Monitoring plant odors in tomato culture for in-situ stress detection
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Plants release a lot of volatile organic compounds (VOCs), which are produced either constitutively or after an induction by external stress factors. These factors could be identified by specific VOC or family of compounds activated and released in response to the stress. This preliminary study suggests that in-vivo monitoring of VOC signatures for crop management seems to be possible and would need to be tested with others genotypes, and portable devices for in-situ stress detection.

Materials and Methods

**Plant Material:**
- Momor (sensitive to abiotic stress)
- Monalbo (sensitive to biotic stress)

**Plant Treatments:**
See table 1

**VOC stored in leaves:**
VOC extraction was realized with a solution of 10 ml of dichloromethane (plus biphenyl as internal standard) in a ultrasonic bath during 10 min. Samples were concentrated with pure nitrogen gas to achieve a volume of 300 μl.

**VOC emission capture:** Cartridges filled with Tenax TA
- Enclosure device for abiotic stress encompassing one leaflet (fig. 1A)
- Enclosure device for biotic stress encompassing one leaf (fig. 1B)

VOC were analysed with a TD-GCMS Shimadzu QP2010
Splitless, injection in high pressure : 250 KPa for 1 min/Column DB 5 (60 m 0.25mm 0.25nm)
Partie GC : 40°C 1 min, 4°C/min between 40 - 170°C, 10°C/min for 170 - 250°C and 250°C 6 min
Partie MS: Solvent cut time : 5 min, End time: 47 min, Threshold : 100, carrier gas: helium, 70 eV

**Statistical analyses:**
T-test of Student was used to compare each treatment to the control

<table>
<thead>
<tr>
<th>Family of stress</th>
<th>Stress</th>
<th>Temperature of measurements</th>
<th>Luminosity in PAR</th>
<th>Stress time exposition</th>
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</thead>
<tbody>
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<td>15 days</td>
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<td>Heat oxidative stress</td>
<td>42°C</td>
<td>400</td>
<td>3h</td>
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<tr>
<td></td>
<td>After heat oxidative stress</td>
<td>42°C</td>
<td>400</td>
<td>3h</td>
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<tr>
<td>Biotic</td>
<td>Botrytis on leaves</td>
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<td>400</td>
<td>3 days</td>
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<tr>
<td></td>
<td>Botrytis on stem</td>
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<tr>
<td></td>
<td>Démor</td>
<td>30°C</td>
<td>400</td>
<td>15 days</td>
</tr>
</tbody>
</table>

Table 1: Stress conditions applied to the two genotypes

![Figure 1: Different enclosure devices used for abiotic stress (1A, 1B) and biotic stress experiments (1C).](image)

![Figure 2: Spectrum of VOCs stored in leaf of a control plant (tomato, cv. Monalbo).](image)

![Figure 3: Concentrations of VOCs stored in leaf of tomato (cv. Monalbo) in control plants and plants kept under deficit irrigation (stars denote statistical differences between treatments).](image)

![Figure 4:](image)

**Conclusion & Perspectives**

We detected quantitative and qualitative differences between the VOC emissions of two tomato genotypes that differ in their sensitivity to environmental stresses (Momor had lower emissions than Monalbo). Some compounds such as (E)-2-heptenal might be used as a potential marker of specific stress while others such as α-terpinene might indicate the global plant health status.

In the case of plants adapted to moderate drought, the detection of stress would require quantitative VOC emission measurements.

Monitoring VOC emissions in tomato culture might be suitable for the in-situ detection of plant health status, but more repetitions with others genotypes are necessary to draw final conclusions.

**References**
