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Role of fungi on soil water repellency

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Fungi have long been suspected to be major culprits in the formation of water repellency in soil. They are known to produce potentially hydrophobic exudates to protect against desiccation stresses. This presentation will review various studies conducted by our group, particularly concerning the generation of low levels of repellency in agricultural soils. We hypothesise that low levels of repellency can have beneficial impacts to soil structural stability; in addition to negative implications such as preferential flow and erosion that plagues highly repellent soils.

Our initial studies used laboratory microcosms filled with sterile soil and inoculated with several white-rot fungi species. Whereas control microcosms remained completely nonrepellent after 14 days incubation, C. versicolor and P. chrysosporium increased repellency by 20 times in extreme cases. These same species, however, reduced repellency when added to an initially repellent sterile soil. Moreover, when added to soil contaminated with anthracene, a hydrophobic PAH, C. versicolor reduced repellency, whereas P. chrysosporium was not different from the sterile control. It appears that individual fungal species have different capacities to create and consume potentially hydrophobic substances in soil.

In agricultural and woodland soils we have found a strong correlation between fungal biomass, measured as ergosterol, and the level of repellency. A closer examination of glomalin, a specific AM-fungal exudate, found a poor correlation with repellency. Although physical disturbance (e.g. tillage, sieving) reduced repellency, highly resilient fungi appeared to restore repellency levels within a couple weeks. These effects are accentuated closer to plant roots, where root exudates may be responsible for repellency

or provide additional substrate for fungal growth.

At present we are investigating the exudates produced by numerous fungal species and the impact on soil repellency. We believe that slight shifts in soil wetting properties could be paramount to microbial competition in soil, thereby influencing colonisation and biodiversity. Fungal exudates may help the organism survive dry spells, but they may also be a future food source and produce a harsh microenvironment that keeps competitors at bay.