Comparing mycorrhizal spore diversity in pre- and post-potted soils of three native tree species for forest restoration

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Abstract

Mycorrhizal fungi are crucial for seedling growth, enhancing nutrient uptake and stress tolerance, which are vital for forest restoration. This study compares the diversity and abundance of mycorrhizal spores in soil before and after potting seedlings of three native tree species: *Phoebe lanceolata* (Nees) Nees, *Podocarpus neriifolius* D. Don, and *Elaeocarpus lanceifolius* Roxb., sourced from three nurseries: Doi Suthep-Pui National Park (DSNP), Mae Sa Mai Village (MSMV), and Doi Suthep Nature Center (DSNC). Two methods were used for spore separation: 1) isolation and counting of fungal spores from the soil, and 2) examination of arbuscular mycorrhizal colonization in plant roots, stained and analyzed for hyphal structures, arbuscules, and vesicles. Before potting, mycorrhizal spore quantity was highest in DSNP soil, likely due to the use of locally sourced soil from nearby forests, compared to the commercial soil used in DSNC. After potting, there was an increase in spore richness, likely caused by soil disturbance and altered conditions that stimulate dormant spores. The highest spore count was found in *E. lanceifolius* Roxb. seedlings from MSMV (106 µm, 190 spores), while the lowest was in *P. lanceolata* (Nees) Nees seedlings from DSNC (250 µm, 6 spores). Species-specific differences in mycorrhizal associations may explain the variation in spore richness. The study found that potting seedlings increases mycorrhizal spore richness, with some species showing higher diversity. Additionally, nurseries using local soil had greater mycorrhizal genus richness, emphasizing the importance of local soil conditions in enhancing mycorrhizal diversity. These findings suggest that improving mycorrhizal management in nurseries could optimize seedling establishment for forest restoration. Future research should monitor the long-term effects of seedling planting on mycorrhizal communities in restoration areas, as well as methods for improving the quality of mycorrhizal inoculation in the nursery process.

Introduction

Mycorrhizal fungi are symbiotic fungi that live in the soil and plant roots, receiving nutrients from plants, which in turn benefit from the fungi's ability to enhance nutrient uptake. This relationship makes mycorrhizal fungi important for forest restoration.

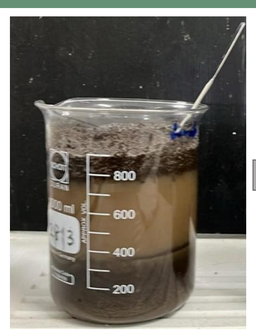
Objective

To compares the diversity and abundance of mycorrhizal spores in soil before and after potting seedlings of three native tree species.

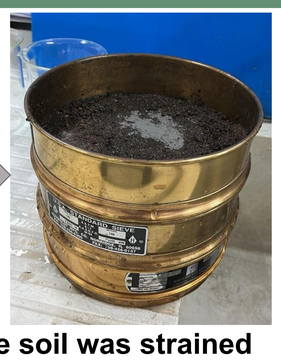
Materials & Methods

Soil method:

1. Before potting
2. After potting



Weigh 50 g. of soil and add 500 ml of distilled water

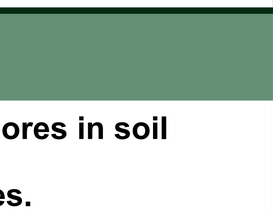


The soil was strained through fine sieves with mesh sizes of 250 µm, 106 µm, and 53 µm.

Wash each layer of soil and separate the water into a beaker and put it under Stereo Microscope

Take it to look for the genus under Compound Microscope

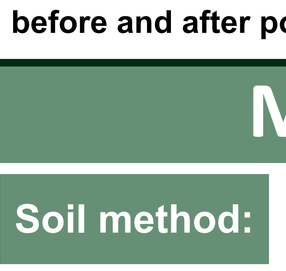
Roots method:



Bleached in KOH 10%(w/v) at 90 °C in a water bath for 1 hr.

Stained with Trypan blue solution 0.05% (w/v)

Boil 90 °C for 30 minutes



Soaked the roots in 50% ethanol solution and stored at 5 °C

Cut to 2 cm, 20 roots and examine under a compound microscope

Results

Species richness (SR)

Table 1. showing the species richness of soil before potting

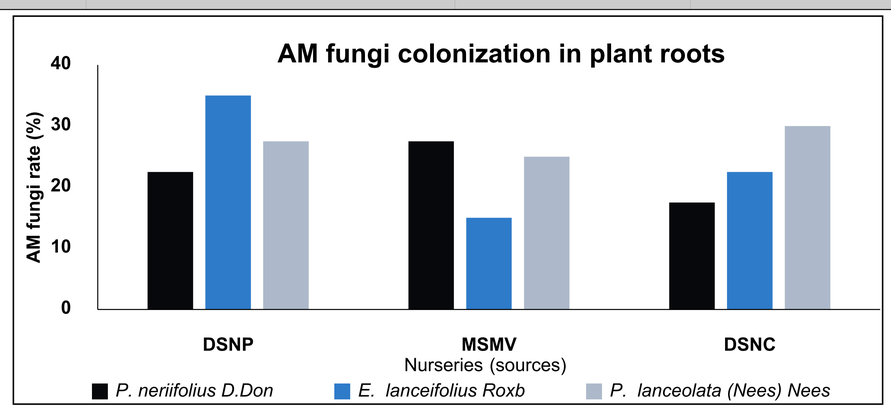
Nurseries	SR	*Glomus* spp.	*Acaulospora* spp.	*Scutellospora* spp.
DSNP	3	1	1	1
MSMV	2	1	1	-
DSNC	2	1	1	-

- Indicates the absence of species

Table 2. showing the species richness of soil after potting

Plant species	SR	*Glomus* spp.	*Acaulospora* spp.	*Scutellospora* spp.
Podocarpus neriifolius D.Don	8	4	3	1
Elaeocarpus lanceifolius Roxb.	8	3	4	1
Phoebe lanceolata (Nee) Nees	6	3	2	1

Graph 1. Rate of AM fungi colonization in plant roots from three nurseries.



Conclusion

The study highlights the critical role of AM fungi in forest restoration, demonstrating their ability to enhance plant growth and support ecosystem sustainability, particularly in biodiverse areas. By fostering a strong symbiotic relationship between plants and fungi, AM fungi contribute significantly to efficient restoration efforts. Ensuring soil fertility and promoting AM fungi biodiversity are key elements in long-term forest restoration and ecosystem balance.

Acknowledgement

I would like to thank the Faculty of Science, Chiang Mai University and SCB2813 for laboratory used. I also thank FORRU-CMU providing financial support.

References

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[2] Boonlue. 2557. Mycorrhizal Fungi. Khon Kaen University. Khon Kaen.