MECHANISMS IN THE BIOCONTROL OF PYTHIUM DAMPING OFF OF COTTON WITH *TRICHODERMA VIRENS*

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Abstract

Recent research on the mechanisms employed by Q strains of *Trichoderma virens* to control *Rhizoctonia solani*-incited cotton seedling damping-off, indicates that antibiosis is much less important in the biocontrol phenomenon than induction of resistance in the cotton host by *T. virens*. These results have given rise to questions about the possible role of resistance induction in the biocontrol of *Pythium ultimum*-incited seedling disease of cotton, and its relative importance when compared to antibiosis. A comparison of parents and mutants of P strains of *Trichoderma virens* with respect to gliovirin production, induction of terpenoid synthesis in cotton, enzymatic digestion of pathogen hyphae, germination and growth from the air dried carrier, and biocontrol efficacy indicates that some mechanisms are more important than others in the biocontrol process. Mutants of *T. virens* that have lost efficacy as biocontrol agents of *P. ultimum*-induced cotton seedling disease still retain a capacity to induce terpenoid synthesis in cotton roots that is the equal of the parent strains. Mutants, however, that are deficient for production of the antibiotic gliovirin uniformly show reduced biocontrol efficacy when compared to the parent strains. This reduction is variable, however, with some mutant strains being much more adversely affected than others. Some mutant strains that are totally ineffective as biocontrol agents have lost both gliolvirin production and the ability to enzymatically degrade pathogen hyphae. This indicates that enzymatic degradation may also be of importance in the biocontrol process. The biocontrol efficacy of mutants that are deficient for production of the phytotoxin viridiol does not appear to be affected in any way. Both biocontrol-effective and non-effective strains may be deficient for viridiol synthesis. A surprising characteristic of one mutant was the capacity to parasitize the hyphae of *P. ultimum*, a phenomenon that was not observed with parent strains. Parasisitm, however, did not enhance the biocontrol efficacy of the mutant over that of the parent strains. Another very interesting phenomenon was the occurrence of a mutant that retains gliovirin production, induction of terpenoid synthesis, and enzymatic degradation, but that has lost biocontrol efficacy. This strain exhibits the characteristics of slow germination and development from the air dried biocontrol preparation. Since *P. ultimum* is a fast acting pathogen that can initiate pathogenesis within hours after planting, time is apparently of the essence when it comes to germination and metabolic activity by the biocontrol agent. The results of these mutational studies indicate that fully successful biocontrol of *P. ultimum*-induced cotton seedling disease by *T. virens* requires antibiotic production, enzymatic degradation of pathogen hyphae, and timely germination and development of the biocontrol agent from the air-dried preparation that is coated on the seed. Induction of terpenoid synthesis in seedling roots does not appear to be necessary for the control of Pythium damping-of f of cotton seedlings.

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