Geophysical Research Abstracts
Vol. 20, EGU2018-9975, 2018
EGU General Assembly 2018

Cultivable bacteria from the Atacama Desert, Chile: Their occurrence and diversity along an aridity gradient

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The hyper-arid regions of the Atacama Desert, Chile, offer some of the most hostile habitats on Earth due to extreme aridity, so surviving bacteria need efficient molecular strategies to cope with desiccation. At DNA level the resistance to desiccation and to ionizing radiation are processed by the same microbial DNA repair mechanisms (Mattimore et al. 1995), hence along a natural gradient of aridity the abundance of radiation resistant bacteria (RRB) should increase the drier the habitat becomes. To test our hypothesis we sampled soil profiles in triplicates along a climatic transect spanning 600 km from arid to hyper-arid conditions in the Atacama Desert in five different depth increments (down to -60 cm). All sampled sites had comparable inclination, altitude, and distance to the Pacific (50km). Soil organic carbon (SOC) stocks, soil water content (SWC), and salinity were determined and cultivable soil bacteria were incubated on a solid TYG –medium. Gamma radiated (up to 25.000 Gy) soil aliquots were taken into cultivation too. The number of colony-forming units (CFU g-1) were counted thereafter. Bacterial diversity was obtained by DNA extraction of 16S rRNA followed by Next Generation Sequencing of the grown colonies. SOC stocks and SWC decreased significantly from 25.5 to 2.1 kg m-2 cm-1 and 60 to 1 mg g-1 along the gradient, thus biotic activity and moisture decreased severely. The number of cultivable colonies decreased significantly with aridity, ranging between ∼2.8 CFU g-1 at the arid site to 0.002 CFU g-1 at the hyper-arid site. The number of colonies of RRBs was far below the non-radiated CFU, ranging between 0 CFU g-1 at the hyper-arid site and 0.006 CFU g-1. However, the number of colonies of RRB′s did not increase in absolute numbers with aridity, but formed a higher proportion in relative terms along the transect.
Finally we evaluate alternative environmental soil parameters besides radiation resistance inducing desiccation tolerance along the gradient and their steering command on community composition.

Reference:
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