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Studying the structure and physiology of soil microbial communities in saline-alkaline double extreme habitats in Hungary

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Soil salinization is usually considered as a worldwide problem, which threatens the productivity of agricultural lands. Naturally occurring salinization, however, can provide an extreme habitat, in which a quite unique halo- and alkalophil biota could develop. While the plant associations of these areas are well-studied, the microbiota of these soils is still mostly unknown. Our project aims to study the structure and functioning of soil microbial communities in salinized area at Apajpuszta (Kiskunság NP) using classical and molecular microbiological methods.

The microrelief differences of the studied area resulted in a mosaic-like vegetation, because lower lying fields are more salinized and has minimal vegetation cover, while areas located higher are less salinized and have more abundant vegetation. Based on the vegetation type, we selected four sites with different degree of salinization (Salt pioneer sward, Puccinellia sward, Artemisia salt steppe, and Achillea steppe). Sampling was done in the dry (June) and wet (October) periods, from each site we took samples from three depths (0-10 cm, 10-30 cm, 30-60 cm). Physical and chemical parameters of the samples were determined, along with major nutrient contents. The bacterial community structure was examined by classical cultivation on three different agar media (modified R2A, YMA with Congo red and ISP5 media), and denaturing gradients electrophoresis (DGGE) based on the 16S rRNA gene. Based on the results of these studies, a further metagenomics analysis using net generation sequencing is also planned. Soil microbial biomass was estimated by substrate induced respiration (SIR), along with general microbial activity by fluorescein-diacetate hydrolysis (FDA). The catabolic fingerprints of the soil microbial communities were examined by the Microresp method, using 23 different organic carbon sources.

Our results showed that both the degree of salinization and the vegetation type has an effect on soil microbial communities. While the former is more influential on the functioning and the catabolic fingerprints, vegetation type had a stronger effect on the structure of the bacterial communities. Also, seasonality has a strong effect on the physiology of these communities.

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