CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
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Project Number
S1911

Project Title
Synergistic Combinations of Mutualistic Epiphytes as Biocontrol Agents against Pseudomonas syringae

Abstract

Objectives/Goals
The objective of this project is to design a more targeted and effective biocontrol agent to reduce the impact of bacterial brown spot disease on green beans. I hypothesized that a greater diversity of leaf bacteria would increase nutrient utilization and antibiotic production against the pathogen, Pseudomonas syringae, protecting the plant from disease.

Methods/Materials
Investigation consisted of inoculating bean leaves with different combinations of antagonists before infection with the pathogen, testing for antibiotic production on agar plates, nutrient utilization profiling, and quantification of naturally occurring bacteria on leaves. Mutant strains inhibited in antibiotic production were tested for confirmation.

Results
My hypothesis was conditionally supported; if the combined strains were compatible, inhibited P. syringae, and competed for similar nutrients, the plant was protected from the pathogen to a degree greater than either individual strain. The results of experimentation showed that the increased population density of epiphytic bacteria on wet control plants generally reduced disease severity by half. Cyclic antagonism of A505, A534, and P. syringae resulted in low lesion counts overall, and the passive combination of A501 and A530 likely reduced lesion numbers through competitive exclusion of the pathogen.

Conclusions/Discussion
The combination of A533 and A538 was most effective in reducing disease severity through their additive antibiotic production and nutrient competitive exclusion. The synergistic combinations of protective bacteria has the potential to employ the strengths of multiple antagonists to control pathogens on a flexible range of crops.

Summary Statement
I combined protective epiphytic bacteria based on their antibiotic production and nutrient utilization properties to effectively inhibit plant pathogens.

Help Received
Prof. Steven Lindow and Renee Koutsoukis at UC Berkeley provided laboratory access, bacterial strains, and advice on improving my idea.