Geophysical Research Abstracts
Vol. 19, EGU2017-15028, 2017
EGU General Assembly 2017

Amyloid proteins are highly abundant in water-repellent but not wettable soils: microbial differentiation matters to soils

Geertje van Keulen (1), Gerry Quinn (1), Kat Sinclair (1), Ed Dudley (1), Martin Swain (2), Stefan Doerr (3), Peter Matthews (4), Lewis Francis (1,5), Andrea Gazze (1,5), and Ingrid Hallin (4)

(1) Institute of Life Science, Medical School, Swansea University, Swansea, Wales, UK (g.van.keulen@swansea.ac.uk), (2) Institute of Biological, Environmental and Rural Sciences, Aberystwyth University, Aberystwyth, Wales, UK, (3) Department of Geography, College of Science, Swansea University, Swansea, Wales, UK , (4) School of Geography, Earth and Environmental Sciences, Plymouth University, Plymouth, UK, (5) Centre for NanoHealth, Medical School, Swansea University, Swansea, Wales, UK

Soil water repellency is a common phenomenon affecting the hydrological responses of many soil and land use types in different climates. This in turn leads to decreased water infiltration, reduced vegetation cover, fertiliser run off and soil erosion. The fundamental (biological) causes of (bulk) soil repellency and its dynamic behaviour remain poorly understood.
We have applied soil metaproteomics, the systemic extraction and identification of proteins from a soil, to understand the biological (adaptive) processes and potential for bio-modification of mineral surfaces, which occur at the molecular level in soils switching between wettable and repellent states.
Extreme, moderate and sub-critical water-repellent UK silt-loam soils under permanent grass vegetation, including Park Grass at Rothamsted Research, were sampled below the root zone depth under wettable and repellent conditions. Soils were subjected to our new extraction methods for determining the specific ultrahydrophobic and total metaproteomes.
Using our ultrahydrophobic extraction protocol, we have identified more than 200, mostly novel amyloid, proteins, which could be extracted from water-repellent soils, but were absent in the comparable wettable soils. One of the novel amyloid proteins was highly abundant in all soils, which has the potential as a soil biomarker for precision land management, especially in irrigation.
Comparative profiling of the total metaproteomes of wettable and repellent soils has revealed similarities and dissimilarities in microbial diversity and their activities, which have created a deeper understanding of soil system processes common and adaptive to soil moisture and to the severity of repellence.