Phenotyping of bacterial effects on the growth and morphology of the ectomycorrhizal fungus *Laccaria bicolor* and identification of Mycorrhization Helper Bacteria in *Populus*

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This study complements and extends ongoing research on the use of *Populus* (the poplar tree) as biomass for a new generation of more efficient and environmentally friendly biofuels. The fungus *Laccaria bicolor* forms a mutually beneficial symbiotic relationship with poplar trees (via an ectomycorrhizal structure) by colonizing the plant’s roots. In addition, special bacteria, called mycorrhiza helper bacteria, promote the pre-symbiotic survival and growth of the fungus *L. bicolor*, and stimulate mycorrhizal formation. Thus, this multitrophic ectomycorrhizal complex improves gross production, nutrition and pathogen resistance of the host plant. In this study, we have identified specific bacterial strains that may work symbiotically with *L. bicolor* and three species of poplar, *P. tremuloides*, *P. deltoides*, and *P. trichocarpa*, to test in co-cultures. We initially co-cultured *L. bicolor* with each of the 23 bacterial strains, including our reference strain BBc6, without any *Populus* to evaluate how the fungi and bacteria acted together. Then we selected one strain that had the highest growth rate, GM18, to be co-cultured with the plants and to be compared to the BBc6 co-cultures with *Populus*. For the co-cultures, we used a poor carbohydrate medium called P20Th-, and spectrophotometry and centrifugation to prepare the bacterial strains. We co-cultured the three poplar species with *L. bicolor* and the two selected bacterial strains to test whether BBc6 works to help poplar (it is known to successfully help Douglas Fir), and to see if GM18 can also facilitate growth of the fungus and plant. The results of this experiment suggest that specific bacterial strains, BBc6 and GM18, can help *L. bicolor* in the formation of ectomycorrhizal structures with *Populus* roots.