average ☐ unsatisfactory

Verbal evaluation, comments of the supervisor:

Anežka joined the Algal Ecophysiology laboratory to conduct a thesis project for her MSc degree within our on-going project on N₂ fixation in the cyanobacterium *Trichodesmium*, focusing on the photophysiological mechanisms related to protection of nitrogenase. She learned quickly to maintain cultures of *Trichodesmium*, independently perform experiments using various microscopes and obtained in-depth knowledge of image analysis approaches to analyze the results. She worked very independently and thoughtfully considered each step. Throughout her project, Anežka impressed me with her analytical thinking. Time and again she pushed us to reconsider our own concepts, and advanced the project with her questioning of previous work. The first months were challenging experimentally, as reproducing previous work was complicated by a series of technical problems with Fluorescence Kinetics Microscopy, the results of which are not included in the thesis. After switching method to fluorescence lifetime analysis, which was performed in collaboration with laboratories at Biology Centre CAS and Physiology Institute CAS, she managed to complete the thesis with an extent of experimental work that is up to standards, despite these initial problems. She showed perseverance in completing the thesis in good time despite a break due to maternity leave and the following time of intensive child care duties. While the focus of her study program is Biophysics, Anežka was able to set her work in the perspective of other disciplines which is visible in the introduction of her thesis, which ranges from marine biogeochemical cycles of carbon and nitrogen to detailed mechanistic explanations of photosynthesis and fluorescence. The thesis includes a rather complex set of results of bulk and single-cell level measurements of pigment composition and fluorescence lifetime measurements on two strains of *Trichodesmium*. Interpretation of this dataset is not straightforward, but Anežka managed to tie it together thoughtfully in a comprehensive thesis. Taking into account all these aspects, I evaluate this thesis as excellent.

Questions to the defense and suggestions for a discussion:

I suggest the following points for discussion during the defense:

- The thesis briefly touches on some potential mechanisms of nitrogenase protection in the strain NIBB. Can this be elaborated? While bulk fluorescence lifetime measurements were not performed on this strain, what could be expected based on the results from pigment analysis and FLIM? How could nitrogenase be protected if not by PBS uncoupling?
- The thesis suggests differences between strains and nitrogen treatments in susceptibility to stress. What would be the physiological link between oxidative stress, PBS uncoupling and N₂ fixation? Couldn't other mechanisms of stress protection vary between strains and thus explain the differences?
- The thesis ends with a call for re-evaluation of the mechanisms of nitrogenase protection in *Trichodesmium*: Can you summarize the current standing based on this thesis and propose any suitable approaches for continuation?

☒ **I recommend**

☐ **I do not recommend**

to accept the thesis as a master thesis.

I suggest that the thesis be graded:

☒ excellent ☐ very good ☐ good ☐ failed

Place, date and signature of the supervisor:

Třeboň, January 10th 2023