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BP-164-W

Symptoms and Signs for Plant Problem Diagnosis – An Illustrated Glossary

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Pests, pathogens and abiotic disorders cause a variety of problems in plants. We often recognize these problems based on the symptoms that result. A **symptom** is a change in plant growth or appearance that may indicate or describe a plant health problem. Examples of symptoms include yellowing, wilting, dieback, galls or blight. Symptoms alone shouldn't be used for diagnosis because a symptom, such as wilting, can be produced by multiple causes (drought, borer, canker, root rot, etc.) Additionally, symptoms on one part of the plant can appear due to damage on a different part of the plant. For example, leaf wilt can be caused by clearwing borer feeding to the stem, or Botryosphaeria canker.

Signs are the evidence of the damaging factor – the actual cause of the problem that allows you to conclusively diagnose a plant health problem. Examples of signs include egg masses, larvae, mycelia, rust, powdery mildew and pustules, to name only a few. Identifying problems is often challenging for the new diagnostician because many causes of diseases are microscopic and because insects may cause damage and fly away.

The location of the damage on the plant, the type of damage, and the symptoms and signs are very important clues in determining the cause and identifying the responsible culprit. Without such information, the correct diagnosis and management may not occur.

This document was created to help users diagnose plant health problems. It is intended for use by Extension Integrated Pest Management (IPM) specialists in Botany, Entomology, Horticulture, and Forestry and Natural Resources and was developed in consultation with them. Growers, arborists, students and Master Gardeners are among others who can benefit. We look forward to feedback that will help us improve this publication.

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ANTHRACNOSE

A group of fungal diseases that often start as leaf spots or fruit rots but may also move into petioles, twigs and branches, ultimately causing cankers or blighting. They are characterized by having asexual spores produced in an acervulus.

Causes: *Fungi, including Apiognomonia spp., Colletotrichum spp., Gnomonia spp., Kabatiella spp., and Stegophora spp.*

Sycamore anthracnose. Pathogen has spread from leaves into branch. Note small canker.

Hosta anthracnose invading from unpigmented leaf margin.

Ivy anthracnose. This spreading leaf spot is producing erumpent pustules that produce thousands of spores to spread the disease.

Beech anthracnose. Note small circular leaf spots and spreading diamond-shaped lesions on the midvein.

BLIGHT

The progressive discoloration, dieback and death of plant parts. May include wilting and/or death of leaves, stems, flowers or entire plants. Blight may be a secondary symptom of stem canker or root rot.

Causes: Borer and stem girdling insects; fungal and bacterial pathogens; root rots.

Late blight of tomato causing leaf spot and stem blighting.

Fire blight canker on apple.

Southern blight, with characteristic mustard seed-like sclerotia.

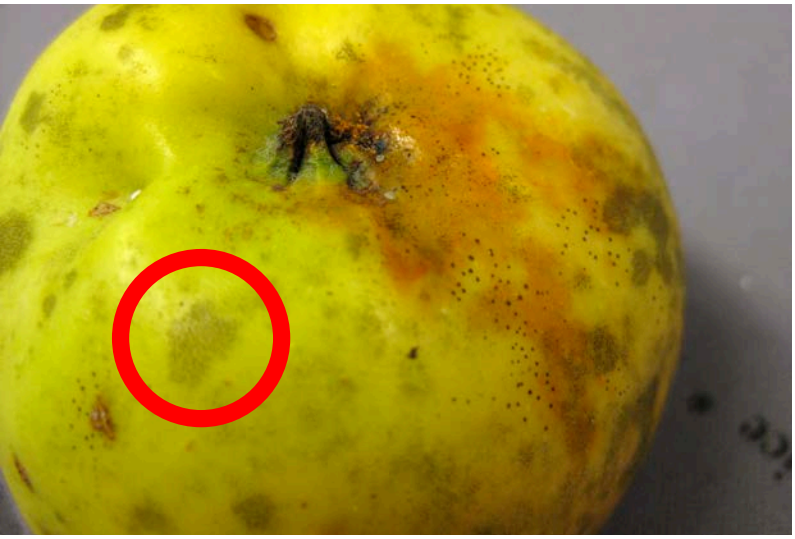
Sporulating Botrytis causing blight on stem.

BLOTCH

Large and irregularly shaped spots or lesions.

Causes: Commonly due to fungal or bacterial disease.

Guigniardia leaf blotch of buckeye.



Sooty blotch (circled in red) and flyspeck of apple.

BRONZING

Copper or bronze color of leaves or needles.

Causes: Mites, abiotic disorders, pathogens.

Bronzing along the veins of this oak leaf is due to mite damage; *photo by Linda Williams, Wisconsin DNR.*

Spider mite damage on Alberta spruce.

Herbicide injury; *photo by Nebraska Cropwatch.*

Ozone injury; *photo from USDA-ARS.*

BROWSE DAMAGE

Feeding or nibbling on plants.

Causes: Vertebrate animals (deer, rabbit, squirrel, rodent, porcupine, etc.)

CANKER

A localized, cracked or sunken lesion on a branch, stem, or trunk. Growth can girdle infected plant parts, resulting in blight or dieback.

Causes: Bacterial or fungal pathogens.

Chestnut blight causes a canker that kills chestnut trees. After introduction to the US in the early 1900s, the chestnut became functionally extinct throughout its native range.

Fire blight canker on apple. As the canker continues to grow, it will encircle and kill the infected branch.

Botryosphaeria canker is particularly virulent to some types of viburnum. The dying branches shown in this photo show symptoms associated with early, mid- and late-stage infections of the pathogen.

A bleeding canker of Phytophthora on the base of a beech tree.

CHLOROSIS

Yellowing or loss of color in normally green tissues due to the destruction of chlorophyll.

Causes: Many insects, pathogens, and abiotic disorders. Examining the pattern of the chlorotic area helps to diagnose the problem.

The peony in the foreground was infected by tobacco rattle virus.

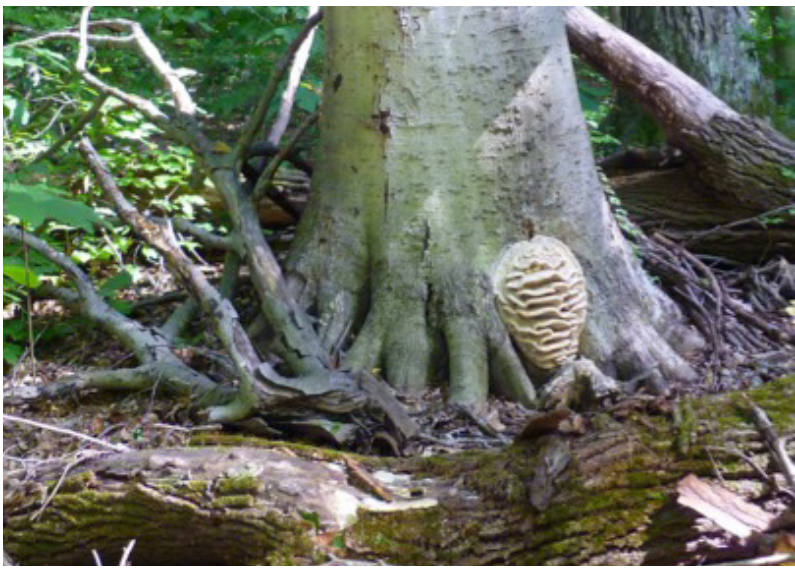
These apple leaves have what is referred to as yellows, a common physiological problem on the Honeycrisp variety.

Chlorosis caused by nutrient deficiency is a common problem of acid-loving plants when these plants are grown in high pH soils. The alkaline soil pH results in iron and/or manganese becoming less available to the plant, as seen in the holly (left) or pin oak (right).

CONKS

Fungal fruiting structures forming a shelf-like structure on woody plants.

Causes: Fungi. Shelf fungi include pathogens and saprophytes (decomposers that rot wood).



Fungal conks are fruiting bodies of fungi that cause decay and wood rot. Removing the conk from the tree doesn't fix the condition as mycelia continue to grow and feed within the tree.

CRACKING

Splitting of tissue.

Causes: Common in some trees and shrubs (e.g., maple, honey-locust, crabapple). This may result from winter injury, previous physical injury and/or different growth rates in adjoining tissue.

Damage in the landscape or even at the nursery results in cracking of the bark. Poor pruning, string trimmer damage, or other injury coupled with weather extremes cause the expansion of what might have been a minor injury.

DAMPING-OFF

A disease of young seedlings. May prevent seedling emergence from soil, or cause seedlings to topple over and die after emergence.

Causes: Fungi, namely *Botrytis, Fusarium, Rhizoctonia,* and *Pythium* spp.

Overhead watering and overly dense growth predisposed these seedlings to damping-off.

Overly wet conditions (as evidenced by algae and moss) resulted in ideal conditions for development of damping-off disease.

DECLINE

The gradual weakening and death of a plant due to a complex of interacting factors.

Causes: Abiotic, insect and pathogen all affecting the same plant.

Age, injury, poor site and root damage (from construction) all predispose trees to opportunistic rots. Together, these factors (and many others) result in the decline of trees.

DEFOLIATION

Loss of leaves.

Causes: Insects, pathogens (fungi and bacteria), and abiotic (heat stress).

Cherry leaf spot causes defoliation, predisposing trees to winter injury and death.

Tulip-poplar regularly undergoes "foliar readjustment" leaf drop in response to August dry spells and drought.

DEFORMITY

The unusual development of a plant or plant part, and may include galls, epinasty, fasciation, etc.

Causes: Insects, mites, nematode, fungi, bacteria, herbicides.

These photos show several examples of galls, one type of deformity. Crown gall (upper left) is a bacterial disease that can spread throughout a plant. Bur knot is common in some apple cultivars and rootstocks (upper right) at the base of an apple tree. Not all galls are caused by Agrobacterium. Some may result from burls, poorly healed branch stubs, and unknown physiological disorders (bottom).

DIEBACK

The gradual but progressive death of individual branches or shoots from tips toward the main stem. Often leading to decline.

Causes: Abiotic and fungi (canker pathogens, wilt pathogens or root rots).

Dieback due to construction and change of grade.

Dieback due to Phytophthora root rot on a viburnum.

Dieback due to winter injury.

DISTORTION

Abnormally shaped or malformed plant tissues.
See also Epinasty, Deformity.

Causes: Insects, pathogens (fungi and bacteria), herbicides.

Fasciation is a common form of distortion seen in plants. Both strawberry and celosia are host for aster yellows, but only the strawberry tested positive for the disease. Herbicide use may also play a role in fasciation.

Cause unknown for this pineapple.

This poinsettia was treated with the insecticide Distance, which can be phytotoxic to poinsettia, causing distortion to leaves.

EPINASTY

An abnormal, downward-curving growth or movement of a leaf resulting from more rapid growth of cells on the upper side than on the lower side of the leaf stalk.

Causes: Herbicides, viruses.

Dicamba drift onto a pear tree; *photo by Roy Ballard.*

Epinasty due to herbicide drift.

Tomatoes and grape are particularly sensitive to herbicide drift.

FLAGGING

A dead branch or shoot on an otherwise healthy plant.

Causes: Insects, pathogens (fungal or bacterial canker).

Flagging on red oak caused by scale insects and Botryosphaeria dieback. The arrow points to an Oak kermes scale insect.

Botryosphaeria canker. Flagging can be a secondary symptom that results when an insect or pathogen girdles a branch.

FRUITING BODY

A spore-bearing fungal structure. Mushrooms, telial spore horns, perithecia and pycnidia are all fungal fruiting bodies.

Causes: Fungi. See also "Conks".

Conks are a type of fruiting body indicating internal decay of a tree; *photo by Jeff Burbrink.*

Cedar-quince rust fruiting bodies (aecial whiskers) produce a significant number of spores that can be seen on leaves, and even sidewalks below.

Fruiting bodies, like these pycnidia on a fir needle, are often less conspicuous, but just as problematic, as the more macroscopic fruiting bodies.

GALL

A tumor, swelling or outgrowth of disorganized plant tissue.

Causes: Pathogens, insects, herbicides, or as a response to injury.

Cedar-hawthorn rust gall on juniper.

Hackberry nipple gall; *photo by Cliff Sadof.*

Imprelis (herbicide) induced gall on honey-locust.

Rhizobial nodulation on soybean plant; source unknown.

Crown gall; *photo by Margery Daughtrey.*

GIRDLE

To circle and cut through; to destroy vascular tissue as in a canker or knife cut that encircles the stem.

Causes: Abiotic, insects (stem girdlers, borers), fungi (canker pathogens).

Basil twig girdler insect damages basil stems through feeding.

Beech with girdling roots that may contribute to the decline and death of the tree when roots "strangle" the stem of the tree.

Eastern white-cedar with fungal canker girdling the twig, resulting in flagging.

GUMMOSIS

Production and accumulation of plant sap on trunks and branches, usually afflicting members of the Prunus genus.

Causes: injury, insect feeding, bacteria, fungi.

Gummosis on cherry due to borer injury.

Gummosis on peach due to canker.

HONEYDEW

The sticky exudate released from the abdomen of many sucking insects.

Causes: insects (aphid, scale, mealybug).

Honeydew is aphid excrement; *photo by Amada 44.*

Varnish or shellacking of plant by aphid honeydew; *photo by Walther Bernal/CBC.*

Aphids causing honeydew on peppers.

Scale, "farmed" by ants, produce honeydew that was then colonized by sooty mold.

HYPHA

Tubular filament of a fungus. The plural is hyphae.

Causes: Fungi and water-molds.

Southern blight spreads via the rapid growth of hyphae.

Powdery mildew is composed of surface hyphae and spores (conidia).

Rhizoctonia spreads via hyphae and rarely produces any spores.

White mold infects by hypha that germinate from sclerotia or ascospores.

INFECTIOUS

Infectious is neither a symptom nor sign, but it is a familiar term. It refers to pathogens capable of causing disease and spreading from plant to plant.

Causes: pathogens (all); fungi, bacteria, nematodes, and viruses are all capable of spreading.

Bacterial ooze from fire blight is transmitted to other plants by wind, rain, insects, and other animals, including humans.

The rapid spread, collapse and death of impatiens, caused by *Rhizoctonia* spp.

The infectious nature of *Phytophthora ramorum*, its ability to spread, and very broad host range makes it a threat to ecosystems around the world.

INOCULUM

Pathogen or pathogen part (e.g., spores, mycelium, bacterial ooze) that infects plants.

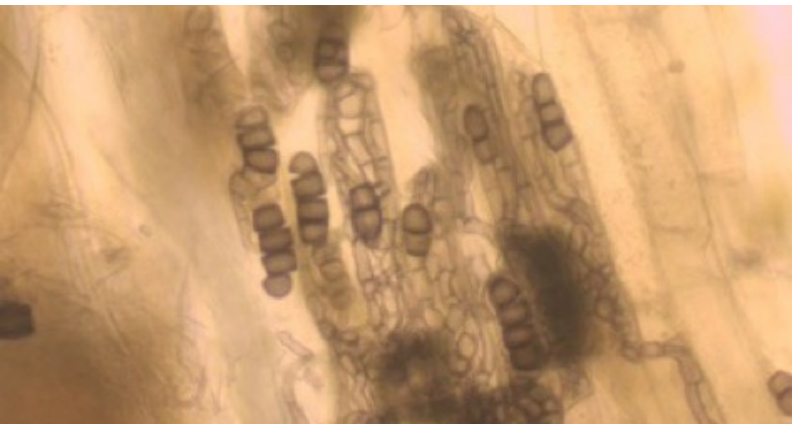
Causes: Pathogens (all).

Apple scab lesions. Each lesion contains approximately 100,000 spores.

Bacterial ooze from fire blight on apple fruit. A single droplet contains more than 1 billion bacteria.

Botrytis blight on coleus.

Cedar-quince rust. Note spores that have fallen in background. These spores cannot reinfect the flowering quince and can infect only the juniper host.



Black root rot chlamydospores in the root cells of pansy.

LARVA

Juvenile stage of an insect or nematode between the embryo and the adult. The plural is larvae.

Causes: A juvenile stage of insects.

Darkwinged fungus gnat larvae (*Bradysia spp.*); *photo by David Cappaert.*

Nematode larva.

Beetle grub larva.

A caterpillar is a larva of moths and butterflies.

LEAF SPOTS

Localized destruction of the chlorophyll by the feeding of pathogens or sucking insects.

Causes: fungi, bacteria, nematodes, viruses, insect (spider mites, lacebugs, plant bugs and thrips), pathogens, algae, abiotic disorders.

Fungal leaf spots are often circular and have distinct margins. They may appear papery.

Tar spot on silver maple.

Concentric rings may form with some fungal or viral pathogens (called ring spots or target spots); *photo by Fulya Baysal-Gurel.*

Early in the infection process, leaf spot symptoms begin with discoloration (yellowing/chlorosis). Some fungal pathogens elicit plant defense responses that may cause a black or dark purple discoloration surrounding the advancing pathogen.

LEAF SPOTS (continued)

Bacterial diseases often have angular and water-soaked lesions.

LEAF SPOTS (continued)

Algal leaf spot. The orange discoloration can be scraped off the plant.

Septoria leaf spot on tomato.

Four-lined plant bug damage may be described as spotting.

LESION

A localized spot on a leaf or other plant part, often roughly circular and discolored. Spots, cankers, blisters and scabs are lesions.

Causes: pathogens (fungi, bacteria, nematode, virus).

Smut lesion.

Bacterial leaf spot lesions on English ivy.

MILDEW (MOLD)

The hyphae, mycelia and spores of fungi that are visible with the naked eye.

Causes: pathogens (powdery mildew, downy mildew, botrytis, white mold, southern blight).

Powdery mildew.

Downy mildew.

MINING

Damage caused by insect feeding, usually between the upper and lower leaf epidermis. If held up to the light, one can see either the insect or frass in the damaged area, which is usually discolored or swollen.

Causes: insect (leaf miners, e.g., boxwood, holly, birch, elm leaf miners.)

Leaf miner damage on columbine.

Leaf miner damage on hawthorn, *photo by Gail Ruhl.*

MOSAIC

Dark green, light green, and/or yellow areas forming a variegated pattern. Similar to mottle.

Causes: virus.

Mosaic due to viral infection.

Mottle due to rose mosaic virus.

Many ornamentals, including this checker lily (*Fritillaria meleagris*) produce a natural mosaic.

MUMMY

A dried, shriveled fruit, partly composed of fungal material.

Causes: fungi.

Brown rot peach mummy.

Black rot mummy on apple.

NECROSIS

The death of tissue, resulting in the tissue turning black or brown.

Causes: Many. Necrosis is a symptom of many different problems.

Impatiens necrotic spot virus on impatiens.

Necrotic lesion on poplar leaf.

Necrosis caused by Volutella blight on pachysandra.

NEEDLE CAST

Foliar diseases in conifers where plants shed or cast off the needles. Needle casts usually begin at the base of the tree and slowly spread up the tree, resulting in lower branch defoliation.

Causes: fungi (e.g., *Rhizosphaera spp., Lophodermium spp.*, etc).

Rhizosphaera needle cast is a common disease of Colorado blue spruce in the Midwest.

Swiss needle cast caused the defoliation and damage of these Douglas-fir Christmas trees.

OOZE

The exudate that results from bacterial infection.

Causes: Bacteria.

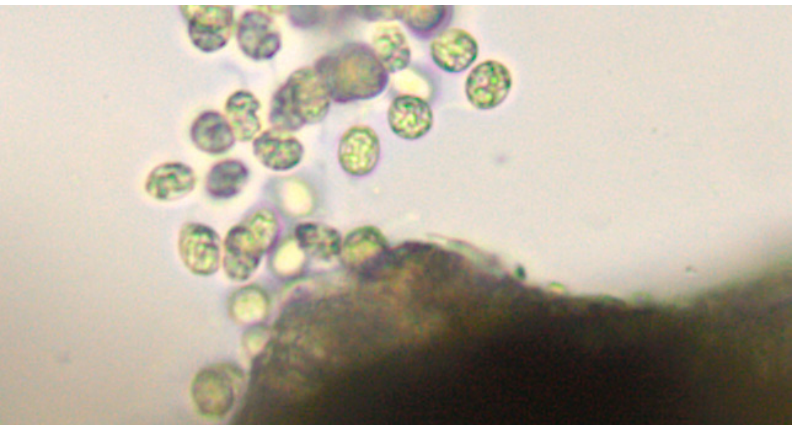
Bacterial ooze of the fire blight pathogen.

Wetwood often results in a frothy ooze that smells alcoholic and often attracts hornets (and gets them drunk).

PUSTULE

A small protruding pimple or blister containing a mass of spores.

Causes: fungi, bacteria.



A micrograph showing a pustule releasing spores.

Pustules of *Nectria* on beech.

Bacterial pustule of soybean; *photo by Adam Sisson, ISU.*

Bitter rot produces erumpent pustules that release spores during wet weather.

Rust pustules on the underside of a hollyhock leaf.
Pink lesions are predominantly sporidia, while the darker orange pustules are mostly composed of teliospores.

RESINOSIS

The formation of pitching tar or resin from conifers in response to injury or infection. Also called pitching out.

Causes: Infection by fungi, parasitic plants. Injury caused by insects, primarily borers.

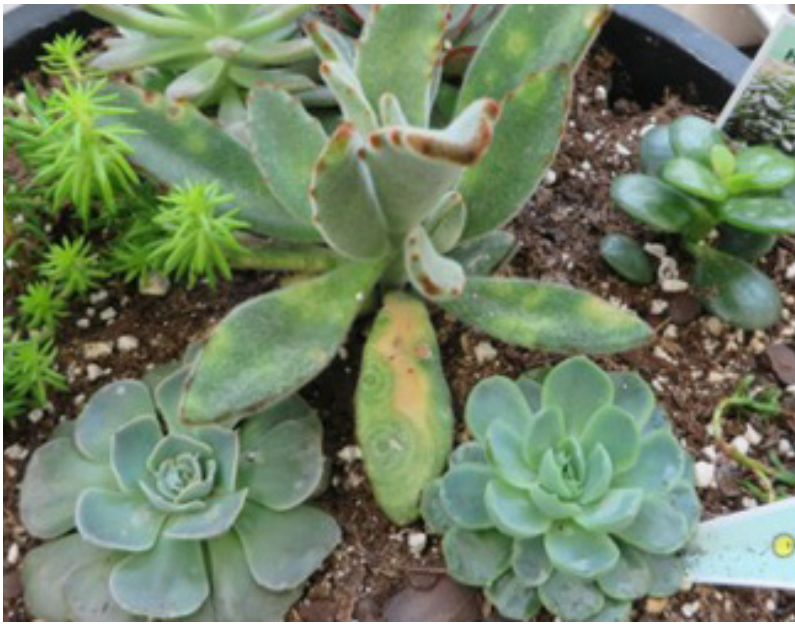
Resinosis is a common response to infection by dwarf mistletoe, a parasitic plant.

Pitching out due to extensive injury.

RINGSPOT

A target-like pattern of yellow, green or dead tissue.

Causes: commonly caused by viruses.



Ringspot symptoms can be caused by multiple viruses.

ROLLING

Leaves that are tied together with silken threads or rolled into a tube often harbor leafrollers or leaftiers.

Causes: Abiotic, insects (e.g., leaf rollers, omnivorous leaftier).

Drought stress causing leaf rolling in hackberry.

Rhododendron during the drought of 2012.

ROT

Decomposition and disintegration of plant tissue. A dry or hard rot consists of decay that is firm; a wet or soft rot is watery, mushy, and often foul smelling. May occur on any plant part.

Causes: fungi and bacteria.

Bud rot of hemp.

Black root rot on annual vinca.

White rot on apple.

Rot resulting in branch failure.

RUGOSITY

The puckering, quilting, thickening or change in texture of leaves.

Causes: pathogen (virus), abiotic (herbicide).

Healthy plants all showing rugosity.

RUSSET

Abnormally discolored, thick and rough skin formation on fruits, tubers, or leaves.

Causes: abiotic, pathogen (fungi) and russet mites.

Immature apple infected with powdery mildew.

Tomato fed on by russet mites; *photo by Ric Bessin, UKY.*

RUST

An orange to brown discoloration of leaves, fruit, flowers.

Causes: Pathogen (fungi)

Rust causing a maze-like pattern on the underside of spurge leaves.

Rust on native goldenrod.

Rust symptoms on upper and lower leaf surface on hydrangea.

Cluster cup rust on buckthorn leaves.

SCAB

Crust-like lesion on leaf or fruit.

Causes: Fungi.

Apple scab is a common disease in the Midwest.

Peach scab can be easily mistaken for bacterial leaf spot.

Potato scab is a problem everywhere potatoes are grown.

SCLEROTIUM

A hard mass of fungal hyphae which permits survival in adverse environments. The plural is sclerotia.

Causes: fungi (ergot of grasses, white mold, Southern blight).

The mustard-seed like fungus balls of *Sclerotium rolfsii.*

White mold produces thick grayish sclerotia that resemble rat feces.

SCORCH

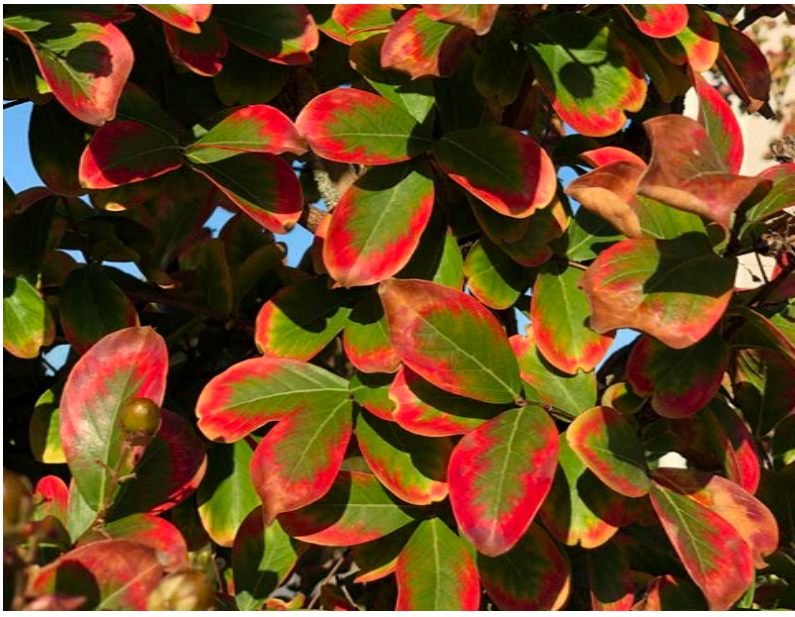
Yellowing, browning and death of leaf tissue from the margin inward.

Causes: abiotic (drought, nutrient deficiency); pathogen (fungal root rot or vascular pathogen; bacterial vascular pathogen).

Bacterial leaf scorch caused by *Xyllela fastidiosa*. Note yellow margin.

Drought of oak causing scorch and defoliation. Drought causes scorch not just of trees but all plants not receiving addition water.

Scorch caused by drought on witch hazel. Which is very susceptible to drought stress.

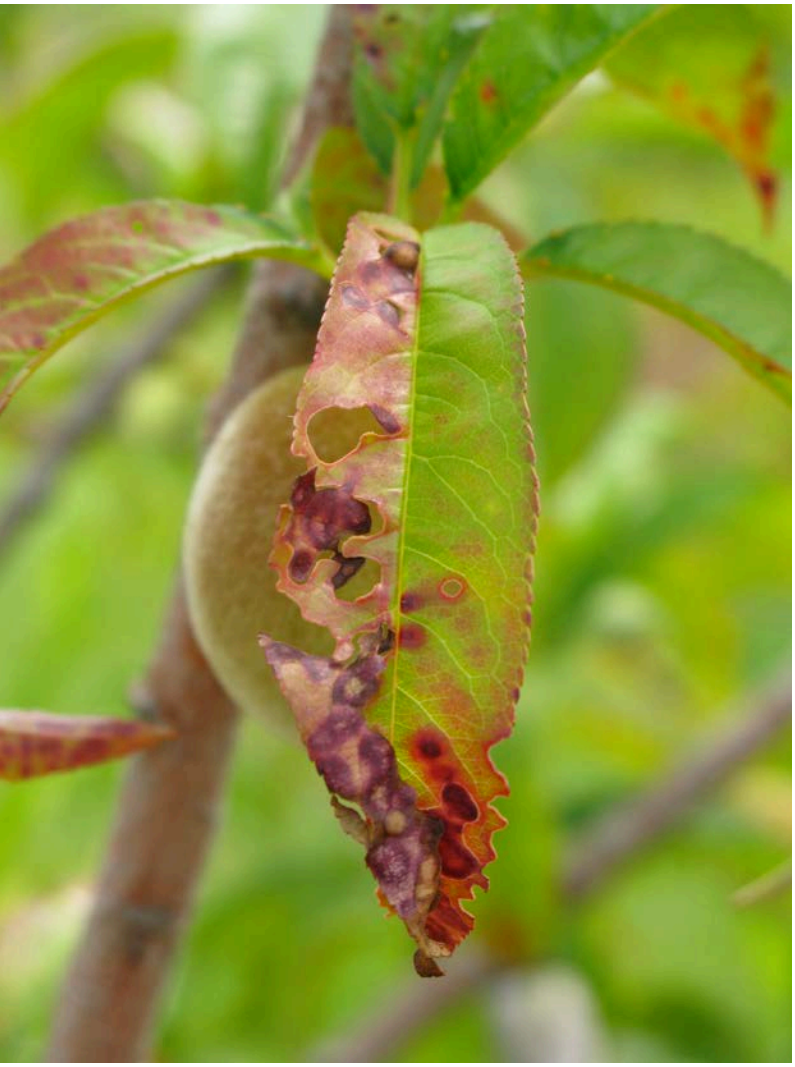


Scorch caused by *Xyllela* on crape myrtle.

SHOT HOLE

Small roundish fragments of leaf drop out, leaving holes in their place. May be mistaken for insect feeding.

Causes: pathogens (fungi, bacteria).



Shot hole of peach and plum, both caused by the bacterial pathogen *Xanthomonas campestris* pv. *pruni.*

SIGN

Visible evidence of an organism causing the problem. May indicate a pathogen or an insect.

Causes: insect, pathogen (fungi, bacteria, nematode).

White, fluffy mycelia is a sign of white mold.

Downy mildew of coleus produces a dusting of greyish spores and mycelia on the underside of infected leaves.

Colorado potato beetles eating this flower are obvious signs of insect feeding.

This sawfly left its skin behind. Molted skin, egg cases, chrysalises, and even feces are all signs of insect activity.

Swallowtail caterpillar on dill.

Tent caterpillar, webbing and feces are visible signs; *photo by Elizabeth Barnes.*

SKELETONIZATION

Feeding between the leaf veins by insects.

Causes: insects (Japanese beetle, sawflies).

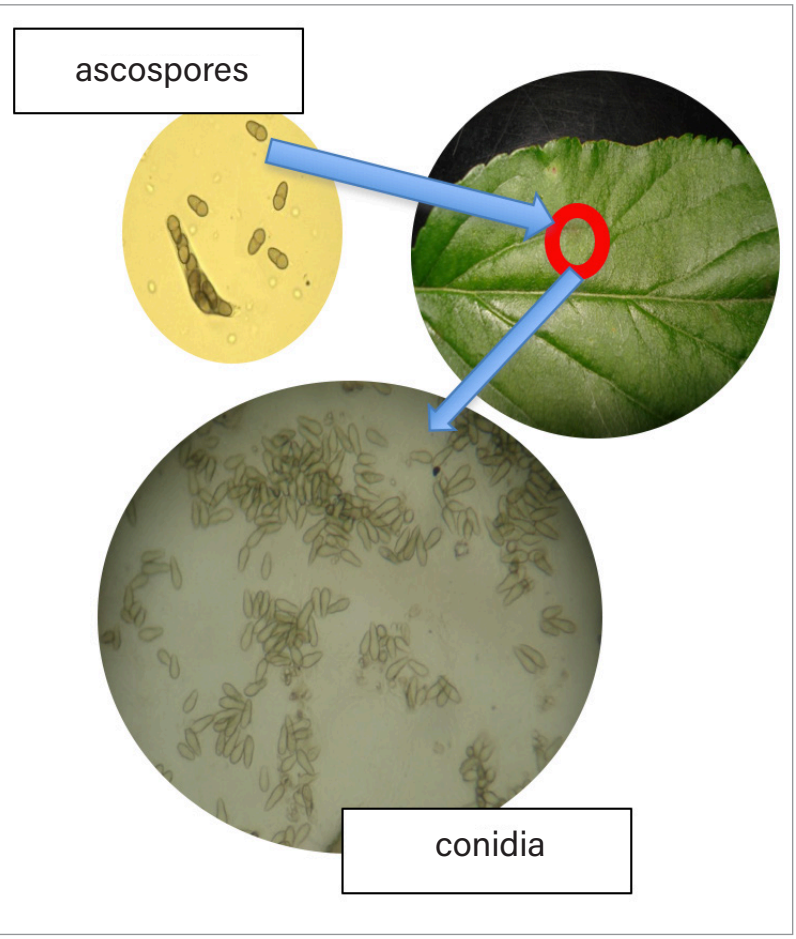
Japanese beetles cause skeletonization of many landscape and garden plants.

Here you can see the sign and symptom of Japanese beetles.

SPORE

The reproductive body of a fungus. May be a product of sexual or asexual propagation.

Causes: Fungi (bacterial plant pathogens do not form spores).



Upon successful infection, one ascospore can produce a single lesion capable of producing over 100,000 spores. Each asexual spore (conidium) can create a new infection, rapidly increasing Inoculum and disease exponentially.

Fungal spores are not usually this conspicuous! A bad outbreak of juniper rust on callery pear; *photo by Joe Boggs.*

SOOTY MOLD

Not a disease but what looks like a fine coating of soot on the leaf surface.

Causes: fungi living in the "honeydew" of aphids or scale insects.

Sooty mold is often found before the aphids, mealybugs, or scale that cause the sooty mold.

Note scale insects on needles along with sooty mold on this pine.

STIPPLING

Localized destruction of the chlorophyll by the injected enzymes where sucking insects feed.

Causes: insect (spider mites, lacebugs, plant bugs and thrips).

Stippling caused by lacebugs can be mistaken for other insect pests or even powdery mildew.

STUNTING

The underdevelopment of any organ of the plant, or the entire plant itself.

Causes: fungi, virus.

Virus caused stunting in petunia.

Stunting and yellowing are symptoms of root rot on this vinca.

Stunting (and strap leaves) caused by herbicide injury.

TATTERS

A physiological disorder, found mainly on oaks, that afflicts new leaves early in the growing season, resulting in a shredded appearance. May be mistaken for insect damage. Specific causes for this symptom are rarely known.

Causes: unknown.

Tatters created the sparse appearance of this oak.

The shredded appearance of all oaks in this nursery.

VASCULAR DISCOLORATION

Darkening of the plant's water-conducting tissue.

Causes: fungi (e.g., Dutch elm disease, oak wilt), bacteria (elm yellows).

Verticillium infection discoloring the vascular tissue of this maple; *photo by Greg Shaner.*

Fusarium wilt of sumac. Note brown vascular tissue.

VEIN BANDING

Tissue along leaf veins is darker in color than the tissue between veins.

Causes: pathogen (virus, abiotic).

Iron chlorosis in hollyhock creates a reverse vein banding appearance.

Hosta virus X can cause a vein banded symptom in some varieties.

WATER-SOAKING

A wet, dark, sunken, translucent lesion.

Causes: Most commonly caused by bacteria.

Bacterial blight causing a water-soaked lesion in Ficus.

Water soaking is a common symptom of crown rot caused by soft rot bacteria, as seen in this orchid.

WEBBING

Strands of fungal hyphae or webs caused by spider mites or insects.

Causes: Insects, mites, fungi.

Rhizoctonia web blight on poinsettia.

Spider mite webbing on spruce.

Webbing caused by tent caterpillars.

WILT

Loss of rigidity and drooping of plant parts.

Causes: drought, insects, nematodes, pathogens (fungi and bacteria).

Drought is primarily caused by a lack of water. Root rots, cankers and wilts are types of diseases that can cause plants to wilt. Borers and girdlers are insects whose feeding also cause wilting.

Primrose being overly dramatic during drought.

Sunflower wilting due to borer damage.

Bacterial wilt of geranium.

Black root rot of vinca causing wilting.

WITCHES' BROOM

An abnormal, brush-like growth of many weak shoots.

Causes: insects (aphids, adelgids, etc.); fungi (rusts); bacteria (phytoplasmas), viruses.

Witches' broom caused by aphids.

Witches' broom caused by the aster yellows phytoplasma.

Witches' broom on blackberry caused by a gall wasp; *photo by Crystal Van Pelt.*