Biogeosciences Discussions

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Comment on bg-2022-83

Christopher Fernandez (Referee)

Referee comment on "Nitrophobic ectomycorrhizal fungi are associated with enhanced hydrophobicity of soil organic matter in a Norway spruce forest" by Juan Pablo Almeida et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2022-83-RC2, 2022

In this study, Almeida et al. used mesh ingrowth bags filled with maize amended (13C enriched) sand to understand how EMF biomass/necromass contributes to the hydrophobicity of SOM under N fertilization. They found that N fertilization caused significant changes in the fungal communities colonizing the mesh ingrowth bags from so called 'nitrophobic' taxa that respond negatively to mineral N deposition to more 'nitrophilic' taxa. Nitrophobic taxa generally produce mycelia that composed of cords/rhizomorphs that are hydrophobic (Ho) while nitrophilic taxa generally have hydrophilic (Hi) mycelia. These changes in community composition corresponded to changes in hydrophobicity of soil organic matter (SOM) in the bags (measured by contact angle) suggesting that hydrophobic fungal necromass deposition (particularly from Piloderma) may be important to the formation of hydrophobic SOM, which is thought to be more resistant to decay and thus increase C storage.

I found the manuscript to be interesting, novel, and improves our understanding of EMF and their influence on SOM hydrophobicity. I also found the study to be methodologically sound and have little in terms of major critiques. The one major comment I did have was on the interpretation of the results and mechanisms driving increased hydrophobicity of the bag SOM substrate: How do you tease apart the effects of fungal in-growth from hydrophobic compounds entering the bags from the surrounding litter/SOM (e.g. ingress of hydrophobic compounds via transport in water)? While I think the evidence presented in the manuscript strongly suggests that the former is probably the major driver, I don't think one can completely rule out the potential effects that the surrounding litter and SOM (and associated changes with the N treatment) may have on the substrate properties in the in-growth bags. I would suggest adding a few sentences in the discussion about plausible alternative mechanisms.

Line comments:

L3 For correct grammar change "fungi" to "fungal" OR just omit "symbiosis"

L37 revise to say "...this mycelium turns into necromass…"

L44 the authors might want to add hypothesized mechanisms behind differences in decomposition rates among hi and ho SOM here

L53 change "saprophyte" to "saprotroph" for consistency (and a more widely accepted term)

L60-63 I would suggest explicitly stating that this particular species of Cortinarius has retained the enzymatic capacity to breakdown complex SOM in order to access nutrients.

L64-68 species are mentioned but genera are given as the examples

L64-68 I would add a sentence stating that for Russula and Lactarius there is quite a bit of variability in response to N fertilization at the species level

L66 missing a "," in front of Suillus

L92-96 Please provide what form the N fertilizer was

L174 The Zygomycota is no longer a recognized Phylum (now split into the Mucoromycota & Zoopagomycota; Spatafora et al. 2016)

Figure 1. This is a matter of style but I feel the data could be presented in a different way that is more intuitive and impactful (e.g. boxplots?). The information is there, for me it just was not conveyed immediately.

Figure 2 I would be curious to see the N treatment treated as a covariate in an ANCOVA.

Is the control slope steeper compared to the fertilized? Just looking at the plots it would appear so and may bolster the support for arguments made in the discussion about Ho and not Hi biomass that is contributing to SOM hydrophobicity.

Figure 3b. Maybe in the key you could add the hydrophobicity of each of the taxa based on genus level classifications in Agerer 2001 and Lilleskov et al. 2011 for those that are not immediately familiar? Additionally, a third panel with the relative abundance of the two hydrophobicity groupings could be added.

Figure 4. “saprotrobes” should be “saprotrophs”