

Plant Diagnosis Key and Questions

The following keys and list of questions are designed to help you narrow down your diagnosis of common plant problems.

Diagnosing Common Insect Problems

- A. Chewed leaves or stems — go to Section I.
- B. Stunted or distorted plant parts — go to Section II.
- C. Tunnels in stems, roots, or trunk of plant — go to Section III.
- D. Wilting, yellowing, silvering or stippling pattern on leaves — go to Section IV.

I. *Chewed leaves or stems.*

A. Leaves chewed

1. Holes chewed entirely through leaf tissue

- a. Katydid, grasshoppers — damage may be found on a number of different types of plants. Katydid are night-feeders, grasshoppers may be seen feeding during the day.
- b. Slugs, snails. Damage occurs on smaller bedding plants and vegetables. Slime trails may be evident. These pests feed at night and are most common during periods of rain and higher humidity.
- c. Weevils and certain leaf-feeding beetles. Common damage on hollies in spring. Damage may occur on other plants. Usually occurs at night.
- d. Caterpillars. Large variety of caterpillars attack many trees, shrubs, vegetables, and turf.
- e. Tent caterpillars and fall webworms. Identified by silken webs in tree crotches (tent caterpillars) or on tips of branches (webworms).

2. Leaf tissue removed from between veins only (skeletonization).

- a. Smaller caterpillars. Smaller species and immature caterpillars.
- b. Leaf beetles. Common species attack elm, willows.
- c. Chafer beetles, June beetles. Primarily night feeders, may be abundant during certain limited times of the spring and summer.

3. Only surface of leaf tissue removed.

- a. Immature caterpillars. Damage usually inconspicuous and spotty during early outbreaks of caterpillars. Damage may quickly progress to skeletonization and loss of entire sections of leaf tissue.
- b. Sawflies. Slug-like caterpillars feeding in groups on surface of leaves.

4. Leaves with mines or tunnels between upper and lower epidermal layers.

- a. Leafminers. Minute flies or beetles that lay eggs and feed inside leaf tissue. Excavated tissue often appears very serpentine as the insect chews its way through leaf tissue.
- b. Tomato pinworm. On tomatoes. Small caterpillars mining upper and outer leaves of tomato plants. Leaves frequently folded and sewn together with silken webs.

5. Leaves with smooth semi-circular holes cut from leaf margin

- a. Leaf cutter bees. Small dark bees attacking various plants — common on rose. These bees use cut leaves for constructing nests for their young.
- b. Leaf cutting ants. Look for ant activity during daylight hours. Leaf material used to grow underground “fungus gardens”, a source of food for the ant colony. Harvester ants will also cut leaves.

B. Plants cut at base

1. Cutworms. Cutworms may be found in vegetables, bedding plants or turf. They can often be found hiding in cracks in the soil, or under debris close to the site of damage. They feed primarily at night.
2. Slugs, snails. Look for slime trails. Pests may be present on plants in the daytime during periods of cloudy or rainy weather.
3. Pillbugs, sowbugs. Generally feed on decaying organic matter, occasionally will attack bases of greenhouse or landscape plants.

C. Twigs girdled near terminals.

1. Twig girdlers, various species. Common on pecan, mimosa, other trees. Beetles girdle twigs prior to, or just after laying eggs in outer portion of branch. Branches usually break during winds and fall to ground.

II. Stunted or distorted plant parts

A. Leaves, fruits, or flower petals stunted or curled.

1. Thrips. Minute insects in flower buds or terminals of the plant. Leaves distorted, cupped. Flowers discolored, streaked, fail to properly open.
2. Galls. Pocket vein gall, a common pest of red oaks, causes a distortion and swelling of central and main veins on underside of oak leaf. Caused by a tiny fly.
3. Stink bugs. Especially pests on vegetables, tomatoes. Relatively large, heavy bodied hemipterous insects. Identified by a triangular-shaped “shield” between the wings on the upper side of the “back”. Can cause shrunken or distorted seeds or fruits on vegetables. Responsible for “catfacing” on tomatoes.

B. Swellings on leaves, smaller stems of trees and shrubs.

1. Oak apple gall. A common gall wasp that causes round, hollow galls on the leaves of red oak trees. Small wasp larva may be present inside the gall.
2. Live oak gall. Hard green, reddish, or brown galls on live oak. May be extremely abundant in some years. Not harmful to tree.
3. Pecan phylloxera. Distinct swellings on stems and leaves of pecans. Stem forms can be damaging to tree.
4. Hackberry nipplegall maker. On hackberry. A tiny planthopper that forms nipple-like galls on native hackberries. Adult insects emerge in late-summer and fall and will enter homes in search of overwintering sites.
5. Various leaf and stem galls. To confirm insect origin, split gall and look for insects or signs of insect presence.

III. Tunnels in stems, roots or trunks of plant

A. Tunnels in trunks and shoots of trees

1. Various deciduous tree borers. Holes generally greater than 1/32 inch, round or oval in shape. Adults generally lay eggs during warm season on bark of tree. Larvae hatch and bore into wood where they feed until ready to emerge as adult beetles or moths.
2. Pine sawyers. Pines. Generally attack trees under stress. Oval holes in bark, extensive tunnelling in cambium under bark. May be evidence of sap-flow from entry and exit points on bark.

3. Bark beetles. Large numbers of small round holes (approximately 1/32 inch diameter). Indicates tree under stress.
4. Asian Ambrosia beetle. Recent invader discovered in East Texas. A type of bark beetle that attacks peaches and a variety of deciduous trees. Toothpick-like protrusions of compacted sawdust extend from holes in bark. Report new finds to Department of Entomology.
5. Peachtree borer. Frass pushed out of holes near base of peach trees and related species.

B. Tunneling in shoots of trees.

1. Nantucket pine tip moth and related species. Ornamental pines and commercial Christmas trees. Bore into terminal shoots of pines causing stunting and death of new growth.
2. Various clearwing borers. Look for frass and shed exuviae (cast skins) protruding from holes in twigs.

C. Tunneling in stems of vegetables, flowers, berry canes.

1. Squash vine borer. Squash. A severe pest of squash and zucchini in vegetable gardens. A type of clearwing borer.
2. Stemboring sawflies. Common in roses, raspberries. Larvae tunnel in stems resulting in easily broken canes.

IV. Wilting, yellowing, silvering or stippling pattern on leaves.

A. Pests excreting honeydew, a sticky, sugary material that adheres to plant stem and leaves. Sometimes affected plant surfaces covered with dark sooty mold.

1. Aphids. Houseplants, flowerbeds, vegetables, trees, shrubs. Round bodied, long-legged insects. Feed on stems and leaf undersides, often in groups or clusters.
2. Mealybugs. Primarily pests on house plants. Insects with waxy excretions covering body, form cottony masses in axils and along stems, and on undersides of leaves.
3. Soft scales. Landscape plants and house plants. Barnacle-like, scale-like, or waxy-covered insects that are sessile (non-moving). Found on stems and on leaves of many tropical indoor plants.
4. Whiteflies. Adult insects are wax-covered, whitish gnat-like insects. When heavily-infested plants are disturbed, large numbers of whitefly adults are commonly seen fluttering above and around plant. Immature stages are minute green or blackish, scale-like insects generally found on the undersides of leaves.

B. Pests not excreting honeydew. Plants not covered with sticky material.

1. Mites. Minute, mobile mites found on leaves, especially on undersides of leaves. Stippling, yellowing of upper plant surfaces. Webbing present on undersides of leaves and in plant axils. Especially severe in hot, dry environments.
2. Aphids. Round-bodied, long-legged sap-feeders found on plant buds, leaves and stems. Not all aphids excrete noticeable amounts of honeydew.
3. Armoured scales. Landscape and house plants. Barnacle- or scale-like in appearance these insects are sometimes difficult to see, especially on the rough bark of trees. Related to soft scales, but generally more flattened in body profile, and do not produce honeydew.
4. Plant bugs. Various colors and body shapes. Piercing-sucking mouthparts. Can feed on plant sap or seeds.
5. Leafhoppers. Small, cylindrical-shaped insects with wings held tent-like over the body and strong jumping legs. Some species are important transmitters of disease.
6. Sharpshooters. Medium-sized (1/4-3/4 inch-long), leafhopper-like insects. Common species feed on crepe myrtle, grape. Produce copious amounts of watery excrement. Rarely damage plants, although grape-feeding species are known to transmit certain diseases.
7. Lacebugs. Common species on sycamores, maples, and azaleas. Highly ornamented wings held flat over the body. These insects generally feed on the undersides of leaves and produce large numbers of black, shiny droppings that adhere tightly to leaf undersides.

8. Box elder bugs and red-shouldered bugs. Feed on seeds of boxelder, chinaberry, soapberry, and chinese pistache. Black to dark-grey bugs with red markings on back and shoulders. Harmless to trees, but large numbers of these insects move into buildings in the fall in search of overwintering sites.
- 9 Chinch bugs. On turf. A small, dark-colored bug with two black, lateral spots on white wings. A pest of St. Augustinegrass.

Diagnosing Infectious Plant Diseases

1. Primary Plant Part Affected
 - A. Leaves — go to Section I
 - B. Flowers or Fruits — go to Section II
 - C. Stems or Roots — go to Section III
 - D. Whole Plant — go to Section IV
2. Multiple Symptoms

In the real world, multiple symptoms (with multiple causes) may occur on the same plant or leaf. It is necessary to continue to ask questions to determine which came first. For example, a nutritional problem (yellowing leaves) may result in the plant being more susceptible to a leaf spot. Or roots that are too wet may lead to infections by *Pythium* or *Phytophthora*.

I. Leaf Symptoms

- A. Leaves have spots
 1. *fungus leaf spots*: spots are roundish, often with darker margins, fruiting bodies (dark pepper-like spots) may be seen near center of spot withhandlens or magnifying glass, spots may have bulls-eye appearance
 - a. early blight of tomatoes, potatoes
 - b. Entomosporium leaf spot of photinia, indian hawthorn
 - c. black spot of rose
 - d. pecan scab
 - e. gray leaf spot of St. Augustinegrass
 2. *bacterial leaf spots*: spots are angular (because they are limited or outlined by plant veins), often with yellowish halo around spot, may have water soaked appearance when spot first appears
 - a. bacterial blight of beans
 - b. bacterial spot of peppers, stone fruits
 - c. bacterial spot of philodendrons
 3. *leaves with orange or rust colored spots*, if you run your finger over the spots, a rusty powder rubs off on your finger
 - a. cedar-apple rust on apples
 - b. rose rust
 - c. cottonwood rust
 - d. rust of fescue grasses

4. *leaves stippled with tiny white spots*

- a. spider mites
- b. air pollution
- c. freeze damage

5. *leaves with discrete spots, evenly distributed on young and old tissue, no fruiting bodies can be seen*

- a. chemical injury

B. Leaves are yellow or discolored

1. *leaves are generally yellow* (may indicate root problems)

- a. nitrogen deficiency, more common on older leaves
- b. insufficient light

2. *leaves are generally yellow but veins remain green* (may indicate root problems)

- a. iron chlorosis, more common on young leaves

3. *leaves are mottled* – yellow and green mosaic pattern

- a. virus, note sharp line between color changes

4. *leaves are green but veins are yellow*

- a. viruses
- b. herbicide damage

5. *leaves are purplish, no apparent spots*

- a. aster yellows (mycoplasma)
- b. nutrient deficiency

C. Leaves have white, gray or black patches

1. *powdery mildew* – white powdery growth on upper leaf surface

2. *downy mildew* – gray, powdery growth on lower leaf surface, yellow spots may appear on upper leaf surface

3. *sooty mold* – black sooty growth on upper leaf surface, leaves sticky with aphid honeydew

4. *lichens* – relationship between a fungus and an alga, injury to plants is indirect, interfering with light or gas exchange

D. Leaf margins are affected, brown dead areas on leaf margins, evenly distributed around leaf

- 1. leaf scorch, insufficient water transport, may indicate root damage or vascular blockage by fungi, bacteria, nematodes or viruses
- 2. salt damage
- 3. cold injury
- 4. chemical injury

E. Leaves are curled or distorted

1. caused by *fungus* pathogens
 - a. oak leaf blister
 - b. peach leaf curl
2. caused by *viral* pathogens
 - a. bean mosaic virus
 - b. cucumber mosaic virus
3. chemical injury
 - a. herbicides
 - b. ethylene

F. Leaves are wilted — this is a general symptom which may be caused by many things

1. too wet or dry
2. too little or too much light
3. plant is root bound
4. roots are girdled
5. transplant shock
6. fungal vascular wilt
7. bacterial vascular wilt
8. viral wilts
9. fungal root rot
10. nematode root damage

II. Root and Stem Symptoms

A. Roots or stems are rotted

1. *fungus stem and root rots* — rots generally are dry, affected tissue appears sunken or shriveled, dark colored
 - a. cotton root rot
 - b. mushroom rot
 - c. take-all patch of turf
 - d. *Pythium* and *Phytophthora* root rots-require excess moisture to spread and cause disease, decay of cortical root tissue
 - e. *Rhizoctonia*, *Fusarium*, *Thielaviopsis* root rots
 - f. Southern blight
2. *bacterial stem and root rots* — rots generally are wet, slimy, soft, and often have foul odor
3. *root rots caused by nematodes* — roots often “sheared” off, secondary fungal and bacterial pathogens may make identification very difficult, send root and soil sample to diagnostic laboratory to confirm diagnosis
4. too much water
5. roots are girdled

B. Stems have cankers or cracks

1. *cankers caused by fungi* — may or may not be sunken, dead tissue, discolored vascular tissue may extend beyond visible canker, fruiting bodies may be present in canker

- a. *Hypoxylon* canker
 - b. mulberry canker
 - c. *Endothia* canker of oak
2. *cankers caused by bacteria* – bacterial ooze may flow from canker or cracks when tree sap is flowing, no fruiting structures present in canker
 - a. bacterial canker of peach and pear
 - b. wet wood
 3. environmental causes
 - a. freeze damage – more damaging on thin-barked trees
 - b. lightning
 4. insects or animals
 - a. squirrels
 - b. borers – holes at random
 - c. sapsuckers – horizontal line of holes
 5. mechanical
 - a. line trimmers, mowing machines
 - b. other mechanical damage
- C. Roots or stems have overgrowths
1. fungal
 - a. Phomopsis gall
 - b. black knot of plum, cherry, etc.
 2. bacterial
 - a. crown gall
 - b. oleander gall
 3. nematode (root knot nematode) – galls not easily picked off root, galls have whitish interior
 4. nitrogen-fixing nodules – on legumes, easily picked off, pinkish or greenish interior
 5. insect
 6. mechanical injury – burls
- D. Stems are dead from tip back
1. fungal
 - a. aerial Phytophthora
 - b. twig blight of mulberry
 2. bacterial – fire blight

3. environmental

- a. drought
- b. freeze injury

III. Flower and Fruit Symptoms

A. Flowers or fruit are discolored

1. fungal causes

- a. Camellia flower blight – Sclerotinia

2. viral causes

- a. rose mosaic virus
- b. ring spot mosaic virus
- c. cucumber mosaic virus
- d. tobacco (tomato) mosaic virus

3. uneven ripening

4. sunscald

B. Flowers or fruit have spots

1. fungal

- a. Botrytis blight
- b. Anthracnose
- c. Apple scab
- d. Pecan scab
- e. black scurf of potato

2. bacterial

- a. Bacterial spot of tomato
- b. Bacterial spot of peach
- c. potato scab

3. viral

- a. cucumber mosaic virus
- b. watermelon mosaic virus

4. environmental – e.g., water spots on African violets

C. Flowers or fruit are rotted or deformed

1. fungal

- a. Botrytis
- b. plum pockets
- c. Southern blight

2. bacterial
 - a. ring rot of potato
 - b. soft rots
3. viral
4. environmental
 - a. blossom end rot of tomato

IV. Whole Plant Symptoms

A. Seedlings die

1. fungal – damping-off, seeding rot
2. nematodes
3. too wet/too dry
4. too hot/too cold

B. Plants stunted

1. Root problems
2. Viruses
3. Nutritional problems
4. Chemical injury

Second Opinion/Lab Culture

Sometime it is necessary to get a second opinion or a lab culture to identify the pathogen or disease. The quality of the sample submitted to the diagnostic laboratory will determine the accuracy of the results of the analysis. The following are steps used to collect proper samples.

1. *Show a progression of symptoms* – Select plants or plant parts that are still partly alive. Plants that are dead or dormant help little in diagnosis. Often the best sample is one just starting to show the symptoms.
2. *Submit whole plant when possible* – Carefully dig the roots if feasible, shake off excess soil but do not wash the roots, place a separate bag around the root system to hold the soil in place.
3. *Place plant in plastic bag, do not add moisture* – Excess moisture stimulates the decomposing bacteria and fungi present on the plant surface. These microorganisms, while doing what they are supposed to do – break down dead organic matter, may mask the plant pathogens making diagnosis difficult.
4. *Keep refrigerated if cannot send immediately*
5. *Package sample carefully* – For example dried leaves in envelopes often are crushed when sent through the post office.
6. *Use overnight mail and avoid sending on weekends, holidays* – Samples decay over time making symptoms less distinct and diagnosis more difficult.

Diagnosing Cultural/Environmental Problems

The following set of questions are designed to help you obtain the maximum amount of background information from the client either in person or over the telephone. The questions are designed to diagnose cultural problems, but

are sometimes helpful in pointing the investigation in the direction of an insect or infectious disease diagnosis.

I. Plant

A. Type of Plant

1. What is the name of the plant affected? Have consumer check for nursery label to obtain name of plant: common, scientific and cultivar names if possible.
2. Is the plant an annual, perennial, woody landscape plant, vegetable, etc.?

B. Age of Plant – How long (months or years) have affected plants have been in their current location in the landscape, garden, or orchard

C. General Symptoms

1. When did the symptoms first occur?
2. Have the same or similar symptoms occurred before?
3. Is there any pattern to symptom occurrence: in the landscape (perhaps in low areas only), or on the plant (both old and new foliage affected equally)?
4. Is more than one kind of plant (species or cultivar) affected?

D. Specific Symptoms

1. Roots

- a. What is the appearance of the roots? Healthy roots are light in color with lots of root hairs. Root rot is evidenced by roots that are dark brown or black in color with few if any root hairs, and the outer layer of root tissue sloughs off easily when pulled firmly between thumb and forefinger.
- b. Is the plant pot-bound?

2. Stem

- a. Are cankers, holes, or wounds evident?
- b. Do holes or other wounds follow a pattern or are they randomly spaced?

3. Foliage

- a. What percentage of leaves are affected on the plant?
- b. Where on the plant are leaves affected? Top, bottom, inner, outer?
- c. Appearance of leaves: healthy, uniform green; or exhibiting yellowing between the veins, mottling, vein clearing, etc.
 1. Nutrient deficiencies can cause stunted plants, pale green or yellow leaves; leaves with dark green veins but yellowed or chlorotic tissue between the veins; reddish or purplish discoloration of the foliage.
 2. Deformed stems and leaves, and strap-like leaves are often caused by phenoxy herbicides.
 3. The occurrence of green leaves exhibiting yellow or white veins is usually the result of herbicide injury, less commonly a virus.
 4. Brown, necrotic (i.e., dead) tissue which begins at the outer edge of a leaf and moves uniformly toward the center of the leaf is termed leaf scorch.
 - a. This is a cultural/environmental problem caused by: too much or too little water, heat or wind stress, or by a blockage of the plant's vascular (i.e., water conducting) tissues by a pathogen.
 - b. This condition is almost never due to an infectious leaf-spotting pathogen.
 - c. Expect leaf scorch and then partial defoliation during summer heat the first and second year after transplanting.