Geophysical Research Abstracts
Vol. 17, EGU2015-3066-1, 2015
EGU General Assembly 2015

Analysis of microbial habitats in soil-root interfaces in space and time

Thilo Eickhorst (1) and Hannes Schmidt (2)

(1) University of Bremen, FB 2 (Biology/Chemistry), Soil Microbial Ecology, Bremen, Germany (eickhorst@uni-bremen.de),
(2) University of Vienna, Department of Microbiology and Ecosystem Science, Vienna, Austria
(hannes.schmidt@microbial-ecology.net)

Microorganisms are of great importance for a wide range of processes in terrestrial systems, especially in soil-root interfaces and the resulting gradients. Their physiology is regulated by the environmental conditions on the scale of microbial habitats which are mainly the features of biogeochemical interfaces. The microbial colonization of soil-root interfaces in soil is hence of great importance when studying processes on this particular scale. A set of techniques has been developed recently to study the colonization and distribution of microorganisms in the undisturbed soil matrix and thus in their microbial habitat in situ. This is done via 16S rRNA targeted fluorescence in situ hybridization (FISH) combined with micropedological resin impregnation. The impregnation of the fragile soil structure is a good way to preserve the in situ arrangements of soil compounds forming the physical structure of the soil matrix including the pore space being relevant for the support with water and air. The preparation of high quality polished blocks and thin sections of these resin impregnated samples enables a detailed analysis of the spatial information on the level of microbial habitats in soil.

A correlative microscopic approach of the aforementioned techniques allows the characterization of soil-root interfaces and the resulting physico-chemical living conditions as well as the identification and localization of soil microorganisms on the microscale. This gives qualitative insights of the features in microbial habitats which are of great importance for the study of the microbial ecology of microbes in soil in space and time.

Since the various processes related to soil-root interfaces have a relevance on the large scale and vice versa upscaling is of great importance for the investigation of their influence on ecosystem functioning. Furthermore spatial modelling based on these observations is required to understand and predict the effects of changing physico-chemical conditions. Accurate quantitative data are therefore required which can be retrieved from correlative microscopic/spectroscopic analysis directly or generated by statistical analysis of individual spatial data or spatial extrapolation.

Examples for these approaches will be presented based on applications in paddy soil systems. The influence of physical structure dynamics as it occurs under submerged paddy soil management due to the cycles of flooding and drying on biogeochemical features and microbial dynamics will be shown. Spatio-temporal effects and their consequences for greenhouse gas emission and iron oxidation will be highlighted. Based on microcosm approaches examples for reliable quantitative data acquisition of microbial distribution in the soil matrix and the soil-root interface will be demonstrated.