Integrated Conventional and Genomic Approaches to Almond Rootstock Development

Project Leaders: Malli Aradhya[1], Craig Ledbetter[2], Daniel Kluepfel[3], Gregory Browne[3], and Andreas Westphal[4]

[1]USDA/ARS, National Clonal Germplasm Repository (NCGR), UC Davis, One Shields Ave, Davis, CA 95616 (530) 752-9392, mkaradhya@ucdavis.edu;
[2]Crops Diseases, Pests, and Genetics, USDA/ARS, 9611 S. Riverbend Ave., Parlier, CA 93648; (559) 596-2817, craig.ledbetter@ars.usda.gov;
[3]Crops Pathology and Genetics, USDA/ARS, Davis, UC Davis, CA 95616, dakluepfel@ucdavis.edu and gtbrowne@ucdavis.edu;
[4]UC Riverside & Kearney Ag. Center, S. Riverbend Ave., Parlier, CA 93648, andreas.westphal@ucr.edu

PROJECT SUMMARY

Objectives:

- Produce genetically diverse *Prunus* interspecific hybrids with potential donors of resistance to soil borne diseases.
- Genotype and evaluate rootstock breeding populations for resistance to soil borne diseases.
- Perform association analysis to develop efficient marker assisted selection strategies.

Background and Discussion:

Rootstocks resistant to soil borne diseases are crucial for sustainable production of almonds in California. In this project, we are focusing on developing rootstocks with host-plant mediated field resistance. Cultivated and wild relatives of peach, almond, and plums are important donors of durable resistance to soil borne diseases (*Agrobacterium* induced crown gall [CG], Phytophthora [PHY] root and crown rots, and root-knot [RK], root-lesion [RL] nematodes [(NEM]), and drought tolerance. Extensive hybridization to produce genetically diverse hybrids, embryo rescue of interspecific hybrids, and clonal propagation for comprehensive disease evaluation are the keys to identifying resistant or tolerant rootstock hybrids. Graft compatibility, propagability, and drought tolerance are important measures for successful rootstock breeding program. During the past five years, 68 different cross combinations in 141 different interspecific hybrids involving cultivated and wild species of peach, almond and plum were produced, embryo rescued, and clonally propagated to produce clonal plants for disease evaluation. We are using Genotyping-by-sequencing (GBS) based single nucleotide polymorphisms (SNPs) to genotype rootstocks. A SNP marker associated with the crown gall resistance has been identified. Highlights of the breeding program:

- Evaluated 61 hybrids for resistance to crown gall for two years, nematodes (root-knot and root-lesion) for one year. Twenty-one hybrids from three cross combinations were tested against Phytophthora root and crown rots.
- Tentatively identified a number of hybrids showing promising levels of tolerance to soil borne diseases and are under further evaluation.
- Twenty-two hybrids were produced during 2016 spring, embryo rescued and clonally propagated to produce ~5100 plants for disease evaluation, and are undergoing disease evaluation for PHY/CG/NEM.
- Twenty-seven hybrids were produced during spring, 2017 and are undergoing embryo rescue and propagation at the Sierra Gold Nurseries.

Project Cooperators and Personnel: John Preece, Carolyn DeBuse, and Jeff Moersfelder, USDA/ARS, NCGR, Davis, CA; Dianne Velasco, Emily Johnson, Georgia Drakakaki and Tom Gradziel, UC Davis; and Chuck Fleck, Sierra Gold Nurseries.

For More Details, Visit

- Poster location 94, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2018) at Almonds.com/Research Database
- 2016 - 2017 Annual Reports (16-HORT16-Aradhya/Ledbetter) on the web at Almonds.com/Research Database
- Related project: 17-HORT10-Gradziel