

Outside The Box: Breeding of Not-So-Common Woody Landscape Plants at the United States National Arboretum

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INTRODUCTION

The woody ornamental breeding programs at the U.S. National Arboretum were started in the late 1950s and are known for the release of improved selections of such landscape staples as viburnums, crapemyrtles, maples, and elms. However, breeding and selection work is also under way on several less common flowering shrubs (*Cercis*, *Corylopsis*, and *Gaylussacia*) and trees (*Celtis*, \times *Chitalpa*, and *Halesia*). Challenges in breeding these genera can include a scarcity of available germplasm; lack of information on seed germination or propagation; unknown taxonomic and genetic information on species relationships; and marketing challenges for the new plants. However, these plants can also offer new opportunities for growers, landscape architects, and gardeners and can serve to broaden the palette and genetic diversity of cultivated landscape plants.

SHRUBS AND SMALL TREES

The primary objective of the shrub breeding program is to develop new cultivars that are disease and pest resistant, tolerant of environmental stress, can fit into today's smaller landscape, and are not invasive. Creating novel combinations of genes through interspecific hybridizations or using new sources of germplasm can result in plants with unique and valuable traits. While there will always be a demand for fundamental landscape plants such as viburnum, pyracantha, crapemyrtles, and crabapples, the industry and the gardening public are also interested in new or unusual plants that can fit into a specific landscape niche.

***Cercis*.** Although redbuds are becoming increasingly common in the landscape, with several new cultivars emerging recently in the trade, there are few programs devoted to breeding new cultivars. The program at the U.S. National Arboretum is focused on breeding new cultivars that are easy to propagate from cuttings, show field tolerance to *Botryosphaeria* canker, and have superior ornamental traits. Efforts are currently under way to incorporate these traits from several species, including *C. canadensis*, *C. canadensis* var. *mexicana*, *C. chinensis*, *C. glabra*, and *C. racemosa*. Crosses between *C. racemosa* and *C. canadensis* have resulted in plants that show traits intermediate between the parents, and a segregating F₂ population is currently under evaluation. Because hand pollinations on redbud can be tedious and time-consuming and redbuds are thought to be largely self-sterile, most of the redbud pollinations are accomplished by enclosing parent plants in a mesh cage or an isolated greenhouse with pollinator bees. In addition to traditional breeding methods, in-vitro studies indicate that some taxa are amenable to regeneration

from leaf pieces, which means that it may be possible to enhance disease resistance by genetic engineering. The breeding collection at the National Arboretum includes over 400 redbud plants, including germplasm, selections, and hybrids.

***Corylopsis*.** The National Arboretum has had small breeding projects in the Hamamelidaceae for almost 2 decades, with a focus on interspecific hybridizations in *Hamamelis* (witchhazel) and *Corylopsis* (winterhazel). While several witchhazel selections are currently under evaluation, recent breeding objectives are to develop new hybrids of *Corylopsis* that are cold hardy to USDA Zone 6, have a compact growth habit, and have large, fragrant flowers. First-generation hybrids between *C. sinensis* and *C. himalayana* are currently under evaluation. These plants will be propagated for replicated field trials and for use as parental material for further crosses. Because of ploidy differences among the taxa, it may be possible to use interspecific hybridizations between certain taxa to generate sterile triploid selections. Species currently under investigation also include *C. glabrescens*, *C. pauciflora*, and *C. spicata*. If successful, this breeding program will result in plants that could lead to the use of *Corylopsis* as an alternative to forsythia in the landscape.

***Gaylussacia brachycera*.** The box huckleberry (*G. brachycera*) is a slow-growing, dwarf evergreen member of the family Ericaceae and can be found growing as isolated colonies in eight states in the eastern U.S.A. Reproduction is primarily through underground runners, as the plants are thought to be self-sterile, so cannot produce seed from isolated clonal populations. What began as part of a cooperative conservation effort has grown into a germplasm collection, evaluation, and breeding project. The *G. brachycera* collection at the U.S. National Arboretum consists of 23 genotypes collected from most of its known native range. In 2006, fruit and seed production from these plants using natural pollinators was prolific due to the presence of diverse genotypes in close pollinating proximity. Studies are underway to determine parameters for optimal seed germination and will be followed by evaluation of the resulting seedlings for traits of interest, including commercial production potential and landscape use as an evergreen groundcover.

URBAN TREES

The continued urbanization of the United States requires countering the loss of genetic diversity of the natural forest with increased diversity of the urban forest. The U.S. National Arboretum has a long tradition of breeding urban-tolerant and pest-tolerant shade trees (e.g., *Platanus* \times *hispanica* 'Columbia' and 'Liberty'; *Ulmus americana* 'New Harmony' and 'Valley Forge'). The arboretum will continue its efforts in breeding large shade trees but has instituted a new program breeding trees specifically for street and utility line applications. Trees in urban environments are subjected to additional stresses beyond that of the general landscape and increasingly are being planted in more restricted spaces. The available palette of urban-tolerant, small trees with compact habit for planting under utility lines is extremely limited. Those species of trees that are of suitable height (e.g., flowering dogwood, *Cornus florida*) are often intolerant of urban edaphic conditions (e.g., soils compacted and anoxic, high soluble salts, fluctuating moisture and temperature), while traditional tree species utilized in urban tree plantings are either too large (e.g., London plane, *P.* \times *hispanica*) or too invasive (e.g., Norway maple, *Acer platanoides*) for modern cityscapes.

***Celtis*.** The genus *Celtis* (hackberry) is composed of approximately 60 species in the north temperate and tropical regions. Several species, including those in North America, are adaptable species that could function as tough, urban-tolerant trees. However, problems with witch's broom, nipple gall, and viruses currently limit their widespread use in the landscape. Studies are currently under way at the arboretum to examine the taxonomy, pollination, and reproductive biology of this genus to determine the feasibility of developing a breeding program.

×***Chitalpa*.** The intergeneric hybrid between *Catalpa* and *Chilopsis* has potential as an urban tree, combining the urban and cold tolerance of *Catalpa* and the drought tolerance, smaller stature, and remontant flowering of *Chilopsis*. Work begun at North Carolina State University by Richard Olsen is continuing at the National Arboretum. The arboretum now holds the largest collection of *Catalpa* in the United States, including taxa with powdery mildew resistance, greater cold hardiness, and unique ornamental foliage and flower traits. New hybridizations are currently underway to breed a new generation of ×*Chitalpa* resistant to powdery mildew, leaf spot, and the catalpa sphinx moth larvae; are remontant flowering; and are fruitless (triploid).

***Halesia*.** The silver bells [*Halesia carolina* (syn. *H. tetraptera*) and *H. diptera*] and their relatives, have potential as small- to medium-sized flowering trees for increasing diversity of urban and suburban landscapes. A long-term evaluation of wild-collected *H. carolina* germplasm has revealed variation in plant habit, growth rate, flowering time, and flower size and color. These selections are being propagated for replicated field trials and for use as parents for breeding. Future efforts will focus on collecting diverse germplasm from other *Halesia* species and sister genera, identifying useful traits, and creating hybrids to enhance ornamental traits, including reduced fruit set.

OTHER PLANTS

In addition to breeding and selection programs on these less common woody landscape genera, the National Arboretum continues to work with more popular and well-known ornamental plants, including *Acer* (maple), *Clethra* (summersweet), *Hydrangea*, *Lagerstroemia* (crapemyrtle), *Prunus* (flowering cherry), *Syringa* (lilac), *Tsuga* (hemlock), and *Viburnum*. For information on cultivars from the research program, please visit the National Arboretum's web site <<http://www.usna.usda.gov/Research/index.html>>.