
Inter-organ communication in petunia flowers via natural fumigation of volatiles relies on karrikin signaling pathway

Boachon Benoit^{*1}, Shannon Stirling², Nitzan Shabek³, and Natalia Dudareva²

¹Laboratoire de Biotechnologies Végétales appliquées aux Plantes Aromatiques et Médicinales – Université Jean Monnet - Saint-Etienne, Centre National de la Recherche Scientifique – France

²Purdue University, Department of Biochemistry – États-Unis

³UC Davis – États-Unis

Résumé

Plants synthesize volatile organic compounds (VOCs) to attract pollinators and beneficial microorganisms, to defend themselves against herbivores and pathogens, and for plant-plant communication. Plants are also constantly exposed to VOCs emitted during plant-plant communication, within-plant self-signaling, and plant-microbe interactions. In general, flowers producing VOCs emit them into the atmosphere to communicate with their environment. However, we have described a new physiological phenomenon: inter-organ transport of terpenoid VOCs in petunia flowers via natural fumigation. Before petunia flowers open, a tube-specific terpene synthase produces sesquiterpenes, which are released inside the buds and then accumulate in the stigma, potentially defending the developing stigma from pathogens. These VOCs also promote reproductive organ development and seed yield highlighting a previously unknown hormone-like function of terpenoid VOCs for within-plant communication. Terpenoid VOC perception and downstream signaling in plant communication are largely unexplored. We further investigated the perception and signaling mechanism by which VOCs naturally fumigated in petunia flowers can induce reproductive organ development and display hormone-like function. We demonstrate that (–)-germacrene D stereospecifically induces the karrikin signaling pathway in petunia flowers through a karrikin-insensitive receptor, PhKAI2ia, which perceives the signal and triggers a KAI2-mediated signaling cascade affecting plant fitness. These studies describe the mechanisms used by plant to communicate with themselves using terpenoid VOCs and provides new insights into plant olfaction and the long-standing question about the nature of potential endogenous KAI2 ligands.

Mots-Clés: Plant volatiles, terpenoids, plant communication, chemical ecology

*Intervenant