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# The roles of volatile terpenes in direct and indirect defenses of plants

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**Slatyer Seminar Room** RN Robertson Building (#46), ANU



Plants are engaged in complex ecological interactions with the organisms of their environment which include pathogens, herbivores and organisms of higher trophic levels. We study the complex ecological interactions mediated by volatile terpenes utilizing maize as a model system. Maize attacked aboveground by the lepidopteran larvae *Spodoptera littoralis* or belowground by the larvae of the coleopteran *Diabrotica virgifera*. *Virgifera* emit specific blends of volatiles which consist mostly of sesquiterpenes. These volatiles can attract natural enemies of both herbivores which are parasitic wasps aboveground and entomopathogenic nematodes belowground.

The volatile terpene signals are generated by the differential expression of terpene synthases, the key enzymes of terpene biosynthesis. Overexpression of the maize terpene synthases in transgenic maize and *Arabidopsis thaliana* allowed to test the biological function of subsets of the maize terpenes in bioassays. The leaf volatiles of TPS10 and TPS23 attract natural enemies of the herbivores and thereby constitute a signal important for the indirect defense of the leaves. In roots, the (E)- $\beta$ -caryophyllene produced by TPS23 attracts natural enemies of the beetle. In contrast, the sesquiterpene products of other terpene synthases appear to affect herbivores and microbial pathogens directly. Experiments with transgenic maize plants demonstrated that indirect defenses can be beneficial in an agronomical environment and may provide new strategies for crop improvement.



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