Integrated Conventional and Genomic Approaches to Almond Rootstock Development

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PROJECT SUMMARY

Objectives:

- Produce genetically diverse interspecific hybrids *with Prunus* spp. that are potential donors of resistance to soil borne pathogens.
- Develop effective marker-assisted selection strategies to improve selection response for rapid development of resistant rootstocks.
- Disease testing of commercial and experimental rootstocks to produce high quality disease and nematode phenotype data.

Background and Discussion:

The soil borne diseases of almond, *Phytophthora* (PHY) rots, *Agrobacterium* induced crown gall (CG), and lesion and root knot nematodes (NEM) are the major limiting factors in orchard/nursery productivity and orchard longevity. Well-adapted, improved rootstocks would provide a critical foundation for the Accelerated Innovation Management (AIM) goals of the California almond industry. Currently used rootstocks have various sensitivities to soil conditions (e.g., salinity, water logging, and drought stress) or soil borne pathogens reducing productivity per unit of water applied and increasing dependency on pesticides. The ongoing rootstock breeding program addresses these problems by exploiting host-plant mediated disease resistance, which is known to be durable and contributes for sustainable production of almond. The program generates hundreds of diverse *Prunus* hybrids annually using potential disease resistance donor species and genotypes. It also focuses on developing genomic tools to improve selection efficiency and rapid development of rootstocks.

During spring 2016, the program produced a number of diverse hybrids; almond (*P.dulcis*) x peach (*P. persica* and wild peaches, *P. mira, P. kensuensis, P. davidiana* and 'Nemaguard'), and peach (*P. persica*) x wild almonds (*P. fenzliana, P. P. tangutica, P. bucharica*, and hybrids (*P. dulcis* x *P. argentea* and *P. dulcis* x *P. bucharica*, and wild peach (*P. mira*). Currently 100 hybrids are undergoing embryo rescue and clonal propagation at Sierra Gold Nursery. We also have seeds germinated of some of these hybrids, which will be clonally propagated to increase numbers for disease evaluation. We conducted two rounds of crown gall evaluation of 40 hybrids produced in previous years and the same set is in Phytophthora and nematode testing trials.

We have identified eight promising hybrids with high levels of resistance to CG (P2-4, P4-25, P4-10, 197-199, 197-217, 197-113, L1-2 and P2-4) and the last two genotypes have shown tolerance to PHY root rot. We will further strengthen single nucleotide polymorphism (SNP) discovery by following genotyping by sequencing approach to associate markers with disease resistance loci. We have identified a marker linked to CG resistance and we are in the process of validating this association. We will collaborate with Georgia Drakakaki, plant sciences, UC Davis to decipher cellular processes governing salt and drought tolerance in almond rootstocks.

Project Cooperators and Personnel: John Preece and Carolyn DeBuse, USDA/ARS, NCGR, Davis, CA and Georgia Drakakaki and Tom Gradziel, UC Davis.

For More Details, Visit

- Poster location 46, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2017) at Almonds.com/Research Database
- 2015 - 2016 Annual Reports CD (15-HORT16-Aradhya/Ledbetter); or on the web (after January 2017) at Almonds.com/Research Database
- Related projects: 16-HORT10-Gradziel;16-PATH1-Browne (COC); 16-PATH7-Duncan/Baumgartner (COC); 16-HORT23-Drakakaki (COC)