Plant Clinic REPORT
Diagnosis and management recommendations
DISEASES • INSECTS • WEEDS

UNIVERSITY OF ILLINOIS EXTENSION

Oak Problems

Oaks provide some of the most beautiful and valuable tree specimens to our forests and landscapes. Wood from oak species is used in a variety of ways including construction, interior finishing, furniture, cooperage and firewood. Their acorns are an important food source to numerous birds and mammals. In terms of diversity, oaks contribute 55 native species to the United States with 21 native to Illinois. Many native and non-native oak species have successfully been used in the landscape, and offer shade, excellent fall color and picturesque shapes.

Red oak group 1st and 2nd year acorn
Dr. Gary Kling, University of Illinois

A plant's overall attributes vary depending upon the species, cultivar and location. Some species, such as the Dwarf Chinkapin oak, can be classified as a shrub, while others produce medium to large trees. The more common oak species, grown within the home landscape in the Midwest, range from 40 to 80 feet tall. The largest recorded Red oak in Illinois was taller than 150 feet. Oaks can also be long lived trees. Specimens of White oak, the state tree of Illinois, have been known to live for more than 200 years. They have often been characterized as a slow growing species, typically growing less than 1 foot per year.

White oak winter habit
Dr. Gary Kling, University of Illinois

Quercus spp. Native to Illinois

Red Oak Group

Q. coccinea	Scarlet oak
Q. ellipsoidalis	Northern Pin oak
Q. falcata	Southern Red oak
Q. imbricaria	Shingle oak
Q. marilandica	Blackjack oak
Q. nuttallii	Nuttall oak
Q. pagoda	Cherrybark oak
Q. palustris	Pin oak
Q. phellos	Willow oak
Q. rubra	Northern Red oak
Q. shumardii	Shumard oak
Q. velutina	Black oak

White Oak Group

Q. alba	White oak
Q. bicolor	Swamp White oak
Q. lyrata	Overcup oak
Q. macrocarpa	Bur oak
Q. michauxii	Swamp Chestnut oak
Q. montana	Chestnut oak
Q. muehlenbergii	Chinkapin oak
Q. prinoides	Dwarf Chinkapin oak
Q. stellata	Post oak

Red oak group leaf example
Dr. Gary Kling, University of Illinois

White oak group leaf example
Dr. Gary Kling, University of Illinois

Oak species can be categorized into two groups: Red and White. The White oak group contains trees with smooth lobed leaves that lack bristly tips and produce acorns that mature in one growing season. The Red oak group has leaves with bristles at the tips of lobes and produce acorns that mature over two growing seasons. The difference between the two groups is important when understanding the susceptibility of individual oak species to diseases such as oak wilt.

Many oak species that we use within the landscape are native. Unfortunately, native does not translate to problem-free. Oaks are vulnerable to a number of insects, pathogens and abiotic problems. Construction near trees can cause damage to roots, as well as cause indirect damage by compacting soils, changing site grades and damaging soil communities of mycorrhizal organisms. Topsoil may be absent,

poisoned by salts or petrochemicals, or degraded by the removal of organic matter. Damage to roots also opens the tree to potential infection by a number of root and trunk rotting fungi, including species of *Armillaria* and *Inonotus dryadeus.*

Cultural Practices and Plant Health

The environmental conditions and cultural practices we provide to trees influence their health and longevity. Priority should first be given to selecting an adequate planting location or plant for a chosen site. Problems arise when trees are planted in locations where the species is not well adapted. For instance, oak trees require full-sun and will grow poorly when planted in shade. Soil preferences vary widely depending upon the oak species. Some oaks will tolerate wet soils, e.g. Swamp White oak, while others prefer well-drained soils and can tolerate drought, e.g. Red oak. Some species, such as the Pin oak, are intolerant of alkaline soils and will develop chlorosis in soils with pH above 6.5. Prior to purchasing and planting an oak species, research the site conditions as well as the cultural requirements. Time spent researching helps ensure the right tree is selected for the right place and helps to avoid future problems.

Purchasing, Planting, and Maintenance

When purchasing plants, one should select healthy, pest free trees that have been grown by a reputable nursery. Inspect the plant from the canopy to the roots. Avoid trees with physical injuries, especially to the trunk. Trees with insects or diseases should also be avoided. Select trees with sufficiently developed root systems with healthy or creamy white colored root tips.

If the tree is not planted properly (incorrect depth, burlap exposed, excessive mulch) or not watered properly (one inch of water per week until established), it may never thrive. Mistakes made during planting are next to impossible to correct later. The International Society of Arboriculture published a fact sheet with nine steps to follow when planting new trees. It can be accessed using the following web link: **www.treesaregood.com/treecare/resources/New_TreePlanting.pdf**

Eventually an oak tree may need to be pruned. Pruning should address structural issues within the canopy or removal of unwanted branches and dead wood. Pruning should be scheduled to avoid the spread of diseases. For example oak wilt infection can be reduced by avoiding pruning early in the growing season during heavy sap flow. Pruning should be scheduled for the dormant season or at least, late in the summer. Unfortunately, trees may be damaged at any time of the year by a storm. The best course of action is to make sure that the damaged portions are properly removed. Homeowners should contract a Certified Arborist to prune or clean up trees with significant storm damage; visit **www.treesaregood.com** to search for a Certified Arborist in your area. Before hiring, ask the arborist to provide proof of insurance. Certified Arborists are recognized by the International Society of Arboriculture and have passed an exam on proper tree maintenance and management practices.

Red oak with girdled roots
Nancy Pataky, University of Illinois

Iron Chlorosis

Chlorosis is the yellowing of normally green leaf tissues due to chlorophyll destruction or lack of chlorophyll production. In most cases, chlorosis is the result of a nutrient deficiency caused either by a lack of available nutrients or the inability of the plant to uptake the nutrients. Pin oak and Northern Pin oak are prone to a chlorosis caused by an iron deficiency. Iron chlorosis develops in high pH soils. Affected trees are commonly found near sidewalks and driveways constructed with limestone bases. Cultural and environmental growing conditions can also influence iron deficiency and chlorosis. Compacted soils, poor drainage, root damage and drought all create an environment unfavorable for root growth.

Symptoms of iron chlorosis may appear as light green to yellow-green or in severe cases bright yellow leaves. Close inspection of the leaves may show yellowing along the leaf margin and between the leaf veins, while the leaf veins remain a normal green color. Affected leaves may be stunted and/or have browning margins. Since iron is relatively immobile within plants, chlorosis appears on the youngest shoots first.

A soil test can identify the soil's pH or if adequate nutrients are present. Avoid planting susceptible species in high pH soils. Correct poor soil drainage and

Iron chlorosis canopy
Travis Cleveland, University of Illinois Plant Clinic

Chlorosis of oak
University of Illinois Plant Clinic

Iron chlorosis leaf symptoms of Pin oak
Travis Cleveland, University of Illinois Plant Clinic

alleviate any compaction. Avoid overwatering. Fertilize the tree with chelates or an available form of iron. Several fertilizer application options are available. The iron may be sprayed onto the foliage, injected into the trunk or added to the soil. Foliar fertilization provides temporary results and will need to be reapplied as new leaves develop. Trunk injections can last several years, but may injure the tree's trunk. Soil injections are labor intensive, but get to the root of the problem, and results can last several years.

Herbicide Injury

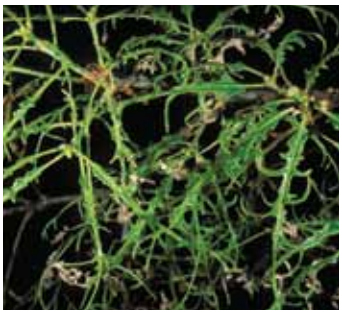
Herbicide drift or misapplication can be a problem, particularly in oaks planted close to farm fields or treated turf. Oaks have been found to be sensitive to selective growth regulator herbicides such as dicamba or 2, 4-D that can translocate to growing points causing deformities in new leaves and shoots. Symptoms such as bud failure, growth suppression, bending, coiling of shoot tips, curling of leaf margins, leaf cupping, chlorosis, browning or blackening of foliage, thickening or leathery leaves, defoliation and sometimes death, can occur. These symptoms may develop several days after exposure or in the spring following a fall exposure. Read and follow all herbicide label directions carefully to avoid injury to the landscape.

Trimec damage on oak
University of Illinois Extension

2,4-D damage on oak
University of Illinois Extension

Leaf Tatters

Research at the University of Illinois has indicated a strong correlation between leaf tatters and exposure to chloroacetanilide herbicides. This condition has occurred for at least 25 years in Illinois. It affects leaves of the White and Bur oaks; however, trees in the Red oak group have occasionally shown symptoms. The symptoms of leaf tatters appear when leaves emerge. The interior vein tissue is reduced, which causes leaves to be lacy or have a tattered appearance. Symptoms may be evenly distributed throughout the crown or may be confined to the lower crown. From a distance, trees may appear defoliated. Within several weeks, affected trees should produce a new flush of leaves that do not show signs of leaf tatters. A tree repeatedly affected by leaf tatters might decline and even die, but no evidence has been found to confirm this theory. Maintain tree vigor by following good horticultural practices such as watering during drought and fertilizing.

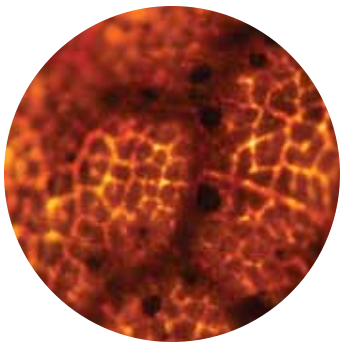


Leaf tatters
James E. Appleby, University of Illinois

Oak anthracnose
Nancy Pataky, University of Illinois Plant Clinic

Oak anthracnose
University of Illinois Plant Clinic

Anthracnose



Oak anthracnose acervuli
University of Illinois Plant Clinic

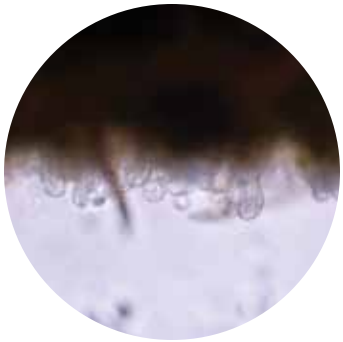
Oak trees are prone to infection by Discula anthracnose, specifically, *Discula quercinia.* White oak has been found to be among the more susceptible oak species. Infections occur as new leaf growth develops during rainy, spring weather. There are three main types of symptoms related to this disease: twig and leaf dieback, leaf distortion and angular necrotic spots on mature leaves. Symptoms are usually most severe on the lower branches where moisture tends to remain for longer periods of time. Fungal fruiting structures (acervuli) can be observed on leaves with the aid of a hand lens or microscope. Severe outbreaks have been known to kill nearly all the foliage on highly susceptible trees. Defoliated trees leaf out again after the weather warms up. Outbreaks usually subside by mid-summer, as the leaves mature and become more resistant to pathogen. Succulent growth, however, can still be attacked at any time of the growing season when wet conditions are prevalent.

The damage caused by oak anthracnose is mostly aesthetic and rarely causes permanent damage. Disease management strategies should focus on promoting tree vigor. Large trees can be pruned to improve air circulation. Raking and disposal of infected leaves can be helpful, especially on smaller trees. Proper watering and fertilizing of the tree is recommended to help reduce tree stress and susceptibility. Fungicides are not usually warranted or recommended for ornamental trees unless the disease is a chronic problem on young trees. Specific fungicide options are provided in the Illinois pest management manuals.

Oak Leaf Blister

On oak, this disease is caused by the pathogen, *Taphrina caerulescens*. Although many oaks may be attacked, Red oak is the most susceptible. Leaf distortion and blister-like growths or puckering of the leaves is common. Affected tissues are often thickened. At first the puckered areas are green, but turn red and then brown as the season progresses. The pathogen overwinters in buds and on twigs, then infects leaves and flowers during cool (optimum 50 to 70 degrees F), moist weather of early spring, at bud swell to bud opening.

Oak leaf blister is an aesthetic problem. Management should focus on promoting oak tree vigor through pruning, watering and fertilizing. Fungicides are not usually warranted or recommended for ornamental trees unless the disease is a continuing problem on young trees. Refer to Illinois pest management manuals for fungicide options. Timing of any fungicide application is critical. Fungicides must be applied in the dormant season, in the late fall or early spring before buds swell.



Oak leaf blister asci
University of Illinois Plant Clinic

Oak leaf blister
Nancy Pataky, University of Illinois Plant Clinic

Oak leaf blister on underside of leaf
Nancy Pataky, University of Illinois Plant Clinic

Powdery Mildew

Powdery mildew infections are caused by many different, fairly host-specific fungal species grouped in six closely related genera. *Erysiphe alphitoides* causes most of the infections on oaks. Powdery mildews, in general, flourish when the days are warm to hot, the nights are cool and humidity is high. They are often more severe on crowded plants growing in the shade where air circulation is poor. The disease symptoms are easily recognized as distinctive white powdery patches on shoots, buds, flowers or stems. The disease progresses to form a felt-like, white mildew growth. Large portions of the plant, especially leaves, may be infected. Late in the season, small spherical, dark

Powdery mildew leaves
University of Illinois Plant Clinic

Powdery mildew Pin oak
University of Illinois Plant Clinic

brown-to-black fungal structures (cleistothecia) may be seen mixed within the felt-like mildew. The powdery mildew covering leaves may also lower the plant's photosynthetic efficiency, resulting in reduced growth. Infected leaves may occasionally display symptoms of stunting, curling, chlorosis and premature leaf drop. Damage from powdery mildew is mostly aesthetic and will not harm the long-term health of the plant. Death of infected plants is extremely rare.

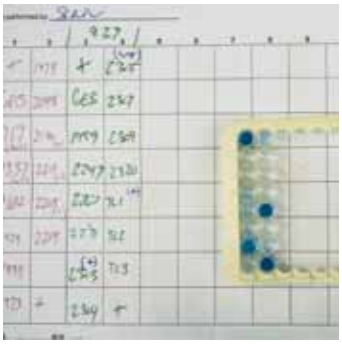
Powdery mildew cleistothecia
Andrew Holsinger, University of Illinois Extension

When possible, select a species and cultivar that is resistant to powdery mildew. Avoid planting susceptible species in shady areas with poor air movement. Dense tree plantings may need to be pruned to promote airflow. Fungicides, when used preventatively, can effectively control this disease. However, the cost of the fungicide application may be prohibitive due to the size of the tree.

Bacterial Leaf Scorch (BLS)

This disease is caused by the bacterium, *Xylella fastidiosa,* which spreads systemically and is found only in xylem tissue. Xylem-feeding leafhoppers, treehoppers, and spittlebugs are thought to spread the bacterium. This disease can also be transmitted between trees through root grafts. This bacterial pathogen has been found to have a wide host range, which includes oak, elm, sycamore, mulberry, sweet gum, hackberry, ginkgo and maple. Look for scorch symptoms that occur early to midsummer and then intensify into late summer. The scorched leaf edges or tissue between veins may be bordered by a yellow or reddish-brown color. Oak trees infected with bacterial leaf scorch will often drop leaves early. The disease progresses gradually with dead limbs and overall tree decline appearing 5 to 10 years after infection.

BLS infected oak canopy
Travis Cleveland, University of Illinois Plant Clinic



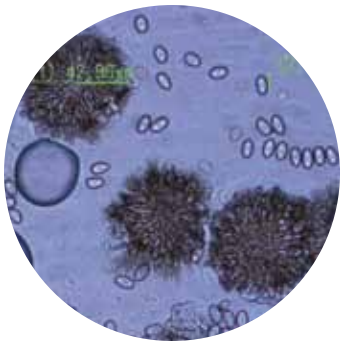
Agdia BLS ELISA assay
Sean Mullahy, University of Illinois Plant Clinic

BLS infected oak leaves
Travis Cleveland, University of Illinois Plant Clinic

Once infected, there is no effective cure for the disease. Insecticide treatment of the insect vector is considered impractical and is not recommended. Trunk injections of antibiotics have been found to reduce bacterial leaf scorch symptoms and delay symptom expression until later in the season, but will not eradicate the disease. Treatments can be done yearly into the root flare at the base of the tree in late May or early June. Pruning can be done to help the aesthetics of the tree for a few years, but has not been shown to slow disease development. Mulching and watering during drought may help prolong the life of the tree. Removing the tree may be necessary for safety. Tree replacement with a non-susceptible host to BLS is recommended.

Bacterial leaf scorch can easily be confused with a number of other oak problems. Confirmation of the disease by a diagnostic laboratory is recommended. The pathogen is most active and bacterial populations are high in the tree's water conducting tissues during late summer and early fall. The University of Illinois Plant Clinic provides serological testing in the fall. Green petiole tissue from symptomatic leaves is preferred for this test. Contact the Plant Clinic in advance for testing dates, sample fees and sample preparation information.

Tubakia Leaf Spot



Tubakia shields or pycnothyrium
Travis Cleveland,
University of Illinois Plant Clinic

This disease is caused by the fungal pathogen, *Tubakia dryina*. All oaks are susceptible to this disease; however, it is usually seen on Red oaks. Stressed trees are more likely to be infected. Infection primarily occurs early in the season, but repeated rain can spread the disease and cause multiple infections to occur. Symptoms appear in mid to late summer as large leaf spots. On oak leaves, a small spot is surrounded by a much larger brown area of dead tissue. This pathogen secretes toxins, which are thought to be responsible for the large lesions. Heavy infection in trees can cause early leaf drop. Distinct fungal fruiting bodies, which resemble tiny shields, can be seen with the aid of a microscope.

This disease is mostly aesthetic. Rake and remove fallen leaves. If stress is believed to be a contributing factor, identify and alleviate possible causes. Treatment with fungicides is not usually necessary or recommended. In order for fungicides to be effective, sprays need to be applied preventatively at bud break and then repeated as long as rain events occur.

Tubakia infected leaves
University of Illinois Plant Clinic

Bur Oak Blight (BOB)

This fungal disease is caused by a newly described pathogen, *Tubakia iowensis*. Several species of Tubakia are known to infect oak and cause minor leaf spots; however, *Tubakia iowensis* is the only species known to cause severe leaf blight and will only infect Bur oak. The earliest symptoms first appear in June as purple-brown spots on the underside leaf veins. In July, the spots expand, and purplish necrotic veins become noticeable on the upper leaf surface. Leaf veins are killed as the infection progresses, and a characteristic wedge-shaped necrotic area develops on the leaf blade. Coalescing lesions and expanding vein necrosis may cause the leaf to die. Severely affected trees may have significant leaf mortality and/or leaves with a scorched appearance. Many, but not all, leaves killed by BOB remain attached to the tree into the winter, well after healthy Bur oaks have dropped their leaves. Symptoms intensify from year to year and progress from the lower branches to the entire crown. This pathogen overwinters as pustules on the diseased leaf petioles that remain attached to the tree. In late April and May, fungal spores are produced and spread by splashing rain about the same time as new leaves are developing and expanding. Several successive years of severe infection and defoliation can kill trees. Death has also been attributed to secondary invaders such as the two lined chestnut borer. Boosting tree vigor may help the tree to limit and prevent secondary invaders. Pruning and removing branch dieback has been suggested to help reduce borer populations. For high value trees, Iowa State University found trunk injections of propiconazole to be effective. Injections should be made in late May or early June after the leaves have fully expanded. Higher application rates reportedly resulted in phytotoxicity to leaves. The rate will also need to be adjusted if the tree has significant branch dieback in the canopy. One application should last several years; however, Iowa State University currently recommends repeat application only after a severe outbreak recurs. Disease confirmation is important for providing accurate disease control strategies and recommendations. Suspect BOB samples can be submitted to the University of Illinois Plant Clinic. To sample for BOB, look for leaves still attached to the tree during dormancy. Collect symptomatic leaves and petioles from the previous growing season still attached to branches and twigs.

BOB leaf wedge necrosis
Travis Cleveland, University of Illinois Plant Clinic

BOB infected petioles
Travis Cleveland, University of Illinois Plant Clinic

BOB infected canopy
Travis Cleveland,
University of Illinois
Plant Clinic

Oak Wilt

Oak wilt is caused by the fungus, *Ceratocystis fagacearum,* which invades the xylem or water-conducting vessels of trees. This fungus prevents water and nutrient flow, resulting in death to the Red oak group within a growing season and over several years for the White oak group. No oak species is immune. The disease is most commonly spread via sap feeding beetles, but can also spread through root grafts. Trees pruned early in the growing season are more likely to be infected as sap feeding beetles carrying the pathogen are attracted to the fresh pruning cuts and wounds. Oaks growing in close proximity to trees recently killed by oak wilt are at high risk of infection via root grafts. Symptoms of oak wilt begin as wilting and discoloration of foliage. Discoloration begins at the margins of the leaves and proceeds inwards. Rapid defoliation is common within the Red oak group, while the White oak group tend to retain their leaves. The sapwood of symptomatic branches often displays brown to black streaking.

Suspect trees should have a diagnosis confirmed by a plant diagnostic laboratory, such as the University of Illinois Plant Clinic. Collect suspected oak wilt samples from living branches showing symptoms. Mail samples the same day they are collected or refrigerate. Send samples early in the week to help to prevent them from being held over the weekend in a hot mail truck. When possible, send samples in an inexpensive cooler with a disposable ice pack. This fungal pathogen is intolerant of temperatures above 90°F. Exposure to these conditions during shipping may result in inconclusive test results. Proper packaging and shipping of samples will reduce the potential for an inconclusive diagnosis. Oaks infected with oak wilt will not recover and cannot be saved. A fungicide is registered to protect healthy trees from oak wilt, but is not effective after infection has been confirmed. Trees that test positive for oak wilt should be removed to prevent the spread of the disease.

Oak wilt leaf symptoms
Guy Sternberg, Starhill Forest Arboretum

Oak wilt streaking
University of Illinois Plant Clinic

Suspect oak wilt tree death near Athens, IL
Guy Sternberg, Starhill Forest Arboretum

Fungal Canker Diseases

A canker is a dead area on the trunk, older branches, or injured plant area on smaller twigs of a tree or shrub. They may be sunken, bumpy, off-color and even wet or water-soaked. Vascular tissue under the canker is dead. The term "canker" is a general one referring to a symptom on the plant, but does not indicate cause. The fungi found in cankers are usually known as stress pathogens; they do not harm the tree or shrub until it is stressed. Fruiting bodies in the cankered are used to identify the fungus. Some common canker fungi of oaks include: *Botryosphaeria spp., Nectria spp.* and *Hypoxylon spp*. As the canker girdles the stem, leaves begin to wilt, turn yellow and then brown. Young twigs may curl downward. When a canker girdles the stem, the twig dies from that point to the tip. If the stem is not girdled, it may show one-sided death, or some leaves are affected and others remain green. The use of fungicides does not help in canker management. Prune out cankered areas and sanitize cutting tools to avoid further spread of canker pathogens. Remove dead wood. To get all of the infected tissue, cut a few inches of wood beyond the cankered wood into the healthy tissue. The internal wood remaining should be white, tan or green. Identify and correct sources of stress such as water imbalance, root compaction, root injury, chemical damage, girdling roots, trunk damage or root rot.

Botryosphaeria canker
University of Illinois Plant Clinic

Hypoxylon canker
Nancy Pataky, University of Illinois Plant Clinic

Tubercularia canker
William Jacobi, Colorado State University, Bugwood.org

Root and Butt Rot

There are more than 500 species of fungi that can cause wood decay. Most oak species are susceptible to root and butt rot. The mushrooms, conks or other fruiting structures still attached to living, but damaged trees help us with identification of the fungus. White rot (whitish, wet, stringy wood) or brown rot (brown, dry, crumbly wood) may occur depending on the type of fungi associated with the root and butt rot. However, a fungal infection could be present with no visible fruiting or mycelial structures. A downed tree after a storm may be the only indication of root rot.

Symptoms may appear as sparse foliage and dieback. Once the fungus involved is identified, it can be determined whether the rot is expected to affect roots, trunk or branches, sapwood or heartwood and sometimes even the amount of decay. Though difficult to prevent, infections can be avoided by watering during drought. Infected trees should be inspected by a Certified Arborist to determine the structural stability. Hazardous trees may need to be removed.

Oak wood rot
Nancy Pataky, University of Illinois Plant Clinic

Berkeley's polypore
Guy Sternberg, Starhill Forest Arboretum

Shelf fungi on oak
Stephanie Porter, University of Illinois Plant Clinic

Yellownecked Caterpillar (*Datana ministra*)

Yellownecked caterpillars have two generations per year in the southern half of Illinois, being present from late June to September, feeding on the leaves of a broad range of trees. There is only one generation in the northern half of Illinois in August and September. Young larvae (caterpillars) are red with yellow stripes; older larvae are black with yellow stripes with an orangish-yellow band behind the head. They are about 2 inches long, when full grown. When disturbed, larvae lift their head and tail to form a distinctive U-shape. They feed in groups, with young larvae eating off the lower leaf surface, while older ones consume the entire leaf except the petiole. Late-season defoliation may not significantly harm tree health, but injury can be unsightly. Larvae crawl down the trunk and burrow 2 to 4 inches into the soil to overwinter as pupae. Caterpillars can be controlled by natural predators, pruning out colonies or pesticide applications in June and August, when caterpillars are small. Specific chemical options are provided in the Illinois pest management manuals.

Yellownecked caterpillar black phase
Phil Nixon, University of Illinois

Yellownecked caterpillars, black phase, & damage on Bur oak
Phil Nixon, University of Illinois

Yellownecked caterpillars, red phase on crabapple
Phil Nixon, University of Illinois

Lecanium scale
University of Illinois Plant Clinic

Oak pit scale on Swamp White oak
K. Sharpe

Kermes scale on Bur oak
Phil Nixon, University of Illinois

Scales (golden, kermes, lecanium)

Scale damage causes distortion of branch tips and leaves as well as reduced growth and dieback. Golden oak scale is a pit scale, meaning the gold-colored, round, waxy-fringed insect resides in a small pit in the bark of branches and trunks. Lecanium scales are generally reddish-brown and hemispherical. Kermes scales can have various color patterns and are hemispherical to spherical, depending on species. Scales are normally kept in check by natural enemies. However, when populations are high enough to cause damage, pesticides may be applied. Control of scales is mostly aimed at the crawler stage because adults have a protective outer coating. Kermes and Lecanium scales are susceptible to dormant oil sprays. Pesticide applications for golden oak scale are done while crawlers are active using specific chemicals listed in the Illinois pest management manuals. Check trees a month later and retreat if crawlers are still present.

Two Lined Chestnut Borer (*Agrilus bilineatus*)

Twolined chestnut borer adult
R. Haack

Two lined chestnut borer adult beetles primarily attack oaks that have been damaged or under stress. The first signs of infestation are wilted foliage on scattered branches in late summer. Leaves will die, but stay attached to the tree for weeks or months before dropping. Affected branches will die. There will also be distinctive D-shaped exit holes about ⅛ inch wide in the bark. Adult beetles are slender, black, about ½ inch long, with two indistinct, golden stripes on their back. Adult beetles are most active from late April in Southern Illinois to early June in Northern Illinois. Insecticidal control is timed for adult emergence. Although this insect is damaging in some states, it is rarely a problem in properly maintained trees in Illinois landscapes. It can be a serious nursery pest.

Twolined chestnut borer damage on White oak
S. Katovich

Twolined chestnut borer larval damage
MN DNR

Twig Pruner (*Anelaphus villosus*) and Twig Girdler (*Oncideres cingulate*)

Twig pruner larva and damage
J. Solomon

These insects seem to prefer oaks, but will attack other trees. They both cause branches up to 3 feet long to litter the ground. The twig girdler adult female lays an egg near the end of a branch, then chews a groove all of the way around the branch, cutting through the bark and much of the sapwood. The branch commonly snaps off here and falls to the ground. The end of the branch will have an external smooth cut, but the pith and inner wood portion will be jagged.

Twig girdler damage
M. Duff

Twig girdler adult
Clemson University

The twig pruner adult female beetle lays an egg at a leaf axil. The resulting larva tunnels through the center of the branch. Late in the summer, the larva tunnels outward through the sapwood, stopping at the bark. This internally weakened branch snaps off in the wind and falls to the ground. The end of the branch will show a smooth cut, but the bark breakage will be jagged. The larvae develop in the fallen branches. Control both species by raking up and destroying the fallen branches, killing the developing larvae.

Leaf and Twig Galls

Galls are plant growths formed after insects and mites feed on the plant tissue, releasing chemicals causing the plant to form the gall. Sometimes, even the physical injury caused by feeding or egg-laying can apparently cause a gall to be formed. Several hundred species of gall wasps and midges affect oaks. Most of these galls cause little or no harm to the health of trees. Of the common oak galls, only gouty and horned oak galls are likely to cause damage. Trees with other types of galls appear as healthy as those that do not have them. This is convenient, since there is no control for formed galls except physical removal. Because gall tissues are not normal in terms of cell makeup, including xylem and phloem conductive tissue; systemic insecticides are usually not effective. Preventative insecticide applications also are rarely effective.

Oak pill gall on Pin oak
Phil Nixon, University of Illinois

Jumping oak gall
Phil Nixon, University of Illinois

Succulent oak galls on Pin oak
Phil Nixon, University of Illinois

Horned Oak Gall (*Callirhytis cornigera*) and Gouty Oak Gall (*Callirhytis quercuspunctata*)

Horned oak gall appears on twigs and branches as brown, woody masses up to 2 inches in diameter, covered with "horns" that are ⅛ to ¼ inch long. Gouty oak gall is similar in appearance without the "horns." These galls are caused by tiny wasps and take 2 years or more to fully develop. Not only are the galls obvious and objectionable to many people, they commonly kill the twigs past the gall's location and can kill the entire tree. However, it is common to find heavily infested trees that appear healthy. It is recommended that galls be pruned off young trees and destroyed to reduce the number of future galls and their impact on the tree's shape. Physically removing galls is not practical on large trees. Insecticides provide little control. Infestations are apparently controlled by naturally occurring parasitic wasps.

Gouty oak galls on Pin oak
Phil Nixon, University of Illinois

Horned oak galls on Pin oak
Phil Nixon, University of Illinois

Horned oak galls on Pin oak branches
Phil Nixon, University of Illinois

Gypsy Moth (*Lymantria dispar*)

Gypsy moth overwinters in the egg stage, hatching out at bud break to early leaf expansion on many oak species. They feed on a wide range of trees, though oak is a favorite. The hairy caterpillars are dark-colored in lightly infested areas and tan in heavy infestations. The larvae have a double row of blue and then red balls down the back. Fully-grown caterpillars approach 2 inches in length. Larvae eat the leaves from the margins inward, leaving only the midvein in heavy infestations. They are most numerous at the top of the tree, working their way down as foliage is eaten. Pupation occurs by the end of June, with moths emerging in July. Insecticides are most effective against younger caterpillars. Recommended insecticide sprays are provided in the Illinois pest management manuals.

Gypsy moth male
Phil Nixon, University of Illinois

Gypsy moth hatching egg masses on branch
Phil Nixon, University of Illinois

Gypsy moth young larva
Phil Nixon, University of Illinois

Goldspotted Oak Borer (*Agrilus coxalis auroguttatus*)

Goldspotted oak borer, a potentially destructive species, has not yet been found in Illinois. It is native to Southeastern Arizona and has recently spread to Southern California. It attacks trees in the Red oak group, not attacking White oak group species. Although it does not cause significant tree death in its native range, it has killed large numbers of oaks in Southern California where it has invaded. Its life cycle is similar to two lined chestnut borer. The larvae tunnel through the cambium, eventually girdling and killing trees. Adult beetles are about ⅜ inch long, slender and blackish with three pairs of gold-colored spots on the wing covers. The beetles create ⅛ inch wide, D-shaped holes in the bark when they emerge. If found, send collected specimens to the University of Illinois Plant Clinic or Illinois Department of Agriculture for proper identification.

Goldspotted oak borer larvae
M. Hoddle

Goldspotted oak borer adult on leaf
M. Lewis

Goldspotted oak borer larval damage
T. Coleman

University of Illinois Plant Clinic Resources

- **Illini Plant and Pest Podcast**
  web.extension.illinois.edu/podcasts/plantandpest/
- **U of I Plant Clinic Facebook Page**
  https://www.facebook.com/UofIPlantClinic
- **U of I Plant Clinic Blog**
  universityofillinoisplantclinic.blogspot.com/
- **Follow Diagnostic Specialist Stephanie Porter on Twitter**
  https://twitter.com/#!/skporter
- **U of I Plant Clinic YouTube Videos**
  https://www.youtube.com/UIPlantClinic/
- **Plant Diagnostic Sample Submission App**
  https://itunes.apple.com/us/app/sample-submission/id669269520?mt=8
- **Home, Yard, and Garden Newsletter**
  http://hyg.ipm.illinois.edu/
- **Training Modules**
  http://mg.cropsci.illinois.edu/
- **Pest Management Handbooks**
  Pest Management for Home Landscape and Commercial Landscape and Turfgrass can be purchased at the following link: https://pubsplus.illinois.edu/

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