How does Microcystis acclimate in a context of short-term thermal fluctuations of different amplitudes?

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Résumé

Cyanobacteria constitute a threat to freshwater ecosystems through toxic blooms which have been demonstrated to increase in frequency and intensity in a warming world. In a context of climate change, temperatures are also expected to become increasingly variable resulting in organisms experiencing greater fluctuations over shorter timescales. These changes have significant implications for ectotherms, including cyanobacteria. Indeed, when ectotherms faced shifts in their thermal environment, they must acclimate by leveraging their phenotypic plasticity to adjust their behavior, morphology or physiology accordingly. To understand how a more variable climate will impact Cyanobacteria performances and cyanotoxin production, it is crucial to investigate how and at what rate they acclimate to their fluctuating thermal environment through phenotypic plasticity.
Here, we tested the hypothesis that the acclimation temperature, as well as the direction and magnitude of variation, will impact the phenotypic plasticity response both qualitatively and quantitatively. To advance our comprehension of these mechanisms, we examined the impacts of acute temperature shifts of 5 or 10∘C, up or down on *Microcystis aeruginosa* PCC7806. These experiments were conducted following a 2-week acclimation period at either 20 or 25∘C. To detect potential rapid responses to these thermal constraints, we sampled cultures in the hours immediately following the temperature shift, extending our observations up to 48 hours. By exploring changes in metabolome composition, we aim to gain insight into the cellular mechanisms deployed by *M. aeruginosa* to cope with this change. Alongside, we tracked physiological traits including the maximum quantum yield of photosystem II (Fv:Fm), total enzymatic activity (measured by Fluorescein diacetate degradation), and the evolution of specific growth rate, aiming to quantify the response to thermal stress.
Our first results indicate a rapid response from cells in less than 30 minutes following the temperature change. However, full acclimation appears to take over 24 hours, potentially lagging behind diurnal temperature fluctuations.

Mots-Clés: acclimation, cyanobacteria, temperature variation, phenotypic plasticity, physiological changes, metabolome

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