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RESEARCH ARTICLE

Morphological, molecular, and biochemical study of cyanobacteria from a eutrophic Algerian reservoir (Cheffia)

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Abstract

The cyanobacteria management in water bodies requires a deep knowledge of the community composition. Considering the reliable and thorough information provided by the polyphasic approach in cyanobacteria taxonomy, here we assess the cyanobacterial community structure of the Cheffia reservoir from Algeria. Cyanobacteria were identified on the basis of morphological traits and next-generation sequencing (NGS); toxins-related genes were localized in addition to the identification of toxins; temperature and nutrient level of water samples were also determined. The polyphasic approach was essential for cyanobacteria investigation; 28 genera were identified through 16S rRNA metabarcoding with the dominance of taxa from *Microcystis* (34.2%), *Aphanizomenon* (20.1%), and *Planktothrix* (20.0%), and morphological analysis revealed the association in this water body of five species within the genus *Microcystis*: *M. aeruginosa*, *M. novacekii*, *M. panniformis*, *M. ichthyoblabe*, and *M. flos-aquae*. The presence of *mcyE* genotypes was detected; moreover, HPLC–PDA and LC–ESI–MS/MS revealed the production of microcystin-LR. Results obtained in our study are very important since this ecosystem is used for water supply and irrigation; as a consequence, a good water management plan is essential.

Keywords Algeria · Cyanobacterial diversity · Hypereutrophic water · NGS · Polyphasic approach · Toxins

Introduction

Cyanobacteria are prokaryotic and oxygenic organisms that thrive across many aquatic and terrestrial habitats (Whitton, 2012; Codd et al. 2017). Eutrophication, promoted by human activities related to urban, agricultural, and industrial development, and climate change are the main factors determining the cyanobacteria development (O'Neil et al. 2012; González and Roldán, 2019). This phenomenon is a major concern for the sanitary and environmental agencies due to their potential to produce cyanotoxins posing undesirable effects to human and environmental health (Metcalf and Codd, 2012; Moreira et al. 2012; Bouma-Gregson et al. 2018; Wu et al. 2019). The first step, to reduce the effects related to cyanobacteria outgrow, is the identification of the cyanobacterial community in the water body. The microscopic analysis of morphological characteristics is traditionally used in the classification of cyanobacteria (Komárek and Anagnostidis, 1999, 2005; Komárek, 2013); yet, the high morphological variability and the low number of phenotypic characters used lead to serious identification issues (Bittencourt-Oliveira and

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