THE SEARCH FOR SHARED SYMBIONTS BETWEEN PINE AND *VACCINIUM*

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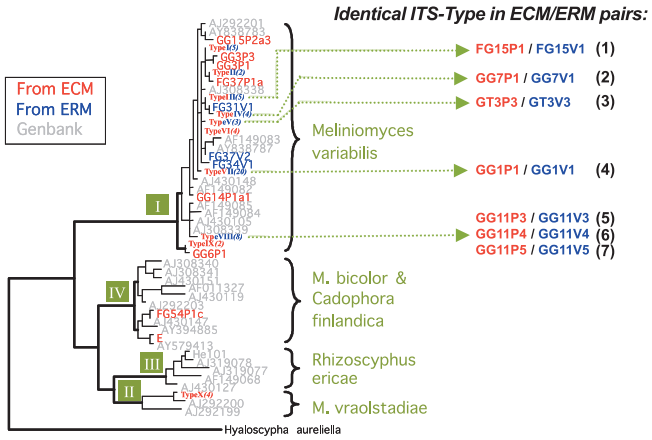
INTRODUCTION

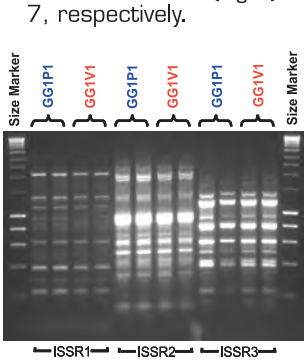
- Ectomycorrhizal (ECM) Trees and ericoid mycorrhizal (ERM) shrubs (Ericaceae) in Northern temperate and boreal forests are thought to support genetically and functionally distinct mycorrhizal fungi.
- The *Rhizoscyphus ericae* aggregate (Ascomycetes) have been found several times in both ERM and ECM roots.
- Our group has shown that a fungal strain isolated from a *Piceirhiza bicolorata* (*P.b.*) ECM root and belonging to the *R. ericae* aggregate, could form simultaneously both ERM and ECM structures in vitro (Villareal-Ruiz et al., 2005).
- We hypothesized that Scots Pine and *Vaccinium* spp., common tree and shrubs in boreal forests, share beneficial mycorrhizal symbionts. To test this hypothesis, we asked if:
  1. **Identical *R. ericae* genotypes co-occur in adjacent ECM and ERM roots.**
  2. ***R. ericae* strains behave as mutualistic symbionts with both root types.**

1. DO **IDENTICAL** FUNGAL GENOTYPES CO-OCCUR IN ADJACENT ECM & ERM ROOTS?

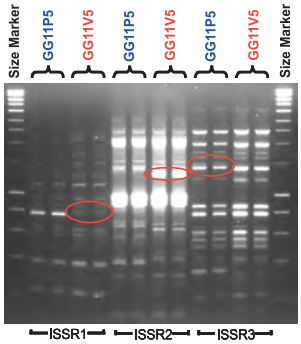
- We cultured fungi isolated from *P.b.* ECM roots and adjacent ERM roots sampled in two Scottish *Vaccinium*/Scots Pine stands.
- 60% of the fungal isolates belonged to the *R. ericae* aggregate. Most of them were assigned to clade I (species *Meliniomyces variabilis*).
- We found 7 ITS-sequences shared between adjacent ERM/ECM isolates.



- Within 2 of these pairs, both ECM and ERM derived-isolates showed identical ISSR patterns (with 3 ISSR primers).
- Below are typical results from ISSR test showing identical (left) and non-identical (right) ERM/ECM genotypes for pairs 4 and 7, respectively.



Pair 4: Identical ISSR patterns



Pair 7: Non-dentical ISSR patterns

- These results show that identical genotypes occur in adjacent Scots Pine and *Vaccinium* roots.

2. DO FUNGAL STRAINS FROM THE *R. ERICAE* AGGREGATE BEHAVE AS MUTALISTIC SYMBIONTS IN BOTH ERM AND ECM ASSOCIATIONS?

- One *M. bicolor* and two *M. variabilis* isolates obtained from a *P.b.* ECM tip and adjacent ERM roots were used in re-synthesis experiments.
- All strains formed typical intracellular ERM coils (photo A) with *Vaccinium*, but infection was uneven. *M. bicolor* sometimes formed a dense mycelial "sheath" around the roots.
- *M. bicolor* formed typical *P.b.* ECM tips with Scots Pine (photo B). *M.variabilis* colonised all Pine root tips but never showed any structure resembling a hartig net or bicolor mantle.

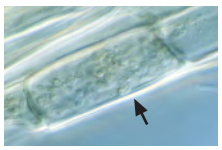


Photo A: Intracellular Coils in *Vaccinium* roots (DIC – x 1000)

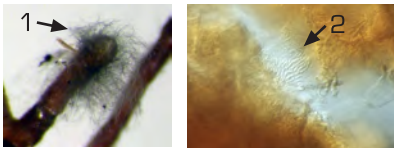
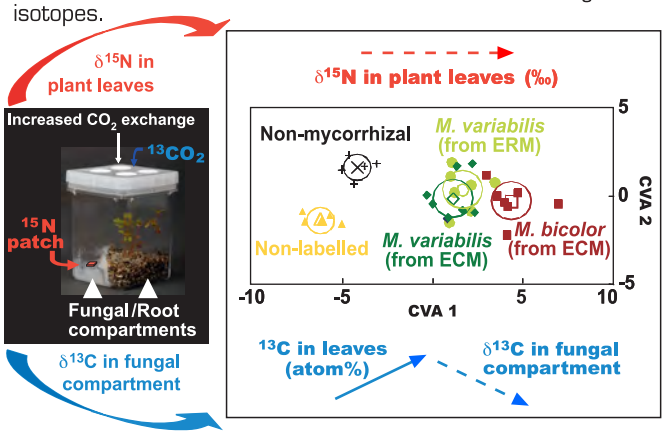


Photo B: Resynthesized *P.b.* ECM tip (1) and detail of hartig net (2).

- Reciprocal transfers of Nitrogen (N) and Carbon (C) between *M. bicolor* or *M. variabilis* and *Vaccinium* was assessed using stable isotopes.



- In the mycorrhizal labelled microcosms, leaves/fungal compartments were significantly enriched with $^{15}N/^{13}C$ compared to non-labelled or non-mycorrhizal controls ($P < 0.001$).
- Based on Canonical Variate Analysis, there was not significant difference between symbioses involving the ERM- and the ECM-derived *M. variabilis*. However, the behavior of *M. bicolor* in symbiosis differed from that of *M. variabilis* mainly because it imposed a greater C drain on its host plant (P=0.015).
- Our data indicate reciprocal transfer of N and C between host plant and fungus, regardless of whether the fungus was isolated from an ECM or ERM root.

CONCLUSIONS

- These data indicate that several ascomycetes have the potential to form both **ECM and ERM mutualistic symbioses** in Scots pine forests.
- Identical genotypes are found in both type of roots, suggesting the **existence of an ECM-ERM fungal network.**
- This has important implications for resource transfers in boreal and temperate forest.

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