Oral presentation at the Eighth International Conference on Mycorrhiza (ICOM8), Northern Arizona University, USA, August 3–7, 2015

Theme

Linking mycorrhizal genomes, transcriptomes, and proteomes to their function: from individuals to ecosystems

Title

Linking genomes, transcriptomes, and spectroscopy provide insights into the litter decomposing mechanisms in ectomycorrhizal fungi

Authors

Rineau F.[1*], Shah F.H.[2], Persson P.[2], Colpaert J.V.[1], Vangronsveld J.[1], Tunlid A.[2]

[1] Centre for Environmental Sciences, Environmental Biology Group, Universiteit Hasselt, 3590 Diepenbeek, Belgium

[2] Microbial Ecology, Dept of Biology, Lund University, Ecology Building (Sölvegatan 37) SE-223 62 Lund, Sweden

* Presenting author (francois.rineau@uhasselt.be)

Abstract

Since Frank's "mycorrhizal decomposition" theory, there has been a lot of debate on the role of ectomycorrhizal fungi (ECM) on C and nutrient cycles. The generally accepted view was that ECM fungi were depending on the degradation of the lignocellulose by saprophytic fungi to access organic nitrogen. This assumption was supported the facts that ECM had much lower enzyme activities than saprophytes, and that drastic reductions of gene families involved in lignocellulose degradation were observed in ECM genomes.

Several recent studies shed a new light on this postulate. A set of various approaches (genomics, transcriptomics, secretomics, enzyme assays and advanced substrate chemical characterization) were combined to examine in a more comprehensive way the involvement of ECM in soil organic matter decomposition. First results on a model ECM species showed that it had a significant capacity to depolymerize polysaccharides and oxidize lignin building blocks while retrieving N from soil organic matter. These processes involved mechanisms similar to what we know from saprophytic brown-rot fungi, and were generated at least to some extent by redox cycling of a pigment. However, contrary to their saprotrophic counterparts, the ECM fungus lacked the genes to convert the degraded carbohydrates into energy. Moreover, the degradation of soil organic matter by this ECM species was dependent on the presence of a simple sugar source. Extension of this experiment to an array of supplementary ECM and saprotrophic fungi showed that all species were able to degrade the organic matter to a significant extent, but that they were doing so using a large variety of enzyme combinations.

Altogether, these results makes us reconsider the role ECM fungi play in the recycling of the organic matter.