Geophysical Research Abstracts
Vol. 15, EGU2013-1081-1, 2013
EGU General Assembly 2013

Quantification of the proliferation of arbuscular mycorrhizal fungi in soil

Ning Zhang, Osu Lilje, and Peter McGee
Australia (ning.zhang@sydney.edu.au)

Good soil structure is important for sustaining agricultural production and preserving functions of the soil ecosystem. Soil aggregation is a critically important component of soil structure. Stable aggregates enable water infiltration, gas exchange for biological activities of plant roots and microorganisms, living space and surfaces for soil microbes, and contribute to stabilization of organic matter and storage of organic carbon (OC) in soil. Soil aggregation involves fine roots, organic matter and hyphae of arbuscular mycorrhizal (AM) fungi. Hyphal proliferation is essential for soil aggregation and sequestration of OC in soil. We do not yet have a mechanism to directly quantify the density of hyphae in soil. Organic materials and available phosphorus are two of the major factors that influence fungi in soil. Organic materials are a source of energy for saprotrophic microbes. Fungal hyphae increase in the presence of organic matter. Phosphorus is an important element usually found in ecosystems. The low availability of phosphorus limits the biological activity of microbes. AM fungi benefit plants by delivering phosphorus to the root system. However, the density and the length of hyphae of AM fungi do not appear to be influenced by available phosphorus. A number of indirect methods have been used to visualize distribution of fungi in soil. Reliable analyses of soil are limited because of soil characteristics. Soils are fragile, and fragility limits opportunity for non-destructive analysis. The soil ecosystem is complex. Soil particles are dense and the density obscures the visualization of fungal hyphae. Fungal hyphae are relatively fine and information at the small scale ($<250\mu$m) is key to understanding how fungi respond to environmental stimuli. This experiment tested whether organic carbon (starch), phosphorus (K2HPO4) and their mixture influences proliferation of hyphae of AM fungi. Hyphae were quantified in an artificial soil matrix using micro-computer aided tomography. Micro-computer aided tomography provides three dimensional images of hyphal ramification through electron lucent materials and enables the visualization and quantification of hyphae. Starch and the mixture of starch plus K2HPO4, stimulated hyphal proliferation, while K2HPO4 alone did not change the density of hyphae. The images also indicate that fungal hyphae attached to the surfaces of the particles rather than grow through the spaces between them. The capacity to quantify hyphae in three-dimensional space allows a wide range of questions to now be addressed. Apart from studying mechanisms of carbon turnover, more complex processes may now be considered. Soil is commonly thought of as a black box. That black box is now a shade of grey.