biology and life sciences forum

MDPI

Abstract

Contributions of TOXICROP Project for the Assessment of the Impacts of Toxic Cyanobacteria in Agriculture †

Alexandre Campos [1,*,‡], Marisa Freitas [1,2], Brahim Oudra [3] and Vítor Vasconcelos [1,4]

[1] CIIMAR-Interdisciplinary Centre of Marine and Environmental Research, Terminal de Cruzeiros do Porto de Leixões, Av. General Norton de Matos, s/n, 4450-208 Matosinhos, Portugal; maf@ess.ipp.pt (M.F.); vmvascon@fc.up.pt (V.V.)
[2] Department of Environmental Health, School of Health, Polytechnic Institute of Porto, Rua Dr. António Bernardino de Almeida, 400, 4200-072 Porto, Portugal
[3] Water, Biodiversity and Climate Change Laboratory, Faculty of Sciences Semlalia, Cadi Ayyad University, Av. Prince My Abdellah, P.O. Box 2390, Marrakech 40000, Morocco; oudra@uca.ac.ma
[4] Department of Biology, Faculty of Sciences, University of Porto, Rua do Campo Alegre, 4169-007 Porto, Portugal
* Correspondence: acampos@ciimar.up.pt
† Presented at the 7th Iberian Congress on Cyanotoxins/3rd Iberoamerican Congress on Cyanotoxins, Ponta Delgada, Portugal, 18–20 July 2022.
‡ Presenting author (oral communication).

Abstract: Water contaminated with microcystins (MCs) or other cyanotoxins is recurrently used in agriculture and for crop irrigation. Several deleterious effects of MCs in plants that may impair crop productivity, including a decrease in growth and tissue necrosis, as well as an inhibition of photosynthesis and metabolic changes, have been reported. Studies also revealed a significant accumulation of MCs in edible tissues and plant organs, which raise concerns related to food safety. The European project TOXICROP precisely tackles this environmental problem. The main aims of the project are to map agricultural risk areas of cyanotoxin occurrence, to assess the fate of cyanotoxins in crops, and evaluate the impacts of using low-quality water for crop irrigation. The project also develops research on water remediation, exploring nature-based technologies. Here, we review part of the research carried out in the project, concerning the toxicity of cyanotoxins in crops. The research from TOXICROP Consortium has revealed for instance that adult strawberry or faba bean plants are susceptible to moderate concentrations of MCs (10 to 20 µg MCs/L). Furthermore, experiments with faba bean and common wheat grown in sterile (microorganism-free) and non-sterile (microorganism-rich) soil, watered with 100 µg MCs/L, revealed that native rhizospheric microbiota play an important role in the mitigation of the phytotoxic impact of MCs on plant growth, reducing toxin accumulation in both soils and plant tissues. Our studies also revealed that leaf vegetables, such as lettuce and spinach, growing in hydroponics are more susceptible to MCs than to the toxin, cylindrospermopsin (CYN). The lowest toxin concentrations affecting spinach and lettuce growth were 5 + 5 and 25 + 25 µg/L CYN/MC mixtures, respectively. The results also reveal that the accumulation of MCs and CYN in plants depends on the conditions in which plants grow and concentrations of toxins in the irrigation water. In some cases, MCs are accumulated in plant tissues and exceed the tolerable daily intake proposed by the World Health Organization. We highlight the importance and contributions of this research to the definition and implementation of regulatory limits for cyanotoxins in irrigation waters.

Keywords: toxic cyanobacteria; cyanotoxins; water quality; alqueva; crop irrigation

check for updates

Citation: Campos, A.; Freitas, M.; Oudra, B.; Vasconcelos, V. Contributions of TOXICROP Project for the Assessment of the Impacts of Toxic Cyanobacteria in Agriculture. *Biol. Life Sci. Forum* **2022**, *14*, 27. https://doi.org/10.3390/blsf2022014027

Academic Editor: Vitor Gonçalves

Published: 22 July 2022

Author Contributions: Conceptualization, A.C., M.F., B.O. and V.V.; methodology, A.C., M.F., B.O. and V.V.; formal analysis, A.C., M.F., B.O. and V.V.; investigation, A.C., M.F., B.O. and V.V.; writing—original draft preparation, A.C., M.F., B.O. and V.V.; writing—review and editing, A.C., M.F., B.O. and

V.V.; funding acquisition, A.C. and V.V. All authors have read and agreed to the published version of the manuscript.

Funding: This work received funding from the European Union's Horizon 2020 research and innovation program under the Marie Skłodowska-Curie grant agreement No. 823860.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.