



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

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Project Title Evaluating Peronospora Presence in Salinas Valley & Analyzing DNA Similarity in Downy Mildew Pathogens Affecting Spinach	
Abstract Objectives/Goals Downy mildew is one of the most destructive plant pathogens across the globe, and the major production constraint on the \$200,000,000 spinach industry in California, the majority of which is grown in the Salinas Valley. Fungicides are costly and time-consuming. They may also stain spinach leaves (copper residue) making even healthy plants unmarketable. Yet they are effective only when immediately applied. Though all downy mildew look exactly the same, only one species <i>Peronospora effusa</i> can infect spinach. 1. There is a need to be able to quickly accurately distinguish an unknown downy mildew to screen seeds and plants alike, and determine whether fungicides are necessary. 2. Understand how isolates <i>Peronospora farinosa</i> f.sp. <i>betae</i> and <i>Peronospora farinosa</i> f.sp. <i>cicla</i> (found in Salinas Valley) are related to the rest of the <i>Peronospora</i> genus. 3. Assess whether <i>Peronospora</i> is a threat in the Salinas Valley. Analyze how it spreads, and propose solutions. Methods/Materials We screened crops and commercial seed for <i>Peronospora</i> using industry approved methods. We used <i>E.Coli</i> to clone the internal transcribed spacer (ITS) region, purified the DNA and sent it for Sanger sequencing to find genetic variations in <i>Peronospora</i> . Next, we created a phylogenetic tree to better understand how the species are related. Results <i>Peronospora</i> filaments were repeatedly found on commercial seed and on crops in the valley. Genetic variations were found between the isolates we sequenced and <i>Peronospora effusa</i> . <i>Peronospora farinosa</i> f. sp. <i>betae</i> and f. sp. <i>cicla</i> have the exact same ITS sequence. Interestingly they are more closely related to the <i>P. effusa</i> than they to other <i>P. farinosa</i> that attack the <i>Chenopodiaceae</i> family of plants. Conclusions/Discussion Genetic differences make it possible to identify unknown isolates and determine whether to use fungicides. <i>Peronospora</i> is systematically evading seed screening procedures, because spinach screening techniques involve culturing seed debris on agar from 20C-25C. <i>Peronospora</i> is an obligate parasite and cannot survive on agar. It prefers cool temperatures and degrades at these high temperatures. Seed debris should be cultured at about 13°C on spinach leaves, not agar.	
Summary Statement We discovered downy mildew is infecting SalinasValley spinach and spreading by contaminated seed;we developed a way to identify the lethal pathogen, and proposed more effective seed screening methods to prevent further spread of <i>Peronospora</i>	
Help Received We thank Ms. Amy Anchieta and Dr. Steve Klosterman for being our mentors for this project--they permitted us to use USDA equipment, and taught us basic laboratory procedures. The experiment was designed and conducted entirely by ourselves.	