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Ectomycorrhizal colonization and intraspecific variation in growth responses of lodgepole pine

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Abstract Across different host plant species, the effects of mycorrhizal colonization on host growth parameters can vary, but intraspecific variation in this relationship has rarely been measured. We tested the direction and consistency of the relationship between ectomycorrhizal colonization level and growth responses across seed families of *Pinus contorta* var. *latifolia*. Root tips of seedlings from eight full sib seed families varied in levels of ectomycorrhizal fungal colonization from 39% to 100%. We observed positive, negative, or neutral relationships between colonization level and shoot mass, depending on plant family. For the majority of seed families no relationship was observed between colonization level and root mass; however, two seed families showed negative relationships. Shoot height differed only by seed family. Results from our study indicate that the relationship between colonization level and host growth depends on host genotype. We suggest that models of plant intraspecific interactions should consider ectomycorrhizal associations when assessing phenotypic variability.

Keywords Intraspecific variation · Phenotypic variation · *Thelephora terrestris*

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Introduction

Phenotypic variation in any organism is a product of its genotype, its environment, and their interaction. Both abiotic and biotic factors are ecologically significant components of an organism's environment. Because many tree species rely on ectomycorrhizal fungi for establishment and survival, variation in the identity and abundance of ectomycorrhizal fungi can impact seedling growth (Dickie et al. 2002). Thus, the presence of ectomycorrhizal fungi in soils is a critical dimension of the biotic environment with which trees will interact. The level of mycorrhizal colonization on root tips of host trees is an indication of the extent of the interaction between the fungi and the tree. Where the environment is a biotic factor (e.g., colonization levels of ectomycorrhizal fungi), the presence of genotype × environment interactions may show the potential for frequency-dependent coevolutionary selection. Here, we present preliminary results from a greenhouse experiment to indicate that the relationship