

# Identification and Management of Plant Diseases in Landscapes



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Soil, Plant and Pest Center: <http://soilplantandpest.utk.edu>

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**Disease****Host****Fungicide\***

<p><b>Powdery Mildew</b> 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, apple, azalea, begonia, columbine, crabapple, crape myrtle, dogwood, euonymus, hydrangea, lilac, magnolia, nandina, phlox, rhododendron, rose, sedum, tuliptree, zinnia</p>	<p>azoxystrobin, chlorothalonil, copper octanoate, kresoxim methyl, myclobutanil, piperalin, propiconazole, thiophanate methyl, triadimefon, trifloxystrobin, triflumizole</p>
<p><b>Downy Mildew</b> 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 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, pansy, rose, rudbeckia, salvia, snapdragon, tobacco, viburnum</p>	<p>azoxystrobin, cyazofamid, dimethomorph, fosetyl Al, potassium salt of phosphoric acid, phosphites, trifloxystrobin</p>
<p><b>Gray Mold (Botrytis Blight)</b> 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 gray-brown mold on diseased plant parts.</p>	<p>Almost any herbaceous or woody plant. Geraniums are particularly susceptible to gray mold.</p>	<p>chlorothalonil, fenhexamid, fludioxonil, iprodione, mancozeb, thiophanate methyl, triflumizole, vinclozolin</p>

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<p><b>Rust (Leaf, Stem, Needle)</b> 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 redcedar 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 hawthorne. Twig rust may cause branch dieback on plants as diverse as hawthorne and hemlock. Daylily rust was first found in the U.S. in 2000 and in TN in 2001.</p>	<p>Amelanchier, apple, aster, azalea, buckeye, 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>azyoxystrobin, chlorothalonil, flutolanil, kresoxim methyl, mancozeb, myclobutanil, propiconazole, triadimefon, trifloxystrobin, triflumizole</p>
<p><b>Virus Diseases</b> 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. Virus diseases may be difficult to diagnose unless you are familiar with symptoms associated with specific virus diseases.</p>	<p><i>Impatiens necrotic spot virus</i>- over 350 ornamental plants <i>Tomato ringspot virus</i>- dogwood, fringetree, peach, cherry <i>Rose mosaic virus</i>- rose</p>	<p>-----</p>
<p><b>Leaf Spot Diseases</b> 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; 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><i>Alternaria LS</i> -aucuba, impatien, marigold, zinnia <i>Bull’s eye LS</i> - magnolia, maple <i>Cercospora LS</i> - buckeye, crape myrtle, leucothoe, laurel, red bud, rose <i>Entomosporium LS</i> - hawthorne, pear, photinia <i>Phyllosticta LS</i> - holly, magnolia, maple, witch hazel</p>	<p>azoxystrobin, chlorothalonil, copper hydroxide, flutolanil, fludioxonil, iprodione, kresoxim methyl, mancozeb, myclobutanil, propiconazole, thiophanate methyl, triadimefon, trifloxystrobin, triflumizole</p>

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<p><b>Shot-hole Diseases</b> 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.</p>	<p>Almond, apricot, cherry, cherry-laurel, peach, plum (plants in the genus <i>Prunus</i>)</p>	<p><u>Bacterial shot hole</u> copper hydroxide</p> <p><u>Fungal shot hole</u> myclobutanil, propiconazole</p>
<p><b>Anthracnose Diseases</b> 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.</p>	<p>Ash, dogwood, euonymus, hosta, maple, oak, sycamore</p>	<p>azoxystrobin, chlorothalonil, mancozeb, myclobutanil, propiconazole, thiophanate methyl, trifloxystrobin</p>
<p><b>Needle Cast/Tip Blights</b> 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 pin 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. 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 four inches of the terminal of juniper shoots.</p>	<p><i>Cylaneusma needle cast</i> - scots pine <i>Fabrella needle blight</i> - hemlock <i>Lophodermium needle cast</i> - Eastern white pine <i>Ploioderma needle cast</i> - loblolly pine <i>Rhizosphaera needle cast</i> - spruce <i>Phomopsis blight</i> - juniper <i>Kabatina blight</i> - juniper, Leyland cypress</p>	<p>azoxystrobin, chlorothalonil, mancozeb, propiconazole, thiophanate methyl</p>

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<b>Disease</b>	<b>Host</b>	<b>Fungicide*</b>
<p><b>Canker Diseases</b> 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. The disease may be initially 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 Roseaceae 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><i>Botryosphaeria canker</i> - ash, crabapple, dogwood, juniper, Leyland cypress, red bud, maple, rhododendron <i>Endothia canker</i> - pin oak <i>Hypoxylon canker</i>-oak, other shade trees <i>Fire blight</i> - apple, cotoneaster, crabapple, hawthorne, pear, pyracantha, serviceberry <i>Nectria canker</i> - dogwood, pear <i>Phomopsis canker</i> - azalea, ash <i>Seiridium canker</i> - Leyland cypress, Arizona cypress <i>Thyronectria canker</i> - honey locust</p>	<p><u>Fire blight</u> streptomycin sulfate, during bloom</p>
<p><b>Leaf Galls</b> 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 + rhododendron leaf gall (<i>Exobasidium</i>) and peach leaf curl + oak leaf blister (<i>Taphrina</i>). Symptoms may be confused with insect galls which are more numerous.</p>	<p><i>Leaf gall</i> - Azalea, blueberry, camellia,, rhododendron <i>Leaf blister</i> - red oak, water oak, willow oak <i>Leaf curl</i>- peach, plum</p>	<p><u>Leaf blister</u> apply fungicide before bud break, chlorothalonil, mancozeb</p>
<p><b>Crown Gall</b> 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.</p>	<p>Euonymus, holly, maple, peach, plum, rhododendron, rose, willow</p>	<p>No chemical controls. Use rogueing, crop rotation, resistance.  Disinfect shears when moving from diseased plants to healthy. Prune out when canopy is dry.</p>

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<p><b>Stem/Crown Rot</b>  <b>Southern blight</b> - 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.  <b>Sclerotinia crown rot</b> - 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.  <b>Rhizoctonia stem rot/damping off</b> - 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. In propagation beds or flats, diseased plants may be killed in circular areas as the fungus moves outward.</p>	<p><b>Southern Blight</b>- Ajuga, apple, clematis, crabapple, forsythia, hosta, many annual and perennial flowers  <b>Sclerotinia Stem Rot</b> - Campanula, euonymus, several herbaceous flowers  <b>Rhizoctonia stem rot</b> - many herbaceous plants and seedlings of woody plants and conifers</p>	<p><u>Southern blight</u>  azoxystrobin,  fludioxonil  flutolanil,  fluoxinil,  PCNB,    <u>Sclerotinia crown rot</u>  thiophanate methyl    <u>Rhizoctonia diseases</u>  azoxystrobin,  fludioxonil,  iprodione,  thiophanate methyl,  trifloxystrobin,  triflumizole</p>
<p><b>Nematode Diseases</b>  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. Foliar nematodes may cause angular leaf lesions similar to downy mildew or bacterial leaf spots.</p>	<p><b>Root knot nematode</b> - Abelia, aucuba, boxwood, dogwood, gardenia, holly, hydrangea, impatien, ligustrum, nandina, photinia, rose  <b>Foliar nematode</b> - Abelia, african violet, anemone, begonia, brunnera, hosta, many perennials  <b>Lesion nematode</b> - boxwood, juniper</p>	<p><u>Foliar nematode</u>  chlorfenapyr - greenhouse use only</p>

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<p><b>Root Rot Diseases</b> 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. One of the best controls is to examine plants prior to purchase for signs of root rot. Do not purchase plants that have discolored, decayed roots.</p>	<p><b>Black root rot</b> - Jap. holly, blue holly, vinca, pansy, petunia <b>Phytophthora root rot</b> - azalea, dogwood, forsythia, fir, holly, juniper pieris, rhododendron, yew <b>Pythium root rot</b> - herbaceous ornamentals</p>	<p><b>Black Root Rot</b> fludioxonil, thiophanate methyl, triflumizole</p> <p><b>Phytophthora and Pythium root rot</b> cyazofamid, dimethomorph, etridiazole, fosetyl AI, mefenoxam, potassium salt of phosphoric acid, propamocarb phosphites</p>
<p><b>Wilt Diseases</b> 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)</p>	<p><b>Bacterial leaf scorch</b> - elm, red maple, mulberry, sycamore, pin oak, shingle oak <b>Dutch elm disease</b> - elm <b>Verticillium wilt</b> - ash, barberry, boxwood, buckeye, catalpa, daphne, elm, lilac, euonymus, smoke tree, maple</p>	<p>Fungicide injection may be used to protect high value elms from Dutch elm disease. propiconazole, thiobendazole Antibiotics: oxytetracycline has been used with limited success against BLS. Growth Regulators: mixed results against BLS</p>

\*For each fungicide, consult the pesticide label for the following information: target disease, target host, cropping system (nursery, greenhouse, commercial or residential landscape), rates, use intervals, compatibility with other pesticides, information on resistance management, mammalian toxicity and phytotoxicity, and other valuable information.

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## Floral Diseases

Disease, Symptoms	Cultural Control	Fungicide*
<p><b>Rust</b></p> <p><u>Symptoms:</u> On geranium, reddish-brown pustules appear in concentric rings on underside of plant. On fuchsia, red leaf spots appear with yellow-orange pustules. On snapdragon, reddish-brown pustules form on underside of leaves.</p>	<p>Discard infected plants. Keep leaves dry.</p>	<p>azoxystrobin, kresoxim methyl, mancozeb, myclobutanil, oxycarboxin, propiconazole, triadimefon, trifloxystrobin</p>
<p><b>Botrytis Blight (Gray Mold)</b></p> <p><u>Symptoms:</u> Grayish mold visible on above ground plant parts. Old leaves, injured leaves and stems are particularly susceptible.</p>	<p>To reduce relative humidity: vent greenhouse at dusk to bring in cooler, drier air and heat. Use horizontal air flow fans especially at night and on overcast days. Irrigate by drip or bottom water. Space plants to improve air circulation and reduce senescence of lower leaves. Remove dead and dying leaves daily and place in a garbage can with a lid.</p>	<p>azoxystrobin, chlorothalonil, fenhexamid, fludioxonil, mancozeb, iprodione, thiophanate, trifloxystrobin, vinclozolin</p>
<p><b>Powdery Mildew</b></p> <p><u>Symptoms:</u> White, powdery fungal growth on leaves, stems, flower buds and/or petals. New growth may be stunted, distorted.</p>	<p>See control measures listed under Botrytis blight.</p>	<p>azoxystrobin, kresoxim methyl, myclobutanil, piperalin, thiophanate methyl, triadimefon, trifloxystrobin, triflumizole</p>
<p><b>Pythium Root Rot</b></p> <p><u>Symptoms:</u> Roots are decayed and discolored. Plants may wilt even though soil moisture is adequate.</p>	<p>Use soil-less growing mixes, that drain well. Do not overwater. Sanitation is important; use clean pots, flats and tools.</p>	<p>etr Diazole, fosetyl AI, mefenoxam, potassium salt of phosphoric acid, propamocarb</p>
<p><b>Black Root Rot</b></p> <p><u>Symptoms:</u> Infected plants are often chlorotic and stunted.</p>	<p>Reduce stress during hot weather. Sanitation is important; use clean pots, flats and tools.</p>	<p>fludioxonil, thiophanate methyl, triflumizole</p>

Disease, Symptoms	Cultural Control	Fungicide*
<p><b>Rhizoctonia Stem Rot &amp; Damping Off</b></p> <p><u>Symptoms for Stem Rot:</u> Distinct lesions form on stem at soil line. Young plants may be killed; older plants may be stunted.</p> <p><u>Symptoms for Damping Off:</u> Young seedlings are attacked at soil line and fall over. Circular areas of dead plants develop in flats.</p>	<p>Use a soil-less mix. Use clean pots, flats, and tools.</p>	<p>azoxystrobin, fludioxonil, flutolanil, iprodione, PCNB, thiophanate methyl, triflumizole, trifloxystrobin</p>
<p><b>Leaf Spot Diseases</b> (Alternaria, anthracnose, black spot, Cercospora, Myrothecium leaf spot and blight) Purple, brown to black leaf spots on foliage. Check plugs closely for signs of disease. Buy only disease free plants. Leaf spot diseases can be difficult to control.</p>	<p>Keep foliage as dry as possible. Irrigate with drip irrigation. Discard heavily infected plants.</p>	<p>azoxystrobin, chlorothalonil, fludioxonil, iprodione, kresoxim-methyl mancozeb, myclobutanil, thiophanate methyl</p>
<p><b>Downy Mildew</b> May be found on snapdragon, pansy and rose. Damage may appear as leaf spots with fungal growth under infected leaves.</p>	<p>Vent cool, humid air. Use fans to keep air moving and foliage dry. Destroy heavily infected plants.</p>	<p>azoxystrobin, dimethomorph, fosetyl AI, kresoxim methyl, potassium salt of phosphoric acid, trifloxystrobin</p>
<p><b>Foliar Nematode</b> Water soaked lesions on shade loving perennials such as hosta and anemone; also on African violet and begonia. May cause distorted growth.</p>	<p>Propagate only nematode free plants. Sanitation is important. Prevent splashing water.</p>	<p>chlorfenapyr</p>
<p><b>Disinfectants</b> Use to disinfect inanimate objects such as pots, flats, benches, walkways etc.</p>	<p>Preclean all surfaces prior to disinfection</p>	<p>Quaternary ammonium chloride disinfectants.</p>
		<p>Hydrogen dioxide (peroxide) disinfectant.</p>

\*For each disease, consult the pesticide label for the following information: target disease, target host, cropping system (nursery, greenhouse, commercial or residential landscape), rates, use intervals, compatibility with other pesticides, information on resistance management, mammalian toxicity and phytotoxicity, and other valuable information.

## Crop Rotation Guidelines for Bedding Plants/Landscape Beds

One method of managing bedding plant diseases is crop rotation. If you have experienced chronic problems with one of the following diseases in a landscape bed, choose a host that is resistant (**R**) or only slightly susceptible (**SS**).

Host	Phytophthora Crown Rot	Rhizoctonia Stem Rot	Black Root Rot	Botrytis (gray mold)	Pythium Root Rot	Root Knot Nematode	Powdery Mildew
Vinca*	<b>HS</b>	<b>SS</b>	<b>S</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>
Impatiens	<b>SS</b>	<b>HS</b>	<b>R</b>	<b>R</b>	<b>S</b>	<b>HS</b>	<b>R</b>
Begonia	<b>SS</b>	<b>S</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>HS</b>	<b>S</b>
Salvia	<b>HS</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>
Petunia	<b>S</b>	<b>S</b>	<b>S</b>	<b>HS</b>	<b>S</b>	<b>SS</b>	<b>R</b>
Coleus	<b>S</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>S</b>	<b>HS</b>	<b>R</b>
Pansy	<b>HS</b>	<b>R</b>	<b>HS</b>	<b>S</b>	<b>R</b>	<b>S</b>	<b>R</b>
Marigold	<b>R</b>	<b>R</b>	<b>R</b>	<b>HS</b>	<b>R</b>	<b>R</b>	<b>R</b>
Snapdragon	<b>HS</b>	<b>S</b>	<b>R</b>	<b>S</b>	<b>S</b>	<b>HS</b>	<b>S</b>
Geranium	<b>S</b>	<b>R</b>	<b>R</b>	<b>HS</b>	<b>HS</b>	<b>?</b>	<b>R</b>
Zinnia**	<b>R</b>	<b>S</b>	<b>R</b>	<b>SS</b>	<b>R</b>	<b>R</b>	<b>S</b>

\*Vinca (Madagascar periwinkle) is very susceptible to foliar phytophthora blight.

\*\**Zinnia linearis* is resistant to powdery mildew. The 'Profusion' series of zinnia is also resistant to powdery mildew.

**HS** = Highly susceptible, control measures needed; **S** = Susceptible, some damage when conditions are very favorable for disease, generally little damage; **SS** = slightly susceptible, rarely causes damage; **R** = resistant

\*\*\*The information in this table was supplied by Dr. R. K. Jones, Professor Emeritus, Plant Pathology, North Carolina State University.