# Unknown allelopathic compound from the chlorophyte Ankistrodesmus falcatus with inhibitory effect against the cyanobacteria Microcystis aeruginosa

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**Abstract**

Phytoplankton succession consists in shifts in species dominance, belonging the antagonist dominant species to one or a few related taxonomic groups. Some examples could be chlorophytes/cyanobacteria, flagellates/cyanobacteria or flagellates/diatoms. These shifts occur during regime transitions (changes in mixing, light, temperature and nutrients). It has been hypothesized that, in some cases, these shifts are induced by allelochemicals working as signalling molecules, causing cascading effects that lead to abrupt collapse or slow replacement of phytoplankton populations. This mechanism might anticipate the onset of unfavourable environmental conditions.
In this work, we studied interspecific competition under nitrate limitation between the cyanobacteria *Microcystis aeruginosa* and the chlorophyte *Ankistrodesmus falcatus*. We aimed to determine the driving factors of competition.

Using nitrate as limiting resource in batch culture, we parameterized growth and uptake functions for each species. We found that the cyanobacterium was, by little, a better competitor than *Ankistrodesmus falcatus*. We also performed a bioassay to test for allelopathic effects. We detected an allelopathic effect of *A. falcatus* against *M. aeruginosa*, but only in the absence of nitrate limitation. This allelopathic effect was never reported before.

In order to test the relative importance of nitrate competition versus allelochemical properties in determining the outcome of competition, we ran long-term nitrate-limited continuous cultures, varying the initial relative abundances of each species (modifying then the potential effect of allelopathy).
We found that, when initial relative abundances favoured *Microcystis aeruginosa*, the outcome was the exclusion of *Ankistrodesmus falcatus*, as predicted by our estimates of growth and uptake parameters. When *A. falcatus* was initially at higher abundances, nutrient competition predicts that the dominance species shoeld be again *M. aeruginosa*, but, the observed allelopathic effect could overturn this result, as recent experimental works demonstrated. However, in this situations, *M. aeruginosa* was also the winner, suggesting that *A. falcatus* allelopathic effect was weak.

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