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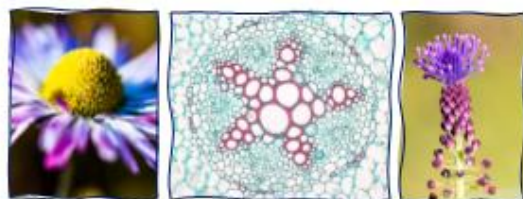
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MICROTECH
LA SCELTA LOGICA

ITALIAN BOTANICAL SOCIETY WORKING GROUPS
CELLULAR AND MOLECULAR BIOLOGY &
BIOTECHNOLOGIES AND DIFFERENTIATION

FROM PLANT MORPHOLOGY TO SUSTAINABILITY

INTERNATIONAL MEETING



**JUNE 11-13, 2025
BARI**

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Metabolomics, Melatonin Regulation, and Microbial Interactions in Lettuce Under Phosphate Stress.

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Reducing the environmental impact of agriculture while increasing efficiency without compromising productivity is a major challenge. Achieving this goal relies on different strategies, for example the efficient management of essential nutrients, such as phosphorous, and the use of plant growth regulators and biostimulants, including melatonin. Phosphorus, a key plant macronutrient, is commonly present in soils as phosphate ions, but only a small fraction is available to plants. To address possible phosphorus deficiencies, the common solution involves the intensive use of phosphate fertilisers, which contributes to significant pollution. As a possible alternative, using soil microorganisms capable of making the phosphate more available for plants represents a promising and sustainable strategy. Melatonin, an indoleamine compound, regulates several physiological processes in both vegetative and reproductive organs, including delaying chlorophyll loss during leaf senescence and improving fruit shelf life. It also plays crucial roles in plant stress protection, making it a promising compound for improving crop resilience and sustainability in modern agriculture.

This project aims to investigate i) the genetic and metabolic responses of lettuce (*Lactuca sativa*) to a soil microbial community under phosphate-limiting conditions, ii) the role of melatonin as plant growth regulator under low phosphorus stress and in microbe-plant interactions, and iii) the genes involved in the melatonin biosynthetic pathway.

The metabolic responses have been characterised by following an untargeted metabolomics approach with a UPLC-HRMS technique, highlighting the different modulation of specific secondary metabolites under defined biotic and abiotic conditions. The results about melatonin content, its involvement as regulator and the biosynthetic genes are under investigation. Preliminary results suggest the presence of melatonin at very low levels in lettuce leaves and the first gene of the pathway has been positively identified as a bona fide tryptophan decarboxylase (*TDC*) gene, which is involved in the production of tryptamine from tryptophan.

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