Natthiya Buensanteai 2008: Mechanisms of *Bacillus amyloliquefaciens* KPS46 on Enhanced Growth Promotion and Induced Systemic Resistance Against Bacterial Pustule in Soybean. Doctor of Philosophy (Plant Pathology), Major Field: Plant Pathology, Department of Plant Pathology. Thesis Advisor: Associate Professor Sutruedee Prathuangwong, Ph.D. 148 pages.

B. amyloliquefaciens strain KPS46 isolated from healthy soybean rhizosphere that has been found to be effective in controlling various diseases and improving crop yield under greenhouse and field conditions, was studied for the ability to activate key elicitors in enhanced plant growth and induced systemic resistance of soybean plants. Soybean cv. SJ4 seeds treated with KPS46 increased root and shoot length, and biomass by more than 20-40% compared with nontreated control. Bioassay data showed that seedling growth phenotype increased by KPS46 was significant upregulation of elicited IAA, surfactin lipopeptide, and the 20-extracellular protein spots, whereas KPS46-UV mutant had no effect on enhanced plant growth with lower or without these signaling molecule productions. The result also demonstrated that KPS46 significantly increased amount of IAA production with the tryptophan increased in the DF salt minimal medium and the highest amount was obtained at the stationary phase of bacterial incubation.

The investigation also revealed that bacterial pustule reduction regarding soybean leaf area infected by *Xanthomonas axonopodis* pv. *glycines* (*Xag*) of KPS46-treated SJ4 seeds was a pattern of induced systemic resistance (ISR) associated with the accumulation of phenolic content and defense related enzymes of increased β-1,3-glucanase and peroxidase activity levels in plants. Moreover, when KPS46 treated seeds of cv. Spencer and the latter seedling primed with *Xag* inoculation, KPS46 was able to activate both rapid salicylic acid (SA) and delayed jasmonic acid/ ethylene (JA/ET) dependent pathways of induced systemic resistance in plants with high and low production levels respectively. However, KPS46-treated root of Arabidopsis mutants and challenge inoculated with pathogenic *Pseudomonas syringae* pv. *tomato*, the JA/ET- insensitive mutant plant showed higher disease severity than SA-insensitve mutant one. These results suggest that KPS46 induces plant resistance against diseases by pathways that requires either SA or JA/ET signaling molecules depending on pathogen and plant species.

The proteome of KPS46-treated cv. Spencer seeds and primed with *Xag* inoculation secreted various defense related proteins including PR1A precursor, catalase, lectin, heat shock protein, ascorbate peroxidase, stress inducible protein SAM22, peroxiredoxin and P21 protein to inhibit disease development. This is the first study to examine the interaction among soybean, KPS46, and *Xag* using biochemical and proteomic level assays that the 20-extracellular proteins secreted by KPS46 appear to function by triggering in the plant pathway responsible for PGPR and ISR. More study of these signaling elicitors is required for the efficacy of improved plant health.

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