IX PhD Students Meeting in Environment and Agriculture

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Book of abstracts

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Dear participants,

It is our great pleasure to welcome you to the **IX PhD Students Meeting in Environment and Agriculture**, held in Évora on the 11th and 12th of December 2024. We have put together a two-day program with the aim of encouraging scientific discussion. This Meeting represents an excellent opportunity for young researchers to exchange ideas and to explore new challenges in research regarding Environmental and Agricultural Sciences.

This event is organized by MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, and IIFA – Institute for Advanced Studies and Research, University of Évora and supported by UNIMED – Mediterranean Universities Union.

The Meeting focuses on eight main areas: Agribusiness; Biology; Environment, Landscape & Sustainability; Biotechnology; Agricultural & Environmental Sciences; Food Sciences; Veterinary Sciences; and Biochemistry. The Meeting includes two invited plenary lectures and several presentations selected from the abstracts submitted by PhD students. In addition, all authors that were not selected for oral communication, will present their work as posters displayed throughout the Meeting.

The PhD Students Meeting in Environment and Agriculture intends to stimulate the interaction between PhD students, to streamline scientific discussion and highlight the ones who will become the researchers of the future.

Finally, we wish to thank the Scientific Committee as well as all the participants who have contributed to the scientific program and hope you will enjoy the Meeting and appreciate the beautiful city of Évora, an UNESCO World Heritage. You should find all detailed information in this book of abstracts, including the detailed programme, abstracts, and a list of participants.

Welcome to Évora!

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Poster 55

From Biofilms to Preservation: Addressing Microbial-Induced Stone Discoloration at Batalha Monastery

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Throughout history, stone has been a preferred material for the construction of iconic structures due to its aesthetic appeal and intrinsic properties. However, like other construction materials, stone is subject to continuous deterioration by microorganisms, making its preservation critical for the protection of cultural heritage.

Batalha Monastery (Portugal), a UNESCO World Heritage Site, exhibits notable surface alterations in the stone architectural elements of both the Founder's Chapel and the church, including extensive pink discoloration affecting the walls and columns. The use of both culture-dependent and -independent methods for identifying the colonizing microbiota indicated that the main microorganisms forming the observed biofilms were the bacterial genera *Halalkalicoccus*, *Bacillus*, *Gordonia*, *Serratia*, and *Methylobacterium*.

In this study, one of the bacterial isolates identified in the stone, from the genus *Gordonia*, was selected to carry out biocolonization tests on limestone, aiming to mimic the discoloration process observed in the monument. Two stone mock-ups were prepared, one kept in darkness and the other exposed to sunlight, to compare the bacterial behavior under different light conditions. Colorimetry and RAMAN spectroscopy techniques were employed, allowing for the in-situ characterization of color changes and pigments produced by the isolate. Furthermore, cleaning tests were also carried out on the mock-ups, in an attempt to remove the carotenes produced. The results from the aforementioned techniques revealed that the bacteria used in the tests, induced significant colorimetric changes in the stone. These changes were more pronounced when the stone was exposed to sunlight compared to those observed under dark conditions. In addition, the results of the cleaning tests demonstrated that the concentrations of the cleaning solution used are highly effective in removing pigments and can safely be suitable for heritage use.

In order to prevent the deterioration of this cultural asset and ensure its preservation, we consider this study to be a critical step towards formulating a precise and effective conservation and intervention strategy for the Batalha Monastery.

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