Title Modes of action of *Pantoea agglomerans* CPA-2, an antagonist of postharvest pathogens on fruits

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Abstract

Pantoea agglomerans CPA-2 is an effective antagonist against the postharvest pathogens *Penicillium digitatum* and *Penicillium italicum* on citrus fruits but its mode of action is unknown. Possible mechanisms studied in this work were antibiosis, induced resistance, competition and production of chitinolytic enzymes. *P. agglomerans* CPA-2 was unable to produce antibiotics or chitinolytic enzymes under the conditions tested. Induction of resistance by *P. agglomerans* CPA-2 was studied in oranges by measuring phenylalanine ammonia lyase and peroxidase enzyme activity in the orange peel at different time points after inoculation with the antagonist and/or the pathogen. No significant augmentation of enzyme activity after inoculation of oranges with *P. agglomerans* CPA-2 in the presence or absence of the pathogen was observed. *P. agglomerans* was effective only when it is in close contact with the pathogens. Competition for nutrients was studied using tissue culture plates with cylinder inserts, which allowed competition for nutrients to be studied without competition for space since physical contact between pathogen and antagonist was avoided. The presence of *P. agglomerans* in the tissue culture wells clearly decreased the germination of *Penicillium* conidia present in the cylinder when diluted orange peel extract or diluted potato dextrose broth was the nutrient source. Germination of *Penicillium* conidia, however, was almost completely inhibited when pathogen and antagonist were in physical contact. These results indicate that competition for nutrients is one of the modes of action of *P. agglomerans* CPA-2, but that physical contact between pathogen and antagonist is important for effective control.