Utilization of Substrates in Post Fire Soil by *Pyronema omphalodes*

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Abstract – With an increasing frequency and intensity of fires happening around the world, the need to increase knowledge of post-fire soil microbial ecology has become urgent. Fires are detrimental to the soil, leaving it dry, deteriorated, and hydrophobic with diverse substrates that prevent organisms from being able to recolonize it. The soil hydrophobicity can also cause erosion, which is another reason it becomes uninhabitable. However, a group of pyrophilous fungi, including *Pyronema omphalodes*, has adapted to the post-fire environment. This fungal species' ability to survive in this soil is important because it can provide nutrients to a new succession of soil-colonizing organisms. There are many substrates present in the soil following a fire, so it is essential to determine which substrates are utilized by *P. omphalodes*. To do this, cultures of *P. omphalodes* were grown on minimal media with different carbon sources, including xylose, pectin, peptone, avicel, and carnauba wax, corresponding to substrates that are found in the post-fire environment. Measurements will be made of colony diameter and biomass volume in order to determine growth rates on the various media, with the goal of discovering which substrate it best utilizes. If we can deduce what *P. omphalodes* grows best on, we can correlate those findings with genomic analysis to infer what enzymes it uses to break down those substrates. Those enzymes are critical as we can use them to remove the pyrolyzed material from the soil and restore the forests after a fire at a faster rate.

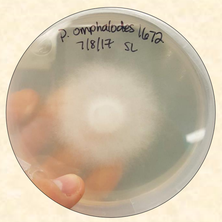
INTRODUCTION

Fires combust organic material into CO_2 and produce a cation rich, high pH ash. Much of the biomass is also turned into pyrolyzed organic matter that is difficult for soil microorganisms to break down. Waxes from trees sip into the soil just as bacteria release fats, lipids, and proteins into the soil due to their inability to withstand the high temperatures of a fire[1].

Pyrolyzed organic matter (PYOM) causes the soil to become hydrophobic, which leads to erosion, runoff, and thus losses in productivity and long-term C storage. It also leads to decreases in soil biomass, which can take years to recover. This can be a problem as it is critical to the processes of organic matter decomposition and nutrient cycling. *Pyronema omphalodes*, however is a group of fungi that is able to quickly respond to post-fire soil and rapidly grow. It is able to return nutrients into the soil necessary by other microorganisms[2].

OBJECTIVE

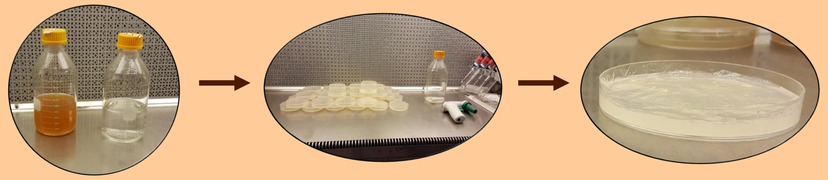
❖Determine what carbon source in post-fire soil the fungi utilize best: avicel, pectin, xylose, peptone, or carnauba wax



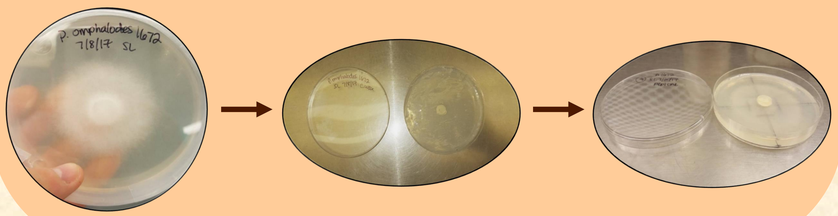
METHODS

Step 1 - Prepare pyro minimal media and cellophane sheets

Step 2 - Pour media and place cellophane

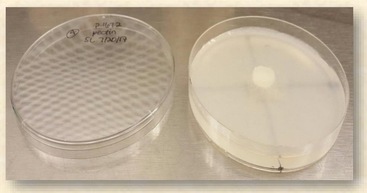


Step 3 - Plate fungi; Measure growth of fungi over 3 days

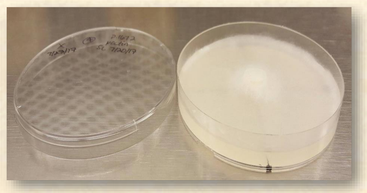


RESULTS

Day 1



Day 2



Day 3

Figure: Fungi growth over 3 days on the pectin

RESULTS

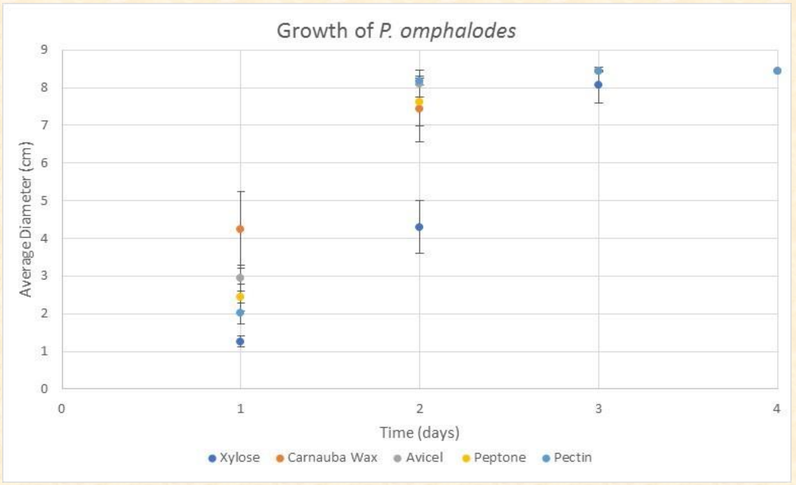


Figure: Shows growth of the average diameter of *P. omphalodes* of 10 samples on each carbon source in both the x- and y- axis over a series of 4 days. The error bars symbolize the variation in the average diameter of the fungus on each substrate.

- ❖ Fungi grew the least on the xylose
- ❖ Fungi grew the most on the carnauba wax compared to most of the other substrates the first day
- ❖ By the 3rd day, the fungi covered most of the plates with each substrate
- ❖ **Observations:**
  - ❖ Most of the fungi on the avicel and carnauba wax was concentrated in the middle but difficult to see as the hyphae was very thin.
  - ❖ Fungi grew like cotton balls, dense and fuzzy, and formed webs on the xylose, peptone, and pectin over the four days .

CONCLUSION

The fungi grew the slowest on the xylose. Initial spread of fungi on carnauba wax was the fastest, but the growth was not dense compared to pectin, peptone, and xylose. For a more complete understanding of which substrate the fungi utilized best, future work includes measuring the biomass produced and comparing with these growth diameter measurements.

REFERENCES

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