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Opinion
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The Toxigenic Cyanobacterium Microcystis Aeruginosa in Epicontinental Waters of Mexico

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Opinion

Different climate models have concluded that the average global temperature has increased in the last century [1]. This change in global temperature has influenced climate conditions worldwide affecting population dynamics (e.g. phytoplankton communities) in ecosystems in different ways [1-3]. In terms of aquatic ecosystems, evidence has shown that some photosynthetic microorganisms may adapt and thrive successfully under warmer climatic conditions, while other cannot [4]. The toxigenic cyanobacterium *Microcystis aeruginosa* (Kützing) Kützing 1846 is a gram-negative photosynthetic prokaryote adapted to a wide range of environmental conditions in mesotrophic and eutrophic aquatic ecosystems [5]. The main family of toxins synthetized by *M. aeruginosa* are microcystins (hepatotoxins); in nature, more than 90 microcystin congeners are known [6]. Microcystins are water-soluble and stable molecules in aquatic and terrestrial environments; when accumulated in the liver tissue they have caused intoxication leading to massive haemorrhage, cell necrosis, and in some cases death in vertebrate animals including humans [7]. In the last decades, *M. aeruginosa* has been of global concern since this species produces both harmful algae blooms (HAB) and deleterious effects (e.g. cytotoxicity, skin toxicity, gastrointestinal disturbances) in diverse freshwater ecosystems linked to anthropogenically-enhanced nutrient-rich waters, higher temperatures, and elevated irradiances, particularly during spring and summer seasons [5,6,8].

In inland waters of Mexico, HAB of *M. aeruginosa* occur throughout the year in some regions and our knowledge of cyanotoxins levels (microcystins) in these ecosystems is scarce. Moderate to elevated concentrations of microcystins have been found in epicontinental waters of Mexico, but the potential health effects by contamination of microcystin remains unclear [9-11]. Planktivorous fish in inland waters of Mexico have been documented to bioaccumulate microcystins [12], but possible health effects on biota with regard to chronic exposure or toxin transportation to higher trophic levels remains to be revealed in several aquatic ecosystems of Mexico. The first documented report of microcystins in Central Mexico was less than a decade ago [10] and until now no epidemiological studies in the country have provided information on the risks, illnesses, effects, and seriousness of microcystin contamination [9,11]. In some Latin American countries such as Brazil, ingestion of contaminated water with cyanotoxins has led to several fatalities in the last decades [13]. Therefore, better water quality monitoring programmes and epidemiological research on cyanotoxins by both Mexican health authorities and the scientific community should be pursued in multiple aquatic ecosystems.

Different strains of *M. aeruginosa* strains from America and Asia have shown their optimal growth rate and highest photosynthetic activity at elevated temperatures (27-35 °C) [14,15]. Likewise, microcystin gene expression proved to be enhanced in cultures of *M. aeruginosa* grown at elevated temperatures (30 °C) [16]. Using Mexican strains of M. aeruginosa in experimental studies, I agree with previous studies and suggest that water warming ~30 °C plus high irradiances (100-120µmolm-2 s-1) benefit the optimal cell growth and highest cell abundance of *M. aeruginosa* under controlled condition. Clearly, more environmental information is required globally to answer in detail many questions on the ecophysiology and ecotoxicology of *M. aeruginosa* under future climatic conditions in diverse aquatic environments. However, based on experimental and environmental studies, the consequences of climate change (e.g. higher eutrophication, water warming, changes in hydrography, alteration in phytoplankton composition, etc.) could potentially increase the frequency, distribution, duration, and intensity of HAB of *M. aeruginosa* in different epicontinental aquatic ecosystems in inland waters of Mexico.

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