

## How do rhizosphere bacteria influence on mycorrhizal synthesis of Japanese black pine ?

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Ridge & Theodorou ( 1972 ) found that fumigation with methyl bromide enhanced infection of *Pinus radiata* by *Rhizopogon luteolus* in a nursery soil. They concluded that this might have been related to different microorganisms recolonizing the soils. Bacteria from the mycorrhizosphere have been shown to enhance ectomycorrhiza formation and have been termed mycorrhiza helper bacteria ( MHB ). The mechanisms responsible for this 'Helper effect ' has been unconfirmed. We investigated some potential mechanisms of the 'Helper effect ' with two combinations; *Pinus thunbergii* - *Suillus granulatus* and *Pinus thunbergii* - *Wilcoxina mikorae*.

Numbers of bacteria were isolated from *Pinus thunbergii* (Japanese black pine) rhizosphere and their effects on the interaction between *P. thunbergii* and ectomycorrhizal fungi and those on the plant growth were investigated in vitro. The number of bacteria inhabiting rhizosphere (rhizobacteria) was ca.  $10^6$  cfu/g - soil. Sequencing analysis showed that they included *Pseudomonas* spp., *Bacillus* spp., *Ralstonia* spp., *Serratia* spp., *Streptomyces* spp., *Burkholderia* sp., and *Rhizobium* spp. The effects of the rhizobacteria on hyphal extension of two ectomycorrhizal fungi, *Suillus granulatus* and *Wilcoxina mikorae*, were examined in plate assay. These fungi showed different sensitivity to the rhizobacteria; the hyphal extension of *W. mikorae* was strongly affected by rhizobacteria, while that of *S. granulatus* was not. The effect of the rhizobacteria on mycorrhization rate was also studied using aseptic pine seedlings. *Pseudomonas* sp.1, *Bacillus* sp. and *Ralstonia* sp.1 significantly promoted ectomycorrhizal establishment of *S. granulatus*. On the other hand, *Serratia* sp.1, *Streptomyces* sp.1 and *Burkholderia* sp. suppressed the ectomycorrhizal establishment of *S. granulatus*. Plant growth-promoting effect was observed in some of the rhizobacteria that suppressed ectomycorrhizal establishment, while such effect was not found in any bacteria that promoted ectomycorrhizal establishment of *S. granulatus*. As for *Wilcoxina mikorae*, *Pseudomonas* sp.1 significantly promoted its ectomycorrhizal establishment, though other bacteria suppressed it. The results obtained in the present study suggested that some bacteria may possess positive effects on hyphal extension of their cohabiting mycorrhizal fungi and on its establishment. We also found that several isolates of bacteria enhanced plant growth regardless of ectomycorrhizal formation.