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Skeleton versus fine earth: what information is stored in the mobile extracellular soil DNA fraction?

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The soil genome consists of an intracellular and an extracellular fraction. Recently, soil extracellular DNA (eDNA) has been shown to be quantitatively relevant, with a high survival capacity and mobility, playing a crucial role in the gene transfer by transformation, in the formation of bacterial biofilm and as a source of nutrients for soil microorganisms. The eDNA fraction can be discriminated and classified by its interaction with clay minerals, humic acids and Al/Fe oxihydroxides, resulting in differently mobile components. The eDNA extractable in water, classified as DNA free in the extracellular soil environment or adsorbed on soil colloids (eDNAfree/adsorbed), is hypothesized to be the most mobile DNA in soil.

Challenging to assess the information stored in this DNA fraction, eDNAfree/adsorbed was recovered from fine earth (< 4 mm) and highly altered rock fragments or skeleton (4-10 mm) of six consecutive horizons (A1-BCb2) of a forest soil profile by washing the two soil fractions with H2O. Quantitative analysis have been conducted in terms of DNA yields (fluorimeter and spectrophotometer), molecular weight and fragment length distribution (gel electrophoresis), and qualitative analysis in terms of the composition and distribution of fungal and bacterial communities (Denaturing Gradient Gel Electrophoresis- fingerprinting).

The mobile soil eDNA, extracted from each horizon, was characterised by low molecular weight (< 2 kb) and amounts ranging from 3.96 ($\pm$0.179) to 0.17 ($\pm$0.023) μg g-1 for the fine earth and from 1.42 ($\pm$0.111) to 0.11 ($\pm$0.007) μg g-1 for the skeleton. Genetic fingerprinting of eDNA recovered from fine earth and skeleton revealed characteristic fungal and bacterial communities of each horizon, but also similarities among the microbial communities of both soil fractions and horizons. This could be interpreted also as a result of the movement of eDNA along the soil profile and from fine earth to skeleton.

The molecular characterization provided information about the autochthonous microflora inhabiting skeleton and fine earth as well as information about the fate of soil DNA in terms of presence, persistence and movement of eDNA and the stored genetic information.