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Biological soil crusts: a microenvironment characterized by complex microbial interrelations affected by the presence of the exopolysaccharidic matrix.

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Biological Soil Crusts (BSCs) are complex microbial communities, commonly found in arid and semiarid areas of the world. The capability of the microorganisms residing in BSCs to withstand the harsh environmental conditions typical of these habitats, namely drought and high solar irradiation, is related with the presence of a matrix constituted by microbial-produced extracellular polysaccharides (EPSs), which also accomplish for a wide array of key ecological roles. EPSs represent a huge carbon source directly available to heterotrophic organisms, affect soil characteristics, water regimes, and establish complex interactions with plants. The induction of BSCs on degraded soils is considered a feasible approach to amend and maintain land fertility, as it was reported in a number of recent studies. It was recently shown that BSC induction is beneficial in enhancing SOC (Soil Organic Carbon) and in increasing the abundance of phototrophic organisms and vegetation cover.
This lecture will describe the results of a study showing that cyanobacterial-EPS resulted advantageous to the growth and metabolism of seedlings of Caragana korshinskii, a desert sub-shrub widely diffused in the area under study, also contributing a defensive effect against the damaging effects of reactive oxygen species (ROS), generated under UV-irradiation, salt stress and desiccation. A study aimed at investigating the possible correlation between the chemical composition and the macromolecular features of the EPS matrix of induced BSCs of different age, collected in the hyper-arid plateau of Hobq desert, Inner Mongolia, China, will be also presented. The results of this study showed that the characteristics of the EPS of the matrix of the investigated IBSCs cannot be put only in relation with the age of the crusts and the activity of phototrophic microorganisms but, more properly, it has to be taken into account the biotic interactions ongoing between EPS producers (cyanobacteria, green microalgae, and microfungi as major) and consumers (e.g. microfungi, heterotrophic bacteria). Moreover, it has to be stressed that the presence of environmental stressors (i.e. soil moisture, crust coverage, and species diversity) seems to be capable of differentiating the developmental level of induced BSCs more than the biotic factors with a consequent differentiation in the characteristics of the EPS-matrix of the crusts hardly correlable with the age.