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Soil stabilization by biological soil crusts in arid Tunisia

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As part of the fight against desertification (LCD) in arid Tunisia, we have been able to highlight the important role played by biological soil crusts (BSC) in soil stabilization. The identification of the major species of cyanobacteria, lichens and bryophytes, their adaptation and terrestrial colonization strategies in this high climatic constraints area through their morpho-anatomical criteria have been set. In addition to their biological composition, their internal arrangement (i.e. texture and microstructure) reflects the structural stability of BSC against erosion. Precisely, the aggregative power of cyanobacteria and their ways of moving inside a soil, the capacity of mosses to grow through the sediments and lichens ability to bind at particles on surface, thus stabilizing the substrate have been demonstrated. Then, the three biological components ability to capture soil particles has been widely illustrated, proving the major environmental contribution of BSC in arid areas biological crusts formation, providing that soils will experience an increase of organic matter and fine particles rates subsequently gaining faster and better stability.

Although the thickness and the morphology of crusts are related to the cover rates of these different biological components, the water properties of the latter, studied at the environmental SEM, illustrate their important role in altering the water cycle. Thus, the mixed crusts, i.e. with good presence of three biological components, cause the highest runoff rates by their ability to retain the water and spread on the surface. In spite of a swelling coefficient in presence of water higher than cryptogams, the cyanobacterial crusts located in newly stabilized areas of our studied region, remain finally insufficiently dense to impact surface hydrology. But, we showed after all that the cyanobacteria, pioneer species, have a certain environmental role. The lichen crusts cause a increased runoff because the lichens have a ability to extend them horizontally on the soil surface. Despite the water capture for their metabolism, the water flows; it isn't released in the depth. The moss crusts show an opposite process with an increased infiltration thanks to the possibility of a vertical transit of water through their sheets, stem and roots. So, in relation to bare soils, a crust with a good microbial and cryptogamic development causes more runoff. As part of the fight against the desertification in arid Tunisia, hydrological impact of BSC may lead to elaborate some ecosystem strategies in water and soils management. Indeed, climate aridity is not synonymous with edaphic aridity.