Arbuscular mycorrhizal fungal spores, an indicator of increased N availability in Mediterranean-type ecosystems

Dias T1, Stürmer S2, Correia P1, Carvalho L1, Martins-Loução MA1, Sheppard S3, Cruz C1

1 Universidade de Lisboa, Faculdade de Ciências, CBA, Campo Grande, Ed. C2, piso 5, 1749-016 Lisboa, Portugal. mtldias@fc.ul.pt
2 Universidade Regional de Blumenau, Departamento de Ciências Naturais, Caixa Postal 1507, 89012-900 Blumenau, SC, Brasil.
3 Centre for Ecology and Hydrology, Bush Estate, Penicuik EH26 7QB, Edinburgh, United Kingdom.

Rationale

Mediterranean-type ecosystems are hotspots of plant biodiversity (Phoenix et al. 2006). They show a great ‘reactivity’ to N availability, so adding N is expected to induce biodiversity changes, both above- and below-ground. A key below-ground component for biocenosis function and productivity is mycorrhiza fungi, which can promote plant growth by supplying limiting nutrients. In Mediterranean-type ecosystems, soil N (0.1%) and P (5 ppm) are limiting factors to plant development. Since the major function of arbuscular mycorrhiza fungi (AMF) is described as increased P acquisition (van der Heijden and Horton 2009), are changes in the AMF community expectable in response to N addition?

Yes, because:

i) several works show that AMF colonization is dependent on N availability, and
ii) increased N availability may increase plant P demand.

Changes in Parameter

Changes in Parameter = (Parameter1 - Parameter0) / (Parameter1 + Parameter0) / 2 “100%

Did AMF spores composition responded to increased N availability?


Morphological evaluation of AMF spores indicated a relation between AMF community and the N addition treatments. Two groups were of particular relevance:

i) AMF species only found in control plots

ii) AMF spores only found in fertilized plots

How did AMF spores diversity respond to the N treatments?


In comparison to the Control:

- 40 kg N-NH4+/ha/y CÂ AMF richness and evenness
- 40 kg NH4NO3/ha/y CÂ AMF richness and evenness
- 80 kg NH4NO3/ha/y may no effect on richness or evenness

Conclusions:

- Only one year of N fertilization was enough to induce changes in the AMF spore community, in terms of both diversity (richness and evenness) and composition (species).
- Taking in consideration the mutually exclusive nature of the two groups of AMF spores species “i” and “ii”, these should be further assessed as indicators of low and high N availability, respectively.
- Changes in AMF spores’ diversity appeared to be related with plants and soil’s response to the N treatments.
- Finally, given the ubiquitous distribution of AMF spores, the observed clear and drastic effect of nitrogen addition on the AMF community is surprising.

References:


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