

Broadleaf Tree Disease, Disorder, Insect and Mite Treatment Options – 2021

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Any management options, including those identifying specific active ingredients, are for the convenience of the reader. The bolded active ingredients mentioned in this publication are those that are most commonly available in pesticides used in South Dakota for Turf & Ornamentals and the inclusion of an active ingredient shall not be taken as an endorsement or the exclusion of one labeled for use a criticism regarding effectiveness. Please read and follow all label instructions and the label is the final authority for a product's use on a pest or plant. Not all active ingredients listed are in forms available to the public and some may require a commercial pesticide license. It is the reader's responsibility to determine if they can legally apply any product identified in this publication.

Broadleaf Diseases and Disorders

Name	Species	Symptoms	Management
<p>Ash, maple, oak, and walnut anthracnose diseases are caused by related fungal species. Ash (<i>Plagiostoma fraxini</i>), maple (<i>Discula</i>), oak (<i>Apiognomonina quercina</i>) and walnut (<i>Ophiognomonina leptostyla</i>).</p> <p>Sycamore anthracnose (<i>Apiognomonina veneta</i>) occurs wherever this tree is found in the state.</p>	<p>Green ash and white ash; silver and sugar maple; bur oak; black walnut.</p> <p>Occurs in eastern SD, mostly southeast.</p> <p>Sycamore anthracnose occurs wherever sycamores are planted.</p>	<p>Large, irregular, tan to brown lesions form on leaves, especially along the leaf margins, leaf may become distorted. Fungus can survive winter in branch cankers and fallen leaves.</p> <p>Oak and sycamore anthracnose can result in twig blight and in severe cases, branch dieback.</p>	<p>No treatment is required unless the tree experienced more than 25% defoliation the previous year Chlorothalonil or myclobutanil may be used with the first treatment at bud swell and two more treatments spaced 7-14 days apart.</p> <p>Sycamore can be treated with a trunk injection of propiconazole or thiabendazole.</p>
<p>Apple scab – <i>Venturia inaequalis</i>, a fungus.</p>	<p>Apple and crabapple.</p> <p>Occurs throughout the state.</p>	<p>Dull, olive-green, velvety spots on leaves, that change to irregular brown blotches.</p> <p>Symptoms may also occur on petals and fruit.</p>	<p>Planting resistant cultivars is the best means of management.</p> <p>Treat with an application of captan, chlorothalonil, myclobutanil or propiconazole or trifloxystrobin every 7 to 14 days beginning as the leaf buds swell and continuing until three weeks after the petals fall or dry weather prevails (about 5 applications).</p> <p>If using a myclobutanil fungicide, alternate with Captan to delay occurrence of resistant variants of apple scab.</p> <p>Note: these treatment options are for crabapples that will not be used for fruit production.</p>

Name	Species	Symptoms	Management
Ash rust - <i>Puccinia sparganioides</i> , a fungus.	Black, green and white ash. Occurs mostly in eastern SD.	Begins as bright orange spots on petioles and undersurface of leaves. These enlarge with the leaves turning brown and dropping by early summer.	Myclobutanil or trifloxystrobin may be used beginning at bud break and repeated 3 times at a 10-14 days interval. However, most trees can tolerate light defoliation from this disease.
Ash yellows – <i>Candidatus Phytoplasma fraxini</i> , a phytoplasma.	Green ash is intermediate in tolerance, black ash is the least susceptible, white ash the most susceptible. Japanese tree lilac is also susceptible.	Witches' broom form on the trunk and major limbs. Leaves on broom tend to be small, simple and chlorotic. Reduced growth may be the only symptoms on green or black ash. White ash infected with ash yellows may experience dieback.	Maintain proper soil fertility and moisture. Symptoms may be confused with those of an emerald ash borer infestation.
Bacterial blight of lilac – <i>Pseudomonas syringae</i> pv <i>syringae</i> , a bacterium.	Occurs on all white flower lilacs. Mostly occurs on common lilac and Japanese tree lilac. Also occurs on Amur maple.	The disease begins with brown spots on the developing leaves and shoots in the spring. A yellow halo may appear around the spots. The leaf spots enlarge and turn black. Infected shoots will turn black and the tips curl. Disease symptoms can be confused with phytophthora, a sample is required to positively identify the pathogen.	Prune out dead shoots during the winter. Infected plants can be treated with a copper fungicide or mancozeb (these have some effectiveness against bacteria) applied just before bud break. An oxytetracycline product can be injected for control of the disease.
Black knot – <i>Apodosporina morbosum</i> – a fungus.	Plums and cherries. The disease is most common on the purple leaf cultivar of common chokecherry and the European mayday tree. Occurs throughout the state.	First year symptoms include faint light green swellings on shoots. The following spring these have enlarged and turned large velvety black masses.	Remove all knots by April 1 and burn them. However, this will only remove the 2nd year knots, the 1st year infection appear only as a slight swelling on the shoots and are easily missed. Since trees with “knots” will continue to produce them, it is generally best to remove heavily infected trees. Treat with chlorothalonil or mancozeb as flower buds begin to open and repeat 10-14 days later. Note: these treatment options are for cherries and plums that will not be used for fruit production.

Name	Species	Symptoms	Management
Black spot of elm – <i>Gnomonia ulmea</i> , formerly <i>Stegophora</i> , a fungus.	American elm. Occurs in the eastern half of the state.	Yellow spots begin forming as the leaves expand in the spring. A black dot forms in the center. Heavily infected leaves may fall prematurely. The appearance of yellowing and wilting leaves is sometimes confused with Dutch elm disease, however, usually black spot will affect the entire canopy and Dutch elm disease usually begins with only portions of the canopy flagging.	No treatments are necessary as elm trees can withstand light defoliation; however, chlorothalonil may be used at leaf flush and repeated 10 days later if tree had more than 25% defoliation the previous year.
Bur oak blight – <i>Tubakia iowensis</i> , a fungus.	Occurs only on a single subspecies of bur oak, <i>Quercus macrocarpa</i> var <i>oliviformis</i> , which is found only in South Dakota east of Hwy 81.	Foliage symptoms appear in early August with infected leaves developing purple-brown lesions along the midvein. Large wedge-shaped areas of chlorosis develop on these leaves by early fall. The affected leaves wilt and often remain attached until spring. The disease intensifies each year and trees may die after repeated infection.	Propiconazole as root flare injections can be performed on trees in late spring after the leaves fully open but before symptoms appear. Injections may provide two years of protection. Use as a therapeutic treatment as not all bur oaks are susceptible.
Cedar-apple rust – <i>Gymnosporangium juniperi-virginianae</i> , a fungus.	Apple and crabapple, a closely related disease infects hawthorns. Occurs throughout the state.	Yellow to orange spots appear on leaves in late spring. On the upper leaf surface tiny pustules form in the spot while on the lower surface small lesions with ribbon-like strands develop. Infected leaves may fall by late summer. Most infections occur within 300 feet of junipers – the alternate host. The most common alternate hosts are the eastern redcedar and Rocky Mountain juniper.	Chlorothalonil, mancozeb, myclobutanil, or trifloxystrobin (noted repeated use of myclobutanil can cause resistance) can be applied as flower buds are opening and repeat at 7-10 days intervals until 2 weeks after petal fall. Captan , a common fungicide for apple scab is NOT effective against cedar-apple rust.
Dutch elm disease (DED) – <i>Ophiostoma novo-ulmi</i> , a fungus.	American elm, red (slippery) elm, and Scots elm are the most susceptible. Occurs throughout the state.	Leaves wilt, turn yellow, and then brown. Affected leaves may remain on branches for some time before falling. The disease may be confused with black spot, a leaf disease, or verticillium wilt, a vascular disease. Always confirm DED by checking a symptomatic twig for the characteristic discoloration and streaking beneath the bark.	Propiconazole or thiabendazole as root flare injections may be used on American elms during the summer. These treatments are best used as a preventative measure. They will only protect trees from beetle vectored infection not those spread via root graft. Infected trees should be promptly removed and a trench cut between the infected trees and nearby (within 40 to 50 feet) healthy elms to prevent the spread of the disease.

Name	Species	Symptoms	Management
Fire blight – <i>Erwinia amylovora</i> , a bacterium.	Primarily apple, crabapple, mountainash and pear. Cotoneaster also very susceptible. Occurs throughout the state.	Infected flowers appear water-soaked, droop and eventually turn black. The disease moves from the flower spurs into the shoots. Leaves quickly wilt and turn black but remain attached to infected twigs. Affected branches appear water-soaked, then shrivel and turn brownish to black.	Infected wood should be pruned at least 12 inches below visible symptoms, treat pruning tools with disinfectant between cuts. Copper fungicides or mancozeb may be used beginning as flowers open and repeat every 5 days till petal fall. Note: copper will injury foliage if applied after the leaf buds begin to open. An oxytetracycline product can be trunk injected in early spring as buds open. This cannot be used on trees where the fruit will be harvested.
Marssonina leaf spot and blight – <i>Marssonina</i> , different species of fungi in this genus affect different tree species.	Cottonwood is the most common host but may also occur on balsam poplar and quaking aspen. Occurs throughout the state.	Dark brown fleck with yellow halos appear on the leaves in late spring, The flecks enlarge and coalesce to form angular gray to black blotches and the infected leaves turn bronze before dropping prematurely. The disease progresses from the base to the top of the tree.	Chlorothalonil or thiophanate-methyl may be used as the buds open and repeated two more times about 2 weeks apart. Treatment not necessary unless the tree has been experienced more than 25% defoliation the previous 2 years.
Oak wilt – <i>Ceratocystis fagacearum</i> , a fungus.	Affects all oaks but fatal to members of the red oak group such as northern red oak and pin oak. Members of the white oak group, bur and swamp white oak, may survive the disease. The disease is not common in South Dakota.	Wilt is often first noted near the top of the tree with the leaves turning a dull green or bronze, usually beginning along the margins. Leaves may also droop and usually begin to fall by mid-summer. Red oak group member may die within 6 weeks of the first symptoms, while members of the white oak group may have the symptoms limited to only a portion of the canopy. Bur oaks, particularly those on modified sites, such as native stands now in mowed areas, are susceptible to the disease and may die after becoming infected.	Removal of dead or dying oaks is an important means of managing the disease. The disease is spread via root grafts so infected trees should be promptly removed and a trench cut between the infected trees and nearby (within 40 to 50 feet) healthy oaks to prevent the spread of the disease. Propiconazole injection may be used on newly infected bur oak but should not be done until the disease has been positively identified.
Plum pockets – <i>Taphrina communis</i> , a fungus.	American plums. Occurs throughout the state.	The disease affects the fruit. The disease begins as a blister on the developing fruit. Eventually the infected fruit become swollen, spongy and hollow.	Copper as a single application just as the buds open. This will reduce, but not eliminate diseased fruit.
Tar spot – <i>Rhytisma acerinum</i> . - a fungus.	Maples, particularly silver maple. Occurs in eastern SD.	After leaves attain full size, yellowish spots appear. These spots become raised, black, and tarlike by midseason.	Treatment not usually necessary. However, mancozeb applied at bud-break and repeated 2 more times 3 weeks apart may reduce damage.

Name	Species	Symptoms	Management
Venturia leaf and shoot blight – <i>Venturia macularis</i> , a fungus.	Quaking aspen but can infect other poplars. Most common in the Black Hills, but occurs throughout the state.	Infected leaves develop irregular brown and black irregular spots. Infected shoots become black and brittle. These shoots curl at the tips forming a shepherd's crook.	No fungicides are currently labelled for control of the disease. The disease is not fatal and is usually limited to trees less than 15 feet tall.
Verticillium wilt – <i>Verticillium dahliae</i> , a fungus	Ash, catalpa, elm, maple, and smokebush. Found entire state.	Foliage on one side of the canopy becomes light green to chlorotic and yellow by midsummer. The sapwood is streaked light green to black except in ash.	Maintain soil fertility and moisture. Prune out infected branches but this will not eliminate the infection as it is soil-borne.
Wetwood - a diverse group of bacteria that includes <i>Methanobacter</i> , <i>Enterobacter</i> and <i>Klebsiella</i>	Elms and cottonwood. Occurs throughout the state.	Light streaks running down the bark, generally originating with pruning wounds. Infected trees will emit a fetid odor and liquid when cut.	Wetwood does little injury to the tree; in fact, the alkaline condition retards the development of decay. Inserting a pipe to drain the liquid causes more injury.
Winter injury	All deciduous trees.	Twig or branch dieback usually to a defined line. The buds may fail to expand with growth delayed until after new buds form.	Remove dead and dying branches. Reduce winter injury by maintaining plant health with watering in late summer/early fall.

Broadleaf Insects and Mites

Name	Species	Symptoms	Management
Ash (lilac) borer – <i>Podosesia syringae</i>	Ash and lilac. Occurs throughout the state.	Early symptoms are yellowing foliage, wilting of terminal twigs and branch dieback. Infested trees have pencil-size holes on lower trunk with sawdust at the base of the trunk.	Bifenthrin , chlorantraniliprole , or permethrin applied to the trunk 10 days after the first sustained male catch in traps or approximately a week after Vanhouttee spireas begin to bloom (early to mid-May), repeat in 3 weeks.
Ash flower gall mite - <i>Eriophye fraxiniflora</i> , a mite	Male lack and green ash. Occurs throughout the state.	Infested male flower clusters become branched and turn black as they dry.	No treatments are necessary as the mites do not harm the tree, however, dormant oil bark spray just before bud break may provide some control.
Ash plant bug – <i>Tropidosteptes anmoenus</i>	Primarily green ash, other ashes are susceptible. Occurs throughout the state.	Light to moderate feeding causes yellow stippling and spotting of brown leaves. Excessive feeding may cause leaves to curl and drop prematurely.	Treat with acephate or imidacloprid applied as a soil drench in spring as the leaves open to reduce populations. Carbaryl may be applied on the foliage when insects are first noticed.
Bronze birch borer - <i>Agrilus anxius</i>	European and Japanese white birch are susceptible. Paper birch are infested only when stressed. Bronze birch borer does not attack river birch.	Dieback beginning generally at the top of the tree. Dying branches may have bumps and D-shaped holes. Trees that have more than 25% crown dieback are generally beyond treating.	Treat trunk with bidrin , bifenthrin or permethrin when buckeyes begin to bloom (early June). Emamectin benzoate may be injected in the lower trunk during spring. Imidacloprid can also be used as a soil drench in the fall to kill newly hatched larvae the following year.

Name	Species	Symptoms	Management
Cankerworms – Spring, <i>Paleacrita vernata</i> and Fall, <i>Alsophila pometaria</i>	Preferred hosts include crabapple, elm and hackberry. Occurs throughout the state.	Larvae feed during the spring (for spring and fall cankerworm) on the softer tissue of the leaves, leaving the main veins. They often appear just as the leaves have fully opened.	Use sticky bands on tree trunk in April-May (Spring cankerworm) or October (Fall cankerworm) to keep female adults from crawling up trunk to lay eggs. Treat with carbaryl , permethrin or Spinosad when leaves have fully expanded, and the larvae are beginning to feed. Acephate may be used as soil drench as the leaves open.
Cottony maple scale – <i>Pulvinaria innumerabilis</i> , a soft scale.	Maples, and lindens are most common hosts. Occurs throughout the state.	The scale overwinters as immature females on twigs. Eggs are laid in the spring beneath the adult scale. After the eggs hatch the young crawlers migrate to the leaves and begin feeding.	Dormant oil can be used just before bud break to kill the overwintering females (note: do not use oils or soaps on maples , it may result in twig and branch dieback). Treat with dinotefuran or insecticidal soap when little leaf linden is in full bloom (mid-June) and 10 days later.
Cottonwood borer - <i>Plectrodera scalator</i>	Cottonwood and poplars. Occurs throughout the state.	Mature larvae are cream-colored and about 1.5 inches long. They are found in the sapwood near the base of the tree and in the roots during summer. Young infested cottonwoods often snap off near the base.	Treat trunks with permethrin in the mid-May as the adult borers are emerging.
Cottonwood leaf beetle - <i>Chrysomela scripta</i>	Cottonwood. Occurs throughout the state.	The mature larvae (blackish with two white spots) skeletonize the leaves and may be found along with the adults during the summer.	Treat canopy with azadirachtin or carbaryl if high populations of larvae are detected.
Cottonwood petiole gall aphids - <i>Pemphigus</i>	Cottonwood. Occurs statewide.	Galls form on the petioles, leaves drop prematurely. The inside of the galls contain clusters of small, light-colored aphids.	Treat with a horticultural oil just before buds open, however treatment is usually not necessary.
Eastern tent caterpillar – <i>Malacosoma americanum</i> , Forest tent caterpillar – <i>Malacosoma disstria</i> and Western (Prairie) tent caterpillar – <i>Malacosoma californicum</i>	Chokecherry, ash, and many other hardwoods. Eastern and Forest tent caterpillars occur in eastern SD while Western tent caterpillar is found in central and western SD.	Eastern tent caterpillar is pale blue with continuous white markings along the side of the body, while western tent caterpillar is also pale blue but with interrupted white lines. The forest tent caterpillar is pale blue and has keyhole shaped markings on the back. All three form nests at the crotches of branches in early summer but the forest tent caterpillar nests are very open.	When nests first appear treat canopy with azadirachtin , carbaryl , malathion , permethrin or Spinosad . Do not spray chokecherry tree in bloom as this will kill pollinators. Acephate may be used as a soil treatment. Apply in the spring after the leaves begin to open.

Name	Species	Symptoms	Management
Elm leaf beetle – <i>Xanthogaleruca luteola</i>	Primarily Siberian elm and hybrid elms that have Siberian elm as one of their crosses. American elm is also susceptible but generally have less damage. Occurs throughout the state.	Feeding results in perforations of the leaf surface, leaving an extensive lacy network of veins that were not consumed by beetles.	Treat with azadirachtin , acephate , carbaryl , or permethrin when the leaves are fully expanded. The first generation of leaf beetles causes most of the damage. Dinotefuran or imidacloprid as a soil drench may provide two seasons of protection but must be applied at least 60 days before feeding begins.
Emerald ash borer - <i>Agrilus plannipennis</i>	This is a fatal threat to all ash in our state. The insect only attacks ash and will NOT attack mountainash or ash-leaf maple (Boxelder). Currently (2020), the insect has been confirmed in Lincoln and Minnehaha Counties.	The symptoms of an infestation are 1) a general decline and thinning of the canopy, 2) extensive woodpecker blanding and drill holes on the upper branches, 3) excessive watersprouts and suckers on the tree and 4) vertical splits on the bark of small diameter (less than 6 inches) trees.	Treatment is not recommended until the insect has been detected within 15 miles. The most effective treatments are injections with emamectin benzoate , or imidacloprid (2 years of control). Trunks may be sprayed with dinotefuran (annual) or a soil injection of either dinotefuran or imidacloprid (annually). The imidacloprid available to the public for a soil drench is only effective on 5 inch diameter or smaller trees (annually).
European elm flea weevil – <i>Orchestes alni</i>	Elms, particularly Siberian elm and hybrid elms that have Siberian elm as one of their crosses. Found throughout the entire state and has displaced the elm leaf beetle.	The adult weevils are about 1/16th inch long with a long snout. They are reddish brown with black spots on their wing covers. They chew holes in the leaves in early summer. Eggs are laid at the leaf tip and the larvae mine the foliage (feeding within the leaf). The mining results in blotches and infested leaves drop prematurely. The adults are the overwintering stage.	Spray the foliage with acephate or carbaryl in late May as the adults begin to feed. This can be repeated in late June to kill the female adults as they are laying eggs. Acephate , dinotefuran and imidacloprid as a soil drench applied in early spring is also effective.
Fall webworm – <i>Hyphantria cunea</i>	Elms, walnuts, chokecherry and other hardwoods.	Pale yellow larvae form nests at the tips of branches in mid to late summer.	When nests first appear spray foliage with acephate , azadirachtin , carbaryl , or Spinosad .
Hackberry nipplegall - <i>Pachypsylla celtidismamma</i>	Hackberry. Occurs throughout the state.	The leaves develop light green nipple-shaped galls on the underside of leaves. The small biting flies that occur in late September are the adults. These are small enough to pass through screens so will often enter homes as the weather cools.	No treatment is necessary as the galls do not harm the trees.

Name	Species	Symptoms	Management
Honeylocust pod gall midge - <i>Dasineura gleditschiae</i>	Honeylocust. Occurs throughout the state.	Injured leaflets form a pod around the midge larvae. These pods eventually turn brown and fall. Look for clusters of red eggs on the newly expanded leaves (can be seen with a 10x len).	Treat with carbaryl or Spinosad just as soon as the bud begins to expand (about the time Serviceberry is in bloom). Repeat treatment every 10 to 14 days till early summer. May also use horticultural oil to kill the first generation, treat a buds expand.
Japanese beetle – <i>Popillia japonica</i>	Mostly a lawn pest, but can also severely defoliate horsechestnut, lindens, mountainash, Norway maple and roses. Common in the southern half of the state.	The adults are about 3/8-inch long with a dark metallic head and dark tan wing covers. There will be two white rear tufts and five white lateral tufts of hairs. The adults emerge in July and defoliate trees by chewing leaf tissue between the veins. This skeletonizing of the foliage gives a lacy appearance to the tree. The larvae feed in the soil on grass roots.	Treatment of the adult stage is a spray of acephate , azadirachtin , carbaryl , or permethrin when adults are first observed. Acephate , dinotefuran and imidacloprid may be used but are ineffective on roses when the beetles are feeding on the petals and may kill bees and other pollinators foraging the flowers of the host.
Lecanium scale - <i>Parthenolecanium</i> , a soft scale	Most hardwoods including ash, elm and maples. Occurs throughout the state.	The scale appears as a hardened brown shell that is tightly attached to the bark. Leaves may become sticky and discolored with heavy feeding.	The crawlers become active in late spring (when lindens are in bloom). Treat with insecticidal soap at that time. Insecticidal soap is the best treatment as it does not injure the scale's natural enemies. Imidacloprid can be used as a soil drench in the fall to control the insects the following year.
Maple bladder gall mite – <i>Vasates quadripedes</i> , a mite	Primarily silver maple but can also occur on sugar. Found statewide.	Mites move from bark scales to unfolding leaves in early spring. The feeding on the underside of the leaves results in galls on the upper side that begin as green bumps that become red and black with time. They cause little harm to the tree.	Most treatments are ineffective as timing is difficult and some insecticides can make the problem even worse.
Oystershell scale – <i>Lepidosaphes ulmi</i> , an armored scale	Ash, maple, lilac, and cotoneaster are common hosts. Found throughout the state.	Scales overwinter as eggs. The eggs hatch in the spring and the crawlers move onto the branches and twigs to begin feeding.	Apply horticultural oil when the crawlers begin to move, about the time lilac flowers begin to fade (late May). An insect growth regulator Pyriproxyfen can be sprayed at this time. Dinotefuran can be applied as a soil treatment earlier in the spring.
Pear slug (sawfly) – <i>Caliroa cerasi</i>	Plum, cherry, cotoneaster and mountain-ash. Occurs throughout the state.	Slug-like larvae can be found feeding on the upper leaf surface between the veins.	Treat leaves with azadirachtin or carbaryl when damage is first noticed, about the end of June.

Name	Species	Symptoms	Management
Two-lined chestnut borer - <i>Agrilus bilineatus</i>	Bur oak throughout the state.	Dieback beginning generally at the top of the tree. Dead branches and trunks may have D-shaped holes. Trees that have more than 25% crown dieback are beyond treatment and should be removed.	Treat trees with bifenthrin or permethrin in mid-May. Imidacloprid can also be applied as a soil drench in the fall for control the following summer.
Rabbit and deer damage.	All plants, but members of the rose family are very susceptible.	Twig and branches eaten or girdled. If more than 2/3s of the stem is girdled the plant is not likely to survive.	The most effective deer repellants contain putrescent egg solids but may not work if the deer population is high. Egg solids or blood meal products are used as rabbit repellants with some success.

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