Geophysical Research Abstracts
Vol. 14, EGU2012-1175-2, 2012
EGU General Assembly 2012

Factors responsible for the patchy distribution of natural soil water repellency in Mediterranean semiarid forest

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Soil water repellency (WR) is commonly observed in forest areas showing wettable and water repellent patches with high spatial variability. This has important hydrological implications; in semiarid areas where water supply is limited, even slight WR may play an important role in infiltration patterns and distribution of water into the soil (Mataix-Solera *et al.*, 2007). It has been proposed that the origin of WR is the release of organic compounds from different plants species and sources (due to waxes and other organic substances in their tissues; Doerr *et al*., 1998). However, the relationship between WR and plants may not always be a direct one: a group of fungi (mainly mycorrhizal fungi) and microorganisms could be also responsible for WR. The aim of this research is to study the relationships between WR in soils under different plant cover with selected soil properties and the quantity of fungi and their exudates. The study area is located in Southeast Spain, "Sierra de la Taja" near Pinoso (Alicante)), with a semiarid Mediterranean climate (Pm=260mm). Samples were taken in September 2011, when WR is normally strongest after summer drought. Soil samples were collected from the first 2.5cm of the mineral A horizon at microsites beneath each of the four most representative species (*Pinus halepensis, Rosmarinus officinalis, Quercus. rotundifolia* and *Cistus albidus*; n=15 per specie) and 5 samples from bare soil with no influence of any species. Different soil parameters were analyzed; water content, soil organic mater content (SOM), pH, WR, easily extractable glomalin (EEG), total mycelium and extractable lipids. The occurrence of WR was higher under *P. halepensis* (87% of samples) and *Q. rotundifolia* (60% of samples). Positive significant correlations were found between WR and SOM content for all species, with the best correlations for *Pinus* and *Quercus* ($r=0.855^{**}$, $r=0.934^{**}$ respectively). In addition, negative significant correlations were found between WR and pH and between SOM and pH for all except for *Q. rotundifolia*. However, the negative correlation found between pH and persistence of WR seems to be related to soil organic matter (SOM) content for all vegetal species. Glomalin exudates from arbuscular mycorrhizal fungi in soil revealed significant differences between species. However, the first results do not point to a direct relationship between EEG content and WR but to soil mineralogy or certain components within SOM pool i.e. litter debris degradation products or specific components within the glomalin extract, as main factors affecting soil WR. Nonetheless, since some samples with the same SOM content (including some under the same vegetation cover) showed different WR persistence, complementary research including a more detailed characterization of most soil functional fractions (SOM and clays) is planned in order to elucidat the main factors influencing the presence and persistence of WR in soils under Mediterranean semiarid forest.

Keywords: Water repellency, hydrophobicity, easily extractable glomalin, mycelium, arbuscular mycorrhizal fungi.

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