RESPONSE TO BIOTIC STRESS

Plant internationalism

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Plants cannot talk, but they do have secret 'languages' to communicate within the ecosystem. One of these languages is coded by their emitted diverse volatile organic compounds (VOCs) that can attract pollinators, repel herbivores, protect against different environmental stresses and, interestingly, alert neighbouring plants to potential attacks. The rationale for evolving this type of emitter altruism can be explained by two hypotheses. The kin selection hypothesis suggests that the emitter plants transmit information specifically to receiver plants with shared genotypes so that they can indirectly benefit from the communication. The mutual benefits hypothesis states that the communication is independent of receivers' genotypes, and the emitter benefits from herbivore resistance exhibited by the whole community. To further elucidate the scenario of the plant–plant communication under herbivory attack, André Kessler's group at Cornell University, United States, investigated the effects of insect herbivory on plant VOC emission and perception in a growing field of tall goldenrod (*Solidago altissima*) under different neighbouring conditions.

The experiments were set up in the plants' native habitat, where the damaged tall goldenrod plants or the undamaged controls were placed in the centre of receiver plants with different genotypes. The researchers found that all plants surrounding the herbivore-damaged emitter plants showed induction of resistance regardless of their genotypes, supporting the mutual benefits hypothesis. However, if the receiver plants had a naïve history of herbivory, the group with kinship to the emitter plant showed stronger responses to the herbivory-induced VOC signals compared to those without kinship, which is consistent with the kin selection hypothesis. Therefore, herbivory likely acts as a preconditioned factor driving the evolution of VOC signalling towards open communication across different genotypes. In addition, the researchers analysed the components of VOCs in the receivers in order to cross-compare their induction patterns after perceiving messages from the emitters. The results showed a distinct difference in the VOC induction landscape between the group of plants with ambient herbivory exposure and others excluded from herbivory by insecticide spraying.

This study demonstrates an interesting and important role of herbivory in the evolution of plant–plant communication by VOC emission and perception. It not only provides evidence to reconcile the two hypotheses in debate, but also showcases a useful system to study organism communications.

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