

**2007 Final Report for Research Project #07-06  
By the Landscape Plant Development Center**

Activities on our research project #07-06, **Development of New, Superior Cultivars of Landscape Plants** are summarized as follows:

### ***Ornamental Pears***

**Overall status of project:**

Since 2001 the following institutions have been evaluating segregating populations of our second-generation pear hybrids and selecting promising individual plants that are well adapted to their respective regional conditions and discarding poor performing plants at each location (University of Georgia – Griffin; Cornell University, Penn State University, Texas A & M, Bernheim Arboretum, North Carolina State University – Mt. Horticultural Research Station, Iowa State University, Michigan State University, University of Minnesota, University of Arizona, and at the Center's research station in Oregon). Also in 2001 and 2002 additional crops of F2 seedlings were grown and screened for resistance to fireblight. Survivors from the 2001 crop were field planted at the Oregon station in 2002. Survivors from the 2002 crop were planted in Oregon and Kansas. We continue to make additional controlled crosses each year and screen them for fireblight resistance before planting out for selection. In 2003, selections propagated asexually were planted for evaluation in Georgia, Pennsylvania, North Carolina, New York, Michigan, Minnesota, Iowa, Texas, Kansas, Oklahoma, Idaho, California, and Washington. Data from these trees are now being compiled and poor performing plants at each location are being or have been discarded.

**Activities during the past year:**

1. In the spring of 2007 additional crosses were made between selected first generation hybrids growing at WSU-Puyallup. Unfavorable cool weather hindered the flowering and a late frost killed many of the flower buds greatly reducing the amount of breeding accomplished.
2. In the late summer of 2006 additional selections were made and propagated by budding.
3. Reduced flowering and fruit set in spring of 2005, 2006 and 2007 is making it difficult to get good data on fruit size and fertility. We are continuing to evaluate quality of the plants that were identified as probably sterile in 2004 and those with small fruit.
4. A couple of selections have been made in Arizona of plants that are resistant to high soil pH. These were propagated in late summer 2005 for further evaluation. We are currently collecting detailed data on performance of these plants and will use that data to make decisions on potential introduction of a number of selections.
5. Some of the dwarf selections may have potential for use as dwarfing rootstocks for fruiting pear varieties. We initiated efforts to explore this potential by budding dwarf selections onto seedling rootstocks. DeAnjou pear was budded onto these in late summer 2005 leaving a 10-12 inch interstem of the dwarf varieties. Plants were cut back in spring of 2006 and the DeAnjou tops are now growing. Those that show dwarfing characteristics will then be propagated on their own roots to test as dwarfing rootstocks.
6. We have selected additional plants for further evaluation. One plant looks especially promising and based on earlier data, it appears to be sterile.

### ***Acer and Carpinus Breeding***

**Overall status of project:**

The *Acer* and *Carpinus* breeding projects are a cooperative effort between the Center and the Morton Arboretum. Dr. Susan Wiegrefe made the initial crosses working as a postdoctoral fellow for the Center. She utilized plants growing in the collections of the Morris Arboretum, Arnold Arboretum, Holden Arboretum and the Morton Arboretum as parents. When Dr. Wiegrefe accepted a plant breeding position at the Morton Arboretum, The Center and the Morton Arboretum entered into an agreement to continue the effort as a cooperative project between the two institutions. Dr. Wiegrefe is no longer working at the Morton Arboretum but the project is continuing as a cooperative effort between the two institutions. Currently F1 populations of these genera are growing at the Morton Arboretum and at the Center's research station in Oregon.

**Activities during the past year:**

1. Many of the F1 hybrids between the species *A. palmatum*, *A. pseudosieboldianum*, and *A. japonicum* growing at the Center's Oregon research station are now flowering. Open

- pollinated seed was collected in fall of 2005 and 2006 and sown in a seedbed at Bailey Nurseries in Minnesota. Seedlings from the 2005 planting were left exposed in winter of 2006-2007 to provide an early selection for winter hardiness. Overall survival was good but most plants had some tip dieback. Surviving plants will be dug in spring of 2008 and transplanted to the Center's new Minnesota research station. Approximately 75 seedlings were planted at the Minnesota station in spring of 2006. These also had some tip dieback but good overall survival.
2. Some of the F1 hybrids of *Carpinus* have very nice plant form and excellent foliage qualities. These are being selected and will be propagated for further evaluation. Many of the F1 hybrids are now flowering and seed was collected in fall of 2006 for growing the F2 population. Additional seed will be collected in fall of 2007 and F2 populations grown out.

## ***Clematis Breeding***

### **Overall status of project:**

We have made good progress in developing non-vining cultivars of *Clematis*. Hybrids between *Clematis integrifolia* and *C. hexapetala* are very promising. Flowers are blue in color and upright facing. We also have many hybrids between *C. integrifolia* and *C. recta*. These have smaller flowers and are also upfacing. In addition we have some hybrids between *C. integrifolia* and several of the large flowered vine cultivars. Some of these are now flowering and are quite interesting.

### **Activities during the past year:**

1. Growing at the Oregon research station are plants resulting from crosses made in 2003 between *C. integrifolia* and large flowered, vine cultivars and between *C. integrifolia rosea* and *C. hexapetala*.
2. Plants from 2002 crosses that are now growing in a field planting at the Oregon research station flowered in 2006. Many of these appear to be vining in form but are likely to be shorter than many of the current vine cultivars. One early selection is quite short and could be grown in a tomato cage.
3. Donahue's Greenhouse, a nursery that specializes in production of *Clematis* has been licensed to grow our selection of *C. integrifolia* x *C. hexapetala*. The plant has been named 'Center Star' and our patent application has been approved (PP17010). 'Center Star' combines the blue flower color from the female parent and the upfacing flowers of the male parent. Flowers are 1\_ to 2" in diameter. Foliage is a dark glossy green. Unfortunately, build up of propagation stock has been slower than we anticipated.
4. Hybrids resulting from crosses between *C. integrifolia rosea* with *C. hexapetala* and with large flowered vining cultivars in an attempt to extend the flower color range are now growing at our Oregon Station.

## ***Improvement of Native Plants***

### **Overall status of project:**

In cooperation with Dr. Robert Schutzki, Michigan State University, Dr. Mark Widrlechner, North Central Regional Plant Introduction Station, we collected seeds of native woody plants in Iowa, Michigan and Minnesota in the fall of 2003 and 2004. These are being grown to select superior individual plants and to utilize in breeding. We also have made some crosses and have plants of a few species that were treated with Ethyl Methane Sulfonate, a chemical mutagen that are being evaluated.

### **Activities during the past year:**

1. The one resulting plant from crosses made in 2003 between *Cornus sericea* 'Cardinal' and *C. s.* 'Isanti' to develop a compact variety with brighter winter twig color looks quite promising as it continues to readily break bud at nodes throughout the growing season. Three plants from open pollinated seedlings of *C. sericea* 'Cardinal' that were treated with Ethyl Methane Sulfonate, a chemical mutagen, also look quite promising. Plants propagated from these selections by softwood cuttings are now growing in the field at our Oregon station.
2. Hybrids between *Physocarpus opulifolius* Diabolo™ and *P. o.* 'Dart's Gold' have brighter leaf color than Diabolo™. Nurseries have been licensed and are now growing one selection that has been named 'Center Glow'. A plant patent application has been approved (PP16894). Seedlings from crosses between 'Center Glow' and its siblings are

- now growing and exhibit a broad range of leaf color ranging from green, yellow to bronze similar to 'Diabolo'. A number of plants have rosy red leaf color at maturity and are brighter in color. Many of these seedlings selected for good foliage color were planted at our Minnesota station in spring of 2007.
3. Three plants of *Cephalanthus occidentalis* that were selected from seedlings treated with EMS are growing at our Oregon Station. These appear to be more compact in plant habit. Cuttings from these plants have been made in summer of 2007.
  4. Two plants of *Ceanothus americanus* have been selected and cuttings were made in summer of 2007 to grow plants for broader evaluation.

## ***Development of Sterile Cultivars***

### **Overall status of project:**

We are working to develop sterile cultivars by modifying ploidy levels. We are treating plants with oryzalin to produce tetraploids. These will then be crossed with diploid plants to produce triploids, which are most frequently sterile. We are cooperating with Dr. Tom Ranney, North Carolina State University, Mountain Horticultural Research Center in that effort. In 2004, *Acer ginnala* tetraploids produced seed and open pollinated seedlings are now growing. Our flow cytometry evaluations to determine ploidy level were made too late in the season on older leaves and gave poor results. Controlled crosses were made in spring of 2005 between the tetraploid plants and normal diploid plants.

### **Activities during the past year:**

1. Tetraploids of crabapple, *Acer platanoides* and *Acer ginnala* have been verified by flow cytometry from plants treated with oryzalin.
2. We continue to observe hybrids resulting from wide crosses to identify sterile plants. Several of our selected pear hybrids appear to be sterile. Some cultivars of *Buddleia* used in breeding appear to be sterile or are of low fertility and we hope that we can select sterile seedlings that have good ornamental traits. Some intergeneric hybrids have degrees of male sterility and others appear to have female sterility as well.
3. Dr. Tom Ranney has used pollen from some of our selected hybrids to make crosses with tetraploid *Pyrus calleryana* that he has induced.
4. In our cooperative effort with North Dakota State University, Dr. David Dai has been successful in establishing plants in tissue culture. He now has developed a satisfactory protocol for gene transformation with *Buddleia* and now we can attempt to introduce genes that result in sterility. He is developing protocol for transformation with other species.

## ***Cooperative Breeding Program with Cornell University***

### **Overall status of project:**

To expand our overall efforts in breeding landscape plants, we initiated a cooperative breeding program with Cornell University in 2003 and contracted with Peter Podaras to make crosses utilizing plants growing at the Cornell Plantations and at the office, greenhouse and field facilities of the Horticulture Department.

### **Activities during the past year:**

1. Peter is continuing to make a lot of crosses in many different plant species in 2007. Heavy emphasis has been in crossing *Buddleia* and *Weigela* on advanced generations growing in the greenhouse. Peter had good nut production of many interspecific crosses from the many *Quercus* crosses made in springs of 2005 and 2006 using *Quercus bicolor*, *Q. macrocarpa*, *Q. muhlenbergii* and F1 hybrids primarily as the female parents and many different species as male parents. Plants from these crosses are now growing. Some cuttings were made in 2006 from hybrid plants grown from earlier breeding efforts. Success was variable. Additional cuttings are being made in 2007.
2. Plants resulting from interspecific crosses of the following species made in 2003, 2004 and 2005 are now growing in the field: *Asclepias*, *Baptisia*, *Betula*, *Buddleia*, *Calycanthus*, *Cornus*, *Diervilla*, *Hypericum*, *Quercus*, *Platanus*, *Sambucus*, and *Weigela*
3. Breeding efforts with *Buddleia* are continuing. We have many interesting selections that we are propagating for further evaluation. Included are plants with different plant forms, flower color, foliage color, degrees of sterility and potential cold hardiness. Objectives in the *Buddleia* breeding effort are to develop cultivars that are improved in one or more of the following characteristics: cold hardiness, compact habit, sterility, and quality or color

- of foliage or flowers. We are also looking at the potential use of some of the selections as annuals in northern climates where *Buddleia* is not reliably hardy. Advanced generation hybrid populations are producing many promising plants with compact plant forms. Over 4000 seedlings were planted at a farm in Maryland in spring of 2007.
4. We continue to explore potential for intergeneric hybridization between closely related genera. Based on the previous success of hybridization of *Aronia* with *Chaenomeles*, Peter attempted crosses between *Sorbus*, *Amelanchier*, and *Pyrus* with *Chaenomeles* in spring of 2005. Crosses between *Buddleia* and *Spigella* made in 2004 produced progeny that had flowers like *Buddleia* in appearance but much larger in size. Some of these progeny have different degrees of sterility. Many of the progeny resulting from crosses between *Diervilla* x *Weigela* may have resulted from pollen contamination and are not true hybrids based on initial plant appearances. However a few F2 plants also appear much like *Diervilla* but foliage is an attractive mottled color of yellow, orange and red and flowers are pink in color. We believe that these are true hybrids between the genera. Many additional crosses were made in 2006 and seedlings are now growing from that effort.

### ***Cooperative Research Efforts with North Dakota State University***

#### **Overall status of project:**

We initiated a cooperative effort with Dr. David Dai at North Dakota State University in July of 2005 to utilize biotechnological approaches for landscape plant improvement. North Dakota State University has excellent facilities for tissue culture and related research activities and the Center is providing funding for a research technician to work on the project. The project goal is to develop new landscape plants by use of various biotechnology approaches including *in vitro* mutation breeding, ploidy manipulation, and genetic transformation. Plant characteristics sought include compact plant habit, sterile cultivars of invasive species, plants with colored foliage, etc.

#### **Progress to date:**

1. Tissue cultures of 15 landscape plant species including *Physocarpus opulifolius*, *Viburnum*, *Cornus sericea*, *Forsythia*, *Ligustrum vulgare*, *Buddleia*, and *Berberis*, have been established. Protocols of *in vitro* proliferation, regeneration, rooting and acclimation of these species have been well developed and are ready to be used for *in vitro* mutation induction and chromosome doubling.
2. Two ways to induce mutations by treating *in vitro* tissues with EMS have been attempted. The first method was to treat *in vitro* shoot tips of *Forsythia*, *P. opulifolius*, and *Cornus sericea* with EMS and shoots were recovered *in vitro*. The second method was to treat calluses induced from leaf tissues with EMS in liquid medium and then regenerated shoots from treated calluses. The EMS concentration and treatment time for each species and cultivar have been determined based on LD<sub>50</sub> and the performance of survival shoots *in vitro* has been evaluated. New shoots were either recovered from shoot tips or regenerated from callus tissues then rooted and transferred to the greenhouse. Morphological screening of mutations is underway. We are optimizing treatment conditions (chemical concentration and treatment time) for each species. About 100 treated dogwood plants are growing in the greenhouse. Putative mutations will be screened. *In vitro*-treated shoots of ninebark and forsythia are recovering and will be rooted out soon.
3. The regeneration system for two *Buddleia* cultivars has been developed. Gene transformation with marker genes is underway. This system will be used to transform *Buddleia* for developing sterile and dwarf plants.

### ***Improvement of Operations at our Oregon Station***

#### **Overall status of project:**

We continue to expand activities and improve our capabilities at our Oregon research station. The poly greenhouse constructed in 2004 is being utilized heavily for propagation of selected plants. Peter Podaras has been sending cuttings from many selections Federal Express overnight from Cornell to our station manager Sarah Doane who is propagating them. We've expanded our container area and soon need to expand it again. The potting shed has been a big asset in facilitating this increased effort. Field plantings have also increased as we have added to both our tree and shrub populations. We continue to evaluate plants in the field and discard less desirable plants.

## ***Initiation of Activities at a New Minnesota Research Station***

### **Overall status of project:**

The Center was given 6.75 acres of land in a housing development in Lake Elmo, Minnesota by the Robert Engstrom Company. We initiated some activity at this site in spring of 2006 by planting many of our *Buddleia* selections and also several *Weigela*, *Pyrus*, and *Sorbus* selections. The Minnesota station provides a valuable resource for evaluating our selections in a zone 4a site for evaluation of cold hardiness and also enables us to plant F2 hybrid populations for initial screening for cold tolerance. A drip irrigation system was set up to temporarily irrigate using city water from a fire hydrant that is adjacent to our plot of land. Landscape fabric was installed between the shrub rows to minimize labor needed for weed control. A local farmer is cropping most of the land again this year.

### **Activities and observations in 2007 include:**

1. As expected, most of the *Buddleia* selections planted in 2006 were not cold hardy, but several selections did winter over without any added protection.
2. Plantings made in spring of 2007 include selections of *Pyrus*, *Buddleia*, *Weigela*, *Diervilla*, *Cornus*, and *Clematis*. Many second-generation seedlings of *Physocarpus opulifolius* Diabolo™ X P. o. 'Dart's Gold' were also planted.

### ***Status of new introductions***

A variegated selection of *Diervilla sessilifolia* looks very promising. A patent application for it is being prepared. We distributed plants to cooperators in spring of 2007 for evaluation under different growing conditions and in different climates. The plant is being propagated to build up stock for introduction. Interest is gaining for landscape use of 'Silver Ball' Pear and 'Center Glow' Ninebark. 'Center Glow' Ninebark will be featured in the September issue of *Fine Gardening* magazine.  
in the Iowa Gardening Magazine.