Geophysical Research Abstracts
Vol. 17, EGU2015-10911, 2015
EGU General Assembly 2015

Investigation of the degradation of 13C-labeled fungal biomass in soil - fate of carbon in a soil bioreactor system

Michael Schweigert (2), Thomas Fester (2), Anja Miltner (1), and Matthias Kaestner (1)

(1) Helmholtz-Centre for Environmental Research - UFZ, Dpt. of Environmental Biotechnology - UFZ, Leipzig, Germany (matthias.kaestner@ufz.de), (2) Helmholtz-Centre for Environmental Research - UFZ, Dpt. of Environmental Microbiology - UFZ, Leipzig, Germany

Nutrient balances and degradation processes in boreal forests are mainly influenced by interactions of plant roots and ectomycorrhizal fungi. Plants benefit from nitrogen compounds provided by their symbiotic interaction partner. In return ectomycorrhiza are provided by large amounts of carbon from the plants which is used for the synthesis of hyphal networks in soil and for metabolic activity for nutrient uptake.

Therefore, ectomycorrhizal fungi play a major role in ecosystems of boreal forests and are consequently an important sink for carbon by building large amount of mycelia.

Recently, it has been shown that microbial biomass residues contribute significantly to soil organic matter formation. This suggests that also residues of ectomycorrhizal fungi may be an important source for soil organic matter formation in forest soils where these fungi are abundant. However, the fate of ectomycorrhizal biomass residues in soils is unknown.

We therefore investigated the fate of ectomycorrhizal biomass in soil in a soil bioreactor system to quantify the contribution of this material to soil organic matter formation. As a model organism, we selected Laccaria bicolor, which was labelled by growing the fungus on 13C glucose. The stable isotope-labeled biomass was then homogenized and incubated in a podzol from a typical forest site in Central Germany. The fate of the labeled biomass was traced by analyzing the amount of 13C mineralized and the amount remaining in the soil. The fungal biomass carbon was mineralized rather rapidly during the first 50 days. Then the mineralization rate slowed down, but mineralization continued until the end of the experiment, when approximately 40% of the 13C was mineralized and 60% remained in soil.

In addition, we analyzed biomolecules such as fatty acids to trace the incorporation of the L. bicolor-derived biomass carbon into other microorganisms and to identify potential primary consumers of fungal biomass. By these analyses, we found a significant incorporation of L. bicolor-derived carbon into a wide variety of different bacterial taxa, indicating the relevance of fungal biomass residues for soil bacteria as a carbon source.

In a later phase of the experiment, we will also trace the fate of soil organic carbon into the fungal biomass and the plant partner (Picea abies). These results will provide a comprehensive view of the role of ectomycorrhizal fungi and their residues on soil carbon cycling.