Arbuscular mycorrhiza fungi spore density and root colonization in a dry Afromontane forest in northern Ethiopia

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Introduction
The abundance and distribution of arbuscular mycorrhizal fungi (AMF) in forest soils depends upon environmental conditions and habitat disturbance.

Objective
We investigated Arbuscular Mycorrhizal Fungi (AMF) spore density and root colonization in three dry Afromontane forest plant communities along a gradient having varying levels of disturbance and different soil properties.

Study site

Fig: Location of the study area, Hugumburda Forest, in the highlands of northern Ethiopia showing overhead (A) and oblique (B) satellite imagery over a global DTM in Google Earth with a vertical exaggeration factor of 3, and a corresponding photograph of the area (C).

Methods
Soil and root samples were collected from 65 permanent plots of 50 m x 50 m, assessed for AMF spore density and root colonization from four sides of each tree plant, and replicated three times for dominant woody species across two soil depths. Analysis of soil chemical properties and determination of soil carbon stock were conducted across two soil depths.

Result

1. AMF root colonization

Fig: AMF root colonization (%) for the plant communities: Jupr-Mase = Juniperus procera-Maytenus senegalensis; Pst-Ceaf = Pterolobium stellatum-Celtis africana and Capu-Opfi = Cadia purpurea-Opuntia ficus-indica plant community. Error bars indicate standard errors of the mean; columns with different letters are significantly different at p ≤ 0.05.

All three-plant communities were colonized by AMF. Juniperus procera-Maytenus senegalensis community (Jupr-Mase) and Cadia purpurea-Opuntia ficus indica community (Capu-Opfi) had the highest and lowest AMF spore density and root colonization respectively. Pterolobium stellatum-Celtis africana community (Pst-Ceaf) did not show significant difference with Jupr-Mase and Capu-Opfi.

2. AMF spore density across plant communities

Fig: Variation of AMF spore density across plant communities: Jupr-Mase = Juniperus procera-Maytenus senegalensis; Pst-Ceaf = Pterolobium stellatum-Celtis africana and Capu-Opfi = Cadia purpurea-Opuntia ficus-indica plant community. Error bars indicate standard errors of the mean; columns with different letters are significantly different at p ≤ 0.05.

The top soil (0-25 cm) had significantly (p < 0.05) higher AMF spore density but lower root colonization percentage than the sub-soil (25-50 cm).

3. Correlation between spore density and root colonization of AMF with soil chemical properties and soil carbon stock (SOC)

We found significant correlation (p < 0.05) between soil carbon and spore density. Plants in Jupr-Mase community were suitable hosts for AMF and had higher soil carbon stock due to low disturbance and dense tree cover.

Conclusion
Conserving remnant dry Afromontane forest have great role on harboring AMF and increased soil carbon stock which is important in increased soil carbon and climate change mitigation.

References


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