CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
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Project Number
34145

Project Title
Molecular Characterization of Wild Beet in the Imperial Valley's Commercial Sugar Beet Fields

Abstract

Objectives/Goals
Wild beet poses a major risk to the 1.2 billion dollar sugar beet industry in the US, since hybridization will allow the glyphosphate resistance gene to transfer to the wild beet. This would render RoundUp, currently the most effective herbicide for wild beet, ineffective.
1. I needed to determine if hybridization has occurred between the wild beet and sugar beet and understand the likelihood of future crossing.
2. I identified geographic areas where wild beet are more likely to obtain resistance.
3. I characterized the wild beet to identify it.
4. I developed a quick and inexpensive test for glyphosphate resistance.

Methods/Materials
I had three phases in my project. In the first phase, I did fragment analysis of 32 SSR markers on the plants and analyzed it to yield its population structure. I verified these results by doing Sanger sequencing the ITS sequences and creating a phylogenetic tree. Next, I mapped the geographic location information of the wild beet with their corresponding population structure to find any correlation between them. Finally, I tested several concentrations of RoundUp to determine if a lower concentration can show whether a plant has glyphosphate resistance.

Results
Phase 1: Hybridization has likely already occurred between the wild beet and sugar beet and can occur again in the future, according to both the population structure and phylogeny.
Phase 2: All of the hybridized wild beet plants are only in the southern part of the Imperial Valley.
Phase 3: The lower concentration of RoundUp was able to kill or show damage on all the plants that do not have glyphosphate resistance and can inexpensively and quickly be used to test for it.

Conclusions/Discussion
Both the phylogenetic tree and population structure suggest that hybridization has most likely occurred, so gene flow between wild beet and sugar beet is a real threat. Both of them also identify the wild beet as being Beta macrocarpa. By comparing geographic location with population structure, I found that special attention must be placed in the southern part of the Imperial Valley to avoid future hybridization. Finally, the chemical assay that I developed can be used to inexpensively and quickly test for glyphosphate resistance.

Summary Statement
I have determined that hybridization between wild beet and commercial beet is a real threat and the area where this threat is the greatest is in the southern part of the Imperial Valley.

Help Received
I thank Dr. Richardson, Ms. Maria Meza, and Ms. Linda Pakish for being my mentors for this project. They permitted me to use USDA equipment, and taught me basic laboratory procedures. The experiment was designed and conducted entirely by myself.