

Oregon Department of Agriculture and Oregon Association of Nurseries  
Nursery Research Project Final Report 2017

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**Title:** Developing sterile forms of economically important nursery crops

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### **Background**

Oregon is among the nation's leaders in production and export of nursery stock, with approximately 80% being shipped outside the state. Unfortunately, some of the species that the nursery and landscape industries have historically relied on have begun to show signs of weediness or in some cases invasiveness. Some crops are being banned in some states or regions (e.g. maples in New England) and others simply are known to produce seedlings in a garden situation (e.g. althea). The Ornamental Plant Breeding Program at Oregon State University has been addressing some of these species over the past seven years. A brief background of several ongoing projects that have been previously funded follows.

**Cherrylaurels.** The estimated wholesale value of cherrylaurels for 2011 in Oregon was between \$17.1 and \$36.4 million. Common cherrylaurel has several deficiencies that could be addressed through breeding including weedy tendencies, excessive fruit litter, quarantine due to western cherry fruit fly, and leaf shothole disease under production conditions. Groups such as the Native Plant Society of Oregon are giving more attention to common cherrylaurel as an invasive species and currently consider it a medium-high impact species. Portugese laurel shares many of the same outstanding characters as common cherrylaurel such as tolerance to sun and shade and pH adaptability but is more tolerant to heat and drought stress and is not susceptible to leaf shothole disease. Fruit development is also prolific in this species and it has started to receive similar attention as common cherrylaurel regarding invasive potential. **Our goals are to 1) develop sterile forms of common cherrylaurel that exhibit the typical phenotype that consumers are used to and 2) develop sterile hybrids of common cherrylaurel x Portugese cherrylaurel that exhibit shothole disease resistance.**

**Maples.** Oregon is the leading producer of shade trees for the US and maples are among the most commonly produced and planted trees across the country. However, several important maple species have been identified as invasive and some have been banned including amur maple in Connecticut and Norway maple in Connecticut and Massachusetts. Other economically important maple species also produce copious amounts of seed, such as trident maple. This species is not yet regulated but the potential remains unless sterile forms can be identified. I propose that development of sterile forms prior to regulation by government agencies will allow producers to continue to grow and market each of these species. We have developed tetraploids of Norway, trident, and Amur maple – as well as triploids of the latter two.

**Our goals are to continue developing more triploids from which superior clones may be selected that exhibit various trait combinations such as leaf colors (new growth, growing season, fall color) and growth forms (fastigate, standard, columnar, etc.).**

**Rose-of-sharon.** The US National Arboretum introduced four rose-of-sharon cultivars described as sterile triploids including 'Diana', 'Minerva', 'Aphrodite', and 'Helene'. These cultivars have since been observed to produce substantial amounts of seed. We began a breeding program to investigate several aspects of reproductive behavior of these and other cultivars. Of particular interest is 1) what is the actual ploidy level of available cultivars, 2) what is the relative fertility of available cultivars, and 3) how are ornamental traits such as eye spot, double flowers, and flower color inherited? We have largely answered the first two questions and are working on the third.

We have identified ploidy levels and fertility of most commercially available cultivars. We also have developed many pentaploid (5x) plants that are being evaluated. Our goal is to use these data we have collected over the last two to three years to develop improved althea (rose-of-sharon) cultivars that are sterile

and exhibit new combinations of traits. We also have expanded our work into those cultivars that resulted from crosses between *H. paramutabilis* x *H. syriacus*.

### Methods and Timeline

**Cherrylaurels:** We will assess fertility of our polyploid forms of 'Otto Luyken' and 'Schipkaensis' in comparison to standard genotype at flowering, which we hope to be spring 2017. We have confirmed that polyploids root equally well as untreated plants, which is essential for production. We also developed 4 polyploid forms of Portugese cherrylaurel (16x). After these plants flower they will be extensively crossed (including reciprocals) with common cherrylaurel. We believe the polyploid Portugese cherrylaurel (16x as opposed to wild-type 8x) will give us a better chance of recovering hybrids with common cherrylaurel, which is a 22x. It is unclear if these plants will flower in 2017 but we will force them as much as possible to encourage growth. We will continue observations of 44x 'Schipkaensis' plants that appear to have increased shothole resistance – possibly distributing plants for limited testing in 2017.

**Maples:** We confirmed that tetraploid norway maples have remained stable over the past nearly 5 years. Four of these plants flowered in 2015 and did not set any seed. It is possible that these tetraploids will exhibit an acceptable level of fertility and we could select among them. Ten genotypes were propagated and we are collaborating with J. Frank Schmidt and Sons who are providing a second location for long-term observation to determine if the tetraploids are sterile. One tetraploid norway maple flowered in 2016 and we collected **471 seed** 12 September 2016 and are being stratified.

Interploidy crosses of amur maples from spring 2015 are germinating and will be tested to keep triploids. We collected **3,574 seeds** from tetraploids interplanted with diploids that are being stratified. One *Acer buergerianum* tetraploid flowered this year and we collected **793 seed** that are being stratified. Also, we have 1 triploid from our original treatments that we are trying to propagate from cuttings to test for performance.

**Rose-of-sharon (althea).** We are continuing to evaluate 2015 progeny them based on flower size, color, and petal number to keep the top 2% of plants with regard to each trait. The criteria for each trait was greater than 3500 mm<sup>2</sup> for petal area, petal number greater than 50, and an "L\*" value less than 58. L\* refers to the depth of color; the lower the value, the richer the color. Superior progeny from 2015 crosses will be field planted fall 2016.

Eighteen (18) 5x plants currently are in the glasshouse for controlled crossing to test fertility. We have been using various fertile parents, as determined from previous years' crossing data, to make crosses using these 5x plants as females. Thus far we have made more than 300 pollinations and more than 250 capsules have aborted – many more are likely to abort. It appears these will be largely infertile as predicted.

We have more than 800 seedlings that are putative backcrosses of interspecific hybrids either to *H. syriacus* or *H. paramutabilis*. These plants are beginning to flower are being evaluated for novel floral traits, improved growth, and fertility. Additionally, Hsuan Chen, Ph.D. student is confirming hybridity using ISSR markers. There are highly ornamental and novel flower types in this population that we are propagating for evaluation. Due to their complex pedigree, we expect very low levels of fertility, which we will confirm in 2017.

### Budget Summary

#### Salary

<b>Faculty Research Assistant (25% FTE)</b>	\$11,250
Other Payroll Expenses (OPE) (OSU health benefits, insurance, retirement)	\$6,750
<b>Student workers</b>	\$5,000
Other Payroll Expenses (OPE)	\$600
<b>Indirect costs</b>	<b>\$6,136</b>
<b>Total</b>	<b>\$23,600</b>

## FINAL REPORT FROM YEAR'S FUNDING

### ***Cherrylaurels.***

The 16x portugese cherrylaurels did not flowering 2017. However, they have grown well. I am uncertain how long the juvenility period will be for these plants, as induced polyploids often are delayed compared to wild-type ploidy. 44x 'Schipkaensis' have continued to display only minor signs/symptoms of shothole disease. We have replicates of various ploidy levels of both 'Otto Luyken' and 'Schipkaensis' (22x, 33x, 44x) that we are observing for shothole disease. We have confirmed ability to propagate varied ploidy levels by stem cuttings.

Work associated with this project has been published in three peer refereed publications listed below. We have conducted preliminary studies to facilitate in vitro germination of seeds once we cross 16x portugese cherrylaurels x 22x common cherrylaurel.

Schulze, J.A. and R.N. Contreras. 2017. In vivo chromosome doubling of *Prunus lusitanica* and preliminary morphological observations. HortScience. 52(3):332-337.

Schulze, J.A., R.N. Contreras, and C.F. Scagel. 2017. Comparing vegetative propagation of two 'Schipkaensis' cherrylaurel ploidy levels. HortTechnology 27(1):69-72.

Schulze, J.A., J.D. Lattier, and R.N. Contreras. 2017. In vitro germination of immature *Prunus lusitanica* seed. HortScience 52(8):1122-1124.

These manuscripts are all available for download by visiting <http://horticulture.oregonstate.edu/content/ryan-contreras>.

### ***Maples.***

We collected and sowed a total of 4,783 seeds from tetraploid forms of Amur, Norway, and trident maples in 2016. We recovered 372 seedlings of Amur maple including 211 triploids, 40 tetraploids, and 8 pentaploids. We recovered 53 seedlings of Norway maple, 47 of which were triploids. No seedlings were recovered from the seed collected from the tetraploid trident maple. Overall germination was greatly reduced in tetraploids compared to diploids. In Amur maple it ranged from 4% to 14%, in Norway maple it was 13%, and was 0% in trident maples.

We have collected seeds from 5 tetraploid Amur maples in 2017 and will be collecting seed from two Norway maples. Based on conversations with other breeders and a search of the literature, I believe that I have created the largest populations of triploid maples anywhere and we are continuing to increase the populations. My hypothesis is that these maples will be sterile and will be critical in returning these species to prominence.

### ***Rose-of-sharon (althea).***

We continue expanding our work in althea and a complete report of all efforts in *Hibiscus syriacus* and related hybrids is beyond the scope of the current report. However, testcrosses from 5x plants developed in 2012 and 2013 were found to have an average of 1.1 seeds per capsule compared to 18 seeds per capsule in 4x plants typically found in the industry. This is a 94% reduction in fertility. In 2015 and 2016 we continued developing hundreds more 5x plants. These plants all will have similar reduction in fertility and have a broad range of ornamental traits, as we developed them from a broad background. We have approximately 50 selections of 5x plants that are equal or superior to industry standards – a subset of these were propagated by stem cuttings for future evaluation.