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ARNOLDIA (ISSN 0004-2633) is published quarterly in spring, summer, autumn, and winter by the Arnold Arboretum of Harvard University.

Subscriptions are $10.00 per year; single copies, $3.00.

Second-class postage paid at Boston, Massachusetts.

Postmaster: Send address changes to
   Arnoldia
   The Arnold Arboretum
   The Arborway
   Jamaica Plain, Massachusetts 02130

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Front cover: American persimmon (Diospyros virginiana). Al Bussewitz photo.
Mature American persimmon tree at the Arnold Arboretum, showing the typical widely spaced irregular branching pattern. Al Bussewitz photo.
Two Promising Fruit Plants for Northern Landscapes

by Edward Goodell

In recent years a trend toward "edible landscaping" has begun to emerge as a natural extension of standard gardening. Two books on the subject have been published (Britz; Creasy), and in Massachusetts a bill creating the innovative Massachusetts Fruition Program was passed by the legislature in 1980. With a budget of $64,000 this program promotes the planting of food-producing trees, shrubs, and vines.

Perhaps the most desirable characteristic in landscape plants is an ability to thrive in low-maintenance situations. This eliminates many commercial fruit species, however, as these usually have been highly selected for fruit production under the assumption that adequate care will be provided. Fortunately, there are many food-producing plants that, for various reasons, have never been developed. On the Arnold Arboretum grounds alone I found about 150 species, from Actinidia arguta to Zizyphus jujuba. The usual reason that such plants are not developed is that they have a deficiency in some characteristic, such as yield, keeping quality, or ease of propagation, that would limit their success as a commercial crop. On the other hand, their broader-based genetic makeup often allows them greater environmental adaptability, and they are therefore less needful of maintenance.

I chose the two plants described here for the quality of their fruits and their adaptability in low-maintenance situations. Many other plants deserve equal attention, including the juneberry, flowering quince, hazelnut, walnut, mulberry, elderberry, hickory, pine nut, grape, and various Prunus species.

Three major climatic factors must be considered in growing woody food plants in the Northeast: minimum winter temperatures, occurrence of late spring and early fall freezes, and the relatively short, cool growing season. Carefully choosing a favorable planting site (e.g., with good air and soil drainage) will enhance a plant's performance in any given climate. Actinidia will grow reliably in northern New England and New York (USDA plant hardiness zone 4; see map on page 119). The persimmon is recommended only for zones 5 and 6 in the Northeast.

Edward Goodell has been a student intern at the Arnold Arboretum for the past 2½ years.
The American Persimmon, *Diospyros virginiana*

If the world's population were polled as to its favorite fruit, the choice would probably be the persimmon. This may be surprising to most Westerners, but it is understandable when one takes into account the fact that the Oriental persimmon (*Diospyros kaki*) is the primary fruit in the diet of more than a billion Chinese, Japanese, Taiwanese, and Koreans. This persimmon, known as the kaki in the Orient, is also gaining a deserved popularity in the warmer portions of this country (USDA zones 7-10) both as a handsome landscape plant and productive orchard tree. Its bright orange, apple-sized fruits are grown commercially in California and now regularly appear in United States markets. Approximately 1000 cultivars exist in the Orient and vary widely in shape, size, color, and flavor. Selected through centuries for their superior fruits, these cultivars originated from the astringent, seedy, small-fruited wild species that is now rarely seen in its native China (Spongberg 1977).

Unfortunately, the Oriental kaki cannot be recommended for areas where winter temperatures dip below 0°F. Thus, for a cold-hardy persimmon we must turn our attention to the native American persimmon (*Diospyros virginiana*). Its large natural range extends as far north as southern Connecticut, west to Iowa, and south to Texas and Florida (Little). Under cultivation, American persimmons originating in the northern part of the range are quite hardy throughout USDA zone 5 (or -20°F average minimum temperature). Even though some cultivars of *D. virginiana* have been selected during the past hundred years, the species remains relatively wild compared to the highly domesticated Oriental kaki. But the success story of its Oriental relative may be an indication of what is in store for this native American fruit tree.

Throughout the persimmon's natural range, the fruits have been long valued as food. Hernando DeSoto's expedition to the Americas in the early 1500s reported persimmon pulp being dried by Native Americans. These "loaves" of dried persimmon kept from one year to another. Native Americans are also known to have added persimmon pulp to corn bread, and they even ground the seeds into a meal (Griffith and Griffith 1982). A beer made from fermented persimmons and honey locust pods was a common drink among southeastern tribes (Carr).

DeSoto's chronicler considered them "better than all the plummes of Spaine" and noted that "they make far better prunes of them." In commenting about the persimmons known to the Roanoke colony in 1585, Thomas Hariot wrote "they are not good till they be rotten (but then) . . . they be lushious sweet" (Roush).

It was Captain John Smith who first described the woeful surprise of eating an unripe persimmon. He noted, "If it not be ripe, it will drawe a man's mouth aawei with much torment." The incredible astringency of the unripe fruit accounts in part for the fruit's lack of
widespread acceptance. But, as Captain Smith went on to say, "when it is ripe, it is delicious as an Apricock." Subsequent colonists agreed and used persimmons in making puddings and beer. The present inhabitants of the natural range of *D. virginiana* also enjoy wild fruits, and commercial sources of trees for home orchards are now available. Each year, during the last weekend in September, some 25,000 visitors join the town of Mitchell, Indiana, in celebrating the persimmon harvest with a feast of persimmon culinary delights.

A 1978 market study conducted in Illinois evaluated the commercial potential of prepared persimmon products (Garrison). Although 85 percent of the participants were initially biased against persimmons, almost all responded favorably to the products' taste and expressed an interest in making persimmons a regular part of their diet.

The astringency of unripe persimmons is mainly responsible for the persimmon's unpopularity. For the fruit to be at its best, it must ripen on the tree before the leaves fall. This has been a major limiting factor in the Northeast, because persimmons are adapted to areas with relatively longer and hotter growing seasons. However, a few cultivars that have proved themselves in the North are available now. A second limiting factor is that the ripe fruits are soft and do not ship or store well. New artificial ripening techniques may soon allow unripe, firm fruit to be mechanically harvested, shipped to distant markets, and stored for long periods. But shipping qualities are not a crucial factor for the home orchardist, and persimmons can be preserved easily in home freezers. Persimmons are also considered difficult to transplant. They do have special transplant requirements, but if a few guidelines are followed they can be successfully established in good vigor.

The American persimmon has many attributes to recommend it. The ripe fruit has a rich flavor and high energy content. The texture of a ripe persimmon is somewhere between that of a baked apple and firm custard. The trees are productive over a wide range of soil types. They are long-lived, beautiful in fruit, and relatively unaffected by pests.

*D. virginiana* is a variable species. Several recognized botanical forms exist (Spongberg 1977), and two races have different numbers of chromosomes (Baldwin and Culp). One race (a tetraploid with 60 chromosomes) is geographically centered in southern Appalachia. This race is probably the primitive *D. virginiana*, its current range approximating the species' northern limit during the Pleistocene glaciations. The second race (hexaploid with 90 chromosomes) is thought to represent a more recent evolutionary change. It predominates in areas north and west of the southern Appalachians. This race, which may deserve a separate subspecies rank, is more vigorous, cold hardy, and drought tolerant than the first. The two races are generally not capable of fertilizing each other. Most of the cultivars suited for the North have been selected from the second race because it also tends to have larger fruit that ripens earlier (McDaniel 1982).
D. kaki also has 90 chromosomes, and efforts have been made to obtain an interspecific hybrid. Russian botanists have reportedly bred several hybrids, but similar attempts in this country have failed to yield a verified hybrid (McDaniel 1982). Seeds produced from controlled cross-fertilizations between the two species usually do not germinate, or if they do, the resultant seedlings show characteristics of the maternal parent only. Future attempts using embryo culture techniques may yield successful hybrids that combine the size and sweetness of the Oriental kaki with the greater cold hardiness of the native American persimmon.

Under natural conditions the persimmon grows best on alluvial bottomland and terraces, where it sometimes reaches approximately 100 feet and has a long slender trunk. It is also found on sandy well-drained soils, where it more commonly grows in a shrubby habit to 33 feet tall.

The American persimmon is usually found in deciduous woodlands in association with maple, poplar, hickory, oak, sassafras, or dogwood. It is very tolerant of shade, germinating and persisting in the under-story but fruiting only lightly. Persimmons can also utilize full light conditions, as shown by their ready colonization of abandoned fields, fence rows, and other disturbed areas such as roadsides. Stumps and fire-damaged trees usually sprout profusely, and roots commonly sucker, producing persimmon thickets. The freely growing persimmon has been both praised as a conservation plant and cursed as an agricultural weed (Fletcher).

The dark persimmon bark is deeply fissured into square scales, in an alligator-skin pattern. Persimmon wood is close grained and heavy. The sapwood is light colored and the heartwood is dark brown like that of another member of the Diospyros genus, the tropical ebony. Persimmon heartwood is not suitable for lumber because it checks excessively during the drying process. However, the hard heartwood has been used for small wooden products, such as tool handles and golf-club heads, in which it has the attribute of polishing as it wears. Unfortunately, the heartwood develops so slowly that the persimmon has never become a commercially important timber tree.

The persimmon is very adaptable to site and soil conditions. Under cultivation, it grows satisfactorily “on very sandy soils, and on heavy clay loams, within a wide pH range” (McDaniel 1971). After an initially rapid growth rate, persimmons generally settle down to a pace of about a foot per year. Open-grown trees rarely grow taller than 30 to 50 feet. They have a roughly pyramidal shape. Young trees have ascending branches and an oval outline, but with maturity the branching becomes more sinuous and horizontal or even slightly pendulous. A specimen planted in 1896 at the Arnold Arboretum is a splendid example of the picturesque zig-zag branching of mature trees.

The deep green foliage often has an unusual slate-colored tint, which makes a persimmon tree stand out in the summer landscape.
Flowers of an American persimmon tree. Al Bussewitz photo.
The individual leaves are oval and 4 to 6 inches long. They tend to droop from their stout petioles, giving the whole tree a languid quality. Fall coloration may be deep yellow mottled with green and red, but in northern areas leaves often fall without changing color dramatically. In winter the American persimmon may be readily distinguished by “the characteristic bark pattern; lack of terminal buds on branchlets, as well as solitary (vascular) bundle scars centered in the leaf scars . . .” (Spongberg 1979).

The leaves expand in May, and the flowers appear on the current season’s growth when the leaves are about half-grown but do not open for several weeks. The flowers are often borne in practically every leaf axil. They are not readily noticed at a distance, however, because they are small and a faint green or cream color. The most apparent sign at flowering is the activity of bees visiting the nectariferous flowers. C. D. Eddy in 1927 described the honey as being of a “very fine quality” and noted that persimmons were rated as one of the more important nectar-producing plants in North and South Carolina. Wind pollination is also a possibility with the very light and powdery pollen.

Persimmon fruits remain light green as they enlarge during the summer. With the arrival of fall, they finally turn amber to deep orange with a light bloom on the skin. Better selections are 1 to 2 inches in diameter, about the size of a small plum. The average fruit is 50 percent high-carbohydrate pulp, and the remainder is seeds and skin. Hard freezes will darken and wrinkle the fruit, but persimmons often hang on the tree through midwinter.

Seedling persimmon plants begin flowering at four to eight years of age. The male plants are generally more precocious than the female (Campbell). A grafted cultivar will bear fruit within three years. A test planting of four-to-six-year-old cultivars yielded an average of 50
pounds per tree (Claypool). Wild trees, estimated to be 10 to 15 years old, averaged 73-pound yields. Most persimmon trees can bear regular, heavy crops. However, if pollination is excessive, an extremely heavy crop can be set. This may result in limb breakage, inadequate ripening, and a light crop the next year. Maximum yields are reached when the trunk diameter approaches 1 foot (approximately 25 years). Uncrowded trees should remain productive for another 50 years. American persimmons planted well over 80 years ago in Urbana, Illinois, show no signs of declining yields (McDaniel 1982).

The reproductive biology of *D. virginiana* is interesting in its complexity. Persimmons are mainly dioecious, with the urn-shaped staminate and carpellate flowers occurring on separate trees. The staminate flowers (on “male” trees) are about the size of a blueberry flower (3/8 inch in diameter). The carpellate flowers (on “female” trees) are about twice as large, and the petals are more spreading. Carpellate flowers are borne singly, whereas staminate flowers are normally in short, stalked clusters of three. The flower pedicels are persistent, so the sex of a tree can be easily determined even during winter.

Frequent exceptions to the dioecious conditions have been observed on cultivated plants. It was first noticed that some female plants would produce seedless, parthenocarpic fruit (without fertilization) when grown in isolation from pollen-bearing trees. Later, when some of these plants began to produce occasional seeded fruits, it was discovered that staminate flowers were occurring on weakly growing branches of normally female trees. Conversely, vigorously growing shoots of male trees will sometimes produce carpellate or perfect (bisexual) flowers.

This variable reproductive expression has been best documented in the persimmon cultivar ‘Early Golden’ and its descendants. J. C.
McDaniel of the University of Illinois, an authority on the American persimmon, has ventured the following theory about these plants. "The fact that 'Early Golden' sometimes (probably frequently on old trees) can be self-pollinating with the aid of insects and that several of its descendants can, too, leads to the speculation that it may have descended from a line of sometimes self-pollinated trees, going back no one knows how many years. It could have originated from a naturally inbred line, and the inbreeding may account for the high concentration of good qualities (size, earliness, good texture and flavor) found in 'Early Golden' and a fairly high percentage of its predominantly carpellate progeny. The inbreeding could result, as it does in other ordinarily cross-pollinated crops, in some reduction of fertility; this may partially account for the fact that 'Early Golden' and its kin seldom mature the full complement of 8 seeds per fruit that is found in ordinary seedling D. virginiana when adequately pollinated at flowering season. Breeders have just begun to do controlled inbreeding with the 'Early Golden' family to test these theories experimentally."

Seedless fruit are smaller and their taste and texture may not be as good as those of seeded fruit (McDaniel 1973). Both yield about the same amount of pulp, because the flesh of seedless fruit contains fibrous materials in place of the undeveloped seeds (McDaniel 1982). However, seedless fruit seem to ripen earlier, a valuable characteristic in the North. Where space is limited, the ability to bear crops without a pollinator is another asset. One male tree to 12 females is the general guideline for correct pollination. Grafting a male branch onto an otherwise female cultivar is a good space-saving technique.

In the North early ripening is a crucial characteristic, as American persimmons are edible only when fully ripe. Unlike the Oriental kaki, which may be ripened artificially by one of several methods, the American persimmon must attain a soft, near ripe state before it will respond to methods of removing astringency. Most northern cultivars originated in the Midwest. They are all perfectly hardy in bud and wood throughout USDA zone 5 (-20°F minimum winter temperatures). Yet when taken north to the Great Lakes and east to New England, many cultivars may fail to ripen properly in summers that are relatively short and cool compared to those of the midcontinent. Members of the Society of Ontario Nut Growers are actively breeding early-ripening varieties for the lakes region. Presumably these will be adapted to New England as well. The search is also on for male trees that will flower and pollinate the first female blooms of the season and thereby lengthen the persimmon's ripening time (Campbell). The recommended cultivars for the Northeast are described on page 118.

Growing Persimmons

The main obstacle faced by the prospective persimmon grower in the Northeast is obtaining good plant material, and grafted cultivars are in short supply. The seeds and seedling trees that are generally available from many mail-order nurseries are almost always of un-
known sex. A few nurseries do offer suitable cultivars for northern climates (see page 129). Cultivar scionwood for grafting is also often available, and requests may be honored for seed from parent trees that are known to produce superior offspring.

Perhaps the best means of obtaining a desired cultivar is to graft it oneself. Nut and fruit organizations are the best source of seed and scionwood of good selections (see page 129). Scionwood is also available at some nurseries, a few of which will do custom grafting upon request. Grafting or budding methods are similar to those used with apples. Both grafting and budding are done in spring or summer using a seedling rootstock that has proved to be winter hardy.

Stems that did not bear fruit during the previous growing season are preferable as scions because those that have borne fruit are known to die during the following winter. Spring grafting and budding are best done when the buds begin to swell (late April in Boston, Massachusetts). Grafts may succeed as late as June if the scions are completely dormant, but early grafts with a longer growing season ahead of them are more likely to survive the first winter. A small plastic bag covering the scion and graft union works well to prevent desiccation. This may be removed gradually after the buds break and the leaves begin to unfold. All growth from the understock should be removed as soon as the union has clearly healed.

Summer budding is also successful. August is the best time, but it may be done as late as four weeks previous to freezing weather. Budwood that is smaller in diameter than the rootstock allows for easier insertion of a bud. After winter, stock plants should be girdled just above grafted buds that have survived. Tying the vigorous new growth of buds to the dead portion of the rootstock above the graft union will prevent wind damage. Otherwise, a stake should be provided for support. The easiest way to propagate persimmon plants is from seed. Of course, the sex of a seedling cannot be known until it flowers, which may take more than four years. Cultivars in the 'Early Golden' group have a reputation for producing better than average offspring. With so few cultivars selected specifically for northern regions, raising the seedlings of the better cultivars that are available may be the best way for most people to obtain a persimmon tree adapted to their needs. Seedlings can be planted in a group and all but the better fruited plants subsequently eliminated.

It is advisable to collect seeds from ripe fruit. Excessive heat, cold, or drying can cause persimmon seeds to lose viability, but seeds have been known to germinate after six years of cold stratification (McDaniel 1970). Three months of cold stratification is needed for good germination. Sow persimmon seed in fall or early spring, about 1 inch deep with some additional light mulch on top to help retain moisture. Rodent predation has not been reported to be a problem. Seeds will germinate within a month in soil temperatures above 60°F. The seedlings quickly develop a long taproot and are tolerant of adverse conditions (Fowells) but perform best with ample moisture and
no competition from weeds. Well-grown seedlings can reach approximately 1 foot high the first season and grow another 3 feet the second season.

If persimmons are grown in a nursery, the time to transplant them to a permanent site is at the beginning of their third growing season. A couple of factors make American persimmons notoriously difficult to transplant. The young trees have deep taproots and long surface roots, which are fleshy and inevitably injured during digging. A prior root pruning will induce fibrous lateral rooting and enhance transplanting success. Also, persimmon roots do not regenerate until after the top is fully leaved out and the soil has warmed. Luxuriant new growth is often mistaken as a sign of a successfully established transplant. If supplemental watering is discontinued, the top may wilt, because the damaged roots cannot supply the transpiring leaves with adequate water.

American persimmons can be successfully transplanted if a few precautions are observed. The most important is to warm the soil early to encourage rapid root regeneration. A black plastic mulch is a good way to do this, and it will also retain moisture and eliminate weed competition. The plastic may be applied before the planting date to speed the warming process. The best transplant hole is large and of good tilth. Pruning the top back 1/3 to 1/2 of its size will equalize damage done to the roots. Persimmon roots are normally dark throughout and should not be mistakenly pruned off as dead. Young persimmon trees respond favorably to irrigation with warm water from a slow-flowing hose exposed to the sun. White latex paint or an opaque trunk guard will prevent sun scald on the trunk. To help the young transplant harden off for winter, remove the plastic mulch and stop watering in August. The two secrets of successful transplanting are: (1) maintain a warm, moist soil and (2) do not mistake lush new growth as a sign that care is no longer needed.

Transplanted trees should not be fertilized during the first season, except for perhaps a cup of bonemeal incorporated into the transplant hole. Satisfactory yields are possible without special treatment, as shown by the heavy yields of wild persimmons and the similar performance of some trees at the Arnold Arboretum. Even so, fertilization will probably increase yields, especially on poorer sites. For maximum production the following regime has been recommended by the Society of Ontario Nut Growers:

(1) Apply 1 pound of 10-10-10 fertilizer for each inch of trunk diameter until fruiting age.
(2) With the onset of heavy fruiting, switch to a 5-10-15 formulation.
(3) Prevent fertilizers from contacting the trunk; that is, broadcast outward beneath the canopy.
(4) Only fertilize during early spring. Heavy feeding during the growing season can shock a persimmon tree, causing it to drop its leaves.
American persimmons, which grow relatively slowly (12 inches per year) and remain compact, have an interesting self-pruning characteristic. After two or three seasons of growth, some fruit-bearing shoots will dry up over the winter and release by abscission before the next growing season. This growth habit minimizes the need for supplemental pruning. The optimum tree form is a low-headed pyramid with widely spaced scaffold branches arranged in a spiral pattern around the central leader. Summer pruning will direct the tree's energy into fruit production rather than vegetative growth, keeping the tree small and productive. Spacing for mature trees on good soil needs to be about 35 feet.

All accounts agree that the American persimmon is practically pest free in the North. Observation of the Arboretum's *D. virginiana* specimens during 1981 revealed no insect pests on leaves, flowers, or fruits. Some plants did seem to have a minor leaf-spot disease. In areas with short growing seasons, the below-optimum photosynthesis in diseased leaves could result in fruits that are less sweet.

With autumn's approach persimmon fruits change color from light green to yellow and finally to a deep golden orange. A few soft fruits may be noticed on the ground. At this point the texture of persimmons still hanging changes from firm to increasing degrees of softness. At its softest the fruit will usually separate from the calyx, leaving it and the pedicel attached to the twig. This is a fully ripened fruit, and it should be delicious. A fruit that will separate from its calyx is very soft and must be handled carefully, however. Because of this, and since persimmons ripen gradually, it is often easier to make a few large harvests of fruits that are less than fully ripe.

Hand picking is the gentlest harvest method, but shake harvesting is less tedious and causes little damage if it is done over a cushioned ground cover. The best containers for collecting fruit are shallow, to minimize crushing the soft, ripe fruits.

The astringency of unripe persimmons is thought to be caused by the chemical compound leucodelphinidin (Griffith and Griffith). As a single molecule leucodelphinidin causes astringency, but polymeric chains of leucodelphinidin longer than four molecules lose their ability to react with the oral mucosa. Ethylene gas evolved during natural ripening or supplied artificially removes astringency by catalyzing the polymerization of leucodelphinidin molecules. The use of ethylene gas is the only artificial ripening method that Eugene and Mary Griffith acknowledge in their book, *Persimmons for Everyone*. In their opinion the prevalent notion that freezing can remove astringency began because the natural ripening period and the frost season often coincide.

American persimmons that are still firm and astringent can be fully ripened by being subjected to 50 ppm ethylene gas for 24 hours and then allowed to sit for several days at room temperature. Creating such a high concentration of ethylene gas is not practical in the average household kitchen, however.
American persimmon (D. virginiana)
In more practical curing methods it is unclear how ripe a persimmon must be when it is picked. The Griffiths state emphatically that the fruits must begin to soften on the tree. Others report successful off-tree ripening of firm, green fruit when it is stored either at room temperature or in a refrigerator. As with the Oriental kaki, this characteristic probably varies from tree to tree. I have not attempted to ripen green fruit artificially.

Storing the fruit in a plastic bag will enhance ripening by retaining natural ethylene gas at a higher concentration. Adding an apple or banana, preferably a ripe one, will further hasten the ripening process. Fruit softness is a measure of ripeness and may be checked without opening the bag. Tree-softened persimmons will ripen fully within a few days or a week, depending on the method used and their initial degree of ripeness. Ripe fruits keep for several weeks in a refrigerator.

Orientals eat their persimmons fresh, dried, and frozen, but never cooked. Traditional American dishes such as persimmon pudding show that cooked preparations can be good, too. Even so, low temperatures and short cooking times are recommended to avoid adverse changes in texture and flavor. The Griffiths’ book is a thorough exploration of the culinary delights of persimmon cookery, with over 250 recipes for soups, salads, breads, frozen desserts, puddings, pastries, beverages, and other delicacies.

In preparing persimmons it is advisable to avoid ordinary carbon steel utensils, which will turn persimmon flesh unattractively dark. Stainless steel is best. Aluminum alone will not stain persimmons, but be wary of aluminum coatings on a steel base. If a utensil is going to darken the fruit, it will do so within five minutes of contact; otherwise it is safe to use. Pulping is usually the first step in persimmon preparations. A sieve with \( \frac{3}{16} \) -inch openings will separate the pulp from the seeds and skin and yet is not so fine that pulping is difficult. Persimmons are ideally suited to preservation by freezing. The flesh remains in good condition and flavorful for years, even if thawed and refrozen. However, it is best to freeze the pulp in individual plastic bags of a convenient size for thawing one at a time. Whole fruits may be frozen and eaten like popsicles or pulped after thawing. Several persimmon recipes from the Griffiths’ book are offered below. Either American or Oriental persimmons may be used.
Persimmon Spice Pudding

1½ cups flour
½ teaspoon salt
¾ teaspoon double-acting baking powder
¼ teaspoon cloves
¼ teaspoon nutmeg
4 cups persimmon pulp
Sift dry ingredients together. Combine persimmon pulp, milk, egg, vanilla, lemon extract, and melted butter. Combine two mixtures, stirring well. Pour into greased baking dish. Preheat oven to 350° and bake 45 to 50 minutes. Serve hot or cold with whipped cream, or with a hard sauce.

Persimmon Ice Cream

1½ quarts cream (30 to 40 percent milk fat)
½ pint milk
3 cups persimmon pulp
Beat first four ingredients lightly, adding in above order. Thoroughly chill mixture (with persimmon pulp chilled separately). Partially freeze before adding persimmon pulp, then complete freezing.

Persimmon Leaves Tea

Gather green persimmon leaves, wash them, and make tea by steeping them in boiling water. The tea has a pleasant flavor, suggestive of sassafras.

Or spread the leaves on paper in a warm place until they are thoroughly dry. Pack them in lightly sealed jars and heat the jars with their contents in a very low temperature oven for about 30 minutes. Remove the jars from the oven and tighten the lids immediately. If the jars are airtight the leaves will be dry and sealed in a partial vacuum. If properly done the leaves will keep indefinitely.

Dried persimmon leaves tea is considered better than that made from fresh ones. Persimmon leaves are high in vitamin C (ascorbic acid).
Persimmon Gingerbread

\[ \frac{1}{3} \text{ cup shortening} \]
\[ \frac{1}{3} \text{ cup sugar} \]
\[ 1 \text{ egg} \]
\[ \frac{3}{4} \text{ cup sour milk, buttermilk or yogurt} \]
\[ \frac{2}{3} \text{ cup dark molasses} \]
\[ \frac{3}{4} \text{ cup persimmon pulp} \]
\[ \frac{1}{2} \text{ teaspoon soda} \]
\[ 1 \text{ cup whole wheat flour} \]
\[ \frac{1}{4} \text{ cup powdered milk} \]
\[ \frac{1}{2} \text{ cup wheat germ or wheat germ flour} \]
\[ 3 \text{ teaspoons double-acting baking powder} \]
\[ 1 \text{ teaspoon cinnamon} \]
\[ 1 \text{ teaspoon ginger} \]
\[ \frac{1}{2} \text{ teaspoon salt} \]

Cream the shortening and sugar. Add egg, sour milk, molasses and persimmon pulp. Stir well. Sift the remaining dry ingredients together and add them to the moist mixture with no more than 20 strokes. Oil a ring mold or 8-inch square loaf pan and dust with flour. Pour the batter into the pan and bake at 350° for about 45 minutes. Be careful not to overbake. Serve with whipped cream or sauce.

Persimmon Beer

Thomas Jefferson, the third president of the United States, enjoyed persimmon beer. Try it and judge for yourself!

1 peck persimmons 1 pound bran
8 gallons water

Combine persimmons, bran and about 1 gallon of warm water. Wash and mix them well. Place the mixture in a tub or barrel with a thin layer of clean straw on the bottom. Add the remainder of the water and set in a warm place to ferment. When the beer is ready for use, the persimmon pieces will rise to the top. Draw off the clear liquid and add molasses or brown sugar if additional sweetening is desired. Place brew in bottles, jugs, demijohns or a keg. Stopper tightly and store in a cool place. The beer is ready for use when cold, immediately after bottling, but if stored for two to three weeks in a cool, dark place it will improve in flavor. The beer is light, lively and pleasant tasting.
Persimmon Cultivars

The following cultivars are the most suited to the Northeast (USDA zones 5 and 6). (Unless otherwise noted, my descriptions are drawn from those of Gerardi, Slate, Brooks and Olmo, and McDaniel 1973 and 1982.)

'Early Golden' is the standard for early ripening, nonastringent fruit. Originating near East St. Louis, it has been widely propagated since 1880 and is popular for its large, firm fruit with few seeds. It generally ripens in the first week of October in Ontario (Campbell), but during recent short, cool growing seasons it has failed to ripen properly (Society of Ontario Nut Growers). 'Early Golden' trees have a spreading branch habit and dense foliage. The young plants fruit precociously. With age they can occasionally self-pollinate by staminate flowers borne on weakly growing branches. 'Early Golden' is the matriarch of a family of selected cultivars that includes many of those best suited to northern regions.

'Garretson', introduced from Pennsylvania in 1920, is apparently a first- or second-generation offspring of 'Early Golden'. It has similar foliage and seed characteristics. From 1940 to 1966 it withstood winters at Geneva, New York, without injury. In the Geneva climate it is more productive than 'Early Golden' and matures its fruits more fully, beginning in early October. The fruits are orangy yellow with a red blush and heavy bloom. They are almost spherical and slightly smaller than those of 'Early Golden', about 1\(\frac{3}{8}\) inches in diameter. 'Garretson' fruit has very good flavor, few seeds, and tender skin. 'Garretson' bears in the second season after grafting and like 'Early Golden' produces staminate flowers and self-pollinates with age. Its yields are just about optimum, heavy but not overly so, which would delay ripening in northern areas. 'Garretson' was the choice cultivar at the Geneva Experiment Station in 1966.

'Meader' is the sole plant surviving from a 1947 'Garretson' seedlot grown near Rochester, New Hampshire. 'Meader' regularly survives -25°F and matures 1\(\frac{3}{4}\)-inch seedless fruits in the cool New Hampshire summers. Experience with 'Meader' at Geneva has shown a tendency towards overbearing. Even so, the largest of the variably sized fruits surpassed in size the fruit of any other cultivar grown there. The dull yellow fruits, which are somewhat furrowed and have a heavy bloom, sometimes develop unattractive dark patches. The skin is relatively tough compared to that of other cultivars, but the flesh is tender and may have a slight but not objectionable astringency. On the whole, the fruit quality is good but not excellent. 'Meader' will produce seeded fruit when grown near a suitable pollinator. Since some fruits of the original plant, which is isolated, have been observed to have seeds in recent years, it can be assumed that it, too, produces some staminate flowers and self-pollinates.

'Killen', selected about 1915 in Delaware, is another probable offspring of 'Early Golden'. It is similar to the latter in texture and seed
shape and in the time required for ripening. The fruits, which are slightly larger than those of 'Early Golden', begin ripening a few days later and continue over a longer season. 'Killen' performs well in southern Connecticut and Geneva, New York. Like 'Early Golden' it is strong growing, precocious, and produces some staminate flowers with age. ‘Killen’ has a record of producing high quality offspring: ‘John Rick’ and ‘Florence’ are two of its progeny, as are the male cultivars ‘George’ and ‘Mike’.

‘John Rick’ was selected by J. C. McDaniel in 1958 and is receiving widespread acclaim for its large, handsome fruits. The orangy yellow fruits are blushed red and are up to 2 inches in diameter. The skin and flesh are tender and flavorful. Its small, soft calyx, which does not puncture other fruits in storage, combined with its overall attractiveness, makes ‘John Rick’ a prime cultivar for fresh marketing. It ripens about the same time as ‘Early Golden’ or perhaps slightly afterwards.
A five-year-old plant growing in St. Elmo, Illinois, yielded 42 pounds of fruit in 1977 (Wills). ‘John Rick’ has not shown an ability to produce staminate flowers like other members of the ‘Early Golden’ family. Seedlings of ‘John Rick’ are very vigorous and precocious but show moderate susceptibility to leaf diseases. If ‘John Rick’ can be shown to ripen fruit dependably in New England, it will then be highly recommended for its fruit qualities.

‘Florence’ has smaller fruit than its sibling ‘John Rick’, but its small seeds give it a high flesh-to-seed ratio, and its delicate flavor is one of the better among northern cultivars. Staminate flowers have also been observed on ‘Florence’.

‘Wabash’, another cultivar suitable for northern climates, is not a member of the ‘Early Golden’ family. It was selected from the wild in southern Illinois and has smaller fruits and redder flesh than any of the cultivars named thus far. The fruit is sweet, aromatic, and seedless where pollinators are absent. It ripens even earlier than the ‘Early Golden’ group, beginning in mid-August at Urbana, Illinois. The leaves of ‘Wabash’ color more than those of most American persimmon trees, making it an attractive yard tree.

‘Morris Burton’ was introduced by a farmer from Mitchell, Indiana, who noticed that his cows always ate its fruits first. Most people who have tasted it agree with the cows, rating ‘Morris Burton’ as the most delicious persimmon they have ever eaten. ‘Morris Burton’ fruit is relatively small and soft but is among the earliest to ripen. Another advantage of ‘Morris Burton’ is that the ripe fruit falls free of the calyx.

‘Juhl’ and an older cultivar ‘Hick’ have shown some promise in trials at Geneva. The fruit color of both is clear yellow with a slight red blush and heavy bloom. The fruit of each is about 1¾ inches in diameter, but ‘Hick’ is variable in size whereas ‘Juhl’ is uniform. ‘Juhl’ may have small dark spots on its skin. Both have tender skin and flesh without astringency. Neither plant overbears and the fruits of both ripen just before those of ‘Garretson’. On the whole, the merits of each approach those of ‘Garretson’, with ‘Juhl’ perhaps slightly superior to ‘Hick’.

‘Richards’, ‘Evelyn’, ‘Utter’, and ‘Pieper’ are mentioned in the Society of Ontario Nut Growers newsletter as selections with promise for areas with cool, short growing seasons. The latter three will produce seedless fruit when not pollinated. ‘Pieper’ ripens fruit in Geneva, and its foliage turns a beautiful yellow before falling, usually with the first heavy frost.

In areas where wild persimmon trees are not abundant, a male tree is needed for pollination if the female cultivar does not have the parthenocarpic ability to set fruit without being pollinated. There are two male cultivars of merit. ‘William’ is a handsome plant that provides copious pollen over a long period. It is the probable parent of ‘John Rick’ and ‘Florence’, as well as ‘George’, another heavily pollinating male.
Actinidia arguta: The Cold-Hardy Relative of the Kiwifruit

*Actinidia arguta* is a vigorously growing fruiting vine native to northeast Asia. It is a cold-hardy relative of the kiwifruit (*A. chinensis*), which has enjoyed a meteoric rise to commercial success in the last two decades. Large plantings of kiwifruit in California and New Zealand now supply northern markets.

Unlike the kiwifruit, *A. arguta* has rarely been cultivated except as an ornamental. Even though the fruits are sold regularly in northern Chinese markets, they are obtained solely from wild plants. The Chinese name for *A. arguta* is *van zhou*, the “soft date” or “juicy date.” In Korea it is known as the “tara” or “wild fig.” Elsewhere, Occidentals have named it the “Siberian gooseberry,” “hardy kiwi,” and “bower Actinidia,” the last to denote its climbing habit. A member of the Arboretum staff, Peter Del Tredici, has dubbed it the “bowerberry,” a name that appeals to me. A single name needs to be settled on.

All of the approximately 35 species of the genus *Actinidia* are native to eastern Asia (Li). The center of their geographical distribution is southwestern China. Two species are tropical, but the others are found primarily in the hills and mountains of temperate areas. The fruits of all species reportedly are edible, but those of *A. arguta*, *A. kolomikta*, and especially *A. chinensis* are most often collected for human consumption.

Five species, *A. arguta*, *A. kolomikta*, *A. polygama*, *A. melandra*, and *A. purpurea*, have been grown outdoors at the Arnold Arboretum and are apparently hardy to −5°F. The first three are native to northeastern China (Manchuria), which has a climate similar to New England’s. The kiwifruit cannot stand our winter temperatures without protection and requires a long ripening season. *A. arguta* is the only species I have observed fruiting in New England.

The native habitats of *A. arguta* are in eastern Siberia, Manchuria, northern China, Korea, and Japan at altitudes from 330 to 6600 feet. *Actinidia* plants typically grow within the forest or at its edge. They are tall-growing vines (to 100 feet), often climbing into the forest canopy. The long arching shoots provide support by twining and by thrusting themselves upward on short divergent branches. The plants also grow as thickets in open areas, climbing over boulders and smothering small shrubs. *A. arguta* plants are very cold hardy. One explorer reported thick ice near the roots of a Manchurian specimen on June 10 (Woeikoff).

As a species *A. arguta* is polygamodioecious, which means that the flowers of most individual plants are either functionally male (staminate) or female (carpellate). However, there are some plants with perfect flowers, while others may have unisexual flowers of both sexes on the same plant. Furthermore, some plants vary their sexual expression from year to year as maples do.

The flower buds appear in May but remain tightly bound in their
A. arguta fruits. Peter Del Tredici photo.
sepals until June, long enough to avoid damage from late frosts. They are borne in small clusters from the leaf axils of the current season's growth. The blooms are strikingly beautiful but are largely hidden beneath the foliage and persist only a week. The individual flowers, about ¾ of an inch in diameter, have black anthers surrounded by five waxy white petals. They have a fragrant scent resembling lily-of-the-valley, which attracts bees and other pollinating insects. Pollination may also occur by wind since the pollen is very light and dry.

_A. arguta_ is among several species in the genus that have been cultivated as ornamentals. The bright red petioles lend an exotic quality to the glossy green foliage, which is unusually resistant to disease and insects. The plants can thrive on a variety of soils, even under conditions of neglect. Because of these qualities the _A. arguta_ vine can be recommended for its landscape value alone. Its only fault is its great vigor, which can be troublesome in small spaces.

The fruits of _A. arguta_ are luscious. Their flavor is similar to that of the kiwifruit, which has been described as combining a multiplicity of flavors as various as strawberry, cantaloupe, banana, fig, watermelon, gooseberry, and rhubarb. Actually, it has its own very distinctive flavor, ranging from tart, during early ripening, to sweet at full ripeness. I much prefer fresh _A. arguta_ fruits to seedless table grapes because of their unique, sophisticated flavor. In texture _A. arguta_ resembles a fig or very ripe peach. The tiny seeds, like those of figs, have a barely perceptible crunch when eaten. _A. arguta_ fruits are usually oblong in shape (¾ by 1¼ inches) and sometimes blocky with flattened sides. Somewhat bigger than large grapes, they weigh 5 to 10 grams. Unlike the kiwifruit, which has a pubescent skin that must be peeled, the smooth-skinned green fruit of _A. arguta_ is eaten whole. Cross-sectional slices of the fruit reveal a glistening pattern of lime-green flesh surrounding a ring of chocolate-colored seeds embedded in a paler green core.

The fruits have a variety of culinary uses. They have traditionally been collected from wild plants and eaten fresh or preserved by drying in the sun. Dried fruit are cooked in breads and pastries or reconstituted for pudding and stew. Underripe and acidic _A. arguta_ fruit can be used in pickles and relishes. In vitamin C content it reportedly equals the kiwifruit: 250–380 mg per 100 grams, or ten times that of a lemon. The fruits have a mild laxative quality.

The sliced fruit is visually appealing, a piquant addition to salads, especially fruit salads. It is also excellent in frozen preparations like slush coolers, frozen sherbet, and ice cream and can be preserved or used to make syrup. Fermented _A. arguta_ fruits make a good wine with a particularly pleasant and interesting bouquet. (Wine made from kiwifruit is reported to be high quality, of a Sylvaner Riesling character.)

Kiwifruit keeps for an extraordinarily long time (4 to 12 months), and preliminary experience with _A. arguta_ suggests that it will, too. In one experiment firm-picked fruit has been ripened to perfection in
one month when held at standard room conditions. Ripe fruit has been stored in a household refrigerator for six to eight weeks with little or no deterioration in quality. Firm-picked A. arguta fruit in cold storage can probably equal the kiwifruit in its ability to keep through the winter. The slightly flattened sides of A. arguta fruits should make them easy to pack and ship with minimal damage.

Elwyn M. Meader, a breeder of many successful crop plants, has grown fruiting A. arguta vines for more than 20 years, and he believes A. arguta has high potential as a commercial crop for northern climates. Meader lives in Rochester, New Hampshire, where temperature minimums frequently reach -25°F, yet his vines bear fruit every year. They were given a test on Christmas Eve 1980, when temperatures rapidly dropped from 27°F at night to -20°F the next morning with high winds. Even this shock, which affected some apple cultivars in the region, had no adverse effect on the next season's A. arguta harvest. And there is no reason to believe that Meader's vines are unusually hardy. None of the couple of hundred seedlings he has grown in the past has shown evidence of winter injury. The report is the same about fruiting vines growing in a small area around Norfolk, Connecticut, known as the "icebox of Connecticut" because of its occasional -30°F minimum winter temperatures. A. arguta plants grown in Lithuania have reportedly withstood -45°F.

It is possible that A. arguta could achieve commercial success like its relative the kiwifruit, particularly north of areas where table grapes can be grown reliably. Delectable taste, pest resistance, storage qualities, and absolute cold hardiness are impressive attributes of this undeveloped fruiting vine.

Much research and development is still necessary for A. arguta to realize its commercial potential. For instance, its productivity has rarely been evaluated. A. D. Woeikoff, in his survey of Manchurian economic flora, states that few plants can equal its fruit-yield to foliage-area ratio. The horticultural staff at the Isabella Stewart Gardner Museum in Boston estimates at least 10 gallons of fruit is collected annually from two large vines in their courtyard. A more specific report from Lithuania calculates 110 pounds of fruit per vine. Based on this figure, an acre of A. arguta could be expected to yield 11 tons of fruit. Regardless of the exact yields, it is safe to say that some A. arguta vines fruit profusely on an annual basis. Seedlings flower in five to seven years and cuttings in three to four years. Several vines that are at least 60 years old show no signs of declining yields.

A. arguta and some relatives are available as seeds, seedlings, or rooted cuttings from a very few sources (see page 129). Evidence shows that many more male vines are produced from seeds than female or bisexual ones; perhaps as many as 5 to 10 males for each female. For optimum fruit set, a male plant for pollination is a good idea, though probably in an inverse proportion to what occurs naturally (1 male for 5 to 10 females). Ideally, bisexual selections will be made available with the ability to self-pollinate or at least cross-pol-
linate with another fruiting cultivar. These can then be vegetatively propagated and the need for devoting space to nonfruiting male vines eliminated.

Propagation

A. arguta was grown and distributed by several nurseries after it was introduced into this country near the turn of the century. Many of the plants I have found date from these early introductions. Arboreta, public and private gardens, and the grounds of institutions are likely sites of fruiting plants.

Fresh seeds germinate much better than ones that have been allowed to dry out. Each fruit contains as many as 200 seeds. Separating the seeds from the pulp is done as it is with tomatoes. The pulp is macerated and allowed to soak in water for several days. After it is agitated, only the pulp and nonviable seeds will float. These can be poured off and the seed remaining on the bottom saved. To ensure uniform germination, the seeds need a period of damp chilling and should be mixed with three times their volume of damp (not moist) peat moss. This mixture must then be sealed in a plastic bag and stored at normal refrigerator temperature for about three months. When it is ready for sowing, the entire stratification mixture may be spread in a flat of sterile media. A light covering of milled sphagnum moss over this will reduce damping-off disease, to which the emerging seedlings are susceptible. Approximately 60 percent to 85 percent of the seeds germinate within 40 to 50 days. Another satisfactory method of germinating the seeds is to store the whole fruit in a refrigerator for a month or longer. After this the fruit can be macerated and the entire pulp planted without separating the seeds. The pulp will decay, and within one or two months after planting the seedlings will begin to emerge.
The seedlings rapidly develop an extensive root system and should be transplanted before they become visibly crowded. They respond well to fertilization and ample spacing, making rapid growth of one to several leaders 1 to 2 feet long. Slightly shaded nursery conditions are recommended, but containerized plants have been successfully grown on asphalt surfaces exposed to full sun and unimpeded winds. The thick waxy leaves seem to resist desiccation, but they can be wind-flailed when new and tender.

*Actinidia* can also be propagated vegetatively like grapes, with a similar high rate of success. Leafy cuttings taken in July and placed under mist root well. No single rooting hormone can be recommended at this time, but alcohol dips have been observed to be injurious. About 50 percent of dormant cuttings taken in spring just before the buds break also root and establish when simply stuck in an outdoor nursery row of good tilth. Profuse callus formation can inhibit root formation in some cases. For this reason summer budding and dormant grafting of the fruit are preferred by some nurseries. But the grafting must be done well in advance of the spring sap flow, or excessive callus will interfere with the graft union's healing process. Sections of root will sprout readily. One- and two-year-old stems can be rooted from layers by pegging them beneath a moist, friable soil.

One- to two-year-old plants may be transplanted to their permanent location. An eventual growing area of 13 by 13 feet is advisable for these vigorous climbers. Plants of unknown sex may be grown much closer together until their bearing qualities can be evaluated and the less desirable plants rogued out. Care must be taken to allow some pollen-bearing plants to remain. These will preferably be within 35 feet of the fruit-bearing plants and will flower at the same time.

The literature on kiwifruit culture stresses the importance of sturdy trellis supports, and this would also apply to *A. arguta*. Trellises suited for grapes are unsatisfactory under the weight of mature kiwifruit vines heavily laden with fruit. An overhead arbor casts a cool shade and allows for easy picking of the hanging fruit. Fruits harvested from the ground after dropping are usually in acceptable condition. Wherever a climbing vine is needed, these vigorous growers can rapidly fill the space.

Pruning probably will enhance yields. The fruiting occurs on the basal portion of relatively short stems. These can be distinguished by their close internodes of less than 2¼ inches as compared to the long, arching vegetative vines with internodes generally longer than 3¼ inches. Without pruning, the vegetative vines overgrow and shade future fruiting vines. Their photosynthesis will be reduced, causing them to initiate fewer flower buds for the next year's crop. Early June is a good time to prune the long vegetative shoots to about eight leaf nodes from their base. This will direct the sun's energy into fruit production and formation of the next year's flowers. Only enough vegetative growth should be left to replace the old framework of the plant occasionally or expand its size. Winter pruning is useful to
A. arguta vines at the Gardner Museum in Boston. Peter Del Tredici photo

remove damaged and tangled vines and to reduce the length of strongly growing shoots.

A. arguta tolerates infertile soils and has no known insect or disease problems (Spangler and Ripparda). Like the kiwifruit, which also tolerates a wide range of soil types, A. arguta probably will not tolerate poorly drained soil. The Japanese beetle and golden nematode have been recognized as pests of the kiwifruit but neither seriously reduces plant vigor. I have observed no insect or disease damage on A. arguta. Even gypsy moth caterpillars do not feed on the foliage.

Cats can pose an unusual problem for Actinidia growers, for they are attracted to the aroma of bruised leaves and roots of the plants. This is especially true of A. polygama, and to a lesser degree A. arguta. Cats may even dig up small transplants. Many of the chemical constituents of catnip leaves are also in A. polygama. In Narcotic Plants Entoben says the Chinese use the leaves of A. polygama, known as “metatabi,” to sedate large cats in zoos. The psychoactive constituents apparently affect humans as well. In China an infusion of table wine and A. polygama leaves is prescribed as a sedative.

A. arguta is an excellent fruiting vine for residential and urban plantings. It is a vigorous ornamental, has no pest problems, tolerates neglect, and bears remarkably delectable fruit. It also has good potential as a commercial crop where the kiwifruit cannot be grown. Although high-quality plants are in short supply, a few sources do exist. If Actinidia vines are planted more widely, as they deserve to be, the selection of improved fruiting cultivars will follow. At present only a few experimenters in this country are cultivating Actinidia species for their fruit. Homeowners and landscape professionals can take part by planting seedlings or propagating existing plants known to fruit well. The effort will be rewarded for many years to come by both the low-maintenance, ornamental foliage and the delicious fall harvests.
Foliage of A. arguta. Edward Goodell photo.
Edward Goodell would like to hear from anyone who knows the location of fruiting *Actinidia* vines. Please contact him at the Arnold Arboretum, Jamaica Plain, Massachusetts 02130.

**Acknowledgments**

I wish to acknowledge the invaluable comments and support of the following reviewers, whose contributions immeasurably upgraded the information: Henry Hartman, Frederick McGourty, Daniel C. Milbocker, V. O. Virkau, and Gregory Williams. Finally, I dedicate this work to Elwyn M. Meader, whose numerous successful introductions of new food plants and generous sharing of information is an enduring inspiration for me.

**Resources**

Much of the information above derives from the work of the Northern Nut Growers Association and the North American Fruit Explorers. Both of these organizations are dedicated to improving less developed food plants by distributing plant materials and evaluating their performance. Each has an open membership policy and publishes informative journals for anyone interested in taking part in its activities.

North American Fruit Explorers — membership organization dedicated to promoting the growing of all types of fruit- and nut-producing woody plants. Publishes *Pomona* quarterly. Membership information: Ray Walker, Box 711, St. Louis, MO 63188.

Northern Nut Growers Association — organized in 1910 to promote minor fruit and nut culture in northern North America. Publishes a highly informative quarterly and report on the annual meeting. Dues $10.00, payable to: John English, Treasurer, R. R. 3, Bloomington, IN 61701.

Massachusetts Fruition Program — innovative state program promoting fruit and nut tree growing; $64,000 has been appropriated for plant purchases. For information contact: Massachusetts Fruition Program, Department of Food and Agriculture, Government Center, Boston MA 02022. Telephone (617) 727-6632.

**Nurseries**

The following is a list of nurseries specializing in tree crops. Many are run as small part-time businesses. Orders should be placed well in advance, because supplies are often limited. Most have catalogs available upon request.
Alexander's Nurseries, Box 309, Middleboro, MA 02346. Seeds and rooted cuttings of selected Actinidia arguta vines.

Beaverlodge Nursery, Box 127, Beaverlodge, Alberta, Canada T0H 0C0. Very hardy (zone 2) fruit trees and shrubs, including improved cultivars of juneberry (Amelanchier sp.).

Campberry Farms, c/o Mr. R. D. Campbell, R R 1, Niagara-on-the-Lake, Ontario, Canada LOS 1J0. Improved strains of nuts and native fruits including persimmons.

Dave Lawyer Nurseries, Route 2, Box 95, Plains, MT 59859. Actinidia seeds and seedlings.

Earl Douglass, Red Creek, NY 13143. Seeds and seedlings of Chinese and American chestnut hybrids.

Farmer's Seed and Nursery, Fairbault, MN 55021. Cold-hardy fruiting selections of rose, juneberry, cranberry, viburnum, elderberry, table grapes, and Prunus species.


Grimo Nut Nursery, R R 3, Lakeshore Road, Niagara-on-the-Lake, Ontario, Canada LOS 1J0. Good selection of walnut, hickory, nut pine, chestnut, northern pecan, hazelnut, mulberry, and edible-kerneled apricot cultivars and seedlings. Custom propagation available.

Gurney's Seed and Nursery, Yankton, SD 57079. Chestnut and persimmon seedlings as well as a selection of other native and standard fruits and nuts.

Hess Nurseries, Box 326, Route 553, Cedarville, NJ 08311. Primarily landscape plants, also juneberry and pine nut seedlings.

International Tree Crops Institute, Appalachian Regional Office, Route 1, Gravel Switch, KY 40328. Actinidia arguta seedlings and chestnut and persimmon seedlings and cultivars.

Jersey Chestnut Farm, 58 Van Duyne Avenue, Wayne, NJ 07470. Selected chestnut seedlings and persimmon cultivars.

Kelly Brothers Nurseries, Dansville, NY 14437. Fruit cultivars and nut seedlings.
Leslie Wilmot Nursery, Route 2, Box 469, Elizabethtown, KY 42701. High quality seedlings and cultivars of walnut, pecan, chestnut, hickory, hazelnut, and fruit trees. Custom propagation available.

Louis Gerardi Nursery, R R 1, O'Fallon, IL 62269. Seeds, seedlings, and cultivars of a wide range of nut trees; also persimmon and mulberry.

Mellinger's, 2310 West South Range Road, North Lima, OH 44452. Wide variety of food-producing plants.

Miller Nurseries, Canandaigua, NY 14424. Seedling chestnuts and wide selection of fruits.

Nebraska Nut and Fruit Tree Seed Program, Nebraska Nut Growers Association, Box 4644, Lincoln, NE 68504. Seed packets of native nut and fruit trees.

New York State Fruit Testing Cooperative Association, Geneva, NY 14456. New and antique cultivars of all commercial fruits, also elderberry and mulberry cultivars. Catalog available to members, annual dues $5.00.

Ray Guidi Nursery, 193 Curtis Avenue, Dalton, MA 01226. Seedlings of native and hybrid nut trees.

Saginaw Valley Nut Nursery, c/o Richard D. Goldner, M.D., 8252 Dixie Highway, Route 3, Birch Run, MI 48415. Good selection of cultivars and seedlings from the walnut family, adapted to cold winters and short growing seasons.

St. Lawrence Nursery, R D 2 Route 56A, Potsdam, NY 13676. Exceptionally hardy fruits and nuts.

Robert G. Seip, R D 1, Box 683, Alburtis, PA 18011. Hickory, walnut, hazelnut, chestnut, and persimmon cultivars and seedlings.

Southmeadow Fruit Gardens, Grootendorst Nursery, Box SM, Lakeside, MI 49116. Extensive listing of choice antique fruit varieties.

Archie Sparks, Beaver, IA 50031. High quality black walnut cultivars, seeds, and seedlings.

Stark Brothers Nursery, Louisiana, MO 63353. Chestnut and persimmon seedlings and cultivars. Largest supplier of home orchard plants.

Talbott Nursery, R R 3, Box 212, Linton, IN 47441. Persimmon cultivars, and chestnut and walnut seedlings.
References


R. albiflorum
During September 1981 I had the good fortune to spend several weeks on a plant- and seed-collecting expedition for the Arnold Arboretum. The trip brought me over 5000 miles of road and eight states in the American West, a terrain sculpted by wind and water and draped in a mantle of botanical wonders.

The purpose of the trip, in addition to that of expanding the Arboretum's collections, was to obtain seeds of plants that may be either endangered or of special interest to the plant sciences or nursery trades. I also wanted to collect herbarium specimens for certification and exchange, as many of the species I was looking for are poorly represented in herbaria throughout the world.

My trip began in the still air of libraries and herbaria, where I spent many hours combing herbarium sheets to gain a familiarity with the plants and sifting through the often cryptic locale data of former collectors. As my stack of notes grew, one element began to emerge and engage my fascination: the mysterious existence of plant disjunctions.

A disjunction, as the name implies, involves a discontinuity within a taxon's range. For example, the primary range of the Cascade azalea (Rhododendron albiflorum) is the Cascade Mountains, from British Columbia to Oregon, and scattered populations exist in the Rocky Mountains of Alberta, Canada, northern Idaho, and western

Robert Nicholson has made several collecting trips for the Arnold Arboretum.
Montana. However, an outlying population exists in central Colorado, about 500 miles from the others. A distribution pattern such as this can raise intriguing questions as to the taxon’s origins and continued existence.

E. C. Pielov, in his book *Biogeography*, created a classification scheme that groups disjunct populations according to their origins. According to his scheme the causes of a gap in the range of an organism are as follows:

1. Splitting of a once-continuous range because of:
   a. Geomorphological changes, i.e., an uplift of mountains
   b. Climatic changes
   c. Evolutionary differentiation and migration

2. Establishment of new populations over long distances (jump dispersal) owing to:
   a. Natural causes
   b. Human agency

Disjunctions, therefore, are islands of botanical life, populations of plants that exist far from the mainland of a species’ range. These populations may differ from primary populations — for example, they may be hardy in a greater range of habitats — and so are of interest to collectors. They also challenge the botanist to determine the cause of the split from the main range. Was it the gradual uplift of the mountains or the slow drying within the new mountain’s rain shadow? Was it the movement of birds in migration or the lethargic sculpting of the glaciers?
P. anstata on the southern slope of Agassiz Peak at the same elevation

The Rhododendrons of Slavonia

The first disjunct population I encountered grew near Slavonia, an abandoned mining town in central Colorado, close to the Wyoming border. In the Routt National Forest, on the edge of the Zirkel Wilderness, grows the state's only native rhododendron species, the Cascade azalea (*R. albiflorum*). This species is better known as a component of the humid lowland forest as well as the subalpine areas of the Pacific Northwest. It favors high-altitude wetlands and tends to form low clumps around lakes and streams. It has an oblong deciduous leaf and in early summer bursts into creamy white blossoms about one inch in diameter.

The species was first found in the Rocky Mountains of Canada by a Scotsman, Thomas Drummond, in the wilderness years of the early 1800s. Sir William Hooker rendered the first description in *Flora Boreali-Americana* in 1840 and called it "a very beautiful and most distinct species which would be a great ornament to our gardens if it could be introduced." The latter qualifier proved prophetic, as horticulturists labored to grow it. A Dr. Graham of the Royal Botanic Garden, Edinburgh, was the first to record its flowering nonsitu and wrote: "This very distinct species was raised at the Botanic Garden from seed gathered by Mr. Drummond in British America in 1828. It does not grow freely and flowered rather sparingly in the open border for the first time in July 1837. It is to be regretted if it is found difficult of cultivation for Mr. Drummond stated it formed a very handsome shrub."
Colorado spruce (P. pungens)

The Cascade azalea has also proved difficult to grow in eastern North America, probably because of the oppressive summer heat.

I thought then that this odd Colorado population, growing so far out of range, might offer a genotypic variation that would be suitable for cultivation. One segment is centered near Slavonia and another, three miles to the northeast, near Gilpin Lake. I reached the area via a long dirt road and found no buildings or remnants of the former town. The area is now a favorite starting point for hunting trips into the Zirkel Wilderness, and on the day I arrived packs of hunters sporting state-of-the-art bows were methodically preparing for their foray into the wild. After I had prepared my own hunting gear — a few seed envelopes and some pruning shears — I crossed a stone and wire bridge and headed up an east-facing slope. It was traversed by several streamlets and springs and supported a profuse growth of mosses. Only a few hundred feet from the bridge I found my first Cascade azalea, and I soon discovered that the plant grew in profusion throughout the area. To see such an unusual plant so common in situ was indeed a rare pleasure.

A canopy of Colorado spruce (Picea pungens) and Douglas fir (Pseudotsuga menziesii) dominated the slope but surrendered somewhat in the wetter areas. The transition zone between the forest and the open mossy area was the niche the rhododendron settled into, forming large mounded patches of yellow fall foliage. There, hidden in
the cool tuck of a mountain in the wilderness, was a plant whose creamy white display in spring must stir the hearts of any who happen upon it. I searched hundreds of branches for seed but found all the capsules disappointingly green. Luckily, I was able to arrange for a later shipment from Michael Calhoun, a local resident with a special interest in the azaleas.

The background of these unique Coloradan populations is fascinating from both biogeographical and historical perspectives. The plants have had only sporadic contact with humans. I had been told at the Denver Botanical Garden that the first discoverer of the stand probably was George W. Kelly, an amateur botanist in Colorado. Now 86 and in the process of writing his 10th book, he generously answered my inquiries about the area in a warm letter. "I am just an amateur botanist but spent many wonderful days in the Slavonia area years ago. This is a real island of botany, almost identical to the coast area many miles to the west. . . . My discovery was the first local recognition of the plant, previously all woody plants were just bushes. I was probably the first to make a herbarium collection. So far as I have heard, this group in the Slavonia area is the only one in the state." Without doubt George Kelly has done the most to make the botanical world aware of the stand, and it was his herbarium specimens that first directed me to the still-extant population.
The earliest published reference to the population is an article that named the plant as a new species, *Azaleastrum warrenii*. Aven Nelson of the Rocky Mountain Herbarium received a single specimen dated July 14, 1911, from Edward R. Warren, a Colorado Springs naturalist. Warren wrote to Nelson, “I found it at my camp on the lower slope of Mt. Zikel, at the head of navigation [for prairie schooners] on the ‘Ute Pass Trail’. If I remember correctly, it was quite abundant. It was a low plant, perhaps not more than a foot high. . . . I evidently did not collect much of it, for I have but a single twig left and am sending you half the flowers and leaves from it.”

Nelson split the plant (as *A. warrenii*) from *R. albiflorum* on the basis of the glandular, ciliolate leaves of the former, which otherwise were glabrous. Five years later, in 1918, J. Francis Macbride transferred the species to the genus *Rhododendron*. Because of the paucity of pressed material, little comparative analysis with *R. albiflorum* was done and *R. warrenii* remained obscure.

In 1936 Louis O. Williams in *Annals of the Missouri Botanical Garden* compared three collections from the Coloradan populations with specimens of *R. albiflorum* from the Northwest. He believed that the two species were the same, and other botanists in the area concurred. The plant is now considered *R. albiflorum*.

The few isolated populations of *R. albiflorum* east of the Cascades
probably originated by different means. Those in Alberta may be the result of jump dispersal following the Wisconsin glaciation. But the disjunct population in Colorado, which may have evaded glaciation, could have resulted either from jump dispersal or range splitting. Rhododendron seed is so small and light that it could easily have lodged itself in fur or feather. Wind is also a dispersal agent for small light seeds, and it is conceivable that seed from the Cascade populations could have been carried east in a powerful storm. Volcanoes are another possibility but a highly unlikely one. *R. albiflorum* is a component of the Cascade flora and inhabits the sides of both active and extinct volcanoes. The recent Mt. St. Helens eruption, which spread ash as far east as Colorado, raises the question as to whether the seeds could have been blown into the stratosphere and carried eastward. Whether the seed could survive the intense heat and poisonous gases of the blast is highly questionable, but it is an idea that gives botanists a big bang theory to call their own. Of course, it is possible that other populations will be found within the 500-mile disjunction, rendering it less dramatic.

Since George Kelly has noted the presence of other West Coast disjuncts, such as Pacific trillium (*Trillium ovatum*) and Lewis mimulus (*Mimulus lewisii*), near Slavonia, it would follow that it is a refugium rather than the end point of a jump dispersal. We might
Banana yucca (Y. baccata)
speculate that the Cascade azalea once had a wider range than it has now. Two events probably diminished the range. First, the Cascade and Sierra Nevada mountains uplifted, blocking Pacific rainstorms and creating dryer environments on their east sides. Second, the Wisconsin glaciation buried the more northerly populations under a sheet of ice. The few populations in Colorado survived probably because they were unaffected by glaciation and because the mountains on whose bases they grow held enough rainstorms to sustain them.

After leaving Slavonia, I spent two days in the Mesa Verde National Park, clambering up and down the jagged canyons looking for the cliff fendler bush (*Fendlera rupicola*), the banana yucca (*Yucca baccata*), and the Rocky Mountain maple (*Acer glabrum*). Next, in southwest Utah, I reached the summit of Abajo Peak, an 11,445-foot mountain capped by Engelmann spruce (*Picea engelmannii*) and offering a number of interesting rockery plants on the exposed rock faces. To the north of that summit, near Moab, Utah, I searched in Negro Bill Canyon for the Knowlton hornbeam (*Ostrya knowltonii*). Although this is one of the rarest North American trees, it is not presently listed at any American botanical garden. It remains so as I failed to locate the species at this site. However, I was able to collect seed from two intriguing cliff dwellers — the monkey flower (*Mimulus eastwoodii*) and the columbine *Aquilegia pallens* — growing in a cliff-face crack where enough moisture was seeping out to support their tenuous existence.

During the following days I visited Oak Creek Canyon, Arizona, a botanical treasurehouse that contains four distinct vegetation zones over its 20-mile length.
Arizona's Isle of Antiquity

To the north of Oak Creek Canyon and overshadowing the city of Flagstaff, Arizona, rise the peaks of the San Francisco Mountains. Humphrey's Peak, the highest in the group, is Arizona's champion mountain and reaches 12,633 feet. Treeline ceases about 1000 feet below that and is chiefly represented by the low matted growth of the bristlecone pine (*Pinus aristata*). This population was the main reason for my visit there, as it is Arizona's only population of bristlecone pine and is 325 miles away from the nearest neighboring population.

The species itself was first discovered by Charles Parry in the high mountains of Clear Creek, Colorado, and subsequently was described by George Engelmann in the *American Journal of Science* in 1862. Engelmann (1860) accurately described both the habitat and habit of the plants: "In sheltered situations it forms a tree 40 to 50 feet high and 1 or 2 feet in diameter, but on the higher bleak mountains it is a stunted bush often exceedingly slow, as a stick of scarcely more than one inch in diameter brought back by Dr. Parry shows nearly fifty annual rings, some of them 1/60 of a line, and none more than 1/6 of a line wide."

The species is most notable for its glacial growth but also for its thick bottlebrush growth of needles and for the white dandrufflike resin exudations that spot these needles. Until recently *P. aristata* growing in the White Mountains of California were regarded as the oldest living organisms on the planet. However, in 1970, on the basis of needle characteristics, D. K. Bailey split the species into two. The Coloradan, New Mexican, and lone Arizonan populations were kept as *P. aristata*, while the more renowned Californian populations and those in Nevada and Utah became a new species, *P. longaeva*. Bailey's work was taxonomically sound and has generally gained acceptance, but it does complicate the biogeographic history of these plants gripping the lava rock of the San Francisco Mountains.

The first collector to scour these mountains is believed to have been E. Palmer in 1869, but the earliest specimens taken of *P. aristata* were probably those of Bischoff, a member of the Wheeler expedition of 1871. Pilgrimages have been made by numerous botanists since to study both the rare Arizonan alpine flora and the vegetation in the zones below. C. Hart Merriam in 1887 was especially attentive to the acute differentiation of the region into vegetation zones that he distinguished on his climb up the mount: "... it may be said that in ascending from the hot and arid desert of the Little Colorado to the cold and humid summit of the mountain, no less than seven zones are encountered, each of which may be characterized by the possession of forms of life not found in the others." Merriam (1898) noted that these zones surround the mountains as skewed concentric rings, each zone of plants terminating farther up the mountain on the warmer southwestern side than on the colder northeastern. In some cases this
altitudinal difference can be as much as 900 feet from one side of the range to the other.

Other significant work on the mountains was done by E. L. Little (1941), who compiled the most complete list of the alpine species (49 in all), and by Thomas Moore (1965), who hypothesized on the origins of the flora. My own ascent of Agassiz Peak began on the western side at the end of the access road. The Arizona Snow Bowl, a ski lodge, is situated at 9600 feet, so I could hike to the upper peaks on its cleared slopes. Despite the ease in walking, however, the trip still had its share of difficulties. As I passed the 10,000-foot level, a thunderstorm blew in from the west and seemed to stall against the peaks. The thunderclaps were both frequent and loud, and at that altitude one had the feeling of being within the storm rather than under it. After contemplating a run for the bottom, I instead opted to huddle next to a Douglas fir and attempt to keep panic at bay. The rains soon became heavier and, lacking rain gear, I had to improvise quickly with the plastic garbage bags I used for herbarium specimens. As I sat and looked up the forested incline, the storm released its final surprise, a barrage of dime-sized hailstones. The forest floor was alive with the white pebbles, which bounced frantically down the slope after their earthward plunge.

The storm finally slid over the peaks and I pushed upward towards the timberline, the upward limit of normal-sized trees. Both Picea
Engelmannii and Pinus aristata reach timberline and extend upward to treeline, surviving as a stunted matted form known as krummholz. Here I took a number of specimens but no seeds, as these trees were barren. At that elevation on the mountain the skewed nature of the vegetation zones became amazingly apparent. Above the tree line on the west side, a short walk of a few hundred feet around the cone of the mountain to the southwest side put me directly back into the krummholz zone.

The last 500 or so feet of Agassiz Peak is the alpine zone. Here and there on the coarse gray volcanic rock were a few ground-hugging plants. Little enumerated some 49 species on the peaks, but the long-term warming trend of the Southwest dooms many. I was able to collect seed from a number of interesting alpines, most notably Heuchera versicolor (Saxifragaceae), which should be a first-rate plant for rock gardens or for ground cover. The lack of oxygen at that altitude more than once tested my determination to collect. All movement seemed draining, and my lightweight Olympus camera felt like a cinderblock around my neck.

Prior to Bailey's split of the species, the nearest populations of P. aristata had been those in the mountains of southwest Utah, some 150 miles north of the San Francisco Mountains. With the new differentiation the closest population shifted to the east, some 325 miles away in the Sangre de Cristo Mountains of New Mexico. How then did the species come to migrate to Arizona, and why is there such a large disjunction between the populations despite the existence of plausible sites for colonies?

During the Wisconsin glaciation, the entire Southwest was subjected to a lowering of yearly average temperatures. As a result, vegetation zones existed at lower altitudes, and the alpine and subalpine floras undoubtedly grew over both a far greater and a more southerly range. With the glacier's retreat the climate warmed, and the cold-loving species began a migration upward for survival. Those populations that ran out of altitude were like nonswimmers stranded on a rock in the incoming tide. There was simply no place left to move to and they perished.

At the San Francisco Mountains, and nowhere else for 325 miles, the correct conditions existed for the continued survival of P. aristata. That such a large disjunction exists is puzzling, for between the Arizonan and New Mexican populations a number of peaks reach altitudes of over 11,000 feet. If we assume that these peaks were the bridge by which P. aristata spread from New Mexico, what can account for the species' absence now? Bailey suggests that the subalpine conifers on these peaks present too much competition for the pine, yet the same conifers are found in the San Francisco Mountains. It could be that an insect infestation or disease eliminated the bristlecone pine from these stations, but it is certainly a question that needs further investigation.
I spent my last days of collecting in Central Idaho. After a long drive through the sparse plain of Southern Idaho on a dark night, I found another of my targeted disjuncts, the Pacific dogwood (*Cornus nuttallii*). The site is known to botanists and nurserymen throughout the northwestern states, and the disjunction is among the most remarkable in the United States.

On the edge of the Clearwater National Wilderness is the small village of Lowell, Idaho. Here two rivers, the Lochsa and the Selway, merge to form a third, the Clearwater. These rivers have cut deeply through the land, and their escarpments are steep and well forested. Along their banks, and extending upwards onto the hillsides, grow several species notable as belonging to the northwestern coastal flora, a flora native to an area 300 miles west on the opposite side of the Cascades. Indeed, the Lowell area is the only area east of the Cascades where *C. nuttallii* is known to exist. The Pacific dogwood was the primary reason for my visit to the area, but I also was successful in collecting seed of other species such as the giant arborvitae (*Thuja plicata*), the great silver fir (*Abies grandis*), the Pacific yew (*Taxus brevifolia*), and the red alder (*Alnus rubra*).

Especially thrilling to me was the discovery of a stand of Oregon maple (*Acer macrophyllum*), one large matriarch and her few sapling offspring. The parent tree measured approximately 75 feet in height, and its twin trunks each measured 2 feet DBH. As I had never heard of
the species being reported in Idaho, I at first thought I had a real find. Subsequent talks with Idaho botanists, including Frederic Johnson, revealed that the stand was known. Locals believe that the parent tree was either a planted specimen or an escape. A coring to determine the tree's age would surely help settle the question. I dug dozens of seedlings from around the tree and brought them back to the Arboretum in the hope that they would prove to be hardier here than their West Coast relatives.

But most remarkable among the area's woody species is the Pacific dogwood (C. nuttallii). It has a large range, extending from British Columbia down into the Sierras of California. It is also one of the largest dogwoods, reaching 100 feet in prime locations. Its flowers, like those of most dogwoods, are inconspicuous, but the petallike bracts that surround them number between four and seven and are somewhat larger than those of its eastern relative, the flowering dogwood (C. florida).
The species has an erratic flowering schedule, having been reported blooming in both spring and autumn. When I visited the Idaho population in late September, some flowers still remained on the trees, and a local resident told me that was their third flush of the year.

The species itself was easy to find and could not be labeled uncommon. The stand begins about 9 miles west of Lowell and seems to grow best within a 4-mile radius of the town. The population stays within the narrow confines of the three river valleys and continues intermittently about 25 miles northeast along the Lochsa River and about 12 miles southeast along the Selway River.

The population is interesting not only for its disjunct location but also for a bit of its early history, a near brush with the area's first itinerant botanists Meriwether Lewis and William Clark. In early September 1805 the party of Lewis and Clark traveled through the
Pacific dogwood (C. nuttallii)
Lolo Pass from Montana and continued their long trek to the mouth of the Columbia River. They proceeded down the Lochsa River watershed and cut north into the Bitterroot Mountains. At one point in their arduous trek, at Hungery Creek, they were within 5 miles of making the initial discovery of the species' most disjunct population. As it developed, Lewis and Clark were the first to discover *C. nuttallii*, but only west of the Cascades.

The Idaho population remained nestled in the deep river valleys and passed unnoticed by the botanical world for another 85 years. J. B. Leiberg was the first to give it attention in print, in a U.S. Geological Survey forestry report in 1900. He was quick to perceive the unusualness of a *C. nuttallii* population in Idaho: “That the species should occur in the basins of the Clearwater drainage is remarkable. Its home in this latitude is in the Cascades and so far as is known, it does not grow at any intermediate station.”

Since Leiberg's report, a number of other coastal disjuncts, such as red alder (*A. rubra*), and endemics, such as *Phlox idahonis*, have been documented in the region, singling it out as a refugium. The formation of this refuge has been thoroughly explained by Rexford Daubenmire. He postulates that the course of the disjunction is a sequence of events including the formation of the Rocky Mountains, the uplift of the Cascade Mountains, and the Wisconsin glaciation.

Beginning in the Oligocene Epoch and continuing into the Miocene Epoch, the Rocky Mountains were formed and separated the continent into eastern and western regions. During the late Pliocene Epoch the Cascades were formed by a combination of volcanic process and uplifting, effectively splitting the *C. nuttallii* population into two. To the east of the new mountains, a rain shadow formed and dried up the lowlands between the Cascades and the Bitterroot Mountains, reducing the range of many species, including *C. nuttallii*.

With the onset of the Wisconsin glaciation, the climate of eastern Washington and northern Idaho was altered by a lowering of temperatures, which drove the more tender species to lower altitudes and latitudes. The Clearwater River drainage area became an important refuge. It was the first area south of the glaciation with a warm, deep valley and an adequate moisture regimen. Here, it has been speculated, were driven the last intermountain populations of *C. nuttallii*, and it is here and only here that they survive today.

The question now remains as to whether this population is a harder race tempered by the elements through the ages or whether it is a race that was able to migrate to the warmest area. I collected 3 pounds of seed from a dozen sites within the population, and some 400 seedlings have been grown from this seed. These seedlings are now being tested at the Arnold Arboretum and a half-dozen East Coast nurseries.

Weather data from the Fenn Ranger Station on the Selway River suggest that climatic extremes in the Clearwater drainage area are comparable to those in Boston, so with any luck a few more refugia for *C. nuttallii* may be created in East Coast gardens.
References


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Introducing Cedrus deodara ‘Shalimar’

by GARY L. KOLLER

As my bus sped through the Japanese countryside, I was captivated by the meticulous order of the fields, with their small plots of vegetables set in rows of seemingly mathematical precision. Here and there, near a house or at the edge of a field, I caught glimpses of a conifer that was unfamiliar to me. The tree caught my eye because of its elegant and yet informal silhouette. Upon inquiring I found the plant to be the deodar cedar (Cedrus deodara), a tree native to the Himalayan Mountains. That was in 1969 and before I learned how plants “migrated” from their homelands to become rather common elements of alien territories.

The memory of those trees remained with me even though I didn’t see the species again until 1972, when I went to study horticulture at Longwood Gardens in Kennett Square, Pennsylvania. At Longwood a multistemmed specimen stood between the palm display greenhouse and the experimental greenhouses. That specimen was younger and smaller than those I remembered in Japan, but it retained the density of needles and branches and the gracefulness of the pendent branch tips. Soon after my arrival at Longwood I began to look into the background of the deodar. I discovered that the tree can grow much higher than its usual 60 to 80 feet; in its homeland some specimens are said to exceed 200 feet. As a species the deodar is marginally hardy in the Philadelphia area, flourishing during mild winters but suffering wind damage to needles and twigs, or succumbing entirely, during very severe winters.

When I came to the Arnold Arboretum in 1976, I discovered that its collection contained specimens of two deodar forms that are more cold hardy than the tree at Longwood. Called ‘Kingsville’ and ‘Kashmir’ (Fordham 1969), they had been selected by the nursery trade and are commercially available. To call our specimens of these two cultivars

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ornamental would have been generous. Large sections of the limbs were dead; the needles that remained exhibited marginal scorch; and new growth was sparse and lacked vigor. Both specimens were small, and I am sure their sorry state reflected a combination of stresses imposed by recent transplanting, poor siting, dry soils with no supplemental water during the reestablishment period or times of drought, and the plant's own vulnerability to severe winters. It is fair to say that the two more cold-hardy cultivated forms of deodar were barely surviving at the Arnold Arboretum in Jamaica Plain, Massachusetts. Passersby would never have taken a second glance at these pitiful specimens.

The Arboretum also had another deodar cedar, which had been selected from a seed batch as exhibiting greater tolerance to our climatic conditions. The seeds had been obtained in India by Mr. Henry Hosmer, a member of the Friends of the Arnold Arboretum who traveled to India and Afghanistan during the autumn of 1964. According to our records Mr. Hosmer collected the seeds at Shalimar, India, and sent them back from Afghanistan in October 1964. As no town named Shalimar appears on maps of India, it is probable that Hosmer was referring to an old and highly respected garden of that name at Dal Lake, Srinagar, in the Kashmir region. While Cedrus deodara probably does not occur naturally at this location, it is quite likely to be among the planted collections.

In due time seedlings were grown from the Shalimar seeds, and one individual not only survived but thrived. It grew rapidly and during spring 1973 was planted in our permanent collections on the bank immediately northeast of the Hunnewell Building. The tree is approximately 17 feet tall and 15 feet across. It has four trunks, and the largest is 3½ inches in circumference at breast height. The needles are lustrous, green, and free of any signs of damage or environmental stress, although they are somewhat sparse. The tree as a whole is thin, but it appears to be healthy. I attribute its lack of vigor to site conditions rather than to the plant itself.

The successful growth of this individual enticed us to experiment with vegetative propagation to increase the selection. After repeated attempts we succeeded in rooting a quantity of cuttings and placed them in a row in our greenhouse nursery. Seven individuals of the same accession and age were planted in the west greenhouse nursery. In 1982, at ten years of age, they were approximately 9 feet tall. These plants were observed as a group and compared with Cedrus libani var. stenacoma and the deodar cedar cultivars 'Kingsville' and 'Kashmir', which were all grown in nearby sections of the nursery. Each spring our seedling and its vegetatively reproduced progeny looked better and exhibited less winter injury than the other plants. In observing the row of rooted cuttings from 1976 until 1982, we noted the following. In most winters there was little or no damage to needles and none to stems and twigs. During the winters of 1979–80 and 1980–81, which were colder and drier than normal (temperatures
reached \(-6^\circ\text{F}\), needle injury was minor, with the terminal ends of the needles turning brown. The plants recovered rapidly the following spring. During winter 1980–81 needles on the lower branches browned, probably as a result of sunlight and heat reflecting off the snow. Also, the terminal leaders of several individuals deteriorated for a distance of 1 to 3 feet. Al Fordham, the former chief plant propagator at the Arboretum, believes this to be due to deodar weevil, for he has observed this insect damaging the other specimens of *Cedrus*.

Our continuing observations support the conclusion that while our cedar is not ironclad in its hardiness it appears to be hardier here in winter and summer than either ’Kingsville’ or ’Kashmir’. Our seedling is therefore worthy of additional testing, and to facilitate that we have decided to add a cultivar name to distinguish this genotype. The name we have chosen is ’Shalimar’ to commemorate the place where it is believed to have originated.

The next step in evaluating the tree’s potential for popular use is to see whether it can be propagated with relative ease and efficiency, as plants that are very difficult to propagate are rarely successful commercially. The process of learning to propagate difficult and unusual species is one of the activities of the propagation staff at the Arnold Arboretum. We conducted numerous propagation tests on *Cedrus deodara* ’Shalimar’ in which we managed to kill a large number of cuttings. However, a method of studied trial and error as to time of taking cuttings, hormone applications, soil medium, wounding, and humidity control gradually identified one means of achieving an 83 percent success rate. Our propagation staff recommends taking cuttings during January and selecting shoots from last season’s growth. The cuttings are treated with a quick (5-second) dip of the base in 10,000 ppm IBA dissolved in 50 percent ethanol. Wounding or not wounding the base of the cuttings seems to make no difference in the position, amount, length, or quality of the roots. In all cases roots were initiated at the basal end of the cutting and tended to consist of a few long, coarse strands. The soil medium consisted of equal parts of sand.

**Cedrus deodara** Cuttings Available

A limited number of *Cedrus deodara* rooted cuttings or scions for grafting are available. We will honor requests for them until April 1, 1983, for a fee of $15.00, for which recipients will be billed. The fee will help to offset the costs of testing, preparing, packaging, and mailing. Requests should indicate whether two rooted cuttings or 25 scions are desired. Please send requests to: Gary L. Koller, Supervisor of the Living Collections, Arnold Arboretum, Jamaica Plain, MA 02130.
and perlite, and the cuttings were given bottom heat of 75° F. The cuttings were placed in closed cases without mist. The ambient air temperature of the greenhouse was maintained at approximately 55° F. Rooting took place in 10 to 12 weeks. Root quality varied, but as long as any roots were evident the plants were potted. Cuttings are normally potted in early spring and put out a new flush of growth almost immediately. The tip of the new growth is weak and droops for some time, but as the plant grows it becomes erect and develops a strong central leader without the aid of staking.

As we introduce Cedrus deodar 'Shalimar', we hope that it will eventually be included in that category of plants that catch the eye and be recognized for its dependability and beauty in northern landscapes.

Reference

Acknowledgments
Drawing of Trillium ovatum, page 141, reprinted, by permission, from Mary E. Parsons, Wild Flowers of California, Roxana E. Ferris, editor; Dover, 1966.

Drawings of Engelmann spruce (page 142), Colorado spruce (page 138), Douglas fir (page 139), Knowlton hornbeam (page 143), and Rocky Mountain maple (page 140) reprinted, by permission, from Robert A. Vines, Trees, Shrubs, and Woody Vines of the Southwest, University of Texas Press, 1960.

Recipes on pages 116 and 117 reprinted, by permission, from Eugene and Mary E. Griffith, Persimmons for Everyone.

Erratum
In our last issue the shading on the map on page 103 was lost in reproduction. It was meant to indicate the contiguous distribution of the spruces of the world, which extends northward to the treeline across the North American and Eurasian land masses.

Back cover: American persimmon tree (Diospyros virginiana). Edward Goodell photo.