CONFÉRENCE

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Species differences in foliar secondary metabolites represent a fundamental niche dimension on Barro Colorado Island, Panama

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Abstract:

Fundamental hypotheses concerning the maintenance and generation of diversity in ecological communities posit a central role for the chemical differences among plants, namely in their ecological function as defenses against herbivores and pathogens. Yet the vast diversity of plant chemical defenses has traditionally precluded community-level studies of chemical ecology. Here, I take advantage of novel methods for untargeted metabolomics based on data generated with liquid chromatography-tandem mass spectrometry to identify, classify, and compare the structures of >8,000 unique foliar metabolites from 314 tree species recorded in the 50-ha forest dynamics plot on Barro Colorado Island (BCI) and ask whether they represent niche differences in the tree community. If species differences in secondary metabolites represent niche differences that influence demographics, community composition, and species coexistence, we expect seedling survival to decline with increasing chemical similarity to neighboring plants. Seedling survival was greater in the presence of chemically dissimilar neighbors. The effect was stronger when chemical similarity was measured in terms of defensive chemical classes, rather than the metabolome as a whole or with respect to conserved, primary metabolites, and was pervasive among the 314 species in the BCI tree community. These results suggest that secondary metabolites define niche differences at the community level, most likely by shaping host-use patterns of insect herbivores and microbial pathogens. Further, my results suggest that chemically mediated species interactions range from enemy-mediated competition to niche partitioning with the potential to contribute to species coexistence. I explore the implications of this approach for community ecology and next steps in the study of ecological metabolomics in a global network of forest plots.

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