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Real Time Read-Out of Plant Metabolism

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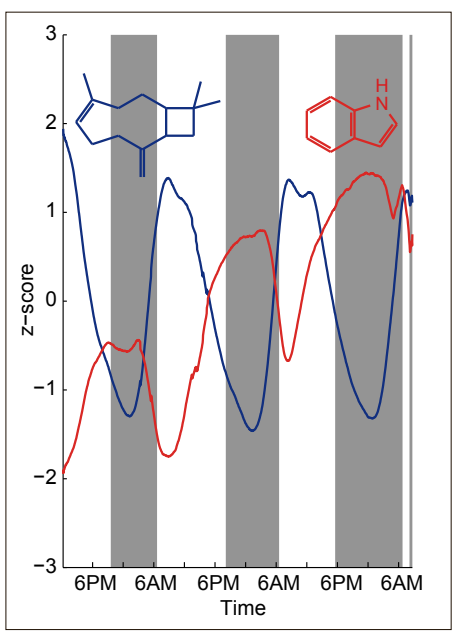
To overcome the fact that they cannot move, plants have developed over years of evolution a chemical arsenal that enables them to communicate with each other and to defend themselves against external insult, such as pests. Such compounds are released to the ambient air and eventually reach their target (*e.g.* other plant, insect, *etc.*). Elucidating the underlying mechanisms of plant communication and defense is crucial, for example, to improve crop production. In order to do so, one needs to elucidate the metabolites released by plants upon certain stimuli.

The traditional way to do so is to sample the air surrounding the plant and analyzing the gaseous compounds by gas chromatography-mass spectrometry (GC-MS). GC-MS has been the workhorse for decades to decipher plants' volatile communications. However, the fact that GC-MS requires sample collection and further manipulation limits the opportunities to capture the highly dynamic processes in their full extent. Complementary to GC-MS, secondary electrospray ionization-mass spectrometry (SESI-MS) enables the analysis of gases in real time, down to parts-per-trillion (ppt) and without sample preparation. We have recently deployed SESI-MS to investigate the emissions of a *Begonia semperflorens* during three entire days, before as well as after mechanically damaging the leaves. As a result, hundreds of species could be tracked with an unparalleled time resolution of 2 min. Diurnal and nocturnal compounds can be clearly identified, as well as chemicals emitted upon piercing the leaves, mimicking insect attack.

The capability of SESI-MS to capture highly dynamic emissions of chemical species and its wide analyte coverage makes it an attractive tool to complement GC-MS in plant studies. SESI-MS provides valuable complementary real-time chemical information of plants metabolism without any sample manipulation.

Begonia semperflorens within the container used to study its chemical emissions. During daylight it produces caryophyllene, among hundreds of other molecules.



Time profiles of caryophyllene (blue) and indole (red) illustrate typical diurnal and nocturnal patterns, respectively.

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Video link: *https://www.youtube.com/watch?v=UZyN1beyKjA*

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