Bacterial community in artificial soils structured by mineral composition and charcoal responded to phenanthrene

Doreen Babin[1], Guo-Chun Ding[1], Geertje Pronk[2], Holger Heuer[1], Katja Heister[2], Ingrid Kögel-Knabner[2], Kornelia Smalla[1]
[1]Julius Kühn-Institut, Institute for Epidemiology and Pathogen Diagnostics
[2]Technische Universität München, Chair of Soil Science
doreen.babin @jki.bund.de

In soil, different organic, inorganic and biological constituents are contacting each other and forming large biogeochemical interfaces upon which important processes for the ecosystem act. As it is still not known how these different components interact, this study focuses on the interplay of soil minerals and charcoal with microbial communities. Since the comparison of microbial communities from natural soils is very problematic, seven different artificial soils were used. They are characterized by a known mineral composition consisting of illite, montmorillonite, ferrihydrite, boehmite, charcoal and quartz sand. After adding autoclaved manure as organic matter and the same microbial community extracted from a natural Cambisol to each artificial soil mixture, they were incubated under constant environmental conditions up to 18 months. Furthermore, the response of microbial communities at biogeochemical interfaces to persistent organic pollutants using phenanthrene as example was explored. Therefore, one-year old artificial soils were spiked with phenanthrene (2 g/kg) and incubated for another 70 days. By a cultivation-dependent approach it was shown that the bacterial density in soil treated with phenanthrene is higher. For *Fungi,* higher colony forming units (CFUs) in the soil with charcoal were monitored whereas the soil with illite showed a higher diversity. Cultivation-independently, total community DNA was extracted and the 16S rRNA gene and ITS amplicons for *Bacteria* or for *Fungi*, respectively, were used in denaturing gradient gel electrophoresis (DGGE) to generate molecular fingerprints. DGGE analysis showed that the mineral composition and charcoal influence the establishment of microbial communities in artificial soils, even after a long incubation time. Especially the charcoal soil showed a distinctly different pattern compared to other artificial soils without charcoal. Additionally, the DGGE data revealed a bacterial response to phenanthrene spiking in the long term.

To conclude, mineral composition, charcoal and persistent organic pollutants using phenanthrene as model compound are important factors that shape the composition of the microbial communities established in artificial soils.