Oregon Department of Agriculture and Oregon Association of Nurseries

Nursery Research Project Proposal 2024

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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 connection to industry. While we have been growing the background knowledge (e.g. genome sizes, disease resistance, heritability of ornamental traits), we have also made great progress on improvement. I have released seven cultivars since 2014 including plants with improved production efficiency, disease resistance, novel ornamental traits, and reduced seedling production. To reach greater market potential, we are balancing non-exclusive release with plant branding companies and nurseries including Plant Haven, Briggs Nursery, Monrovia, and many others. We have cultivars released using both models and are in continual discussion the industry at-large, the Ornamental Plant Breeding Crop Advisory Committee (OPCAC), and the OAN Research Committee. There are eight (8) 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 were field planted in spring 2023. These plants 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. 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 are sterile. Based on industry guidance I have reduced efforts on this project but maintain a small project. 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 that will be field planted fall 2023. These plants have flowered and set some fruit. If we can combine disease resistance, flowering, fruiting, and superior habit I believe we could improve marketability of *C. apiculatus.*

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. Plants flowered in 2019, including a remarkable purple, weeping selection with pink flowers that was released in 2023 ('ORSTSTYx1'). 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 are being observed for segregation of color and weeping habit to determine how these traits are inherited and the genotypes of Evening Light, Marley's Pink, and Fragrant Fountains – in addition to newly developed selections from OSU. This will allow future targeted breeding for these traits by us and other programs.

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. 2023 was a good year for growth and these plants will be phenotyped during spring 2024.

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 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. 'ORSTPHILx1' was released and is marketed by Monrovia as Swan Lake®. Future directions will include using a new release from Garden Genetics that reportedly is reblooming. Incorporating that trait would raise our cultivars to a higher level and improve marketability beyond "3 weeks of flowering".

New cultivars of street trees. We need more options for street trees to replace ash and 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 spaced on 10-foot centers for 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. In 2022, I interplanted superior forms of Oregon white oak (*Q. garryana*) 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. We have been growing plants derived from an arboreal form of the typically shrubby *Celtis reticulata*. We are working to 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 selected excellent tree forms that we will cross with various 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, including during autumn when their fruit are on display but also as boxwood alternative. 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 including one national brand that has plants in advanced trials. Possible 2024 release.

Spiraea. *Spiraea thunbergii, S.* x*arguta*, and *S. prunifolia* 'Plena' are "old timey" shrubs that are less popular due to their rangy, unkempt habits. However, they are exceedingly hardy and work in low-input landscapes. I believe with improvement and marketing, they could be strong performers. We have been using gamma radiation of rooted cuttings to induce mutations and measuring the impact. Thus far, we have not achieved the goal of a truly compact form, but treatments are early and additional treatments are planned for 2024. As an easy to produce and grow shrub with name recognition, it seems an easy lift.

Budget Summary

Salary	
FRA support (6 months)	$34,299
Other payroll expenses	$19,707
Field plot and greenhouse fees	$3,000
Supplies	$1,000
Total	**$58,005**