Soil Biodiversity and Plant Ecological Strategies Shape Arbuscular Mycorrhizal Fungi Community Response to Drought

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Résumé

Arbuscular mycorrhizal fungi (AMF) are obligate symbionts of plant roots, representing one of the oldest and most widespread symbioses on Earth. Their diversity is considered as an important driver of plant and ecosystem functioning. However, we know critically little on the influence of plant diversity, soil biological diversity, and environmental stressors and their combined effects on AMF diversity and community composition within plant roots. Various aspects of plant ecological strategies, particularly their degree of reliance on AMF, may further shape AMF diversity within roots.
Here, we set up a full factorial experiment of 336 mesocosms involving plant diversity, soil biological diversity and drought. We characterized the ecological strategy of 16 herbaceous plant species, both above and belowground, and examined root AMF metabarcoding profiles to assess AMF community composition and diversity in roots of all mesocosms. To capture temporal variability, we measured each of the 16 monocultures at two time points, after four and 16 months of plant growth.

Drought stress, as well as low soil and plant biodiversity, all negatively impacted AMF diversity within plant roots. Notably, high soil biodiversity provided partial buffering against the adverse effects of drought on AMF diversity. The ecological strategy of plant species, particularly their reliance on AMF, strongly controlled the AMF diversity and community composition in roots. Finally, AMF diversity showed large variation over time and among experimental treatments, albeit less so for plant species heavily reliant on AMF.
This suggest that ecosystems experiencing losses in both above and belowground biodiversity, along with climate extremes, may lose the ability to support diverse AMF colonization of roots. It also implies that plant species heavily reliant on AMF exert significant control over AMF composition. In diverse AMF populations, these plants maintain high investment in AMF, which helps mitigate the adverse effects of drought. However, as soil AMF populations decline, these plants may become the most vulnerable.

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Mots-Clés: soil biodiversity, plant diversity, AMF, mycorrhizal dependency, drought, plant strategy, plant functional traits