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Education

PhD Entomology, Auburn University

Broadly interested in understanding the multifaceted uses of chemical signals (both volatile and non-volatile) by herbivores, natural enemies, plants and their associated microorganisms and insects. Moreover, my research on beneficial soil microbes seeks to find microbial-based solutions for improving crop production, alleviating drought stress in crop plants and sustainable pest management. We use a comparative approach with model tritrophic systems and employ several chemical ecology tools.

Natural, healthy, and functioning ecosystems comprise plants, plant-associated mutualists, insect herbivores, parasitoids and a complex network of microorganisms. Chemical signals (both volatile and nonvolatile) and chemical-mediated communication play central roles in almost every possible interaction in multitrophic communities. Volatile organic compounds (VOCs), in particular, that provide species-specific and highly reliable information mediate many conversations among plant-plant, plant-herbivore, plant-herbivore-natural enemy, beneficial soil microbe-plant-herbivore-natural enemy, and insect-insect participants. Through volatiles and volatile signaling, plants, insects, and the complex network of microorganisms with which they associate can advertise their physiological and ecological states. Importantly, these signals can broadcast the presence of insect pests and other abiotic stressors such as drought, which are among the most serious constraints to crop production and food security worldwide. These complex chemical-mediated communications are poorly understood, but once deciphered, they potentially could provide novel opportunities for manipulating beneficial microbe-plant-insect-natural enemy interactions to promote crop yields and food security.

Research in my lab is aimed at understanding the multifaceted uses of chemical signals (both volatile and non-volatile) by herbivores, natural enemies, plants and their associated microorganisms and insects. The overarching goals are to decipher many of these complex chemical-mediated conversations, whose outcomes are important with relevance to agriculture, insect pest management and the functioning of ecosystems. Results obtained from my research can open avenues for integrated management of pests and disease vectors and for the rapid detection of plant stress.

Volatile cues for recruitment of mutualists to help plants to tolerate biotic and abiotic stress
Conversations in the dark: Who is listening?

In nature, plants are part of complex communities. Plants grow in soil and living in the soil are complex communities that include beneficial soil microorganisms such as plant growth-promoting rhizobacteria (PGPR) and mycorryhizal fungi (AMF). Both PGPR and AMF form symbioses with diverse groups of plants; among these are agricultural crops such as corn, cotton, tomato and soybeans. These microbes confer beneficial effects such as increased plant growth and enhanced tolerance to biotic and abiotic stress. Our research is unravelling the systemic effects of mycorrhizal fungal mutualisms on the chemical phenotype of tomato plants.

Volatile cues for monitoring abiotic plant stress intensity Stressed plants: Who is listening? Plants are continuously exposed to multiple abiotic stressors, including drought and soil pollution. With the ongoing global climate change scenario, the severity, frequency and duration of drought in the North American corn and soybean belt areas such as Illinois and other agriculturally relevant areas around the world is predicted to continue to increase in the future. We are investigating the dynamic changes in identities and quantities of volatile emission by drought stressed plants and the consequences for plant-insect interactions.