POPmodels

Understanding Poplar-Microbe Interfaces: From model systems to model synthetic communities

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Summary —

Only a small fraction of soil fungi forms beneficial symbioses. Ectomycorrhizal fungi (ECM), but also endophytes with various effects on their hosts, are important members of the tree microbiome. Despite their importance for tree growth and stress, very little is known about the mechanisms of communication or how they contribute to ecosystem processes such as nutrient cycling.

Our knowledge on the molecular signaling in ECM interactions was obtained with a few model systems, including *Laccaria bicolor*-Poplar. By contrast, molecular mechanisms underlying trees-endophytic fungi interactions and their possible effects on ECM fungi are closed to a black box. One challenge will be to extend our studies from simple *in vitro* systems to more complex, natural systems. In this project, we aim at determining whether plants differentially recognize beneficial microorganisms and, further, how do plants engage at the same time with mutualistic microorganisms and restrict non-mutualistic fungi?

In our experiments we will track the colonization of the roots of Poplars in controlled conditions by single to multiple microorganisms and the activities of these microorganisms. In WP1 confocal microscopy and DNA metabarcoding will be used to follow the colonization of Poplar roots either by a simple or increasingly complex synthetic fungal community of ectomycorrhizal fungi and endophytes. In WP2 we will use a metatranscriptome approach to monitor the functional changes in Poplar roots and in the potentially associating fungi during colonization.

The outcome of this project will increase our knowledge on the molecular mechanisms, functions, succession and selection mechanisms of symbiotic interactions. Do the molecular mechanisms identified in simple *in vitro* systems hold true in more complex systems? The proposed project integrates into the international project Plant-Microbe Interfaces (https://pmiweb.ornl.gov/), with the overall aim to investigate the mechanistic bases underpinning symbiotic plant-microbe partnerships and their response to biotic and abiotic challenges.