

Landscape Manager's Guide to Diseases of Cool and Warm-Season Trees and Ornamentals.

COOL SEASON

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Problems with ornamental plants in the landscape result from varied and overlapping causes. Some causes are more obvious than others; such as a poor planting or pruning, severe weather, or a harsh environment. Often, the cause is more complex and hidden, as is the case with fungi or bacteria attacking a plant.

Each plant has a certain amount of built-in resistance to assaults on its health. When man takes a plant out of its natural habitat and makes it fit his design, he needs also to take responsibility for the resulting problems he has caused the plant.

Diseases are some of the toughest problems to understand and correct. The purpose of this Guide is to explain the primary disease-related problems of landscape plants.

Types of plant pathogens and control tactics

This list of pathogens is by no means complete. Its intent is to help you become familiar with the types of plants pathogens you may encounter and to provide some generalized ideas concerning control. It is important to remember that generalities concerning biological phenomena are filled with exceptions.

Bacteria: Bacteria comprise a diverse group of single-celled microbes, which cause many diseases of ornamental plants. Commonly encountered diseases include bacterial leaf spot of English ivy; fireblight on crabapples, Mountain ash, hawthorn, Cotoneaster and Pyracantha; and crown gall on crabapples and Eucalyptus.

Control of bacterial diseases is usually a preventative (prior to infection).

Always begin with clean plant material from a reliable source. Resistant cultivars can be grown in many cases.

For fireblight, promptly prune out diseased plant parts. Be sure to sterilize your pruner with alcohol (70%) between cuts. Avoid mechanical damage to plants to reduce crown gall infection.

Nematodes: Several types of very tiny roundworms cause plant diseases on many ornamentals. Lesion nematodes (*Pratylenchus*) and pin nematodes (*Paratylenchus*) cause plant stunting and poor growth because they weaken the root system by feeding on it. The root knot nematode (*Meloidogyne*) causes nodules to form on roots, impairing root function and stunting the plant.

Good sanitation is the primary means of controlling these soil-borne pathogens. Soil fumigation will kill adults as well as eggs. After plants are growing, nematicides granules or drenches can be applied.

Generally, fumigation and/or nematicide treatments in landscapes should be done only after a nematode soil analysis indicates treatments are necessary.

Viruses and Mycoplasmas: These are systemic plant disease causing agents that live and multiply only within living cells of the host. They are most often spread by plant contact or by sucking insects, especially aphids and leafhoppers.

The symptoms they cause are very diverse, depending upon pathogen. Generally, vein banding, mosaic (a mixture of irregular-shaped dark and light green areas on the leaf), flecking, or spotting will show up on leaves. Sometimes, growth abnormalities



Anthracnose, left, is a fungus disease common to dogwoods. It attacks flowers first, then leaves and young twigs. Early fungicide application is important.

Apple scab, on crabapples, shown below, is a major disease requiring early application of fungicides and planting of resistant crabapple varieties.



will appear. This is often similar to damage caused by herbicides. Finally, they can cause stunting of plants.

You should try to prevent spread of viruses by controlling insects and avoiding unnecessary handling of plants.

Powdery Mildew Fungi: The powdery mildew causing fungi are very host specific. Generally, the powdery mildew that infects one plant will not infect any other.

Powdery mildew is commonly seen on roses, lilacs, English oak, deciduous azaleas and zinnias. The white growth appearing on leaves and stems is the fungus growing on the surface of the tissue. Small structures, called haustoria, grow within the host cells, injuring them as they obtain food.

Powdery mildew will not usually kill a plant but may weaken it and reduce winter hardiness. The unsightly fungus lesions greatly reduce

the quality of the plant.

Powdery mildew can be effectively treated with chemicals. The white lesions will remain, however, even though the fungus may be dead. For highly susceptible plants such as roses, a regular preventive spray program should be planned and carried out.

Rust Fungi: The rust fungi are also quite host specific. Rusts usually sporulate abundantly on leaf tissue. It is the masses of orange to dark red col-

SEASE CONTROL GUIDE

Some Common Diseases of Woody Ornamentals and Fungicides Registered for Their Control

Host	Disease	Fungicides
Crabapple	Scab	Benlate, Daconil 2787, Mancozeb, Phaltan, Zyban
Dogwood	Leaf spot	Benlate, Daconil 2787, Fixed coppers, Maneb, Zineb, Zyban
Hawthorne	Leaf spot	Benlate, Daconil 2787, Fixed coppers, Zyban
Hawthorne	Rust	Bayleton, Daconil 2787, Fixed coppers, Zyban
Juniper	Tip blight	Benlate, Fixed coppers, Zyban
Lilac	Powdery mildew	Bayleton, Karathane, Sulfur, Triforine, Zyban, Rubigan
Maple	Leaf spot	Fixed coppers
Pine	Tip blight	Benlate
Pyracantha	Scab	Benlate, Daconil 2787, Fixed coppers
Roses	Black spot	Benlate, Captan, Daconil 2787, Fixed coppers, Mancozeb, Maneb, Phaltan, Triforine, Zineb, Zyban, Rubigan
Roses	Powdery mildew	Benlate, Karathane, Milban, Triforine

This list is presented for information only. No endorsement is intended for products mentioned, nor is criticism meant for products not mentioned. Registration data derived from labels and from the National Pesticide Information Retrieval Service.

ored spores that we notice on plants when they become diseased.

Rusts are seen on many crops, but are most commonly seen on Washington or Lavalley hawthorne, chrysanthemums and snapdragons.

Rusts are, for the most part, cool-weather diseases. Rust spores are spread in air currents and splashing water. They must have water in order to germinate and infect the leaf. Therefore, control involves watering early in the day and using protective fungicide sprays.

Leaf Spotting and Blighting Fungi: Like the rusts or mildews, these fungi are spread either long distances by air or shorter distances by splashing water. Most notable among this group are *Entomosporium* leaf spot on hawthorn; scab on crabapple and Pyracantha; *Botrytis* flower blight; and anthracnose on shade trees.

To control leaf spotting fungi, main-

tain plant vigor. Grow resistant cultivars. Also, chemicals can be sprayed on the plant to prevent infections.

Water Molds: *Pythium* and *Phytophthora* fungi are often called water molds because they have a spore stage that is adapted to spread by swimming in water. These organisms attack a wide variety of plants, causing root rots, stem rots and cutting rots. Many times, they will not kill a plant. They will "prune" the root system, resulting in poor growth, yellowing or stunting of the top portion of the plant.

These organisms are generally found in all soils. Environmental control can be achieved by improving the drainage of the soil. The fungi do not survive well in properly drained planting beds. Finally, soil drench fungicides can be used prior to planting or routinely on plantings where high maintenance is possible.

Root and Crown Rotting Fungi:

Aside from water molds, many other fungi cause root and crown rots. The fungus *Rhizoctonia* lives in the soil and attacks a wide variety of crops. Some species of *Fusarium*, *Cylindrocladium*, *Sclerotinia* and *Thielaviopsis* behave similarly. All of these fungi can persist in the soil for many months through specially adapted resting structures.

Control of these fungi involves promoting vigorous growth through good horticultural programs. Do not plant transplants too deep. Soil drenches may be applied, although the materials used will generally be different from those used for water mold control.

Stem and Twig Cankering Fungi:

Many fungal organisms, such as *Phomopsis*, *Diplodia*, *Fusicoccum*, etc., cause stem or twig cankers. Most notable examples include twig blight on juniper, branch blight on Shumard oak, and tip blight on Red or Austrian pine. These pathogens primarily sporulate in the spring. The spores are spread by splashing water, insects and wind.

Fungicides that are currently available often do not effectively control these diseases. Cultural control involves maintaining plant vigor, protecting the plants from winter injury, pruning out diseased plant parts and growing resistant cultivars.

Plant Wilting Fungi: *Verticillium* is a fungus that causes wilting of a large number of woody ornamentals such as hard maples, redbud and Russian olive.

The fungus invades through injured roots, grows into the stem and plugs the vascular system of the plant. Along with wilting, it often causes browning of the vascular system. It also has a resting structure to help it resist adverse soil conditions.

Ceratocystis ulmi is the plant wilting fungus that causes Dutch Elm Disease. It is spread from plant to plant by root grafts or by being carried by elm bark beetles.

Control programs involve preventive fungicide injections and insecticide sprays. For infected trees, prompt removal of the tree or the infected portion is the only thing to do.

Plant wilting fungi cannot be controlled easily with chemicals. Once they are within plants, they are not subject to chemical killing. Therefore, we are once again dealing with control via sanitation, growing resistant plant types and maintenance of vigor.

Fungicides

Fungicides work in consort with other integrated practices of disease man-

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agement. Control of stress, use of resistant plants, and sanitation remain as basic preventive elements of a good disease management program.

Fungicides generally act as preventives as well. If they are applied to the plant surfaces prior to the infection of the pathogen, they will prevent the infection and development of disease on that plant tissue.

There are several new products and new combinations of old fungicides available for use in landscapes and nurseries. Even though they are highly effective, they still

Combinations of fungicides are generally needed for broad spectrum disease control of diverse plants in landscape accounts.

must be considered preventives and used in consort with other integrated control practices. It is also important to remember that many of them are not necessarily better than the old products that we already have available to us!

One of the newest fungicides to become available for use on woody ornamentals has been Bayleton 25WP. This systemic fungicide is quite effective for many diseases, most notably the rusts and the powdery mildews. It is labeled on a good variety of plants in the landscape. Bayleton is a preventive fungicide that is best applied in cool weather to take advantage of the uptake and movement of the product within the plant tissues. The interval between applications can generally be lengthened to as many as 30 days under proper environmental conditions.

Rubigan is another systematic fungicide, especially effective on powdery mildew.

Another very useful product for nurserymen and landscapers is Zyban fungicide. This wettable powder product is a combination of a systemic fungicide (Thiophanate-methyl) plus a surface protectant (Mancozeb). As such, it truly provides broad spectrum control. Again, the product has a very good label and is therefore legally useful on many, many ornamentals in the nursery and landscape.

Daconil 2787 is a fungicide that is known by many nurserymen and

landscapers. What some may still fail to realize is that the Daconil label has been greatly expanded in recent years and now includes more than 40 different ornamentals and ornamental diseases. Again, as with the other products mentioned, Daconil is quite effective and would be quite useful on those products for which it is labeled.

There are two new products that are available for use for control of the *Botrytis* blight diseases we tend to see in the fall on flowering plants, most notably on herbaceous perennials and annuals. These products are Chipco 26019 and Ornalin. Whereas their labels are somewhat restricted as to the kinds of diseases they control, many will find them useful. Nurserymen might find them particularly useful for the control or management of winter storage mold diseases. Triforine and Milban are also new fungicides with modest ornamental labels. Both are effective against powdery mildews. Triforine is also used widely on roses for rust and black spot control. It is the active fungicidal ingredient in Ortho's Funginex and Orthenex.

Many fungicides that have been available for some years are still found by many to be extremely useful and possibly the most efficacious products that nurserymen and landscapers can use. These include the EBDC fungicides (Maneb., Zineb, and Mancozeb), the fixed copper fungicides (such as Kocide 101, or Bordeaux mix), Karathane (for powdery mildews, but temporarily suspended), Phalthan, Sulfur, and the systemic fungicide Benlate.

The label on Kocide 101 has recently been expanded to include many more ornamentals. It is especially useful for nurserymen. Benlate, as most of you know, is already widely labeled on all ornamentals for powdery mildews, anthracnose, and many other diseases. The EBDC fungicides are still not as widely labeled as we would like. They are very efficacious on a variety of diseases and are especially useful in combination sprays.

You will note that for most, there is one of the older products available as well as one or more of the new products. A careful study of the labels of fungicides currently available will enable landscapers and nurserymen to select products that are properly labeled and registered on the plants they wish to spray.

What about scheduling fungicide sprays into routine management programs. This is a difficult subject which can be approached in many different ways by many different practitioners.

Generally, we will need to combine

two fungicides together to net the broad spectrum of disease control that we would need when trying to service landscape accounts or nurseries that contain a diversity of plant materials.

Over the years, many nurserymen have found that a combination of an EBDC fungicide plus a fixed copper fungicide has given good results. This would be especially important in nurseries where control of bacterial fire blight is needed because of close spacings of large blocks of susceptible plants (such as crabapples, cotoneasters, pyracantha, etc.). Generally, these bacterial diseases are not successfully controlled with sprays by landscapers because of the need to spray frequently throughout the rainy periods of the growing season.

Many landscapers, on the other hand, have gained from a combination of an EBDC plus Benlate fungicide. Again, we are talking about products that have been available for some time! The new product Zyban is, in fact, a combination very similar in mode of action to that of an EBDC + Benlate.

Both Bayleton and Daconil 2787 are excellent products that are probably best used alone. Many landscapers and nurserymen are alternating one of the above combina-

Preventative programs with proper spray intervals are the secret to successful disease management.

tions with either Daconil 2787 or Bayleton. They are applying sprays monthly in the landscape and bi-weekly in the nursery. Bayleton would be an excellent fungicide to choose if there were a severe powdery mildew or rust disease that required special attention.

Whereas it may seem that the world of fungicides has changed a lot in recent years, one must realize that the basic approaches and the usefulness of chemicals in the landscape and nurseries to control infectious diseases has remained essentially the same. Preventive spray programs with proper intervals between applications are the secrets to successful disease management. Obtain labels of the new products, study them and see how they will fit into your disease management program.

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Plant Disease Development Calendar

PLANTS	DEVELOPMENT OR DISEASE	PATHOGEN SCIENTIFIC NAME	PLANT PARTS AFFECTED	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
Trees															
Crab Apple	Flowering														
	Cedar apple rust	Gymnosporangium sp.	leaves												
	Fire blight	Erwinia amylovora	shoots												
	Powdery mildew	Podosphaera leucotricha	shoots												
Dogwood	Scab	Venturia inaequalis	fruit leaves												
	Flowering														
	Anthraxnose	Elsinoe corni	leaves flowers												
	Leaf spot	Septoria floridiae	leaves												
Oak	Scorch	Physiological	leaves												
	Flowering														
	Anthraxnose	Gnomonia veneta	leaves												
Pine	Leaf blister	Taphrina caerulescens	leaves												
	Rust	Cronartium sp.	leaves												
	Flowering														
Red Bud	Eastern gall rust	Cronartium quercuum	branches trunk												
	Fusiform rust	Cronartium fusiforme	branches trunk												
	Needle cast	Hypoderma lethale	needles												
	Needle rust	Coleosporium sp.	needles												
Red Cedar	Flowering														
Red Maple	Cedar apple rust	Gymnosporangium sp.	branches												
	Flowering														
Saucer Magnolia	Anthraxnose	Gloeosporium apocryptum	leaves												
	Flowering														
Sycamore	Anthraxnose	Gnomonia platani	shoots												
Woody Plants															
Azalea	Flowering														
	Leaf gall	Exobasidium vaccinii	leaves												
	Petal blight	Ovulinia azaleae	petals												
Camellia japonica	Flowering														
	Flower blight	Scierotinia camelliae	flower												
Camellia sasanqua	Leaf gall	Exobasidium camelliae	shoot												
	Flowering														
Crape Myrtle	Leaf gall	Exobasidium camelliae	shoot												
	Flowering														
Forsythia	Powdery mildew	Erysiphe lagerstroemiae	leaves flowers												
	Flowering														
Pyracantha	Flowering														
Rhododendron	Fire blight	Erwinia amylovora	shoots												
	Flowering														
	Leaf gall	Exobasidium vaccinii	shoots												
Rose	Dieback	Phytophthora cactorum and other species	young shoots												
	Flowering														
	Black spot	Diplocarpon rosae	leaves												
Rose	Botrytis	Botrytis cinerea	flowers stems												
	Powdery mildew	Sphaerotheca pannosa	leaves												



Mosaic virus of a rose, shown left, is characterized by a bright yellow zig-zag pattern on the foliage. The virus will not affect plant vigor and can be pruned out. Infected roses should not be used for budding or grafting. Boxwood blight, below, can be contained by good sanitation, debris removal, and fungicide applications.



WARM SEASON

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The south is blessed with an environment conducive for the growth of most ornamentals plants. Unfortunately, the same environment is also good for the development of a number of disease agents, especially fungi.

In an article such as this it is impossible to list all of the various ornamentals grown in this region and the diseases that occur on them. Rather, an attempt will be made to list nine of the more common ornamentals grown in the sunbelt and the major disease problems that they face.

Azaleas

Azalea Petal Blight: This disease is largely confined to azaleas grown in the southern coastal states from Maryland to Texas. Indian and Kurume azaleas are especially susceptible.

The disease first appears as small, water-soaked spots on the petal. These spots sometimes give the flower a freckled appearance. Under favorable conditions these spots enlarge rapidly and cause the flower to become limp and eventually collapse. The whole flower appears to "melt

down" and tends to cling to the foliage rather than fall to the ground as spent healthy flowers.

Petal blight often affects the blooms of entire plants within a matter of a few hours progressing so rapidly that it destroys the beauty of the plant overnight.

The fungus lives from season to season on infected blossoms in the mulch. Therefore, to control flower blight it is important to remove all the old mulch from the plants and replace with new mulch before the plants begin to bloom. Drench the soil with Terraclor in early January using one cup of 75% WP in enough water to wet 100 sq. ft.

When the blossoms begin to open, apply either Benlate, Thylate or Bayleton as a blossom spray. More than one application may be needed during the blooming period.

Twig Die-Back: There are several fungi that have been associated with this disease complex. These fungi normally enter the plant through either bud or leaf scars. The die-back organism may kill a few inches of the twigs or, if untreated, may consume the entire plant.

To control die-back it is important

to prune and destroy all of the infected branches. Remember the normal pruning period for these plants is just after blooming. Since the infection period is just after the bloom season, it is important to continue your spray program for petal blight beyond the blooming period.

Leaf Gall: Leaf and flower gall is a common disease on azaleas and camellias in the south. The fungus may infect the developing leaves, stems and flowers causing severe distortion, swelling and thickening of the plant parts. As the galls form, the infected parts may become white or light green in color. The disease may be particularly severe during cool, moist weather.

The best control is to remove the galls when you first notice them on the plant. This is easiest to do when there are only a few galls present.

There may be situations where removing galls is not practical. In such cases, a spray program is advisable for the control of this disease. Spray the plants once before the new leaves are unfurled using Maneb, Captan or Zineb. Apply at 14-day intervals during the spring or as long as young leaves are present.

Boxwood

Boxwood Blight (Canker): The term, branch and twig blight, is used to describe the problem of twigs or entire branches dying when the remaining parts of the plant appear healthy. Leaves may shed prematurely leading to the death of the twig. The affected foliage takes on a light, straw color.

Several fungi are associated with blighting of boxwoods in the south. In order to insure maintenance of healthy plants where blight has become a problem it is recommended that an annual practice of pruning,

Anthracnose control requires early, monthly applications of fungicides prior to blooming and another application in September.

sanitation and spraying be carried out. The annual removal and burning of all dead leaves and twigs lodged in and around the plants is important.

Several applications of a broad spectrum fungicide such as Daconil, Maneb or fixed copper have shown to be effective in preventing most blighting problems. The first application should be made when the plants are pruned. The second application should be made when new growth is approximately one-half completed. The remaining applications can be made at various intervals depending upon further disease development.

Nematodes: Nematodes are small, worm-like organisms that attack the root system on plants. Boxwoods grown in the south are susceptible to a number of nematodes including root-knot, lesion, spiral, stubby-root, lance and ring.

Nematode-affected plants are weak, stunted and gradually decline. If nematodes are suspected, a soil nematode analysis is needed to determine the types and population of the nematodes present.

Few chemicals are available for the homeowner's use in controlling nematodes. In some cases it is more practical to replace infested plants with a different variety of plant that is not affected by nematodes.

Phytophthora Root Rot: Off-color foliage followed by sudden wilting and death of the entire plant is characteristic of this disease. Yews, rhododendrons and a large number of other

woody ornamental plants are also subject to *Phytophthora*. It is extremely difficult to rid infected plants of this disease.

The blight is more severe in poorly drained soil. Chemical control is difficult.

Camellia

Flower Blight: This blight is confined to the flowers which turn brown and drop. Most species and varieties of camellias appear to be equally susceptible to this blight.

The control of camellia flower blight, even though it is caused by a different fungus, is similar to that for azalea petal blight.

Die-Back: A canker and die-back of camellias is widespread and frequently destructive in the southern states. The fungus normally enters through wounds or through natural openings such as scars left by abscising leaves or petals in the spring.

To control, prune and destroy all cankered twigs. When the cankers occur on the main stem of the plants, surgical removal of the diseased portions may be attempted. Be sure to use tree paint containing a fungicide to cover all cut areas.

A fungicide application can be made shortly after the blooming season to try to protect the plant from entrance of the fungus through natural openings. Materials such as benomyl or daconil have proven to be effective.

Leaf Gall: The symptoms and control of leaf gall on camellia are similar to those that occur on azaleas.

Virus Diseases: There are several virus diseases that occur on camellias. These normally appear as variegation or yellowing in the leaf or flower. Not all yellowing of camellia leaves is a result of a viral infection however, but may be some type of nutritional disorder.

Plants suspected of harboring a virus should be discarded or at least isolated from healthy plants. Care should be taken while pruning so that suspected plants are pruned last to prevent spreading the virus to healthy plants.

A successful disease control program on camellias means you must follow a well planned integrated disease control program. Here is an example of such a program that will help reduce many of the camellia diseases.

1 Buy only disease-free plants. Isolate new plants from existing plants for 3-6 months to check for any possible disease development.

2 Take cuttings from current season's growth from the top of healthy plants.

3 Root in a disease-free environment. If possible, use a sterile rooting me-

dium.

4 Prune plants properly. Do the major pruning just after the flowering period. Paint the wounds properly with a pruning paint.

5 Use good cultural practices.

■ Provide proper air circulation.

■ Use correct amount of fertilizer. Over fertilization causes problems, especially during time when plants are most susceptible to die-back.

■ Mulch when possible.

■ Remove and destroy diseased or spent flowers.

6 Use chemical controls. In areas where flower blight and die-back are problems, follow an annual spray program along with the previous suggested practices.

Dogwood

Anthracnose: Spot anthracnose is a serious fungus disease that attacks flowers, leaves, young shoots and berries of dogwood.

The flowers are usually malformed and covered with small, circular, reddish to purple spots. The margins of these spots are normally much darker in color than the centers.

Leaf infection occurs after the blooming season is over. Heavily infected young twigs may die back several inches from the tips.

Annual removal and burning of all dead leaves and twigs lodged in and around plants helps reduce the incidence of boxwood blight.

Anthracnose control requires early application of fungicides prior to blooming. A regular spray program is required for good control. Monthly applications of fungicides such as Benlate, Maneb or Captan can be applied during March, April, May and September.

Nectria Canker: This fungus attacks dogwoods as well as other hardwoods in the southeast.

The first symptom is usually a dark area on the bark with a water-soaked appearance. These areas will begin to swell resulting in a great deal of bark splitting. Infected areas may be a few inches to several feet in diameter and can completely gird the trunk.

Cankers are targets for insects and are easily broken during heavy winds. Control is very difficult after infection occurs.

If the canker is small, cut the tissue back to healthy wood and paint with a wound dressing. Severely affected trees should be removed. No good chemical controls are available.

Gardenia

Canker: Symptoms of this fungus disease are yellowing, wilting, shrivelling and falling of leaves and buds. The cankers girdle the stems causing die-back. Cankers may become enlarged to twice the size of the normal stem.

Experience has shown that the fungus gains entrance through mechanical injuries so care should be taken when pruning the plants or mowing around plants to prevent this disease from spreading.

Also, spraying with a broad spectrum fungicide such as Maneb or Daconil soon after pruning is recommended.

Sooty Mold: Sooty mold is a frequent problem on leaves of evergreen shrubs such as azaleas, camellias, and gardenias.

Sooty mold is a black, powdery coating that develops on leaves and twigs during the cool, moist weather of late winter and early spring and fall. There are several fungi or molds that grow in the sugary dew left on plants by insects such as aphids, scale, white flies, and other insects that suck sap from plants. This honey dew or sugary substance may occur on low shrubs on which insects are not feeding but this material falls from larger shrubs or overhanging limbs of trees.

The fungi that cause sooty mold do not attack the plants directly but derive their nutrients directly from the honey dew itself. These fungi will also grow on honey dew on walls, sidewalks, fences, automobiles or anything on which the honey dew is present.

The control of sooty mold is indirectly achieved by controlling the insects that produce this sugary material. Once sooty mold has been established it is not easy to remove.

The best method is to soak affected plants in a water and detergent mixture. This can be achieved by using one tablespoon of household liquid detergent per gallon of water and spraying on these plants. Wait for a few minutes and then wash the material off with a strong stream of water. This may have to be repeated several times. Once this has been accomplished then procedures should be started for the control of the insects.

Holly

In the south holly is subject to attack by only a few disease causing organisms. Many times poor appearance of

Junipers Resistant to Phomopsis and Twig Blight

<i>Juniperus chinensis</i>	
cv.	Femina*
	Iowa
	Keteleeri*
	Pfitzeriana Aurea
	Robusta
var.	sargentii
	sargentii, cv. Glauca
cv.	Shoosmith
<i>Juniper horizontalis</i>	
cv.	Depressa
cv.	Depressa Aurea
	Procumbens
<i>Juniper scopulorum</i>	
cv.	Silver King
<i>Juniper virginiana</i>	
cv.	Tripartita*
<i>Juniperus communis</i>	
cv.	Ashfordii
	Aureo-spica*
var.	depressa*
cv.	Hulkjaerhus
	Prostrata Aurea
	Repanda
var.	saxatilis
cv.	Suecica*
<i>Juniper sabina</i>	
cv.	Broadmoor
	Knap Hill
	Skandia
<i>Juniper squamata</i>	
cv.	Campbellii
var.	Fargesii*
cv.	Prostrata
	Pumila

* Also reported resistant to cedar-apple rust.

plants is often caused by improper planting, dry weather, cold weather and planting varieties that are not adapted to the area.

The amount of damage from disease on hollies can be minimized by giving plants plenty of growing space and pruning out all diseased twigs and branches as they appear.

Tar Spot: Yellow spots appear on the leaves of American and English hollies late in the spring. These later turn reddish-brown and finally, by fall, a dark black color.

If at all possible, all diseased leaves should be gathered and burned. Make several applications of a broad spectrum fungicide such as Maneb, Ferbam or a copper fungicide.

Die-Back and Canker: There are several fungi that cause die-back and canker of holly. These are usually noted as sunken areas on the twigs and stems that cause varying degrees of die-back of young twigs.

Prune and destroy all diseased twigs and begin a spray program with a broad spectrum fungicide such as Maneb or a copper fungicide. Repeat at weekly intervals until all new

growth is established.

Junipers

Twig Blight: Juniper twig blight, also known as Phomopsis blight, infects several species of juniper and arbovitae growing in the southeast.

Early disease symptoms consist of yellowing and dying of the scale leaves, especially the tips. This is followed by a progressive dieback of the new growth. Small black lesions are formed on the stems and cankers may form on the woody stems especially near a side branch.

In the southeast, twig blight spreads rapidly during periods of rainy, humid weather in the spring and fall. During dry weather, prune out as much of the infected branches as possible and destroy.

Research has shown some varieties are more tolerant to twig blight than others.

Protective fungicides need to be applied frequently in order to protect new foliage. In most cases the application of these fungicides can be limited to periods in which flushes of new growth occur.

Fungicides which have shown to be effective in controlling twig blight are copper fungicides (such as copper sulphate) and benomyl (Benlate). A spreader sticker should be added to the spray for best results.

Cedar-Apple Rust: Where apples and red cedar are grown together the cedars may become covered with hundreds of galls an inch or more in diameter. Infection occurs on the leaves which stimulates the development of the gall. The second spring after infection, the galls form numerous, long, yellow, tongue-like outgrowths during warm, rainy weather. The spores from these galls are spread by wind to leaves of nearby apples which may become seriously diseased and fall prematurely. The damage to red cedar is usually not that serious.

Photinia

Photinia Leaf Spot: The major problem on photinia (red top) grown in the south is *Entomosporium* leaf spot. The fungus attacks old growth as well as new succulent tissue. The spots occur on both lower and upper surfaces of the leaf and are usually surrounded by a purple to red margin. As they mature these lesions will have a gray center.

Once the disease is well established in a planting of photinia, control is sometimes very difficult and lengthy. For control to be successful, a good spray program, along with sanitation and pruning must be carried

out. Diseased plants should be pruned in the spring just before they put on new growth. Be careful to prune out as much of the diseased areas as possible. Remove and burn any fallen leaves beneath the plant that may contain disease.

As the leaves begin to unfold, start the spray program and continue it on a 10- to 14-day schedule throughout the early part of the growing season.

Effective fungicides against this disease include Maneb, Funginex, Zineb, or copper fungicides.

Roses

Many different disease agents affect roses in the southeast. To adequately control these diseases the landscaper or grower must recognize these dis-

Six Steps to Keeping Roses Healthy

- 1 Buy only good quality, disease-free plants from a reputable nurseryman.
- 2 Space plants for good air circulation.
- 3 Don't guess —soil test.
- 4 Keep roses well mulched throughout the growing season. When disease problems are severe then replace mulch annually.
- 5 Sanitation: Collect and burn fallen leaves in the autumn or when disease pressure is high. Prune properly in the fall or spring according to the type and variety. Destroy all prunings. Make clean slanting cuts 3 to 4 inches behind a canker, dip shears between each cut.
- 6 Use a good chemical control program. Use a recommended fungicide and insecticide spray at recommended intervals throughout the growing season beginning as the new leaves unfold. □

eases and be able to control them either by variety selection, sanitation or chemical control.

Black Spot: As the name black spot implies, the most prominent symptom

of this disease is black spots on either side of the leaves. A number of other diseases cause dark spots on the leaves but you can distinguish black spot by the darker color and the fringed borders of the spots.

There is usually a great deal of yellowing and chlorosis associated with this disease. Black spot causes premature leaf drop and may result in severe defoliation of the plant. The black spot fungus may weaken plants and make them more susceptible to other disorders.

Although rose varieties may vary in their susceptibility to the fungus, no variety is completely immune. Hybrid teas are generally more susceptible than other varieties.

The first step toward controlling black spot is sanitation. If only a few leaves show symptoms these should be removed and destroyed. Since the fungus overwinters in leaves and canes, remove all diseased leaves from around the plants at the end of the growing season.

Before new leaves appear in the spring remove and burn old mulch and replace with fresh mulch.

A regular spray program throughout the growing season is usually necessary to control this disease. You may use one of the several fungicides including Maneb, Moncozeb, benomyl, chlorothalonil or funginex. All give acceptable control of black spot if applied on weekly intervals during the spring and at 2-week intervals during the dry part of the summer.

Once plants become severely infected, the fungicides are of little value other than keeping the disease from spreading, therefore, regularly spraying and thorough coverage are important.

Die-Back and Stem Canker: Die-back and stem canker are really a complex of diseases since they are caused by several different types of fungi. However, identifying these diseases is not of great importance since the control is very much the same for all.

The die-back phase of the disease appears as a black sunken lesion that causes death of the terminals of the cane. Die-back normally gets established through wounds.

When pruning be sure to dip all pruning tools in a 70% solution of denatured alcohol or household liquid bleach diluted one part bleach to four parts water.

The fungicides that are effective in controlling black spot will also control die-back and canker.

Powdery Mildew: A white powdery fungus growth on the surface of

leaves, buds, or stems of roses usually indicates powdery mildew. Infection on young leaves may cause curling and sometimes a purple discoloration.

Badly infected flower buds do not open properly. Most of the sanitation procedures for the control of other rose diseases are also valuable in controlling powdery mildew.

When this disease is a problem spray dormant plants with commercial lime sulfur (1:15).

During the growing season you can hold powdery mildew in check by spraying with benomyl, dinocap (Karathane), cycloheximide (Acti-dione), or wettable sulfur. Be sure to add a

Black spot fungi overwinter in leaves and canes of roses. Remove all diseased leaves from around the plants at the end of the growing season.

spreader sticker and follow label directions closely.

Viruses: There are several virus diseases that attack roses in the south. The type of symptom expressed will depend upon the type of virus present.

Some of the mosaic viruses will cause pale to bright yellow spots to occur on the leaves. Occasionally ring spots will occur or some type of light yellow zig-zag pattern across the leaf. Also, the mosaics will result in a puckering of the younger leaves.

Some of the streak viruses will produce a brown to reddish ring pattern in the leaves. Brown or green rings may also occur on some of the canes.

Generally speaking, the viruses cause very little loss of plant vigor or affect flower production. The major problem is with discoloration and deformity of the foliage.

Occasionally symptoms may be masked during hot weather. Infected roses should not be used for budding or grafting. Propagators can use heat treatment of root stock to rid the plants of most viruses.

If virus symptoms do occur on established plants, severe pruning may rid the plant of the virus. If this is not successful, then it is best to remove the plant since the virus may be transmitted to healthy plants either by pruning instruments or by insects. **WT&T**