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Evaluation of cyanobacteria population and microcystin detection at Billings Reservoir (São Paulo, Brazil)

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Cyanobacteria are a large group of Gram negative bacteria that perform oxygenic photosynthesis, with cosmopolitan distribution and large distribution in eutrophic environments. In addition, the unrestrained growth trend of some species of the total population produces blooms that are harmful to the aquatic environment, altering the entire balance of the ecosystem. Most flower-forming species are capable of producing cyanotoxins which are toxic secondary metabolites for most eukaryotes and characterized according to their mode of action (neurotoxins, hepatotoxins, cytotoxins and dermatotoxins). Among the cyanotoxins, the microcystin can be highlighted as the most studied among the others, due to its wide distribution in various environments worldwide. Due to their great potential to cause acute or chronic reactions, the presence of cyanotoxins in water bodies used for public supply must be monitored. Some species of cyanobacteria are known to be potential producers of cyanotoxins and their presence in water bodies serves as a warning sign for the possible presence of the toxin in water. The research group of the Laboratory of Ecophysiology and Environmental Monitoring of the Federal University of São Paulo (UNIFESP) has been monitoring the dynamics of cyanobacteria and the presence of microcystins in the Billings Reservoir, the largest water resource in the Metropolitan Region of São Paulo (RMSP) in Brazil since 2014. Monitoring of cyanobacteria is performed by identifying the species present in the sample and counting them under an inverted microscope, later expressed in biovolume, representing the volume that cyanobacteria occupy in one liter of the water sample. The presence of microcystin was monitored by two methodologies: a direct one, performed by high performance liquid chromatography (HPLC), and an indirect one, detecting the presence of the genes responsible for the production of microcystin in the samples by polymerase chain reaction (PCR). The biovolume of cyanobacteria dominated in relation to the other phytoplankton components for most of the studied period, often with

values considered extremely high, reaching up to 50 times the limit suggested by Brazilian legislation (1 mm³/L). This value is the maximum limit for water to be used for public supply. In most cases, potentially cyanotoxin-producing species, such as *Microcystis aeruginosa*, *Plankthotrix isothrix*, *Woronichinia naegeliana*, *Dolichospermum* sp. and *Raphidiopsis raciborskii* were dominant or abundant species in relation to other cyanobacterial species. Starting in 2016, the research group started monitoring the presence of genes responsible for microcystin production and such genes were found in all samples studied since the beginning of the study. In 2019, in addition to indirect detection, microcystin quantification was also performed in collaboration with Dr. Gregory Boyer, from the College of Environmental Science and Forestry. Microcystin concentrations ranged from 0.33 µg/L to 50.7 µg/L, the latter value being 50 times greater than the limit established by Brazilian legislation of 1.0 µg/L. The high concentration of microcystin is related to the large biovolume of cyanobacteria observed in the studied period. The dominance of cyanobacteria in the studied periods and the results of the presence of microcystin-producing genes and the detection of values above those allowed by legislation generates a health concern, since several points of the Billings Reservoir are used for public supply.

Speaker Biography

Has a degree in Biological Sciences from the Faculty of Philosophy Sciences and Letters of Ribeirão Preto/USP (1977), a master's degree in Ecology and Natural Resources of São Carlos (1982) and a PhD in Ecology and Natural Resources from the Federal University of São Carlos (1993). Postdoctoral at São Carlos Institute of Physics with a scholarship from the Foundation for Science Support of the State of São Paulo. She has been a professor at the Federal University of São Paulo / Campus Diadema since 2008. She is a permanent member of the Pós-Graduate Program in Ecology and Natural Resources. She has experience in Cryptogamic Botany, working in the following sub-areas: freshwater microalgae, Limnology, EPR and nanostructured films using algal polysaccharides. Currently also working in the area of reservoir monitoring and focusing on cyanobacteria and detection of cyanotoxins through molecular techniques.

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