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## **Underground alarms: volatile-mediated recruitment of beneficial soil bacteria by plants under biotic stress**

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Propositions  
accompanying the thesis

## **Underground alarms**

### **Volatile-mediated recruitment of beneficial soil bacteria by plants under biotic stress**

1. Root volatile-mediated signaling to microbes is a critical but underexplored component of rhizosphere ecology (this thesis).
2. Aboveground biotic stresses can systemically shape root-associated volatile profiles and microbial communities (this thesis).
3. The genetic background of a plant may influence its root volatile profile and its capacity to recruit beneficial microbes (this thesis).
4. Root-emitted volatiles (rVOCs) are not metabolic byproducts but functional signals that influence bacterial traits relevant to rhizosphere competence (this thesis).
5. Understanding how soil bacteria perceive and respond to rVOCs requires integrated omics approaches.
6. Microbial recruitment alone is not sufficient, the outcome of the plant “cry for help” depends on what recruited microbes do, not just that they arrive.
7. Volatile signaling in the rhizosphere is as vital as nutrient exchange, yet remains largely overlooked.
8. What a plant emits as a distress call may also be intercepted as an opportunity by its enemies.
9. What science can do for society depends not only on its discoveries, but also on who is included in the conversation.
10. Navigating the uncertainties of research requires more resilience than any protocol can teach.
11. Sometimes, what we choose not to study reveals as much about science as what we do.

Muhammad Syamsu Rizaludin, Leiden, 21 January 2026