

Disease Control for Trees, Shrubs and Flowers, 2018

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Disease	Hosts	Management Strategies*
<p>Powdery mildew is easily identified by the presence of white to gray mycelium on affected leaves and/or flowers. The first sign of disease is usually isolated colonies of white fungal growth. With time whole leaves may be totally covered with fungal growth. On some plants, such as pin oak, mildew may be present only on the undersides of leaves. On dogwood, crape myrtle and nandina, infected leaves may be curled, twisted or otherwise distorted. Leaves may be abnormally red with little mycelium visible; on sedum, lesions are scabby and brown.</p>	<p>Amelanchier, azalea, begonia, columbine, crabapple, crape myrtle, dogwood, euonymus, hydrangea, lilac, magnolia, nandina, oak, phlox, rhododendron, rose, sedum, tulip tree, verbena, zinnia</p>	<p>Host Resistance — Use disease-resistant species/cultivars for crabapple, crape myrtle, dogwood, lilac, rose, zinnia</p> <p>Chemical Control — Azoxystrobin, chlorothalonil, copper hydroxide, copper octanoate, kresoxim-methyl, myclobutanil, polyoxin D, propiconazole, pyraclostrobin, tebuconazole, triadimefon, trifloxystrobin, triflumizole</p>
<p>Downy mildew — Although this sounds similar to powdery mildew, the diseases are very different; caused by fungi from entirely different taxonomic classes. The fungi that cause downy mildew are more closely related to fungi that cause phytophthora and pythium root rots than the fungi that cause powdery mildew. Symptoms of downy mildew can range from leaf spots and defoliation to rapid blighting of diseased shoots. Angular leaf spots on rose may range from red to brown to black. Signs to look for include gray-to-white tufts of mycelium on the undersides of leaves, directly below chlorotic lesions. Look for mycelium early in the morning while the leaves are still wet.</p>	<p>Alyssum, brambles, coleus, grape, impatiens, pansy, rose, rudbeckia, salvia, snapdragon, tobacco, viburnum</p>	<p>Host Resistance — For downy mildew of garden impatiens use begonias, coleus, New Guinea impatiens or SunPatiens, Torenia</p> <p>Chemical Control — Azoxystrobin, cyazofamid, dimethomorph, fenamidone, fluopicolide, fluoxastrobin, fosetyl-al, mancozeb, mefenoxam, potassium salt of phosphorus acid, potassium phosphite</p>
<p>Gray mold may be found on herbaceous and woody ornamentals usually during cloudy, cool, moist weather. Stems, leaves and flowers may be attacked. Woody ornamentals in overwintering structures may become infected. Symptoms of infection are blighting of flowers, tan-to-brown leaf spots, shoot blights and stem rot. A sign of disease is</p>	<p>Almost any herbaceous or woody plant</p>	<p>Sanitation — In greenhouses and propagation areas, remove infected plant parts or plants.</p> <p>Environmental — In greenhouses use fans and vent to remove moist air at the end of the day. Minimize leaf wetness.</p>

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gray-brown mold on diseased plant parts.		
		<p>Chemical Control — Chlorothalonil, copper sulphate pentahydrate, fenhexamid, fludioxonil, iprodione, mancozeb, triflumizole</p>
<p>Rusts — Signs include bright yellow, orange, reddish-brown or chocolate-brown raised pustules are visible usually on the undersides of leaves. Gelatinous tendrils of rust spores are produced from galls each spring on eastern red cedar infected with cedar-apple rust. Pine needle rust produces pustules on pine during spring. Early symptoms on leaves are yellow leaf spots. Rust galls may appear on stems of pine, cedar and hawthorn. Twig rust may cause branch dieback on plants as diverse as hawthorn and hemlock. Daylily rust was first found in the U.S. in 2000 and in TN in 2001.</p>	<p>Amelanchier, apple, aster, azalea, cedar, crabapple, daylily, fuchsia, geranium, grasses, hawthorn, hemlock, hollyhock, iris, jack-in-the-pulpit, juniper, mayapple, oak, pear, pine, potentilla, quince, snapdragon, sunflower</p>	<p>Host Resistance — Cedar rust resistant cultivars are available for apple, crabapple, hawthorn.</p> <p>Chemical Control — Azoxystrobin, chlorothalonil, mancozeb, myclobutanil, propiconazole, pyraclostrobin, tebuconazole, triadimefon, trifloxystrobin</p>
<p>Virus Diseases — Plants infected with viruses exhibit a variety of symptoms, including mosaic, ringspots, stem lesions, rosette (witches broom), “oak-leaf” pattern, stem pitting, stunting, flower break, etc. Hosta virus X (HVX) is fairly common on hosta. HVX is most easily diagnosed on gold hosta cultivars where abnormal green stripes appear parallel with veination of leaves. Canna yellow mottle virus is very prevalent on the Tropicana series of canna. Symptoms include stunted plants, necrotic streaks in leaves and muted variegation. Rose rosette is a viral disease transmitted by eriophyid mites. Virus diseases may be difficult to diagnose unless you are familiar with symptoms associated with specific virus diseases.</p>	<p>Canna yellow mottle virus — Tropicana series of canna lily Hosta Virus X — Many common cultivars of hosta Impatiens necrotic spot virus — Over 350 ornamental plants Tomato ringspot virus — dogwood, fringetree, peach, cherry Tomato spotted wilt virus — Perennial plants Rose mosaic virus and Rose rosette — Rose</p>	<p>Sanitation and Cultural Control — Do not propagate plants with symptoms of a viral disease. In production, remove and discard infected plants. For impatiens necrotic spot, monitor and manage thrips populations in greenhouses. Rose rosette — Remove roses with symptoms of rose rosette. Break up mass plantings by using a non-host as a barrier between smaller plantings. Remove multiflora rose near rose plantings. Pruning and control of the vector (eriophyid mites) are being evaluated.</p>
<p>Leaf spot diseases are usually caused by fungi, but a few may be caused by bacteria. These are among the most common plant diseases. Symptoms vary depending on the pathogen and host. Some common symptoms include frog-eye or bull’s eye spot marked with concentric rings; irregular, round tan spots with small black fruiting bodies;</p>	<p>Alternaria LS — Aucuba, impatiens, marigold, zinnia Black spot — Rose Bull’s eye LS — Magnolia, maple Cercospora LS — Buckeye, crape myrtle,</p>	<p>Host Resistance — Choose disease-resistant cultivars of rose, crabapple, Indian hawthorn, buckeye, horse chestnut Sanitation and Cultural Control — Rake and remove diseased leaves. Minimize leaf wetness; use drip irrigation. Chemical Control — Azoxystrobin, chlorothalonil, copper hydroxide, copper</p>

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<p>angular tan or black spots; black or tan spots surrounded by a yellow “halo”; oval-shaped leaf spots; and tan-to-gray spots with red or purple margins. Fungal leaf spot diseases are usually favored by wet seasons, high humidity and/or frequent overhead irrigation. Many leaf spots cause premature defoliation.</p>	<p>leucothoe, laurel, red bud, rose Entomosporium LS — Indian hawthorn, pear, photinia Leaf blotch — Buckeye, horse chestnut Phyllosticta LS — Holly, magnolia, maple, witch hazel Scab — Crabapple</p>	<p>octanoate, fludioxonil, kresoxim methyl, mancozeb, myclobutanil, propiconazole, Pyraclostrobin, tebuconazole, Thiophanate methyl, trifloxystrobin, triflumizole</p>
<p>Shot Hole Diseases — Some plants shed diseased leaf tissue in response to fungal or bacterial infections. Infected leaves are covered with circular, “shot” holes where diseased tissue has fallen out. Infected leaves may become chlorotic and drop prematurely. Shot-hole diseases may be caused by fungi or bacteria. Damage from shot-hole disease may be confused with insect feeding. Remember, shot-hole disease only occurs on plants in the genus <i>Prunus</i>. Similar symptoms on other plants may be caused by insects.</p>	<p>Almond, apricot, cherry, cherry-laurel, peach, plum (plants in the genus <i>Prunus</i>)</p>	<p>Sanitation and Cultural Control — Rake and remove fallen leaves. Minimize leaf wetness, especially for bacterial shot hole diseases of laurel. Chemical Control — Chlorothalonil, copper hydroxide, copper octanoate, mancozeb</p>
<p>Anthracnose refers to diseases that cause leaf, stem and/or fruit lesions. These diseases may appear as irregular leaf spots/lesions along leaf margins and across or between veins. Anthracnose may kill entire leaves, young shoots and twigs, plus cause premature defoliation. Diseased leaf tissue may fall out of leaf lesions. Stem cankers may form at the base of succulent shoots. Look for anthracnose diseases of ash, dogwood, maple and sycamore during April and May.</p>	<p>Ash, dogwood, euonymus, hosta, maple, oak, sycamore</p>	<p>Sanitation and Cultural Control — Rake and remove fallen leaves. Prune and remove cankered or dead branches. Space to increase air movement and minimize leaf wetness. Use drip irrigation to minimize leaf wetness. Chemical Control — Chlorothalonil, copper hydroxide, copper octanoate, tebuconazole, thiophanate methyl</p>
<p>Needle Blight and Cast of Conifers — Basically a leaf spot disease of conifers that leads to premature shedding of needles. During certain times of the year, distinct yellow-to-brown lesions are visible on pine needles. Infected needles turn brown and shed. Fungi that cause needle cast are generally weak pathogens that infect older needles in the interior of the tree’s canopy. Black fruiting bodies of various fungi may be observed in single or multiple rows along the length of infected needles.</p>	<p>Cyclaneusma needle cast — Scots pine Lophodermium needle cast — Eastern white pine Ploioiderma needle cast — Loblolly pine Rhizosphaera needle cast, Stigmina needle cast — Spruce Phomopsis blight — Juniper</p>	<p>Sanitation and Cultural Control — For field grown plants, choose locations with good air movement. Space plants to minimize needle wetness. For needle blights such as Kabatina, prune if desired to remove diseased shoots. Chemical Control — Chlorothalonil, copper hydroxide, thiophanate methyl + chlorothalonil</p>

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<p>Conifers infected with needle cast have brown needles and thin canopies. The most common tip blight diseases of juniper include phomopsis blight, which attacks new flushes of growth in late spring or early summer. Kabatina blight of juniper attacks juniper injured from snow or ice in late winter through early spring. Tip blights rarely kill more than 4 inches of the terminal of juniper shoots.</p>	<p>Kabatina blight — Juniper, Leyland cypress Passalora needle blight — Leyland cypress</p>	
<p>Canker Diseases — Canker-causing fungi may live as endophytes on susceptible host. An endophyte means the fungus is living on and/or in host tissue, but there are no signs of disease. But let the plant come under significant stress and dieback may not be far away. Leaf death and twig dieback are some of the first symptoms of canker diseases. Cankers are usually found on branches but may infect trunks of young trees. Initially the disease may be undetectable except by shaving the surface of a branch to reveal brown discoloration of bark and/or underlying sapwood. As cankers enlarge, oval, sunken areas may develop on branches. Large cankers may girdle and kill branches and entire plants if they develop on the trunk or main stems of shrubs. Gum production (gummosis) is often associated with fungal and bacterial cankers of cherry. Resin is often associated with canker diseases of junipers. Fire blight is a bacterial disease that may cause cankers. Fire blight is usually observed on plants in the Rosaceae family. Early symptoms may be blossom blight during bloom, followed by the shoot blight phase and signature symptoms such as shoots killed rapidly in the shape of a “shepherd’s crook.” Water-soaked cankers may be found on the trunk and branches of infected plants.</p>	<p>Botryosphaeria canker — Ash, crabapple, dogwood, juniper, laurel, Leyland cypress, red bud, maple, rhododendron Endothia canker — Pin oak Fire blight — Apple, cotoneaster, crabapple, hawthorn, pear, pyracantha, serviceberry Nectria canker — Dogwood, pear Phomopsis canker — Azalea, ash Seiridium canker — Leyland cypress, Arizona cypress Thyronectria canker — Honey locust</p>	<p>Sanitation and Cultural Control — For fungal canker diseases, keep plants irrigated during dry periods, remove diseased branches, remove heavily cankered plants. Fire blight — Streptomycin may be used during bloom, copper sprays afterward. Dormant pruning to remove cankered branches. There are apple, crabapple and pear cultivars resistant to fire blight. Chemical Control — Thiophanate methyl or mancozeb may be applied to wounds immediately after pruning to minimize canker diseases.</p>
<p>Leaf galls — Conspicuous white, yellow, red or gray blisters or galls develop on leaves. Leaves may become puffy, puckered, thickened or curled. Infected leaves may drop early. The most common leaf gall diseases are azalea</p>	<p>Leaf gall — Azalea, blueberry, camellia, rhododendron Leaf blister — Red oak, water oak, willow oak Leaf curl — Peach, plum</p>	<p>Azalea leaf gall can be removed and destroyed. Peach leaf curl — Two to three fungicide sprays. At 50% leaf fall in late October, one to two dormant sprays in late winter before flower buds open. Chlorothalonil,</p>

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leaf gall, peach leaf curl and oak leaf blister. Symptoms may be confused with insect or mite induced galls, which are more numerous.		Bordeaux mixture, lime sulfur, fixed copper.
Crown gall — Rough-surfaced, hard or soft, spongy, swollen tumors or galls up to several inches in diameter may form on stems or roots. Galls may be flesh-colored, greenish or dark. Galls are usually found near or below the soil line. Galls may form at wounds made during propagation. As galls continue to develop and enlarge, surface layers may become brown, woody and roughened. Plants with crown gall usually become unthrifty and possibly stunted. Plant death may eventually occur.	Apple, crabapple, Euonymus, holly, maple, peach, plum, rhododendron, rose, willow, wisteria	Sanitation and Cultural — Crown gall may be more severe in heavy soils where water stands. Avoid fields with a history of crown gall. Destroy infected ornamental plants with crown gall.
<p>Stem Rots</p> <p>Southern blight — Usually occurs in gardens, perennial borders and nurseries during hot weather, near mid-summer. Symptoms include wilting, leaf scorch, followed by plant death. Signs of disease include white mycelium on the stem of infected plants and tan to reddish-brown round, spherical resting structures of the fungus (sclerotia) on the stem and soil surface.</p> <p>Sclerotinia crown rot — Unlike southern blight, this disease usually appears during mid-spring to early summer when conditions are cool and moist. Affected plants usually wilt and die. White mycelium may be visible on stems near the soil surface. Black, oblong sclerotia may be present on the outer surface of woody plants or in the stem pith of herbaceous plants. Diseased stems should be split lengthwise and examined for signs of sclerotia.</p> <p>Rhizoctonia stem rot/damping off - This disease is often the cause of damping off (stem rot) of seedling plants. Seedling annual or perennial flowers or woody ornamentals may be killed by this fungus after it attacks the stem near the soil surface. Diseased seedlings often fall over and die. In the field, the fungus may move short distances down the row killing several adjacent plants.</p>	<p>Southern Blight — Ajuga, apple, clematis, crabapple, forsythia, hosta, many annual and perennial flowers, rarely on some turf species</p> <p>Sclerotinia Stem Rot — Campanula, euonymus, several herbaceous flowers</p> <p>Rhizoctonia stem rot — Many herbaceous plants and seedlings of woody plants and conifers</p>	<p>Sanitation and Cultural Control — For southern blight and Sclerotinia crown rot, remove infested plants plus soil near the stem as to remove sclerotia.</p> <p>Chemical Control —</p> <p>Southern blight and Rhizoctonia stem rot — Azoxystrobin or flutolanil as directed spray or drench for prevention of stem rots</p> <p>Sclerotinia crown rot — Thiophanate methyl</p>

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In propagation beds or flats, diseased plants may be killed in circular areas as the fungus moves outward.		
<p>Nematode Diseases — Millions of nematodes may live in a square meter of soil; however, only a few are parasites of plants. Most plant parasitic nematodes attack plant roots; some attack foliage. Nematode damage can be difficult to diagnose as most of the damage occurs below ground. Plants damaged by nematodes may appear stunted, unthrifty, discolored and have discolored roots with lesions or galls. One sure way to identify nematode problems is to submit a soil and/or root sample for analysis at a plant diagnostic laboratory; submit symptomatic foliage where foliar nematode is suspected.</p>	<p>Root knot nematode — Abelia, aucuba, begonia, boxwood, dogwood, gardenia, holly, hydrangea, impatiens, ligustrum, nandina, photinia, rose</p> <p>Foliar nematode — African violet, anemone, begonia, brunnera, hosta, many shade loving perennials</p> <p>Lesion nematode — Boxwood, juniper</p>	<p>Sanitation and Cultural Control — Avoid planting susceptible hosts into infested soil. Destroy infested plants. Do not propagate plants infested with foliar nematodes or root knot nematode.</p>
<p>Wilt diseases are usually responsible for the slow to moderate decline of trees and some shrubs. Individual branches may discolor and die. Some wilts may affect only one side of the plant. A common symptom associated with wilt diseases is vascular discoloration (discolored sapwood). Leaf scorch and a reduction in canopy size are additional symptoms. Wilt pathogens may be spread by insects (Dutch elm disease by elm bark beetles; Bacterial leaf scorch by leaf hoppers). Bacterial leaf scorch is very common on pin oak, other oaks in the red oak family.</p>	<p>Bacterial leaf scorch — Elm, red maple, mulberry, sycamore, pin oak, shingle oak</p> <p>Dutch elm disease Elm</p> <p>Verticillium wilt — Ash, barberry, boxwood, buckeye, catalpa, daphne, elm, lilac, euonymus, smoke tree, maple</p> <p>Fusarium wilt — Mum, more common on herbaceous plants</p>	<p>Sanitation and Cultural Controls — Plant diversity prevents the loss of large numbers of street trees. Plant diverse tree species.</p> <p>Dutch elm disease — Remove and destroy infected trees to limit spread of elm bark beetles. Trees of high value may be injected with fungicides by arborists.</p> <p>Verticillium wilt — Do not plant susceptible maple into infested fields. Replace diseased shade trees with resistant species.</p>
<p>Root Rot — Plants affected with fungal root rots may be stunted, wilted, look generally unthrifty (mimic nutrient deficiency), and eventually die. Discolored decayed roots are sure symptoms of root rot diseases. Poor drainage, standing water, improperly constructed landscape beds, planting infected plants, and excessive irrigation favor phytophthora and/or pythium root rots.</p>	<p>Black root rot — Japanese holly, blue holly, inkberry, vinca, pansy, petunia</p> <p>Phytophthora root rot — Azalea, dogwood, forsythia, fir, holly, juniper pieris, rhododendron, yew</p>	<p>Sanitation and Cultural Controls — Check root health, if possible, prior to purchasing plants in containers.</p> <p>Phytophthora root rot — Avoid planting susceptible plants into heavy, poorly drained soils. Avoid soil contamination of new pots and bark media. Place container plants on gravel or ground cloth. Irrigate from water sources free of Phytophthora.</p> <p>Black Root Rot — Alkaline soil pH favors disease development. Avoid soil contamination of flats, pots and soil-less media.</p> <p>Chemical Control —</p> <p>Phytophthora root rot — Cyazofamid, etridiazole, fluopicolide, fosetyl-AI,</p>

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		mefenoxam, mono and di-potassium salts of phosphorous acid, potassium phosphite Black root rot — Thiophanate methyl, thiophanate methyl + iprodione, fludioxinil, polyoxin D,
Boxwood Blight — The two distinctive symptoms of boxwood blight are circular necrotic lesions on leaves and small black lesions on green twigs. Infected plants may defoliate.	<i>Buxus sempervirens</i> , <i>Buxus microphylla</i> , <i>Buxus sinica</i> , <i>B. sempervirens</i> ‘ <i>Suffruticosa</i> ’, most cultivated boxwood species/cultivars are susceptible to this disease, but vary in sensitivity.	Know the symptoms of boxwood blight before purchasing plants. Isolate plants for 2-4 weeks after purchase and observe for symptoms. Clean shears after clipping hedges. Chemical Control — Chlorothalonil and propiconazole will protect healthy plants, but not cure infected plants. Fungicides can be applied to suppress disease after infection, but will have to be applied often (7-14 days) and indefinitely.

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Images of many of the diseases listed in this document are archived at the Soil, Plant and Pest Center Facebook page: facebook.com/SoilPlantPestCenter

*Precautionary Statement

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