

Title Disease control and plant defense pathways induced by *Bacillus mojavensis* isolate 203-7 and *Bacillus mycooides* isolate BmJ

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Abstract

The objective of this study was to investigate the plant defense pathways induced by *Bacillus mojavensis* isolate 203-7 (203-7) and *B. mycooides* isolate BmJ (BmJ) and to test their ability to control fungal pathogens on tomato and cucumber by means of systemic acquired resistance (SAR). An *Arabidopsis thaliana* mutant-*Botrytis cinerea* pathosystem was used to investigate plant defense pathways activated by 203-7 and BmJ. *A. thaliana* wild type (Col-0), *ein2-1*, *jar1-1*, *NahG*, *ndr1-1/npr1-2* , and *npr1-1* mutants were induced by application of bacilli, distilled water, or chemical inducers. Both bacilli reduced disease severity on wild type and *NahG* mutants, but provided no reduction on *jar1-1*, indicating that induction was salicylic acid (SA) independent but jasmonic acid (JA) dependent. 203-7 induced plants had lower disease severity on *npr1-1* and *ein1-2* mutants but were equivalent to buffer controls on *jar1-1* mutants. BmJ did not decrease disease severity on *npr1-1*, *jar1* or *ein2-1* mutants. Enzyme assays confirmed the induction of chitinase, β -1,3-glucanase, and superoxide dismutase by 203-7 and BmJ. These results demonstrate that induction by 203-7 is JA dependent and NPR1 independent. BmJ is SA independent but NPR1 and JA/ethylene dependent. Bacilli were tested for their ability to control *B. cinerea* grey mold on hydroponically grown greenhouse tomatoes and *Glomerella cingulata* var. *orbiculare* on cucumber by means of SAR. Weekly foliar applications of bacilli were able to significantly ($\alpha=0.05$) reduce the severity of grey mold leaf lesions and to reduce the area under the disease progress curve (AUDPC) calculated for seven *Botrytis* stem canker ratings. Chitinase, β -1,3-glucanase, and SOD activity of apoplastic fluids were not significantly ($\alpha=0.05$) increased by the treatments. Bacilli reduced total and live spore production of *G. orbiculare* per mm² of lesion and increased β -1,3-glucanase activity of cucumber apoplastic fluids. Applications of BmJ compared to fungicides for the control of anthracnose in cucumber (var. General Lee) and cantaloupe (var. Athena) were evaluated in 2004 and 2005 field

experiments. BmJ applied seven days before inoculation provided disease reduction in cucumber and cantaloupe statistically equal to the fungicide treatments.