Geophysical Research Abstracts
Vol. 17, EGU2015-1008, 2015
EGU General Assembly 2015

Heterotrophic bacteria in soils of Larsemann Oasis of East Antarctica

Nikita Churilin (1) and Vera Soina (2)

(1) V.V. Dokuchaev Soil Science Institute, Moscow, Russian Federation (nikitachur@ya.ru), (2) M.V. Lomonosov Moscow State University, Moscow, Russian Federation (soina@yandex.ru)

The study of diversity and functional state of microorganisms in subsurface rocks layers, their participation in the biochemical weathering and formation of organic horizons of soils is important for understanding ecology and microorganisms in Antarctic soils. The study of cultured forms of microorganisms and their potential viability is still relevant to characterize the physiological state, biological activity and resilience of microorganisms involved in the initial soil formation. Improvement of isolation techniques of viable bacteria from the extreme habitats has a particular importance for rising the efficiency of environmental monitoring.
The aim of the study was to investigate the viable heterotrophic bacteria involved in the formation of soils from wet valleys Larsemann Oasis, which is one of the warmest ice-free space of East Antarctica. Soil samples were taken from the intermountain humid valleys, where silt-gravelly substrates formed moss, algae, lichen cover.
We used nutrient solutions (trypticase soy, R2A and glucose-peptone) to isolate cultured bacteria and study their morphological types in the light microscope. The total number of microorganisms was determined by fluorescent microscopy with acridine orange. SEM was used for morphological studies of bacterial communities in situ. To activate the growth processes we added into nutrient solutions various regulatory metabolites that have dose-dependence and operate at the community level. Physiological and functional conditions were determined by the duration of the lag phase and specific growth rate of bacterial communities in nutrient solutions containing various organic substrates.
Soils form under protection of «stone pavement» and organisms leave the surface, so the forming organo-mineral horizon occurs inside of rock, thus the microprofile can form on both sides of the organic horizons. UV radiation, lack of moisture and strong wind are main limiting factors for microorganisms' growth in Antarctic soils.
Primitive soils and permafrost layer have a great unevenness in the number of cultivated and potentially viable cells in different horizons. This phenomenon is characteristic for habitats with stable and alternating negative temperatures that can be attributed to the irregular migration of cells during freezing and heterogeneity of microbial populations along the depth of dormancy.
One of the identified features was the lack of correlation with the organic content.
SEM study of microbial communities in native Antarctic soils revealed the presence of biofilms, which can play an important role in weathering of rocks and primary soil formation, by forming organic horizon and protecting cells from environmental impact. Biofilms can also influence on distribution of bacterial cells in forming soils.
Growth regulators (indoleacetic acid, wheat germ agglutinin, alkylhydroxybenzenes, pyruvate Na and serotonin) were used in experiments on the growth reactivation using soil samples with low number of microorganisms. The results obtained by this analysis can be used for further research to develop methods of the most complete selection of viable bacteria from Antarctic soils.
We also determined the physiological condition of bacterial populations and their maximum specific growth rate. This method determines the functional (trophic) diversity of microbial communities and the maximum specific growth rate that reflects the environmental strategy of bacterial growth. In spite of the extreme conditions, a variety of physiological and metabolic willingness to consume polymers hydrolytic bacterial associations of endolithic soil is highest in the surface horizon and sharply decreases in the mineral horizon.