

Microbiomes structure and diversity in different horizons of full soil profiles

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Topsoil is a most common object for soil metagenomic studies; sometimes soil profile is being formally split in layers by depth. However, Russian Soil Science School formulated the idea of soil profile as a complex of soil horizons, which can differ in their properties and genesis.

In this research we analyzed 57 genetic soil horizons of 8 different soils from European part of Russia: Albeluvisol, Greyzemic Phaeozem, three Chernozems (different land use – till, fallow, wind-protecting tree line), Rhodic Cambisol, Haplic Kastanozem and Salic Solonetz (WRB classification). Sampling was performed from all genetic horizons in each soil profile starting from topsoil until subsoil. Total DNA was extracted and 16S rRNA sequencing was provided together with chemical analysis of soil (pH measurement, C and N contents, etc.).

Structure and diversity of prokaryotic community are significantly different in those soil horizons, which chemical properties and processes of origin are contrasting with nearest horizons: Na-enriched horizon of Solonetz, eluvial horizon of Albeluvisol, plough pan of Agrochernozem. Actinobacteria were abundant in top horizons of soils in warm and dry climate, while Acidobacteria had the highest frequency in soils of moist and cold regions. Concerning Archaea, Thaumarchaeota prevailed in all studied soils. Their rate was higher in microbiomes of upper horizons of steppe soils and it was reducing with depth down the profile.

Prokaryotic communities in Chernozems were clustered by soil horizons types: microbiomes of A (organic topsoil) and B (mineral) horizons formed non-overlapping clusters by principal component analysis, cluster formed by prokaryotic communities of transitional soil horizons (AB) take place between clusters of A and B horizons. Moreover, prokaryotic communities of A horizons differ from each other strongly, while microbiomes of B horizons formed a narrow small cluster. It must be explained by more diverse conditions in upper A horizons.

Thus, ecological differences between soil horizons are important factor of differentiation of prokaryotic communities in soil profile; their structure can be specific for horizon type.

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