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Review of the dissertation

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Systematics of coccal green algae of the classes Chlorophyceae and Trebouxiophyceae

submitted by Mgr. Lenka Štenclová
at the School of Doctoral Studies in Biological Sciences, University of
South Bohemia in České Budějovice, Faculty of Science

Coccal green algae represent a species-rich assembly of photosynthetic organisms. They evolved in different phylogenetic lines, of which the classes of Chlorophyceae and Trebouxiophyceae contain the most taxa. They are highly interesting from many points of view. They are model organisms of plant physiology and evolutionary research. They are widely distributed in our environment, are ecologically significant, because they occur practically everywhere, in all waters, in the soil, in and on plants and animals and play a major production-biological role in these habitats. They are used in various applications in biotechnology.

No matter in which scientific field and in which economic application coccal green algae are used, it is always necessary to know the taxonomic affiliation as precisely as possible. This is the only way to interpret scientific contexts, reproduce results and enable targeted working approaches. However, the systematics of coccal green algae is a difficult field of work, because similar microscopic morphotypes, such as spheres, needles, filaments, have developed independently in the different lineages and therefore a clear determination of the species is not possible without knowledge of further features, e.g. of ultrastructural or molecular-phylogenetic nature. Anyone who is interested to study systematics of coccal green algae should have to master a rich set of methods and to combine classical and modern methods.

Lothar Krienitz
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Lenka Štenclová approached the problem from the direction of a polyphasic approach. She has successfully combined light and electron microscopic methods with various molecular tools. The selection of the research organisms has been very successful. They are examples from different taxonomic groups, which are particularly well suited to demonstrate and master the current and future challenges of the systematics of coccal green algae in a model-like manner. Mrs. Štenclová was not afraid to select difficult taxa.

Her credo, expressed in the chapter Conclusions of the publication Štenclová & Fučíková (2019): "Our study also shows that molecular phylogenetics needn't be thought of as a replacement for traditional morphological taxonomy. Instead, a DNA-based phylogeny can be a useful tool to complement morphological approaches, and give them more evolutionary meaning. We use a phylogeny to re-evaluate morphological criteria for taxon classification, and re-interpret morphological characters in light of independently derived evolutionary relationships."

The dissertation was written in cumulative style. The following works were combined:

Manuscripts published:

Štenclová, Fučíková, K., Kaštovský, J. and Pažoutová, M. (2017) Molecular and morphological delimitation and generic classification of the family Oocystaceae (Trebouxiophyceae, Chlorophyta). *Journal of Phycology*. 53(6):1263-1282. (Impact Factor 2017 = 3.000)
Štenclová & Fučíková, K. (2019) *Dispora speciosa*, a new addition to the genus *Parallela* and the first coccoid member of the family Microsporaceae. *Phytotaxa*. 419(1):63-76.
DOI:10.11646/phytotaxa.419.1.4 (Impact Factor 2018/19 = 1.168)

Manuscripts under submission:

Silva, Štenclová, Archanjo, & Bagatini. Revised phylogenetic position of genus *Nephrocytium* (Sphaeropleales, Chlorophyceae), with description of *Nephrocytiaceae* fam. nov. and *Nephrocytium vieirae* sp. nov.
Štenclová: Distribution of the Crucigenioid algae inside the classes Chlorophyceae and Trebouxiophyceae.

Manuscripts in preparation:

Species concept of *Oocystis*
Phylogeny of *Juraniella* and *Kirchneriella*
Chloroplast morphology and phylogeny of *Oonephris*

The dissertation is rounded off by a detailed chapter introducing and summarizing the research topic. The text is well written, the illustrations are of excellent quality, the phylogenetic analyses and family trees are of top level. Lenka Štenclová has shown that she works at the forefront of algal systematics. The work fully meets the requirements of a dissertation.

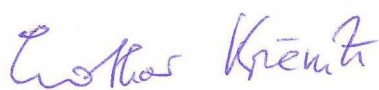
Overall assessment: Summa cum laude

As I am unfortunately unable to attend the defense in person, I have agreed with Dr. Kaštovský to formulate a few questions here, the answers to which will then be evaluated by the Defense Commission on site:

How do you assess the diacritical value of the existence of pyrenoids? Given the evidence of this organelle in closely related taxa within one and the same genus (e.g. *Chloromonas*), should all taxa described for pyrenoid presence be revised? How do you see the problem especially in examples of the genera *Oocystis/Oocystella*; *Nephrocytium/Nephrochlamys* and in general for the systematics of green algae as a whole?

Molecular phylogenetic methods are used to discover more and more cryptic species (examples are given in your work) that are hidden under one and the same morphotype. More and more taxa are overloading the possibilities of the conventional way of describing species. Thus Song et al. 2017 (J. Eukaryotic Microbiol. doi:10.1111/jeu.12482) have refrained from describing new phylogenetic lines of the *Dictyosphaerium* morphotype as species and genera. Which ways out of this dilemma do you think there are?

What possibilities do you see in the cooperation at the interface between systematics and ecology? What challenges have you been confronted with in your own work.



Dr. habil. Lothar Krienitz