NURSERY RESEARCH
2012 Project Final Report

Project Title: Development of new, superior cultivars of landscape plants
Date: April 1, 2013

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Project Background

The Landscape Plant Development Center is a non-profit corporation that was established in 1990 with a goal of developing stress tolerant landscape plants for all geographic regions of North America. To operate in the most efficient and effective manner possible, the Center develops cooperative projects with other institutions to accomplish its mission. The Center has one full time and three part time paid staff. Sarah Doane, manager/plant breeder at our Oregon research station is our full time staff person. Part time staff consists of Teri Line, our administrator and Karen Weiss is manager of our Minnesota station.

The Landscape Plant Development Center is in a transition phase in management of its operations and research while Harold Pellett is in the process of retirement. The Center has developed an arrangement with Oregon State University, Department of Horticulture for a cooperative approach for breeding of Landscape Plants. LPDC will reimburse Oregon State University for approximately ¼ of Dr. Ryan Contreras's salary and fringe benefits so that he can devote some of his efforts and utilize the laboratory equipment at Oregon State University to further LPDC's breeding research. Dr. Contreras will collaborate with Dr. Pellett in guiding the traditional breeding efforts of the Center and will be involved in research with LPDC utilizing biological approaches to developing new plants. He will also be involved in starting additional research to develop sterile forms of purple foliage selections of *Berberis thunbergii*, and expanding efforts to develop sterile cultivars of *Acer ginnala*, *Acer platanoides*, Crabapples, etc. Sarah Doane will be involved in the breeding efforts along with her duties of research station manager. LPDC will also continue the cooperative efforts with Dr. Rita Hummel at Washington State University-Puyallup.

Project Objectives

This is an ongoing, long-term research project. Funds requested will be devoted to continuing and expanding our ongoing research in 2012 to develop superior landscape plants.

Current status of long-term research project:

Currently we have major breeding efforts with interspecific hybridization of *Pyrus, Acer, Carpinus, Clematis, Physocarpus, Quercus, Buddleia,* and *Weigela.* We also are developing superior cultivars of North American native plant species including *Ceanothus, Cephalanthus, Cornus, Viburnum*, etc. We feel that many of our native plant species can be more useful in landscape situations with selection of plants with superior plant forms. Our research also includes developing sterile cultivars of valuable landscape species that become "weedy" and naturalize too freely into native ecosystems.

We have identified seven selections for introduction and are entering the stock buildup/ production evaluation phase with those selections. These include two landscape pear cultivars, two Mountainash selections, a weeping selection of *Carpinus* and compact cultivars of *Cornus sericea* and *Viburnum*. We have many additional promising selections that we are evaluating for potential introduction in the near future.

Overview of Methods and Time Lines

Plant collections of participating institutions are utilized as parents to make crosses that combine stress tolerance with desirable aesthetic qualities. The first-generation hybrids are usually intermediate in their tolerance to stresses between that of their parents. In the second generation, tolerance of a few individuals can equal or even exceed that of the most tolerant original parent.

To take advantage of this potential, we grow the first-generation hybrid population in a favorable climate (provided by our Oregon research station and the Washington State University Research and Extension Center - Puyallup) and cross-pollinate those plants to produce the second-generation progeny. Plants of the second generation are then planted at sites in different geographic areas. Superior plants well adapted to the climatic conditions of the region in which they are grown are then selected and further evaluated for potential introduction. In addition to continuing and expanding the projects currently underway, we initiate additional breeding efforts as funding becomes available. In 2006, we received a donation of land in Lake Elmo, Minnesota and initiated activities to evaluate and develop plants in a cold climate. That site now provides us with a facility to evaluate cold tolerance of our selections and to grow F2 populations to select individual plants that possess greater cold tolerance.

Induced polyploids developed or identified by Dr. Contreras will be used to backcross to wild-type diploids in order to develop triploids that will be evaluated for fertility. Duration between development of polyploids and backcrossing is highly species specific. For example, Norway maples that have been identified as polyploids in 2009 have yet to flower; however, we hope that with the aid of greenhouse forcing that tetraploid Japanese barberry will flower in 2012.

Benefit to Nursery Industry

This project results in superior new plants, which directly benefits the members of the nursery industry. New plants are the lifeblood of the industry. They create excitement for gardeners leading to increased sales of nursery products. In addition to developing stress tolerant plants, our breeding emphasis is development of plants of smaller stature, and sterile plants of species that have invasive tendencies. Those traits are especially valuable to the industry in the current market.

In addition to the four plant introductions that we have made, we have many promising selections of *Carpinus, Pyrus, Buddleia, Viburnum, Sorbus, Clematis, Ceanothus* and *Weigela* that we are evaluating for potential introduction. Some compact forms of *Cornus sericea, Physocarpus opulifolius, Forsythia,* and *Cephalanthus occidentalis* are also under evaluation.

PROGRESS

Ploidy manipulation of japanese barberry

Seed of *Berberis thunbergii* var. atropurpurea 'Rose Glow' were collected on Oregon State University Corvallis, OR campus. Seed were cleaned by maceration and moist stratified at 4 ºC for 40 days. Upon removal from stratification 225 seed with emerged radicles between 0.2 to 2cm in length were treated with 0.002% oryzalin in a solution of 1% DMSO, woody plant medium (WPM) and 30 g/L sucrose stirred for 24 hours at 22 ± 3 ºC. At 24 hours, seeds were rinsed 3 times with DI water and planted into Sungro SB40 potting media in 10x20 inch flats with drainage holes. Plants were grown in a glasshouse until 5-6 true leaves emerged. Upon true leaf emergence, plants were tested to determine ploidy using the flow cytometer. Flow cytometry was conducted on nuclei that were extracted by chopping approximately 1 cm^2 leaf tissue of barberry simultaneously with *Pisum sativum* 'Ctirad', which was used as an internal standard. The suspension was passed through a filter and then nuclei were stained with DAPI. Stained nuclei were then analyzed.

We recovered 69 polyploid individuals, 46 of which were homogenous tetraploids (Table 1). These individuals are being grown at the Lewis-Brown farm in Corvallis, OR. They have yet to flower. At flowering, we will cross a subset of these individuals with improved diploid genotypes. Recent observations indicate that many of these individuals will flower in 2013. We are moving forward with plans to cross as many individuals as possible with an improved form at the LPDC Oregon Station.

Mutagenesis of japanese barberry

We are using non-targeted mutation using gamma radiation in attempts to develop new japanese barberry cultivars that exhibit novel phenotypes and are sterile. Non-targeted mutagenesis has been shown to induce sterility by disrupting genes associated with flowering and/or gamete production.

Unstratified seed of *B.t.* var. *a.* 'Rose Glow' were exposed to a range of levels of gamma radiation (Table 2). Following treatment, seed were stratified and planted. Seedlings that germinated were potted and are being grown at the Lewis-Brown farm in Corvallis, OR. These plants will be grown to reproductive maturity and data on flower production, seed production, and germination percentage will be collected. It appears many of these plants will flower in 2013. We will also grow a second generation from mutation (M_2), as mutations often are recessive and may not be expressed in the first generation. Seed will be collected in 2013 and collect all data described above, as well as evaluate the M_2. We plan to field grow these plants at the LPDC Oregon Station.

Developing sterile crabapples

A tetraploid form of *Malus* 'Prairiefire' was developed and is planted at the LPDC Oregon Station. This individual flowered in 2011 and open pollinated (OP) seed were collected. Seed were germinated at OSU in Corvallis and seedlings their ploidy levels were determined using flow cytometry. There are wild-type diploid individuals located at the farm, so it was presumed that resulting progeny would be a mix of self- and cross-pollination, therefore we expected to see both triploid and tetraploid individuals. There were 39 seedlings that germinated and analyzed, 33 were tetraploids resulting from self-pollination of the mother plant and 6 were triploids resulting from cross-pollination from a diploid individual at the farm. Currently, these individuals are growing in #7 nursery containers but we plan to field plant these in Spring 2013 at the LPDC Oregon Station for long-term evaluation of ornamental characters, pest and disease issues, and fertility. We expect that the tetraploids may have a slightly reduced fertility and the triploids will be sterile.

Table 1. Results of treating 225 seed of *Berberis thunbergii* var. *atropurpurea* 'Rose Glow' that had elongated radicles (0.2 to 2 cm) with oryzalin to induce polyploidy.

Ploidy level	Number
2*x*	53
2*x* + 4*x*	23
4*x*	46

Table 2. Results of exposing unstratified seed of *Berberis thunbergii* var. *atropurpurea* 'Rose Glow' to varying rates of gamma radiation.

Treatment	# seed treated	Germinated	% germ
Control	50	28	56%
5 Krad	175	45	26%
10 Krad	175	43	25%
20 Krad	175	35	20%