Geophysical Research Abstracts
Vol. 12, EGU2010-8266, 2010
EGU General Assembly 2010
© Author(s) 2010

Soil microbial activities beneath Stipa tenacissima L. and in surrounding bare soil

I. Novosadová (2), J. D. Ruiz Sinoga (1), J. Záhora (2), and H. Fišerová (2)

(1) University of Malaga, Geography, Physical Geography, malaga, Spain (sinoga@uma.es), (2) Mendel University of Brno. Czech Republic.

Open steppes dominated by Stipa tenacissima L. constitute one of the most representative ecosystems of the semi-arid zones of Eastern Mediterranean Basin (Iberian Peninsula, North of Africa). These steppes show a higher degree of variability in composition and structure. Ecosystem functioning is strongly related to the spatial pattern of grass tussocks. Soils beneath S. tenacissima grass show higher fertility and improved microclimatic conditions, favouring the formation of "resource islands" (Maestre et al., 2007). On the other hand in "resource islands" and in surrounding bare soil exists the belowground zone of influence. The competition for water and resources between plants and microorganisms is strong and mediated trough an enormous variety of exudates and resource depletion intended to regulate soil microbial communities in the rhizosphere, control herbivory, encourage beneficial symbioses, and change chemical and physical properties in soil (Pugnaire et Armas, 2008). Secondary compounds and allelopathy restrict other species growth and contribute to patchy plant distribution. Active root segregation affects not only neighbours´ growth but also soil microbial activities. The objective of this study was to assess the effect of Stipa tenacissima on the key soil microbial activities under controlled incubation conditions (basal and potential respiration; net nitrogen mineralization).
The experimental plots were located in the province Almería in Sierra de los Filabres Mountains near the village Gérgal (southeast Spain) in the small catchment which is situated between 1090 – 1165 m a.s.l. The area with extent of 82 000 m2 is affected by soil degradation. The climate is semiarid Mediterranean. The mean annual rainfall is of about 240 mm mostly concentrated in autumn and spring. The mean annual temperature is 13.9° C. The studied soil has a loam to sandy clay texture and is classified as Lithosol (FAO-ISRIC and ISSS, 1998). The vegetation of these areas is an open steppe dominated by Stipa tenacissima. In February 2009 representative soil samples from the top 10 cm were taken beneath grass tussock and from bare soil. Soil samples in three replicates were incubated after rewetting with distilled water (basal microbial activities) and after rewetting with the glucose solution and with the mixture of glucose and peptone solution (potential microbial activities). The CO2, C2H4 evolved under controlled conditions (60% WHC, 24°C) during a 37-day aerobic incubation were determined. Ammonia and nitrate nitrogen were estimated in percolates after simulated rainfall (on the 16th day of incubation) and in the incubated soil samples at the end of incubation. Net ammonification and net nitrification rates were determined by subtracting initial soil mineral N from both mineral N in percolates plus final mineral N contents at 37th day.
Basal, potential microbial respiration and net nitrification in the soils beneath S. tenacissima were, in general, not significantly different from the bare soils. The differences between plant-covered soil and bare soil in cumulative values of CO2 production and in amounts of accumulated NO3–N (net nitrification) were less than $\pm$ 10%. Greater differences were found in the net ammonification, which were higher beneath S. tenacissima, mainly in the control (basal activities) variant (about 38 %). Significantly less ethylene produced by microbial activity in soils beneath S. tenacissima after the addition of glucose indicates the dependence of rhizospheric microbial communities on available carbon compounds mainly from root exudates. It can be concluded, similarly as published Goberna et al., (2007), that the distribution of soil microbial properties in semi-arid Mediterranean ecosystems is not necessarily associated with the patchy plant distribution and that some microbial activities characteristics can be unexpectedly homogenous.