Rootstock Improvement

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Project Summary/Abstract

Briefly describe the long-term objectives for achieving the stated goals of the project.

Develop improved Prunus Rootstocks.

A. Separate out general hybrid-vigor effects from specific major gene control of desired rootstock traits to allow more predictable progress by public and private breeding programs targeting rootstock improvement.
B. Compile a more comprehensive knowledge of breeding value and deficiencies for this genetically diverse germplasm.
C. Improve methods to generate and clonally propagated large interspecies-hybrid populations to capture targeted traits within a commercially viable background. Concurrently, developed methods to generate large segregating progeny populations from species and hybrids in order to sort out major gene effects of Objective A.
D. Generate new and diverse species-hybrids with promising rootstock potential for testing and selection. Also, develop and test methods for generating binary or chimeric rootstocks, that is, rootstocks combining 2 or more segments from different species.

Scope of Work

Describe the goals and specific objectives of the proposed project and summarize the expected outcomes. If applicable, describe the overall strategy, methodology, and analyses to be used. Include how the data will be collected, analyzed, and interpreted as well as any resource sharing plans as appropriate. Discuss potential problems, alternative strategies, and benchmarks for success anticipated tQ achieve the goals and objectives.

Changes in almond and peach management practices have led to the need for a new generation of rootstocks. Responding to this need, a number of public and private efforts have been initiated to research, develop and test new rootstocks for almond and related stone fruit. Germplasm derived from interspecies hybrids is often pursued to attain the largest possible range of vigor and desirable horticultural traits; however, the acquisition of such exotic germplasm is often difficult and time-consuming. As part of the long-term almond and peach scion development programs at UCO, breeding strategies have been developed for combining almond, peach and plum as well as related Prunus species including P. argentea, P. bucharica, P. davidiana, P. fenzliana, P. domestica, P. mira, P. orthosepala, P. scoparia, P. tangutica and P. webbii. Selections within this breeding germplasm have demonstrated traits that appear desirable for rootstocks, including high vigor, possible salinity and disease tolerance, and modified scion architectures facilitating high-density orchard plantings. In the 1st year of this project (2017-18), UCO interspecies germplasm has been propagated and made available along with current RosBreed molecular marker data (where available), to interested public and private rootstock programs (Ref. 1-4, 8 & Appendix). The ongoing Industry sponsored Rootstock Workgroup has identified the need for further improvements in: Germpiasm access (availability of large segregating populations for multi-trait selection), Complexity (genetic diversity as well as the successful species/interspecies recombination of these diverse traits into a commercially viable background), and Quality (identify those traits that are under sufficiently strong genetic control {i.e. heritable} to allow a reasonable probability of their successful identification, transfer and recombination to achieve the multiple productivity and resistance traits required in future commercial rootstocks).

In 2019-20 this project will continue testing and data compilation while introducing new species hybrid combinations based on prior year performance. Germplasm derived from interspecies hybrids is often pursued to attain the greatest range of vigor and desirable horticultural traits. However, the development of such exotic germplasm is often difficult and time-consuming and, as has been recently shown with the UCB1 pistachio hybrid rootstock; the genetic, genomic and cultural interactions can be complex and unpredictable. As part of our long-term UCO almond and peach variety development programs, breeding lines have been developed combining almond, peach and plum as well as related Prunus species. Early selections within this germp.l asm have demonstrated traits that appear desirable for rootstock/interstocks, including possible drought, nutrient, insect and disease tolerance, and modified scion size/structure. This germplasm is being made available to interested public and private rootstock development programs as clonal and seedling material. Over 3,000 genotypes derived from this diverse UCO germplasm including peach (P. persica), almond (P. dulcis), P. mira, P. davidiana, P. scoparia, P. tangutica, P. webbii, P argentea, P. orthosepala, and P. bucharica have been tra_ nsferred for evaluation in several public and private programs for resistance to drought, salinity, boron toxicity, as well as diseases and pests. The development of effective molecular markers is considered crucial to efficient interspecific rootstock breeding in order to develop markers targeting desired as well as undesired traits, and to determine species pedigree and trueness-to-type. However, an initial UCO analysis, as part of our RosBreed project, identified aberrant marker inheritance patterns in some of our almond by peach hybridization and introgression lines. The ongoing RosBreed project at UCO, while targeting molecular markers for peach, also makes available opportunities to utilize established markers to explore this related germplasm. This project leverages these previously established germplasm and collaborator resources allowing a more comprehensive assessment of marker reliability and inheritance following wide crosses in almond, peach, plum and closely related species.