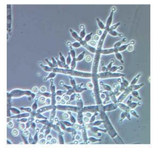
The effects of bacterial and fungal morphology on necromass decomposition

Josephine Johnston[1], Achala Narayanan[2], Peter Kennedy[2]

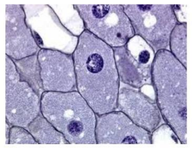
1. Department of Ecology, Evolution, and Behavior, University of Minnesota, USA 2. Department of Plant and Microbial Biology, University of Minnesota, USA

Background

- Necromass (dead microbial material) represents a significant portion of all soil organic matter (the biggest terrestrial carbon pool on earth).[1]
- Filamentous vs. Non-filamentous: mycelia allows an organism to forage their environment for nutrients, while non-motile organisms rely on direct proximity.[2]



Filamentous (Mycelia)[3]



Non-filamentous (unicellular)[4]

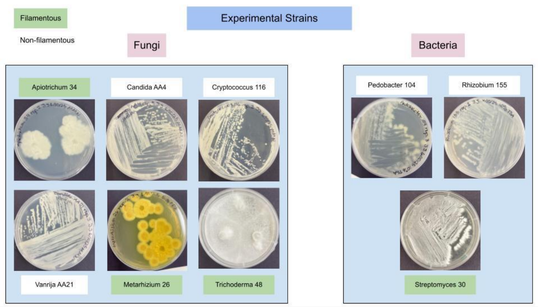
Research Questions:

(1) How well do fungi vs. bacteria decompose necromass regardless of morphology?

(2) How well do morphological traits of bacteria and fungi explain necromass decomposition?

Experimental Design

- Bags containing necromass were inserted into glass jars containing soil (soil microcosms).
- Nine cultures were selected based on domain and morphology.
- Soil microcosms were inoculated with a selected strain and allowed to incubate for two or four weeks.
- Treatment groups consisted of three replicates at each timepoint.



Hypothesis

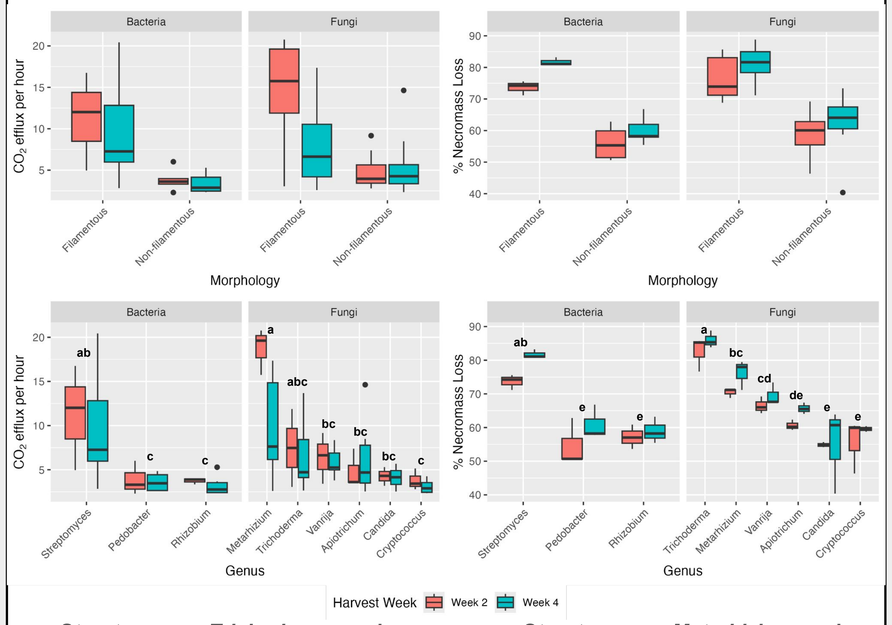
H1: Fungi will decompose more necromass than bacteria, given their arsenal of hydrolytic and oxidative enzymes.

H2: Filamentous organisms will decompose more necromass than non-filamentous organisms, regardless of domain because they have greater spatial access to the necromass.

Results

Filamentous organisms had a higher percent difference in necromass loss across harvest weeks.

FIlamentous organisms had a higher respiration rate across harvest weeks.



***Streptomyces*, *Trichoderma*, and *Metarhizium* had high percent differences of necromass loss across harvest weeks.**

***Streptomyces*, *Metarhizium*, and *Trichoderma* had higher respiration rates than other genuses across harvest weeks.**

Conclusions

- Morphology, rather than domain, correlates with necromass decomposition (as mass loss).
- Domain is not a significant determining factor in an organism's respiration rate while morphology is.
- Yeasts and and non-filamentous bacteria do not differ in total necromass decomposition (as mass loss and respiration).
- All filamentous organisms surveyed (*Metarhizium, Trichoderma,* and *Streptomyces)* had the highest total decomposition.

Future Directions

- Increasing sample size of both filamentous and non-filamentous bacteria.
- Including dimorphic strains or genetic mutants to evaluate the role that morphology plays in decomposition while keeping strain identity constant.
- Manipulating the water holding capacity of soil microcosms to evaluate how moisture mediates morphology effects.
- Analyzing the chemical profiles of decomposed necromass to identify differences in the compounds they are consuming.

References & Acknowledgements