Oregon Department of Agriculture and Oregon Association of Nurseries
Nursery Research Project Proposal 2022

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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 with regard to 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 two new cotoneaster cultivars during 2018 and 2019 that met our criteria. In order to reach greater market potential, these 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. The committee previously supported nine (9) projects but I have concluded formal breeding efforts on *Galtonia candicans*, *Ribes sanguineum*, and *Sarcococca confusa* as I think we have sufficiently met the goals and we have moved selections of these into grower trials and/or the patenting process. These projects have been removed and I have added a new project on *Pyracantha*.

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. They 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 have received a small grant from the International Lilac Society to sequence Bloomerang, which will serve as our reference genome onto which we will arrange our other DNA markers. 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 have shown no symptoms of blight and had good form. We field planted those selections in 2017 and many of these remain free from *Pseudomonas* blight but it has been a learning experience to see how delayed some plants exhibit susceptibility under our significant pressure. 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. However, I feel confident about the progress that has been made including five selections that were propagated during 2020 to begin the advanced testing phase.

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. We are still evaluating the data but based on visual observations, I feel it likely has sufficient resistance to advance 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 via stem cuttings as well as budwood being shared under an MTA with Ekstrom Nursery, Blue Heron Farms, and Robinson Nursery to assist in building numbers for additional testing and release. Several national/international brands are interested.

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. We pollinated all females with F1 hybrids that included both weepers (AG and MW). A rough count in the field tallied ~200 capsules and each will have many seeds resulted in 1,800 F2 plants that were planted about 10 days prior to the historic heat dome. Against prediction, we had very minimal losses (2-3%), which would be tolerable in a normal year, let alone with 117F temps. Credit goes to Tyler Hoskins and our excellent undergraduate researchers supported by these funds. The segregation we already have seen is very exciting. The dark purple phenotypes are dramatic, and it appears we will have the complete range of phenotypes.

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. I currently have a student in

the Advanced Masters Platform (AMP) that I am co-advising with Dr. Nackley (funding for Raven Hartley in a separate proposal). This student is working on selection, propagation, and production (including scheduling) of our plants, including mockorange. Her studies evaluated various rooting methods and have shown promise to optimize rooting our cultivars. Our plan is to be able to deliver plants and methods to growers.

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 the following species with a chemical mutagen to induce useful mutations: *Quercus robur*, *Phellodendron amurense, Celtis occidentalis, Celtis koraiensis,* and *Zelkova serrata.* We planted 600 trees resulting from treatment and already have identified useful mutations. It is early in the evaluation process, but it appears likely that cultivars will result. 75 trees were flagged, 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. 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 will grow these out 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.

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. The next target for this genus is to begin working with 'Thornless', a cultivar I learned of that shares the phenotype with its cultivar name. Our selections with compact habit, combined with thornlessness (if heritable) will be outstanding shrubs. During 2021 we tested our 2 superior forms for fire blight, and they were both symptom free. However, we did not have a susceptible control for *Pyracantha*. We plan to test again with a susceptible cultivar to confirm findings.

I have attempted to be brief and, in that interest, omitted photos for this year's proposal. However, I would be most happy to provide additional details and/or photos on our progress and plans for the future. Transparency is key and I want the committee to be fully aware of our status on these projects.

Budget Summary

Salary	
Tyler Hoskins (6 months)	28,590
Other payroll expenses	17,726
Supplies and Services	
Field plot and greenhouse fees	$1,500
Supplies	$1,000
Total	**$48,816**