

# *arnoldia*

*The Magazine of the Arnold Arboretum*

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# arnoldia

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*Arnoldia* Circulation Manager  
The Arnold Arboretum  
125 Arborway  
Boston, MA 02130-3500

Nancy Rose, *Editor*  
Andy Winther, *Designer*

*Editorial Committee*  
Phyllis Andersen  
Peter Del Tredici  
Michael S. Dosmann  
William (Ned) Friedman  
Kanchi N. Gandhi

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The ARNOLD  
ARBORETUM  
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*Front cover:* This specimen of *Malus sargentii* (accession 20408-D), collected by Charles S. Sargent during his 1892 expedition to Japan, has no single leader but instead has several trunks and a uniquely intertwined branching structure. Photo by Miles Sax.

*Inside front cover:* *Eucalyptus leucoxylon* subsp. *megalocarpa*, seen here in flower at the Chelsea Physic Garden, London, is one of the trees featured in *New Trees: Recent Introductions to Cultivation*. Photo by John Grimshaw.

*Inside back cover:* A mass planting of royal azalea (*Rhododendron schlippenbachii*) in the Arboretum's Explorers Garden displays lovely spring bloom and colorful autumn foliage. Photos by Nancy Rose.

*Back cover:* The bright red fruits of *Malus sargentii* provide color (and food for birds) in autumn and early winter. Photo by Nancy Rose.



# One Hundred Years of Popular Information

*Peter Del Tredici*

## PUBLICATIONS HISTORY

On May 2, 1911, the Arnold Arboretum published the first issue of the *Bulletin of Popular Information*. Arboretum director Charles Sprague Sargent was the editor, and he stated that its specific goal was to meet the complaints of people who "... do not know when the trees and shrubs in the Arboretum bloom and therefore miss flowers which they want to see." These first bulletins came out once a week during the spring, early summer, and fall and were "mailed without charge to anyone interested in trees and shrubs and their cultivation." They were four pages long and without illustrations. The intention of the publication was to tell people who lived in the area what exciting things were happening on the grounds of the Arboretum and to provide some basic facts about selected plants, including their history of cultivation and suitability for New England gardens. The fact that the *Bulletin* came out thirty-nine years after the establishment of the Arboretum in 1872 suggests that public outreach to visitors was not originally very high on Sargent's to do list. By 1911, however, he apparently felt that the time was ripe to connect with the gardening public who wanted to know more about the collections. Despite its tardy introduction, the *Bulletin of Popular Information* established an Arboretum tradition of outreach through publications that continues today.

After four years of publication, Sargent initiated a "New Series" of the *Bulletin* on April 28, 1915. Unlike the first series, this one had volume numbers and an index and established a subscription rate of one dollar. The first issue of the second series concluded with the rather quaint note that, "Automobiles are not admitted to the Arboretum, but visitors who desire carriages to meet them at the Forest Hills entrance can obtain them by telephoning to



Charles S. Sargent, first director of the Arnold Arboretum, photographed at the Arboretum in 1904.

P. J. Brady, Jamaica 670, or Malone & Keane, Jamaica 344." From the perspective of today's digitally connected world, it's hard to imagine a time of when entire telephone numbers rather than just area codes consisted of three digits.

Series Three of the *Bulletin* began in April 1927—a month after Sargent's death—edited by Ernest H. Wilson. It was printed on coated paper for the first time, which allowed for the insertion of a full page black-and-white photograph in each issue. Following Wilson's untimely death in an automobile accident on October 15, 1930, long-time Arboretum staff member

J. G. Jack took over the task of producing the *Bulletin* with contributions from Oakes Ames, W. H. Judd, and the young Edgar Anderson. Anderson took over full responsibility for the publication in 1932 and initiated a fourth series in 1933. In 1935, Anderson left the Arboretum to work at the Missouri Botanical Garden and horticulturist Donald Wyman took over the *Bulletin*, publishing his first article on “Tree Troubles” in March 1936. Elmer Drew Merrill had been appointed director of the Arboretum in 1935 and in March 1941 he made the decision to change the name of the *Bulletin* to *Arnoldia*. He had two reasons for doing so: first, he thought that the title *Bulletin of Popular Information* was too cumbersome, and second, that it was difficult to cite in scientific papers

because it had been published in four separate series without sequential volume numbers. He also felt that changing the name to *Arnoldia* would not only “reflect proper institutional credit on its sponsoring institution.” Merrill retained Wyman as editor of the newly christened publication, a post Wyman held until 1969—a 34-year record of longevity that no one is ever likely to top. During the entire period of Wyman’s editorship, *Arnoldia* came out more or less twelve times per year with each issue being of variable length.

Following Wyman’s retirement in 1969, Richard Howard, who served as director from 1954 through 1977, changed *Arnoldia* from its pamphlet format to a magazine format in 1970. A card-stock cover with a full-bleed (printed



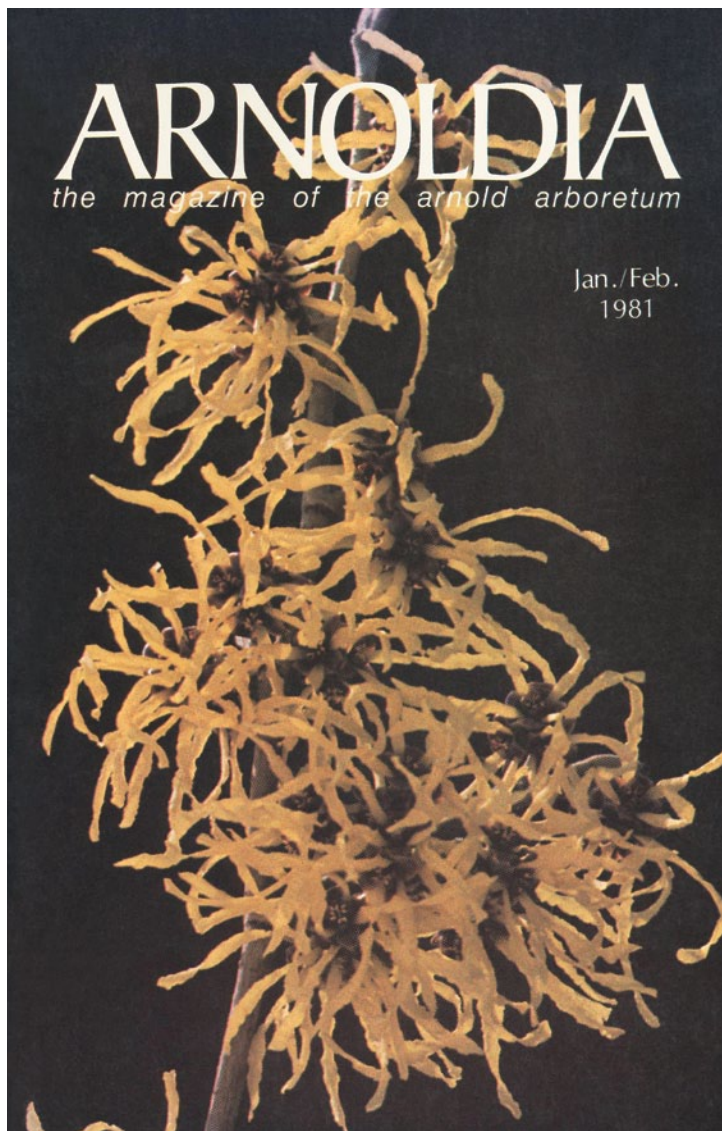
NANCY ROSE

Bound copies of every issue of the *Bulletin of Popular Information* and *Arnoldia* are housed in the Arboretum’s library. All issues are also available through the Arboretum’s website (<http://arnoldia.arboretum.harvard.edu>).



all the way to the edges) photograph was added, and it was published six times per year (including the Director's Report) with a subscription price of \$3.50 per year. Interestingly, no one was listed as editor in the front of the magazine, but in the staff list at the end of the 1972 Director's Report, Jeanne S. Wadleigh was listed as "Editor of *Arnoldia*," a position she held until 1979. During this period of time, the content of the magazine changed considerably from what it had been under Wyman's leadership. For one thing, many of the articles were written by non-Arboretum staff and for another, there were a number of "theme" issues that were later republished as stand-alone books, including "Low-Maintenance Perennials," "Colonial Gardens," and "Wild Plants in the City." Dr. Howard himself wrote many articles for *Arnoldia* covering many aspects of the Arboretum's history, including the important two-part "E. H. Wilson as Botanist" (Volume 40, Numbers 3 and 4, 1980). Shiu-ying Hu, who first came to the Arboretum as a graduate student in 1948, brought the Arboretum's China connection up to date with some fascinating articles about her return to mainland China in 1975 (Volume 35, Number 6, 1975; Volume 37, Number 3, 1977).

When Peter Ashton became director of the Arboretum at the end of 1978, he was determined to have *Arnoldia* reflect the broader research mission not only of the Arboretum but also of the Organismic and Evolutionary Biology Department of Harvard University. He also wanted *Arnoldia* to reach a broader audience of readers. To this end, he added color covers to *Arnoldia* in 1981, reduced its publication cycle from six times per year to four in 1982, and increased its dimensions (from about 6 by 9 inches to about 7½ by 10) in 1983. In addition to these stylistic changes, the magazine expanded its former focus on plant collections, botany, horticulture, and landscape history to include articles about cutting-edge research on ecology, molecular



The first full-color *Arnoldia* cover appeared in 1981, featuring a photograph of *Hamamelis x intermedia* 'Arnold Promise' by Al Bussewitz, a long-time Arboretum volunteer.

biology, rare plant conservation, and tropical forest biodiversity. Ashton felt that scientists affiliated with the Arboretum needed to be able to explain the relevance of their research to the greater public, especially the Arboretum's membership. Since then, *Arnoldia* has continued to publish articles on a wide range of topics that embody the mission of the Arboretum, and to provide a means for scholars to share their research with interested readers.

## WRITERS AND CONTENT

It is worth noting that the editors of the publication during its first fifty-eight years—Sargent, Wilson, Anderson, and Wyman—were also its principle writers. This aspect gave it both a highly personal and authoritative tone. The people who were writing about the plants knew what they were talking about and, because the Arboretum was a research and not a commercial institution, they could be counted on for unbiased information. All of these botanists wrote with a high level of confidence based on the completeness of the Arboretum's collections and on the soundness of their observations and judgment.

Issues of the *Bulletin* from the Sargent years, in particular, make for fascinating reading because they tell the story of the early introduction of many now-familiar plants. Sargent was also very adept at capturing the essence of plants, sometimes in completely unexpected ways, such as his description of *Populus tomentosa* leaves, which “hang on long flattened stalks and, fluttering in the slightest breeze, make, as the blades come together, a noise like drops of rain in a heavy shower falling on a tin roof” (July 2, 1915). Many of the plants that were first described in the *Bulletin* have gone on to become famous ornamentals, and a few have become infamous invasive species. To illustrate the latter category, I found this quote about Amur corktree in the June 14, 1911, issue of the *Bulletin*: “*Phellodendron sachalinense* [now classified as *P. amurense*], which is a native of Saghalin [Sakhalin] and the northern island of Japan, has grown in the Arboretum into a tree about thirty feet high, with a tall, straight trunk, and wide-spreading branches forming a shapely flat-topped head. The seedlings springing up naturally near the old trees indicate that it is likely to

hold its own in New England. The hardiness of this tree, its rapid growth, and the fact that it is not injured by insects, suggest that this is a good subject to plant in narrow streets. Seeds will be sent from the Arboretum in the autumn to anyone who may desire to grow this tree.”

This fascinating quotation reveals much about the early history of the Arboretum that, had it not been written down, would have been



NANCY ROSE

The picturesque forms and thick, corky bark of the mature corktrees along Meadow Road often draw the attention of Arboretum visitors (*Phellodendron amurense* var. *lavalleyi* seen here).



forgotten. To begin with, the observation that Amur corktree is capable of spreading on its own is the earliest record of the species' invasive tendencies, which landed it on the Massachusetts Prohibited Plant List in 2009. Second is Sargent's unequivocal, but somewhat misguided, recommendation to plant it on narrow streets. And finally there is the offer of free seeds for anyone who wants to grow the tree. Taken together, these statements provide a stunning example of the role that botanical gardens have played in popularizing and distributing plants. The rules seem to have been, first test it, then evaluate it, and then distribute it. What's remarkable is that it only took one hundred and twenty-seven years for Amur corktree—which the Arboretum introduced from St. Petersburg, Russia, in 1882—to go from its initial introduction in Massachusetts to being banned by the state. This quotation illustrates the treasure trove of information that these early bulletins contain about the plants grown

and introduced by the Arboretum. Since the *Bulletin* was written as a running narrative of seasonal events (rather than separate articles) it takes a little more effort to sort through the information contained in the issues, but reading through them page by page leads to the discovery of many buried gems. (All past issues of the *Bulletin* and *Arnoldia* are available on the Arboretum's website at <http://arnoldia.arboretum.harvard.edu>)

The *Bulletin* issues written by E. H. Wilson are as fascinating as those of Sargent because he describes the origin and cultivation of many of his Chinese plant introductions with words that generations of horticultural writers have shamelessly copied without proper attribution. It's particularly interesting to read how excited he got about the first blossoms of his newer introductions, many of which he had not seen before. In a very real sense, Wilson's *Bulletin* entries contain the raw observations that became the basis of his later articles and books.

ARCHIVES OF THE ARNOLOID ARBORETUM



### From *Bulletin*—May 16, 1927 (Series 3, Volume 1, No. 6)

**“*Exochorda Giralddii* Wilsonii. In the Shrub Garden and on Bussey Hill large plants of this vigorous growing Pearl Bush are now rapidly opening their flowers. These are pure white, each one and a half inches across, and borne on erect six- to eight-inch long racemes. It is native of central China and has been growing in the Arboretum since 1907, when seeds were received from Wilson. So far the plant has never suffered winter injury and it blooms more abundantly each succeeding year. It is a shrub of almost tree-like dimensions and easily the finest of the tribe.”**

—Ernest H. Wilson

Noted Arboretum taxonomist Alfred Rehder photographed this large specimen of *Exochorda giraldii* var. *wilsonii* growing by his home in Jamaica Plain, Massachusetts, in May 1921.





This photo by Donald Wyman shows tree damage at the Arboretum from the hurricane of September 21, 1938.

## Weather Talk

ONE THEME that runs through the Arboretum publications is a thorough discussion of weather and its effects on the collections. This seemed to be especially true for the *Bulletin*, which was aimed primarily at a local audience and often emphasized the immediacy of the growing season. Take, for example, the October 16, 1929, entry by E. H. Wilson, “The phenomenal drought which Massachusetts in common with other states has endured will long be remembered for it caused grave anxiety among all who garden. In late June the Arboretum enjoyed one good rainfall but not another worth mentioning until October 2nd. For fully two months supplying water to suffering trees and shrubs was the principal work engaged upon. Fortunately, there was no great heat but at the height of the drought it looked as if a great many plant must die. Thanks to the water stored from the heavy rains of spring the trees suffered but little and as autumn arrived a general freshening among all woody plants was noticeable. Today it is difficult to realize that extreme drought has been experienced. The power of resuscitation enjoyed by plants is, indeed, marvelous.”

Perhaps the most famous weather event to affect the Arboretum was described by Wyman in the October 7, 1938, *Bulletin*: “Rain had been falling rather consistently for four days when on September twenty-first, over large areas in New England, the downpour assumed the proportions of a deluge. Rivers in western Massachusetts were at flood stage, and everywhere the ground was soggy from excessive rain. By late afternoon the rain slackened and the wind increased to a gale. At 4:50 p.m. when the lights went out in the Administration Building staff members expected a “blow”, but certainly did not anticipate the hurricane which caused frightful damage throughout New England. The Arboretum lost approximately 1500 trees, and a recent newspaper estimate of the number of trees lost in Massachusetts—only one of the New England states touched by the storm—reached the appalling figure of 100,000,000. There is no way of checking such an estimate, but with definite information concerning the number of trees destroyed in a few Boston suburbs, this figure seems possible... Hemlock Hill in the Arboretum is one of the higher points between Boston and the Blue Hills. With wind velocities at times approximating 125 miles an hour it is understandable that great damage was done to the particular plantings on the southern or exposed side on the top of that hill. To the older friends of the Arboretum, this damage will seem the most serious.” (The tradition continues with an annual report in *Arnoldia* recapping the previous year’s weather and its effects on Arboretum collections.)

# Science at the Arboretum: Seeing the Forest Through the Trees

*William (Ned) Friedman*

**THE ARNOLD ARBORETUM** is all about science, and has been since its founding in 1872 by Harvard University. The Arboretum's mandate as stated in the original deed—to grow all of the trees and shrubs from anywhere on Earth that could be grown here—was a long-term research proposal in itself, one that continues to this day. Over the decades research in many fields has been conducted at the Arboretum by our scholars as well as colleagues from institutions around the world.

The opening of the Weld Hill research building early this year brings a new era of science to the Arboretum. Weld Hill's state-of-the-art facilities include laboratories, greenhouses, and spectacular teaching equipment for undergraduates. Microscopes with lasers allow scientists to

peer into the microscopic world of plants; molecular biology equipment allows us to unravel the DNA that codes for the processes that make each plant and plant species unique and exquisitely responsive to its environment; and highly sophisticated banks of growth chambers permit botanists to study the effects of climate change on plants under controlled conditions. Importantly, Weld Hill allows Arboretum researchers formerly based at Harvard's Cambridge campus to expand



The Weld Hill research facility at the Arnold Arboretum.

their work at the Arboretum. It also provides great new opportunities for students, scientists, and visiting scholars to conduct research using the living collections and the Weld Hill facilities. In essence, the Arnold Arboretum of Harvard University is poised to become a worldwide hub for the study of plant biodiversity. With over 15,000 curated living organisms, there are unlimited and unique opportunities to conduct botanical research at the Arboretum.

Research has limited value until it is shared with others, of course. A vital part of the Arboretum's mission over the years has been to translate the science of the Arboretum to a wide audience. Arboretum publications, especially *Arnoldia* and its predecessor, the *Bulletin of Popular Information*, have been important vehicles for disseminating information about the fascinating world of plant science to Arboretum friends and colleagues around the world. As research grows at the Arboretum we will continue to share it through *Arnoldia* as well as our much expanded website and education programs.

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William (Ned) Friedman is Director of the Arnold Arboretum and Arnold Professor of Organismic and Evolutionary Biology at Harvard University.



While these later publications were more complete and formal, the original *Bulletin* observations provide a more intimate connection to the seasonal cycles of the Arboretum.

For me, the most remarkable thing about the Sargent and Wilson contributions is their timelessness. Having worked at the Arboretum for over thirty years, I can read their words and get the feeling that I can go right out onto the grounds and see the exact same scenes (or close to them) that they were describing.

“Bussey Hill, where the new and rarer plants from the Orient are quartered, is perhaps the most interesting place in the Arboretum at the moment [May 16, 1927]... From the overlook itself looking toward the south, the Hemlock Grove looms majestic; westward across the Oaks, over and beyond the steely gray, misty, cloud-like clump of American Beech, Spruce, Fir, and Pine stand conspicuous. Everywhere wholesome scented air, opening bud, blossom, and green grass—everything fresh and clean—the Arboretum in spring is rich in charm and beauty.”

When it comes to writing articles, no one was more prolific—in both the *Bulletin* and *Arnoldia*—than Donald Wyman. He published hundreds of pages of observations on the Arboretum’s collections covering an amazing array of topics including crabapples (his specialty), rhododendrons, lilacs, winter injury, hurricane damage, trees with interesting bark, the order of bloom of Arboretum plants, seashore gardens, hedges, vines, and a number of arcane topics such as the use of spent hops for mulch (in *Arnoldia* Volume 7, Number 12, December 12, 1947). More than any other of the Arboretum’s horticulturists, he had no qualms about passing judgment on the suitability of plants for spe-



RICHARD SCHULHOF

Bussey Hill still provides magnificent views and beautiful plants, including this 102-year-old sand pear (*Pyrus pyrifolia*) in the open area just below the summit.

cific purposes, based on his notes on the performance of the collections over the years. In horticultural circles of the 1940s and 1950s, Wyman was the voice of authority in the northeast when it came to recommending (or condemning) plants.

## THE FUTURE

In reading through Arboretum publications from the past hundred years it’s interesting to note how some things change and some stay the same. Many horticultural recommendations published in the *Bulletin* and *Arnoldia*



are still valid today, though a few (like planting Oriental bittersweet [*Celastrus orbiculatus*]) no longer hold, given the luxury of hindsight. Modern ecological challenges including climate change, urbanization, and globalization have increasingly become part of plant research and, subsequently, topics of *Arnoldia* articles. Concern over invasive plants and pests, greater emphasis on global plant conservation, and the need to improve our urban forests are some of the themes seen more often in the magazine in recent years. *Arnoldia* has also reflected some of the changes within plant science in recent decades, such as the use of molecular genetics to identify plants and new thinking about how

plant groups are related. The opening of the Arboretum's Weld Hill research facility brings many exciting new research opportunities (see page 8) and *Arnoldia* will be a major venue for sharing new scientific knowledge with the public. And, as always, *Arnoldia* will feature articles on the plants of the Arnold Arboretum, the very thing that inspires so many of the the Arboretum's staff members and visitors to appreciate nature and care about the environment all around the world.

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Peter Del Tredici is a Senior Research Scientist at the Arnold Arboretum. He served as editor of *Arnoldia* from 1989 through 1992.

RICHARD SCHULHOF



Through the pages of *Arnoldia* and our website, we will continue to share the magnificent plants of the Arnold Arboretum with all. Seen here in autumn color, a three-flowered maple (*Acer triflorum*) and Japanese stewartia (*Stewartia pseudocamellia*) in front of the Arboretum's Hunnewell Visitor Center.



# Can *Taxodium* Be Improved?

David Creech, Lijing Zhou, Yin Yunlong, and Teobaldo Eguiluz-Piedra



COURTESY OF STEVEN J. BASKAUF, HTTP://BIOIMAGES.VANDERBILT.EDU

Growing in wetland conditions, this stand of baldcypress (*Taxodium distichum*) displays the distinctive knees (pneumatophores) characteristic of the species.

Degradation of coastal forests and associated wetland habitats by excessive flooding and saltwater intrusion is a global problem, and may become even more so if predicted climate changes and consequent rises in sea level occur. In the United States, there's been great concern about the degradation of the entire Mississippi River Delta biotic system, much of which can be traced to man-made changes in the nature and flow of the Mississippi river. One example of this degradation is the loss of coastal forests south of New Orleans, which has left this city more vulnerable than ever to the impact of hurricanes. (Allen 1992; Earles 1975; Krauss et al. 1999)

These circumstances make it increasingly important to identify, select, and even improve tree species that have some innate tolerances to flooding and salinity. Such trees will be valuable for restoring degraded coastal areas as well as for urban landscapes and other greening projects. For this reason, we are particularly interested in *Taxodium distichum*.

## **TAXODIUM TAXA**

Of all native swamp forest tree species in the southern United States, *Taxodium distichum* (baldcypress) has long been recognized as being among the most tolerant to flooding and salinity. This long-lived and generally pest-free

deciduous conifer is a popular landscape tree in many parts of the world. Once established, *Taxodium* is tolerant of flooding, salt, alkalinity, and strong winds.

The precise nomenclature for *Taxodium* remains a matter of some debate. Once considered three species—*T. distichum* (baldcypress), *T. ascendens* (pondcypress), and *T. mucronatum* (Montezuma cypress)—we believe there's enough consensus in recent literature to list *Taxodium distichum* as a single species with three botanical varieties:

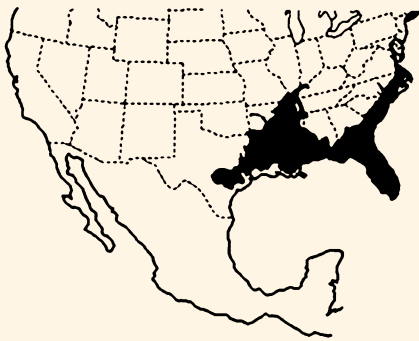
- *Taxodium distichum* (L.) Rich. var. *distichum* (baldcypress)

- *Taxodium distichum* var. *imbricarium* (Nutt.) Croom (pondcypress)
- *Taxodium distichum* var. *mexicanum* (Carriere Gordon) (Montezuma cypress) (Arnold and Denny 2007)

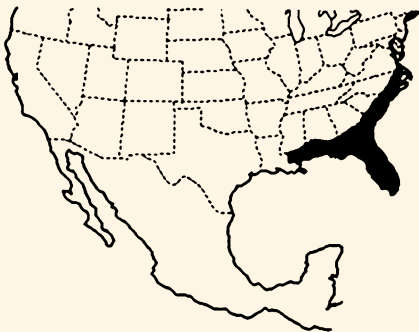
While baldcypress and pondcypress natural ranges overlap in many areas across the South, the commingling of baldcypress and Montezuma cypress natural ranges is less apparent. Hardin (1971) was the first to speculate on the nature of intermediates where baldcypress and pondcypress ranges overlap. The same is perhaps true for baldcypress communities in central and southwestern Texas. They are often

Montezuma cypress-like, leading many to believe this is the result of natural introgression present between baldcypress and Montezuma cypress in this transitional zone.

**Baldcypress** is native to much of the southeastern United States, from Delaware to Texas and inland up the Mississippi River to southern Indiana. It occurs mainly along rivers with alluvial flood deposits. Baldcypress is a durable conifer particularly well adapted to wetland habitats. It is easy to grow from seed and is relatively free of pests and diseases. The tree is modestly to highly resistant to *cercosporidium* needle blight and tolerates compacted soils and low-oxygen or swampy soil conditions. It stands strong in the face of hurricanes, is amazingly long lived (1,000+ years) and, with time, can become quite large (70+ feet [21+ meters] tall). Baldcypress produces knees (pneumatophores), which are considered a negative in most landscaping situations since they can



**Baldcypress**  
*Taxodium distichum* (L.) Rich.  
var. *distichum*



**Pondcypress**  
*Taxodium distichum* var. *imbricarium* (Nutt.) Croom



**Montezuma cypress**  
*Taxodium distichum* var. *mexicanum* (Carriere Gordon)

Range maps for *Taxodium*.



interfere with routine maintenance such as lawn mowing. While their exact function is unknown, knees may contribute substantially to wind throw resistance (Conner et al. 2002).

Baldcypress in the western part of its range (central and western Texas) is generally more salt and alkalinity tolerant, and is less prone to produce knees than baldcypress from more eastern sources. East Texas genotypes of *Taxodium* planted in San Antonio, Texas, where soils are highly alkaline, often turn chlorotic and perform poorly. As with pond cypress and baldcypress, botanists and horticulturists speculate that baldcypress in central to western Texas are perhaps commingled with Montezuma cypress and represent transitional genetics (Lickey and Walker 2002).

**Pondcypress** occurs in the southern portion of the range of baldcypress and only on the southeastern coastal plain from North Carolina into Louisiana. While southeast Texas is not normally included as part of the pondcypress natural range, an approximately 1,200-year-old pondcypress at Shangri La Gardens, Orange, Texas, appears to broaden the range. Pondcypress occurs in blackwater rivers, ponds, bayous, and swamps, usually without alluvial flood deposits. Pondcypress is relatively easy to distinguish by its feathery foliage, which is ascendant, rather than more splayed and flat as in baldcypress, but this may not always be consistent. Landscapers often use pondcypress as a specimen, particularly when moist soil conditions exist and a smaller stature (40+ feet [12+ meters]) is desired.

**Montezuma cypress** should probably be named Moctezuma cypress because by all accounts it has the name of the fifth Aztec King, Moctezuma (1466–1520), whose reign included the



This very large, old pondcypress grows at Shangri La Gardens, in Orange, Texas. While outside the normally accepted range for the species, this pondcypress appears to be spontaneous, not planted.



“Árbol del Tule,” the giant Montezuma cypress at Oaxaca, Mexico, is considered to be one of the world’s largest trees.

first contact between the Mesoamerican civilization and Europeans. It is popular in Mexico among pre-Hispanic cultures and is widely planted in public parks and gardens in most major cities in Mexico. A Montezuma cypress near Oaxaca, Mexico, the famous “Árbol del Tule,” features a trunk over 56 feet (17 meters) in diameter and is estimated to be over 2,500 years old.

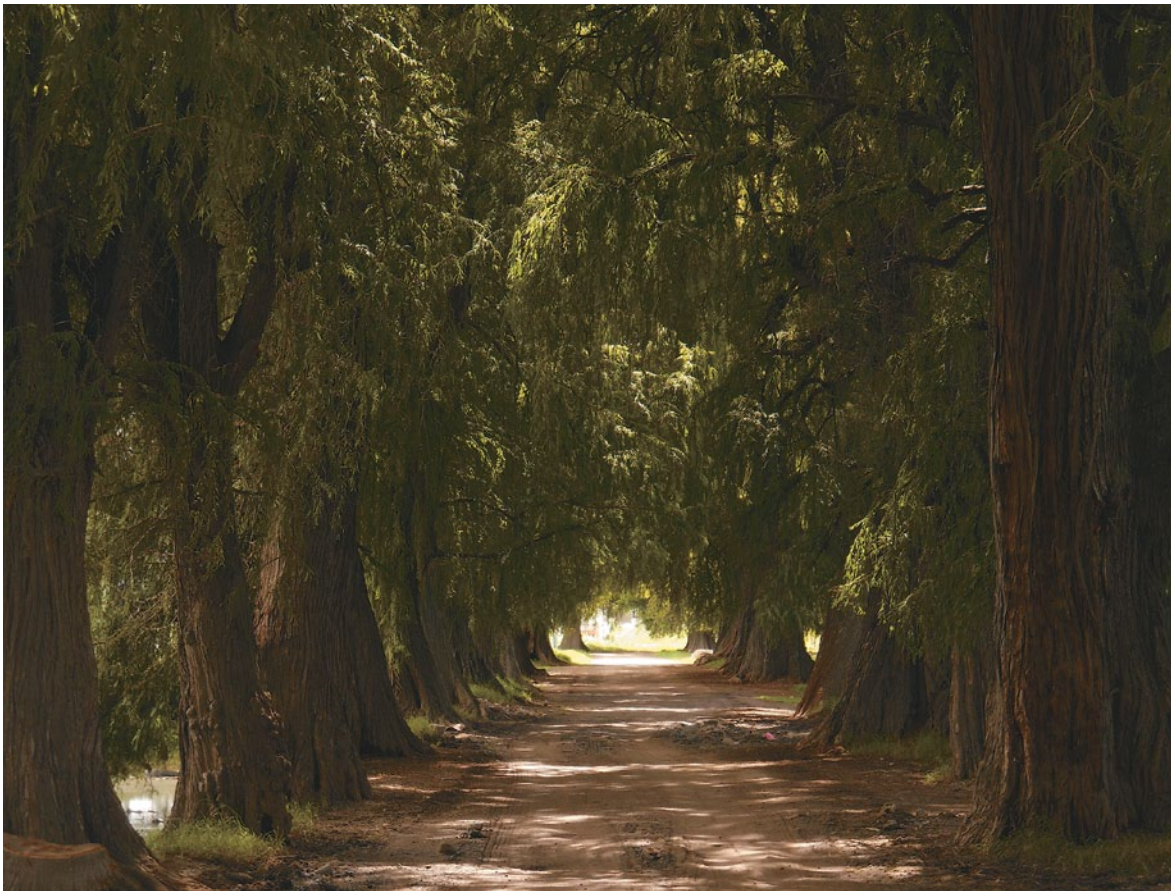




**A 10-year-old Montezuma cypress from the Viveros Genfor nursery being transplanted into a landscape near Texcoco, Mexico.**

Montezuma cypress is native to Mexico (in 27 of the 32 states), some areas of Guatemala, the tip of South Texas, and, perhaps, a few populations in New Mexico. It typically grows next to water sources such as creeks, rivers, lakes, and ponds and performs better in deep loamy soils than in volcanic soils where firs, pines, and oaks are found. While it will grow in a hot tropical climate, it does not perform best there.

Montezuma cypress differs from baldcypress and pondcypress in several ways: it is substantially evergreen, produces smaller seeds, never produces



**“Paseo de los Ahuehuetes,” a beautiful allée of Montezuma cypress near Texcoco, Mexico.**



distinct knees, is generally more tolerant of salt and alkaline soils, and is less tolerant of extended flooding. At Stephen F. Austin State University Gardens in Nacogdoches, Texas, Montezuma cypress forces new growth early in the spring and continues to grow late into the fall. Observations of Montezuma cypress in USDA plant hardiness zone 8 (average annual minimum temperature 10 to 20°F [-12 to -7°C]) and lower suggest that there may be hardiness and winter damage issues, particularly with trees derived from lowland, subtropical Mexican genotypes. This may be a seed source provenance problem, and there is good reason to believe that Montezuma cypress can be grown much further north if the proper genotypes are selected as seed sources.

Montezuma cypress is not usually considered a superior landscape tree in the southern United States since it often fails to form a strong central leader and is generally more susceptible to *Cercosporidium* needle blight than baldcypress, especially when grown in humid areas. However, there are exceptions, and further breeding and selection may bring better choices. At Stephen F. Austin State University Gardens there are several Montezuma cypress specimens worth noting, including one that survived the December 23, 1989 freeze (0°F [-17.8°C]) with no damage. Over the years, Montezuma cypress has withstood droughts of considerable magnitude at Stephen F. Austin State University Gardens. In fact, we note that Montezuma cypress can shed almost all its foliage in a summer drought, yet it will push new growth when rain or irrigation finally returns. Montezuma cypress kept in a high state of vigor often keeps foliage through mid-winter.

In Mexico, Montezuma cypress is much appreciated, but little genetic improvement has been undertaken. Coauthor Teobaldo Eguiluz-Piedra is supervising a large planting of genotypes near Texcoco, Mexico, that includes ten provenances. While just in the first

year, there are already apparent differences in foliage color, tree form, growth rate, and branching characteristics. In Mexico, Montezuma cypress is considered quite variable from one provenance to another and nursery conditions can greatly impact growth rate and form. The Viveros Genfor nursery in Texcoco has grown Montezuma cypress for the last twenty years and reports that it requires no more water than ash, oaks, or other conifers, contrary to what might be expected from Montezuma cypress's natural preference for a riparian habitat. Most of the nursery's propagation is by seed collected from mature trees that are more than 500 years old. Viveros Genfor is also cloning the oldest Montezuma cypress trees nearby using juvenile tissue from rooted cuttings with a modest success rate.

### TAXODIUM CULTIVARS

While most *Taxodium* plants sold in the United States are seedlings, there are a number of cultivars available, primarily of baldcypress. Mostly available as grafted trees through specialty nurseries, baldcypress cultivars vary in form, ultimate size, and foliage color. For over twenty years, Stephen F. Austin State University Gardens has acquired a wide array of cultivars from specialty nurseries, arboretum and botanical garden collections, and private conifer enthusiasts. Baldcypress cultivars at the Gardens



The "Treehenge" planting of 'Cascade Falls' baldcypress at Stephen F. Austin State University Gardens.

ROBERT MAYER



Foliage and cones of the baldcypress cultivar 'Pendens'.

include 'Sofine' (Autumn Gold™), 'Pendens', 'Mickelson' (Shawnee Brave™), 'Fastigiata', 'Contorta', 'Secret', 'Hurley Park', 'Peve Minaret', 'Peve Yellow', 'Jim's Little Guy', 'Cody's Feathers' (synonym 'Wooster Broom'), 'Cave Hill', 'Cascade Falls', and 'Falling Water'. Only two pondcypress cultivars are listed—'Prairie Sentinel' and 'J.B.'—and two cultivars of Montezuma cypress, the mounding weeper 'McClaren Falls' and modestly weeping 'Sentido', can also be seen in the collection. In addition to cultivars, Stephen F. Austin State University Gardens has numerous specimens of baldcypress, pondcypress, and Montezuma cypress from a wide range of documented provenances.

### TAXODIUM HYBRIDS

Controlled *Taxodium* hybridization (crosses between botanical varieties of *Taxodium distichum*) can combine the best characteristics of superior parents and allow for selection of superior clones from the progeny. Much hybridization work has occurred at the Nanjing Botanical Garden, where selection criteria for controlled cross and open pollinated seed crops include growth rate, salinity and alkalinity tolerance, flooding tolerance, *Cercosporidium* needle blight resistance, form, and ease of cutting prop-

agation. In several studies in China, *Taxodium* hybrids often demonstrated improvements in growth rate, salt tolerance, form, and vigor.

One *Taxodium* hybrid was given the cultivar name 'Nanjing Beauty' and was cooperatively introduced in 2004 by Nanjing Botanical Garden and Stephen F. Austin State University Gardens. A baldcypress × Montezuma cypress cross, this clone was originally selected in 1988 from the breeding work of Professor Chen Yong Hui at the Nanjing Botanical Garden. Chen and others report that the selection's attributes include 159% faster growth than baldcypress, longer foliage retention in fall and early winter, and no knees. It also tolerates alkaline soils and fairly high salt concentrations. Cuttings root at good percentages and the clone is commercially available in China. 'Nanjing Beauty' is currently under evaluation in over 30 locations in the southern United States and is offered by several nurseries across the South.

Additional crosses made at the Nanjing Botanical Garden in 1992 used pollen from a superior selection of Montezuma cypress applied



A row of the *Taxodium* hybrid cultivar 'Nanjing Beauty' growing at a nursery near Jinjiang, Jiangsu, China.





Planted at the Stephen F. Austin State University Gardens in March 2010 as small one-gallon-container plants, these specimens of “merit” clone T406 from China had a very fast growth rate. This photograph is from July 2011.

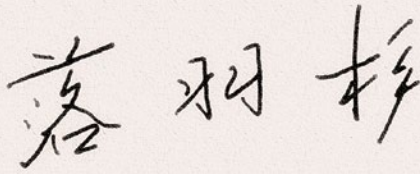


Peter Raven (left), President Emeritus of the Missouri Botanical Garden, views the *Taxodium* advanced selection blocks with Yin Yunlong at the Nanjing Botanical Garden, Nanjing, China.

to female flowers of ‘Nanjing Beauty’ (then known as selection T302). Fifteen selections were made in 1995, with the main characteristics for selection being fast growth rate, dark green leaf color during the growing season, and red-orange leaf color in the autumn. Several of these clonal selections are now widely used in China. Additional Montezuma cypress × baldcypress hybrids have been selected, including four “merit” clones that have been verified by molecular identification, and tested in the field for salt tolerance, growth rate, form, etc. (<http://sfagardens.sfasu.edu/UserFiles/File/PLANTS/Taxodium%20breeding%20brochure%20feb%2020100.pdf>). These selections are rapidly multiplied by cutting propagation, with high rooting percentages the norm. Acceptance of “merit” clones by the industry in China indicates that more and more *Taxodium* cultivars will enter the commercial market in the future. With great potential for use as timber, energy biomass, carbon sinks, and water conservation forests, *Taxodium* hybrids can be widely used for urban and rural greening, shelterbelts for farmland, and forests for coastal areas in southeastern China.

### **ASEXUAL PROPAGATION OF TAXODIUM**

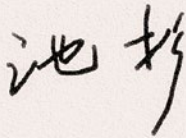
For superior *Taxodium* clones to make a substantial impact on nursery numbers, it is important to propagate asexually. While grafting is common (especially for ornamental cultivars such as those with dwarf or weeping forms), it is expen-



Baldcypress



Montezuma cypress



Pondcypress

## Taxodium in China

**TAXODIUM** varieties and hybrids play a very important role in the southeastern China coastal vegetation plan, particularly in the floodplains of the delta and associated bottomlands and estuaries of the Yangtze River. The planting of coastal windbreak forests in this area was initiated in 2005. There are many reforestation projects under way on the mainland side of dikes that run along the sea, both north and south of the mouth of the Yangtze. These projects have received massive provincial and federal financial support and millions of trees will be planted by midcentury.

*Taxodium* hybrids have also found a place in many of the large parks being constructed in the major cities of southeastern China. As grand allées or individual specimens, many Chinese foresters feel that in this region of China baldcypress is indeed a special tree. It has become more and more popular in the nursery industry, competing primarily with *Metasequoia*, *Glyptostrobus*, and others.

sive. Cutting propagation of *Taxodium* is generally reported as difficult, but rooting success is influenced by genotype, the physiological age of the clone, rooting hormones, substrate, and the vigor of the cutting wood. (Pezeshki and DeLaune 1994; St. Hilaire 2003; Zhou 2008).

Young trees generally root with greater ease than older trees. Coauthor Yin Yunlong reports that the original plant of 'Nanjing Beauty', selected in 1988, has over time become more difficult to root, a condition attributed to chronological and physiological age factors.

To counter lower rooting percentages, a strict protocol for achieving cutting propagation success has been developed. Small well-rooted liners are field planted at close spacing and grown for one year, with trees often reaching 3.3 to 6.6 feet (1 to 2 meters) in the first growing season. Then, in that first winter, they are cut back to 1 foot (0.3 meters) tall. These pollarded trees produce vigorous upright shoots in the spring. Cuttings are collected in early summer and one

upright shoot is left on the stock tree to grow for the rest of the season into a straight tree, 6.6 feet (2 meters) tall, ready for sale in the winter. Yin Yunlong notes that collecting cuttings from upright shoots produces upright growing plants of better form than trees produced from cuttings taken from side branches, a technique to avoid the problem of plagiotropic growth.

Early summer cuttings are rooted under part shade to sun, using intermittent mist and a well drained mix in deep rooting beds. While rooting hormones are utilized, cutting wood quality and maintaining good turgor are recognized as critical factors for high rooting percentages (80+%). Four cutting trials in 2006 at Stephen F. Austin State University Gardens indicated that a high concentration of K-IBA (5,000 to 10,000 ppm) improved rooting as did slightly wounding the basal portion of the stem. Other studies indicate better rooting with hormones, very well drained substrates like perlite, and no wounding (Zhou 2007, King et al. 2011).



### IMPROVING TAXODIUM

Several *Taxodium* germplasm collections exist in the southern United States but they remain relatively unexploited. In addition to the *Taxodium* collection at Stephen F. Austin State University Gardens, Dr. Donald L. Rockwood, University of Florida, Gainesville, Florida, manages a large planting of varied genotypes, many of which serve as seed sources for superior seedlings, with plantings that target tolerance of fly ash, salinity, or polluted soils. Dr. Ken W. Krauss, at the United States Geological Survey, National Wetlands Research Center, Lafayette, Louisiana, is collecting seed from survivor trees in the Mississippi Delta that have been exposed to increasing inundation and salt surges (Krauss

et al. 2000; Conner and Inabinette 2005). By cruising the massive “ghost cypress forests” (large stands of dead or declining baldcypress) of the southern delta, individual survivor trees can be found that perhaps have good resistance to subsidence and high salinity. Their progeny may offer promise for reforestation projects in marginal sites, and the opportunity for selecting superior clones is immense. Finally, Dr. Mike Arnold, Texas A & M University, College Station, Texas, has planted a large collection of baldcypress genotypes from across the South; the collection includes central and western Texas provenances, as well as a collection of Montezuma cypress from Mexico and southern Texas (McDonald et al. 2008)



At the government nursery near Jinjiang (Jiangsu, China), I viewed over a million *Taxodium* cuttings in the one-acre field of propagation beds during a visit in September 2011. The nursery manager, Mr. Zho, employed a half-dozen ladies who used high-pressure hoses to hand mist the cuttings. Every day, for 8 to 12 weeks, each worker managed her own long run of propagation beds, dragging her hose and wand and waving a stream of mist over the crop. After each run, the ladies would rest and visit with each other, waiting until the beads of water on the cuttings had evaporated, the signal that it was time to repeat the process. When I asked why he used this strategy, Mr. Zho reflected that he had previously used automated boom misters on a timer, but he had found that the ladies knew better when the cuttings needed water—they had a feel for the crop—and rooting percentages were now very high.

—David Creech

*Taxodium* has many positive environmental attributes as a wetland species and as a landscape plant. It is fortunate that there is such great diversity available in the baldcypress, pondcypress, and Montezuma cypress gene pool, since with great diversity comes great opportunity for selection. No doubt superior *Taxodium* clones can be found in the progeny from controlled cross and open pollinated seeds. Improvements in salt and alkalinity tolerance, growth rate, resistance to *cercosporidium* needle blight, drought resistance, and form could be expected from a breeding program. In the United States and Mexico, where *Taxodium* is used primarily as an ornamental, the market for improved *Taxodium* cultivars is relatively small in comparison to China, where *Taxodium* has a huge market built on hundreds of "greening" companies vying for government contracts. Millions of trees are needed for a wide array of development projects: large gardens and parks, highways, railroad lines, canal edges, and the coastal windbreak forest project. We have much to gain by connecting the native *Taxodium* germplasm resources in the United States and Mexico with the many *Taxodium* improvement projects under way in China.

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For a more extensive literature review, access the MS thesis and PhD dissertation of coauthor Lijing Zhou under "Arboretum" then "Links" on the Stephen F. Austin State University Gardens website <http://sfagardens.sfasu.edu>

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David Creech is Director of the Stephen F. Austin State University Gardens in Nacogdoches, Texas; Lijing Zhou is a Graduate Research Assistant at Stephen F. Austin State University; Yin Yunlong is a Professor at the Institute of Botany in the Chinese Academy of Sciences and Jiangsu Province, Nanjing Botanical Garden, Nanjing, China; and Teobaldo Eguiluz-Piedra is a forest geneticist and owner of Viveros Genfor nursery in Texcoco, Mexico.



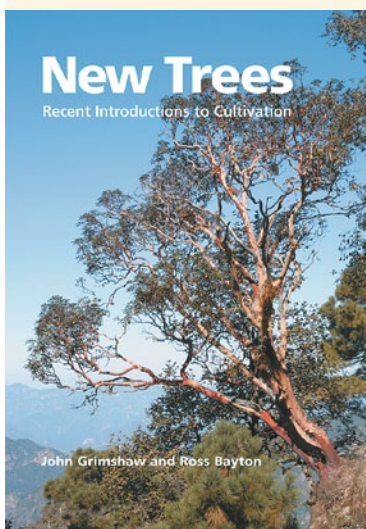
# The Writing of *New Trees: Recent Introductions to Cultivation*

John Grimshaw

In 2002 I was living and working in the Netherlands. One afternoon the phone rang and a richly English voice identified its owner as Giles Coode-Adams. Might I be interested in writing a book about recently introduced trees?

Following early retirement from a career in finance, Giles had devoted his time to horticultural causes, first fund-raising for Kew and later becoming Treasurer and then President of the Royal Horticultural Society. Among his numerous commitments he was also Chairman of the International Dendrology Society's Scientific and Education Committee, reflecting his personal interest in trees and woody plants in general. While involved with Kew he had been the occasional recipient of young specimens grown from seed collected on expeditions, and indeed had taken part in a seed-collecting trip to Japan. The only problem was that, for so many of the recently introduced trees he was encountering, there was no useful literature to look them up in.

His proposal to the committee that a book on such trees would be valuable was accepted and they started looking for authors. I am still not quite sure how they found me, as I was then by no means dendrological, but I had recently co-authored and edited a well-reviewed book on snowdrops (*Galanthus*) that may have had something to do with it. To cut a long story short, the committee decided I was the right person for the job. Generous sponsors provided funding and the task could begin.



**Editor's note:** *New Trees: Recent Introductions to Cultivation* is an extensive new reference manual published by the Royal Botanic Gardens, Kew, in 2009. In this essay, co-author John Grimshaw describes the process of putting such a detailed publication together.

*New Trees: Recent Introductions to Cultivation*

John Grimshaw and Ross Bayton

Kew Publishing, Royal Botanic Gardens, Kew. 976 pp. 2009

ISBN 978 1 84246 1730

## SETTING PARAMETERS

The assignment was to produce a book about all the tree species introduced to cultivation in recent decades, or those that had been in cultivation for longer but for which there was no good description. The standard reference in Britain is the venerated W. J. Bean's *Trees and Shrubs Hardy in the British Isles*, first published in 1914 and last updated in the 1970s to form the eighth edition. Its botanical descriptions are complemented by readable discursive text about the plant and its cultivation requirements, rather than the terse encyclopaedic format of, for example, Krüssmann's more comprehensive but less informative works (*Manual of Cultivated Conifers* and *Manual of Broadleaved Trees and Shrubs*). But Bean's book obviously fails to cover any introductions made since the 1970s, and many species, then poorly known, were covered in a footnote only. There are surprising omissions, too: the familiar American East Coast natives *Pinus taeda* (loblolly pine) and *Quercus muehlenbergii* (chinkapin oak) were first introduced to Europe



New shoot and young cones of *Pinus taeda*, loblolly pine.

in the seventeenth century, but are not covered by Bean, probably because they have never been very successful in the British Isles.

It was therefore decided that the text should follow the format of description and discussion, and that any tree not discussed fully by Bean and now established in cultivation should be included in the new book. Its working title was *New Trees*, and as nobody could think of anything better, that stuck, with the addition of the subtitle *Recent introductions to cultivation*. But there were many other thorny issues for the Editorial Subcommittee. What geographical area should it cover? What is a tree?

On paper the last is easily answered. We applied the definition "a woody plant, normally with a single trunk reaching or exceeding 5 meters (16.4 feet) in height, at least in its native habitat," thus excluding shrubs with multiple stems developing from below or close to the ground. In reality, of course, the distinction is much less simple and some things snuck in

that are on the shrubby side, while some large shrubs are omitted. The difficulty is well-illustrated by *Heptacodium miconioides* (seven-son flower), a shrub that can achieve 10 meters (32.8 feet) or more in height and be pruned to a single trunk: it was excluded.

The book was to cover trees already in cultivation, rather than possibilities in the wild, so its coverage was determined by which species were established in collections in public and private gardens (ascertained by comparing accessions lists). Unlike Bean's coverage, however, the new book was to be international in scope, reflecting the nature of the International Dendrology Society (IDS), but retaining the view that the trees should be hardy in temperate climates such as that of Britain. Where to draw the boundaries was less easy, but in Europe there is a clear distinction between the continental and



Tree or shrub? *Heptacodium miconioides* (seen here displaying showy pink calyces in early autumn) was deemed too shrublike to fit into *New Trees*.



maritime climates of the north and the Mediterranean climate to the south. An obvious vegetational difference is the commercial cultivation of olives in the Mediterranean and this matches, with remarkable precision, the area of southern Europe experiencing USDA Zone 9 winter temperatures (average annual minimum temperature 20 to 30°F [-6.6 to -1.2°C]). Maritime areas further north may also have Zone 9 winter averages, but it is impossible to grow the subtropical species that thrive in the Mediterranean basin here. We also excluded such remarkable “hotspots” as the Isles of Scilly (Zone 10) whose diversity of species otherwise ungrowable in northern Europe would skew the book too far away from its core audience.

North America, with its diversity of climates, presented a different challenge. The southeastern corner of the United States, southern

California, and the southwestern deserts all have a very distinct garden flora appropriate to their climatic conditions, again deviating from the key sense of temperate. So we decided that we’d include collections north of San Francisco on the west coast, and anything from North Carolina northwards in the east, and just strike boldly across the continent between those two points in defiance of geography, hardiness zones, etc. I don’t think we missed many significant collections by this approach.

### RESEARCHING NEW TREES

With these parameters set it was possible to go through collection lists and work out what we would be covering. I forget how many names were on the original list but in the end we covered about 850 species in full, and mentioned many others that had a toehold in cultiva-



Drawing of *Magnolia laevifolia* by Hazel Wilks (Figure 56, p. 477, *New Trees: Recent Introductions to Cultivation*).

### Picture This

**ILLUSTRATING** a book of this nature is a challenge. Many of the species covered are very little known in cultivation, and then are usually rather young specimens. In addition, taking a good picture of a tree is not very easy: the light must be right and there needs to be a vantage point for the photographer. A wide appeal for images was made and resulted in a diverse haul showing either details or the whole tree, in cultivation or in the wild, enabling us to produce (eventually) a well-illustrated book.

In addition to photographs, the book includes a series of 100 exquisite line drawings to illustrate species covered, all drawn by artist Hazel Wilks. She was also based in the Kew Herbarium and worked from dried and living specimens sourced from the Kew collection or further afield. Some complicated arrangements had to be made for receiving fresh material from elsewhere—I recall some anxiety when a precious box of fresh *Magnolia* flowers was delayed in the post.

tion. At this point I was joined by Ross Bayton, who was completing his Ph.D. at the University of Reading. With a horticultural as well as botanical background he was ideally suited to his task of preparing the botanical descriptions for each species. He worked at the Royal Botanic Gardens, Kew, where the authorities generously provided us with desk space in the herbarium (in Sub-basement A—which was better than it sounds) and all facilities, and so was able to tap the unique resources of Kew for information. Much came from published sources, but herbarium and living material was consulted for many descriptions.

Each description covers the morphological characters in detail, and provides notes on the tree's geographical distribution, its habitat, conservation status, hardiness zone, and sources of useful illustrations. The taxonomy was taken from recent authoritative sources and where there are issues (such as differing opinions on correct name) a note was provided. A unique feature of the book is its cross-referencing to the works of Bean and Krüssmann, which enables the reader to locate a description of an "old" tree quickly, and the opportunity was taken to supply up-to-date names for these taxa where there has been a change. *New Trees* therefore acts as an index to descriptions of almost all temperate cultivated trees, under almost any name. When using the book, please take time to read the introduction carefully.

In addition to directing the whole enterprise, my task was to produce the horticultural commentary for each species. This entailed gathering information about the tree from growers across the area on provenance and performance, then trying to make sense of it. That makes it sound easy! In reality it required a huge amount of traveling and endless emails and phone calls, as well as online and library research. In the process, however, I had a wonderful time, visiting arboreta all over North America, Europe, and the British Isles, meeting a host of interesting people. The generosity



The venerable 1900 accession of *Larix sibirica* in the conifer collection at the Arnold Arboretum.

with which contacts gave their time to help with the project was remarkable.

Traveling to see collections was the highlight for me. I usually had a list of specimens to see, so I'd concentrate on those, but of course one can't just ignore good trees, so I quickly gained a comprehensive education in all sorts of woody plants, not just recent introductions. Unfortunately, the only chance I had to visit the Arnold Arboretum was on a foul wet day in June 2006 when I and my guide Eric Hsu, then a Putnam Fellow at the Arboretum, got soaked to the skin. These were not conducive conditions



for recording details of trees, but one that really interested me was a large specimen of *Larix sibirica* whose label recorded that it had come from H. J. Elwes in 1900: I connected with this tree on several levels.

Henry John Elwes (1846–1922) was an important landowner in Gloucestershire, where he lived on the family estate at Colesbourne Park, where I now manage the gardens for his great-grandson, Sir Henry Elwes. With ample financial resources, Henry John Elwes was able to travel widely, and developed interests in many areas of natural history. He was a noted ornithologist and lepidopterist and a keen big-game hunter, but gardeners principally remember him for his discovery of *Galanthus elwesii* (in Turkey in 1874). A quest for wild sheep took him to the Altai mountains of central Siberia in 1897 (where I followed his route, by chance, a hundred years later), but while there he saw magnificent forests of *Larix sibirica* and arranged for seed to be sent to him. About this time he became seriously interested in trees, having plans to plant large areas of woodland on the Colesbourne estate, and he started corresponding with notable dendrologists, including Charles Sprague Sargent at the Arnold Arboretum. This, presumably, is how the Arnold Arboretum received a seedling of *Larix sibirica*. Exchanges were mutual: a specimen of E. H. Wilson's collection of *Paulownia tomentosa* W769 made in Hubei in 1908 still grows at Colesbourne. *Larix sibirica*, on the other hand, was a failure here. Despite the local opinion that Colesbourne lacks a *d* in its first syllable, our climate is in reality not cold enough. Like most Siberian conifers, *Larix sibirica* comes into growth too early in mild maritime climates, and then the young shoots get frosted.

In consequence of its general uselessness in the British Isles *Larix sibirica* was given only a cursory note by Bean, but in other countries it is much more successful—in the United States, as evidenced by the Boston tree, and, for example, vigorous, healthy specimens in Minnesota; in Scandinavia; and in Iceland and Greenland, where it is the best tree for forestry planting. So, although not a recent introduction, it was an important species to cover in *New Trees*.

## WHERE IN THE WORLD?

Once all the accounts were complete I counted the species that had come from different geographical regions. Introductions had come from all over the world, but as expected, nearly 50% were from China and the Sino-Himalayan region, which seems to be an inexhaustible source for garden plants of all kinds; one sometimes wonders what Wilson, Forrest, et al., were doing, when so much was missed! That, of course, is unfair. They had different targets, searching different areas and altitudes, and the difficulties of travel must have meant that many collections simply failed to arrive in a viable state. We also know, from the analysis made by Michael Dosmann and Peter Del Tredici of the survivorship of the collections made by the Sino-American Botanical Expedition (SABE) in 1980, that many species collected



TONY KIRKHAM

New foliage of *Liquidambar acalycina* is attractively flushed with bronze to red tones.

on any expedition soon fall by the wayside, or become represented by very few individual specimens in cultivation.

The SABE trip of 1980 remains one of the most significant of expeditions to China in terms of the species it brought back; *Liquidambar acalycina* is outstanding and so are *Sorbus hemsleyi* and *Sorbus yuana*, although the latter is still poorly known and needs to be more widely distributed, preferably in pairs of unrelated clones to ensure a good set of its spectacular fruits. The stamp-collecting habit of only planting one individual is a great problem in arboreta across the world: we really need to encourage people to plant groups to maximize genetic diversity, especially as conservation in cultivation is one of the justifications for many a collecting trip.

The thirty-year run of mild winters in the British Isles has encouraged us to broaden our horizons into genera that would previously have been considered too tender for all but the mildest of gardens, with explorers trawl-

ing lower and lower altitudes, especially for broad-leaved evergreens. Among their haul in Asia have been a mass of evergreen magnolias (formerly in the genera *Michelia* and *Manglietia*), diverse oak relatives such as *Castanopsis* and *Lithocarpus*, evergreen maples and a whole string of genera that are unfamiliar at best and previously unknown to horticulture: *Bretschneidera*, *Dipentodon*, *Exbucklandia*, *Huodendron*, *Sinopanax*, and *Sloanea*, to name a few. Other genera such as *Daphniphyllum* have had their diversity in cultivation greatly increased, while genera known as indoor plants have produced some surprisingly tough hardy species, *Schefflera* being a notable case.

The Sino-Himalayan region is vast, providing many frontiers on which to explore. In recent years Taiwan has been a popular destination, yielding both evergreen and deciduous species of great garden value, while Vietnam has become recognized as another hotspot. The mountains in the north, such as Fan Si Pan and elsewhere in the region round Sapa, are just

JOHN GRIMSHEW



*Lithocarpus kawakamii*, an evergreen species native to Taiwan, growing at Tregrehan in Cornwall.



high enough and just far north enough for their plants to have a sporting chance of being hardy in milder areas. One of its special trees is what is known as *Aesculus wangii*, although the name is technically invalid, which produces nuts 10 centimeters (3.9 inches) across—they are a trophy in themselves. Upon germination, seedlings rocket up to over a meter (3.3 feet) within weeks. Its habit of coming into leaf early may be a problem, but the tree itself seems to be winter hardy in Britain, at least.

Strange though it may seem, Australia was the next most prolific source for recent tree introductions. This apparent anomaly can be explained by the single genus *Eucalyptus*, although there are several *Acacia* and *Callitris* species plus odds and ends from other genera too. Although of negligible interest in much of the area covered, *Eucalyptus* has a devoted fan club in the milder parts (maritime Europe, the Pacific Northwest). These enthusiasts have been searching out populations in the coldest part of each species' range, a classic example of intelligent plant-hunting, unlike the usual grabbing of material from the first population found. Whether or not such sourcing has done them any good after a series of hard winters in both of these regions remains to be seen—many eucalypts have been devastated. As they grow so fast, however, it won't be long before we see another crop appearing. *Eucalyptus nitens*, the shining gum, holds the record for the fastest-growing tree in Britain, achieving 20 meters (65.6 feet) in six years in Oxfordshire, making a splendid-looking tree in that time, but alas, it was killed last winter.

Mexico has also been an important destination for plant explorers in recent decades. With its huge diversity of ecosystems this is hardly surprising. Conifers and oaks are the two most important groups of Mexican trees for temperate gardens, but there are hardy *Cornus*, *Crataegus*, *Fagus*, *Platanus*, and *Tilia* too. It is always astonishing to think of "temperate" genera occurring in the tropics, but there is a huge diversity of *Magnolia* in tropical America, and rainforest maples and oaks are diverse in southeast Asia. Half the diversity of *Juglans* (walnut) is found in the Neotropics! Most of these tropical species are too tender for tem-



JOHN GRIMSHAW

An impressively large nut from the tree known as *Aesculus wangii* (the name has not been validly published), native to Vietnam.

perate horticulture, but this shouldn't prevent experimentation with species along the tropical fringes. Many Mexican evergreen oaks are proving to be remarkably tough, and even if they are defoliated by a severe winter will usually resprout next spring. Of all the new trees I studied for the book I was most impressed by *Quercus rysophylla*, an evergreen oak with big leaves that emerge red or bronze, and which forms a stately and handsome tree, hardy in western Europe, the southeastern United States, and the Pacific coast. Experts continue to discover new species of oaks in the United States and Mexico, usually isolated on obscure mountain ranges. One such is *Q. acerifolia*, from a few mountains in Arkansas, a handsome red oak with excellent autumn colors. Liberated from its native habitat it is proving to be versatile, succeeding across the northern and eastern United States, including in the Arnold Arboretum.

In general, trees from Chile and New Zealand are for specialist growers in mild moist climates, and one has to be bold to grow any African woodies: even species from the most temperate parts of South Africa and the high mountains of East Africa are very tender. But in the right conditions it is fun to try—and even

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*Eucalyptus chapmaniana* (left) and *Eucalyptus macarthurii* (right).

outside the right conditions too. Only by pushing the boundaries can we ascertain true hardiness limits, and although there will be many failures there will be some very welcome successes. In this period of climatic uncertainty and increasing pest and disease problems we need diversity to ensure our gardens remain vibrant with interesting trees and constant experimentation is the way forward. *New Trees*, published in 2009, documents a period of intensive exploration for plant material that at least equals the efforts of earlier generations, and provides a reference point for the future from which success or failure can be judged.

Working on this project and writing the book was an immense privilege and the appreciation it has received makes it even more worthwhile. I am only one player in the team, though, and the book could not have been written without the help of dozens of dendrologists around the world, the support of the sponsors and the IDS and the sterling efforts of my co-author Ross

Bayton and artist Hazel Wilks. The editing and layout were done by the incomparable Sarah Cannon, with technical assistance from Lloyd Kirton at Kew Publishing. These latter-end stages are when the really hard part of writing any book comes, when it is being edited and put together as a volume, and deadlines are flying towards one. The ultimate deadline was the launch, a grand reception in London planned by the IDS with a set-in-stone date of May 19, 2009. The last changes were made to the text on March 30, and the finalized proofs were delivered to Kew next day, giving us six weeks. I call that brinkmanship, but the German printers stuck to their timetable and the books reached England with a week to spare. That was a relief.

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Dr. John Grimshaw is a gardening botanist based at Colesbourne in Gloucestershire, United Kingdom. He documents his horticultural activities in his blog John Grimshaw's Garden Diary (<http://johngrimshawsgardendiary.blogspot.com/>)

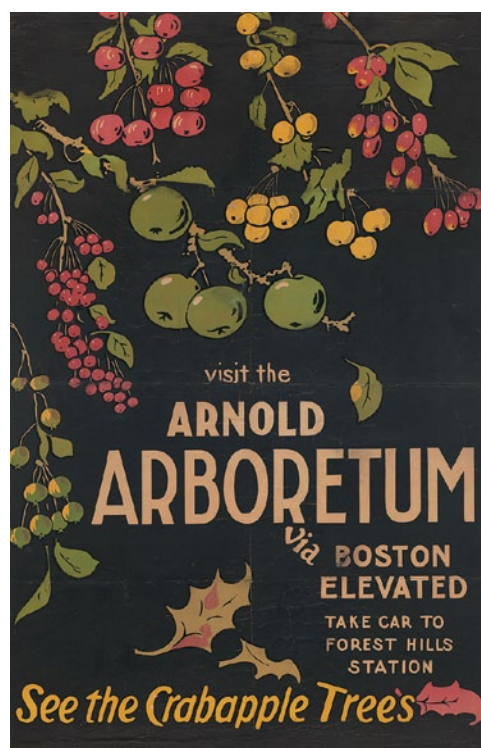


# A Year With the Apples of the Arnold Arboretum

*Miles Sax*

I have spent the past year as a horticultural apprentice working in the *Malus* (apple and crabapple) collection of the Arnold Arboretum, a collection that has long been recognized for its importance to the horticultural and scientific worlds. Because of the Arboretum's many introductions and broad distribution of both cultivars and previously undiscovered *Malus* species from wild origin, it has been hailed as the "'Mother Arboretum' for flowering crabapples" (Fiala 1994). Once celebrated in an annual event known as Crabapple Saturday, this collection remains popular with Arboretum visitors, especially during spring bloom and fall fruit display.

The dynamic nature of arboreta, including ongoing change in the fields of taxonomy, nomenclature, and research technology, inevitably leads to the need for periodic large scale review of the plant collections. Although historically the Arboretum's *Malus* collection has been a high priority, in recent decades hor-



ARCHIVES OF THE ARNOLD ARBORETUM

An old poster touts the Arnold Arboretum's crabapple collection.



PHOTOS BY THE AUTHOR EXCEPT WHERE NOTED

Part of the Arnold Arboretum's *Malus* collection in spring bloom, including white-flowered *Malus hupehensis* (accession 324-55-B) at left.

ticultural maintenance had been deferred. In addition, the collection was in need of an infusion of new plant material. With the goal of providing an elevated level of plant care along with an in-depth collections review, my task as the Arboretum's horticultural apprentice became defined. Working within both the horticulture and curation departments, I jumped into the job of evaluating and renovating the *Malus* collection of the Arnold Arboretum.

### COLLECTIONS AND THE CURATORIAL REVIEW PROCESS

Collectors of all sorts often collect items in sets, and it is this action that gives the collections defined parameters and scope. At the Arnold Arboretum the objects we collect are woody plants, but the question of how we define our "sets" is one that is not so easily answered.

Since the Arboretum's inception in 1872, this idea of collections has always been at the heart of the institution's mission. A phylogenetic planting order (Bentham and Hooker's then-new taxonomic system) was used in the original landscape design; Charles S. Sargent understood that placing plants in the same genus together would allow scientists to observe different species concurrently. Far-flung plant explorations introduced a steady flow of new plants to the Arboretum's collection, but as time passed it

became clear that simply having a large collection of plants wasn't enough. With finite resources and space, a more focused approach must be utilized in order to answer the question of scope, that is, "What does a comprehensive collection look like?" To answer this fundamental question of scope we use curatorial review, a process by which a collection is examined to quantify its value and determine goals for its development. Curatorial review is an important step in making sure that the Arboretum's mission is being achieved.

Specimens within a living collection have finite life spans, so the collection development process must be ongoing. At the Arnold Arboretum this process is primarily driven by the framework of the Living Collections Policy, which defines and prioritizes the scope of our collection. Guided by the Living Collections Policy I conducted my review of the *Malus* based on two subcategories within the policy, those for Core and Historic collections. The Core Collection of the arboretum is made up of accessions that are central to the mission of the Arnold Arboretum; plants that fall into this category are of highest importance for collection expansion and acquisition of new material and represent the heart and soul of the Arboretum's collections. The Historic Collection subcategory holds groupings of plants that are associated with the Arboretum's past expansion and influence in the horticultural world. These collections, which include historic (pre-1953) cultivars and cultivars that originated from the Arboretum, are maintained but not usually expanded. Subcategories within the Living Collections Policy are not mutually exclusive and some accessions, including many in the *Malus* collection, fall into multiple categories.

My review process for the *Malus* collection started with a taxonomic review, which included verification of identity. In autumn 2010 all of the *Malus* on Peters Hill (the location of the *Malus* collection)



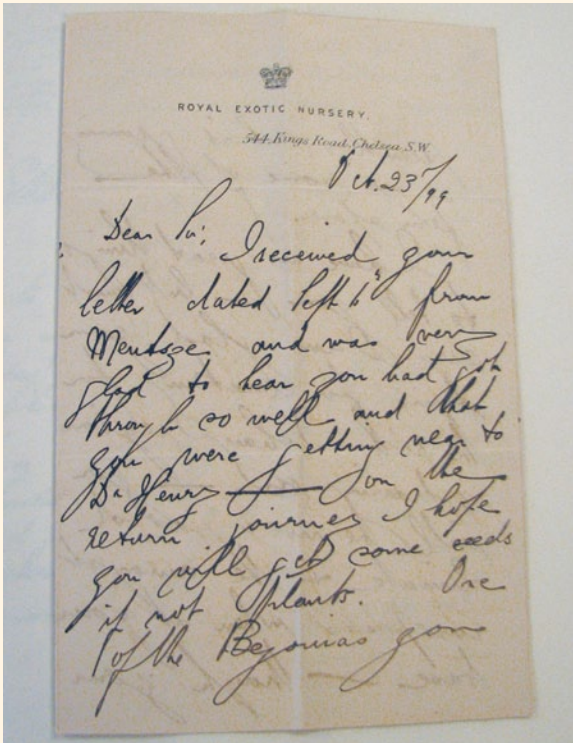
The crabapple cultivar *M. x purpurea* 'Aldenhamensis' (accession 303-50-B seen here) originated in England and was introduced to the United States by the Arnold Arboretum in 1923.



were examined and data were taken on size, shape, and color of the fruit. In spring 2011 a similar review was done by recording the size, shape, and color of flowers along with other morphological characteristics. This information was compared to existing descriptive references. For cultivars, the late Father John Fiala's book *Flowering Crabapples: The Genus Malus* was the primary resource used in determining identity and exploring the ornamental history of the genus. Because there is no current monograph of *Malus*, for accessions of wild provenance we used the flora pertinent to the region in question, e.g., *Flora of China*. This initial review was done to verify the plant material and confirm its correct taxonomic identity, allowing us to update nomenclature and ultimately make sure our plants are correctly labeled.



The petaloid stamens of this *Malus sieboldii* 'Fuji' (accession 418-68-C) flower are an example of the importance of field observation in a curatorial review. These petal-like structures, viewed from afar, make the flowers appear to be double. This curious discovery was not noted in Fiala's previous descriptions of this selection.



The archives of the Arnold Arboretum hold a treasure trove of documents, including many examples of Ernest H. Wilson's correspondence.

## Plant Detectives

**OBSERVING** physical characteristics (flower color, leaf shape, etc.) is the most common way of identifying plants but it's not the only way. A trip to the Arboretum's curation department can give a researcher access to records detailing the origins or place of collection for many plants located on the grounds. Another resource is the cache of maps—many hand drawn—detailing the exact locations of plants come and gone. The herbarium in the Arboretum's Hunnewell building and the main Harvard University Herbarium yield pressed specimens of wild plants that we enjoy as landscape ornamentals today. A trip to the Arboretum's library may uncover volumes of floras spanning the world, or historical horticultural periodicals detailing the latest plant introductions that were in vogue at the time. The library's extensive archives provide a wealth of original documentation such as Ernest H. Wilson's journals and letters to Charles Sprague Sargent from his many far-flung plant collectors. To have these resources condensed in a single place allows for research and discovery to be made in a way that is unique to the Arnold Arboretum.

But sometimes even all these resources are not enough to make a definitive conclusion on a plant's true identity

or origin. In recent years the ability to look at a plant's genetic makeup has proved to be a very powerful tool in plant systematics. To that end, the USDA Plant Genetic Resource Unit in Geneva, New York, has graciously offered to genotype a handful of the Arboretum's mystery *Malus*. When the results are returned we can look forward to some answers from this unique plant identification technology.

## New Cultivars for the *Malus* Collection

**WHILE** typically collections at the Arnold Arboretum aren't built with a strong focus on cultivars (cultivated varieties, which are plants that have been selected for a particular trait, named, and clonally propagated), an exception is made for the *Malus* collection because of its unique history and its role in the dissemination and promotion of the flowering crabapple. But many of the currently accessioned cultivars originated prior to the 1960s, so in the curatorial review process we have identified an infusion of newer cultivars for collection expansion. Here are a few of the cultivars that are of high interest to us and that Arboretum visitors may be able to see on Peters Hill in the future:

NANCY ROSE



'LOUISA'

### *Malus* 'Louisa'

A small tree with a weeping habit, flower buds rose, opening pink. The small fruits are yellow with a red cheek. This disease resistant crab apple is a Polly Hill introduction and named in honor of her daughter.

### *Malus* 'Molten Lava'

A broadly weeping tree that features good disease resistance, lots of eye-catching orange-red fruit, and interesting winter bark. A John L. Fiala introduction.



NANCY ROSE

'MOLTEN LAVA'

### *Malus sargentii* 'Select A' (Firebird®)

This cultivar is of note because of its low, spreading form and the small, bright red fruits that are retained well into the winter months. A Johnson Nursery introduction by Michael Yanny.

### *Malus ioensis* 'Klehm's Improved Bechtel'

A cultivar of the North American native prairie crabapple. This selection features large, fragrant, double pink flowers and sparse fruit production. It is somewhat more disease resistant than *M. ioensis* but is susceptible to cedar-apple rust. Selected by Clyde Klehm.

COURTESY KLEHM'S  
SONG SPARROW NURSERY



'SATIN CLOUD'

### *Malus* 'Satin Cloud'

A small rounded branching tree that has spicy fragrant blooms that lead to a profusion of small yellow fruit. It has exceptional disease resistance and striking fall foliage color of purple, red, and orange. This unique octoploid was hybridized by John L. Fiala and introduced by Klehm Nurseries.



Knowing what the collection actually comprises was the first step in being able to ask the question, “What is the collection missing?” There was no way to assess what additions would be required without first understanding all the options. The Arboretum’s collections focus primarily on plants of documented origin, in particular wild provenance, so that became the framework for the assessment. We assembled a list of all known *Malus* species and their infraspecific taxa (e.g., subspecies, varieties) from around the world and compared it with our existing accessions, with the goal of identifying key areas where the collection lacked diversity.

Armed with this information, the curation department now has a desiderata (wish list) of plants and we can request material from other botanical institutions and germplasm repositories. The list will also be useful when determining goals for future plant collecting expeditions.

## HORTICULTURAL CARE OF THE COLLECTION

Horticultural care and maintenance of the *Malus* collection was a major part of my apprenticeship. One of my primary goals was to take a hard look at “best practices” for growing apples in order to develop an action plan that would reflect some of the new thinking on orchard cultural practices.

The Arboretum collection grows primarily ornamental crabapples rather than eating apples, but many of the horticultural concerns are shared. Eating apples have been cultivated for centuries in a variety of settings, so apple orchards provide an interesting model system for understanding how we manage human created plant ecosystems. Consumer interest in organic products has increased, as have demands that growers utilize better practices that are more environmentally friendly. What initially started with farmers is now spilling over into



MICHAEL DOSMANN

The author pruning in the *Malus* collection.



Detailed information was collected on each accession in the collection. Seen here, the colorful fruit and fall foliage of *Malus* 'Henry Kohankie' (accession 604-61-A).

the fields of commercial and public horticulture. Integrated pest management (IPM) practices, including using products that are more environmentally friendly (and many of which use biology to outcompete pests), are used increasingly by commercial orchardists as well as by public gardens such as the Arnold Arboretum. In recent years some apple growers have gone beyond the principles of IPM to develop holistic management practices that not only produce desirable fruit but also healthy trees in a robust environment. Holistic management practices see the orchard environment as a series of intertwining cyclical systems, each of which are evaluated and management practices are devised to work with their unique characteristics.

After learning more about this holistic approach I wanted to incorporate it into the management of the Arboretum's *Malus* collection. The goal is to end up producing high quality ornamental fruit, but as a secondary benefit of growing healthy trees. My initial step involved looking at the landscape on Peters Hill as a whole: the flora and fauna that interact there, the soil's physical structure, water movement, and other environmental factors that affect the site. Then during my curatorial review I visited each *Malus* specimen and made phenological observations relating to fruit development, pest and disease pressure, competing weeds, and overall tree health and vigor.

All of these observations were entered into our BG-BASE, the Arboretum's plant records database; having this information readily available allowed us to develop management priorities and gave structure to a process that could otherwise be overwhelming.

As the next step, I attempted to view each specimen as a whole and then break it down to the individual parts that allow it to function. So when observing a single specimen I don't just see a "tree," I see the trunk, branching structure, differences in vigor and type of growth (e.g., normal, water sprouts, or root suckers), leaf canopy (or lack thereof), leaf

biology, disease presence and extent, observable roots, and understory plant communities. All of these factors may play a part in disease, pest, and health issues for individual specimens, and we can then use individual tools to assess the details of needed plant care.

Finding out about the soil—its physical properties, chemistry, biology—was an essential step in determining care for the collection. I conducted a traditional soil chemistry test to assess pH, organic matter, and micro- and macronutrients. Soil tests can be useful in plant management, but having optimal pH and available nutrients doesn't ensure that plants can fully utilize the resources, especially if there are other factors, such as soil compaction, that inhibit the plants' roots from being able to access the nutrients. Taking this into consideration, we used a soil penetrometer to test for compaction and found that soil in the main *Malus* collection on Peters Hill had a compaction layer at roughly 6 inches deep. Compaction is a common phenomenon in urban and rural environments where years of machine use, driving, grazing of animals, or even walking can put pressure on the soils. The air spade, a tool that uses a stream of compressed air to physically loosen the soil, is used regularly at the Arboretum to improve root health, but to treat the more than 350 specimens of *Malus* in the collection would be impractical.



## My Favorite *Malus*

THE ECLECTIC mix of wild germplasm, hybrids, and early cultivars in the Arnold Arboretum's *Malus* collection gives inquisitive visitors a chance to see crabapples rarely found in the commercial trade.

Here are a few of my favorites:

### *Malus* 'Mary Potter'

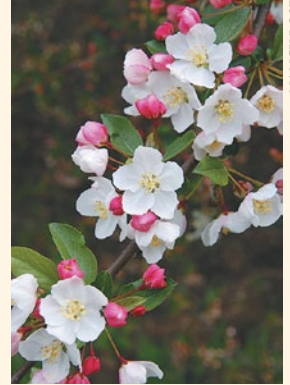
**FEATURES:** A medium height, wide-spreading tree with high disease resistance, offering abundant white flowers and small (0.4 inches [1 centimeter] diameter) red fruits.

**DESCRIPTION:** This specimen is the original selection of the cultivar. Introduced by the Arnold Arboretum, this Karl Sax selection is considered by many to be his best *Malus* hybrid. Named in honor of C. S. Sargent's daughter, this hybrid is a result of cross between *M. sargentii* 'Rosea' x *M. x atrosanguinea*.

ACCESSION NUMBER: 181-52 B

LOCATION: 51-SW

ORIGIN: Arnold Arboretum



NANCY ROSE



### *Malus kansuensis* var. *calva*

**FEATURES:** Rare in cultivation, its small stature and unique flowers and fruit make this an interesting apple in the collection.

**DESCRIPTION:** Small, slow-growing tree; flowers are creamy white and fruits develop a caramel yellow color with a red cheek. The fruit is somewhat flattened on the top and bottom and has vertical ridges around it, giving it a pumpkin-like appearance.

ACCESSION NUMBER: 134-43 A

LOCATION: 49-SE

ORIGIN: China

### *Malus tschonoskii*

**FEATURES:** Silver-white, tomentose undersides of leaves, attractive orange to red fall color, tall (40+ feet [12+ meters]) upright-pyramidal shape.

**DESCRIPTION:** This accession is the Arnold Arboretum's oldest apple in the collection as well as one of the tallest. Collected by C. S. Sargent in 1892 during his expedition to Japan. The flowers and fruits of this specimen are insignificant, but the unique leaves and form look unlike any other apple. To the casual passerby it would be difficult to identify it as an apple tree at all.

ACCESSION NUMBER: 3678-A

LOCATION: 17-SW

ORIGIN: Japan



NANCY ROSE



### *Malus hupehensis*

**FEATURES:** The fruits are yellow with a red cheek and provide a nice contrast with the crimson to purple fall leaf color.

**DESCRIPTION:** Wide-branching, vase-shaped tree. Leaves and copious fruit develop out of short branch spurs, giving a distinctive appearance. Leaves have reportedly been used as a tea substitute in parts of China. The species was introduced by the Arnold Arboretum and was first collected from China by E. H. Wilson in 1908.

ACCESSION NUMBER: 324-55 B

LOCATION: 50-SW

ORIGIN: China

### *Malus x robusta* 'Arnold-Canada'

**FEATURES:** A rare cultivar that is a towering giant of an apple tree. By far the tallest specimen in the collection.

**DESCRIPTION:** Primary scaffolding branches alone are larger than the main trunks of many other *Malus*. The distinctive bark has an appearance somewhat similar to *Prunus* (cherry). This specimen features copious fruits that are orange-yellow with a bright red cheek. Rarely found in other collections outside the Arnold Arboretum

ACCESSION NUMBER: 172-52 B

LOCATION: 50-SE

ORIGIN: Hybrid



Instead, to deal with soil compaction on Peters Hill we've recently started an experiment using forage radishes (*Raphanus sativus* var. *longipinnatus*) in four 1/8-acre plots. These radishes (also known as daikon) are noted for their extensive taproots—the thick upper portion grows up to 20 inches long and the slender lower section can extend several additional feet (Weil et al. 2009). Sown under trees and in fields in late summer or early fall, they develop roots and eventually are killed by freezing temperatures. In the spring the roots decompose, adding nitrogen to the soil and leaving deep fissures that allow water, air, and nutrient infiltration. If results in our trial plots are positive this low time- and resource-use solution could be an appropriate option for the *Malus* collection.

We are also looking deeper into the collection's soil ecology through analysis of the "soil food web," a system involving a variety of soil organisms including protozoa, nematodes, mycorrhizal and other fungi, and bacteria (Ingham 2009). (The relative ratios of fungi and bacteria can be quite important to soil health.) The results of this analysis may lead us to options such as introducing beneficial predatory nema-

todes to control existing damaging nematodes or applying specific mycorrhizal fungi. This is the benefit of a holistic perspective and having the technologies available to view and interpret these complex life systems.

### THE TALE OF *MALUS SPONTANEA*

As I discovered through my curatorial and horticultural work, there are many interesting stories—and even a few mysteries—among the plants in the *Malus* collection. One of these stories involves an unusual specimen (accession 10796-2-A, a *Malus spontanea* previously listed as *Malus halliana* var. *spontanea*) that sits at the bottom of Peters Hill. The main trunk and scaffolding branches of this specimen lie horizontal to the ground with smaller branches reaching skyward. On first glance it appears this apple has developed a low, spreading form with a well-developed branching system, but closer inspection reveals a hollowed tree base, indicating that this tree once stood upright. The records are inconclusive as to how this specimen reached its unusual position but theories range from hurricanes to head-on collisions with stolen cars pushed down Peters Hill.



Fire blight killed this specimen of *Malus yunnanensis* (accession 915-88-A) on Peters Hill.

**FIRE BLIGHT** (caused by the bacterium *Erwinia amylovora*) in the *Malus* collection has become a disease of particular concern because it can kill trees quickly. In the last few years over a dozen specimens were severely damaged or killed by the disease including the type specimen of *Malus toringoides*. Managing this disease has been a primary focus for me. To address this bacterial pathogen the majority of my pruning efforts have been aimed at systematically removing the cankers this disease creates. By removing these sources of inoculum from the environment the hope is to reduce the bacteria to a manageable level. Additionally, in the spring an organic copper spray was used to prevent new infections this year. This spray worked as a preventative from fire blight on the trees and also had the added benefit of supplying the soil with copper, which tests indicated was on the low side. This treatment will be conducted for two years in tandem with the pruning efforts to knock down the disease to a manageable level. In subsequent years regular monitoring and sanitation pruning should prove adequate for control of the disease.





This specimen of *Malus spontanea* (accession 10796-2-A, previously listed as *Malus halliana* var. *spontanea*) has an interesting shape and an interesting history.

Perhaps because of its provenance or its status as an E. H. Wilson-collected lineage it was preserved and is now growing perfectly well in its new orientation.

Initially struck by its unusual form, I came to realize that this *Malus* had an interesting tale to tell. While conducting my curatorial review I was searching through our plant records in an effort to verify the identities of the *Malus* in our collection. My research brought me upon four living specimens of *Malus halliana* var. *spontanea*, all of which are the Wilson lineage and one of which was the *Malus* in repose. Looking at the provenance information I noticed that the original accession (10796-A) was wild-collected from Japan by Wilson during his 1918 expedition. Although the taxonomy of *Malus halliana* is a bit unclear, what struck me as odd is that this species is reported as a native of China. My initial thought was that this was an accident in nomenclature and so I began to pursue the tree's true identity. Accession information stated that the plant was wild-collected by Wilson, but without providing an exact location. *Malus halliana* has been cultivated as an orna-

mental in Japan for generations, but since the Arboretum's specimens were supposedly from wild origin I realized something wasn't adding up and exact provenance information would have to be unearthed to get to the true identity of this specimen.

Weeks later, while conducting the conservation portion of my curatorial review, I was searching *Malus* on the Botanic Gardens Conservation International's (BGCI) website. To my surprise I saw that on the 1997 IUCN Red List of Threatened Plants *Malus spontanea* (as a species, not a variety of *M. halliana*) was flagged as vulnerable. Realizing that the *Malus* in question might be of conservation value, I decided I had to give another go at this mystery apple. I figured that if our records indicated that this plant was wild collected from Japan, somewhere buried in the archives there must be conclusive evidence of the true identity of this tree.

After multiple searches in our herbarium, archives, and historic records, I eventually found the information I had been looking for in an article on new taxa by Alfred Rehder in the *Journal of the Arnold Arboretum* (Rehder

## Historic Eating Apples

**FEW CULTIVARS** of eating apples are currently in the Arboretum's *Malus* collection. Pomologist and apple explorer John Bunker of Fedco Trees nursery in Maine kindly shared his biogeographic review of significant heirloom varieties in New England. These heirloom apples are both delectable and well suited for our region's climate. As the Arboretum's *Malus* collection expands, visitors may one day be able to stroll Peters Hill and explore the apples that once defined the Northeast's early orchards and fruit heritage. Listed below are some apple cultivars originating in individual New England states. See Bunker's book *Not Far From The Tree* for detailed cultivar descriptions and a historical perspective of New England orchards.

### CONNECTICUT

'Black Gilliflower'  
'Chandler'  
'Hurlbut'  
'Pumpkin Sweet'

### MAINE

'Black Oxford'  
'Cole's Quince'  
'Starkey'  
'Winthrop Greening'

### MASSACHUSETTS

'Baldwin'  
'Hubbardston Nonesuch'  
'Roxbury Russet'  
'William's Favorite'

### NEW HAMPSHIRE

'Granite Beauty'  
'Milden'  
'Nodhead'  
'Red Russet'

### RHODE ISLAND

'Dyer'  
'Peck's Pleasant'  
'Rhode Island Greening'  
'Tolman Sweet'

### VERMONT

'Bethel'  
'Malinda'  
'Northern Sweet'  
'Scott's Winter'



Color plates from *The Apples of New York*, 1905, by horticulturist S. A. Beach, show 'Rhode Island Greening', 'Hubbardston'(synonym 'Hubbardston Nonesuch'), and 'Roxbury'(synonym 'Roxbury Russet').





The *Malus* collection holds many unusual crabapples including this cultivar, 'Redford' (accession 277-42-A), which has large fruits with bright pink flesh.

1926). In his brief description of *Malus halliana* var. *spontanea* (which was his lumping based upon 1914 species determination of *M. spontanea* by Makino), Rehder gave details about Wilson finding and collecting this tree on volcanic Mount Kirishima on Japan's southern island, Kyushu, where *Malus spontanea* is known to be endemic. With this piece of information I could now confirm the provenance of the *Malus* in question. Additional review of more recent literature led me to recommend that the Arboretum disregard Rehder's lumping of the variety into *M. halliana* and elevate it to the species rank that it deserved.

Considering that this plant is of conservation value I realized simply confirming its identity wasn't enough. A review of other institutions' collections inventories revealed that the Arnold Arboretum, the USDA National Plant Germplasm System, and the Holden Arboretum were the only three collections with holdings of *Malus spontanea*. All three of these holdings are from the same Wilson-collected lineage. After bringing this to the attention of Arboretum curator Michael Dosmann, he put me in contact with Dr. Hiroyuki Iketani of Japan's National Institute of Fruit Tree Science. Dr. Iketani is the head of the genetic resource laboratory and has an interest in the relationships of Japanese *Malus* and *Pyrus* of wild and cultivated origin. He informed me that *Malus spontanea* is considered to be a national treasure in Japan and that fewer than 300 wild individuals exist. Recent volcanic activity in the area is putting further stress on these rare plants. In an effort to preserve this species at risk of extinction, Dr.

Iketani offered to collect seed from the remaining wild populations and send them to both the USDA and the Arnold Arboretum. Once this plant material clears the importation process we look forward to the infusion of these plants of high conservation value into the collection.

## CONCLUSION

Working as an Arboretum apprentice for the last year has been a fulfilling experience that has pushed me both intellectually and physically. The chance to engage with both the horticulture and curation departments led to many synergistic benefits. In 2010 I made 369 observations that resulted in data entries in BG-BASE, and in 2011 I added another 560 observations, for a total of 929 observations on 479 individual plants. These data will be valuable for long-range curatorial planning as well as current horticultural maintenance, and may also be of benefit to fellow botanical institutions who hold *Malus* collections. My apprenticeship has been extended for another year so I will be able to continue my efforts to push this collection toward the highest levels of care and curatorial value.

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Miles Sax is a horticultural apprentice at the Arnold Arboretum.

# The Royal Azalea: *Rhododendron schlippenbachii*

Nancy Rose

**R***hododendron schlippenbachii* is perhaps most noted for its lovely spring bloom, but this deciduous azalea is also a standout in the autumn garden when its leaves turn striking shades of yellow, orange, and red. In addition, royal azalea displays attractive summer foliage and a handsome winter silhouette, making it that object most desired by gardeners—a plant with all-season ornamental interest.

Royal azalea has long been a favorite of mine, so I was tickled to find out that several illustrious Arboretum horticulturists have also written glowingly about this species. As Peter Del Tredici mentioned in the first article in this issue, many timeless bits of information and opinion can be gleaned by reading through old issues of the *Bulletin of Popular Information* and *Arnoldia*—here, Charles Sprague Sargent, first director of the Arboretum, describes royal azalea's native range and growth habit:

*R. Schlippenbachii* is one of the commonest shrubs of Korea and often forms the dominant undergrowth in open woods. From Korea it crosses into northeastern Manchuria where it grows on the shores of Possiet Bay; it occurs, too, in two localities in northern Japan. Wilson found it extraordinarily abundant in Korea on the lower slopes of Chiri-san and on the Diamond Mountains, which were where he visited this region in June "a wonderful sight with literally miles and miles of the purest pink from the millions of flowers of this Azalea." In Korea this Azalea on the wind-swept grass-covered cliffs of the coast grow[s] less than a foot high but flowers abundantly. In the forests of the interior it often grows to a height of fifteen feet and forms a tall and slender or a broad and shapely shrub. (*Bulletin of Popular Information*, May 5, 1921)

Typically blooming in mid-May at the Arboretum, royal azalea is covered with large flowers in clear shades of pink, somewhat resembling a mass of pink butterflies resting on the branch

tips. In the same *Bulletin* article quoted above, Sargent wrote, "The pale pink fragrant flowers, which are about three inches in diameter and marked on one of the lobes of the corolla with red-brown spots, are perhaps more beautiful than those of any other Azalea, certainly of any Azalea which has proved hardy in the Arboretum." And Ernest H. Wilson wrote in the May 16, 1927, issue of the *Bulletin*, "The blossoms on this lovely Korean Azalea are now open on the Bussey Hill. A sturdy bush of upright habit, bearing on naked twigs terminal clusters of large pale to pure pink blossoms. This is a very hardy and satisfactory Azalea." (Cold hardy through USDA Zone 5 [average annual minimum temperature -10 to -20°F/-23.4 to -28.8°C], and possibly into Zone 4.)

Royal azalea also has distinctive foliage. The large, broad-obovate leaves are arranged alternately, but they are crowded together at branch tips, giving a whorled appearance. Foliage color is medium green during the summer and, as Donald Wyman reported in the May 14, 1937, *Bulletin*, "One of its valued characteristics is the fact that in the fall the leaves turn from yellow to orange [and] crimson, thus enabling landscape gardeners to utilize it for autumn as well as spring color."

There are several accessions of *Rhododendron schlippenbachii* growing at the Arboretum, including several mass plantings in the Explorers Garden on Bussey Hill. One of the easiest and most impressive to view is a large group of plants of accession 465-70 nestled under towering oaks just off of Bussey Hill Road (seen in photos at right). If visiting at any time of the year (though especially spring and fall) be sure to see this lovely azalea species that has a long history of appreciation at the Arboretum.

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Nancy Rose is a horticulturist and the editor of *Arnoldia*.







