Towards a better understanding of the plant defense responses triggered by the surfactin-type bacterial lipopeptide

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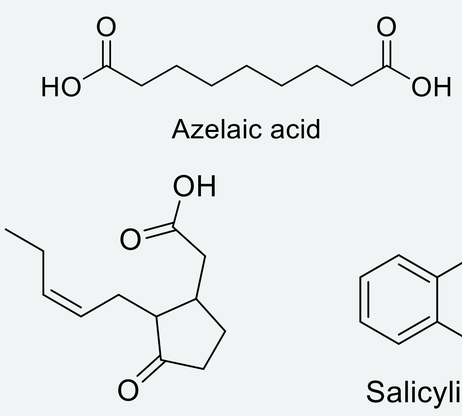
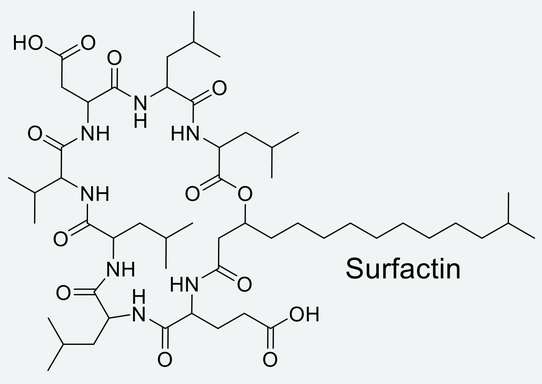
Context

Plants are subjected to various biotic and abiotic stresses during their development, including wounding, pathogen attack, insects, viruses, temperature variations, drought, and many others. Among the plant responses to these stresses, the production of phytohormones, reactive oxygen species and cytosolic calcium are notably induced.[c-d] Phytohormones in particular play a regulatory role in plant development, reproduction and death.[a]

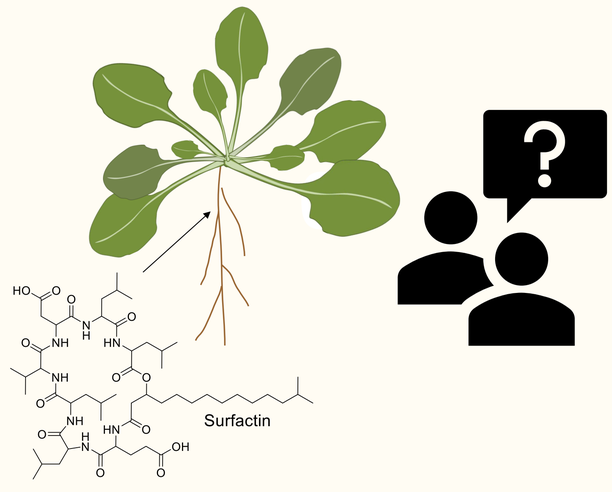




In nature, plants interact with microogranisms, some of which are beneficial to them. These are called PGPR (plant-growth promoting rhizobacteria) and produce a series of metabolites. Among the PGPRs that exist, the genus *Bacillus sp*. produces a series of secondary metabolites, including surfactin. Surfactin is a lipopeptide with the ability to trigger plant immune responses leading to the so-called induced systemic resistance. This priming reduces the effect of pathogen infections due to a stronger and a faster response from the plant.[b]

Objectives

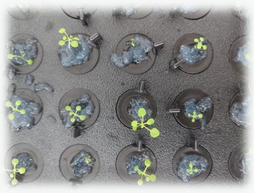
This study aims to understand the metabolome modifications induce by the presence of surfactin and to identify and characterize the molecules that are translocated from roots to leaves.

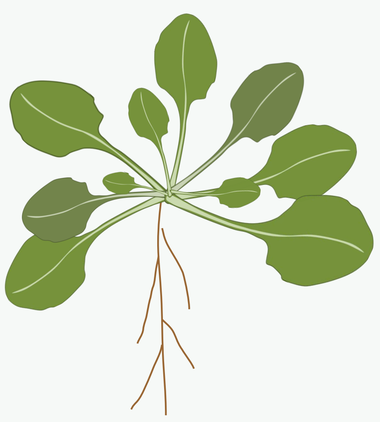


In addition, the immune response set up in leaves of plants that have been primed and then attacked by a pathogen will be explored.

Methods

0 Cultivation of wild type *A. thaliana* in hydroponics conditions





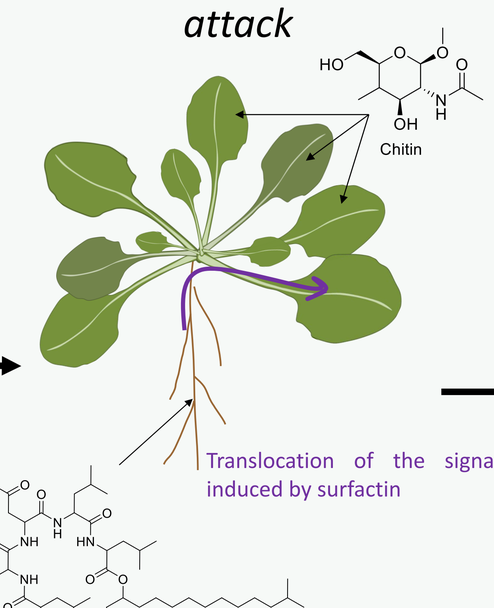
1 Priming induction

Addition of surfactin in the nutrient solution

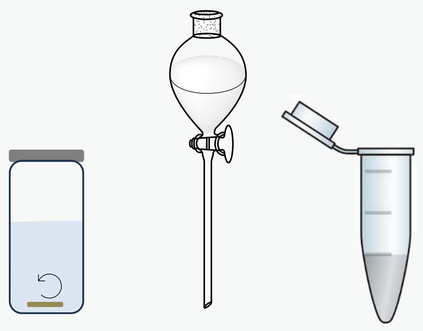
2 Stress induction

Spraying chitin on leaves

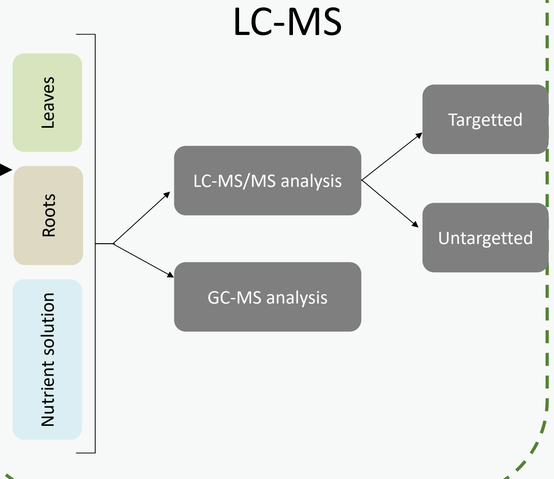
Chitin or chitin derivative is used to mimic a fungal attack



3 Metabolome extraction



4 Analysis by GC-MS and LC-MS

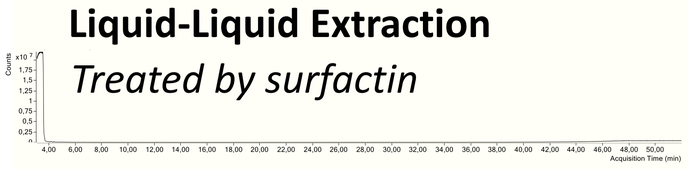


Results

Metabolome extraction of the nutrient solution and analysis by GC-MS

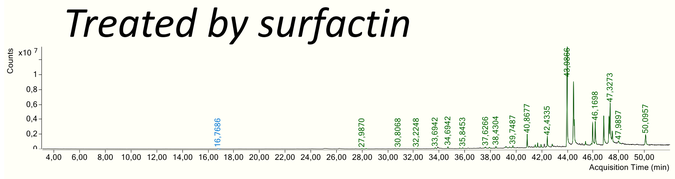
Liquid-Liquid Extraction

Treated by surfactin

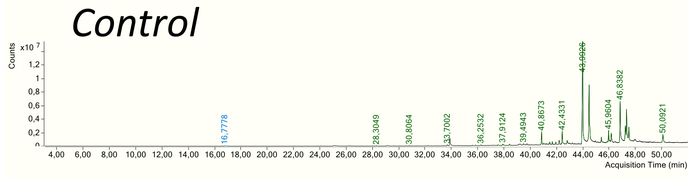


Stir Bar Sorptive extraction (SBSE)

Treated by surfactin



Control



SBSE is more efficient than the liquid-liquid extraction for metabolome extraction.

The metabolome extracted consists mainly of fatty acids.

Conclusion and perspectives

We are developing two LC-MS/MS approaches that will be combined: a targeted analysis of phytohormones and a non-targeted analysis. In addition, we are investigating by GC-MS possible changes in the profile of volatile organic compounds emitted by the plant upon surfactin perception. These two techniques will enable to characterize changes in the metabolome of leaves and roots following surfactin priming in *A. thaliana*.

References

a) Zhao B., & al. J. Agric. Food Chem (2021)
b) Prsic J., & al. Front. Plant Sci. (2020)
c) Jeworutzki E., & al. The Plant Journal (2010)
d) Mousavi S., & al. Nature (2013)

Acknowledgements

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