The Importance of Preserving Cultivated Germplasm: A Baseline Assessment of 19 Shrub Genera at US Public Gardens

Emily Russell; Whitney D. Phillips; Andrew Bunting; Andrew C. Bell, PhD
Chicago Botanic Garden

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INTRODUCTION

Public gardens preserving woody plant germplasm often focus on wild-collected or unnamed genotypes rather than cultivars. Yet cultivars have intrinsic value for horticultural heritage, conservation, and plant breeding. Over time, older cultivars can lose popularity and become difficult to obtain despite possessing desirable traits and unique genes that may be needed under the new environmental pressures of global climate change. With increased awareness of the significance of cultivars, public gardens can play a crucial role in preservation.

GENERA IN STUDY

First, 19 genera of shrubs were chosen for the study. The goal was to choose a mix of ornamental shrub genera frequently used in gardens and landscapes for varying traits such as flowers, fruits, or foliage. An effort was made to include genera that are currently popular with consumers and plant breeders as well as some that are now considered old-fashioned. For genera that contain not only shrub species but also trees or herbaceous perennials, such as *Cornus* and *Hibiscus*, only the shrub species were included in the study. For genera with a large number of species with extensive numbers of cultivars, the investigators chose to focus on a few species and eliminate others from the study for practicality. For example, the species *Hydrangea macrophylla* was eliminated because while it is a popular garden plant, many cultivars are bred as a floriculture crop and the sheer number of cultivars would overwhelm the scope of the project. For *Hypericum* and *Viburnum*, only the most commonly used landscape species were included. Please see the following list of 19 genera, with species included where applicable.

Genus	Species Included (if not all)
Aronia	
Buxus	
Callicarpa	
Clethra	
Cornus	Alba group: *alba, amomum, asperifolia, australis, bretschneideri, glabrata, obliqua, oblonga, paucinervis, pumila, racemosa, rugosa, sanguinea, sessilis, stolonifera, walteri*
Deutzia	
Forsythia	
Fothergilla	
Hamamelis	
Hibiscus	*syriacus*

Hydrangea	*arborescens, paniculata, quercifolia, serrata*
Hypericum	*androsaemum, calycinum, densiflorum, frondosum, kalmianum, olympicum, prolificum,* x *inodorum,* x *moserianum*
Philadelphus	
Physocarpus	
Sambucus	
Spiraea	
Viburnum	*carlesii, cassinoides, dentatum, dilatatum, farreri, lantana, lentago, nudum, plicatum, prunifolium, rufidulum, trilobum, utile,* x *burkwoodii,* x *rhtidophylloides*, plus Don Egolf selections
Vitex	
Weigela	

COMPILING MASTER LISTS OF CULTIVAR NAMES

Next, master lists of all known cultivar names were created for each genus in the study. The primary sources checked for each genus are listed below.

- BGCI. [2016]. PlantSearch online database. Botanic Gardens Conservation International. Richmond, UK. Available from: www.bgci.org/plant_search.php
- Dirr, Michael. 1998. Manual of Woody Landscape Plants. Champaign, Illinois: Stipes Publishing.
- Hatch, L. [2016]. Genus Central of www.cultivar.org, New Ornamentals Society, Raleigh, North Carolina.
- Plant Information Online, University of Minnesota Libraries. [2016]. Available from: http://plantinfo.umn.edu/
- Plant Names Database, Chicago Botanic Garden. [2016].
- Plant Names Database, Royal Horticultural Society. [2016]. Available from: http://apps.rhs.org.uk/horticulturaldatabase/
- Unassigned Cultivar Registrations (working list, 12-11-2015). Lura, Stefan. US National Arboretum.

Genus-specific sources, such as checklists, articles, or monographs were used when available, including the following.

- Batdorf, Lynn R. 2011. International Registration List of Cultivated *Buxus* 2011.
- Cappiello, Paul and Don Shadow. 2005. Dogwoods. Portland, OR: Timber Press.
- Dirr, Michael. 2007. Viburnums: Flowering Shrubs for Every Season. Portland, OR: Timber Press.
- Hall, Elisabeth. 2013. Colorful *Callicarpa*. American Nurseryman. Available from: http://www.amerinursery.com/growing/colorful-callicarpa/
- Howard, Richard A. 1965. A Checklist of Cultivar Names in *Weigela*. Arnoldia 25: 49-69.
- Matney, Beth. 1999. *Hibiscus syriacus*: A List of Cultivars in Collections and Print. Available from: http://members.tripod.com/~h_syriacus/cultivar_list.htm
- *Philadelphus* Name Checklist. Russian Philadelphus Society.

- Ranney, Thomas G, Lynch, Nathan P, Frantz, Paul R, Cappiello, Paul. 2007. Clarifying Taxonomy and Nomenclature of *Fothergilla* (*Hamamelidaceae*) Cultivars and Hybrids. HortScience 42(3): 470-473.
- Rammeloo, Abraham. 2014. *Hamamelis* Cultivar Names: Checklist 2014. Arboretum Kalmthout. Available from: http://www.arboretumkalmthout.be/en/Discover/Hamamelis/named-cultivars.html

The US Patent Collection Database, nursery catalogues, and the inventories of other public gardens were referenced as well.

The investigators made an effort to note synonyms, however, a detailed review of the nomenclature was not within the scope of this project. It is very likely that the lists contain some invalid names. The investigators did not wish to include cultivar names that were likely to have never been grown in the North America, since the goal of the study is to determine which cultivars have been lost to collections or are currently at risk in the United States and Canada. Some cultivar names of Russian, Asian, and European origin were purposely excluded, and name sources from other regions were not sought out. As a future expansion of the research, it would be beneficial to refine the master lists of cultivar names by consulting experts in each genus on nomenclature, date of introduction, history of the cultivar, and origin.

COLLECTING TAXA LISTS FROM PUBLIC GARDENS

The investigators then reached out to public gardens in the United States and Canada to request a list of taxa currently growing in their living collections. The first wave of outreach was via the American Public Gardens Association's Professional Sections forums. A posting was made in the following sections: College & University Gardens, Historic Landscapes, Native Plants, Plant Collections, Plant Nomenclature & Taxonomy, and Small Gardens. These six sections include staff members from a total of 333 public gardens. Next, the investigators formulated a target list of gardens with substantial enough collections and plant records to be of high value to the study, then personally reached out to these gardens via email to request a taxa list. In all, 102 gardens contributed a taxa list (please see list at www.chicagobotanic.org/collections/curation/shrub_cultivars). Some gardens requested their taxa lists not be published without explicit permission.

COMPILING COLLECTIONS DATA AND MASTER CULTIVAR LIST

To compare the master cultivar lists with the taxa lists from 102 institutions, an Excel spreadsheet was created with a column for each garden and a row for each cultivar name in a given genus. Plant names were recorded in each column exactly as given in an institution's plant records so as not to make a determination about correct nomenclature, which is not the goal of this study. Formulas tally the number of gardens with no cultivars of that genus, the number of gardens with living plants of each cultivar, and the number of cultivars held at each garden.

The Botanic Gardens Conservation International PlantSearch, containing inventories from 1,146 institutions, was also referenced for half of the genera. The total number of BGCI gardens holding each cultivar was added to the spreadsheet next to the number of sites in the study, so that a comparison could be made between the two.

ANALYZING DATA

For each genus, the following numbers were recorded: total number of cultivar names cited in the literature, the number of cultivars not found at any gardens in the study, the number of cultivars at-risk, the most common cultivar, the number of gardens with no cultivars, the top 5 public gardens with the most cultivars, if the genus is included in APGA's Plant Collections Network and if so, who holds the collection.

Cultivars are considered at-risk if they are found at zero, one, or two sites in the study, and if they were introduced prior to 2014.

Cross-referencing with Botanic Garden Conservation International's (BGCI) PlantSearch database was completed for half of the genera in the study, occasionally revealing discrepancies in the number of institutions holding at risk cultivars. However, since BGCI member gardens come from all over the world, results could be skewed by the greater popularity of that plant in other regions compared to the United States. It does not guarantee the safety of cultivars in American collections. BGCI inventories could also be out of date; confirmation is needed that at risk cultivars are still alive in collections.

RESULTS AND DISCUSSION

Please see our website for results by genus: www.chicagobotanic.org/collections/curation/shrub_cultivars. A discussion of *Hamamelis* follows here.

Hamamelis is a relatively well-documented genus, with a checklist published in 2014 and three Nationally Accredited Collections. The available checklist increases confidence in the accuracy of the master cultivar list for this genus, which contains 217 cultivar names and should contain few, if any, undetected synonyms. Almost half (104) of *Hamamelis* cultivars were found at two or fewer gardens in the study and are therefore considered at-risk. Almost a quarter (51) of the cultivar names were not found at any gardens in the study.

For the genus *Hamamelis*, investigators cross-referenced BGCI data and found that 19 of the at-risk cultivars were listed at more than two BGCI sites worldwide. More research is needed to see if these sites are within the country or international, and to confirm that the BGCI inventory is up-to-date and plants are still alive. The BGCI data could be interpreted as confirmation that at least 85 cultivars of *Hamamelis* are at risk internationally.

While 80 gardens have some cultivars of *Hamamelis* in their collections, more than half of those (60%) have the most popular cultivar, 'Arnold Promise.' The most numerous collection of *Hamamelis* cultivars can be found at the Bartlett Tree Research Laboratories, which holds a total of 114 cultivars. The next most numerous collections are the Dawes Arboretum (83 cultivars), the Missouri Botanical Garden (70 cultivars), the Morris Arboretum (62 cultivars), and the New York Botanical Garden (58 cultivars). The three Nationally Accredited Collections of *Hamamelis* are held by Bartlett Tree Research Laboratories, the Dawes Arboretum, and Green Spring Gardens.

The results indicate that a significant number of cultivars are lost in cultivation or in danger of being lost. Public gardens could do more to safeguard ornamental cultivars in their collections. Though the study does not include all collections in the United States and Canada, the investigators believe that these 102 gardens represent a baseline of cultivar preservation in the United States and Canada.

NEXT STEPS

A more detailed and thorough review of the nomenclature could be conducted for each genus, to remove synonyms and invalid names, record dates of introduction, history of the cultivar, and origin.

Experts in each genus could be sought out to assign value to the cultivars and help determine if at risk cultivars are worth preserving. A survey of ornamental plant breeders conducted as a part of this grant identified one or more experts willing to review 11 of the genera included in the study: *Callicarpa*, *Clethra*, *Cornus*, *Deutzia*, *Hibiscus*, *Hydrangea*, *Philadelphus*, *Physocarpus*, *Spiraea*, *Viburnum*, and *Weigela*.

A data request could be made to BGCI to potentially locate at risk cultivars in more American collections. The member gardens listed could then be contacted for confirmation the plant is still alive. A review of nursery offerings could be conducted to determine which cultivars are at-risk in the horticultural trade.

A cultivar preservation plan could be developed. Gardens with large holdings of a genus could apply for accreditation with the Plant Collections Network to facilitate germplasm preservation. Among the 19 genera in the study, only four are currently included as an Accredited National Collection with the Plant Collections Network: *Buxus*, *Hamamelis*, *Hydrangea*, and *Spiraea*. Gardens holding at-risk cultivars could be encouraged to propagate and share plants with other gardens. Public gardens in general could be encouraged to diversify their holdings and seek out at-risk cultivars.