Toxin-producing cyanobacteria in the large lakes south of the Alps: detection of new producers and molecular identification methods

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Cyanobacteria produce a huge variety of secondary toxic metabolites that can cause serious health problems in humans and animals. Cyanotoxins include hepatotoxins (e.g., microcystins, MCs), neurotoxins (e.g., anatoxin-a, ATX) and endotoxins. The general aim of the project is to identify, at the species and strain level, cyanobacteria producing toxins, especially anatoxins, in Lake Garda and in the other large and deep lakes south of the Alps.

The dominant cyanobacteria in these lakes are represented by *Planktothrix rubescens*, which is responsible of the production of MCs. Nevertheless, in the last two decades there was a rapid spread of an invasive species, *Dolichospermum lemmermannii*, which is able to synthesize both MCs and neurotoxins (ATX). This appearance raised questions linked to the potential production of new toxins. Recent research showed significant concentrations of ATX, which, most of the time, were not matched by the presence of sizeable populations of *D. lemmermannii*, posing problems about the identification of the toxin producers. This emerging risk makes necessary to analyse in detail the causes of ATX production. First we will evaluate toxin concentrations and the dominant toxic cyanobacteria in environmental samples. Secondly we will use metagenomics to study the complexity of the cyanobacterial communities. Hereafter, using a molecular approach, based on high throughput DNA and mRNA sequencing we will detect the presence of ATX encoding genes, both in whole environmental samples and isolated strains. In this last we will even investigate the cell ultrastructure to get further data about the ATX production mechanisms. This multidisciplinary approach will allow to identify potential new anatoxin producers and different toxin encoding genes, as well as to unravel the community structure and the ecological determinants triggering anatoxin production.