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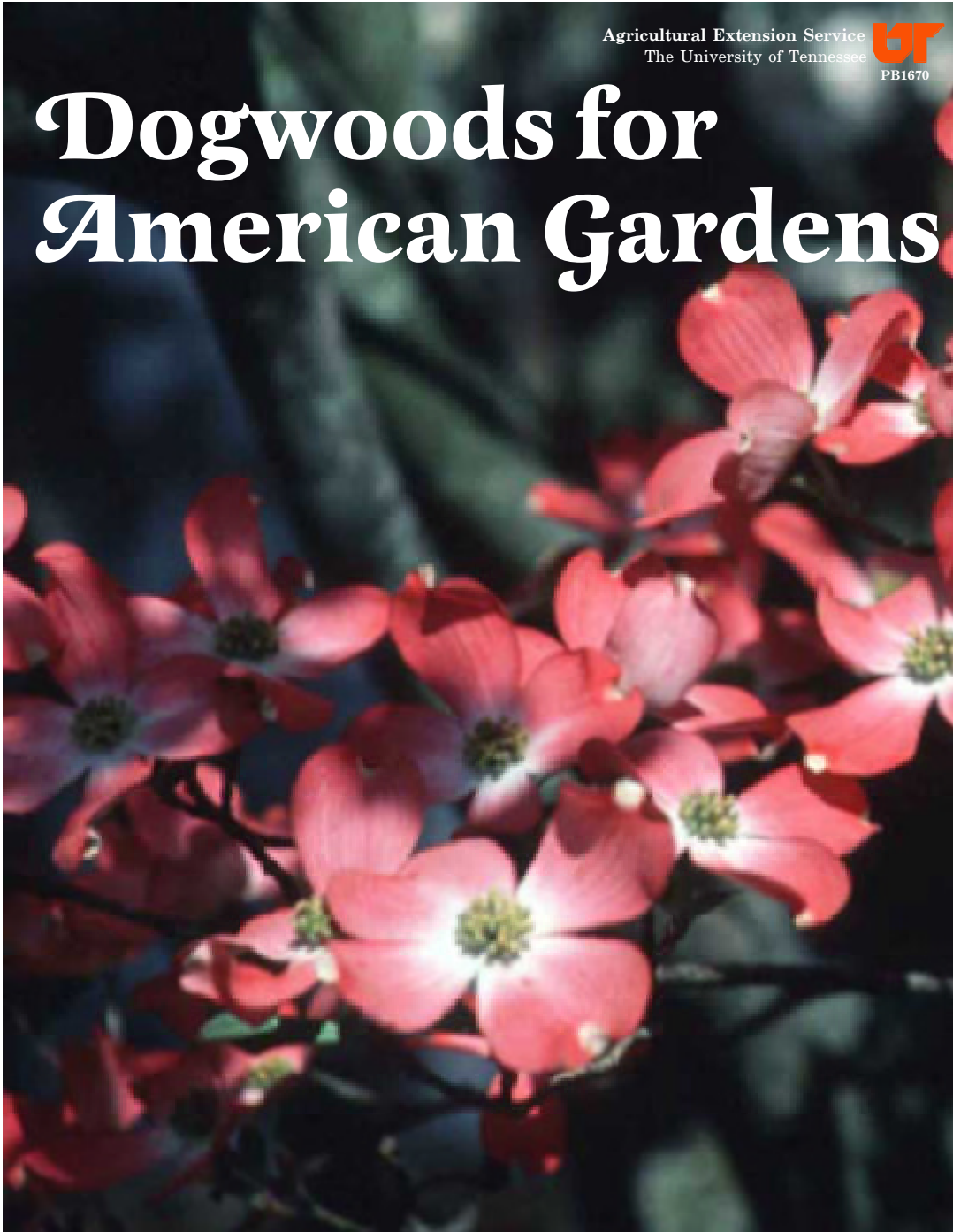
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Agricultural Extension Service
The University of Tennessee



Dogwoods for American Gardens



Dogwoods for American Gardens

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Acknowledgements

The authors acknowledge the contributions of Professors Donald B. Williams, Charles H. Hadden and Harry E. Williams for their original publication entitled "The Flowering Dogwood in Tennessee" (The University of Tennessee Agricultural Extension Service Publication 589, 1969), which was used as a base for this publication.

Appreciation is expressed to Hubert P. Conlon, Mark A. Halcomb, Carol J. Reese and Stephen Garton for their peer review of this publication. We also thank Wanda H. Russell for editorial review and Gary R. Dagnan for publication design.

Printing of this publication is funded by the USDA Forest Service through a grant with the National Urban and Community Forestry Advisory Committee.

Cover Photo: Wayne K. Clatterbuck

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Credit: Wayne K. Clatterbuck

Web Sites

The University of Tennessee Dogwood Research Group maintains a Web site (dogwood.ag.utk.edu) that is devoted to cultivation and growth of flowering dogwoods. The site contains descriptions and photographs of *Cornus* species, dogwood cultivars, diseases and insect pests. The site is kept up to date concerning new disease epidemics and outbreaks of insect pests, has a FAQ (Frequently Asked Questions) section and maintains a forum where individuals can ask/or discuss problems they are having with their dogwoods.

A series of publications about site and tree selection, tree maintenance and tree care for urban landscapes are available at The University of Tennessee Agricultural Extension Service Web site (www.utextension.utk.edu/publication/forestry.htm).

Dogwoods for American Gardens

Introduction

Seventeen species of dogwood are native to the United States, with about 50 throughout the northern hemisphere of the world. The familiar species we call “flowering dogwood,” *Cornus florida*, is related to many others. This publication discusses those of ornamental value. Most dogwood species are either shrubs or small trees and can be easily divided into two main groups: those with red fruit (occasionally yellow) and those with blue-black (sometimes whitish) fruit.

Most of the **red-fruited** species have large showy bracts surrounding a terminal cluster of tiny true flowers. These large-bracted dogwood species are all trees, except for the bunchberry, a low-growing ground cover found in northern climates. Most of the **blue-fruited** species are shrubs and all have whitish, flat-topped flowers of tiny clusters called cymes or umbels. These flowers are without the showy bracts.

The native flowering dogwood, *Cornus florida*, is one of the most beautiful small trees in the world, with ornamental value in all seasons. Nearly all flowering dogwoods in the wild have white bracts, but a rare pink form does occur naturally.



Red fruit of *Cornus florida*. Credit: Mark T. Windham

Modern selections grown by nurseries have been chosen for large, white, clear pink or dark red bracts; variegated leaves; double bracts; weeping or dwarf growth habit and other special characteristics.

The beauty of flowering dogwood is not limited to a particular season or a single part of the tree. Most selections begin with a glorious floral display in April, followed by attractive green foliage arrayed on horizontally spreading branches. A show of bright red berries appears in late summer and is accompanied by early development of dark red foliage. The beauty cycle ends with an interesting winter silhouette of

horizontal gray branches tipped with upturned, button-like flower buds.

In addition to its beauty, the dogwood is an important food source for birds and wildlife. Berries of the flowering dogwood are eaten by many species of songbirds and small mammals from August until they are gone, often as late as February or March.

This publication provides cultural information and ornamental characteristics to help you select dogwoods for your landscape and how to maintain them in good health. If you have any questions, contact your Cooperative Extension Service.

Facts and Legend

The name **dogwood** apparently originated in Europe. The bark of one of the European species was boiled in water and used for washing dogs suffering from mange. Most authorities believe that *dogwood* is a corruption of *dagwood*, with *dag* being an old name for a meat skewer. The hard wood of this species is useful for that purpose.

The name dogwood is less inspirational than the legend that the dogwood once grew as a tall, straight tree and was used for timber. But when the wood was used to make the cross of Calvary, Jesus was so moved that he promised the tree would never again grow large enough to be employed for such a purpose. It is also said that the bracts of the dogwood are set in the shape of a cross and bear nail marks of the Crucifixion, and the red leaves in autumn

have been associated with Jesus's blood on Calvary. The dogwood also served in the field of medicine at one time. Dogwood bark was one of many barks used as a fever medicine before quinine came into general use.

Of more importance is the role the dogwood once played in the textile industry and in sports. The wood from dogwood was used to make shuttles for weaving machines because of its very heavy, fine-grained and very hard properties, and because with wear it becomes extremely smooth and resistant to abrasion. The same qualities made it useful for golf clubs, jeweler's benches and as wedges for splitting logs.

Given time and favorable growing conditions, some dogwoods attain large stature. Currently, the largest known dogwood tree in the United States is a Pacific dogwood,

Cornus nuttallii, in Clatskanie, OR that is 60 feet tall with a 58-foot branch spread and a trunk diameter of more than 3 feet. The largest flowering dogwood is in Sampson County, NC and is 31 feet tall with a 48-foot branch spread and a trunk diameter of just greater than 3 feet. Champion trees often do not retain their title long due to loss of branches from disease or storms or from being outgrown by competitors.

Kinds of Dogwood

Dogwoods are in the genus *Cornus* within the *Cornaceae* family. The most common ornamental and native species of *Cornus* are described in this section. Those native to the United States are marked with a single asterisk (*). Hardiness is indicated by the USDA plant hardiness zone (Figure 1).

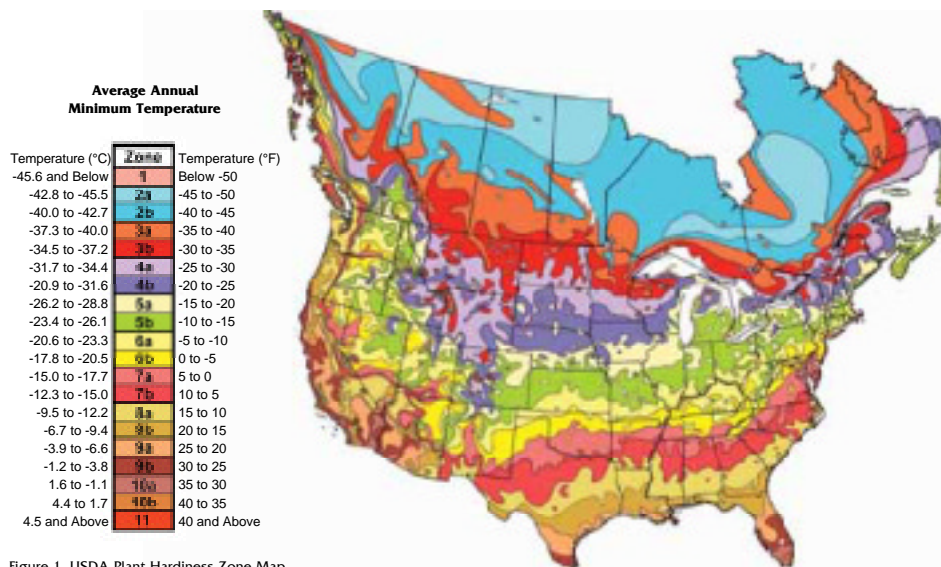


Figure 1. USDA Plant Hardiness Zone Map
Credit: USDA-Agricultural Research Service

****Cornus florida***, Flowering Dogwood. Zones 5-9. Native to the Eastern United States from the Gulf of Mexico and central Florida to east Texas, Oklahoma and Arkansas to Chicago and southern New England. Typically grows 12-20 feet tall with a 6-12 inch trunk diameter, but sometimes larger. Considered a short- to medium-lived tree in landscapes, but may live 100 years on good sites. Blooms in mid-spring as leaf buds break. Four showy bracts, notched at the tip, rapidly expand and turn white, centered by a cluster of 20 or more tiny true flowers with four petals, four stamens and one stigma. Scarlet oblong-oval berries in the fall are valued food for birds and wildlife. A few yellow-fruited forms occur. The distinctive "alligator" bark is broken into small squarish blocks. Buttonlike flower buds occur on upturned horizontal branches in winter. There are many selections and cultivars chosen for superb ornamental characteristics.

Cornus kousa, Japanese or Chinese or Kousa Dogwood. Zones 4-8. Native to China, Japan and Korea, this tree will grow in the U.S. wherever our native flowering dogwood grows. Blooms have four-pointed flower bracts about as large as those of flowering dogwood, but appear a few weeks later. The foliage develops before the bracts appear. The long-lasting bracts are displayed above the leaves on long flower stems. The aggregate fruit looks like a rosy-red golf ball, the size of a nickel or larger, and contains several seeds embedded in pulpy orange flesh. The pulp is said to be edible when ripe. As fruits gain in weight and size, they hang under the branches on long stalks like ornaments. Borers or diseases rarely trouble kousa dogwoods. The average kousa dogwood tree has to be a few years older than comparable flowering dogwoods to develop a heavy bloom display. Some mature kousa trees have beautiful flaking mottled bark patterns on a smooth trunk. The flower bracts of some kousa dogwoods may become tinted with pink when the plant experiences cool weather, is under stress or when the bracts age. Varieties are currently being selected that are considered truly pink flowering. Nursery producers are

becoming more experienced with growing kousa dogwoods, and better types are being evaluated.

****Cornus nuttallii***, Pacific Dogwood. Zones 6b-9a. The native range is a broad band along the West Coast from about San Francisco, excluding the Imperial Valley, northward into British Columbia. Grows taller and more upright than flowering dogwood. Blooms are also larger and typically have six bracts (un-notched) instead of four. May re-bloom in late summer. Flower bud scales (bracts) do not enclose the over-wintering flower cluster. Bark remains smooth. Unfortunately, it does not seem to thrive in the East. Hybrids between

Pacific dogwood and flowering dogwood are known.

Cornus mas, Cornelian Cherry. Zones 5-8. A hardy European species that seems to be at the southern limit of its heat tolerance in the mid-South, where it frequently presents a poor appearance by the end of summer. It grows as a small tree or multi-stemmed shrub up to 15-20 feet tall. Cornelian cherry blooms in very early spring, before forsythia, with many clusters of small, yellow, bractless flowers. The oblong cherry-like fruit is both ornamental and edible and may be used for preserves. A few cultivars are available in the trade.



Cornus nuttallii, Pacific Dogwood. Credit: Mark T. Windham



Cornus mas 'Aurea', Cornelian Cherry. Credit: Willard T. Witte

Cornus officinalis, Japanese Cornel. Zones 5-8. This shrub or tree is very similar to Cornelian cherry, but grows larger (to 30 feet), and has the added attraction of interesting exfoliating bark that flakes off to create gray, brown and orange patches on mature trunks. Flowers are similar to Cornelian cherry but bloom a week earlier, well before the leaves emerge. The edible but flavorless scarlet berries ripen after Cornelian cherry.

**Cornus sericea* (formerly *C. stolonifera*), Red Osier Dogwood. Zones 2-7. Native stands grow in moist-to-wet sites from Newfoundland to Manitoba, south to Virginia and Kentucky, west to Nebraska, but have a wider adaptability in landscapes. This multi-stemmed shrub grows to 7 feet and spreads slowly by underground stems, making thickets. Flat clusters of chalky white flowers form a cyme that blooms in late spring, often followed by white berries. Varieties are available with bright red, olive-yellow or green stems for winter color. 'Silver and Gold' has white variegated leaves and yellow stems. Again, these plants are grown for winter bark color and old branches should be pruned to the ground every year or two to induce a good growth of new, brightly colored branches.

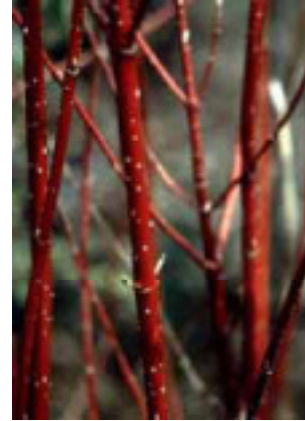
**Cornus alternifolia*, Pagoda Dogwood. Zones 3-7. This small, widespreading tree is native from New Brunswick to Minnesota, south to Georgia and Alabama, and west to Missouri and Arkansas. Pagoda dogwood has a strongly horizontally branching habit and reaches about half the size of flowering dogwood. Yellowish-white flowers in an upright cyme bloom in mid- to late spring and are very fragrant. These are followed by fruit that changes from green to red to blue-black, on red stalks. Unlike most dogwoods, this species has alternate leaves instead of opposite, though this may be hard to see because leaves tend to be clustered near the tips of the branches. A rare white variegated form, 'Argentea', has smaller leaves. An antique common name was pigeonberry, apparently bestowed during the era of the passenger pigeon.

**Cornus racemosa*, Gray Dogwood. Zones 4-8. A shrubby tree to 15 feet, found on moist sites from Maine to Manitoba, south to Florida, and west to Missouri and Oklahoma. It tends to grow in colonies due to a suckering habit, so it is often better suited for wildlife and native plant gardens than well-groomed landscapes. White flower panicles in mid-spring are followed briefly by white berries. Red fruit stalks remain ornamentally interesting until fall. A recent selection is named 'Jade'.

**Cornus amomum*, Silky Dogwood. Zones 5-8. This shrub ranges from Maine to Indiana, south to Georgia and Florida, and grows to 9 feet. White flower clusters form a flat-topped cyme that blooms in early summer, followed by blue berries. While considered too coarse and straggling for most gardens, in the proper setting it has a place, as in a native plant garden or wildlife garden.

Cornus controversa, Giant Dogwood. Zones 4b-8. Native to China and Japan, this is the largest and fastest growing of the dogwoods, capable of attaining 60 feet. Giant dogwood develops distinctly spreading horizontal branches at an early age. Creamy white flower clusters form a 3-7 inch flat-topped cyme in early summer that are showy and may be followed by bluish-black berries. The large paired leaves may turn reddish or purplish in autumn. It is rare outside of arboretums. A beautiful variegated form exists.

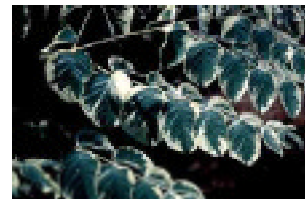
Cornus alba, Tatarian Dogwood. Zones 2-7. The native range is Siberia though northern China to Korea. This large shrub, multi-stemmed to the base, grows to 9 feet unless cut back. Since it is grown primarily for the winter display of bright coral-red stems, which is brightest on new growth, the old dull branches should be cut every spring to ground level before growth starts. This also keeps plants to a manageable size. Tatarian dogwood has yellowish-white flowers in 1½ to 2-inch cyme with flat-topped clusters in late spring, often followed by white berries. Several varieties have variegated foliage. 'Argenteo-marginata' has an irregular creamy-



Red twigs on *Cornus sericea*, Red Osier Dogwood. Credit: Willard T. Witte



Cornus alternifolia, Pagoda Dogwood. Credit: Willard T. Witte



Foliage of *Cornus controversa* 'Variegata' or "wedding cake tree." Credit: Willard T. Witte



White fruit on *Cornus alba*, Tatarian Dogwood. Credit: Willard T. Witte



Cornus baileyi, Bailey Dogwood. Credit: Willard T. Witte

white margin around a leaf center of subdued grayish-green. On 'Gouchaltii' and 'Spaethii' the marginal leaf variegation is yellow. Either can add a nice spot of light color to a summer garden. Some afternoon shade is beneficial.

Cornus sanguinea, Bloodtwig Dogwood, is a European cousin of Tatarian dogwood. The rough-looking, suckering shrub is rarely recommended for ornamental use other than for its purplish-red winter twig color.

**Cornus obliqua*, Pale Dogwood, and **Cornus asperifolia*, Roughleaf Dogwood, are shrubby cousins of silky dogwood and occur in roughly the same range and habitats. They differ in minor botanical characters such as twig color, pith color and hairiness (pubescence) of the leaves.

**Cornus canadensis*, Bunchberry. Zones 2-6a. This subshrub (to 9 inches tall) spreads by woody rhizomes forming a ground cover in the woods. The white bracts and red

berries are quite similar to flowering dogwood. Bunchberry grows from Alaska, Canada and Greenland and can sometimes be found at high elevations as far south as West Virginia. A challenging groundcover plant for garden experts, it requires shade, moisture, an organic soil and cool temperatures.

Cornus macrophylla, Bigleaf Dogwood. Zones 5-7. Rare in the U.S., this small tree ranges from the Himalayas to China and Japan. The tree grows to 35 feet, with large leaves 4-7 inches long. Flowers are yellowish-white in 4-6 inch loose panicles in late summer followed by bluish-purple berries. This species is virtually unknown outside of arboretums in this country.

**Cornus baileyi*, Bailey dogwood, is a non-stoloniferous cousin of red osier dogwood and occurs in the same range. The other main difference is a distinctly wooly pubescence of young shoots and the undersides of leaves. Some botanists ascribe it to be a subspecies of *C. sericea*.

Cornus walteri, Walter dogwood, is hardy to zone 5 and is native to central China and Korea. It has a tree type stature, growing to 30-40 feet high and wide with the "alligator" bark typical of our native flowering dogwood. The 2-3 inch flat cyme is formed by white flower clusters in mid-summer, followed by small black berries that mature in early fall. This species deserves wider testing and use.

Botanical manuals describe many more species of native and exotic dogwoods, but most are of lesser ornamental value than those described above or are of only local interest.

From the species of *Cornus* mentioned above, one can see that the native flowering dogwood is just one member of a large and diverse genus. It is the dogwood of interest to most gardeners, and is unquestionably beautiful, a small tree for all seasons. However, many of the other species and their cultivars have special ornamental merit of their own and can add to the diversity of our landscapes.

The word 'cultivar' is a horticultural term for 'cultivated variety,' as distinguished from a botanical variety ('varietas') or form ('forma') that occur naturally in the wild. A cultivar name should always be enclosed in single quotation marks. The next section contains capsule descriptions of the most important and available cultivars for several species.

Cultivars of Flowering Dogwood, *Cornus florida*

Several botanical varieties and forms of flowering dogwood have been grown in gardens over the years; more than 80 cultivars have been developed from either seed or sports (mutations). Newer cultivars continue to be developed. Selections have been made for pink or red bract color, ability to bloom at a young age, large bract size, variegated foliage, weeping or dwarf habit of growth and disease resistance.

Pink and Red Flowering Dogwoods: The first record of a pink flowering dogwood in the wild was by Mark Catesby of Virginia in 1731. Occasional finds of wild pink dogwood still occur to this day. Most pink and red dogwood will not come true from seed and are usually propagated by bud grafting. Unnamed selections are often marketed under the name 'Rubra', which seems to be applied to any pink type not identified as a specific variety. Most pink and red cultivars are not as winter hardy as most white cultivars, nor are they as heat tolerant, except for a few selections originating in the Deep South. New foliage often comes out in the spring with a distinct red tinge, and usually develops brilliant red fall color.

Variegated Foliage: Variegation is expressed when mutations occur that block development of chlorophyll in one or more layers of leaf tissue. In these cases, the variegated part is usually cream, yellow or golden due to the xanthophylls and carotenes still in the tissue. If formation of

yellow pigment is also blocked, variegation will be white. Since several layers of leaf tissue may be affected independently of each other, it is possible to have multicolor variegations, expressed as central blotches, marginal bands or irregular splashes along leaf veins.

Many variegated cultivars maintain their showy leaf variegation pattern longer into summertime when grown in full sun. In the shade, green pigment may eventually develop throughout the leaf blade, resulting in fading of the variegation pattern. Because variegated-leaved plants have less chlorophyll, they grow slower and set fewer flower buds than green-leaved plants. White sectors of variegation are more susceptible to leaf scorch when plants are stressed than yellow or pale green sectors. Variegated parts of leaves are the first to show fall color, as the developing anthocyanin pigments are not masked by chlorophyll. Many types of leaf variegation tend to be unstable and one or more shoots occasionally revert to all green. Green shoots are more vigorous and must be immediately and entirely pruned or they will overgrow and crowd out the desired variegated part of the plant.

Novelties and Special

Characteristics: Some flowering dogwood cultivars are grown for the unusual habit of growth (dwarf, weeping, fastigiate or columnar), leaf shape (willowleaf), yellow berries, double flowers, fragrance or larger than normal berries or flowers. These novelties add interesting accents to many landscapes.

Southern vs. Northern Origin:

Many selections found in the wild have been propagated and brought into cultivation. In the capsule descriptions below, the origin is noted when known. The origin is important because flowering dogwood is closely adapted to its ecological niche, especially in regard to winter hardiness, bloom time in the spring and acclimating for winter dormancy in the fall. A southern ecotype grown in the north may winterkill due to lack of hardiness, bloom too early in the spring and thus have flowers

blasted by killing frosts, and not go dormant soon enough in the fall to survive killing fall frosts. Northern ecotypes grown in the deep South may not grow and bloom well and may suffer from heat stress. These factors are obviously more critical at the extreme southern and northern limits of the range where flowering dogwood can be grown. Also in the north, leaf buds may be winter-hardy while flower buds may be damaged from severe cold, so good flower bud hardiness is sought in northern cultivars. Listed below are capsule descriptions of some of the more important modern cultivars of flowering dogwood in the nursery trade, parks and arboreta.

'Appalachian Spring'. This new cultivar is the only flowering dogwood that is resistant to dogwood anthracnose (*Discula destructiva*). It has apple green leaves about one third larger than the species, and sculpturally curving white bracts, followed by the typical red berries. Red to purple fall color. Unfortunately, this cultivar is susceptible to powdery mildew.

'Autumn Gold'. White bracts. Recent introduction from Winchester, TN with conspicuously golden fall and winter bark color.

'Cherokee Brave'. A recent introduction from Winchester, TN with good resistance to powdery

mildew. Red blooms have a paler center. New growth with reddish leaves turning green at maturity.

'Cherokee Chief'. Considered as one of the best red-flowering dogwoods on the market today. Deep rose-red blooms and reddish leaves on new growth. Vigorous grower with central leader and uniform branching.

'Cherokee Daybreak'. Improved white-flowered variegated selection resists scorch in full sun. Leaves have a blotched green and gray-green center with a wide irregular margin of creamy white that turns pink in cooler fall weather. White bracts. Susceptible to powdery mildew.

'Cherokee Princess'. Selected in Mayfield, KY for its large white blooms exceeding 4 inches in diameter. Very floriferous and blooms at an early age. Highly resistant to spot anthracnose.



Cornus florida 'Cherokee Brave'.
Credit: Willard T. Witte



Cornus florida 'Cherokee Princess'. Credit: Willard T. Witte

Dogwood Breeding and Cultivar Development



According to the most recent estimates, there are about 80 cultivars of the flowering dogwood, *Cornus florida*, that have been named. This partly reflects the many decades that nursery producers have been growing this species. Some of the older cultivars, while documented in the horticultural literature, may no longer exist; that is, they have not been perpetuated in nursery production and have died out of landscapes.

There are about 70 cultivars of *Cornus kousa*, the Chinese dogwood. Many of these are of recent origin, owing to a surge of interest in this species. Many newer Chinese dogwood cultivars have yet to be tested for adaptation and performance over a wide range of climates and sites, but some are destined to add new interest to our gardens.

Until recently, nearly all dogwood cultivars came to be named because someone noticed something different and worthwhile about a particular individual dogwood seedling and then decided to propagate it and name it. Since dogwood is an obligate outcrosser (it does not pollinate its own flowers), there is always some genetic variability existing in every new crop of seed. Plant enough seed from enough different sources and some of the possibilities will be expressed in a few of the seedlings, such as a dwarf or weeping or fastigiate (columnar) habit of growth, bract color, bark color, variegated foliage of several different patterns, ability to bloom at an early age, insect or disease resistance and so on.

Dogwoods may also change because of the expression of somatic mutations, which is a random change in a gene that may occur once in every several million cell divisions. For example, if a mutation occurs that affects the formation of chlorophyll, and this mutation just happens to be located in a layer of leaf tissue of an expanding bud or shoot, then it is possible that a bud sport or branch sport might arise with variegated leaves on a tree that otherwise has all green foliage. This does not happen very often, but on a nursery with hundreds of thousands of dogwoods in production, it will likely occur. It takes an alert eye to pick out mutations and a wise nursery producer will offer a bounty to workers who identify one.

Up until the last decade, there was no purposeful breeding of dogwood to produce new cultivars, unlike field and forage crops where breeding programs have

been going on for almost a century. Then Dr. Elwin Orton of Rutgers University in New Jersey began working with dogwood in his ornamental plant-breeding program. In the early 1990s, he patented and released the Stellar series, which are hybrids between *Cornus florida* and *Cornus kousa*. With one exception ('Ruth Ellen'), these have astronomy-based names such as 'Aurora', 'Constellation', 'Stellar Pink', etc. Dr. Orton has also made crosses with *Cornus nuttalli*, and some of the resulting progeny are out on trial prior to naming and release. Dr. Orton also bred and patented an unusually vigorous *Cornus florida* with fruit nearly twice normal size and named it 'Wonderberry'.

Researchers at The University of Tennessee Institute of Agriculture (UTIA) began searching for disease-resistant flowering dogwoods in the early 1990s. They discovered several in the wild and propagated them for further testing. One, named and released as 'Appalachian Spring', is highly resistant to dogwood anthracnose. It is currently being increased and should be on the market by 2005. Then in the mid 1990s, an epidemic of powdery mildew severely impacted dogwood seedlings in nurseries all over the eastern United States. UTIA scientists searched nursery fields for resistant seedlings and rescued about 80. After extensive testing, three of these are being named and patented: 'Jean's Appalachian Snow', 'Karen's Appalachian Mist' and 'Kay's Appalachian Blush'. They are being increased and should be available for purchase by 2007.

UTIA researchers currently have a dogwood-breeding program aimed at combining resistance to the two diseases (anthracnose and powdery mildew) in new plants. They have even worked out methods to employ honeybees, which normally do not visit dogwood flowers, to achieve cross-pollination. Hundreds of seedlings have been produced and are being tested, and breeding orchards of dogwood have been planted to produce seed.

The same UTIA scientists are screening *Cornus kousa* seedlings for heat and drought tolerance. A number of these seedlings have been selected and are being placed in an evaluation program.



'Appalachian Spring' is a flowering dogwood cultivar that is resistant to dogwood anthracnose.
Credit: Mark T. Windham

'Cherokee Sunset'. Good red bracts and strongly variegated foliage. Leaves have a broad irregular yellow margin that resists scorch in summer heat. Fall color ranges from pink on the margins through red and purple centers. Resistant to spot anthracnose. This unique dogwood was considered stable enough for introduction in 1979, eight years after discovery.

'Cloud 9'. Introduced from Chase, AL in 1951. Wide, overlapping white bracts in profusion. Blooms at an early age. Due to heavy flowering and fruiting, it is slower growing than most dogwoods. A very similar cultivar, 'Barton', selected in 1956 in Birmingham, AL became mixed with 'Cloud 9' in the trade and DNA fingerprinting shows plants currently offered under either name are the same.

'First Lady'. Introduced from McMinnville, TN in 1969. This variegated cultivar has white blooms, but is not a heavy bloomer. The leaves have yellow variegations splashed over a light and dark green background. It tends to scorch less than plants with white variegations. Leaves may turn all-green in summer if grown in too much shade. It is highly resistant to spot anthracnose. A less vigorous cultivar, but a beautiful specimen when well cared for.

'Fragrant Cloud'. Introduced from Gatlinburg, TN in 1968. Said to have a profusion of white flowers and a slightly fragrant scent like gardenia. This vigorous grower is seldom offered. Resistant to spot anthracnose.

'Green Glow'. PP#4444. Introduced from Portland, OR in 1973. This is a mutation of 'Welchii' with a slight golden vein centered in dark green leaves. Upright growth habit. Rare.

'Golden Nugget'. Introduced from Winchester, TN. Similar to 'First Lady' and 'Hohman's Golden', this white-bracted cultivar has yellow leaf margins and tends to turn all green in the shade.

'Hohman's Golden'. Introduced from Wayne, NJ in 1964. Green and yellow variegated foliage and white blooms. Named after Henry J.



Cornus florida 'Cherokee Sunset' (left) and 'Cherokee Daybreak' (right)
Credit: Willard T. Witte

Hohman, founder of the Kingsville Nursery in Maryland.

Howell Hybrids. Not a cultivar name, but refers to a group of about 10 numbered seedlings grown by Howell Nursery, Sweetwater, TN prior to 1960, from a supposed cross of a pink tree from the North and a pink tree from the South ('Prosser'). Seedling #1 became 'Cherokee Chief' and #2 or #3 became 'Sweetwater Red'. 'Cherokee Brave' is assumed to be a seedling of 'Cherokee Chief'.

'Jean's Appalachian Snow'. A new, powdery mildew-resistant cultivar developed by the Tennessee Agricultural Experiment Station. Very large, pure white, blocky bracts, similar in size to 'Cherokee Princess', are overlapping. Even the indented cleft at the tip of the bract lacks pigmentation. Red berries; good fall color.

'Karen's Appalachian Blush'. A new, powdery mildew-resistant cultivar developed by the Tennessee Agricultural Experiment Station. The bracts are long and floppy, delicate in appearance, and do not overlap. Bracts are white with a pale pink blush developing on the margins. Red berries; good fall color.

'Kay's Appalachian Mist'. A new, powdery mildew-resistant cultivar



Cornus florida 'First Lady'.
Credit: Willard T. Witte

developed by the Tennessee Agricultural Experiment Station. Creamy white bracts that slightly overlap. Cleft at the tip of the bract is flat and deeply pigmented. Red berries; good autumn color.

'Mystery'. Introduced from Winchester, TN in 1965. This dwarfish compact tree has blooms with large white bracts, but occasionally some bracts develop pink blushes or reddish blotches. Drought-tolerant. Rare.

'Ozark Spring'. White-flowered cultivar introduced in Kansas for better flower bud hardness. White bracts and wine-red fall color. Selected from among 125 plants grown from seed collected in Crookston Hill region of Oklahoma. Has flowered after sustaining temperatures of -30 degrees F.

'Pendula'. Weeping form with drooping bracts and white flowers. May come true to type from seed. Original clone, found wild in Maryland, was raised in a Philadelphia nursery before 1880. Not a particularly attractive weeping tree. There may be several weeping forms in the trade under this name.

'Pink Sachet'. Similar to 'Cherokee Chief' but with pronounced flower fragrance. Assumed to be a seedling of 'Cherokee Chief'. Uncommon.

'Plena'. An older, white-bracted cultivar with semi-double flowers of medium size. Blooms about two weeks later than single-flowered types, thus escaping late spring frost damage. Blooms last longer than single-flowered dogwoods, which tend to drop bracts as soon as berries set. Does not set fruit. Very prolific bloom, but visual impact reduced as some flowers hidden by developing foliage. Appears to be immune to spot anthracnose.

'Pluribracteata'. A "double" form with 7-8 and often more large bracts and true flowers more or less aborted. Blooms 7-10 days later than most other flowering dogwood cultivars, thus escaping spring frost damage. Does not set fruit. Some authorities lump 'Plena' under this name. There may be several double-flowering forms.

'Poinsett'. Golden yellow berries in the center of a group of red autumn leaves are said to resemble a poinsettia. Compact and vigorous growth with long, pointed leaves.

'Prosser'. Of historical significance as the progenitor of most of our current red-flowered dogwood cultivars. Found by Bruce Howell, Knoxville, TN around 1920, on property owned by Brown Prosser about three miles from Howell Nursery. Poor growth habit. Flowers have a good dark red color but inferior conformation. New leaves dark reddish green.

'Purple Glory'. New foliage maroon to purple suffused over a light green background. Flower bracts dark red. Susceptible to dogwood canker.



Cornus florida 'Rubra'. Credit: Willard T. Witte

'Pygmy'. A slow-growing plant, reaching perhaps 4 feet in eight years, which generally produces an abundance of small, 1½ -inch flowers. Uncommon.

'Rainbow'. White flowers, and the most brilliant variegated foliage imaginable under protected conditions. Bright deep yellow and green leaves in spring and summer turning to pink, red and blue-lavender in fall. Red berries. Leaves have a wide, irregular, creamy yellow margin and a green center.

The lighter margin overlays portions of the green tissue extending to the center of the midrib, creating yellow-green splotches. Subject to scorch in exposed sunny sites.

'Red Beauty'. A semidwarf compact tree with many small red blooms. Flowers at an early age. From a controlled cross in the Rutgers University, NJ breeding program.

'Robert's Pink'. Apparently a choice pink-flowering dogwood originating in southern Louisiana in the early 1900s. A vigorous-growing, pink dogwood adapted to the Deep South.

'Royal Red'. New foliage opens blood red, then becomes greenish and turns bright red in fall. Flowers are deep red and very large. Uncommon.

'Rubra'. First described as a botanical variety in 1770. Later, properly classified as a *forma* in 1915. This name is not valid at the cultivar level, but represents botanical forms with washed out pink to dark red flowers on different trees. First discovered in Virginia, but occurs more widely, though infrequently, in the wild. It is a beautiful plant when properly grown. The flowers are not as cold hardy or as heat tolerant as the white form. Tends to open a few days later than typical white form.

'Salicifolia'. A small, rounded tree; the leaves are very narrow and willow-shaped. It has a fine texture and does not flower well.

'Spring Song'. A northern type of 'Rubra' with especially large flowers of rich, rosy red.

'Springtime'. The original tree was selected from a planting in Spring Grove Cemetery, Cincinnati, Ohio in 1957. Large, white, overlapping bracts, 5 inches across from tip to tip. Wide-spreading growth habit; undersides of the leaves turn a distinctive purplish color in the fall. Highly resistant to spot anthracnose.

'Sterling Silver'. An excellent white variegated dogwood that does not

burn in full sun. Slower growing than normal, developing a layered effect as it ages.

'Stokes Pink'. Pink bracts on a medium-size, vigorous, upright tree. Good in warm climates.

'Sweetwater Red'. Selected in 1954 by Howell Nursery, Knoxville, TN and introduced in 1961. Deep red flowers and reddish foliage, good red-purple fall color, and moderately disease resistant. See Howell Hybrid listing.

'Weaver'. A 1941 Florida selection with stronger and larger bronzy new foliage, and larger and more numerous blooms. Well-suited for Florida, as it does not require as long a period of chilling to overcome winter dormancy as more northern ecotypes.

'Welch Bay Beauty'. Particularly handsome double form with flowers like gardenia, seven sets of whorled white bracts 4.5 to 5.5 inches in diameter. Lower bracts shed before those above. Trees bloom at an early age and blooms last longer than most dogwoods. Found in the wild in Baldwin County, AL in 1972. Performs better in Deep South. Holds leaves longer and develops good autumn color; 20 feet tall. Probably not as hardy as most 'Pluribracteata' forms.

'Welchii'. Perhaps the oldest selection with tri-color variegation, it has leaves that are a combination of green, creamy white and pink. Best in partial shade to avoid leaf scorch. Spectacular rose red to red purple fall color, white bracts. Does not perform well in the South and generally should be planted in partial shade. Sparse bloomer. Sometimes reverts to green foliage type and these reversions should be pruned immediately as they occur. A selection called the 'Kingsville Form' has better color and is a better grower.

'Welch's Junior Miss'. Rather attractive, large-flowered form with deep pink bracts grading to whitish in the center and small white bract tips. Found as a wild plant in 1957 in Mobile County, AL. A rather

attractive small-flowered form that tends to have sparse bloom. Resistant to spot anthracnose. Holds its color in the Deep South. Requires less chilling than other dogwoods to break winter dormancy. Vigorous grower with red coloring of new growth. Blooms late in season.

'Wonderberry'. Unusually vigorous, dark green leathery leaves, brilliant red tubular fruit about twice-normal size, and abundant white flowers in early spring. From a controlled cross of the breeding program at Rutgers University, NJ.

'World's Fair'. Large white bracts. Blooms at an early age, stocky trunk, large-diameter limbs, drought resistant, hardy to -7 degrees F.

'Xanthocarpa'. White blooms and yellow fruit. Botanically this is a *forma* of the species. Since more than one genotype has been placed under this *forma*, the name is invalid at the cultivar level. Several clones are in cultivation (see 'Poinsett'). Stems show no trace of red pigment, being devoid of anthocyanin pigments.

Cultivars of Kousa Dogwood, *Cornus kousa*

'Aget'. Chance seedling. Large bracts, re-blooming or long-blooming bracts may persist from June to September.

'Akabana'. Originated in China. Growth habit is consistent with the species. Said to have perfect pink bracts, but the warmer the weather, the poorer is the expression of red pigment. There is some question as to whether this is distinct from other pink-blooming cultivars, as 'Akabana' is the Japanese generic name meaning "red flower" that is applied in Japan to all pink-flowered forms.

'Angustata' (aka 'Augustifolia') and sometimes ascribed to the species *Cornus capitala* by some botanists. Evergreen in Zone 7 or warmer climates, semi-evergreen

or deciduous in Zone 6. Narrow glossy leaves droop distinctly in fall and winter. Purple to wine winter foliage color. This recent introduction from China may be elevated to species rank by botanists. Winter hardiness unknown, but probably less than most *C. kousa*. Definitely recommended for trial in climates previously considered too warm for good performance of most kousas. Blooms later than most *C. kousa*.

'Autumn Rose'. Long, drooping, wavy (almost ruffled) leaves present a different, yet distinctive appearance. A small upright tree selected for its unusual creamy, pale greenish-white bracts in early summer. Fall color ranges from pink to light red. Sparse production of fruit.

'Beni Fuji'. Small, vase-shaped tree with a multitude of small, starry-pink bracts. Slightly distorted leaves smaller than normal, reddish new growth.

'Big Apple'. Large spreading tree with heavy-textured dark green leaves and very large fruit, hardy to 5 degrees below zero F.



Cornus kousa 'Augustata'.
Credit: Willard T. Witte



Cornus kousa 'Big Apple'.
Credit: Willard T. Witte



Cornus kousa 'Blue Shadow'.
Credit: Willard T. Witte



Cornus kousa 'Hearththrob'™.
Credit: Willard T. Witte

'Blue Shadow'. Blooms at an early age. Very dark green foliage, with a blue sheen or undertone. Some white bracts may remain at fruiting time, excellent fall color and very heat tolerant. One of the best selections for the mid-South.

'Bush's Pink'. Pink bracts hold their color well through the whole flowering season, at least in cool climates. Heavy bloomer has same growth rate and size as species. The leaves show red pigment.

'China Girl'. A Holland introduction selected for very large bracts. Blooms at an early age. Large fruit.

'Chinensis'. Not valid as a cultivar name and relatively meaningless as a variety name, but used in the nursery trade as a generic adjective signifying more vigorously growing, free-flowering plants with broader leaves than the "Japanese" type.

'Dwarf Pink'. The plant was found wild in Gumma Prefecture, Japan and produces light pink bracts. Low, spreading growth habit with a maximum height of 6 to 9 feet.

'Elizabeth Lustgarten'. Selected from seedlings grown by Lustgarten Nursery, Long Island,

NY. Plant is upright, but lateral branches are weeping. Forms graceful rounded crown, leading branches weep 2 feet from highest point of curve, 7 feet high and 4 to 5 feet wide after 12 years.

Galilean™. One of the newest introductions. Has enormous hunter green leaves and large white bracts. A very broad, upright, vase-shaped tree, becoming rounded at maturity.

'Gold Cup'. Leaves slightly concave with a gold blotch in the center of the leaf.

'Gold Star'. Leaves green with irregular, butter-yellow blotch in center through spring and summer. Will revert to green, as is true for many plants with the center variegation. All green shoot reversions should be pruned out. Introduced in 1983 by Brookside Gardens from Japan. Quite handsome, but appears quite slow growing. Bracts are white. Usually does not scorch in full sun.

'Greensleeves'. This is a fast growing tree, with symmetrical branching. The leaves are probably the darkest green of the kousas. The edge of the leaves is like waves. Prolific blooms.

Hearththrob™. A very new introduction ('Schmred') with a deep red, burgundy bloom, but flower color is not as intense in the mid-South as in the Far West.

'Julian'. Bracts curved up at tip, excellent fall color, large fruit greater than 1 inch across.

'Little Beauty'. Shrubby form from wild collected Korean seed, distributed by North Carolina State Arboretum.

'Lustgarten Weeping'. Weeping type with no tendency for stem or trunk to develop upward. Said to be beautiful because the flowers are positioned along the weeping stems so they are directly in view. A 12-year old plant is 10 feet wide and 2-3 feet high. Branches arch 12 to 15 inches above ground. Branches can be grafted on a standard to produce a small weeping tree.

'Madame Butterfly'. Extremely floriferous plant with flowers borne on long pedicels and long narrow floral bracts turning vertical about the midpoint of their length – giving the appearance of "swarms of butterflies" on the branches.

'Milky Way'. This cultivar derives from a group of 15 seedlings of the chinensis type selected, propagated and released by a prominent mail order nursery in Perry, Ohio in the 1960s. Trees bloom at an early age. In commerce, it may not always be a vegetatively propagated cultivar, but it may be a seedling from a small group of selected parents. This is a very broad, bushy form with distinctly flaking mottled bark on older branches. It is suitable for small landscapes. 'Milky Way' may be a commercially manufactured name for this group of plants rather than a discrete clone; nevertheless, these plants appear more floriferous.

'Moonbeam'. Flowers said to be 7-8 inches in diameter, on long peduncles inclined so blooms are readily visible at eye level. Plant hardy to 20 degrees below zero F. Large leaves.

'National'. Vigorous, vase-shaped tree; dark green foliage. Exfoliating bark, large creamy white bracts, fruits are larger than normal. New growth is reddish.

'Porlock'. Said to be a hybrid of *C. capitata*, originating in an English garden as a self-grown seedling. Foliage may be partially evergreen in milder climates. A large vigorous plant. Bracts creamy-white, but age to pink.

'Radiant Rose'. Large pink flower, plant with spreading arching habit. Red pigment in leaves and branches. Grows to 25 feet. Red fall color. May be similar or identical to 'Satomi'.

'Rochester'. A Rhode Island selection with more vigor and larger, creamy white flowers than most kousas.

Samaritan™. One of the newest introductions and an offspring of 'National'. Variegated creamy white and green foliage remains attractive

all summer. White bracts, vigorous growth, radiant pink and burgundy fall color.

'Satomi'. Pink-flowering form named in Japan and introduced to Europe and U.S. in the 1980s. Red pigment in leaves and branches. Excellent fall color. Hardy to -20F. This is the correct name for 'Rosabella' and 'New Red'. Best bract color in light shade and cooler climates. Disease-prone.

'Snowboy'. Leaves pale gray-green with regular to irregular white margin 2 to 5 mm wide and with occasional splashes of yellow-green, pink or paler gray-green variegation throughout. Not a particularly stable form and not particularly vigorous. Slow-growing and shrubby. Foliage may scorch in full sun. Introduced in late 1970s by Brookside Gardens from Japan.

'Speciosa'. Very dark green leaves curl slightly at margins, imparting an interesting bicolor effect due to the lighter undersides. Large white bracts. Hardy to -15 F. Slow-growing.

'Square Dance'. Upright growth habit with flowers most visible from above. Hardy to 5 degrees below zero F. Named for the square pattern of the bracts. Good fall color.

'Steeple'. Upright growth habit, foliage deep green, glossy, with good fall color. 1961 source from Martha's Vineyard, MA.

'Summer Majesty'. Long blooming season with "bracts like snow banks," which after 3-4 weeks acquire a pink blush for another month. A mature tree would be 20-25 feet.

'Summer Stars'. Heavy-blooming variety retaining flowers six weeks into summer. The fruits supposedly develop with the bracts still present. Robust dark green foliage changes to reddish purple in fall. Drought-tolerant. Introduced by a New Jersey nursery from a Long Island, NY source.

'Sunsplash'. A slow-growing form with bright yellow and green variegation and orange fall color.

'Temple Jewel'. Subtly variegated foliage of green, gold, and light pink,

boldest on new growth; older foliage reverts to green with a light green edge, variable expression, small flowers and normal growth habit. Not as colorful as 'Goldstar'.

'Trinity Star'. Selected by an Oregon nursery. New growth is a mottled show of pink, green and white. Leaves are clustered in a twisted whirling pattern, which forms a flat-topped dense outline. Fall colors are pink and red.

'Triple Crown'. Plant with small and dainty growth habit, heavy flowering with blooms mostly in triple clusters. Plant hardy to -20F. Source from Milton, MA.

'Variegata'. There is more than one variegated form under this name in cultivation. The cultivar originated in Japan and was introduced to Long Island, NY in 1862. Leaves can be green but heavily streaked with white, yellow or gray-green; marginal or centrally variegated, sometimes all on the same plant. Variegated kousas are usually slower growing and often are unstable with branches of the variegated leaves reverting to green, which must be pruned to maintain variegation.

'Weaver's Weeping'. Exceptionally heavy flower display on weeping branches. Easy to train a dominant leader with remaining branches cascading toward the ground.

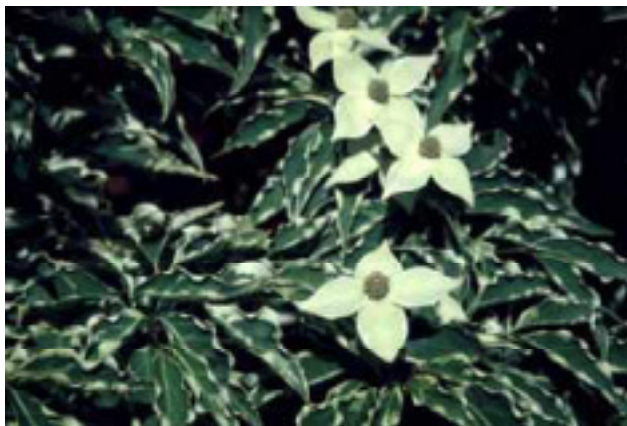
'Willamette'. 1995 Oregon introduction. Holds dark green foliage color even in hot, dry summers. Excellent fall color, prolific flowering.

'Wilton'. 1978 New Jersey introduction. Plant holds flowers longer than normal.

'Wolf Eyes'. Center of leaf is gray-green, with a bright white margin that is scorch-resistant; leaf surface is somewhat rippled. Slow-growing, compact habit. White bracts have less impact than on green-foliaged cultivars. One of the best and most stable variegated forms.

'Xanthocarpa'. Yellow fruits. Several forms may pass under this name.

Many other cultivars have been selected and named with various attributes of growth habit, flowering, foliage variegation, and fruit size and color. Few of these are readily available, but some may be obtained from specialist nursery growers or found in arboreta. New cultivars continue to be introduced, for example 'Samaritan', 'Christian Prince' and 'Galilean'. Some are too new to be described. There appears to be increasing interest in using improved *C. kousa* cultivars in American gardens because of their improved drought and heat tolerance.



Cornus kousa 'Wolf Eyes'. Credit: Willard T. Witte

Cultivars of Pacific Dogwood, *Cornus nuttallii*

Partly because of its smaller range, there has been less activity in cultivar development in this species. Pacific dogwood is difficult to grow in the Eastern U.S., in part because the bracts do not completely cover the flower cluster during the winter, leading to cold injury of the exposed flowers.

'**Boyd's Hardy**'. Propagated from the sole survivor of a batch of seedlings grown in Tennessee that withstood 19 degrees below zero in 1964. Rare.

'**Colrigo Giant**'. Blooms up to 8 inches across with overlapping, cup-shaped bracts. Extra large, heavy-textured green leaves; wonderful fall color. Cultivar name formed by combining the initial letters of the Columbia River Gorge, OR, where it was found before 1963.

'**Eddiei**'. Leaves are green-streaked and spotted with gold. Discovered growing wild about 1918 by H. M. Eddie.

'**Goldspot**'. Striking leaves, heavily spotted with gold. Similar to 'Eddiei'.



Stellar Pink™ of the Stellar series. A hybrid cross of *Cornus florida* and *Cornus kousa*. Credit: Willard T. Witte

'**North Star**'. Strong, vigorous growth; dark purple, young shoots; and larger flowers than the species. Leaves have wavy margins. Rare.

'**Pilgrim**'. Southernmost specimen tested by the Saratoga Horticultural Foundation in California. Found wild along highway Rt. 17 near Santa Cruz County. Blooms up to 4 inches across.

'**Eddie's White Wonder**'. Hybrid of Pacific dogwood and flowering dogwood from controlled cross made by a West Coast nursery. Combines larger flowers of the former with excellent autumn color of the latter. Branches becoming pendent with age.

Interspecific Hybrid Dogwoods

Chief among these is the Stellar series introduced by Rutgers University in the early 1990s, which resulted from crosses between *kousa* dogwood and flowering dogwood. These cultivars grow fast when young, and take several years to develop a heavy floral display and spreading branching habit. They are distinctly upright growing when young. In flower form and blooming time they are intermediate between the parent species. Except for Ruth Ellen™ they appear to be generally free from the major dogwood diseases and insects. They are all sterile and set no fruit, and the energy saved appears to be spent in flower bud formation, as all are exceptionally floriferous. They have been patented and trademarked. We list the trademark name.

There are also hybrids between Pacific dogwood and flowering dogwood (see 'Eddie's White Wonder' above) and between *kousa* dogwood and *C. capitata*, Evergreen Himalayan dogwood (see 'Norman Hadden' and 'Porlock' below).

'**Aurora**™. Vigorous and upright when young. Bracts are white and have a heavily textured, velvety appearance that becomes

creamy white as they age. Extremely floriferous.

'**Constellation**™. Vigorous and erect when young. More like *C. kousa* than *C. florida* in branching habit, but with more branches near the ground. Mature height at 20 years estimated at 22 feet, with an 18-foot spread. White egg-shaped bracts with acute tip do not overlap. Bloom season starts about three days after most *C. florida* stop blooming and lasts about two weeks. Extremely floriferous. Wine red fall color, holding leaves late into the season.

'**Celestial**™ (formerly Galaxy™). Begins bloom 4-6 days after Ruth Ellen™. At first, bracts form a deep cup and have a greenish tinge, but they flatten out and become fully white in a few days. Bracts are rounded, well textured and slightly overlap.

'**Ruth Ellen**™. Mature plants wider than tall, estimated at 19 feet in height and 24 foot spread after 20 years. White bracts become showy as flowering dogwood season ends. Bracts do not overlap and are round to slightly egg-shaped with a tapering base and a bristle tip. Susceptible to powdery mildew.

'**Stardust**™. Appears to have dropped out of nursery production since introduction. Bracts do not overlap.

'**Stellar Pink**™. Vigorous and erect when young. Mature size and form similar to Constellation™. Flower heads are without a stalk. Rounded, overlapping soft pink bracts, with more intense coloration in cooler weather. Bracts are egg-shaped with a short acute tip and tapered base. Bloom season begins about six days after *C. florida* ends.

'**Norman Hadden**'. Probably a hybrid of *C. kousa* and *C. capitata*, Himalayan Evergreen dogwood, an Oriental warm temperate to subtropical species with blooms and fruits similar to *C. kousa*. A mature tree in southern England in 1989 was about 12 feet tall and 16 feet wide. Bracts open creamy white in June and age to a deep pink in July. Virtually unknown in the U.S.

'Porlock'. Same type of cross as 'Norman Hadden'. The plants appear very similar to *C. kousa* in foliage characteristics, but hardiness and blooming is unknown.

How to Grow the Flowering Dogwood

The flowering dogwood will grow in a variety of exposures and soils, but it does best in a well-drained soil that receives regular rainfall throughout the growing season. Dogwoods will grow in sun or shade, but in nature, dogwoods are seldom found growing in full sun. The natural environments for dogwood are in partly shady places and the edge of woodlands. Flowers are more abundant and typically trees are shorter and more compact in sun than in shade. Planting dogwoods in full sun without irrigation is a major contributor to stress that may cause plants to die after transplanting, or may be more likely to be invaded by dogwood borers.

Thus, site selection is very important. In choosing a site to plant flowering dogwood, it may be wise to observe dogwoods in their natural environment. Some natural dogwoods die of drought, disease and pest attack along the way, but much can be learned from observing natural sites. Consider the following:

- In natural environments, few dogwoods are found in full sun or out by themselves. They are found at the edge of woodlands or mixed with other kinds of trees, usually larger than the dogwood.
- All of nature's trees start from seed and grow in place, so there are no transplanting problems.
- In nature, there are few chances for injury to the tree's trunk and roots. This is not

the case when dogwoods are planted in managed landscapes. Soil is piled around some trees and taken away from others. In other cases, soil is compacted over the root system. The dogwood has a shallow, fibrous root system and can be seriously affected by fill soil. Digging or ditching may cut some roots.

Trunks are often "de-barked" by lawnmowers and string trimmers.

- Native dogwoods occur where they are in harmony with the environment. Borers attack few natural understory dogwoods, for instance.

Although nature has winning ways, we can change some of them and still grow dogwood successfully in full sun, in the lawn and in the woods. Too many of our transplanted dogwoods now die within the first few years. By learning more about dogwood, most of this loss can be prevented.

Soil

The kind of soil is not of great importance in growing flowering dogwood. The best soil would be slightly acid with a fair amount of organic matter and would not dry out quickly in summer, like a gravelly soil. The most important factor is for the soil to have good internal drainage so it is not saturated with water during wet weather. Dogwood absolutely will not tolerate saturated or poorly-drained soil, even for a few days.

When to Plant

The best time to plant dogwood is during the dormant season, late fall through spring, when the ground is not frozen or so wet as to hamper digging

or to affect soil structure. In warmer climates, January can be suitable, weather permitting. Dogwoods grown in field production and harvested with a soil ball, called balled and burlapped or B&B, are typically available from nurseries in late fall to early spring. It is best to purchase a B&B dogwood within a few months of harvest.

Container-grown dogwoods are offered year around and can be planted any time of the year, providing soil moisture is available.

Dogwoods are harvested in the dormant season as bare-root plants, but generally they are sold as liners to other growers. Seldom are dogwoods harvested as bare-root plants sold in the landscape market. If you should obtain bare-root plants, keep the roots moist and do not allow them to dry out. Plant the trees as soon as possible. Dogwoods are temperamental as bare-root plants and survivability will increase if planting is done quickly after being lifted from the nursery.

We do not recommend transplanting trees from natural areas because of the danger of spreading disease, namely *Discula anthracnose*. Purchase your dogwoods from a reputable garden center. Avoid trees with broken or dead branches, trunk damage or leaf spots. These are signs of unhealthy plants.

How to Plant

Dogwood naturally occurs as an understory tree in areas with high organic soil and plenty of natural mulch. They do not perform well in areas of poor drainage, or extremely dry sites. Even though dogwoods naturally occur in partial shady areas, they can perform well in full sun, provided adequate soil

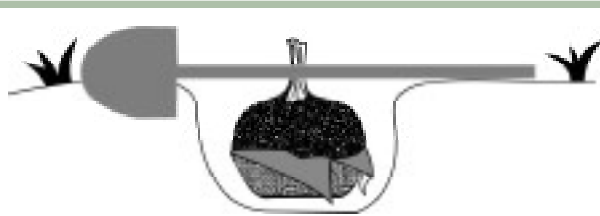


Figure 2a. Measuring the planting depth of a B&B root-ball.

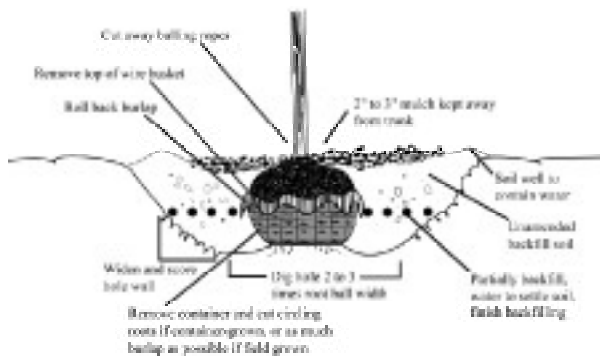


Figure 2b. Planting a B&B tree.
Credit: UT Extension PB 1621, Planting Ornamental Plants by Donna C. Fare, 1999

moisture is available. Dogwoods have a shallow root system that can be adversely affected in periods of drought. Good planting sites and proper planting procedures will ensure the dogwood gets off to a good healthy start in the landscape.

The first rule for planting any tree is to dig a hole large enough to accommodate all the roots. A good practice is to dig the hole two to three times wider than the ball of soil or spread of the roots. Dig the hole with sloped sides, rather than straight, to give the new feeder roots maximum room to grow. Don't dig any deeper than the root ball or container. Unless backfill soil is firmed

thoroughly, the plant will slowly settle and subsequently be too deep. Laying a shovel handle or straight edge across the hole helps to determine the proper depth (Figure 2). Always avoid setting the dogwood tree any deeper than it grew before transplanting. It is preferable to set the tree a couple of inches higher than the soil level, especially if the soil is a heavy clay.

Use the same soil that came out of the hole for backfill. The assumption that soil amendments like peat moss will be helpful to the plant's establishment and survival has not been proven in research. Adding soil amendments is

likely to create a "pot" where roots grow in the amended soil, but do not penetrate and grow well into the native soil. The only time we would recommend amending the backfill is in a gravelly soil where moisture retention is needed.

For balled and burlapped trees, the burlap may be left on, provided it is natural burlap. Plastic burlap should be removed. An easy way to determine what type of burlap you have is to try to burn a small piece. Plastic burlap will melt before burning. Be sure to completely remove any strings from around the stem or trunk and fold the burlap away from the trunk. The string may be sisal or polypropylene plastic and eventually will girdle the trunk if left on.

Large B&B trees are often dug with a mechanical spade and placed in wire baskets lined with burlap at the nursery. The wire basket helps support the root system while moving the tree. Always handle a large tree by the root ball, not the trunk. Large trees may require two or more people to carry them, or the use of a tree dolly. Do not remove the burlap and twine before the plant is set in the planting hole. The tree should be placed on solid ground rather than loose soil. Untie any rope, jute or polypropylene twine that is tied around the trunk. Pinning nails should also be removed from the upper part of the root ball. It is not necessary to remove the wire basket, but cut off the top ring and fold the burlap down or cut off the top third of burlap. Backfill the hole halfway with existing soil, tamp down lightly, water to firm the soil and eliminate air pockets. Finish backfilling and water again. Rake the soil

evenly over the entire area so the backfill is even with the existing soil line. The top of the ball or container surface should be visible. Remove excess soil. Cover the entire area with 2-3 inches of mulch. A thorough soaking with water finishes the planting operation and is a good soil-firming technique.

Water container plants prior to planting. Remove the plastic container. Check the outside of the root ball and cut any circling or girdling roots. If the root system is matted on the outside of the ball, use a sharp knife to make three or four shallow vertical cuts from top to bottom. This is a form of root pruning and will help stimulate new root growth. Do not be afraid to cut twisted roots.

A primary rule for planting a dogwood tree is never let the roots become dry. For trees with a ball of soil, this is usually not a problem. Still, balls or containers that are stored for a while must not be allowed to dry out. For bare-root seedlings, keep roots covered with a damp cloth, burlap or moist packing material such as moss, mulch or wood shavings. The fine roots should never be allowed to dry out. Healthy dogwood roots will have white growing tips.

Care After Transplanting

After transplanting, trees more than 8 feet high may need to be secured with stakes or guy wires during the first year to prevent them from being blown about or dislodged by high winds. This may not be necessary with large B&B plants due to the weight of the root ball. Large-container dogwoods are grown in a media that is much lighter

than soil; thus staking may be essential. However, do not stake the plants so tightly that they can not move at all. A certain amount of movement or flexing tends to strengthen the trunk as new growth occurs. Remove the stakes and guy wires at the end of the first growing season.

Lawnmowers and string trimmers injure many young dogwood trees, and those injuries attract dogwood borers. The best way to keep the lawnmower or string trimmer from injuring the trunk is to maintain a weed-free and grass-free mulched area extending out 18-36 inches from the trunk.

Flowering dogwoods are especially prone to borer attack during the first two years after planting. Tree stress and trunk injury invite borers. A spray schedule, as discussed in the Insects section of this publication, should be followed beginning early in the first growing season to control this pest. The spray schedule combined with keeping the trunk free from injury will minimize the risk of borer damage.

Fertilizing

Little or no fertilizer is recommended the first season. Research has shown that the tree will not respond much at all to fertilizer the first growing season after transplanting. When there is a desire to obtain faster growth, fertilizer can be applied beginning early in the second season. The tree may never need extra fertilizer if the soil is moderately fertile and growth and foliage color are acceptable. A well-fertilized lawn will benefit trees planted in the lawn.

The best fertilization practice for dogwood trees is to use a complete garden fertilizer

such as 10-10-10 or 13-13-13 and spread it over the ground under the canopy and branches. Use up to 8 ounces (1 cup) per inch of trunk diameter. Water in well to prevent damage to grass. For optimal growth, apply fertilizer just as buds start to swell in the spring, before leaves start to grow (February and March) and an application in May-June. If this technique is used, apply 1/2 cup (4 ounces) at each application.

Too much nitrogen along with too much water may encourage strong vegetative growth. This may not be at all bad, especially when the tree is young. However, excessive vegetative growth may be responsible for a poor set of flower buds. In such a case, using less nitrogen will probably yield more flowers. It may require one to three years for a fast-growing tree to "slow down" enough to set a good crop of flower buds.

Mulching

The forest floor is mulched naturally with leaves. The nutrients are recycled. In landscapes, newly planted and older trees will benefit from mulching. Mulch helps to hold soil moisture and can reduce or eliminate competition from weeds and grass. If weeds start to grow in the mulched area close to the trunk, hand-weed that area. Do not use a lawnmower or string trimmer close to the tree trunk.

Mulch can be organic material, such as composted leaves, grass clippings, pine needles, wood chips or shredded bark. Avoid using any organic material that is fresh or not composted. A layer 2-3 inches deep, extending out about 2-3 feet from the trunk, is recommended. Don't overdo it. Mulch

more than 4 inches deep or piled up against the trunk can be detrimental. Excessive mulch can impede water and air movement to the root system, and if mulch keeps the trunk bark continually moist, it could cause decay. Additional mulch should be added every couple of years to replace that which slowly decays.

Watering

For most soils and most years, natural rainfall is usually adequate to support good growth of dogwood. But during the first two growing seasons following planting, dogwoods often require extra water to eliminate stress and promote new growth. However, be sure to water trees, even mature trees, during severe drought periods at the first sign of leaves wilting. Dogwoods are shallow-rooted and cannot draw on moisture reserves deep in the soil. Drought-stressed dogwood trees are apt to wilt or drop leaves and lose part or their entire berry crop if they do not receive supplemental watering. The most severe drought stress usually occurs in late summer.

Avoid overwatering newly planted dogwoods. Seldom is it necessary or desirable to water young trees more often than once a week. One good soaking weekly (about 1 inch of water) or even every other week would be far better than a small amount of water daily. Water applied in small amounts seldom provides adequate moisture throughout the root system and encourages root growth near the soil surface. Roots need air to live just as much as they need water. Overwatering drives the air out of the soil and will likely result in root decay. The symptoms (wilting and leaf scorch) of a tree dying from root rot caused by too much water are

the same as those of a tree suffering from a lack of water.

Caution Transporting plants in leaf can cause severe injury. Avoid windburn or desiccation by covering the plants with a tarp or cover during transport. Do not let covered plants sit in full sun. Damaging temperatures build up quickly. Lift plants by the root ball, not the trunk, to prevent root breakage in the soil ball. The planting techniques described above should start your dogwoods off to a long and healthy life.

Pruning

Once a dogwood is planted and established, it needs little or no pruning. Remove dead, diseased or broken branches as soon as they become apparent. Remove any suckers that appear at the base of the trunk, especially on grafted trees. Otherwise, pruning is a matter of personal preference. Some people prefer some limbs to branch out low to the ground. Others may prefer to remove low limbs or trim back limbs near a walkway or against a house. Multiple trunks may be either eliminated or retained. In any case, make pruning cuts clean and nearly flush with the remaining branch. Leave only a "shoulder." Never leave a branch stub. Pay attention to borer prevention practices, because pruning wounds are attractive to borers and serve as entrance sites. Late winter to early spring is the best time for pruning. Pruning may be done any time it is needed, but most practitioners prefer the dormant season. Rapid spring growth will begin the healing process faster than at any other time. Even pruning during bloom is not damaging to the tree and can sometimes yield some nice branches for decoration indoors.

Will My Dogwood Bloom?

The question, "Will my dogwood bloom?" is asked many times upon purchasing a tree. Homeowners can be assured the answer to that question is nearly always "Yes." Probably all healthy dogwoods will bloom. Most unhealthy ones will, too. In fact, a tree fatally injured by borers or lawnmower damage will bloom heavier than normal, although perhaps with smaller flowers. Such an injured tree will often die during the summer following the extra heavy bloom.

Not all dogwoods begin blooming at the same age. Nursery-grown plants of some cultivars have flowers the second or third year, while native trees may be 4-6 years old or older before blooming. One can tell by September if a tree will bloom the next spring. The button-shaped flower buds are formed the summer before blooming. If they are not present on the tree by September, the tree will not flower in spring. If the large buds that tip the branches can be found, the tree should bloom. There is very little danger of cold weather killing the flower buds except on the extreme northern edge of the dogwood range.

Dogwoods do not always bloom the same amount each year. In fact, if a healthy dogwood tree blooms heavily one year, followed by a large berry crop, then the tree will likely bloom poorly the following year. The simple reason is a large amount of energy is required to produce a large number of flowers and fruit. Too little energy then will be available for the tree to produce a large number of blooms the following year. This is why a "good dogwood show" one year is often followed by a "poor show" the next. Very

likely the year following a “poor show” will be good again.

Certain individual dogwood trees have the habit of coming into partial bloom in the fall, at least in some years. One cultivar, 'September Dog', was even selected and named because it consistently showed this odd behavior. Such trees are usually from a southern selection and the flower buds may have a different dormancy pattern than others. Some flowers may develop when summer and fall stress periods are followed first by moderately cool nights and then an unseasonably warm period in the early fall. These flowers are almost always on abnormally long flower stalks with smaller than normal bracts that are often contorted and may be blushed with pink. If berries do form, they are lost to frost, so fall blooming is no advantage to the plant. Fall dogwood blossoms are an interesting abnormality that does not appear to hurt the tree.

Integrated Management of Insects and Diseases of Flowering Dogwood

Dogwoods can be killed or seriously damaged by insect and disease pests. Poor cultural practices can often cause a decline in the physical condition of the tree favorable for infestation by insects and diseases. Periods of hot, dry weather, trees growing in full-sun location and accidental injuries with garden tools frequently provide the opening through which these pests enter the plant tissues.

Specific pesticide information is not given in this publication. Pesticide registrations, labeling

and use are constantly changing. Consult with your local Extension agency for the currently recommended chemical controls.

Insects

The Dogwood Borer

The dogwood borer, *Synanthedon scitula* (Harris), is the most destructive insect pest of the dogwood. Damage is done under the bark on the trunk and at the base of older branches by a cream-colored larva with a reddish-brown head. The larva has two reddish-brown spots directly behind the head on the thorax. The full-grown larva is about 0.6 inch long. The adult dogwood borer is a blue-black moth with clear wings and some yellow markings. The adult moth does not damage the tree.

These moths emerge over a four-month period from spring through September, beginning in March in the extreme South, in late April in eastern Tennessee, in mid-May in Virginia and late in May in Connecticut. The

female moth lives only seven to nine days; during this time she lays the eggs that produce the destructive larvae. New moths continue to emerge, mate and lay eggs over an extended period of time from infested trees. A larva hatched during one year will not make an adult until the following year. The larva does its damage while tunneling and developing inside the tree from one year to the next. After this feeding period, the larva forms the pupa, and in eight to 12 days the adult emerges from the pupa case.

Damage – Eggs laid on the dogwood trunk by the moth hatch into very small larvae in eight to 10 days. Some of the young



Dogwood borer adult moth.
Credit: Frank A. Hale



Dogwood borer larvae damage.
Credit: Mark T. Wilson

larvae find an opening in the bark in which they can enter. Once inside, they are well protected and begin feeding, but probably will not kill the dogwood unless the tree is very small. Usually it takes several larvae in one tree to completely kill the tree. The tree will die whenever one or more larvae eat completely around the trunk and block the flow of food from the treetop to the roots. Often the tree will die back to the point of injury, and new shoots will arise below this point. These new shoots can often be kept to regrow a new tree providing additional borer injury does not take place.

Fortunately, the dogwood borer will not attack all dogwood trees. The adult moth is a "light-loving" insect. Native trees in their natural understory habitat are seldom attacked. Trees that are never damaged by sunscald, lawn mowers, construction equipment or strong winds are much less likely to be attacked by borers than trees that are first stressed and injured in some way.

Control – Damage from the dogwood borer can be prevented by protecting the tree

Precautionary Statement

To protect people and the environment, pesticides should be used safely. This is everyone's responsibility, especially the user. Read and follow label directions carefully before you buy, mix, apply, store or dispose of a pesticide. According to laws regulating pesticides, they must be used only as directed by the label. Persons who do not obey the law will be subject to penalties.

trunk from the larva and by removing the larva after it is in the trunk. Obviously the first method is best. Prevention may take place in one or more of the following ways:

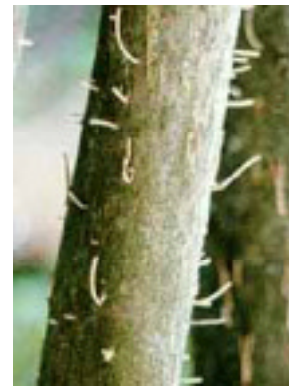
- Make pruning cuts in late winter to facilitate rapid healing during rapid spring diameter growth.
- Avoid physical injury to the tree by unnecessary cutting or bruising. Mulch around trees or remove grass by hand rather than mowing close to a tree.
- Insecticides can be used on the lower branches and trunk to kill newly hatched larvae before they can enter the tree. Once inside the bark, the larvae may not be killed by insecticides. For maximum protection, an insecticide residue should be on the trunk during the entire egg-laying period. Spray the trunk, the lower limb scaffold and the soil around the bark of the trunk. These preventative insecticide sprays will also aid in the control of flatheaded borers.

Asian Ambrosia Beetle

The Asian ambrosia beetle, *Xylosandrus crassiusculus* (Motchulsky), is able to attack apparently healthy trees, shrubs and vines of a wide host range. The reddish-brown female beetles are 2.1 - 2.9 mm long, while the males are only 1.5 mm long. The larvae are white, legless, "C-shaped" and not easily distinguishable from the larvae of other ambrosia beetles, bark beetles and most weevils. The larvae feed on the ambrosial fungi that the adults introduce into the galleries. The wilting and death that occur in many of the attacked plants is not thought to



Asian ambrosia beetle in ambrosial fungi filled brood gallery.
Credit: Frank A. Hale



Asian ambrosia beetle frass from the trunk of a crape myrtle.
Credit: William G. Hudson

be caused by gallery formation or the ambrosial fungi. The Asian ambrosia beetle is thought to be a vector of wilt fungi.

Signs of attack include toothpick-diameter tubes of sawdust-like frass (excrement) sticking out from the many small holes in the trunk or infested limbs, wilting and oozing sap. The flight of the adult female beetles, determined by trap catches, occurs in late winter to early spring during warm spells while the trees are still dormant. If trees are being attacked, recommended insecticide sprays should be initiated at 10-14 day intervals and discontinued only after the plants have leafed out.

Dogwood Club Gall

The dogwood club gall is recognized as a distinct swelling near the tip of branches. It may be found on transplanted trees and those growing in the natural state. The gall is caused by a small (2 mm long), reddish-brown fly, *Resseliella clavula* (Beutenmueller).

In the spring the female fly lays eggs in the small terminal leaves. The resulting tiny larvae bore into the twig at the base of a leaf. One month after eggs are laid, swelling is noticeable. The larva completes its growth inside the gall by September, exits and drops to the ground to overwinter. The adult flies will emerge the next spring to repeat the cycle.

Damage – A light infestation of club galls will hardly be noticed and will not stunt tree growth. Most buds that develop beyond the gall will die. Trees with many galls will not be attractive and the number of flowers the following spring will be reduced.

Control – The club gall can be controlled by pruning and insecticides. By pruning out twigs containing galls before August 1 and burning them, future infestations can be reduced.

Dogwood Twig Borer

The dogwood twig borer, *Oberea tripunctata* (Swederus), causes wilted leaves or the drooping of girdled branches. Damage is done by a dark green, long-horned beetle that measures about one-half inch long and has three black spots on the light tan prothorax (directly behind the head). The beetle is usually found only in small numbers.

Adult beetles begin to appear in April and May in

North Georgia, from May through July in Pennsylvania and from late May to early August in Michigan. They feed on the midvein on the underside of the leaf that can cause the leaf to curl downward. This leaf feeding causes little damage. The more serious damage is associated with egg laying and the resulting larva. The female adult beetle uses its mouthparts to make small punctures around the branch to girdle it. Two girdles are made $\frac{1}{2}$ to 1 inch apart about 3-6 inches from the tip of a small branch. The beetle then lays an egg between the two separate girdles. The egg hatches in seven to 10 days and the young larva tunnels into the bark. The developing larva tunnels down the center of the limb, expelling frass through a row of small holes in the bark. A portion of the branch may be cut off from within. The larva passes the winter in the center of the stem. The borer pupates between two plugs of sawdust. The development from egg to adult usually takes two years.

Damage – The wilting of leaves and the drooping girdled twigs are the main evidence of damage. Since the beetle occurs in small numbers, trees are not likely to be killed, but appearance may be impaired.

Control – Prune infested limbs in the spring before the adult beetles emerge from infested twigs. Make pruning cuts below the tunneled part of the branch and burn prunings. This pruning cut will often be 6 inches or so below the girdled area.

Dogwood Sawfly

The dogwood sawfly, *Macremphytus tarsatus* (Say), is a defoliating pest primarily of gray



Dogwood club gall at tip of twig. Credit: Frank A. Hale



Wood fibers pushed out of hole in the twig by dogwood twig borer. Credit: Frank A. Hale



Dogwood twig borer larva in hollowed out dogwood twig. Note plug of coarse woody fibers at end of twig. Credit: Frank A. Hale

dogwood in the Great Lakes states and the Northeast. Sawflies are classified in the same insect Order, Hymenoptera, as ants, bees, wasps, yellowjackets, hornets and hornetsails. While they do not sting, the adult female sawflies use their serrated ovipositor to insert eggs into the leaf tissue. The adults emerge from late May through July (one generation per year) and soon deposit more than 100 eggs in the underside of a single leaf.

The larvae of foliar feeding sawflies have more than five pair of fleshy prolegs on the abdomen, while butterfly, moth and skipper caterpillars (Lepidoptera) have a maximum of five pair.

Damage – After hatching, the yellowish orange larvae skeletonize the leaf. They soon molt to the second instar stage and become covered with a white, powdery material that can be rubbed off. They then devour all of the leaf except for the midvein. The last instar larvae are 1 inch long with four rows of black spots in addition to the white material. The larvae leave the plant in search of a place to overwinter, where they bore into rotting wood and can even damage wooden clapboard, wood-fiber wallboard or garden furniture.

Control – Spray the foliage with recommended labeled insecticide when dogwood sawflies are first detected.

Rose Leafhopper

Dogwood leaves become white and stippled due to the feeding activity of the rose leafhopper, *Edwardsiana rosae* (Linnaeus). Leafhoppers overwinter as eggs in the stems of roses, blackberry or raspberry. Eggs usually hatch in the spring after the threat of frost has passed. The young, greenish-white, red-eyed nymphs feed on the underside of the leaves until they mature.

The first brood of adults migrates to dogwood, maple, elm, apple and other woody plants. They insert eggs into the plant tissue on the underside of the leaves. The eggs soon hatch and the summer generation continues to develop. Several generations will develop during the season.

Control – Spray the foliage with recommended labeled insecticides when leafhoppers appear. Repeat applications at 7-10 day intervals as needed.

Cottony Maple Scale

The cottony maple scale, *Pulvinaria innumerabilis* (Rathvon), is a very large and conspicuous scale insect found on a wide variety of ornamental plants. Adult females are generally reddish-brown and have a median ridge. Adult females overwinter and enlarge rapidly in the early spring. The white ovisacs containing up to 1,000 eggs are developed under the raised abdomen in mid to late spring. The crawlers move to the leaves in late spring, where they develop into adults in late summer. This scale produces large quantities of honeydew, which frequently supports the growth of sooty mold.

Control – Lady beetles and other predators and parasitoids will often control this pest without the need for insecticide if given time. Dormant oil can be applied in late winter while the trees are still dormant. Target the crawlers (first active immature stage) with a recommended labeled insecticide in the spring. A couple of applications at weekly intervals may be needed.

Walnut Scale

The walnut scale, *Quadraspidiotus juglansregiae* (Comstock), can also cause extensive damage to dogwood by inhibiting the terminal growth of limbs and by encrusting the limbs and trunk leading to death of the tree. Initial infestations occur on the underside of the limbs, but will completely encrust the limbs within two to three years. The walnut scale



Walnut scale on a dogwood limb. Credit: Frank A. Hale

has two generations per year. The adult female walnut scale lays eggs in June and again in August in Ohio, in mid-May and again in mid-August in California. The crawlers emerge from the eggs several weeks after they are laid.

Control – Adults are difficult to control because of the wax-like protective covering over their bodies. Crawlers are the easiest stage of the walnut scale to control. Consult with your local county Extension agent for when to expect crawlers and apply the recommended chemical controls.

Two-spotted Spider Mites

Two-spotted spider mites, *Tetranychus urticae* Koch, are warm-season mites that can quickly build to tremendous numbers in hot, dry weather. They can develop from egg to adult in only eight days at 77-95 degrees F. They attack more than 180 host plants, including 100 cultivated species. Two-spotted spider mite populations often increase on common plants such as violet, chickweed, pokeweed, wild mustard and blackberry. They can then disperse to other plants, including dogwood.

Damage – Two-spotted spider mites damage leaves by piercing the outer leaf surface with their sharp, slender mouthparts. When they extract the sap, a tiny bit of leaf tissue collapses in the area of the puncture. Soon, a minute chlorotic (yellow) spot forms at each feeding site. After a heavy attack, an entire plant may become yellowed, bronzed, partially defoliated or completely killed. Two-spotted spider mites are generally found on the underside of the leaves where they feed, lay eggs and

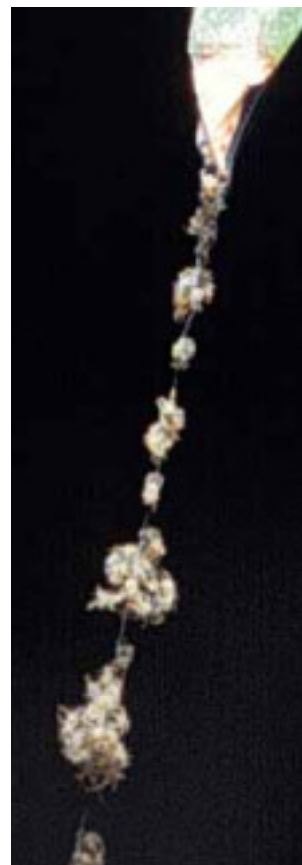
spin webbing. High populations of two-spotted spider mites, especially during extended dry periods, can entirely cover leaves with webbing.

Monitoring – Inspect dogwoods periodically during the spring and summer. Use a magnifying glass to look for the mites, cast skins, eggs and their webbing on the underside of leaves. Hold a white card under the plant foliage and shake or tap the foliage to dislodge mites onto the card. The mites can be observed as they crawl across the card. Observe the top of leaves for the tiny, chlorotic feeding spots on either side of the mid-vein of the leaf.

Control – It is best to begin chemical treatments at the first signs of mites or mite damage. At least two sprays, five days apart, will be needed. Summer horticultural oil sprays should not be made more than once per week. Some miticides have a long residual so that one application is sometimes sufficient for control of small populations. To slow the buildup of resistance to some of the newer miticides, the label may limit its use to once per year, or not allow it to be used in successive applications. Some miticides only control immature mite stages, so a different miticide to control adult mites may be required.

Diseases

In the landscape, dogwoods are planted into all types of situations. While the inner foliage of the trees may be shaded, trees may be planted in direct sunlight or into full or partial shade. Trees may be located in open (airy) areas or in landscapes that contain dense foliage. Dogwoods



Two-spotted spider mite webbed in a mass on the tip of a peach leaf.
Credit: Frank A. Hale

may be planted in well-drained soils that are high in organic matter. Weed control practices can cause either mechanical injuries from cultivation or chemical (herbicide) injury. All of these factors may contribute to the stress of the tree and affect the tree's ability to resist plant pests and pathogens.

To aid in identification of dogwood health problems, a simple key of common symptoms



a.

Symptoms of spot anthracnose include reddish-brown, elliptical spots on (a) bracts and (b) leaves. Infected bracts may be smaller, distorted or destroyed. Credit: Mark T. Windham (both photos)



b.

and signs of dogwood diseases is included (see sidebar). Common diseases and an overall pest management strategy are described below.

Spot Anthracnose

Spot anthracnose is caused by the fungus *Elsinoe corni*. The disease is most pronounced on the bracts of the tree, which makes the disease more important in a landscape situation. Usually the lower branches are first affected by the disease, which may move rapidly through the tree canopy. Bracts may have circular to elliptical spots with reddish borders. On green leaves, reddish spots are small, circular lesions with dead centers. Spot anthracnose is usually worse when the weather remains cool and wet. Late frost damage may predispose bracts to attack by the pathogen.

Control – Several cultivars are susceptible to spot anthracnose and include the cultivars 'Cloud 9' or 'Barton'. These cultivars bloom relatively early in the spring. In a cultivar trial, these cultivars experienced

freeze damage from sudden cold spells. Later-blooming cultivars, such as 'Plena', were rated as very resistant to this disease in the same trials.

Labeled fungicide sprays can be used to control this disease in specimen plants. Sprays should be applied prior to bud break, after bract fall, a month later and in September after the new flower buds have formed.

Dogwood Anthracnose

Dogwood anthracnose is a disease that can cause mild symptoms like spot anthracnose or symptoms so severe that the tree dies. It is caused by the fungal pathogen, *Discula destructiva*. Symptoms of this disease include lesions with purple or reddish borders, leaf and twig blights, a profusion of epicormic branching and/or limb and trunk cankers. The disease usually begins as a lower branch dieback and infected trees may have little ornamental value.

The infection is aided by cool, wet weather. Dogwood anthracnose epidemics are worse in trees growing in



a.



b.



c.

Dogwood anthracnose causes (a) leaf spots, (b) twig cankers and (c) trunk cankers. Credit: Mark T. Windham (all 3 photos)

shaded environments. Trees at high elevations, planted in high-humidity areas (such as near streams) and on north-facing slopes may be more likely to suffer severely from this disease. Research at The University of Tennessee has demonstrated that trees suffering from water stress are also more likely to suffer severely from this disease.

Control – In landscapes, cultural practices such as placement of trees in sunny, open environments to encourage good air movement; high foliage temperatures (resulting from radiant heating); and lower relative humidities are sufficient to reduce damage from this disease to acceptable levels. Trees should be purchased at reputable nurseries and not dug from wooded areas, where an infected plant could be selected.

The Tennessee Agricultural Experiment Station has released a new cultivar, 'Appalachian Spring', which is resistant to dogwood anthracnose. This cultivar should be in the retail market in 2005. Many strains of *C. kousa* are resistant to this disease. However, not all strains of *C. kousa* are resistant and caution should be taken when making blanket claims of resistance. Trees in the Constellation series of *C. florida* x *C. kousa* hybrids developed by Dr. Orton at Rutgers University may be susceptible under some environmental conditions. Levels of resistance to dogwood anthracnose vary among other *Cornus* species. Resistance is found in native species such as *C. alternifolia* and *C. sericea* and exotic species such as *C. controversa* and *C. mas*.

Dogwood Canker

The cause of dogwood canker is still unknown after many years of research involving several different organizations. The disease is characterized by cankers on the main trunk that have rough, cracked bark. Cankers are often sunken in the inner node regions and swollen at nodes.

Control – Unfortunately, there are no chemical controls. Select plants with smooth, slick bark and no signs of canker. Avoid the cultivar 'Purple Glory' because it was highly susceptible to this disease in a cultivar trial. Trees with dogwood canker are often infested with dogwood borers.

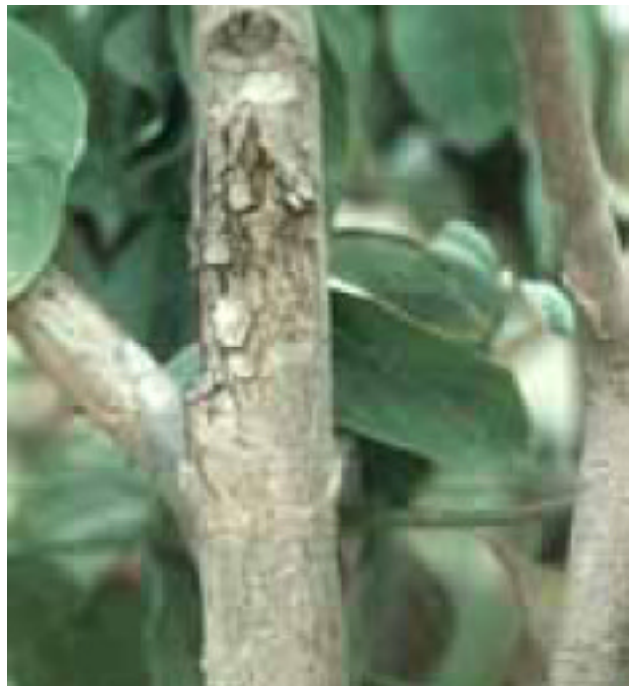
Phytophthora Root Rot

This disease is attributed to *P. cactorum* and *P. cinnamomi*. Trees may be stunted or wilt and die suddenly. Roots and possibly the lower stem may be black and necrotic. The disease is usually severe in low areas where drainage is poor.

Control – Avoid planting trees in areas with poor drainage.

Powdery Mildew

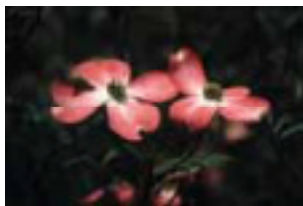
The fungal disease *Microsphaera corni* causes powdery mildew. The disease is characterized by white aerial hyphae on the leaf surface. Trees with severe infections may be stunted and the foliage distorted. Trees with severe powdery mildew infections in 1994



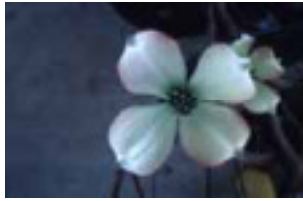
Dogwood cankers are characterized by rough and sunken cankers and swollen nodes.
Credit: Mark T. Windham



Powdery mildew infected leaves have white powdery fungal growth on their surfaces. Credit: Mark T. Windham



a.



b.



c.



d.

Dogwood cultivars (a) 'Cherokee Brave', (b) 'Karen's Appalachian Blush', (c) 'Kay's Appalachian Mist' and (d) 'Jean's Appalachian Snow' are resistant to powdery mildew. Credit: Mark T. Windham (all 3 photos)

were slow to leaf out in 1995. Since powdery mildew infection interferes with normal photosynthesis and cell metabolism, severely infected trees may have had a reduction in winter hardiness because of decreased levels of stored carbohydrates when they went dormant. The disease is favored by periods of warm, dry weather with cool nights (periods of high relative humidity).

Control – Spraying with fungicides labeled for powdery mildew should be effective in controlling this disease if applied early in the epidemic. Trees protected with fungicides have significantly increased height and trunk caliper as compared to untreated trees. Once the plants have “turned white,” fungicidal sprays have little value.

In tests conducted at Auburn University and at The University of Tennessee, the red-flowering cultivar 'Cherokee Brave' displayed good resistance to this disease. The Tennessee Agricultural Experiment Station has recently released three new white-bracted cultivars, 'Karen's Appalachian Blush', 'Kay's Appalachian Mist' and 'Jean's Appalachian Snow' that are resistant to powdery mildew. Variegated cultivars, such as 'Cherokee Sunset', 'Cherokee Daybreak', 'First Lady' and 'Rainbow' are unusually susceptible to this disease.

Other Dogwood Diseases:

Several other diseases may occasionally damage dogwood. Symptoms of *Septoria* leaf spot caused by *S. cornicola* and *S. florida*, are small, angular leaf lesions. The disease occurs during wet summer months. Lesions of *Botrytis* blight, caused

by *B. cinerea*, are necrotic. Infected bracts may fall and stick to dogwood leaves and cause lesions similar to dogwood anthracnose. The disease is observed during wet, cool weather. Control measures are not necessary for either disease.

Clitocybe root rot, caused by *C. tabescens*, usually attacks older trees that have been weakened by stress. Leaves may be scorched and twigs may die. Yellow-brown mushrooms may be present at the base of the tree. After the tree dies, black strands of fungal material may be found under the bark or in soil near roots. To prevent this disease, maintain healthy, vigorous plants. Water plants during droughts. Do not plant trees in soil with history of this disease.

Virus infections are not very common in dogwoods. Symptoms include mild mottles and mosaics. Virus-infected trees may be stunted and more susceptible to other diseases. Most dogwood viruses are in the Nepo virus group and include cherry leaf roll virus, cherry ringspot virus and tobacco ringspot virus. No control is necessary.

Leaf Scorch is not a disease, but a physiological problem that appears as browning of leaf tissue between veins and along the margins and tips of leaves. These areas are the first to brown, as they are the last areas to receive water from the roots. Scorch is common when there is hot, dry, windy weather during periods of intense sunlight. During these conditions, the dogwood's foliage transpires water faster than the tree's roots can replace it. Leaf scorch is common on newly transplanted trees and on



Leaf scorch is common during periods of drought. Credit: Mark T. Windham

established trees severely stressed by drought, mechanical injury, borer injury and after soil compaction during construction. Watering trees during periods of drought can usually prevent leaf scorch. Mulching around the base of trees with organic mulch such as pine or hardwood bark can slow soil water loss.

Summary

The beauty and utility of the flowering dogwood, *Cornus florida*, explains why it is one of America's most popular native ornamental trees. It enhances the beauty of both woods and homes every spring in its native range. *Cornus florida* is the only tree recognized by many as "dogwood," despite the fact that there are beautiful dogwoods of other

species and hybrids that lengthen the "dogwood season of bloom."

Growing and maintaining dogwoods requires consideration of the following:

- a) Select a healthy tree for planting.
- b) Purchase dogwoods from a reputable nursery; do not dig trees in the wild.
- c) Select a good planting site.
- d) Prepare the planting hole.
- e) Protect roots from drying.
- f) Water well at planting and during drought.
- g) Mulch with 2-3 inches of organic material.
- h) Stake or brace larger trees.
- i) Avoid mechanical and chemical injury to trees.
- j) Use insecticides and fungicides as appropriate.

Typically after establishment, dogwood trees experience few problems if maintained according to these guidelines. Take proper action against insects and disease when they occur. Given reasonable care, the flowering dogwood and its relatives can be grown successfully in much of the country and will add beauty to the landscape for many years.

General Disease Management for Dogwoods Growing in Landscapes

1. Select healthy plants. Inspect tree trunks for symptoms of dogwood canker and mechanical injuries and signs of borer infestations.
2. Place dogwoods in full sun if dogwood anthracnose is present. In areas where this disease is not present, place trees in as much shade as possible to avoid dogwood borers.
3. Water thoroughly during drought periods. Avoid wetting the foliage with irrigation systems, especially during evening hours.
4. Maintain dogwoods in a vigorous condition. Avoid mower or weed trimmer injuries by mulching trees.
5. Prune trees to promote good air movement.
6. Spray the dogwood trunks with an insecticide in early April and early July if trees are growing in an area where borer infestations are likely.
7. Select cultivars not known to have unusual problems with diseases and insects. Also select those which are well adapted to cultivation in the landscape.
8. Inspect trees often and send symptoms and/or signs of problems to your county Extension agent for early diagnosis.

Key to Diseases of the Flowering Dogwood

1	a) Disease affects the roots.....	2
	b) Disease affects the trunk or large limbs.....	3
	c) Disease affects bracts, leaves, or twigs.....	4
2	a) Wilted trees with rotted roots.....	See <i>Phytophthora</i> root rot
	b) Thick strands of fungal growth underneath bark or in adjacent soil.....	<i>Clitocybe</i> root rot (see other diseases)
3.	a) Bark cracked and fissured; affected area swollen at nodes, sunken at internodes.....	See Dogwood canker
	b) Profusion of water sprouts; elliptical cankers under bark at base of shoots.....	See Dogwood anthracnose
	c) Clusters of yellow-brown mushrooms at base of older trees.....	<i>Clitocybe</i> root rot (see other diseases)
4.	a) Problem occurs on bracts.....	5
	b) Problem occurs on leaves.....	6
	c) Problem occurs on twigs.....	7
5.	a) Small reddish circular/elliptical lesions on bracts; bracts may be distorted and dingy yellow.....	See Spot anthracnose
	b) Lesions enlarge over time and may have reddish borders.....	See Dogwood anthracnose
	c) Lesions similar to those caused by dogwood anthracnose; during cool, wet weather, gray "fuzzy" fungal growth present.....	<i>Botrytis</i> blight (see other diseases)
	d) Necrotic area limited to edges of bracts, bracts may be distorted.....	Frost damage (not a disease)
6.	a) Twigs blighted, dead leaves hanging from twigs...	See Dogwood anthracnose
	b) White powdery fungal growth on twigs.....	See Powdery mildew
7.	a) Small circular lesions with red borders, lesions do not enlarge but may coalesce.....	See Spot anthracnose
	b) Lesions may enlarge to size of dimes, may be oval, elongated or "run up veins;" lesions with red/purple borders; necrotic lesions on shaded foliage may light entire leaf.....	See Dogwood anthracnose
	c) Lesions small and angular.....	<i>Septoria</i> leaf spot (see other diseases)
	d) Lesions necrotic, occur where leaves touch or where fallen bracts adhere to leaves.....	<i>Botrytis</i> blight (see other diseases)
	e) White, powdery growth on leaf surface, leaves may be distorted.....	See Powdery mildew
	f) Mild mosaic or mottling in leaves.....	Virus diseases (see other diseases)
	g) Distorted, twisted, and/or crinkled leaves, severe mosaics.....	Herbicide damage (not a disease)
	h) Leaf scorch around leaf margins and at leaf tip.....	Physiological – water deficiency (not a disease)

Selected References

- Atkinson, Thomas H., John L. Foltz, and Robert C. Wilkinson. 1988. *Xylosandrus crassiusculus* (Motschuylsky), an Asian ambrosia beetle recently introduced into Florida (Coleoptera:Scolytidae). Florida Department of Agriculture and Consumer Service Entomology Circular 310.
- Daughtrey, M.L., C.R. Hibben, K.O. Britton, M.T. Windham and S.C. Redlin. 1996. Dogwood anthracnose: understanding a disease new to North America. *Plant Dis.* 80:349-358.
- Davis, Michael and Roland R. Dute. 1995. Asian ambrosia beetles threaten southern orchards and tree nurseries. *Alabama Agricultural Experiment Station Highlights of Agricultural Research* 42:17-18.
- Davis, M.A. and R.R. Dute. 1997. Fungal associates of the Asian ambrosia beetle, *Xylosandrus crassiusculus*. *Proc. South. Nurs. Assn. Res. Conf.* 42:106-112.
- Engelhardt, George P. 1946. The North American clearwing moths of the family Aegeriidae, U.S. National Museum Bull. 190:1-222.
- Fare, Donna C. 1999. Pruning landscape trees, shrubs and groundcovers. The University of Tennessee Agricultural Extension Service, Knoxville. PB 1619. 19 p.
- Fare, Donna C. 1999. Planting wood ornamentals. The University of Tennessee Agricultural Extension Service, Knoxville. PB 1621. 7 p.
- Fattig, P.W. 1947. The Cerambycidae or long-horned beetles of Georgia. Bull. 5. Atlanta, GA: Emory University Museum. 48 p.
- Gosling, D.C.L. and N.M. Gosling. 1977. An annotated list of the Cerambycidae of Michigan (Coleoptera): 2. The subfamilies Lepturinae and Lamiinae. *Great Lakes Entomologist.* 10 (1):1-37.
- Hagan, A.K., B. Harding, C.H. Gilliam, J. Keever, J.D. Williams, and J. Eakes. 1998. Susceptibility of cultivars of several taxa to powdery mildew. *J. Environ. Hort.* 16:147-151.
- Hale, F.A. and H. Williams 1998. Two-spotted spider mites. The University of Tennessee Agricultural Extension Service, Knoxville. SP 290-D. 3 p.
- Hudson, W. And R. Mizell. 1999. Management of Asian ambrosia beetles, *Xylosandrus crassiusculus*, in nurseries. *Proc. South. Nurs. Assn. Res. Conf.* 43:198-210.
- Johnson, W.T. and H.H. Lyon: contributing authors C.S. Koehler and J.A. Weidhaas. 1991. *Insects that feed on trees and shrubs.* 2nd ed., rev. Cornell University Press, Ithaca, New York. 560 p.
- Jones, R. K. and R. C. Lambe. 1982. Diseases of woody ornamental plants and their control in nurseries. North Carolina Agricultural Extension Service, Raleigh. AG-286. 139 pp.
- Kirk, H.B. and J.N. Knull. 1926. Annotated list of the Cerambycidae of Pennsylvania (Coleoptera). *Canadian Entomologist.* 58(1):21-26.
- Lindquist, R. K. 1991. Identification of Insect and Related Pests of Horticultural Plants; A Pictorial Guide. T. R. Roll and H. K. Tayama (eds.). Ohio Florists' Association Services, Inc. Columbus, Ohio.
- Pless, Charles D. and W.W. Stanley. 1967. Life history and habits of the dogwood borer, *Thamnosphesia scitula* (Lepidoptera: Aegeriidae) in Tennessee. *Journal of the Tennessee Academy of Science.* 42(4):117-123.
- Ranney, T.G., L.F. Grand, and J.L. Knighten. 1994. Resistance of *Cornus kousa* taxa to dogwood anthracnose and powdery mildew. *Proceedings of Southern Research Conference.* 39:212-216.
- Schread, John C. 1965. Dogwood borer. *Circ.* 199. New Haven, CT: Connecticut Agricultural Experiment Station. 3 p.
- Sinclair, W.A., H.H. Lyon, and W.T. Johnson. 1987. *Diseases of Trees and Shrubs.* Cornell University Press. Ithaca NY. 575 pp.
- Solomon, J.D. 1995. Guide to insect borers of North American broadleaf trees and shrubs. *Agric. Handbk.* 706. Washington, D.C: U.S. Department of Agriculture, Forest Service. 735 p.
- Underhill, G.W. 1935. The pecan borer in dogwood. *Journal of Economic Entomology.* 28(2):393-396.
- Windham, M.T. and R. Freeland. 1990. Disease and frost resistance and certain horticultural characteristics of ten dogwood cultivars. *Tennessee Farm and Home Science* 155:25-31.
- Windham, M.T. and A.S. Windham. 1998. Chemical control of powdery mildew in flowering dogwood. *Proc. of South. Nurs. Assoc. Res. Conf.* 43:251-252.
- Windham, M.T. and A.S. Windham. 1999. Enhancement of growth of flowering dogwood by using fungicides to control powdery mildew. *Proc. of South. Nurs. Assoc. Res. Conf.* 44:224-225.
- Windham, M.T. and W.T. Witte. 1998. Naturally occurring resistance to powdery mildew in seedlings of *Cornus florida*. *J. Environ. Hort.* 16:173-175.
- Windham, M.T., E.T. Graham, W.T. Witte, J. L. Knighten and R. N. Trigiano. 1998. *Cornus florida* 'Appalachian Spring': a white flowering dogwood resistant to dogwood anthracnose. *HortScience* 33:1265-1267.
- Windham, M.T., W.T. Witte, R.N. Trigiano, S. Schlarbaum, and A.S. Windham. 1997. Reactions of *Cornus* species to powdery mildew. *Proc. of South. Nurs. Assoc. Res. Conf.* 42:227-233.



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PB1670-30M-12/00 R12-4910-19-001-01

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