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Whodunnit? Solving the mysteries of soil phosphorus solubilisation in an ectomycorrhizal tripartite interaction

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Temperate and boreal forest trees are dependent on soil microorganisms for the acquisition of limiting nutrients, including phosphorus. These include ectomycorrhizal fungi, which form a symbiotic association with the roots of the trees, and soil-dwelling bacteria. The exact roles of and mechanisms used by ectomycorrhizal fungi and soil bacteria in plant phosphorus nutrition and phosphorus cycling are unclear, as are the effects of fungal identity and nutrient availability on these processes.

We compared the effects of inoculation with two species from the ectomycorrhizal fungal genus Pisolithus on the amounts of phosphorus available to and present in Eucalyptus grandis seedlings, under different levels of nitrogen fertilisation and atmospheric CO_2. We then further explored the phosphorus-solubilising abilities of the fungi and soil bacterial community using in vitro plate assays, soil enzymatic assays and qPCR analyses.

We show evidence of synergistic interactions between the ectomycorrhizal fungi and soil bacterial community to improve phosphorus nutrition in the soil – interactions that are impacted by both nitrogen and CO_2 levels and the species of the fungus. Our findings expand the current understanding of how ectomycorrhizal fungi and soil bacteria contribute to forest tree phosphorus nutrition and reveal how this interaction has important implications for sustainable forest management practices and estimations of future climate impacts on forest ecosystems.