Oregon Department of Agriculture and Oregon Association of Nurseries

Nursery Research Project Proposal 2023

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TITLE: New cultivars of nursery plants with novel ornamental traits and disease resistance

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BACKGROUND:

The Ornamental Plant Breeding Program at Oregon State University has grown into one of the leading university breeding programs in the US by developing a scientific basis for crop improvement and contribution to the scientific knowledge base. While we have been growing the background knowledge (e.g. genome sizes, disease resistance, heritability of ornamental traits) on a multitude of crops we have simultaneously been improving many crops. I have released one flowering currant in 2014, and two new cotoneaster cultivars during 2018 and 2019 that met our criteria. To reach greater market potential, the latter cultivars are being marketed by Plant Haven – a decision that was made after seeking much industry input from many conversations at-large as well as with the Ornamental Plant Breeding Crop Advisory Committee (OPCAC), which currently includes industry representatives (Jeff Stoven, Laurie Rogers-Roach, Mark Bigej, and Guy Meacham). There are seven (7) projects briefly outlined below that I am requesting continuing or new funding.

Lilacs. Growers have shared many times that they would like an alternative to Bloomerang® that grows better in production and has a more prolific second flush of flowers. We have been breeding with many related cultivars (e.g 'Miss Kim', 'Palabin', 'Josee') that are reliable growers. The hybrids we have developed show a broad range of phenotypes and many shown great promise. After field observations and propagation of six (6) selections, we are focusing on 3 that have merit and we are evaluating for ultimate release. One is a standout and is being increased by a cooperating nursery who has visited numerous times and shown great enthusiasm to release our plants. These selections are without disease symptoms, have strong rebloom, and are vigorous. We identified and published research involved in the first step to develop useful markers for reblooming in lilac. Control of reblooming is a two-gene model (Chen et al., 2020) and are working with Kelly Vining (bioinformatics) to transform these into markers we will use to screen future populations. We sequenced Bloomerang, which will serve as our reference genome onto which we will arrange our other DNA markers and advance the marker assisted selection (MAS) process. During 2020 I developed additional populations that will be used to validate our markers along with more sequencing of these genotypes. Once I deploy these markers our lilac breeding will be revolutionized by streamlining. Instead of growing 500 plants and only 100 may have the genes for reblooming, we can germinate 1,000 plants and screen them such that we only grow plants with the genes. We may end up growing the same number of plants to evaluate, but all or most of the plants will have our trait of interest. I am not aware of anyone else using similar modern genetic and genomic tools in lilac breeding.

In common lilacs, we have focused on floral traits (e.g. picotee, double, intense color), foliar traits (purple leaves from 'Old Glory'), and blight resistance (primarily from 'Old Glory'). We initially planted 68 hybrid selections from our various crosses that had shown no symptoms of blight and had good form for three years in containers, but I was disappointed to see the relatively high incidence of *Pseudomonas* in the field planted material during 2022. This highlights the need for long-term evaluation and the impact of environment. However, there remains several promising selections that were flagged for propagation and continued observation. We are continuing to grow our first F_2 generation by collecting open-pollinated seed from our first hybrid crop. Additionally, we made additional crosses with 'Sensation' in combination with 'Old Glory', 'Prairie Petite', and others in continued efforts to produce

more phenotypic variation. This project is slow, as plants often take several years to flower and disease symptoms can be delayed.

Cotoneasters. We released 'Emerald Sprite' and 'Emerald Beauty', which is a replacement for 'Coral Beauty' that is more disease resistant and more densely branched than the industry standard. Intersubgeneric hybrids continue to be of high interest scientifically and I believe have merit for their increased hardiness and potential fire blight resistance. The first was developed in 2011 (H2011-01-002) but has not "taken hold", as industry input is that a deciduous cotoneaster is less desirable unless it produced fruit. However, this selection along with other similar hybrids we envision, have potential to be disease resistant and at least a zone or two hardier than plants 'Emerald Sprite' or 'Emerald Beauty' – and also are sterile. I heed the guidance of industry while maintaining some efforts in this area. Regardless of parentage, fire blight will continue to be a major focus and all parents and progeny are/will be screened. One very interesting area we have pursued is determining the resistance of our cultivars (and industry standards) to a mutant isolate of fire blight that overcame the Mr5 resistance from apple, which had previous been impervious to the pathogen. 'Emerald Sprite' maintained a high degree of resistance, while 'Emerald Beauty' still outperformed 'Coral Beauty'. An exciting new hybrid between 'Emerald Sprite' x *C. apiculatus* was propagated and tested for fire blight during spring/summer 2021 and was symptom free. We are advancing to replicated trials. The plants have not flowered yet but have excellent habit and foliage traits.

Styrax japonicus. To combine the weeping habit of Marley's Pink (MP) and Fragrant Fountains (FF) with the purple foliage of Evening Light (EL), we made crosses in 2016 and have 15 hybrids between EL and MPP as well as 8 hybrids of EL and FF. This is an exciting population that impresses more as it matures and there may be 3-4 viable cultivars among them including glossier and vigorous weepers, better purple-upright forms, but most notably there are two purple weeping selections. One is superior in foliage color and the other is a superior grower. Plants flowered in 2019, including a remarkable purple, weeping selection with pink flowers that has been propagated and shared under an MTA with Ekstrom Nursery, Blue Heron Farms, Robinson Nursery, and Hans Nelson and Sons to assist in building numbers for additional testing and release. One major international brand is interested in releasing and approval was received from the OAN Research Committee in 2021. In addition to the outstanding purple weeping selection that has been propagated and numbers increased, we have grown out a large population of seedlings from varying crosses of purple x weeping. These F2 seedlings were potted into #1 during October 2022 and will be grown on for phenotyping in 2023 for segregation of color and weeping to determine how these traits are inherited and what the genotypes of Evening Light, Marley's Pink, and Fragrant Fountains – in addition to newly developed selections from OSU.

Cercidiphyllum japonicum. Similar to the styrax project, we are combining the weeping habit of Amazing Grace (AG) and Morioka Weeping (MW) with the red foliage of Red Fox. Additionally, we would like to select a new red foliage form that is a better performer than Red Fox, as many growers have shared that they are dropping it due to poor performance. From the 102 F_1 hybrids field planted at the Lewis Brown we had two females and 8 males flower in 2020, from which we collected 1,800 seedlings and ultimately field planted 1,500 F2 plants. A late spring freeze killed the leaders on nearly all of the trees in the field, but we have retrained them and they are now putting on vigorous growth. As expected, we are seeing a wide range of phenotypes from slow and shrubby to vigorous and upright. Many are showing signs of varying degrees of weeping and range from emerald green to deep purple – bordering on black. I'm ever encouraged that we will identify superior growers and novel phenotypes from among the roughly 1,100 remaining plants.

Philadelphus. There is great opportunity for improvement in this genus. Many available cultivars lack fragrance, are rangy, or both. We have been combining traits from taxa such as *P. madrensis* and *P. mexicanus* with 'Snow White', 'Blizzard', 'Miniature Snowflake', and others. Our unique combinations of fragrance, form, and leaf traits set our selections apart from what I have observed. We rooted a total of 37 selections from stem cuttings in 2017, nine of which had potential as releases. We distributed 5 different selections during 2019. These have varied texture, size, and flowering

characteristics. While we are maintaining our larger collection, in 2020 we focused our efforts on more comprehensive production evaluation of these selections. As we transitioned to 2021, we focused on production blocks for growers to provide feedback as we prepare for release and patent. One important consideration we identified during 2019 is the extreme variability in rooting. We have identified successful methods to root superior selections. Additionally, in a side-by-side comparison, OSU selections are markedly better in production than Blizzard based on the lack of branching and overall poor growth of the latter. OSU selections exhibit finer texture, dense branching, and vigorous growth when treated the same. One national company is in the process of increasing numbers of one clone.

New cultivars of street trees. We need more options for street trees to replace ash and also compliment maples and other staples. To that end, we initiated a mutation breeding program in 2018. We treated thousands of seeds of *Quercus robur*, *Phellodendron amurense, Celtis occidentalis, Celtis koraiensis,* and *Zelkova serrata.* We planted 600 trees and then reduced to 75 trees that were spaded and spaced on 10-foot centers for long-term evaluation. Of note are selections derived from fastigiate English oak that had good form (without pruning) and no powdery mildew, good forms of amur corktree (varied in size), dramatic color on hackberry, good form and color on zelkova. Fastigiate English oaks remain free of powdery mildew whereas the stump sprouts of susceptible sister seedlings are infested. However, recent industry input indicated that adoption of a new fastigiate English oak simply based on lack of powdery mildew may be poor. While I am not discarding these trees, I plan to interplant superior forms of Oregon white oak (*Q. garryana*) along with other forms (e.g. those with better fall color) within the row to attempt hybridization in hopes of recovering novel and superior hybrids. We grew out 15 M2 seedlings from one female corktree that are variable in size, though it is very early in observations. Based on the positive results, I plan to expand this line of research. Other street trees of interest that I plan to move toward include lindens, elms, and red oaks. Additionally, we recently received seeds collected from an arboreal form of the typically shrubby *Celtis reticulata*. We have been growing these out and will identify the best tree-forms, with the goal of hybridizing with some superior forms of *C. koraiensis* that we have in our plots. The goal is more heat, drought, and "western climate" tolerance from this western US native. I have taken a similar approach with *Cercis*, by treating *C. occidentalis* and have many that appear to be excellent tree forms at this early stage of observation. We will begin hybridizing in 2023 with industry cultivars of *C. canadensis* that have desirable phenotypes but are less adapted to the dry summers of the PNW.

Pyracantha. Pyracantha or firethorn provide interesting options in the landscape, particularly during autumn when their fruit are on display. With the issues surrounding boxwood blight, I think options such as pyracantha as boxwood alternatives should be further explored. Unfortunately, they tend to be large, rangy and require substantial pruning in production and in landscapes. To address that, I initiated a mutation program to develop more compact forms. We treated 12,000 seeds collected from 'Teton' with a range of a chemical mutagen. We had decreasing survival with increasing EMS concentration – a sign of effective treatment. We potted 1,430 plants into #1 containers and collected height data. Our data confirmed that increasing concentration reduced plant height. We propagated 5 selections but have reduced to two based on growth observations during 2021. During 2021 we tested our 2 superior forms for fire blight, and they were both symptom free. Of the two selections, one has been superior in container cultivation and appears to be on track for release. Several companies expressed interest in 2022 but we have yet to distribute. Liners are available.

Budget Summary

Salary	
Tyler Hoskins (6 months)	$24,719
Other payroll expenses	$15,573
Supplies and Services	
Field plot and greenhouse fees	$3,000
Supplies	$1,000
Total	**$44,292**