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Phylogenetic and mycogeographical aspects of *Lactarius* and *Rhizopogon* associated with *Pinus radiata* in south-central Chile

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Abstract

Pinus and *Eucalyptus,* being grown worldwide for timber and paper pulp industry, are depending on ectomycorrhizal fungi during their entire life cycle; especially *Pinus* is frequently found to be colonized by highly host-specific root mycobionts such as *Suillus* spp. or *Rhizopogon* spp. Although compatible fungi are usually not naturally present when the host tree genus is not native in the planted area, as in the case of Southern Chile, adventitious communities of ectomycorrhizal fungal partners with unknown origin are commonly observed along the extensive range of Chilean *Pinus radiata* plantations. We performed a molecular phylogenetic analysis focused on two taxa of *Lactarius* sect. *Deliciosi* and *Rhizopogon*, two very common but insufficiently studied ectomycorrhizal fungi in plantations of *P. radiata* in central Chile, in order to clarify both identity and origin of adventitious fungal strains. Based on ITS sequences from different specimens covering a larger distribution area, we identified the examined taxa as *Lactarius quieticolor* and *Rhizopogon roseolus*. This is the first record of *L. quieticolor* for South America and there is some evidence that the geographic origin of the examined strains of both species is in the Eurasian region rather than in North America where their host tree *P. radiata* is native, which raises the discussion how mycorrhizal partners of different geographical origins meet in an allochthonous area.

Keywords: Ectomycorrhizal fungi, *Lactarius quieticolor*, molecular systematics, rDNA ITS region, *Rhizopogon roseolus*

Introduction

On a global scale, timber and wood pulp industry is largely depending on a rather small number of fast-growing tree species, mainly conifers and *Eucalyptus* spp., some of which have also been extensively planted in regions outside their natural range of distribution due to their high stress tolerance in degraded areas and outstandingly fast harvest cycles which are superior to most native trees (Alvarez *et al.* 2013). *Pinus radiata* D. Don performs particularly well in Southern Chile where growth rates in certain areas even exceed those observed in its natural area close to the Mediterranean pacific coast of United States and Mexico (Muñoz 2008). All pines are obligatory ectomycorrhizal and their natural communities of symbiotic fungi are characterized by a high proportion of family- or genus-specific mycobionts such as *Suillus* or *Rhizopogon* (Smith & Read 2008). Although large-scale nursery treatment of forest trees with selected mycorrhizal inoculum is a rather new technique and still uncommon in most countries, naturally established mycorrhizal communities have existed for decades in plantations of *P. radiata* around the world, even thousands of miles away from their natural habitats (Mikola 1969). A striking example is the southernmost part of Southamerica which is far outside the natural distribution range of *Pinus*, so that most species of the pine-specific set of ectomycorrhizal mycobionts are also naturally absent (Garrido 1986; 1988). Native andino-patagonian forests in this geographical region are dominated by *Nothofagus* and of Gondwanean origin; their mycota shows a high degree of endemism, including most ectomycorrhizal species (Palfner 2001). A particular feature is the low diversity of Boletaceae and Russulaceae and the complete absence of genera like *Cantharellus* or *Lactarius*, common in conifer forests of the

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