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The role of microbial-produced extracellular polymeric matrix in the formation and survival of biological soil crusts

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Biological soil crusts (BSCs) are complex communities commonly constituting organo-mineral layers in arid and semiarid environment having a major influence on these ecosystems (Belnap and Lange, 2001). They have high tolerance towards a-biotic stresses and fluctuations in moisture, illumination, salinity and nutrients. The plasticity exhibited by BSCs is hugely contributed by the presence of the extracellular polymeric matrix (EPM) that is synthesized by crustal organisms, notably cyanobacteria and microalgae. This polysaccharidic net plays key roles in biofilm relations with the surrounding constrained environment. Notably, EPM concurs in coping with water scarcity, freezing and salt stress; increases biolayers stability against erosion, and is involved in nutrient provision (Rossi and De Philippis, 2015).
We conducted several investigations in a research area located in the Inner Mongolian desert (Inner Mongolia, China) where BSCs were induced over different sites through inoculation-based techniques performed in different years.
Our studies were aimed at determining the role of EPM in BSC development and survival in such a hyper-arid system.
This presentation will report the results concerning the role of EPM in water capture from non-rainfall sources, water maintenance at the topsoil, and in water infiltrability, the latter being a factor with important ecological implications. In additions we investigated the role of the matrix as a source of carbon for the crustal heterotrophs.
Furthermore, EPM was extracted with methods optimized in our lab, aiming at removing tightly bound fractions and loosely bound fractions from BSCs having different ages. The fractions were analyzed in terms of monosaccharidic composition, and molecular weight (MW) distribution. We show how the relative amounts of uronic acids increase in the EPM with the age of the crusts, implying advantages for the community-water relations. In addition, we observed significant differences in MW distribution between EPM fractions and in relation to the age of the crusts, hinting at distinct roles of the same fractions within the crust system.

References

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