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Metabolite Profiling in Green Microalgae with Varying Degrees of Desiccation Tolerance

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Abstract:

Trebouxiophyceae are microalgae occupying even extreme environments such as polar regions or deserts, terrestrial or aquatic, and can occur free-living or as lichen photobionts. Yet, it is poorly understood how environmental factors shape their metabolism. Here, we report on responses to light and temperature, and metabolic adjustments to desiccation in *Diplosphaera epiphytica*, isolated from a lichen, and *Edaphochlorella mirabilis*, isolated from Tundra soil, assessed via growth and photosynthetic performance parameters. Metabolite profiling was conducted by GC–MS. A meta-analysis together with data from a terrestrial and an aquatic *Chlorella vulgaris* strain reflected elements of phylogenetic relationship, lifestyle, and relative desiccation tolerance of the four algal strains. For example, compatible solutes associated with desiccation tolerance were up-accumulated in *D. epiphytica*, but also sugars and sugar alcohols typically produced by lichen photobionts. The aquatic *C. vulgaris*, the most desiccation-sensitive strain, showed the greatest variation in metabolite accumulation after desiccation and rehydration, whereas the most desiccation-tolerant strain, *D. epiphytica*, showed the least, suggesting that it has a more efficient constitutive protection from desiccation and/or that desiccation disturbed the metabolic steady-state less than in the other three strains. The authors hope that this study will stimulate more research into desiccation tolerance mechanisms in these under-investigated microorganisms.

Keywords: *Chlorella*, *Diplosphaera*, *Edaphochlorella*, green algae, microalgae, metabolite, metabolomics