Use of ecometabolomics in chemical ecology to disentangle plant-environment interactions on various scales

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Abstract

Ecometabolomics tools, ranging from untargeted metabolic fingerprinting to profiling of target compounds, offer a great potential to gain a deeper understanding of the huge variation in the chemical composition of organisms on various scales and its relevance in driving interactions between species. A large variation can be found not only between species, but also within species and even within individuals. Challenging various plant species with an identical treatment (i.e., the same arbuscular mycorrhizal fungus species), species-specific versus general phytochemical plant responses to this mutualism could be revealed in systemic leaf tissues. Within the plant *Bunias orientalis* (Brassicaceae), we used metabolomics tools to disclose the phytochemical variation between populations of this range-expanding and partly invasive species, which likely experienced different selection pressures across its distribution range. Chemical differences in leaf quality found in plants of different populations growing under common garden field conditions had pronounced effects on herbivores and pathogens interacting with this species. Finally, within the species *Tanacetum vulgare* (Asteraceae), chemical differences between tissues (i.e., flowering stems versus leaves of different age) were enclosed which may explain, why herbivores show distinct preferences for certain plant parts. Analyses of phloem exudates of these tissues revealed a high intra-individual variation in plant chemistry that may be an important driver for plant-aphid interactions determining niche differentiation. I will demonstrate examples on these various scales to highlight the advantages of ecometabolomics approaches in chemical ecology.

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