Common Ornamental Pests of Utah









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FOREWORD

This guide was developed to aid in the identification and management of common arthropod, disease, vertebrate and weed pests found in ornamental plantings in Utah. This guide is not intended to be an exhaustive list of all ornamental pests in Utah. For additional information on the weeds presented in this book, please see the "Common Weeds of the Yard and Garden" (USU Extension) from which the weed information in this guide was derived.

After using this guide to identify a pest, verify the pest's identity using online resources or by contacting the Utah Plant Pest Diagnostic Lab.

- Phone: (435)-797-2435
- Email: utahpestlab@gmail.com

Spreads in this guide include descriptions of:

- The pest, disease or weed identification.
- Signs and symptoms of damage.
- Basic biology and life history of the pest, disease or weed.
- Integrated pest management recommendations.

Pesticide Recommendations

Most of the pesticide recommendations in this guide are general and require additional product research by the user. Be aware that pesticide recommendations are subject to change at any time due to loss of registration, chemical or product discontinuation or changes in labeling. Consult the Utah Plant Pest Diagnostic Lab or your local Utah State University County Extension Office for current pesticide recommendations. By law, pesticide users are required to read and follow the pesticide product label.

Abiotic Disorders

Ornamental plants can be adversely affected by both living (biotic) and non-living (abiotic) stressors. Biotic injury to plants is a result of insect, mite, plant pathogen, animal, etc., activity. The primary focus of this guide is to identify biotic issues with ornamental plants. This section briefly covers common abiotic disorders in ornamental plantings in Utah.

Diagnosing abiotic disorders is difficult and requires knowledge of the plant species' susceptibility to pests and environmental conditions, plant and site history, past and current environmental and climatological conditions, and human activities such as cultural and chemical management practices. Many abiotic disorders resemble biotic disorders and distinguishing between them can be challenging. Follow the general diagnosic steps below to help determine if your plant is affected by a biotic or abiotic issue.

1. Properly identify the plant involved.
2. Conduct a thorough inspection of the plant.
3. Identify and record plant symptoms.
4. Inspect the site and consider site history. Abiotic issues may be a result of human, or other, activity occurring off-site (e.g., herbicide/sterilant drift or leach).
5. Look for general patterns among affected plants at the plant and landscape level.
6. Determine the plant management history, including planting, cultural and chemical practices.
7. Compile information and make a diagnosis. A diagnosis may involve multiple abiotic stressors or a mix of biotic and abiotic issues.
8. Contact the Utah Plant Pest Diagnostic Lab or your local county extension agent or horticulture specialist for assistance diagnosing abiotic disorders.

The following section briefly discusses the most common abiotic disorders of ornamental plants in Utah.

When diagnosing plant health issues, always consider the abiotic factors listed below as a possible cause for symptoms. Prolonged stress caused by abiotic disorders can lead to pest attack.

Common Causes of Abiotic Disorders

- aspect (i.e., south and west sides receive more sun/heat)
- changes in soil level after planting
- cold or hot temperature extremes
- construction
- direct sun
- drought
- excessive wind
- extreme fluctuations in temperature
- fertilizer over/under application
- herbicide/sterilant drift/leach or misuse
- improper plant selection for Utah or site
- improper planting
- improper pruning
- irrigation: too much or too little
- mechanical damage from lawn equipment, etc.
- nutrient deficiency
- pet urine/feces
- pollution (ozone, smog, etc.)
- restricted root zone (concrete planters/sidewalks/etc.)
- root damage
- salt damage (deicing salt use or excessive fertilizer use)
- sand blown in the wind
- site history (construction, etc.)
- soil compaction
- soil nutrient composition
- soil pH
- soil salinity
- soil texture
- sun/heat reflected off of glass or buildings
- water supply/composition
- wind
- winter sun reflected off of snow

Deicing Salt Damage

Description

Salt used to melt winter snow and ice can splash directly on ornamental plants or can be deposited on the soil around plants. Excessive salt can create drought-like burning or scorch symptoms on leaves or needles, marginal yellowing and necrosis and in serious cases can lead to leaf or plant death. Excessive fertilizer use can also cause salt damage to plants.

Management

Minimize salt damage by limiting deicing salt in areas near plants or by piling salt-affected snow in areas that won't affect plants. Do not apply excessive fertilizer. Have soil tested by the USU Analytical Lab prior to making a fertilizer application or to test for excessive salinity.

Salt damage on quaking aspen (William Jacobi, Colorado State University, Bugwood.org)

Salt damage on pine (William Jacobi, Colorado State University, Bugwood.org)

Salt damage on yew (Joseph LaForest, University of Georgia, Bugwood.org)

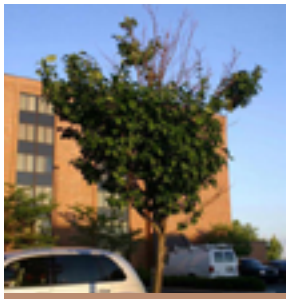
Drought/Underwatering

Description

Utah is a very dry state. Trees that are not adapted to drought conditions will be stressed without supplemental irrigation during the growing season. Drought stress will manifest as leaf wilt, leaf folding or rolling, leaf scorch, leaf yellowing, premature leaf drop or leaf death, and overall tree decline. Some drought symptoms are similar to salt damage, as salt reduces the ability of a plant to take up water.

Management

Properly identify the tree or plant species of concern and determine the particular water requirement needed. Typically, less frequent, deep watering within the root zone will provide better results. Frequent, shallow watering may not adequately penetrate the root zone, especially if competing turfgrass is present. For more information on watering trees and plants, see the Utah State University fact sheet "Efficient Irrigation of Trees and Shrubs."



Drought damage (William Fountain, University of Kentucky, Bugwood.org)

Drought damage (Robert L. Anderson, USDA Forest Service, Bugwood.org)

Drought damage (Robert L. Anderson, USDA Forest Service, Bugwood.org)

Herbicide Damage

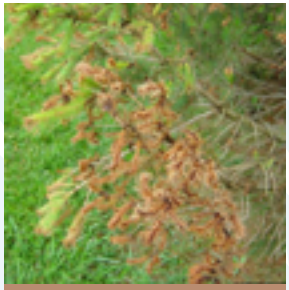
Description

Herbicides are designed to kill plants. Misuse, volatilization, drift or root uptake of herbicides can cause wide-ranging deformities in plants, leaf and branch dieback and plant death. Signs of herbicide damage include leaf deformation, twisting, cupping, yellowing, wilting, browning, scorching, brown spotting/speckling, narrowing, strapping and dieback.

Management

When using herbicides, always follow the labeled directions. Calibrate the sprayer before applying any herbicide and avoid applying when it is windy. Herbicides can drift even in the slightest breeze. If breezy, use lower sprayer pressure to produce coarse spray droplets. Keep the spray nozzle close to the ground and spray only the targeted area. Spray when the air temperature is below 80°F. Homeowners should not use soil sterilants or long-term vegetation control chemicals. Never use herbicide spray equipment to apply insecticides or fungicides.

2, 4-D damage on cotton (Clemson University, USDA Cooperative Extension Slide Series, Bugwood.org)



Herbicide damage on spruce (Jason Sharman, Vitalitree, Bugwood.org)

Herbicide damage (Ryan Davis, Utah State University Extension)

Improper Planting

Description

Improper planting is a very common cause of tree decline and stress in Utah. Improper planting includes selecting the wrong plant for the site, selecting a poor planting site, planting root-bound/circling stock, digging an inadequate planting hole, inadequately preparing soil, planting too deeply, not removing non-biodegradable burlap or metal baskets from around the trunk, improper staking, mulching too high, miswatering, and not monitoring the tree after planting. Symptoms of improper planting can take years to manifest and are often overlooked; these, however, should be looked for first when diagnosing plant health issues.

Management

Always select the best tree for the site. Use Utah State University's "treebrowser.org" website to help select the proper tree for the site. Assess the planting site for soil and environmental conditions and prepare the site accordingly to prevent planting issues.

Improper mulching (Jason Sharman, Vitalitree, Bugwood.org)

Improper planting depth and girdling roots (Linda Haugen, USDA Forest Service, Bugwood.org)

Improper planting depth (Robert Benjamin, Bugwood.org)

Iron Chlorosis

Description

Iron chlorosis is one of the most common abiotic disorders affecting plants in Utah. While Utah's soils are high in iron, the pH of the soil makes iron less available to susceptible plants. Plants suffering from iron chlorosis have a diagnostic yellow leaf with green veins. In some cases, interveinal or marginal necrosis can occur. Plants chronically affected by iron chlorosis will eventually fade and die, but the process takes many years. Stress caused by a decrease in the ability of the plant to produce food makes affected plants prone to attack by pests and diseases.

Management

Select plants that are not susceptible to iron chlorosis. Affected plants may be treated (with varying results) using foliar, soil or injectable iron products. For more information on management of iron chlorosis, see Utah State University's fact sheet "Control of Iron Chlorosis in Ornamental and Crop Plants."

Iron chlorosis symptoms on maple (Marion Murray, Utah State University Extension)

Severe iron chlorosis symptoms on maple (Marion Murray, Utah State University Extension)

Iron chlorosis symptoms on maple (Larry Sagers, Utah State University)

Leaf Scorch

Description

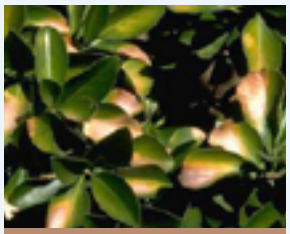
Leaf scorch is a general plant response to various environmental conditions including drought, underwatering, intense sunlight and heat, wind, soil compaction, and nutrient deficiencies. Scorch is common on many trees but is most severe on ash, maple, pine, horse chestnut, elm, and poplar. Leaf scorch includes necrotic leaf margins or interveinal regions. Severe scorch can kill leaves.

Management

The primary cause of leaf scorch is a lack of water in the root zone coupled with wind and sunlight. Keep plants appropriately watered. Protect plants from excessive wind or direct/reflected sunlight during drought conditions. Plant trees in areas where they will not have restricted root zones or compacted soils. For more information on watering trees and plants, see the Utah State University fact sheet "Efficient Irrigation of Trees and Shrubs."

Leaf scorch (Andrew Koeser, International Society of Arboriculture, Bugwood.org)

Leaf scorch on horse chestnut (Marion Murray, Utah State University Extension, Bugwood.org)



Leaf scorch (Jack Kelly Clark, University of California Statewide IPM Program, Bugwood.org)

Mechanical Damage

Description

Mechanical damage to plants includes any activity that damages the roots, root collar, stem, branches or leaves. Damage to the roots, root collar or stem can manifest as crown dieback and leaf dieback. Mechanical damage is frequently caused by mowers/weed wackers/lawn maintenance tools, vehicles, soil compaction, soil piled on root zones or against a tree, over-mulching, girdling, construction, trenching in the root zone, vandals, improper planting, improper pruning and improperly aimed sprinkler heads.

Management

Minimize mechanical damage by setting up tree protection zones to keep lawn maintenance equipment, vehicles, construction activities, etc., away from the tree and the root zone.

Mower/weed wacker damage (David Robinson, University of Illinois, Bugwood.org)

Dirt piled on pine root zone (John Hartman, University of Kentucky, Bugwood.org)

Cut roots during construction (Peter Bedker, Bugwood.org)

Overwatering

Description

Overwatering can cause as much stress as severe drought. Every plant should be watered to meet its water requirements. Site, soil and environmental factors will also affect watering rates. Too much water will saturate soils, displacing air and starving the roots of oxygen. Saturated soils will cause roots to die, negatively affecting water uptake. Overwatering symptoms include canopy dieback, leaf yellowing, necrosis, marginal scorch, wilting and leaf loss. Tree death can occur where standing water is persistent.

Management

Minimize overwatering damage by understanding the water needs of your plants. Plant species with similar water requirements in watering zones so they can be watered properly. Have your soil texture analyzed to determine its water-holding capacity (e.g., clay holds water, sand is permeable). For more information on watering trees and plants, see the Utah State University fact sheet "Efficient Irrigation of Trees and Shrubs."

Standing water in root zone (USDA Forest Service - Ogden, USDA Forest Service, Bugwood.org)

Overwatered pine (William Fountain, University of Kentucky, Bugwood.org)

Leaves yellowing from overwatering (R.J. Reynolds Tobacco Company Slide Set, Bugwood.org)

Restricted Root Zone

Description

A plant's roots are as important as its leaves. Often, plants are installed in sites where the root zone will be greatly restricted as they grow. A restricted root zone will cause generalized tree stress and may lead to attack by insects or diseases. Restricted root zones also make plants more vulnerable to windthrow, especially when soils are saturated. Restricted root zones are often enclosed by concrete or asphalt which will reflect heat and light toward the tree, adding additional stress.

Management

If a planting site has a restricted root zone, select a plant that will be an approprite size for the site when it is fully grown. Use Utah State University's "treebrowser.org" website to help select the proper tree for your site.

Restricted root zone (William Fountain, University of Kentucky, Bugwood.org)

Restricted root zone (William Fountain, University of Kentucky, Bugwood.org)

Restricted root zone (Andrew Koeser, International Society of Arboriculture, Bugwood.org)

Sunscald

Description

Sunscald occurs primarily in the winter months, but can occur on plants that have undergone recent pruning or damage that has exposed normally shaded, thin bark tissue. Direct, intense sunlight can heat unadapted tissues causing cell death. Sunscald is most prevalent on the south-southwest sides of tree trunks, but can occur on exposed branches. During the winter, intense direct and reflected sunlight will activate tissues under the bark. At night, temperatures fall and the cells freeze, causing cell death. This damage is not often noticed for a few years until the bark has split open exposing the compartmentalized damage below. These sites are prone to attack by flatheaded borers and fungal and bacterial pathogens.

Management

Wrap thin-barked trees with white horticultural wrap or a plastic tree guard in the fall and remove in spring after the threat of persistent snow. A 50:50 mix of white exterior latex paint with water applied to lower trunks can also provide protection.

Sunscald on a branch (Jack Kelly Clark, University of California Statewide IPM Program, Bugwood.org)

Sunscald on a tree trunk (eXtension.org

Sunscald on a tree trunk (Purdue University)

Winter Desiccation

Description

Winter is a strenuous time for urban evergreen plants. Evergreen plants still require water in the winter. Winter desiccation occurs when inadequate water is available in the root zone to meet the demands of leaf transpiration. When the roots are unable to provide adequate water to the leaves, cells begin to die from the tip down. This effect is pronounced during periods of strong wind or intense sunlight. Damage is typically worse on south and southwest sides of plants, or the direction facing the prevailing winds. Damage is typically worse on newly planted trees with underdeveloped root systems.

Winter desiccation (Clemson University, USDA Cooperative Extension Slide Series, Bugwood.org)

Winter desiccation (Mike Schomaker, Colorado State Forest Service, Bugwood.org)

Management

Continue watering evergreen plants as long as the ground is not frozen. Watering in late fall and early winter can supply the roots with water required for transpiration by the leaves. Newly planted trees with limited root zones need to be watered frequently until roots adequately establish.

Winter desiccation (William Jacobi, Colorado State University, Bugwood.org)

Carpenter Ants

Camponotus spp.

Pest Description

- one node (bump between middle and rear body sections)
- black or black with a reddish-brown body
- abdomen covered in yellowish hairs
- worker ants of many sizes
- evenly rounded thorax
- sawdust outside of nests/galleries

Host Plants, Diet & Damage

- invade hollow landscape trees, log piles, etc.
- feed on living and dead insects, protein, sweets and honeydew excreted by aphids and other insects
- chew and remove wood to create galleries and tunnels

Biology, Life Cycle & Damaging Life Stage

- one queen housed in the primary nest, typically outdoors
- nest in wood, especially moist or decaying wood
- have a primary nest and separate satellite nests
- adult worker ants are the damaging life stage

IPM Recommendations

- Identify ants to determine species.
- Find nesting locations by following workers back to their nest, if possible.
- Remove and replace water-damaged or decaying wood or severely infested landscape trees.
- Prune vegetation away from structures to eliminate contact.
- Remove food and water sources.
- Seal potential ant entryways if ants are entering a structure.
- Use ant baits to help eliminate nests that are hard to find.
- Destroy nests using an appropriately labeled liquid, dust or bait insecticide.

Adult carpenter ant; thorax evenly rounded (April Nobile, Antweb.org)

Carpenter ant damage (Edward H. Holsten, USDA Forest Service, Bugwood.org)

Carpenter ant damage (Joseph O' Brien, USDA Forest Service, Bugwood.org)

Field Ants

Formica spp.

Pest Description

- black or reddish brown and black
- one node (bump between middle and rear body sections)
- most common ant found in yards and gardens
- often mistaken for carpenter ants, but not as likely to forage indoors
- worker ants of multiple sizes
- depression in thorax differentiates them from carpenter ants (see arrow in top image)

Host Plants, Diet & Damage

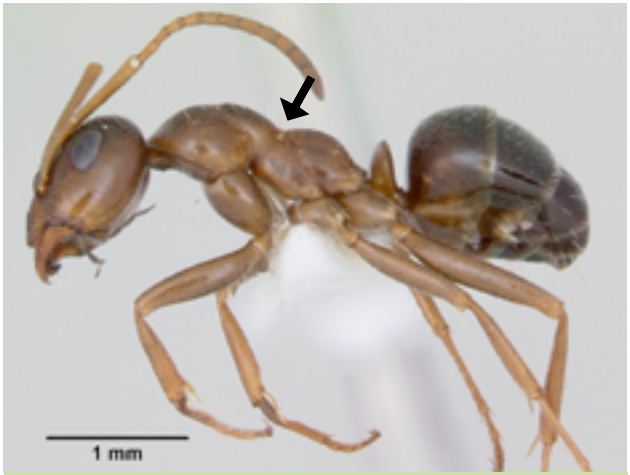
- feed on a variety of foods such as honeydew, sweets and insects
- can be scavengers or predators
- become a nuisance during swarming flights
- nest outdoors in loose soil, turf, decaying wood or other landscaped areas
- may produce mounds (sometimes incorporating twigs, dried leaves and other plant materials) in exposed areas, in turfgrass or nest under rocks, logs, etc.
- can swarm and bite humans if a mound is stepped on

Biology, Life Cycle & Damaging Life Stage

- typically one queen per colony
- do not frequently come indoors
- adult worker ants are the damaging life stage

IPM Recommendations

- Locate and destroy nests in lawn and adjacent areas using liquid, granular or bait-formulated pesticides.
- Control soft scale, mealybug or aphid populations on nearby ornamental plants.
- Seal or eliminate potential ant entryways into homes or structures.



Adult field ant; note depression in thorax (April Nobile, Antweb.org)

Field ant worker (David Cappaert, Michigan State University, Bugwood.org)

Field ant mound (Steven Katovich, USDA Forest Service, Bugwood.org)

Harvester Ants

Pogonomyrmex spp.

Pest Description

- red to brown to black
- larger ants; 1/5 – 1/2 inch long
- two nodes (bumps between middle and rear body sections)
- workers of equal or different sizes
- row of hairs on the underside of the head
- spines on back sometimes present

Host Plants, Diet & Damage

- feed on seeds and grasses
- inflict painful stings when disturbed; some species leave stingers in the wound
- occasional pests of lawns
- strip large areas of grass and vegetation around nesting sites

Biology, Life Cycle & Damaging Life Stage

- one queen per colony
- nests appear as flat, bare circular patches of soil averaging several feet in diameter
- nests may be several feet deep
- swarm from June to October
- adult workers are the damaging stage

IPM Recommendations

- Use granular ant baits labeled for lawn use around the nest opening.

Harvester ant (Joseph Berger, Bugwood.org)

Harvester ant nest entrance (Whitney Cranshaw, Colorado State University, Bugwood.org)

Harvester ant nest (Whitney Cranshaw, Colorado State University, Bugwood.org)

Pavement Ant

Tetramorium caespitum

Pest Description

- 1/10 - 1/8 inch long; light to dark brown with fine grooves lining the head and thorax (middle body section)
- two nodes (bumps between middle and rear body sections)
- legs and antennae lighter than the rest of the body
- worker ants of one size

Host Plants, Diet & Damage

- prefer greasy and protein materials such as meats, pet food, sweets, bread, nuts and insects
- nests often located outdoors under stones, pavement cracks, wood, next to buildings and under building foundations
- swarms and mounds can be unsightly and alarming
- can infest gardens and other outdoor areas
- nuisance pest indoors and outdoors

Biology, Life Cycle & Damaging Life Stage

- one queen per colony
- characteristically produce small mounds at nest entrances
- typically swarm in spring after rain; can swarm indoors
- adult workers are the damaging stage

IPM Recommendations

- If the nest can be located, directly drench the shallow nest with an appropriately labeled insecticide.
- Use liquid insecticidal bait stations.

Adult pavement ant; two nodes (see arrows) (April Nobile, Antweb.org)

Pavement ant with wings (Whitney Cranshaw, Colorado State University, Bugwood.org)

Pavement ant swarm (Joseph Burger, Bugwood.org)

Pyramid Ants

Dorymyrmex spp.

Pest Description

- small; 1/8 inch long; color ranging from yellow, brown to black
- single node (bump between middle and rear body sections)
- worker ants of one size
- have a pyramid-shaped projection on top of the thorax (see arrow in top image)

Host Plants, Diet & Damage

- feed on sweets and live and dead insects
- honeydew produced by aphids and other insects
- crater-like mounds can become dense and unsightly in turf and outdoor areas
- occasionally invade buildings in search of food or moisture
- can bite

Biology, Life Cycle & Damaging Life Stage

- one queen per colony
- prefer open, dry, sunny areas; soil nesting
- distinctive "crater" nests consisting of a hole surrounded by a mound of excavated soil
- nests are typically small and shallow
- common in the drier, sandier parts of the state
- adult workers are the damaging life stage

IPM Recommendations

- If the nest can be located, directly drench the shallow nest with an appropriately labeled insecticide.
- Use sweet ant baits.

Pyramid ant; note pyramid-shaped projection (Gary Alpert, Harvard University, Navajonature.org)

Pyramid ants (Jerry A. Payne, USDA Agricultural Research Service, Bugwood.org)

Pyramid ant mound (John Pearson, Bugguide.net)

Cooley Spruce Gall Adelgid

Adelges cooleyi

Pest Description

- small; early stages may be 1/20 inch long
- aphid-like appearance
- produce white, cottony egg masses on spruce twigs
- most visible inside of 2–3 inch pinecone-looking galls
- galls are green in the spring and turn brown in summer

Host Plants, Diet & Damage

- spruce (primary host) and Douglas-fir (alternate host)
- feed on plant sap; cause large, 2–3 inch long galls on spruce
- stipple and bend needles on Douglas-fir
- damage primarily aesthetic
- damage is rarely a threat to tree health

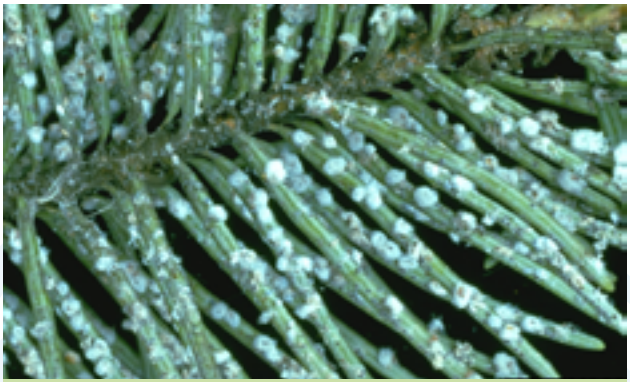
Biology, Life Cycle & Damaging Life Stage

- overwinter as adult females or nymphs on spruce bark or beneath spruce buds
- in spring, eggs are laid near new buds and hatch around budbreak
- nymphs feed on sap at the base of needles, forming galls
- galls protect insects from foliar pesticide applications
- in mid-summer, nymphs exit galls and fly to Douglas-fir
- multiple generations occur on Douglas-fir before some adelgids return to spruce
- some adelgids overwinter on Douglas-fir

IPM Recommendations

- The Cooley spruce gall adelgid has little negative effect on tree health; tolerate pest.
- Some spruce trees are more resistant than others.
- Do not plant spruce and Douglas-fir close together.
- Apply horticultural oil before budbreak (warning: oils may discolor spruce needles).
- Apply cover spray (carbamate or pyrethroid) before budbreak.
- Apply a systemic insecticide (neonicitinoid) in the spring.

Winged adults (Whitney Cranshaw, Colorado State University, Bugwood.org)



Cooley spruce gall adelgid infestation (Petr Kapitola, Central Institute for Supervising and Testing in Agriculture, Bugwood.org)

Galls on spruce branches, typical of Cooley spruce gall adelgid infestation (Whitney Cranshaw, Colorado State University, Bugwood.org)

Giant Conifer Aphids

Cinara spp.

Pest Description

- up to 1/5 inch long; large aphids with long legs
- purple to black in color; bodies may have a coating of grayish-white powder
- winged or wingless

Host Plants, Diet & Damage

- found on many species of conifer, including juniper
- feed on bark, twigs, foliage and roots
- honeydew production can lead to black needles (sooty mold)

Biology, Life Cycle & Damaging Life Stage

- overwinter as eggs on bark or needles
- emerge in spring from eggs
- often found in large groups on host trees

IPM Recommendations

- Giant conifer aphids have little negative effect on tree health; tolerate pest.
- Spray with high pressure water to dislodge aphids.
- Use insecticidal soap.
- Apply a systemic insecticide (neonicitinoid) in the spring.

Cypress aphids (James Denny Ward, USDA Forest Service, Bugwood.org)

Giant conifer aphid infestation on blue spruce (Bob Hammon, Colorado State University, Bugwood.org)

Cinara aphids on fir (USDA Forest Service - Ogden, USDA Forest Service, Bugwood.org)

Leafcurl Ash Aphid; Woolly Apple Aphid; Woolly Beech Aphid

Prociphilus fraxinifolii; Eriosoma lanigerum; Phyllaphis fagi

Pest Description

- small, ~ 1/8 inch; pear shaped; color variable depending on species
- bodies covered in a white, waxy filament that gives a cottony or woolly appearance (more apparent on some species than others)

Host Plants, Diet & Damage

- cotoneaster, hawthorn, beech, ash, crabapple, firethorn, elm, etc.
- attack roots, trunks, limbs, leaves and shoots
- white, waxy substance can build up on plants
- some species curl, twist, or cup leaves or feed on roots
- honeydew or sooty mold may be present

Biology, Life Cycle & Damaging Life Stage

- some have alternate hosts; others migrate between different parts of the same plant
- overwinter as immatures on roots or as eggs on bark
- emerge in spring and move up trunks to feed on leaves
- mid-summer through fall, aphids migrate back to ash roots to overwinter
- when aphid populations become high, winged aphids will fly to nearby hosts
- winged adults may emerge from the roots in fall to mate

IPM Recommendations

- These aphids have little negative effect on tree health; tolerate pest.
- Monitor bark, branches and undersides of leaves for aphids in the spring.
- Waxy coating and protection from curling leaves make cover sprays less effective.
- Apply a systemic insecticide (neonicitinoid) in the spring.

Leafcurl ash aphids (left) and leafcurl ash aphid damage (right) (James Solomon, USDA Forest Service, Bugwood.org)

Left: Woolly apple aphid colony (Whitney Cranshaw, Colorado State University, Bugwood.org); Right: Woolly apple aphid long-term damage to apple tree (H.J. Larsen, Bugwood.org)

Woolly beech aphids (left) and woolly beech aphid damage (right) (Louis-Michel Nageleisen, Department of Forest Health, Bugwood.org)

Petiolegall & Vagabond Gall Aphids

Pemphigus spp.; Mordwilkoja vagabunda

Pest Description

petiolegall aphid

- small, 1/13 inch; pale green; covered in a waxy film; with or without wings
- recognized by round galls on Populus spp. petioles

vagabond gall aphid

- very small, 1/50 – 9/50 inch; color variable; with or without wings
- recognized by galls noticeable after leaf fall

Host Plants, Diet & Damage

petiolegall aphid

- creates round galls on cottonwood, poplar and aspen petioles; damage primarily aesthetic

vagabond gall aphid

- creates unsightly galls on cottonwood and aspen; damage primarily aesthetic

Biology, Life Cycle & Damaging Life Stage

- form galls by feeding on host tissue
- adults and immatures cause damage
- overwinter as eggs within galls or in bark crevices
- eggs hatch in spring as foliage expands, forming galls
- alternate to a summer host around mid-summer once galls have dried out
- return to host in fall to lay overwintering eggs

IPM Recommendations

- Little negative effect on tree health; tolerate pest.
- Keep trees healthy and stress free.
- Apply horticultural oils to overwintering eggs in spring prior to budbreak.
- Once galls form, insecticide cover sprays will not be effective.
- Apply a systemic insecticide (neonicitinoid) in the spring.

Poplar spiral gall aphids (Milan Zubrik, Forest Research Institute - Slovakia, Bugwood.org)

Galls on petiole of leaves produced by poplar petiolegall aphids (Herbert A. 'Joe' Pase III, Texas A&M Forest Service, Bugwood.org)

Left: Leaf galls produced by vagabond gall aphids (Minnesota Department of Natural Resources, Bugwood.org); Right: Dry vagabond aphid galls (Whitney Cranshaw, Colorado State University, Bugwood.org)

Other Aphids

Aphididae (many)

Pest Description

- most less than 1/8 inch; over 500 aphid species in Utah
- range in color from green, yellow, purple, red to black
- teardrop to oval in shape with two "pipes" (cornicles) sticking out the rear end
- some aphids excrete a white, cottony substance
- may or may not have wings

Host Plants, Diet & Damage

- some are host specific; some feed on multiple host plants
- feed on plant sap using straw-like mouthparts
- can feed on roots, trunk, stems or leaves
- can cause twisting, cupping, leaf rolling, galls and unsightly cottony masses
- do not typically cause major tree/plant health issues
- exude honeydew onto plants, homes and cars
- sooty mold growing on honeydew can be unsightly
- mass fall migrations can sometimes cause alarm
- some transmit plant diseases

Biology, Life Cycle & Damaging Life Stage

- life cycles are variable depending on aphid species
- overwinter as eggs outdoors
- mating may occur; females can give birth to living young
- wings may form during migrations between hosts or when populations become too high
- nymphs and adults are the damaging life stages

IPM Recommendations

- Little negative effect on tree health; tolerate pest.
- Wash off aphids with a strong stream of water.
- Apply horticultural oils to overwintering eggs in spring.
- Apply insecticidal soap to nymphs and adults.
- Apply a systemic insecticide (neonicitinoid) in the spring.
- Apply a cover spray (pyrethroids) when aphids are present.

Left: Adult and nymph green peach aphids (David Cappaert, Bugwood.org); Right: Potato aphid life stages (Joseph Berger, Bugwood.org)

Green peach aphid life stages (Whitney Cranshaw, Colorado State University, Bugwood.org)

Adult green peach aphid with wings (Scott Bauer, USDA Agricultural Research Service, Bugwood.org)

Black cherry aphid life stages (Whitney Cranshaw, Colorado State University, Bugwood.org)

Left: Sooty mold on lower leaf (Daren Mueller, Iowa State University, Bugwood.org); Right: Aphid eggs (Whitney Cranshaw, Colorado State University, Bugwood.org)

Ash Bark Beetle (Western)

Hylesinus californicus

Pest Description

- adults: ~ 1/6 inch long; dark with white to yellow scales; clubbed antennae
- larvae: white grubs with no legs and a brown head capsule

Host Plants, Diet & Damage

- ash
- feed on sapwood and phloem layers under the bark
- typically attack smaller branches, but can attack the trunk
- prefer highly stressed trees
- leaves above the damaged areas will turn color and die
- if the main stem is attacked, tree death may occur
- create small round holes in limbs
- galleries can be found under bark
- can introduce fungal pathogens

Biology, Life Cycle & Damaging Life Stage

- overwinter as late-stage larvae under the bark or as adults in bark notches
- larvae and adults become active in mid- to late-spring
- adults mate and eggs are laid within a gallery that encircles and girdles the branch
- larvae hatch and burrow outward from parental gallery
- typically one generation per year
- adults and larvae damage limbs and occasionally the main stem

IPM Recommendations

- Control is generally not warranted.
- Remove and discard infested branches prior to beetle emergence.
- Reduce stress on ash trees.
- Apply insecticides (carbamates; pyrethroids) to the bark and branches to prevent damage to susceptible trees in areas of active ash bark beetle activity.

Adult western ash bark beetle (T. H. Atkinson, Barkbeetles.info)

Adult western ash bark beetle (T. H. Atkinson, Barkbeetles.info)

Left: Ash bark beetle galleries (Swiss Federal Institute for Forest, Snow, and Landscape Research, Bugwood.org); Right: (Milan Zubrik, Slovakian Forest Research Institute, Bugwood.org)

Cedar/Cypress Bark Beetles

Phloeosinus spp.

Pest Description

- adults: ~ 1/8 inch long; black to reddish brown
- larvae: white grub with a brown head capsule; no legs

Host Plants, Diet & Damage

- Utah and Rocky Mountain juniper; eastern red cedar; Arizona cypress; Leyland cypress; other cypress trees
- feed on tree phloem under bark
- can notch bark
- can girdle branches and stems of stressed trees resulting in discolored or dead foliage
- girdling causes branch or tree dieback or death
- can introduce fungal pathogens
- larvae and adults both cause damage

Biology, Life Cycle & Damaging Life Stage

- overwinter as larvae under tree bark
- typically one generation; two generations may occur in some locations
- adults can attack trees from spring to fall, depending on location (mid- to late-summer for most of Utah)
- prefer damaged or stressed trees

IPM Recommendations

- Reduce stress and keep trees healthy and damage free.
- Do not overwater. Occasional deep irrigation is preferred.
- Prune dead or dying material from affected trees during winter and remove from site.
- Apply insecticides (carbamates; pyrethroids) to the bark on the main stem and branches to prevent damage to susceptible trees in areas of active cedar/cypress bark beetle activity.

Cedar bark beetle (Steven Valley, Oregon Department of Agriculture, Bugwood.org)

Twig dieback from cedar bark beetle feeding; note opening (see arrow) (Whitney Cranshaw, Colorado State University, Bugwood.org)

Frass left by cedar bark beetles (Donald J. Goheen, USDA Forest Service, Bugwood.org)

Elm Bark Beetles

Scolytus multistriatus; Scolytus schevyrewi

Pest Description

- Scolytus multistriatus (SM): 1/13–1/9 inch; reddish brown
- Scolytus schevyrewi (SS): 1/9-1/6 inch; reddish brown with black band across wings
- both have a "thumbnail-like" rear end with a center spine
- larvae: white grubs with a brown head capsule; no legs

Host Plants, Diet & Damage

- SM: elm; possibly hackberry
- SS: elm; host range broader in Russia
- feed on the phloem of stressed trees
- larval feeding can girdle branches or trees
- both species can vector Dutch elm disease to non-resistant elms
- without disease transmission, neither typically kills trees

Biology, Life Cycle & Damaging Life Stage

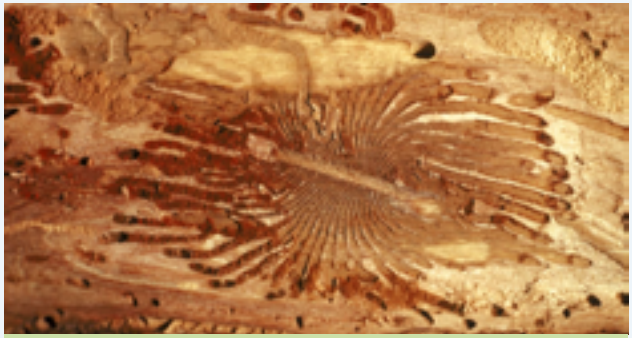
- overwinter as larvae under the bark
- pupate and emerge April to mid-May through summer
- two to three generations per year
- larvae are the damaging life stage

IPM Recommendations

- These beetles are very common, but rarely damage Utah's common Siberian elms; tolerate pest.
- Reduce stress and keep trees healthy and damage free.
- Prune dead or dying elm trees or branches and remove from site.
- If Dutch Elm Disease is a concern, use an appropriately labeled, systemic fungicide on susceptible trees.

Smaller European elm bark beetle (left) and banded elm bark beetle (right); note black band around wings (Pest and Diseases Image Library, Bugwood.org)

Banded elm bark beetle larva (Whitney Cranshaw, Colorado State University, Bugwood.org)



Elm bark beetle wood galleries (USDA Forest Service, Bugwood.org)

Spruce Ips

Ips hunteri; Ips pillifrons

Pest Description

- adults: ~ 1/6 inch; brown to black
- rear end of beetle is concave and surrounded by four prominent spines
- larvae: white grubs with brown head capsule; no legs

Host Plants, Diet & Damage

- blue spruce (mostly); Engelmann spruce
- feed on tree phloem
- produce pitch tubes and sawdust-like frass
- kill trees systematically from the top down
- can introduce fungal pathogens

Biology, Life Cycle & Damaging Life Stage

- overwinter as larvae (mostly) or adults under the bark
- two to three generations per year
- emerge in early spring with warming temperatures (warmer than 50°F)
- males mate with multiple females creating diagnostic gallery pattern
- larvae are the damaging life stage

IPM Recommendations

- Reduce stress and keep trees healthy and damage free.
- Irrigate properly.
- Remove affected material (usually tree tops) and remove from site, or debark.
- Monitor nearby spruce trees for signs of Ips attacks.
- If known populations are nearby, an insecticide (carbamate; pyrethroid) applied to the bark prior to beetle flight can protect trees.

Adult blue spruce engraver (Joseph Benzel, USDA APHIS ITP, Bugwood.org)

Blue spruce engraver larva (Whitney Cranshaw, Colorado State University, Bugwood.org)

Left: Spruce ips damage (William M. Ciesla, Forest Health Management International, Bugwood.org); Right: Spruce ips wood galleries (Whitney Cranshaw, Colorado State University, Bugwood.org)

Pine Engraver

Ips pini

Pest Description

- adults: ~ 1/6 inch; reddish brown to black
- rear end of beetle is concave and surrounded by four prominent spines
- larvae: white grubs with a brown head capsule; no legs

Host Plants, Diet & Damage

- ponderosa pine; Jeffrey pine; lodgepole pine; Jack pine; other stressed pine trees
- feed on tree phloem
- produce pitch tubes; sawdust-like frass
- kill trees systematically from the top down
- can introduce fungal pathogens

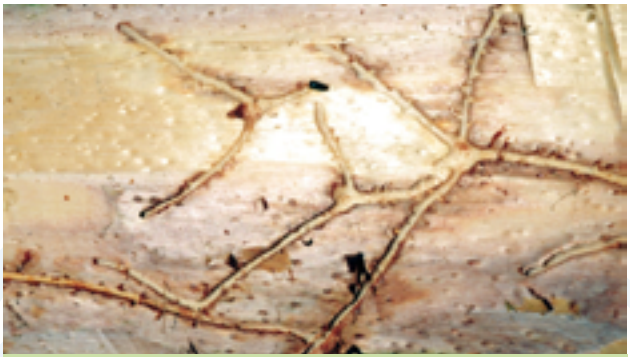
Biology, Life Cycle & Damaging Life Stage

- overwinter as adults (mostly) under tree bark or in limbs or duff on the ground
- two to three generations per year
- emerge in early spring with warming temperatures (warmer than 50°F)
- males mate with multiple females creating diagnostic gallery pattern
- larvae are the damaging life stage

IPM Recommendations

- Reduce stress and keep trees healthy and damage free.
- Irrigate properly.
- Remove affected material (usually tree tops) and remove from site, or debark.
- Monitor nearby pine trees for signs of Ips attacks.
- If known populations are nearby, an insecticide (carbamate; pyrethroid) applied to the bark prior to beetle flight can protect trees.

Adult pine engraver (Ken Walker, Museum Victoria, Bugwood.org)



Pine engraver wood galleries (A. Steven Munson, USDA Forest Service, Bugwood.org)

Pine engraver damage (William M. Ciesla, Forest Health Management International, Bugwood.org)

Pinyon Ips

Ips confusus

Pest Description

- adults: ~ 1/6 inch; reddish brown to black
- rear end of beetle is concave and surrounded by prominent spines
- larvae: white grubs with a brown head capsule; no legs

Host Plants, Diet & Damage

- two-leaf pinyon; single-leaf pinyon; other pinyons
- feed on tree phloem
- produce pitch tubes; sawdust-like frass
- kill trees systematically from the top down
- can introduce fungal pathogens

Biology, Life Cycle & Damaging Life Stage

- overwinter as adults under bark
- two and a half to three generations per year
- emerge in early spring with warming temperatures (warmer than 50°F)
- males mate with multiple females creating diagnostic gallery pattern
- larvae are the damaging life stage

IPM Recommendations

- Reduce stress and keep trees healthy and damage free.
- Irrigate pinyons during extended drought periods.
- Remove affected material and remove from site, or debark.
- Monitor nearby pine trees for signs of Ips attacks.
- If known populations are nearby, an insecticide (carbamate; pyrethroid) applied to the bark prior to beetle flight can protect trees.

Adult pinyon ips (Pest and Diseases Image Library, Bugwood.org)

Ips beetle larva (Erich G. Vallery, USDA Forest Service, Bugwood.org)

Pitch tubes and boring dust left by pinyon ips (left) and pinyon ips wood galleries (right) (William M. Ciesla, Forest Health Management International, Bugwood.org)

Shothole Borer

Scolytus rugulosus

Pest Description

- adults: 1/16 – 1/10 inch; black to reddish brown
- have a "thumbnail-like" rear end
- larvae: white grubs with a brown head capsule; no legs

Host Plants, Diet & Damage

- crabapple and other fruit trees; cydonia; hawthorn; elm
- feed on phloem and sapwood
- produce frass and oozing from holes in trees
- attack cut, broken or unthrifty limbs or stems
- when beetles emerge, they leave small "shotgun" holes in the bark
- can introduce fungal pathogens

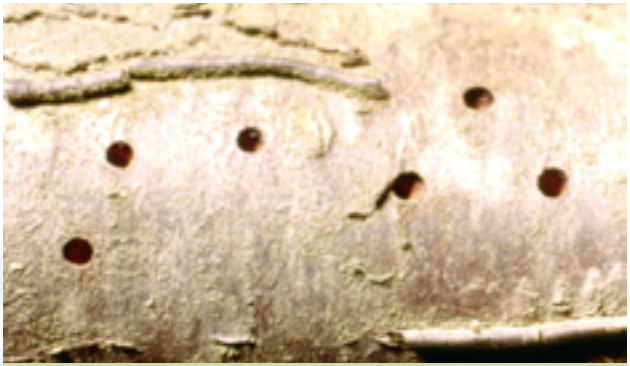
Biology, Life Cycle & Damaging Life Stage

- overwinter as larvae in sapwood chambers
- one to two generations per year
- emerge in April to mid-May
- larvae are the damaging life stage

IPM Recommendations

- Reduce stress and keep trees healthy and damage free.
- Prune affected material and remove from site, or debark.
- Monitor fruit trees for signs of attack.
- If known populations are nearby, an insecticide (carbamate; pyrethroid) applied to the bark prior to beetle flight can protect trees.

Adult shothole borer (Pest and Diseases Image Library, Bugwood.org)



Exit holes produced by shothole borers (Clemson University, USDA Cooperative Extension, Bugwood.org)

Shothole borer galleries produced by larval feeding (Shawn Steffan, Utah State University Extension)

Walnut Twig Beetle

Pityophthorus juglandis

Pest Description

- adults: 1/16 inch – 1/13 inch; yellowish brown; three times as long as wide
- larvae: white grubs with a brown head capsule; no legs

Host Plants, Diet & Damage

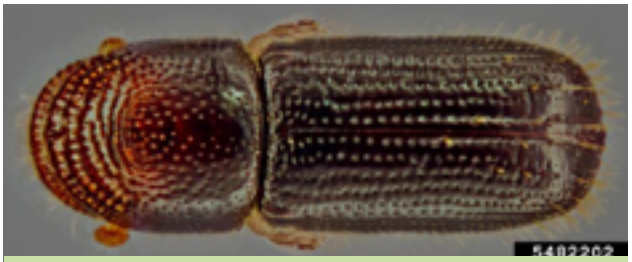
- walnut
- feed on phloem
- primarily attack walnut trunks and branches
- cause yellow flagging in tree canopy or canopy dieback
- introduce the pathogenic fungus Geosmithia morbida ("thousand cankers disease")
- kill or weaken susceptible walnuts, especially black walnut

Biology, Life Cycle & Damaging Life Stage

- overwinter as larvae and adults
- emergence begins in April
- two to three generations per year
- larvae and thousand cankers fungi introduced by adult beetles are the primary damaging stages

IPM Recommendations

- Monitor closely for beetle activity, tree health, and thousand cankers lesions under bark.
- Prune infected branches and remove from site.
- Pesticides have very limited use in protecting trees from the beetle and fungus.
- Infested trees should be identified as quickly as possible, removed, and debarked.
- Do not transport walnut firewood.



Adult walnut twig beetle (Steven Valley, Oregon Department of Agriculture, Bugwood.org)

Exit holes produced by walnut twig beetles (left) and walnut twig beetle larva (right) (Whitney Cranshaw, Colorado State University, Bugwood.org)

Walnut twig beetle galleries and cankers caused by Geosmithia morbida (Mary Ann Hansen, Virginia Polytechnic Institute and State University, Bugwood.org)

Leafcutter Bees

Megachilidae spp.

Pest Description

- adults: 1/5 inch – 1 inch; mostly small bees
- some resemble small honey bees (black and yellow)
- carry pollen on the underside of their abdomen
- important native pollinators

Host Plants, Diet & Damage

- rose; lilac; Virginia creeper; ash; any broadleaf, deciduous plants
- nectar and pollen
- cut and remove 1/4 inch – 1/2 inch ovoid chunks of leaf tissue from leaf margin
- may sting, but sting is mild; non-aggressive
- damage is aesthetic, not a threat to plant health

Biology, Life Cycle & Damaging Life Stage

- overwinter as larvae within cells created by the parent bee
- active in late-June and July
- one generation per year
- solitary; they do not make large nests like honey bees
- nests typically consist of less than 12 cells
- nest in the soil, in wood or in hollow plant stems
- leaf pieces are used to construct cells within the nest
- queen provisions larvae with pollen-nectar balls within individual cells
- adult bees are the damaging stage

IPM Recommendations

- Damage is aesthetic; tolerate leafcutting bees.
- Leafcutter bees are important native pollinators and should be preserved, if possible.
- Reduce/eliminate nesting habitat by sealing holes in wood.
- Use cheesecloth to exclude bees from individual plants.

Adult leafcutter bee (Johnny N. Dell, Bugwood.org)

Leafcutter bee leaf damage (Whitney Cranshaw, Colorado State University, Bugwood.org)

Leafcutter bee nest in wood made from leaves (Rodtuk, Flickr.com)

Cicadas

Cicadidae

Pest Description

- adults: 1 – 2 inches; clear, lacy wings held tent-like over body; make a telltale clicking or buzzing noise
- immatures: live underground
- shed skins from immatures can be found on the sides of host trees

Host Plants, Diet & Damage

- many deciduous trees and shrubs
- adults suck sap from plant branches, but damage is minimal
- immatures suck sap from plant roots
- most damage occurs when large populations of egg-laying females wound trees
- excessive egg laying can score and kill small branches

Biology, Life Cycle & Damaging Life Stage

- overwinter as immatures in the soil
- require few to many years to develop
- immature development occurs underground
- pupate above ground on the sides of host plants
- leave cast pupal skin stuck to tree
- adults are active throughout summer
- females lay eggs in slits cut in branches
- immatures drop from eggs to the soil and feed on underground roots
- adult, egg-laying females are the damaging stage

IPM Recommendations

- Damage to plants and trees is usually minimal; tolerate this insect.
- The mobility of this insect makes insecticidal control difficult.
- Cover small trees to exclude large populations of cicadas.

Adult periodical cicada (John Ghent, Bugwood.org)

Slits in branch created by egg-laying females (Pennsylvania Department of Conservation and Natural Resources, Bugwood.org)

Left: Pupal skins stuck to a tree (Whitney Cranshaw, Colorado State University, Bugwood.org); Right: Periodical cicada emergence holes (Jim Occi, BugPics, Bugwood.org)

Greater Peachtree Borer

Synanthedon exitiosa

Pest Description

- female adults: 1 inch; metallic blue with an orange stripe around abdomen
- male adults: 7/8 inch; black with yellowish-white stripes
- immatures: up to 1 1/4 inches; pinkish-white caterpillar with a brown head capsule; no legs
- pupal skin often extrudes from exit hole near tree crown

Host Plants, Diet & Damage

- cherry; nectarine; plum; peach; apricot
- larvae feed on cambium in large roots and lower trunk
- loose, dead bark; gummy, frass-filled masses at tree base
- partial girdling can cause wilting and yellowing leaves
- girdle trees causing tree death
- young trees particularly vulnerable to complete girdling

Biology, Life Cycle & Damaging Life Stage

- overwinter as larvae under the bark
- adults are active from mid-June through late-August
- lay eggs in mid-summer in soil at the base of host trees
- larvae hatch and attack the lower trunk/root crown
- one generation per year
- larvae are the damaging life stage

IPM Recommendations

- Use resistant tree varieties.
- Monitor using delta traps and greater peachtree borer pheromone lure starting in mid-June.
- Hang monitors as close to the ground as possible.
- Mating disruption may be used in orchards > than 1 acre.
- Avoid winter trunk injury by painting the lower 12 inches of trunk with a 50:50 latex paint:water solution.
- Use a horticultural tree wrap only in the winter.
- When moth flight begins (early-July in northern Utah), apply an insecticide (anthranilic diamide (non-fruit and nut bearing trees); carbamate; organophosphate; pyrethroid)) to the lower 12 inches of the trunk and soil.

Left: Adult female peachtree borer (Clemson University, Bugwood.org); Right: Adult male peachtree borer (J. A. Davidson, University of Maryland, Bugwood.org)

Peachtree borer larvae (Eugene E. Nelson, Bugwood.org)

Peachtree borer damage to base of tree (H. C. Ellis, University of Georgia, Bugwood.org)

Lilac-Ash Borer

Podosesia syringae

Pest Description

- adults: 1 – 1 1/2 inches; black with yellow markings
- look like paper wasps
- larvae: up to 1 inch; pinkish-white with a brown head capsule

Host Plants, Diet & Damage

- ash; privet; lilac
- major pest of smaller ash trees in Utah
- larvae feed on cambium tissue and sapwood
- primarily found in the trunk and larger branches
- limb and canopy dieback are common
- leave irregularly round exit holes
- pupal skins extrude from exit holes (eventually fall out)

Biology, Life Cycle & Damaging Life Stage

- overwinter as larvae in chambers in the trunk
- adults are active late-April through late-July (northern Utah)
- eggs laid on bark
- larvae bore directly into cambium/sapwood layers to feed
- one generation per year
- larvae are the damaging stage

IPM Recommendations

- Monitor using delta traps and a clearwing moth pheromone lure starting in April.
- Hang monitors from branches at about shoulder height.
- Keep trees healthy and stress free.
- Do not plant ash (Fraxinus spp.) trees.
- Use a horticultural tree wrap to protect from winter sun.
- Use renewal pruning to remove older, more susceptible branches.
- Prior to moth flight, apply an insecticide (anthranilic diamide; pyrethroid) to stem and main scaffold branches.
- Systemic neonicitinoids are not effective against this insect.

Adult lilac-ash borer (James Solomon, USDA Forest Service, Bugwood.org)

Lilac-ash borer larva (James Solomon, USDA Forest Service, Bugwood.org)

Left: Dieback caused by lilac-ash borer (James Solomon, USDA Forest Service, Bugwood.org); Right: Lilac-ash borer pupal skins left in exit holes (Whitney Cranshaw, Colorado State University, Bugwood.org)

Sequoia Pitch Moth

Synanthedon sequoiae

Pest Description

- adults: 1 – 1 1/2 inches; black with yellow markings
- look like paper wasps
- larvae: up to 1 inch; pinkish white with brown head capsule

Host Plants, Diet & Damage

- Austrian pine; scotch pine; other pines
- larvae feed on cambium tissue and sapwood
- primarily found in the trunk and larger branches
- larvae found within large resin masses on bark or in a bark notch behind the resin mass
- pupal skins extrude from exit holes in the resin mass
- damage is aesthetic; cause unsightly resin masses on trees, but rarely harm trees
- resin masses/old wounds can be re-infested

Biology, Life Cycle & Damaging Life Stage

- overwinter as larvae within resin masses or in tree
- adults are active late-April through August (northern Utah)
- eggs laid on bark near wounds or old attack sites
- larvae bore directly into cambium/sapwood layers to feed
- one generation every 2 years, but overlapping populations occur
- larvae are the damaging stage

IPM Recommendations

- Management is typically not needed.
- Properly plant and keep trees healthy.
- Pick resin masses from tree and crush larvae within.
- Avoid pruning/injuring trees April through August.
- Insecticide treatments are not recommended; specifically systemic insecticides (e.g., imidacloprid, dinotefuran) are not effective.

Left: Adult sequoia pitch moth (Jerald E. Dewey, USDA Forest Service, Bugwood.org); Right: Sequoia pitch moth larva (Christine Buhl, Oregon Department of Forestry, Bugwood.org)

Pitch mass with empty pupal case (Scott Tunnock, USDA Forest Service, Bugwood.org)

Pitch masses at base of tree caused by sequoia pitch moth larvae (Scott Tunnock, USDA Forest Service, Bugwood.org)

European Earwig

Forficula auricularia

Pest Description

- adults: 1/2 – 5/8 inch; elongate brown body with a red-brown head
- prominent pair of pinchers on the rear of the body
- reduced wings expose abdomen

Host Plants, Diet & Damage

- tree fruits; berries; vegetable fruits; leafy vegetables and herbs; grasses; grains; ornamentals
- omnivorous: feed on plant buds, flowers, fruits and leaves, fungal spores, detritus, insects
- can be beneficial predators
- create tattered appearance in leaves and flowers; make holes in fruit
- nuisance pest indoors

Biology, Life Cycle & Damaging Life Stage

- overwinter as adults in the soil or in aboveground aggregations
- 30-50 eggs laid in spring; may lay one or more clutches
- females care for young through first immature stage
- hide in dark, tight and moist places during the daytime
- at least two generations per year

IPM Recommendations

- Low population levels can be tolerated.
- Monitor with rolled corrugated cardboard traps, baited traps (e.g., vegetable oil with fish oil or bacon grease), or by investigating night activity with a flashlight.
- Exclude from trees using sticky adhesive such as Tangletrap.
- Exclude from homes with properly installed door sweeps.
- Pesticide applications may be necessary to control large, damaging populations.

Adult European earwig (David Cappaert, Bugwood.org)

Earwig damage to leaves (Whitney Cranshaw, Colorado State University, Bugwood.org)

Pitfall trap baited with canola oil (Whitney Cranshaw, Colorado State University, Bugwood.org)

Ash Flower Gall Mite & Cottonwood Catkingall Mite

Eriophyes fraxiniflora; Eriophyes neoessigi

Pest Description

- minute; four-legged, cigar-shaped mite; white to yellow
- microscope or hand lens required to see mites; use symptoms for identification

Host Plants, Diet & Damage

ash flower gall mite

- found on the flowers of male ash trees
- swollen masses of fused male flowers remain green throughout the growing season
- brown, lumpy galls are noticed after leaf drop and are present from year to year

cottonwood catkingall mite

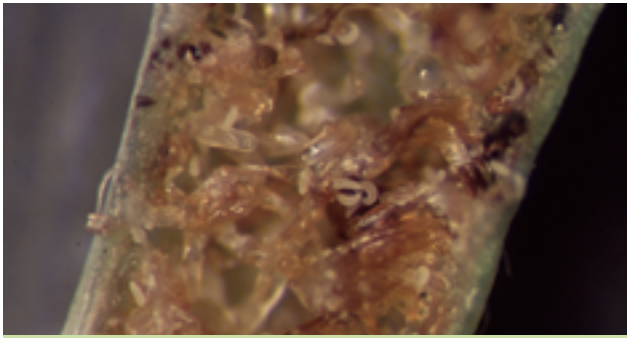
- colonize catkin flowers on Freemont cottonwood and other cottonwoods
- produce wrinkled/curled catkins that hang grapelike
- galls present until mid-summer (healthy catkins fall in spring)
- new galls are green but eventually turn brown

Biology, Life Cycle & Damaging Life Stage

- overwinter in budscales
- emerge from budscales in spring just prior to budbreak
- migrate from buds to feeding sites in spring
- migrate back to buds in the fall
- immatures and adults are damaging

IPM Recommendations

- Damage is aesthetic; tolerate pest.
- Apply horticultural oils at budbreak to target migrating mites.
- Apply an insecticide (avermectin; carbamate; METI acaracide; insecticidal soap; lime sulfur; tetronic and tetramic acid derivatives) at or just prior to budbreak.
- Do not use horticultural oils in combination with, or within 30 days of applying sulfur or a sulfur-containing product.



Eriophyid mites (Whitney Cranshaw, Colorado State University, Bugwood.org)

Left: Ash flower gall mite damage to male flowers (Steven Katovich, USDA Forest Service, Bugwood.org); Right: Galls left by ash flower gall mites (Whitney Cranshaw, Colorado State University, Bugwood.org)

Cottonwood catkingall mite damage to flowers (left) and galls left by cottonwood catkingall mites (right) (Whitney Cranshaw, Colorado State University, Bugwood.org)

Fingergall & Pouchgall Mites

Eriophyes negundi; Phytoptus emarginata

Pest Description

- minute, four-legged, cigar-shaped mite; opaque white to yellow in color
- microscope or hand lens required to see mites; use symptoms for identification
- there are many finger and pouchgall mites that affect other plants/trees

Host Plants, Diet & Damage

boxelder pouchgall mite

- boxelder leaves
- galls are raised green domes on the top of the leaf

chokecherry fingergall mite

- chokecherry and other Prunus spp. leaves
- fingerlike galls scattered randomly on leaf surfaces; turn yellowish to light brown

Biology, Life Cycle & Damaging Life Stage

- overwinter in budscales
- emerge from budscales in spring just prior to budbreak
- migrate from buds to feed on new leaves in spring
- migrate back to buds in the fall
- immatures and adults are damaging

IPM Recommendations

- Damage is aesthetic; tolerate pest.
- Apply horticultural oils at budbreak to target migrating mites.
- Apply an insecticide (avermectin; carbamate; METI acaracide; insecticidal soap; lime sulfur; tetronic and tetramic acid derivatives) at or just prior to budbreak.
- Do not use horticultural oils in combination with, or within 30 days of applying sulfur or a sulfur-containing product.

Galls on leaves produced by boxelder pouchgall mites (Whitney Cranshaw, Colorado State University, Bugwood.org)

Linden gall mite (Milan Zubrik, Slovakian Forest Research Institute, Bugwood.org)

Willow leafgall mite (Whitney Cranshaw, Colorado State University, Bugwood.org)

Poplar Budgall Mite

Eriophyes parapopuli

Pest Description

- minute, four-legged, cigar-shaped mite; opaque white to yellow in color
- microscope or hand lens required to see mites; use symptoms for identification

Host Plants, Diet & Damage

- cottonwood
- galls are woody and cauliflower-like; typically found on one side of the branch
- galls remain on tree year to year and are unsightly
- galls can reduce leaf production and kill branches

Biology, Life Cycle & Damaging Life Stage

- overwinter primarily in galls, and less frequently in buds
- migration of mites from galls to new buds occurs May through August
- galls may harbor mites for up to 4 years
- immatures and adults are damaging

IPM Recommendations

- Damage is primarily aesthetic; tolerate pest.
- Plant resistant poplar varieties.
- Prune galls or heavily infested branches out of trees in early spring during dormancy.
- Apply horticultural oils at budbreak to target migrating mites.
- Apply an insecticide (avermectin; carbamate; METI acaracide; insecticidal soap; lime sulfur; tetronic and tetramic acid derivatives) at or just prior to budbreak.
- Do not use horticultural oils in combination with, or within 30 days of applying sulfur or a sulfur-containing product.

Galls produced by poplar budgall mites (Whitney Cranshaw, Colorado State University, Bugwood.org)

Galls produced by poplar budgall mites (Whitney Cranshaw, Colorado State University, Bugwood.org)

Galls produced by poplar budgall mites (Whitney Cranshaw, Colorado State University, Bugwood.org)

Bronze Birch Borer

Agrilus anxius

Pest Description

- adults: 1/4 – 3/4 inch; slender; bronze black
- larvae: creamy white with an enlarged head area; tapeworm-like appearance

Host Plants, Diet & Damage

- birch, especially paper birch
- feed on phloem and etch sapwood of trunk and branches
- create serpentine galleries under the bark
- galleries may be externally visible on trunk as raised bumps
- leave diagnostic, D-shaped exit holes in bark
- can cause canopy dieback or complete tree death

Biology, Life Cycle & Damaging Life Stage

- overwinter as larvae under the bark or in the sapwood
- adults present late-May through August (peak in July)
- eggs laid singly or in groups under bark flaps
- early in an infestation, attacks are focused on smaller branches in the upper canopy
- one generation per year is typical, but may take 2 years
- prefer stressed, weakened trees
- *bronze poplar borer (Agrilus liragus) is a similar species on Populus spp.
- larvae are the damaging stage

IPM Recommendations

- Avoid planting susceptible birch species, especially paper, silver and gray birch.
- Monarch birch, Japanese white birch and river birch are more resistant.
- Keep trees well watered.
- Minimize iron chlorosis to reduce stress.
- Apply an insecticide (pyrethroid; carbamate) to stem and branches.
- Apply a systemic neonicitinoid soil drench (imidacloprid) or granular (dinotefuran) after leaf expansion.

Adult bronze birch borer (Whitney Cranshaw, Colorado State University, Bugwood.org)

Bronze birch borer larva and gallery (David G. Nielsen, The Ohio State University, Bugwood.org)

Bronze birch borer exit holes (left) and damage to birch tree (right) (Steven Katovich, USDA Forest Service, Bugwood.org)

Emerald Ash Borer

Agrilus planipennis*

*This pest does not currently occur in Utah.

Pest Description

- adults: 1/2 – 3/4 inch; slender; emerald green with purple body under wings
- larvae: creamy white with an enlarged head area; tapeworm-like appearance

Host Plants, Diet & Damage

- feed on all ash trees
- infestations initially occur in the top third of the canopy
- later, beetles infest the main trunk
- feed on phloem and etch sapwood of main trunk or branches
- create serpentine galleries under the bark
- cracked bark; epicormic branching; woodpecker feeding
- leave diagnostic, D-shaped exit holes in bark
- causes canopy dieback and complete tree death

Biology, Life Cycle & Damaging Life Stage

- overwinter as larvae in the sapwood
- adults present late-May through August
- eggs laid on bark or in bark crevices
- one generation per year
- prefer stressed, weakened trees
- similar-looking beetles (Agrilus spp.) occur on other, non-ash trees in Utah
- larvae are the primary damaging stage

IPM Recommendations

- Monitor all ash trees for canopy dieback, water sprouts, woodpecker damage, serpentine, frass-packed galleries under the bark and D-shaped exit holes.
- Report suspicious ash trees or insects to the Utah Plant Pest Diagnostic Lab (see page 1 for contact information).

Adult emerald ash borer (David Cappaert, Bugwood.org)

Left: Emerald ash borer larva (Pennsylvania Department of Conservation and Natural Resources, Bugwood.org); Right: D-shaped exit holes produced by emerald ash borers (Daniel Herms, The Ohio State University, Bugwood.org)

Emerald ash borer damage (left) and wood galleries (right) (Daniel Herms, The Ohio State University, Bugwood.org)

Flatheaded Appletree Borer & Pacific Flatheaded Borer

Chrysobothris femorata; Chrysobothris mali

Pest Description

- adults: 1/2 – 3/4 inch
- larvae: 3/4 – 1 1/4 inches; creamy white with an expanded, flat head region

flatheaded appletree borer

- body is greenish bronze above and beneath; wing covers with light, zigzag bands

pacific flatheaded borer

- body is brown with gray markings on the wing covers

Host Plants, Diet & Damage

- many hosts: apple, pear, stone fruits, beech, cotoneaster, linden, maple, oak, sycamore, willow, etc.
- feeding beneath bark can kill cambium and sapwood, girdling smaller trees
- attack usually occurs around pre-existing damage
- oozing sap from under the bark of fresh boring wounds
- splitting, peeling or flaking bark
- lumpy, water-soaked areas of bark above larval feeding
- hard-packed frass under flaking bark, or in galleries
- oval-shaped exit holes

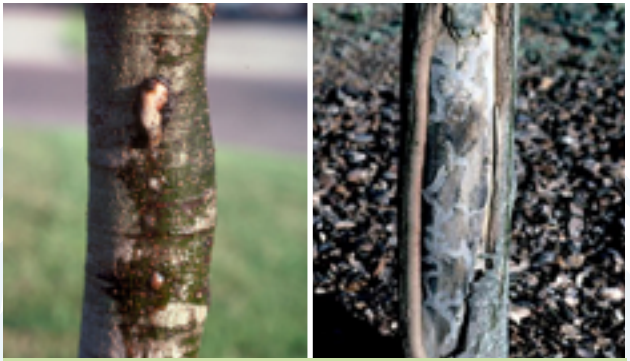
Biology, Life Cycle & Damaging Life Stage

- overwinter as larvae under bark, sapwood or heartwood
- adults emerge from late spring to early fall (peak in June and July in northern Utah)
- eggs laid on bark, usually near wounds
- larvae are the damaging stage

IPM Recommendations

- Reduce stress and keep trees healthy and damage free.
- Wrap thin-barked trees with horticultural wrap in the winter.
- Prevent mechanical or environmental injury to trees.
- Apply an insecticide (carbamate; pyrethroid) to bark of stressed or injured trees prior to and during peak beetle flight.

Left: Flatheaded appletree borer (Joseph Berger, Bugwood.org); Right: Flatheaded appletree borer larva (James Solomon, USDA Forest Service, Bugwood.org)



Left: Flatheaded appletree borer damage (James Solomon, USDA Forest Service, Bugwood.org); Right: Flatheaded appletree borer larval galleries (John Ruter, University of Georgia, Bugwood.org)

Adult pacific flatheaded borer and exit hole (Utah State University Extension)

Honeylocust Borer

Agrilus difficilis

Pest Description

- adults: 1/4 – 3/4 inch; slender, black with greenish-purple reflections
- beetle with yellow spots on abdomen below the wings
- larvae: creamy white with an enlarged head area; tapeworm-like appearance

Host Plants, Diet & Damage

- honeylocust
- feed on phloem and etch sapwood of main trunk or branches
- affect damaged areas of honeylocust bark, especially sun-scalded areas
- wet areas on bark and oozing from bore holes
- create serpentine galleries under the bark
- leave diagnostic, D-shaped exit holes in bark
- can cause canopy dieback or rarely complete tree death
- trees attacked by this insect are usually in poor condition, damaged, or grown in harsh hardscapes

Biology, Life Cycle & Damaging Life Stage

- overwinter as larvae under the bark or in the sapwood
- adults present late-May through September
- eggs laid singly or in groups under bark flaps
- one generation per year
- prefer stressed, weakened trees
- larvae are the damaging stage

IPM Recommendations

- Keep trees well watered.
- Plant in sites that minimize stress on honeylocust.
- Prevent mechanical or environmental injury to trees.
- Apply an insecticide (carbamate; pyrethroid) to bark of stressed or injured trees prior to and during peak beetle flight.

Adult honeylocust borer (Kansas Department of Agriculture, Bugwood.org)

Left: Emerald ash borer larva (looks similar to honeylocust borer larva) (Pennsylvania Department of Conservation and Natural Resources - Forestry, Bugwood.org); Right: Honeylocust borer stuck in exit holes (bark removed) (Ryan Davis, Utah State University Extension)

Honeylocust borer damage (left) and honeylocust borer D-shaped exit holes (right) (Ryan Davis, Utah State University Extension)

Honeylocust Pod Gall Midge

Dasineura gleditchiae

Pest Description

- adults: 1/8 inch; tiny flies
- females: black with red abdomen; males: black
- larvae: 15/64 inch and white yellow in color; found inside rolled honeylocust leaves
- eggs: minute, kidney shaped and yellowish red

Host Plants, Diet & Damage

- honeylocust
- larvae feed on honeylocust leaves
- leaflets are curled into pod-shaped galls
- galls; premature leaflet drop; leaflet browning; leaflet and twig dieback

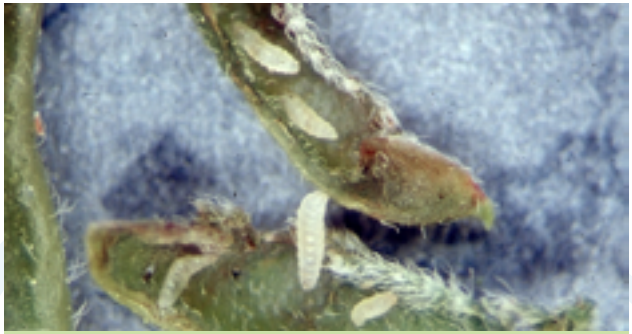
Biology, Life Cycle & Damaging Life Stage

- overwinter as adults around honeylocust trees
- emerge prior to honeylocust budbreak in spring
- females lay one to several eggs on individual leaflets
- larvae can be found inside of curled leaflets
- larvae pupate inside pod gall
- at least three generations per year
- larvae are the damaging stage

IPM Recommendations

- In landscape situations in Utah, management is often not needed.
- Monitor honeylocust buds and new shoot growth for eggs in the spring (late-March to April) with a hand lens.
- Target early eggs and egg-laying adults with insecticides.
- Apply an insecticide (carbamate; horticultural oil; pyrethroid; spinosyn) to leaves when monitoring indicates that eggs are present in early spring.

Adult honeylocust pod gall midge (Whitney Cranshaw, Colorado State University, Bugwood.org)



Honeylocust pod gall midge larvae (Whitney Cranshaw, Colorado State University, Bugwood.org)

Galls enclosing honeylocust pod gall midge larvae (Utah State University Extension)

Poplar Twiggall Fly

Hexomyza schineri

Pest Description

- adults: 1/6 inch; stout, shiny and dark; tiny flies
- larvae: yellow green; found within galls

Host Plants, Diet & Damage

- feed on poplar, cottonwood and aspen
- create galls (swellings) in current year twigs and shoots
- galls can be found along the entire length of twigs and shoots
- galls do not affect the overall health of the tree

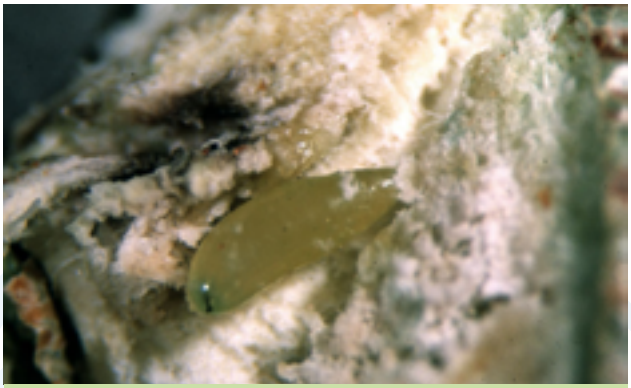
Biology, Life Cycle & Damaging Life Stage

- overwinter as fully developed larvae within the gall
- pupate within the gall or in the soil in spring
- emerge in April and May, coincident with spring twig growth
- eggs are laid under the bark of emerging twigs
- one generation per year
- larvae are the damaging stage

IPM Recommendations

- Trees can tolerate these galls, so management is not necessary.
- Management with insecticides can be difficult.
- A systemic neonicitinoid insecticide soil drench applied at budbreak may provide some suppression.

Adult poplar twiggall fly (Whitney Cranshaw, Colorado State University, Bugwood.org)



Poplar twiggall fly larva (Whitney Cranshaw, Colorado State University, Bugwood.org)

Galls produced by poplar twiggall flies (William M. Ciesla, Forest Health Management International, Bugwood.org)

Arthropods

Cynipid Gall Wasps

Cynipidae

Pest Description

- adults: very tiny and seldom seen
- larvae: grub-like; found within galls
- pest noticed by the presence of galls
- each species creates a unique gall

Host Plants, Diet & Damage

- most common on roses and oaks
- galls can occur on acorns, branches, buds, flowers, leaves, roots and twigs
- larval feeding causes round, spiny, single/multiple or other types of galls
- galls do not typically affect the overall health of the tree
- excessive galling of branches and twigs can cause plant stunting or dieback

Biology, Life Cycle & Damaging Life Stage

- overwinter as larvae in the gall
- pupate within the gall or in the soil in spring
- emerge in April and May, coincident with budbreak
- eggs laid on emerging plant tissue or on/in swollen buds
- larval feeding produces galls
- most have one generation per year
- larvae are the damaging stage

IPM Recommendations

- Galls do not affect the overall health of the tree; tolerate pest.
- Rake and remove fallen leaves in the fall.
- Remove galled plant parts and destroy.
- Management with insecticides can be difficult and spotty.
- Apply an insecticide (carbamate; pyrethroid) at or just prior to budbreak to prevent egg laying to reduce gall formation (may not prevent all new gall formation).

Galls formed by cynipid gall wasps (Gyorgy Csoka, Hungary Forest Research Institute, Bugwood.org)

Marble galls (Milan Zubrik, Forest Research Institute - Slovakia, Bugwood.org)

Cynipid gall wasp galls (Milan Zubrik, Forest Research Institute - Slovakia, Bugwood.org)

Rose Gall Wasps

Diplolepis spp.

Pest Description

- adults: ~ 1/8 – 15/64 inch; orange to brownish to red; tiny, globular wasps
- larvae: tiny, white, legless grubs found inside of galls

Host Plants, Diet & Damage

- rose
- each species makes a unique gall (spiny, globular, mossy, blister)
- galls can occur on any rose organ (leaf, stem, bud, root)
- galls formed by saliva from feeding larvae
- most galls do not cause serious damage

Biology, Life Cycle & Damaging Life Stage

- overwinter as pre-pupae in mature galls
- one generation per year
- most of the life cycle is spent protected inside the gall
- emergence timed for host-organ susceptibility
- larvae are the damaging stage

IPM Recommendations

- Galls rarely cause harm to plants; do nothing.
- Prune galls in late summer through winter to remove adult wasps prior to spring emergence; dispose from property.

Adult rose gall wasp (Thiotrix, Wikimedia Commons)

Gall made by mossyrose gall wasps (Milan Zubrik, Forest Research Institute - Slovakia, Bugwood.org)

Galls made by rose gall wasps (Left: Luis Fernandez Garcia, Wikimedia Commons; Right: Oliveoligarchy, Wikimedia Commons)

Grasshoppers

Acrididae

Pest Description

- adults: ~ 1/8 – 1 1/2 inches; brown to green
- nymphs: look like adults without fully developed wings
- well-developed rear legs for jumping
- there are many species of grasshoppers in Utah

Host Plants, Diet & Damage

- feed on many different ornamental plants, grasses, vegetables, forage and crops
- cause chewing damage on leaves: skeletonizing, small to large holes and marginal feeding
- chew primarily on leaves, stems and seedpods

Biology, Life Cycle & Damaging Life Stage

- overwinter as eggs (in egg pods) in the soil
- eggs hatch in spring or early summer
- development takes about 1 1/2 – 2 months
- one (most) or more generations per year
- nymphs and adults are the damaging stages

IPM Recommendations

- Damage from small populations can be tolerated.
- Exclude grasshoppers from plants using fine mesh material (row covers).
- Pesticide-based management should occur on a larger scale (e.g., a neighborhood) rather than on an individual property.
- Use insecticide baits containing Nosema locustae or wheat bran + carbaryl.
- Apply an insecticide (carbamate; pyrethroid) to protect specific plants.

Top left: Two-striped grasshopper (Whitney Cranshaw, Colorado State University, Bugwood.org); Top right: Differential grasshopper (David Cappaert, Bugwood.org); Bottom left: Red-legged grasshopper (Russ Ottens, University of Georgia, Bugwood.org); Bottom right: Migratory grasshopper (Joseph Berger, Bugwood.org)

Grasshopper feeding damage to plants (Kansas Department of Agriculture, Bugwood.org)

Black Pineleaf Scale

Dynaspidiotus californica

Pest Description

- adults: 5/64 inch; gray to black oval shells
- immatures: crawlers (mobile stage) 3/64 inch; yellow orange; no wings
- immatures: nymphs (sessile stage) resemble adults, but are smaller

Host Plants, Diet & Damage

- pine (common on Austrian, Scotch, and mugo) and Douglas-fir
- feed on the sap from needles
- affected needles can be blotchy yellow
- thinning crowns with yellowing/browning needles
- presence of scales can also be unsightly if heavy
- serious infestations can cause needle drop or tree death

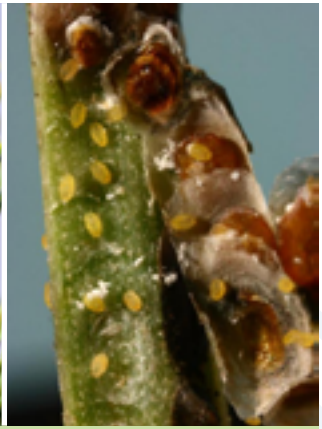
Biology, Life Cycle & Damaging Life Stage

- overwinter as immature scales
- mating occurs in June
- eggs are laid in late-June and early-July
- eggs are laid under the female scale
- crawlers are present from mid- to late-July
- crawlers blow to new locations via wind currents
- crawlers develop an outer shell and remain stationary
- one generation per year
- nymphs and adults are the damaging stages

IPM Recommendations

- Keep trees healthy and stress free.
- Monitor scale populations on pines.
- Monitor scale crawlers from early to mid-July using double sided tape wrapped around twigs.
- Apply horticultural oil to smother scales or scale crawlers when monitoring indicates crawlers are present.
- Apply a systemic dinotefuran soil drench, granules or bark band in June.
- Imidacloprid is ineffective against hard scales.

Adult black pineleaf scales (Whitney Cranshaw, Colorado State University, Bugwood.org)



Left: Black pineleaf scale infestation (Steven Katovich, USDA Forest Service, Bugwood.org); Right: Black pineleaf scale crawlers/nymphs (Donald Owen, California Department of Forestry and Fire Protection, Bugwood.org)

Black pineleaf scale damage (Susan Rose, Bugwood.org)

Euonymus Scale

Unaspis euonymi

Pest Description

- males: 1/16 inch; white, oysterlike hard scales
- females: longer and wider than males; mottled brown
- immatures: crawlers (mobile stage) 3/64 inch; yellow orange; no wings
- immatures: nymphs (sessile stage) resemble adults, but are smaller

Host Plants, Diet & Damage

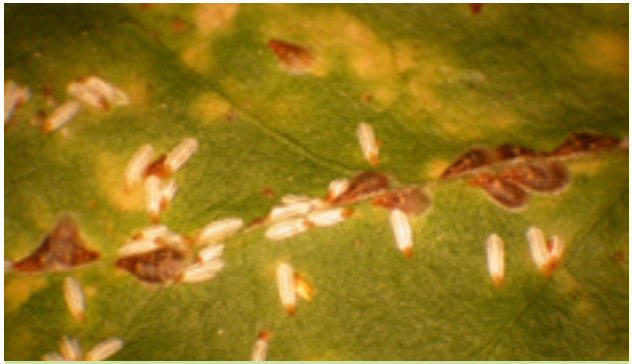
- Euonymus, Camellia, boxwood, bittersweet, Daphne, Eugenia, ivy, Hibiscus, holly, jasmine, privet, honeysuckle, olive, Paxistima, Pachysandra, Solanum and Prunus
- feed on leaves (mostly on the undersides) and stems
- males are typically found on the undersides of leaves; females mostly found on stems/petioles
- create yellow-white spots on leaves
- scales covering stems appear bumpy, corky or frosted
- feeding can cause thinning, leaf drop and plant death
- damage is often worse when plants are located near buildings/walls/etc.

Biology, Life Cycle & Damaging Life Stage

- overwinter as fertilized females or male pre-pupae
- males molt into flying insects and mate with females
- eggs laid in early spring (May to June) under the female
- crawlers present late-May to June and July to October
- crawlers disperse via crawling or wind currents
- there are two generations per year, but life stages overlap
- nymphs and adults are the damaging stages

IPM Recommendations

- Keep trees healthy.
- Monitor scale populations on host plants (e.g., Euonymus).
- Non-synchronized life cycle makes crawler control with foliar-applied insecticides difficult.
- Apply a systemic dinotefuran soil drench, granules or bark band in May. Imidacloprid is ineffective against hard scales.



Adult euonymus scales; note brown females and white males (Lisa Ames, University of Georgia, Bugwood.org)

Euonymus scales (Edward L. Manigault, Clemson University, Bugwood.org)

Euonymus scales (Joseph LaForest, University of Georgia, Bugwood.org)

Juniper Scale

Carulaspis juniperi

Pest Description

- males: narrower, longer, whiter than females; oyster-shaped
- females: 1/16 inch; yellowish brown to white; circular
- immatures: crawlers (mobile stage) 3/64 inch; yellow orange; no wings
- immatures: nymphs (sessile stage) resemble adults, but are smaller

Host Plants, Diet & Damage

- juniper, cypress, false cypress, incense cedar, northern white cedar
- feed on the sap from needles/scales
- affected foliage turns "off-color," yellow to brown
- new growth may stop
- serious infestations can cause tree death

Biology, Life Cycle & Damaging Life Stage

- overwinter as fertilized females
- crawlers present late-May to late-June
- males and females both form scale coverings and remain stationary; males become mobile during mating
- one generation per year, maybe two in warmer regions
- nymphs and adults are the damaging stages

IPM Recommendations

- Keep trees healthy and stress free.
- Monitor scale crawlers from late-May to late-June using double sided tape wrapped around twigs.
- Apply horticultural oil to smother scales or scale crawlers when monitoring indicates crawlers are present.
- Apply a systemic dinotefuran soil drench, granules or bark band in May.
- Imidacloprid is ineffective against hard scales.

Juniper scales (U.S. National Collection of Scale Insects Photographs, USDA Agricultural Research Service, Bugwood.org)

Juniper scales (Joseph LaForest, University of Georgia, Bugwood.org)

Juniper scale damage (Joseph LaForest, University of Georgia, Bugwood.org)

Oystershell Scale

Lepidosaphes ulmi

Pest Description

- females: 1/8 inch; brown to gray; oystershell shaped
- immatures: crawlers (mobile stage) 3/64 inch; pale yellow; wingless
- immatures: nymphs (sessile stage) resemble adults, but are smaller
- scales blend in with bark and can be difficult to see

Host Plants, Diet & Damage

- over 128 hosts known; worst on lilac, aspen, ash, cotoneaster, willow, poplar and maple
- feed on sap from cells of stems and branches
- bark may become completely encrusted in scales
- bark splitting may occur
- dieback may occur on single branches, in clusters, or over entire plants
- serious infestations can cause tree death

Biology, Life Cycle & Damaging Life Stage

- overwinter as eggs under the female's cap
- crawlers present from late-May to early-June
- males and females both form scale coverings and remain stationary; males become mobile during mating
- one generation per year; two generations in warmer regions
- nymphs and adults are the damaging stages

IPM Recommendations

- Keep trees healthy and stress free.
- Monitor scale crawlers from early-May to early-June using double sided tape wrapped around twigs.
- Apply horticultural oil to smother scales or scale crawlers when monitoring indicates crawlers are present.
- Apply a systemic dinotefuran soil drench, granules or bark band in early-May.
- Imidacloprid is ineffective against hard scales.

Adult oystershell scales (U.S. National Collection of Scale Insects Photographs, USDA Agricultural Research Service, Bugwood.org)

Oystershell scale adult and crawlers/nymphs (Whitney Cranshaw, Colorado State University, Bugwood.org)

Oystershell scale adults (Whitney Cranshaw, Colorado State University, Bugwood.org)

Pine Needle Scale

Chionaspis pinifoliae

Pest Description

- females: 1/16 – 1/8 inch; white; yellowish spot at one end
- males: similar to females but smaller and narrower
- immatures: crawlers (mobile stage) 3/64 inch; yellowish orange; no wings
- immatures: nymphs (sessile stage) resemble adults, but are smaller

Host Plants, Diet & Damage

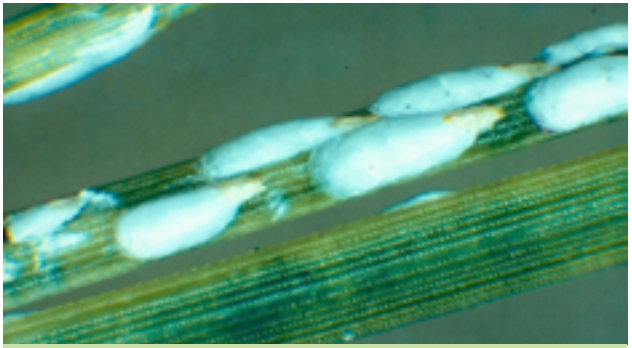
- pine (especially mugo, Austrian and Scotch); spruce; fir; Douglas-fir
- feed on sap from needles
- needles may initially be spotted yellow, turning to brown
- needle, branch and canopy dieback may occur
- heavily infested trees appear frosted
- serious infestations can cause tree death

Biology, Life Cycle & Damaging Life Stage

- overwinter as reddish eggs under the female's cap
- crawlers present from early-May to early-June
- males and females both form scale coverings and remain stationary; males become mobile prior to mating
- second generation crawlers present late-July through August
- two generations per year
- nymphs and adults are the damaging stages

IPM Recommendations

- Keep trees healthy.
- Monitor scale crawlers from early-May to early-June and in late-July using double sided tape wrapped around twigs.
- Apply horticultural oil to smother scales or scale crawlers when monitoring indicates crawlers are present.
- Apply a systemic dinotefuran soil drench, granules or bark band in early-May.
- Imidacloprid is ineffective against hard scales.



Adult pine needle scales (Tim Tigner, Virginia Department of Forestry, Bugwood.org)

Pine needle scales (William M. Ciesla, Forest Health Management International, Bugwood.org)

Pine needle scale damage (John A. Weidhass, Virginia Polytechnic Institute and University, Bugwood.org)

Pigeon Tremex

Tremex columba

Pest Description

- female wasps: 1 1/2 – 2 inches; yellow and black; thick bodied; 1/2 inch ovipositor (egg-laying "stinger")
- males: lack ovipositor
- larvae: white grubs up to 2 inches; weak, fleshy thoracic legs

Host Plants, Diet & Damage

- highly stressed or recently killed maple, ash, elm, oak, hickory, sycamore, beech, apple and pear
- create round tunnels within the wood
- may increase wind, ice or snow breakage by reducing wood strength
- associated with a white rot fungus that can weaken trees
- adult wasps leave a round exit hole when emerging
- large size and strange appearance often prompts interest

Biology, Life Cycle & Damaging Life Stage

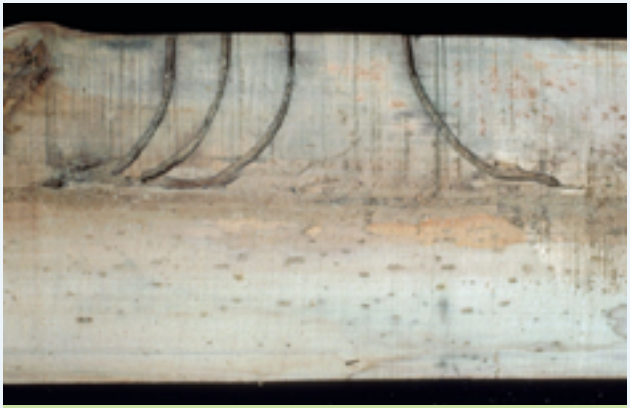
- overwinter as larvae in the heartwood
- pupate in mid- to late-summer in cells just below bark
- adults emerge in late summer and probe trees with their ovipositor
- eggs are laid directly into wood at about 1/2 inch depth
- white rot fungus softens wood that larvae will consume
- larvae feed under the bark until the following summer
- one generation per year is typical
- larvae are the damaging stage

IPM Recommendations

- Manage trees to improve or maintain health.
- Pesticide applications are not recommended because the wasp attacks dying and dead trees.

Adult female pigeon tremex wasp (Steven Katovich, USDA Forest Service, Bugwood.org)

Pigeon tremex exit holes (James Solomon, USDA Forest Service, Bugwood.org)



Pigeon tremex galleries (James Solomon, USDA Forest Service, Bugwood.org)

Cottonwood Leaf Beetle

Chrysomela scripta

Pest Description

- adults: 1/2 inch; yellowish with elongated black marks on wings
- larvae: black with six legs; resemble lady beetle larvae
- eggs: yellow; laid in clusters of 25 or more on the undersides of leaves
- other, similar-looking leaf beetles also feed on poplars and willows in the West

Host Plants, Diet & Damage

- poplar, cottonwood and willow
- feed on leaves, twigs and succulent bark of host trees
- larvae skeletonize and adults chew leaves
- damage may be localized or over the whole tree
- older defoliated trees may become stressed
- young trees may die after repeated defoliations

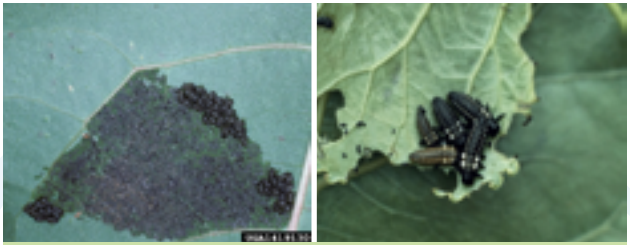
Biology, Life Cycle & Damaging Life Stage

- overwinter as adults in leaf litter or debris and under bark
- adults emerge when new leaf growth starts
- eggs are laid on the undersides of leaves
- larvae feed in groups on the undersides of leaves
- larvae develop into pupae on leaves in about 2 weeks
- pupation occurs for about 2 weeks and adults emerge
- two generations per year are common
- larvae are the primary damaging life stage, but adults also cause damage

IPM Recommendations

- Manage trees to improve or maintain overall health.
- Pesticide applications are not typically needed for this pest.
- Apply a pesticide (azadirachtin; Bacillus thuringinesis var. tenebrionis; carbamate) to foliage at egg hatch.

Adult cottonwood leaf beetle (Whitney Cranshaw, Colorado State University, Bugwood.org)



Gregarious larval feeding (Whitney Cranshaw, Colorado State University, Bugwood.org)

Left: Cottonwood leaf beetle eggs (Lacy L Hyche, Auburn University, Bugwood.org); Right: Larva (Gerald J. Leonard, Louisiana State University, Bugwood.org)

Arthropods

Elm Leaf Beetle

Xanthogaleruca luteola

Pest Description

- adults: ~ 1/4 inch; yellowish green; black stripes on wings
- larvae: initially black; become yellowish after feeding
- older larvae: ~1/3 inch; rows of black projections on their backs that resemble stripes
- eggs: yellow; laid in double or triple rows of up to 25 on the undersides of leaves

Host Plants, Diet & Damage

- elm and zelkova
- larvae skeletonize and adults chew holes in leaves
- damaged leaves turn brown and may drop prematurely
- trees may die after multiple years of repeated defoliations
- adults can become an overwintering structural nuisance

Biology, Life Cycle & Damaging Life Stage

- overwinter as adults on or near host trees
- adults emerge in spring when new leaf growth starts
- eggs are laid on the undersides of leaves
- larvae feed in groups on undersides of leaves
- larvae pupate on the ground or in bark fissures
- new adults emerge in about 2 weeks and lay eggs
- two generations per year are common
- larvae are the primary damaging life stage; adults also cause damage

IPM Recommendations

- Manage trees to improve or maintain overall health.
- Pesticides are not typically needed.
- Monitor the undersides of leaves for eggs and larvae or take note of previous year's populations and damage.
- Consider foliar sprays (azadirachtin; carbamate; pyrethroid; spinosyn) for newly hatched larvae.
- Apply a soil (imidacloprid; dinotefuran) or foliar systemic (acephate) after leaf expansion.
- Apply an insecticidal bark band (carbamate; pyrethroid) a few feet wide to intercept 1st generation larvae.

Adult elm leaf beetle (Joseph Berger, Bugwood.org)

Elm leaf beetle larvae (Pest and Diseases Image Library, Bugwood.org)

Elm leaf beetle damage to leaves (Whitney Cranshaw, Colorado State University, Bugwood.org)

Sumac Flea Beetle

Blepharida rhois

Pest Description

- adults: ~ 1/4 inch; cream colored with red markings on the wings; prothorax and head are orange
- wing coloration/pattern can be variable
- larvae: up to ~1/4 inch, yellow with pale stripes and black heads; larvae partially covered in fecal material
- eggs: laid in small groups and are covered with various colors of excrement

Host Plants, Diet & Damage

- skunkbush; smokebush
- feed on leaves, creating a ragged appearance
- larvae occasionally defoliate plants
- damage may be localized or over the whole tree
- repeated defoliation may cause plant death

Biology, Life Cycle & Damaging Life Stage

- overwinter as adults outdoors
- adults emerge in spring and feed on expanding foliage
- eggs are laid on branches in fecal egg cases
- larvae hatch and feed in groups on leaves
- larvae are typically present from mid-May to early-June
- larvae crawl down the tree and pupate in the soil
- new adults emerge in about 2 weeks and lay eggs
- after emerging, adults continue to feed until overwintering
- one generation per year
- larvae are the primary damaging life stage, but adults also cause damage

IPM Recommendations

- Manage trees to improve or maintain overall health.
- Pesticides are not typically needed for this pest.
- Monitor the leaves for larvae in mid- to late-May.
- Apply an insecticide (Bacillus thuringiensis var. tenebrionis; carbamate; pyrethroid) to branches and leaves just after egg hatch to control young larvae.

Adult sumac flea beetle (David Cappaert, Bugwood.org)

Sumac flea beetle egg cases (left) and sumac flea beetle 1st instar larvae (right) (Ryan Davis, Utah State University Extension)

Sumac flea beetle late instar larvae (Whitney Cranshaw, Colorado State University, Bugwood.org)

Leafhoppers

Cicadellidae

Pest Description

- adults: ~ 1/8 – 5/8 inch; wings held tentlike over the back; one to two rows of spines on hind legs
- many are whitish to light green; coloration highly variable including reds, browns and patterns
- nymphs: smaller than adults, typically lime green in color; wings absent but wing buds present

Host Plants, Diet & Damage

- apple, birch, cherry, cottonwood, dogwood, elm, grape, hawthorn, honeylocust, linden, oak, poplar, red maple, sumac, Virginia creeper, willow and other ornamentals
- feed on sap from leaf cells
- white to yellow stippling/flecking on tops of leaves
- hopper burn: yellowing, browning, stunting, leaf curling
- some transmit plant diseases

Biology, Life Cycle & Damaging Life Stage

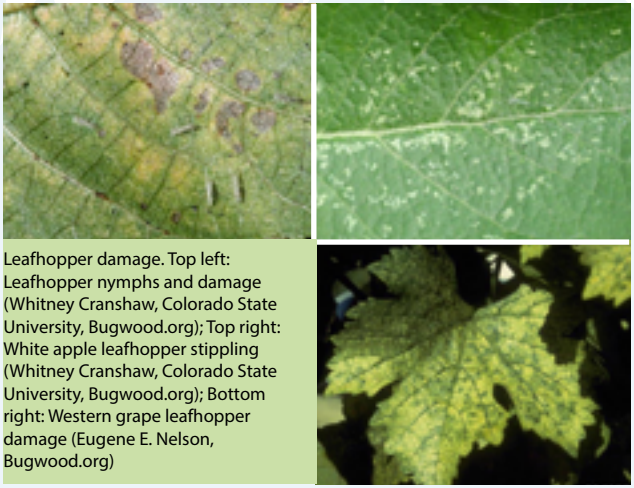
- overwinter as eggs inserted into or on plant tissue or as adults
- eggs hatch in spring and nymphs begin feeding
- overlapping life stages present during summer
- two or more generations per year
- nymphs and adults are the damaging stages

IPM Recommendations

- Manage trees and shrubs to improve or maintain overall health.
- Monitor the undersides of leaves for leafhopper adults and nymphs.
- Insecticide applications are not typically needed for leafhoppers and may have varying efficacy.
- Apply insecticidal oils or soaps to undersides of leaves to control nymphs.
- Apply an insecticide (azadirachtin; carbamate; pyrethroid; systemic neonicitinoid) when nymphs or adults are present.

Examples of adult leafhoppers. Top left: Adult potato leafhopper (Steve L. Brown, University of Georgia, Bugwood.org); Top right: Adult leafhopper (David Cappaert, Bugwood.org); Bottom left: Adult leafhopper (David Cappaert, Bugwood.org)

Example of immature leafhopper: potato leafhopper nymph (Frank Peairs, Colorado State University, Bugwood.org)



Leafhopper damage. Top left: Leafhopper nymphs and damage (Whitney Cranshaw, Colorado State University, Bugwood.org); Top right: White apple leafhopper stippling (Whitney Cranshaw, Colorado State University, Bugwood.org); Bottom right: Western grape leafhopper damage (Eugene E. Nelson, Bugwood.org)

Leafminers & Needleminers

Coleoptera; Diptera; Hymenoptera; Lepidoptera

Pest Description

- adult leafmining insects include small beetles, flies, sawfly wasps or moths
- larvae are tiny grubs/caterpillars that fit between the upper and lower leaf tissues
- feeding causes telltale patterns in leaf tissue

Host Plants, Diet & Damage

- leafminers: many deciduous tree species
- needleminers: many coniferous tree species
- larvae feed on mesophyll cells on the interior of the leaf
- larval feeding creates silvery white blotches or tunneling in the leaf
- mining may turn leaves brown and translucent
- larval frass is typically present in the galleries
- damage is an aesthetic issue and rarely harms trees

Biology, Life Cycle & Damaging Life Stage

- life cycles are highly variable
- larvae may pupate in the leaf or in the soil below plants
- eggs laid in small groups or singly on or in plant tissue
- one or more generations occur every year, depending on the species

IPM Recommendations

- Manage trees to improve or maintain overall health.
- Pesticide applications are not typically needed for leafminers and needleminers.
- Predators and parasitoids typically manage larvae.
- Apply an insecticide (azadirachtin; neonicitinoid; pyrethroid; spinosyn) to foliage just prior to egg laying.
- Apply a systemic neonicitinoid as a soil drench after leaf expansion in spring.

Left: Adult birch leafminer sawfly (Cheryl Moorehead, Bugwood.org); Right: Elm leafminer larva (Whitney Cranshaw, Colorado State University, Bugwood.org)

Left: Aspen leafminer damage (William M. Ciesla, Forest Health Management International, Bugwood.org); Right: Birch leafminer damage (Brian Kunkle, University of Delaware, Bugwood.org)

Left: Spruce needleminer damage (Steven Katovich, USDA Forest Service, Bugwood.org); Right: Elm leafminer damage (Whitney Cranshaw, Colorado State University, Bugwood.org)

Banded Ash Borer

Neoclytus caprea

Pest Description

- adults: 1/2 – 1 inch; black to dark brown beetles with yellow markings on the wings
- larvae: up to 1 1/4 inches long; white grubs with or without legs

Host Plants, Diet & Damage

- ash, hickory, elm, mesquite, white oak
- larvae feed on phloem and sapwood under the bark
- attack primarily unhealthy or damaged trees
- unhealthy trees or individual branches may die from continued infestation
- are typically considered a firewood pest when adults emerge from cut logs inside homes
- damage could be confused with that of emerald ash borer (see page 72)

Biology, Life Cycle & Damaging Life Stage

- overwinter as adults under the bark
- adults emerge in spring and deposit eggs on host bark
- larvae feed under the bark in the phloem and later in the sapwood
- larvae pupate in the fall
- one generation per year
- larvae are the damaging stage

IPM Recommendations

- Manage trees to improve or maintain overall health.
- Prune infested wood/branches.
- On trees with ongoing infestations, apply an insecticide (carbamate; pyrethroid) to the bark on the trunk and large scaffold branches in spring prior to egg laying.
- For firewood, allow insects to complete their life cycle outside before bringing the wood inside.
- Beetles will not infest structural wood, furniture, etc., and are only a nuisance indoors.

Adult banded ash borer (David Cappaert, Bugwood.org)

Banded ash borer larva (David Cappaert, Bugwood.org)

Banded ash borer exit holes (Lacy L. Hyche, Auburn University, Bugwood.org)

Locust Borer

Megacyllene robiniae

Pest Description

- adults: 3/4 inch; black beetles with brilliant yellow markings
- larvae: up to 1 inch long; white grubs without legs

Host Plants, Diet & Damage

- black locust and its cultivars (e.g., purple robe locust)
- feed on the xylem of host trees
- extensive tunneling in the wood may cause structural weakness of branches or trunk

Biology, Life Cycle & Damaging Life Stage

- overwinter as larvae in the bark
- tunnel into and feed on heartwood in the spring and summer
- adults emerge around August, mate and lay eggs on the bark
- one generation per year
- larvae are the damaging stage

IPM Recommendations

- Manage trees to improve or maintain overall health.
- Prune infested wood/branches and chip or burn.
- Apply an insecticide (carbamate; pyrethroid) to the bark on the trunk and large scaffold branches in late-July/ early-August prior to egg laying.

Adult locust borer (Kevin D. Arvin, Bugwood.org)

Locust borer larvae (Whitney Cranshaw, Colorado State University, Bugwood.org)

Locust borer damage to trees (Whitney Cranshaw, Colorado State University, Bugwood.org)

Pine Sawyers

Monochamus spp.

Pest Description

- adults: 5/8 – 1 inch; black beetles with whitish-gray markings, or not
- very long antennae, about one to three times the body length
- larvae: up to 1 inch long; white grubs without legs,

Host Plants, Diet & Damage

- pine, fir, Douglas-fir, spruce
- feed on the sapwood and heartwood of recently killed trees
- trees are typically dead or near death when attacked

Biology, Life Cycle & Damaging Life Stage

- overwinter as larvae in the wood
- feed on wood until mid-summer when they pupate
- adults fly from July to September
- eggs laid in chewed niches in the bark
- one generation per year or every 2 years in northern climates
- larvae are the damaging stage

IPM Recommendations

- Manage trees to improve or maintain overall health.
- Primarily attacks recently killed trees; no control is recommended to protect trees.
- Prune infested wood/branches and chip or burn.
- No pesticide treatment is recommended.

Adult whitespotted pine sawyer borer (Whitney Cranshaw, Colorado State University, Bugwood.org)

Adult whitespotted sawyers (Left: William M. Ciesla, Forest Health Management International, Bugwood.org; Right: Joseph Berger, Bugwood.org)

Black pine sawyer wood galleries (left) and sawyer beetle larva (right) (Milan Zubrik, Slovakian Forest Research Institute, Bugwood.org)

Poplar Borer

Saperda calcarata

Pest Description

- adults: ~ 1 inch; gray with black speckles and brown markings
- larvae: up to 1 1/4 inches long; white grubs without legs

Host Plants, Diet & Damage

- aspen, cottonwood, poplar and willow
- larvae feed on sapwood and heartwood
- cause structural weakness of branches and stems
- wounds allow secondary pathogens to invade
- boring holes ooze rust-colored sap and frass
- major pest of aspen trees in landscape and forest settings
- smaller diameter trees can be killed

Biology, Life Cycle & Damaging Life Stage

- overwinter as larvae in the wood
- adults fly from mid-June through August
- one generation is completed in about 3 years
- larvae are the primary damaging stage

IPM Recommendations

- Avoid planting aspen at low elevation valley sites.
- Manage trees to improve or maintain overall health.
- Remove and chip/burn heavily infested trees.
- Spray Steinernema nematodes into active larval galleries.
- Apply a pyrethroid insecticide to the bark in early-June.

Adult poplar borer (Whitney Cranshaw, Colorado State University, Bugwood.org)

Poplar borer adults and larvae (James Solomon, USDA Forest Service, Bugwood.org)

Poplar borer damage (Minnesota Department of Natural Resources, Bugwood.org)

Prionus Borers

Prionus spp.

Pest Description

- adults: large, 1 3/4 – 2 1/4 inches; reddish brown, relatively smooth with deeply notched antennae
- larvae: up to 4 1/4 inches long and about 3/4 inch in diameter; legless and whitish in color

Host Plants, Diet & Damage

- sweet cherry, peach, apricot, other stone fruits, cottonwood and other ornamental trees and shrubs
- larvae feed on roots, reducing the tree's ability to take up water and nutrients
- larval feeding can open up trees to root rot pathogens
- feeding in the root crown and upper roots can girdle trees
- cause limb dieback and overall reduce tree vigor
- infestation and damage are worse on sandy soils

Biology, Life Cycle & Damaging Life Stage

- overwinter as larvae in the roots or soil
- pupate in spring
- adults emerge and fly July to September
- eggs are laid in soil near host trees
- larvae move into the soil and feed on roots working their way upward toward the root crown
- in the third year, larvae pupate near the soil surface next to root crowns
- one generation is completed in 3 years
- larvae are the primary damaging stage

IPM Recommendations

- Manage trees to improve or maintain overall health.
- Monitor beetles with a pheromone and bucket light trap.
- Monitor trees for canopy dieback.
- Apply an insecticide (carbamate; pyrethroid) to the lower trunk and soil to target adults and inhibit egg laying.
- Apply a systemic neonicitinoid to the root zone to suppress younger larvae.

Top: Adult female (left) and male (right) Prionus root borer adults; Right: Prionus root borer larvae (Diane Alston, Utah State University Extension)

Prionus root borer damage. Top left: Burrowing damage in crown; Top right: Canopy dieback; Bottom right: Root furrowing (Diane Alston, Utah State University Extension)

Cankerworms

Alsophila pometaria (Fall Cankerworm (FCW));
Paleacrita vernata (Spring Cankerworm (SCW))

Pest Description

- adult males: 1 1⁄8 inches long; dull gray brown
- adult females: 5/16 inch long; dull gray brown; wingless
- larvae: ~ 1 inch long; green to light brown to black; inchworms that crawl by arching their backs
- FCW larvae: three pairs of prolegs and three white stripes on either side of the abdomen
- SCW larvae: two pairs of prolegs and one larger white stripe down each side of the abdomen
- eggs: barrel shaped, shiny gray with a light brown ring around a dark brown spot; laid in clusters

Host Plants, Diet & Damage

- feed on leaves of apple, ash, red and white oak, maple (including boxelder), elm, cherry, linden and honeylocust
- tattered skeletonizing (leaving veins) or total defoliation
- can stress trees or kill trees over years of defoliation

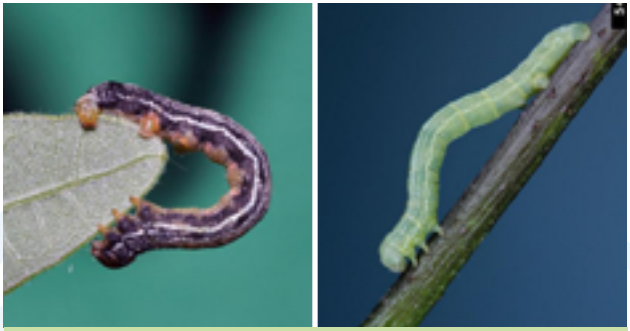
Biology, Life Cycle & Damaging Life Stage

- overwinter as eggs on host (FCW) or pupae in soil (SCW)
- eggs hatch in early spring around budbreak
- FCW and SCW larvae feed at the same time
- FCW adults emerge after a hard freeze in fall; SCW adults emerge in early spring
- wingless females climb trees to mate with winged males
- larvae can be blown from tree to tree on silken threads
- one generation per year
- larvae are the damaging stage

IPM Recommendations

- Manage trees to maintain overall health.
- Monitor trees in early spring for egg masses and larvae.
- If populations are low, allow minor feeding on trees.
- Apply an insecticide (Bacillus thuringiensis; carbamate; pyrethroid) to target larvae when they are smaller than 1/2 inch (~10 days after egg hatch).

Left: Adult fall cankerworm (William M. Ciesla, Forest Health Management International, Bugwood.org); Right: Adult fall cankerworm and eggs (John G. Hent, Bugwood.org)



Left: Fall cankerworm larva (William M. Ciesla, Forest Health Management International, Bugwood.org); Right: Fall cankerworm larva (Joseph Berger, Bugwood.org)

Left: Adult spring cankerworm (Nolie Schneider, Bugwood.org); Right: Spring cankerworm larva (James B. Hanson, USDA Forest Service, Bugwood.org)

Carpenterworm Moth

Prionoxystus robiniae

Pest Description

- adults: female wingspan ~ 3 inches, length is 1 3/4 inches; males smaller
- adults: mottled white, gray and black; blend with bark
- larvae: up to 3 inches long; white to pink; brown head capsule; black dots on abdomen
- pupae: skins are dark brown with a double row of spines
- eggs: laid in sticky masses

Host Plants, Diet & Damage

- ash, aspen, elm, birch, black locust, oak, cottonwood maple and willow; poplar favored
- larvae feed on sapwood but primarily in the heartwood
- larval galleries can extend 6-10 inches within the heartwood and are 1/2 inch in diameter
- boring activity weakens branches and stems
- bark can become disfigured and scarred
- frass and pupal skins may be evident in exit holes

Biology, Life Cycle & Damaging Life Stage

- overwinter as larvae in the wood
- adults emerge mid-May through July.
- egg masses are laid on tree bark, usually near wounds
- larvae spend most of their time in the heartwood
- one generation every 3 to 4 years
- larvae are the damaging stage

IPM Recommendations

- Keep trees healthy with proper cultural practices.
- Avoid mechanical injury to trees.
- Monitor trees for irregularly shaped holes with expelled frass or pupal skins.
- Nematodes (Steinernema carpocapsae or feltiae) may be sprayed into holes to kill larvae within galleries.
- Apply an insecticide (carbamate; pyrethroid) to the bark in mid-May prior to egg laying.

Adult carpenterworm moths (James Solomon, USDA Forest Service, Bugwood.org)

Carpenterworm moth damage. Left: Scarred bark (Bob Hammon, Colorado State University, Bugwood.org); Middle: Larval gallery; Right: Frass in exit holes (James Solomon, USDA Forest Service, Bugwood.org)

Carpenterworm moth larva (William H. Hoffard, USDA Forest Service, Bugwood.org)

Carpenterworm moth pupal skin protruding from an exit hole (Bob Hammon, Colorado State University, Bugwood.org)

Douglas-fir Tussock Moth

Orgyia pseudotsugata

Pest Description

- adults: wingspan 1 – 2 inches
- larvae: ~ 1 2/5 inches long; black body with prominent, colorful tufts of hair
- pupae: ~ 1 inch long; brown and mixed with hairs; located on or near the host tree
- eggs: laid in masses near pupal cases and covered with hairs from the female

Host Plants, Diet & Damage

- spruce, Douglas-fir, true firs
- feed on new foliage, then older foliage causing brown branch tips
- damage is typically focused on the top of the tree (do not confuse with Ips beetle damage)
- larvae can defoliate branches, killing part or all of the tree

Biology, Life Cycle & Damaging Life Stage

- overwinter as egg masses on host trees
- eggs hatch around mid- to late-May
- larvae migrate or are wind dispersed to new trees
- larvae feed on new needles and later on older needles
- full grown larvae pupate on or around the host tree starting around mid-July to early-August
- adult males fly in late-July to mid-August
- one generation per year in Utah
- larvae are the damaging stage

IPM Recommendations

- Manage trees to improve or maintain overall health.
- Monitor trees for egg masses in early spring.
- Monitor starting in mid-May for egg hatch and larvae.
- Apply an insecticide (Bacillus thuringiensis var. kurstaki; carbamate; diacylhydrazine; pyrethroid) to newly expanded foliage targeting larvae when they are small.

Douglas-fir tussock moth life cycle. Top left: Adult and pupal case; Top right: larvae; Bottom left: Eggs (William M. Ciesla, Forest Health Management International, Bugwood.org); Bottom right: Larva (Donald Owen, California Department of Forestry and Fire Protection, Bugwood.org)

Douglas-fir tussock moth damage (Forest Service Region 2-Rocky Mountain Region, Bugwood.org)

Fall Webworm

Hyphantria cunea

Pest Description

- adults: wingspan is 1 1⁄2 inches long; pure white, sometimes with brown or black spots
- larvae: ~ 1 inch long; hairy, sometimes with distinct, paired black spots on back
- larvae: two color forms: redheaded race is dark with reddish hairs; blackheaded race is pale yellow to green with light-colored hairs
- larvae form silken tents around feeding area
- pupae: light brown, hairy masses
- eggs: small, round and laid in masses on leaf undersides

Host Plants, Diet & Damage

- over 100 host species; cottonwood, chokecherry, mountain-ash, elm and willow are preferred
- feed on leaves within unsightly, silken tents
- young larvae feed in groups, finely skeletonizing leaves
- older larvae can defoliate trees
- can stress or kill trees via multiple years of defoliation

Biology, Life Cycle & Damaging Life Stage

- overwinter as pupae near or on host trees
- adults emerge in June and July and mate
- deposited eggs hatch in 1 to 2 weeks
- larvae feed on foliage for about 6 weeks before pupating
- one generation per year in northern Utah
- larvae are the damaging stage

IPM Recommendations

- Manage trees to maintain overall health.
- Monitor in late-June to early-July for egg masses or larvae.
- Minor feeding from small populations can be tolerated.
- Apply an insecticide (Bacillus thuringiensis var. kurstaki; carbamate; pyrethroid) to foliage targeting larvae when they are small.

Adult fall webworm and eggs (Lacy L. Hyche, Auburn University, Bugwood.org)

Left: Fall webworm larvae (G. Keith Douce, University of Georgia, Bugwood.org); Right: Fall webworm tent (Lacy L. Hyche, Auburn University, Bugwood.org)

Fall webworm communal feeding (Lacy L. Hyche, Auburn University, Bugwood.org)

Leafroller Moths

Archips spp.; Choristoneura spp.; Argyrotaenia spp.

Pest Description

- adults: wingspan ~ 3/4 inch; wings held tent-like over back; color variable
- larvae: up to 1 inch and found within rolled leaves; typically green with a brown to black head capsule
- eggs: gray brown and often laid in overlapping clusters on or around the plant

Host Plants, Diet & Damage

- deciduous trees and shrubs; fruit trees
- larvae feed on leaves and roll leaves using silk
- leaf skeletonizing and leaf damage; fruit cat-facing or loss
- defoliation in severe cases

Biology, Life Cycle & Damaging Life Stage

- overwinter as eggs or larvae on or around host plants
- overwintering eggs hatch after budbreak
- species overwintering as larvae emerge around budbreak
- larvae spend most of their developmental period inside of the rolled leaf
- species with one generation per year will lay overwintering eggs in mid-summer
- species with two generations per year will lay eggs in spring and summer
- pupate within the rolled leaf, or on or around the host
- one to two generations per year depending on species
- larvae are the damaging stage

IPM Recommendations

- Keep trees healthy with proper cultural practices.
- Monitor trees for egg masses, larvae and rolled leaves.
- Management is seldom warranted; tolerate pest.
- If needed, apply an insecticide (azadirachtin; Bacillus thuringiensis var. kurstaki; carbamate; pyrethroid; spinosyn) to foliage targeting newly hatched larvae in spring.

Adult fruittree leafroller moth (Todd M. Gilligan and Marc E. Epstein, USDA APHIS ITP, Bugwood.org)

Left: Leafroller moth eggs (Steven Katovich, USDA Forest Service, Bugwood.org); Right: Leafroller moth larva (William M. Ciesla, Forest Health Management International, Bugwood.org)

A rolled leaf formed by a leafroller moth larva (Steven Katovich, USDA Forest Service, Bugwood.org)

Pine Tip Moths

Eucosma; Diorctria; Petrova; Rhyacionia

Pest Description

- adults: wingspan ~ 3/4 – 1 inch; wings held tent-like over back; color variable
- larvae: 1/2 – 3/4 inch; dark brown to orange red with dark brown head capsule and thoracic plate
- pupae: ~ 5/16 – 1/2 inch; yellowish brown to dark brown, depending on age
- eggs: nearly flat, green turning to orange red and laid on needles, needle bases or bud scales

Host Plants, Diet & Damage

- pine, spruce, Douglas-fir and arborvitae
- damage is primarily aesthetic
- feed on buds, twigs, terminal shoots; some feed on cones
- bore into and kill twigs and terminals causing wilting, dead tips and deformation; flagging/crooking
- resin, frass and webbing may be present at damage sites
- damage typically most severe in nursery setting

Biology, Life Cycle & Damaging Life Stage

- overwinter as larvae or pupae on branches, trunks, within galleries or soil, or debris next to host
- emergence or activity begins in early spring prior to or around budbreak; some species emerge later
- depending on species, some larvae will leave host tissue in mid- to late-summer to find overwintering sites
- one generation per year
- larvae are the damaging stage

IPM Recommendations

- Manage trees to improve or maintain overall health.
- Minor damage does not require management.
- To prevent damage in areas where these moths are present, apply an insecticide (pyrethroid) to foliage.
- Identify tip moth species to determine treatment timing. For most species, treatment is just prior to or just after budbreak.

Adult pine tip moth (USDA Forest Service - Ogden Archive, Bugwood.org)

Left: European pine shoot moth larva (Milan Zubrik, Forest Research Institute - Slovakia, Bugwood.org); Right: Pine tip moth eggs (Donald Owen, California Department of Forestry and Fire Protection, Bugwood.org)

Pinyon tip moth damage (Brytten Steed, USDA Forest Service, Bugwood.org)

Western Tent Caterpillar

Malacosoma californicum

Pest Description

- adults: wingspan 1 – 2 inches; heavy bodied; dark red brown to yellow, tan or gray
- larvae: ~ 2 inches; hairy; coloration can be highly variable
- pupae: made of white silk with a white to yellow dusting
- eggs: brown to gray, shiny; laid in masses on branches

Host Plants, Diet & Damage

- quaking aspen, alder, bitterbrush, California lilac, chokecherry, cottonwood, crabapple, fruit trees, mountain mahogany, nine-bark, oak, poplar, serviceberry, sumac, wild currant and wild rose
- feed on leaves within unsightly, silken tents
- larvae can defoliate leaves or trees
- yearly defoliation can cause reduced growth or kill trees

Biology, Life Cycle & Damaging Life Stage

- overwinter as unhatched larvae within eggs on host trees
- larvae hatch around budbreak in spring
- larvae feed within silken tents; later larval stages may become solitary
- pupation occurs 1 to 1 1/2 months after spring egg hatch
- pupae are silken cocoons stuck to host trees, non-host trees or in leaf litter
- adults fly late-July through August and lay egg masses
- one generation per year in northern Utah
- larvae are the damaging stage

IPM Recommendations

- Manage trees to improve or maintain overall health.
- Monitor trees after budbreak for larvae and silken tents.
- Severe damage to ornamental plants is uncommon; tolerate pest.
- Apply an insecticide (Bacillus thuringiensis var. kurstaki; carbamate; organophosphate; pyrethroid; spinosyn) to foliage targeting small larvae.

Western tent caterpillar egg mass and adult (Jerald E. Dewey, USDA Forest Service, Colorado State University, Bugwood.org)

Left: Western tent caterpillar adults (Jerald E. Dewey, USDA Forest Service, Bugwood.org); Right: Western tent caterpillar larva (Whitney Cranshaw, Colorado State University, Bugwood.org)

Left: Western tent caterpillar tent (Robert Efram, Bugwood.org); Right: Western tent caterpillar larvae (Whitney Cranshaw, Colorado State University, Bugwood.org)

Western Grapeleaf Skeletonizer

Harrisina metallica

Pest Description

- adults: wingspan ~1 1/3 inches; blackish-metallic blue; wasplike
- larvae: ~ 5/8 inch; yellow, purple and black bands
- pupae: ~ 3/4 inch; flat, white silken cocoons
- eggs: translucent yellow; laid in groups
- in Utah, only an issue in the St. George area

Host Plants, Diet & Damage

- grape, Virginia creeper, Boston ivy
- young larvae feed in groups on the underside of leaves leaving the upper surface of the leaf intact
- late stage larvae skeletonize leaf tissue leaving large veins
- defoliation can lead to sun-damaged fruit
- feeding on grapes can lead to bunch rot
- spines on larvae can cause skin welts

Biology, Life Cycle & Damaging Life Stage

- overwinter as pupae in silken cases under bark or debris
- spring emergence coincides with leaf expansion
- eggs are laid in clusters of 10-200 on leaf undersides
- young larvae feed on leaves in groups, then feed singly in later stages
- two to three generations per year
- larvae are the damaging stage

IPM Recommendations

- Manage grapes to improve or maintain overall health.
- Monitor grapes for egg masses or larvae on the undersides of leaves after leaf expansion.
- Apply an insecticide (avermectin; Bacillus thuringiensis var. kurstaki; diamide; organophosphate; neonicitinoid; pyrethroid; spinosyn) to foliage when monitoring indicates small larvae are present.

Western grapeleaf skeletonizer larva (Whitney Cranshaw, Colorado State University, Bugwood.org)

Western grapeleaf skeletonizer larvae (Whitney Cranshaw, Colorado State University, Bugwood.org)

Left: Adult American grapeleaf skeletonizer (David Cappaert, Bugwood.org); Right: Western grapeleaf skeletonizer cocoon (Whitney Cranshaw, Colorado State University, Bugwood.org)

Ash Plant Bug

Tropidosteptes spp.

Pest Description

- adults: 3/8 inch; pale yellow, brown to black; yellowish-green triangle on back between wings
- nymphs: similar in appearance but are smaller, ovoid, wingless and may vary in color
- eggs: oblong and laid on bark or undersides of leaves

Host Plants, Diet & Damage

- ash
- feed on sap of ash leaves
- white stippling on top of leaves; wilting, curling, stunted and drying leaves
- brown to black fecal spots on damaged leaves
- browning leaves and leaf drop later in the season
- most damage occurs on young foliage in late-May

Biology, Life Cycle & Damaging Life Stage

- overwinter as eggs near buds or within bark fissures
- egg hatch begins in late-April to mid-May
- first generation develops into adults and eggs are laid in June on leaf midribs
- second generation feeds from July until frost
- second generation eggs laid in late summer and fall
- two generations per year
- nymphs and adults are the damaging stages

IPM Recommendations

- Manage trees to improve or maintain health.
- Damage is mostly aesthetic; tolerate pest.
- Ash plant bugs on young or nursery trees may require management.
- Apply an insecticide (carbamate; insecticidal soap; pyrethroid) about 1 week after budbreak to manage young first generation nymphs. Target the undersides of foliage.

Left: Ash plant bug (University of Minnesota); Right: Ash plant bug (Whitney Cranshaw, Colorado State University, Bugwood.org)

Ash plant bug damage. (Top: Whitney Cranshaw, Colorado State University, Bugwood.org; Bottom left: James Solomon, USDA Forest Service, Bugwood.org; Bottom right: Whitney Cranshaw, Colorado State University, Bugwood.org)

Boxelder Bug

Boisea spp.

Pest Description

- adults: 1/2 inch; black body and wings with three red lines on back
- nymphs: smaller and are bright red with black legs and wing pads
- eggs: cylindrical; orange to red and laid in clusters

Host Plants, Diet & Damage

- seeds of maple trees; primarily boxelder tree seeds
- feed on sap from boxelder seeds
- occasionally cannibalistic
- occasionally cause damage to non-host fruit, such as apples
- no damage done to trees
- nuisance: congregate around buildings; can come indoors and annoy occupants
- overwinter in cracks, crevices, leaf litter and in buildings

Biology, Life Cycle & Damaging Life Stage

- overwinter as adults in and around homes
- become active in March with warming temperatures
- adults lay eggs on and near boxelder trees around budbreak
- two generations per year; overlapping life stages present
- nymphs and adults are the damaging stages

IPM Recommendations

- No damage to trees; nuisance pest only.
- Remove unwanted/volunteer female boxelder trees (i.e., with seeds) in the area if possible.
- Seal cracks that may allow bugs to enter buildings.
- Vacuum to remove indoor and outdoor populations.

Boxelder bug adult (Joseph Berger, Bugwood.org)

Boxelder bug adults and nymphs (Steven Katovich, USDA Forest Service, Bugwood.org)

Boxelder bug nymphs and eggs (William M. Ciesla, Forest Health Management International, Bugwood.org)

Elm Seed Bug

Arocatus melanocephalus

Pest Description

- adults: 1/3 inch; alternating black and red pattern outside of wings; red underside (abdomen)
- triangular segment behind head is black and surrounded by red on the top portion of the wings
- nymphs: smaller; red abdomens and black wing pads and head

Host Plants, Diet & Damage

- elm; linden
- feed primarily on sap from elm seeds and leaves
- no damage done to tree
- congregate on structures and can come indoors during hot periods of the summer
- overwinter in cracks, crevices, leaf litter and in buildings
- may stain lightly colored materials with fecal material
- emit an unpleasant odor when bothered

Biology, Life Cycle & Damaging Life Stage

- overwinter as adults in and around homes
- become active in March with warming temperatures
- adults lay eggs on elm seeds and trees in May
- one generation per year, but overlapping life stages may be present

IPM Recommendations

- No damage to trees; nuisance pest only.
- Remove unwanted/volunteer elm trees in the area if possible.
- Seal cracks that may allow bugs to enter buildings.
- Vacuum to remove indoor and outdoor populations.
- Remove elm seeds that have collected around buildings.

Elm seed bug adults (top), late instar nymph (bottom left) and young nymph (bottom right) (Ryan Davis, Utah State University Extension)

Elm seed bug feces (Ryan Davis, Utah State University Extension)

False Chinch Bug

Nysius raphanus

Pest Description

- adults: 1/8 – 1/6 inch; grayish brown and slender
- nymphs: smaller, lack wings and are mottled gray with reddish markings

Host Plants, Diet & Damage

- primarily plants in the crucifer family; turfgrasses; agricultural crops; many other plants
- suck sap out of plants and seeds
- rarely cause serious plant damage
- in crops and landscapes, they tend to occur in spotty aggregations on plants
- nuisance; may aggregate in large numbers on buildings especially if hosts are harvested or managed with herbicide

Biology, Life Cycle & Damaging Life Stage

- overwinter as adults near host plants
- in spring, eggs are laid around the bases of host plants
- nymphs feed on host plants throughout plant development
- three generations per year; overlapping life stages present

IPM Recommendations

- Damage to plants is rare; tolerate pest.
- Primarily an aesthetic or nuisance issue.
- Apply an insecticide (pyrethroid) to host plants when present.

Adult false chinch bug (Russ Ottens, University of Georgia, Bugwood.org)

False chinch bugs (Whitney Cranshaw, Colorado State University, Bugwood.org)

False chinch bug nymphs and adults (Whitney Cranshaw, Colorado State University, Bugwood.org)

Arthropods

Honeylocust Plant Bug

Diaphnocoris chlorionus

Pest Description

- adults: ~ 3/16 inch; pale green; highly mobile
- nymphs: smaller than adults; do not have wings, and have an orange spot on the back
- eggs: oblong and white in color

Host Plants, Diet & Damage

- honeylocust
- feed on sap of honeylocust leaves and buds with straw-like mouthparts
- white stippling on top of leaves; wilting, chlorotic, dwarfing, curling, bent and drying leaves
- dead leaf tissue will fall out of leaves when expanded causing irregular holes in leaves
- heavy damage can kill small branches and inhibit leaf development
- most damage occurs on young foliage in late-May and June

Biology, Life Cycle & Damaging Life Stage

- overwinter as eggs inserted into bark of twigs and branches
- egg hatch begins in May at the time of vegetative budbreak
- mate in late-May or June and lay overwintering eggs
- nymphs and adults disappear in July
- one generation per year
- nymphs and adults are the damaging stages

IPM Recommendations

- Manage trees to improve or maintain health.
- Damage is mostly aesthetic, especially on larger trees.
- Plant resistant cultivars.
- Young or nursery trees may require control.
- Begin monitoring prior to budbreak.
- Apply an insecticide (carbamate; pyrethroid; horticultural oils; insecticidal soap) just after budbreak.

Adult honeylocust plant bugs (Daniel Herms, The Ohio State University, Bugwood.org)

Honeylocust plant bug nymph (Whitney Cranshaw, Colorado State University, Bugwood.org)

Honeylocust plant bug damage (Whitney Cranshaw, Colorado State University, Bugwood.org)

Lace Bugs

Corythuca spp.

Pest Description

- adults: tiny, 1/8 – 5/16 inch long; delicate, lacy wings held flat over the back; flat appearance
- nymphs: smaller, typically darker with spines on the body; body is rounded or flattened
- eggs: cylindrical, black and laid in evenly spaced clusters on the undersides of leaves

Host Plants, Diet & Damage

- primarily oak, chokecherry and sycamore in Utah; apple, ash, California lilac, poplar, firethorn, willow
- feed on sap from the undersides of leaves
- cause yellow to white stippling or spots and interveinal necrosis visible on the top of leaf
- damage resembles that of spider mites and leafhoppers
- undersides of leaves appear dirty; adults, nymphs, eggs and shed skins present
- infestations on oak can cause leaf necrosis and leaf drop
- leave black, varnish-like fecal spots on leaf undersides

Biology, Life Cycle & Damaging Life Stage

- overwinter as adults on or near host plants
- fly to expanding host foliage in spring to feed
- adults lay eggs on the undersides of host leaves
- nymphs and adults feed on the undersides of leaves
- two or more generations per year; overlapping life stages present

IPM Recommendations

- Manage trees to improve or maintain health.
- Damage is primarily an aesthetic issue; tolerate pest.
- Apply an insecticide (carbamate; horticultural oil, insecticidal soap, neem oil, neonicitinoid (soil systemic); pyrethroids; spinosad) to the undersides of leaves.

Adult lace bugs and eggs (David Cappaert, Bugwood.org)

Left: Adult hawthorn lace bug and fecal spots (Jim Baker, North Carolina State University, Bugwood.org); Right: Walnut lace bug nymphs (Whitney Cranshaw, Colorado State University, Bugwood.org)

Lace bug stippling (Jim Baker, North Carolina State University, Bugwood.org)

Sycamore Plant Bug

Plagiognathus albatus

Pest Description

- adults: ~ 1/4 inch; yellowish brown with whitish wings
- nymphs: smaller, lack wings and are yellowish brown

Host Plants, Diet & Damage

- sycamore and London planetree
- suck sap out of leaves creating necrotic areas
- feeding on young leaves may cause distortion
- heavy feeding causes a tattered appearance in leaves

Biology, Life Cycle & Damaging Life Stage

- overwinter as eggs embedded in tree bark
- eggs hatch in spring when leaves have expanded to about 1 1/2 inches
- nymphs feed on top and bottom of leaves
- individuals are present until mid-summer
- one generation per year
- nymphs and adults are the damaging stages

IPM Recommendations

- Manage trees to improve or maintain health.
- Damage to trees is mostly aesthetic; tolerate pest.
- Spray nymphs with a strong stream of water.
- Apply an insecticide (carbamate; horticultural oil; insecticidal soap; pyrethroid) about 1 week after budbreak to affected plants.
- Apply a systemic neonicitinoid at budbreak.

Top, middle and bottom: Sycamore plant bug adults and feeding damage (Marion Murray, Utah State University Extension)

Hackberry Nipplegall Psyllid

Pachypsylla celtidismamma

Pest Description

- adults: ~ 5/32 inch long; mottled brown; look like tiny cicadas
- nymphs: smaller, lack wings and are cream to brown in color
- eggs: yellowish white; cylindrical but tapered

Host Plants, Diet & Damage

- hackberry
- feed on sap from leaves
- form prominent, raised galls primarily on the undersides of leaves
- blistergalls and budgalls may also be formed by related Pachypsylla on Celtis spp.

Biology, Life Cycle & Damaging Life Stage

- overwinter as adults on bark or in nearby structures
- emergence and mating begin at budbreak
- eggs are laid on the undersides of leaves
- nymphal feeding creates a gall that surrounds them
- nymphs develop within the gall and emerge as adults in late summer
- one generation per year
- nymphs and adults are the damaging stages

IPM Recommendations

- Manage trees to improve or maintain health.
- Damage is primarily an aesthetic issue; tolerate pest.
- Apply an insecticide (carbamate; pyrethroid; spinosyn) to the undersides of leaves after egg hatch but before galls form.
- Apply a systemic neonicitinoid at leaf budbreak to prevent galls from forming.

Adult hackberry nipplegall psyllid (C. William Newsom, Wikimedia Commons)

Galls of hackberry nipplegall psyllids (Whitney Cranshaw, Colorado State University, Bugwood.org)

Hackberry nipplegall psyllid eggs (Whitney Cranshaw, Colorado State University, Bugwood.org)

Arthropods

European Pine Sawfly

Neodiprion sertifer

Pest Description

- adults: 1/3 inch; males are mostly black with feathery antennae; females are reddish brown
- larvae: caterpillarlike and ~ 1 inch; green body with white, green and gray/black stripes; shiny black head
- larvae will rear their heads when disturbed

Host Plants, Diet & Damage

- mugo pine; other pine species
- prefer to consume older needles from tip to base
- larvae often feed in groups
- brown scars on needles where eggs have been inserted

Biology, Life Cycle & Damaging Life Stage

- overwinter as eggs inside needles
- eggs hatch in mid-spring and larvae feed on old needles
- pupate on host bark or around the host in early to mid-summer
- adults emerge in late summer to mate and lay eggs in needles
- one generation per year
- larvae are the primary damaging stage

IPM Recommendations

- Manage trees to improve or maintain health.
- Monitor in fall through early spring for egg-laying scars on needles and in the spring for damage to old needles and larvae (late-April to early-May).
- Low-level infestations can be tolerated.
- Wash larvae off with a strong spray of water.
- Spot-treat young larvae with an insecticide (azadirachtin; horticultural oil; insecticidal soap; organophosphate; pyrethroid; spinosyn) when monitoring indicates their presence.

Adult European pine sawfly (Louis-Michel Nageleisen, Department of Forest Health, Bugwood.org)

Left: Younger European pine sawfly larvae (Gyorgy Csoka, Hungary Forest Research Institute, Bugwood.org); Right: Older European pine sawfly larvae (Steven Katovich, USDA Forest Service, Bugwood.org)

Left: European pine sawfly eggs (Steven A. Munson, USDA Forest Service, Bugwood.org); Right: European pine sawfly damage (Steven Katovich, USDA Forest Service, Bugwood.org)

Pearslug/Pear Sawfly

Caliroa cerasi

Pest Description

- adults: 1/5 inch; shiny black wasps; fly-like
- larvae: up to 1/2 inch long; covered in olive green to black slime; sluglike
- mature larvae: orangish yellow without the slimy coating

Host Plants, Diet & Damage

- primarily pear and cherry; cotoneaster, hawthorn, mountain ash, plum
- feed on plant tissue
- skeletonize the upper surface of leaves
- severe damage can cause brown leaves and leaf drop
- 2nd generation typically causes most of the damage

Biology, Life Cycle & Damaging Life Stage

- overwinter as pupae in the soil
- pupate in spring; adults emerge in late spring and mate
- females lay eggs into upper surfaces of leaves
- 1st generation eggs hatch in early summer; larvae develop through late July
- mature larvae drop from plants and pupate in the soil
- 2nd generation larvae are present in late-August and September
- mature larvae drop from the tree and overwinter as pupae in the soil
- two generations per year
- larvae are the damaging stage

IPM Recommendations

- Manage trees to improve or maintain health.
- Monitor in July, late-August and September for larvae.
- Damage from low-level populations can be tolerated.
- Wash larvae off with a strong spray of water.
- Apply an insecticide (carbamate; insecticidal soap; pyrethroid; spinosyn) to foliage when larvae are present.

Adult pear sawfly (Cheryl Moorehead, Bugwood.org)

Pear sawfly larvae (Jerry A. Payne, USDA Agricultural Research Service, Bugwood.org)

Pear sawfly damage (Lesley Ingram, Bugwood.org)

Cottony Maple Scale

Pulvinaria innumerabilis

Pest Description

- females: 1/8 inch; convex; pale to dark brown
- immatures: crawlers (mobile stage) ~ 3/64 inch, yellow orange; no wings
- immatures: nymphs: smaller, flattened and oval; translucent yellowish; found on leaves
- egg sacs: white/cottony; grow from under females

Host Plants, Diet & Damage

- most common on maple; many hosts
- feed on plant sap from leaves/twigs/small branches
- infestations produce unsightly cottony masses
- branch and twig dieback; early leaf drop
- honeydew production; sooty mold

Biology, Life Cycle & Damaging Life Stage

- overwinter as mated, 2nd instar nymphs on twigs and branches
- cottony egg masses grow in spring
- eggs hatch June through July
- crawlers settle on the undersides of leaves near the midrib or veins
- mating occurs in late summer
- mated females migrate to twigs and branches to overwinter
- one generation per year
- nymphs and adults are the damaging stages

IPM Recommendations

- Manage trees to improve or maintain health.
- Monitor scale populations on host plants.
- Apply an insecticide (carbamate; horticultural oil; insecticidal soap; organophosphate; pyrethroid) to coincide with scale crawler activity.
- Apply a systemic neonicitinoid in spring after leaves have expanded.

Immature cottony maple scales and egg mass (Raymond Gill, California Department of Agriculture and Food, Bugwood.org)

Cottony maple scale egg sacs (Eugene E. Nelson, Bugwood.org)

Cottony maple scale egg sacs (Inzelbeth, Wikimedia Commons)

European Elm Scale

Gossyparia spuria

Pest Description

- females: ~ 5/16 inch; oval; brown with a white fringe
- males: smaller than females; male cocoons appear as white, puffed rice
- immatures: crawlers (mobile stage) ~ 3/64 inch, yellow orange; wingless
- immatures: nymphs flattened and oval; translucent yellowish
- overwintering immatures with a light gray-white waxy coating

Host Plants, Diet & Damage

- elm; common on 'Camperdown' elm in Utah
- feed on plant sap from twigs, small branches and leaves
- leaf yellowing and premature leaf drop
- severe infestations may kill branches
- honeydew production leads to sooty mold on leaves and branches

Biology, Life Cycle & Damaging Life Stage

- overwinter as 2nd instar nymphs in bark cracks or twig notches
- reach maturity and mate from mid-April to late-May
- egg hatch occurs from mid-June to mid-July
- crawlers settle on the undersides of leaves along main veins
- one generation per year
- nymphs and adults are the damaging stages

IPM Recommendations

- Manage trees to improve or maintain health.
- Monitor scale populations on host plants.
- Apply an insecticide (carbamate; horticultural oil; insecticidal soap; organophosphate; pyrethroid) to coincide with scale crawler activity.
- Apply a systemic neonicitinoid in spring after leaves have expanded.

European elm scale (Joseph Berger, Bugwood.org)

European elm scale crawlers/young instars (Whitney Cranshaw, Colorado State University, Bugwood.org)

European elm scale male cocoons (left) and late-instar females (right) (Whitney Cranshaw, Colorado State University, Bugwood.org)

European Fruit Lecanium Scale

Parthenolecanium corni

Pest Description

- adults: highly variable; females are ~ 1/8 inch; globular; yellowish to dark brown; mottled; males winged, fly-like
- immatures: crawlers (mobile stage) are tiny (3/64 inch), yellow orange and wingless
- immatures: nymphs are smaller, flattened and oval to globose; brownish yellow to dark brown

Host Plants, Diet & Damage

- many ornamental and fruit trees
- feed on plant sap from twigs, small branches and leaves
- can cause tree stress and decline
- honeydew production leads to sooty mold on leaves and branches

Biology, Life Cycle & Damaging Life Stage

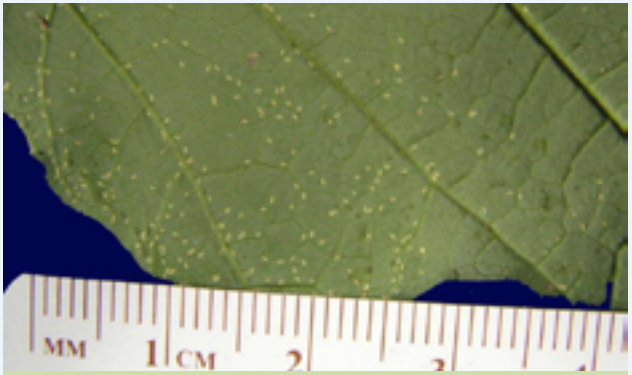
- overwinter as 2nd instar nymphs in bark cracks on twigs or branches
- around April, females reach maturity and mate
- can reproduce without mating
- eggs are laid under the female scale covering
- egg hatch and crawlers migrate to leaves from mid-June through late-July
- in fall, 2nd instar scales migrate back to twigs
- one generation per year
- nymphs and adults are the damaging stages

IPM Recommendations

- Manage trees to improve or maintain health.
- Monitor scale populations on host plants.
- Apply an insecticide (carbamate; horticultural oil; insecticidal soap; organophosphate; pyrethroid) to coincide with scale crawler activity.
- Apply a systemic neonicitinoid in spring after leaves have expanded.

Adult European fruit lecanium scales (Lacy L. Hyche, Auburn University, Bugwood.org)

European fruit lecanium scale damage (Lacy L. Hyche, Auburn University, Bugwood.org)



European fruit lecanium scale crawlers (Ronald S. Kelley, Vermont Department of Forests, Parks and Recreation, Bugwood.org)

Fletcher Scale

Parthenolecanium fletcheri

Pest Description

- adults: highly variable; females are ~ 1/8 inch; globular; yellowish to dark brown; mottled; males winged and fly-like
- immatures: crawlers (mobile stage) are tiny (3/64 inch), yellow orange and wingless
- immatures: nymphs are smaller, flattened and oval to globose; brownish yellow to dark brown

Host Plants, Diet & Damage

- arborvitae, yew, juniper
- feed on plant sap from twigs, small branches and leaves
- can cause tree stress and decline
- honeydew production leads to sooty mold on leaves and branches

Biology, Life Cycle & Damaging Life Stage

- overwinter as 2nd instar nymphs on twigs, needles or bud scales
- around May, females reach maturity and mate
- can reproduce without mating
- eggs are laid under the female body
- egg hatch occurs from mid-June through late-July
- crawlers settle on needles, bud scales or branches
- one generation per year
- nymphs and adults are the damaging stages

IPM Recommendations

- Manage trees to improve or maintain health.
- Monitor scale populations on host plants.
- Apply an insecticide (carbamate; horticultural oil; insecticidal soap; organophosphate; pyrethroid) to coincide with scale crawler activity.
- Apply a systemic neonicitinoid in spring after leaves have expanded.

Adult female fletcher scales (Whitney Cranshaw, Colorado State University, Bugwood.org)

Fletcher scale nymphs (J. A. Davidson, Bugwood.org)

Fletcher scale eggs under adult female (Lorraine Graney, Bartlett Tree Experts, Bugwood.org)

Spruce Bud Scale

Physokermes piceae

Pest Description

- adults: highly variable; females ~ 1/8 inch; globular; yellowish to dark brown with light, white dusting
- adults: often aggregate at the base of new growth; look very similar to spruce buds
- immatures: crawlers (mobile stage); tiny (3/64 inch), yellow orange and wingless
- immatures: nymphs are smaller, flattened and oval to globose; brownish yellow to dark brown
- most common on lower branches

Host Plants, Diet & Damage

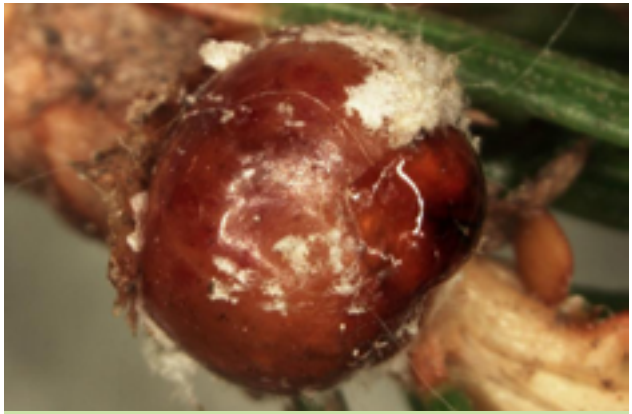
- spruce; occasionally pine
- feed on plant sap from twigs, needles and scales
- can cause tree stress, decline, and branch death
- copious honeydew may lead to sooty mold

Biology, Life Cycle & Damaging Life Stage

- overwinter as 2nd instar nymphs on needles or bud scales
- in spring, overwintering nymphs migrate to twigs to feed
- around May, females reach maturity and mate
- can reproduce without mating (parthenogenetic)
- eggs are laid under the female body
- egg hatch occurs from mid-June through late-July
- crawlers migrate to needles, scales or twigs and feed
- one generation per year
- nymphs and adults are the damaging stages

IPM Recommendations

- Manage trees to improve or maintain health.
- Monitor scale populations host plants.
- Apply an insecticide (carbamate; horticultural oil; insecticidal soap; organophosphate; pyrethroid) to coincide with scale crawler activity.
- Apply a systemic neonicitinoid in spring after new needles have expanded.



Spruce bud scale (Sandra Jensen, Cornell University, Bugwood.org)

Adult female spruce bud scales (Steven Katovich, USDA Forest Service, Bugwood.org)

Soft scales (Andrea Battisti, University of Padova, Bugwood.org)

Sycamore Scale

Stomacoccus platani

Pest Description

- very tiny scale, ~1/16 inch; hand lens needed
- feeding symptoms are diagnostic
- waxy masses on bark or leaves contain eggs or nymphs
- common in warmer locations, (i.e., southern Utah)

Host Plants, Diet & Damage

- sycamore and London planetree
- feed on the sap of leaves and branches
- small, yellow to brown spots at feeding sites; disease-like in appearance
- leaf distortion; twig dieback; premature leaf drop

Biology, Life Cycle & Damaging Life Stage

- overwinter as nymphs under bark scales on the trunk or twigs
- eggs laid in cottony masses in late winter and early spring
- eggs hatch beginning in early spring
- nymphs move to emerging foliage to feed
- nymphs develop on leaves, then migrate back to bark to reproduce
- three to five generations per year

IPM Recommendations

- Manage trees to improve or maintain health.
- Monitor scale populations on host plants. Look for white, cottony wax on bark or leaves.
- Apply an insecticide (carbamate; horticultural oil; insecticidal soap; organophosphate; pyrethroid) to coincide with scale crawler activity; summer applications are less effective.
- Apply a systemic neonicitinoid in spring after leaves have expanded.

Sycamore scale nymphs (U.S. National Collection of Scale Insects Photographs, USDA Agricultural Research Service, Bugwood.org)

Sycamore scale eggs and nymphs under bark scale (Jack Kelly Clark, UC Statewide IPM Project, University of California)

Sycamore scale feeding damage (Jack Kelly Clark, UC Statewide IPM Project, University of California)

Clover Mite

Bryobia praetiosa

Pest Description

- adults: very tiny, ~ 1/32 inch; green to black, sometimes with red/orange markings/legs
- very long front legs that look like antennae
- eggs: smaller than adults and red

Host Plants, Diet & Damage

- primarily found on turfgrass, but can be found on vegetation near buildings or on structures
- can cause browning of turfgrass near walls and hot spots

Biology, Life Cycle & Damaging Life Stage

- overwinter primarily as eggs, but any life stage can be present
- eggs hatch as early as February with warm temperatures
- become dormant eggs during summer
- active and migrate indoors in the late spring and fall (often found on building exteriors)
- two generations per year

IPM Recommendations

- Manage trees to improve or maintain health.
- Create a turf- and weed-free boundary around buildings 3-5 feet minimum.
- Within boundary, use pea gravel or mulch to repel mites.
- Within boundary, use plants that are unattractive to clover mites such as geranium, chrysanthemum, zinnia, marigold, salvia, rose, petunia or shrubs such as barberry, juniper and yew.
- Ensure that seals around windows are in good repair.
- Vacuum mites indoors and outdoors (siding).
- Apply an insecticide/acaricide (dicofol; insecticidal soap; pyrethroid) to affected plants when mites are active (spring/fall).

Adult clover mite; note long front legs (Rayanne Lehman, Pennsylvania Deptartment of Agriculture, Bugwood.org)

Clover mites (Whitney Cranshaw, Colorado State University, Bugwood.org)

Clover mite adult and eggs (J. Kalisch, University of Nebraska)

Honeylocust Spider Mite

Platytetranychus multidigituli

Pest Description

- adults: very tiny, ~ 1/80 – 1/60 inch; pale green to yellowish green
- immatures: smaller and pale green
- eggs: smaller than adults and greenish

Host Plants, Diet & Damage

- honeylocust
- feed on undersides of leaves typically near the mid-rib
- stippling causes yellowing of leaves and canopy
- most damage caused by mid-summer
- may cause premature leaf drop in late summer

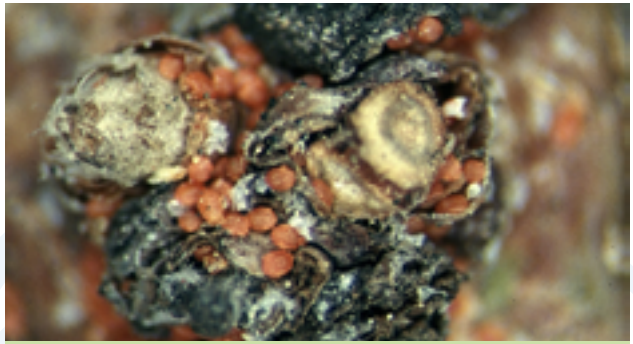
Biology, Life Cycle & Damaging Life Stage

- overwinter as orange-colored females on or under bark or bud scales
- adults become active around budbreak
- eggs are laid on leaves and hatch around early-June
- one generation can occur every week to 2 weeks
- prefer hot, dry weather
- populations build through July and decline in August
- can disperse via wind
- overlapping life stages present in late spring throughout the growing season; many generations per year
- immatures and adults are the damaging stages

IPM Recommendations

- Manage trees to improve or maintain health.
- Monitor spider mite populations on host plants with a "paper test" starting after budbreak (see page 303).
- Preserve beneficial mites and organisms.
- Apply a dormant oil to target overwintering adults. Apply an insecticide/acaricide (dicofol; horticultural oil; insecticidal soap; METI acaracide; organotin miticide; pyrethroid) when mites are present on leaves.

Adult honeylocust spider mites (Utah State University Extension)



Overwintering female honeylocust spider mites (Whitney Cranshaw, Colorado State University, Bugwood.org)

Yellowing of leaves caused by honeylocust spider mites (Whitney Cranshaw, Colorado State University, Bugwood.org)

Spruce Spider Mite

Oligonychus ununguis

Pest Description

- adults: very tiny, ~ 1/64 inch; dark brown/reddish to dark green
- eggs: smaller than adults and are brown to red

Host Plants, Diet & Damage

- all conifers, especially blue and Alberta spruce in Utah
- feed on needle cell contents
- cause yellowing/stippling; needle browning and dieback
- may cause premature needle drop
- fine webbing on needles; dirty appearance
- damage may be patchy within canopy
- prefer older growth

Biology, Life Cycle & Damaging Life Stage

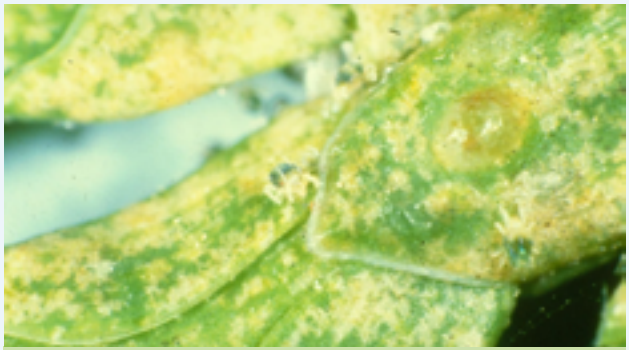
- overwinter as eggs near needle bases
- egg hatch begins around mid-March to mid-April
- cool-season mite, active primarily in spring and fall
- overlapping life stages present in late spring
- over-summer primarily as eggs; dormant in summer at temperatures warmer than 80-90ºF
- a single generation takes 2 to 3 weeks; up to six generations per year are possible
- can disperse via the wind
- immatures and adults are the damaging stages

IPM Recommendations

- Manage trees to improve or maintain health.
- Monitor spider mite populations on host plants with a "paper test" starting after budbreak (see page 303).
- Preserve beneficial mites and organisms.
- Apply a dormant horticultural oil or insecticidal soap to needles and twigs in spring or fall when mites are present.
- Apply an insecticide/acaricide (bifenazate; horticultural oil; insecticidal soap; pyrethroid) when mites are present on leaves.

Adult spruce spider mite and eggs (Ward Strong, BC Ministry of Forests, Bugwood.org)

Spider mite webbing on spruce needles (Petr Kapitola, Central Institute for Supervising and Testing in Agriculture, Bugwood.org)



Spruce spider mite damage (John A. Weidhass, Virginia Polytechnic Institute and State University, Bugwood.org)

Two-Spotted & McDaniel Spider Mites

Tetranychus urticae; Tetranychus mcdanieli

Pest Description

- adults: very tiny, ~ 1/60 – 1/80 inch; greenish yellow
- two-spotted: two black spots on back typically present
- McDaniel: multiple pairs of black spots typically present
- immatures: smaller and clear to yellowish
- eggs: smaller than adults and are yellowish

Host Plants, Diet & Damage

- two-spotted: hundreds of plants are affected
- McDaniel: typically found on fruit trees; many hosts
- warm-season mites; prefer hot, dry weather
- feed on plant cell contents
- yellow/bronze stippling, leaf browning and dieback
- may cause premature leaf drop and plant death
- fine webbing on host plants; dirty appearance

Biology, Life Cycle & Damaging Life Stage

- overwinter as orange-colored females around host plants
- egg laying begins once adults become active in spring
- can disperse via wind
- generation times are short: 1 to 3 weeks
- overlapping life stages occur; many generations per year
- immatures and adults are the damaging stages

IPM Recommendations

- Manage trees to improve or maintain health.
- Monitor spider mite populations on host plants with a "paper test" starting in April (see page 303).
- Preserve beneficial mites and organisms.
- Spray top and undersides of plants with a stiff stream of water to disrupt mites (homeowner).
- Apply an insecticide/acaricide (avermectin; dicofol; hexythiazox; horticultural oil; insecticidal soap; pyrethroid) when mites are present on plants.

Two-spotted spider mites and spherical eggs (Whitney Cranshaw, Colorado State University, Bugwood.org)

Overwintering female spider mites (Aleksey Gnilenkov, Wikimedia Commons)

Spider mite damage (Whitney Cranshaw, Colorado State University, Bugwood.org)

Brown Marmorated Stink Bug

Halyomorpha halys

Pest Description

- adults: ~ 5/8 inch long; brown/gray in color; shield-shaped
- alternating white and black bands on antennae; smooth shoulders (no spines)
- black and white alternating pattern surrounding wings
- nymphs: smaller with orange and black markings
- eggs: white, round and laid in clusters of 20-30 on leaf undersides

Host Plants, Diet & Damage

- broad host range: ornamentals, fruits, vegetables, crops, weeds, etc.
- stipple leaves causing yellow spotting
- cat-facing on fruits and deformation of vegetables
- major nuisance pests in structures
- emit an unpleasant odor when smashed

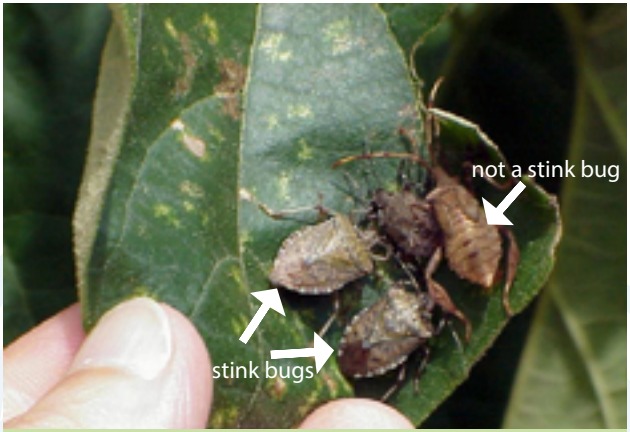
Biology, Life Cycle & Damaging Life Stage

- overwinter as adults in structures or in hidden places outdoors
- adults become active April through May and feed prior to egg laying
- eggs are laid continuously throughout the growing season
- two generations per year
- immatures and adults are the damaging stages

IPM Recommendations

- Manage trees to improve or maintain health.
- Monitor ornamentals and other plants starting in April.
- Stink bug damage to ornamentals can be tolerated.
- Apply an insecticide (pyrethroid) to ornamentals when adults or nymphs are present.

Adult brown marmorated stink bug; note bands on antennae and pattern surrounding wing (David R. Lance, USDA APHIS PPQ, Bugwood.org)



Stink bug leaf damage (Gary Bernon, USDA APHIS PPQ, Bugwood.org)

Stink bug eggs and nymphs (David R. Lance, USDA APHIS PPQ, Bugwood.org)

Stink Bugs

Acrosternum; Brochymena; Chlorochroa; Eustichus

Pest Description

- adults: ~ 1/2 – 5/8 inch long; brown to green; shield-shaped
- nymphs: smaller with variable markings and coloration
- straw-like mouthparts used for sucking
- eggs: typically round to barrel-shaped and laid in clusters on leaves

Host Plants, Diet & Damage

- broad host range: ornamentals, fruits, vegetables, crops, weeds, etc.
- rough stink bugs are beneficial predators; occasionally minor feeding on leaves
- damage to ornamentals is usually negligible
- stipple leaves causing yellow spotting
- bud abortion, cat-facing/pitting on fruits and deformation of vegetables
- can emit an unpleasant odor

Biology, Life Cycle & Damaging Life Stage

- overwinter as adults in hidden places outdoors (under bark, leaf debris, wood piles, etc.)
- adults become active with warming temperatures in the spring
- one to many generations per year
- immatures and adults are the damaging stages

IPM Recommendations

- Manage trees to improve or maintain health.
- Monitor ornamentals and other plants starting in April.
- Stink bug damage to ornamentals can be tolerated.
- Apply an insecticide (pyrethroid) to ornamentals when adults or nymphs are present.

Top left: Consperse stink bug (Steven Valley, Oregon Department of Agriculture, Bugwood.org); Top right: Green stink bug (Vik Nanda, Wikimedia Commons); Bottom left: Rough-shouldered stink bug (Bugwood Wiki)

Stink bug nymphs (Herb Pilcher, USDA Agricultural Research Service, Bugwood.org)

Western Flower Thrips

Frankliniella occidentalis

Pest Description

- adults: very tiny, ~ 1/16 inch; elongated and yellowish to dark brown
- fringed wings visible under magnification
- nymphs: smaller and yellowish; wingless

Host Plants, Diet & Damage

- many herbaceous plants and flowers; fruits; vegetables; few ornamentals
- feed on plant sap and pollen
- cause yellow/bronze stippling; cupping; leaf browning and dieback
- may cause premature leaf drop and plant death
- can damage flowers and fruit
- can transmit diseases
- leave tiny black varnish-like fecal spots on leaves

Biology, Life Cycle & Damaging Life Stage

- overwinter as adults in debris around host plants
- adult activity begins in spring around budbreak
- eggs laid inside leaf and bud tissue
- eggs hatch in about 1 week; first two nymph stages (and adults) feed on plant tissue, pollen and nectar
- pre-pupae and pupal stages develop in the soil
- many generations per year; continuous indoors
- immatures and adults are the damaging stages

IPM Recommendations

- Manage plants to improve or maintain health.
- Monitor thrips populations on host plants with a "paper test" (see page 303) or visual inspection.
- Preserve beneficial mites and organisms.
- Apply an insecticide (azadirachtin; horticultural oil; insecticidal soap; neem oil; pyrethroid; spinosyn) when monitoring indicates it is necessary.

Adult western flower thrips and varnish-like excrement (David Cappaert, Bugwood.org)

Flower thrips damage. (Top: Chazz Hesselein, Alabama Cooperative Extension System, Bugwood.org; Bottom left: Carroll E. Younce, USDA Agricultural Research Service, Bugwood.org; Bottom right: Bruce Watt, University of Maine, Bugwood.org)

Poplar & Willow Borer

Cryptorhynchus lapathi

Pest Description

- adults: ~ 5/16 – 3/8 inch; long snout; black with white/ brown markings; resembles bird feces
- larvae: up to 5/16 inch long; white grubs without legs; brown head capsule

Host Plants, Diet & Damage

- primarily willow; poplar
- young/newly planted trees preferred
- damage typically occurs on the lower stem
- adults cause minor chewing injury on stems and shoots
- larvae feed on inner bark into the sapwood
- frass is pushed out from the entrance holes
- cause deformation and weakness of branches and stems
- smaller diameter trees can be killed

Biology, Life Cycle & Damaging Life Stage

- overwinter as larvae in the sapwood
- larvae resume feeding in the spring
- pupate under the bark around May
- adults present from May to mid-July
- one generation per year
- larvae are the primary damaging stage

IPM Recommendations

- Manage trees to improve or maintain overall health.
- Remove and destroy infested plant material.
- Apply an insecticide (carbamate; pyrethroid) to the main stem May through mid-July.

Adult poplar and willow borer weevil (Gyorgy Csoka, Hungary Forest Research Institute, Bugwood.org)

Poplar and willow borer damage (Milan Zubrik, Forest Research Institute - Slovakia, Bugwood.org)

Poplar and willow borer larva (Fabio Stergulc, University of Udine, Bugwood.org)

Root Weevils

Otiorhynchus spp.

Pest Description

- adults: 1/4 – 1/2 inch; square snout; black with white/ brown flecks
- larvae: up to 1/3 inch long; white grubs without legs; brown head capsule

Host Plants, Diet & Damage

- many hosts: lilac, euonymous, strawberry, broadleaved evergreens preferred
- larval feeding on host plant roots can lead to weakened plants causing dieback
- adults create unsightly marginal leaf notches
- considered a nuisance pest when entering homes

Biology, Life Cycle & Damaging Life Stage

- overwinter as nearly full-grown larvae; some as adults
- larvae resume feeding in the spring
- adults emerge around June and are active through fall
- eggs are laid in the soil around the plant base
- adults do not fly; fall to the ground when disturbed
- nocturnal feeders
- one generation per year
- larvae and adults are damaging

IPM Recommendations

- Manage trees to improve or maintain overall health.
- Monitor plants for marginal leaf notching.
- Minor damage may be tolerated.
- Apply an insecticide (pyrethroid) to foliage in the evening to control feeding adults when damage is present.
- Apply a systemic neonicitinoid as a soil drench in May or after leaves have expanded in spring.

Adult black vine weevil (Joseph Berger, Bugwood.org)

Root weevil feeding damage (Whitney Cranshaw, Colorado State University, Bugwood.org)

Black vine weevil larva (Peggy Greb, USDA Agricultural Research Service, Bugwood.org)

White Pine Weevil

Pissodes strobi

Pest Description

- adults: ~ 1/4 inch; long snout; black with white/orangish flecks
- larvae: up to 3/8 inch long; white grubs without legs; brown head capsule

Host Plants, Diet & Damage

- primarily blue spruce; white pine
- common at high elevations (e.g., Wasatch and Summit counties) or in nursery situations
- larvae feed under the bark of terminal leaders
- larvae girdle young (1-3 years) leader growth only
- damaged trees have bushy appearance; reduced growth
- dead leaders turn brown and curl (shepherd's crook)
- dead leaders riddled with holes and stringy frass
- severe damage is rare

Biology, Life Cycle & Damaging Life Stage

- overwinter as adults in duff around trunks
- adults migrate up trunks (or fly) to canopy in late spring
- feed and lay eggs below the terminal buds
- feed and pupate within the terminal and emerge from late-July through fall
- minor adult feeding occurs until dormancy in fall
- one generation per year
- larvae are the primary damaging stage

IPM Recommendations

- Manage trees to improve or maintain overall health.
- Monitor spruce trees in June/July for terminal death.
- Prune infested terminals prior to adult emergence.
- Apply an insecticide (pyrethroid) to target feeding/egg laying adults on the top 3 to 4 years of terminal growth and the lower trunk prior to emergence in spring.
- Apply a systemic neonicitinoid soil drench in fall to control larvae the following year.

White pine weevil adults (Dave Powell, USDA Forest Service, Bugwood.org)

Left: White pine weevil damage to leader (Scott Tunnock, USDA Forest Service, Bugwood.org); Right: White pine weevil exit holes (Steven Katovich, USDA Forest Service, Bugwood.org)

White pine weevil larvae and girdling damage (William M. Ciesla, Forest Health Management International, Bugwood.org)

Anthracnose

Apiognomonia spp.; Discula spp.; Kabatiella spp.

Hosts, Symptoms & Signs

- sycamore, maple, oak
- all three species show irregular-shaped necrotic lesions on leaves often on veins or on the margins
- on sycamore, new shoots show wilting and dieback
- cankers can develop on branches and trunk
- clusters of dead and live branches may form "witches' brooms" from repeated dieback
- premature leaf drop late spring/early summer on maple and oak
- dieback of newly emerging shoots and expanding leaves on oak

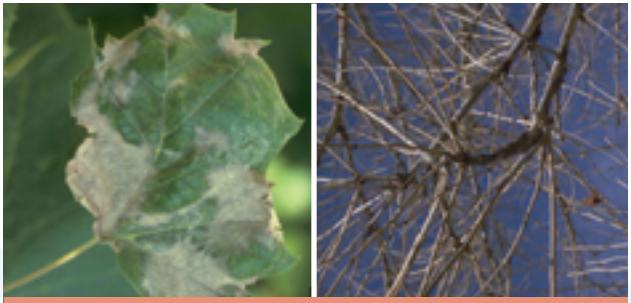
Disease Cycle

- overwinters in buds, twigs, fruit, fallen leaves or petioles depending on host and anthracnose species
- spores are water- or air-dispersed during leaf expansion, especially during spring rains when temperatures are 50-68°F
- infected leaves can spread disease to other leaves during rain events throughout the growing season

IPM Recommendations

- Manage trees to improve or maintain overall health.
- Rake and destroy fallen leaves to remove overwintering inoculum.
- Prune out dead branches or branches with cankers.
- Water and fertilize as necessary to maintain tree vigor.
- Apply preventative fungicides before leaf buds open, then every 10 to 14 days until disease conditions become unfavorable.

Left: Anthracnose on canyon maple (Marion Murray, Utah State University Extension); Right: Anthracnose on oak (Joseph O'Brien, USDA Forest Service, Bugwood.org)



Anthracnose on sycamore (William Jacobi, Colorado State University, Bugwood.org)

Anthracnose trunk canker on sycamore (left) and crown thinning caused by anthracnose on sycamore (right) (William Jacobi, Colorado State University, Bugwood.org)

Armillaria Root Rot

Armillaria mellea

Hosts, Symptoms & Signs

- trees
- aboveground symptoms: over time the foliage turns yellow, thins and branches die back; eventually the tree dies
- below ground, the roots are rotting leading to the above ground symptoms; infected conifers may exude resin at the base of the tree

three signs to look for to diagnose Armillaria:

- the mycelial fan under the bark that can be seen when the bark of a dead tree is peeled back
- rhizomorphs on the roots and under the bark (rhizomorphs are thick strands of hyphae that are dark brown; they can look like shoelaces)
- mushroom clusters at the base of the tree in late summer and fall

Disease Cycle

- Armillaria fungus is soilborne
- colonizes the roots and causes root rot
- rhizomorphs can grow through the soil from one tree root to neighboring tree roots, infecting neighboring trees
- once the tree is dead, Armillaria can survive on dead roots and other wood for decades in the soil until a new host plant is found
- Armillaria can be a problem in areas where woodlands used to be

IPM Recommendations

- Keep trees vigorous and avoid excessive moisture.
- Remove affected trees and remove as much of the roots as possible (roots can extend several feet away from the trunk).
- If Armillaria has been a problem in the past, plant resistant trees.

Mycelial fans of Armillaria (William Jacobi, Colorado State University, Bugwood.org)

Armillaria rhizomorphs (Minnesota Department of Natural Resources, Bugwood.org)

Mushrooms at the base of a tree, a sign of Armillaria root rot (USDA Forest Service, Bugwood.org)

Cytospora Canker

Leucostoma sp.

Hosts, Symptoms & Signs

- many deciduous trees; spruce
- branch dieback; cankers develop that are oval shaped
- fruiting structures develop on bark at canker or on dead branches
- weak pathogen; healthy, vigorous plants do not get infected
- attacks stressed trees through wounds caused by pruning, insect feeding or winter injury or by other pathogens

Disease Cycle

- overwinters as fungus in the bark
- produces fruiting bodies that ooze spores in spring
- splashing water (irrigation or rain) spreads spores to neighboring branches or trees; if the spores land on a stressed tree in a wound, they germinate and start colonizing the tree, creating a canker over time
- severely infected trees will die within a few years; sometimes a tree is able to wall off an infection site and confine the pathogen; it will continue to live but it will have the canker present for the rest of its life

IPM Recommendations

- Avoid mechanical and winter injury.
- Prune dead branches in the winter and burn them (infected branches should be cut 4 inches below the end of the canker). Disinfect pruning tools between cuts using a 10% bleach or 70% alcohol solution or disinfecting wipes.
- Plant disease-free plants (avoid planting trees that already have dead branches).
- Control insects and other diseases.
- There are no effective fungicides available.

Cytospora canker on spruce (Joseph O'Brien, USDA Forest Service, Bugwood.org)

Fruiting structures on a dead branch (Melodie Putnam, Oregon State University)

Cytospora spores oozing from branch (Claudia Nischwitz, Utah State University Extension)

Fire Blight

Erwinia amylovora

Hosts, Symptoms & Signs

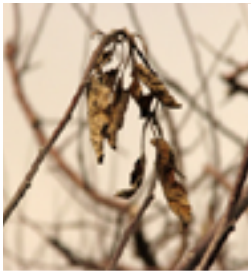
- Rosaceae (rose family)
- spring: flowers turn brown and die
- spring: shoots/leaves will start to die back from the tip; the tip is sometimes bent forming a "shepherd's crook"
- older infections develop cankers on large branches or the main trunk
- cankers look wet when bacteria are oozing from them

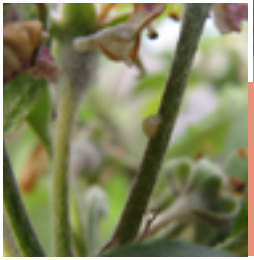
Disease Cycle

- overwinters within infected tissues at canker margins
- disease growth begins in spring when the tree breaks dormancy
- bacterial ooze from cankers can be splashed by water or transmitted by bees and flies during pollination
- the bacteria is spread during bloom to blossoms and anytime to shoots through natural openings or damage
- trees remain susceptible to infection until new growth stops; succulent growth (e.g., root sprouts) can be infected anytime

IPM Recommendations

- Manage trees to improve or maintain overall health.
- Prune infected shoots 12 inches below the symptomatic area to remove the bacteria that have moved beyond the symptomatic part of the shoot.
- Disinfect pruning tools between cuts using a 10% bleach or 70% alcohol solution or disinfecting wipes. If tools are not disinfected, fire blight could be spread to healthy plants during pruning.
- Apply copper products during the dormant season on cankers.
- Apply antibiotics in spring to prevent blossom infections.
- Visit https://climate.usurf.usu.edu/traps to view the fire blight risk forecasting system to assess risk for ornamental trees.





Top left: Fire blight shepherd's crook (Marion Murray, Utah State University Extension); Top right: Fire blight-killed branch (William Jacobi, Colorado State University, Bugwood.org); Bottom left: Bacterial ooze from fire blight (Marion Murray, Utah State University Extension)

Top left and right: Fire blight branch canker (William Jacobi, Colorado State University, Bugwood.org); Bottom left: Fire blight stem canker (Marion Murray, Utah State University Extension)

Leaf Spots

Many fungi & bacteria

Hosts, Symptoms & Signs

- caused by many fungal and bacterial pathogens
- affects all ornamentals
- leaves start to develop brown to black spots in varying sizes
- in some cases, the brown areas will fall out leaving a hole behind
- in some cases (i.e., black spot on roses), infected leaves will turn yellow and fall off

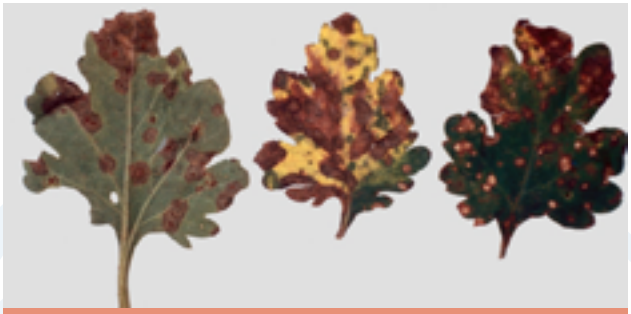
Disease Cycle

- overwinter in fallen leaves or diseased branches
- spores land on leaves and germinate during moist conditions and colonize the leaf
- fruiting structures develop on lesions; spores spread from lesions during wet conditions, colonizing new areas of the same, or nearby leaves
- bacteria from lesions are washed across the leaf and enter new leaves through openings like stomates or small wounds

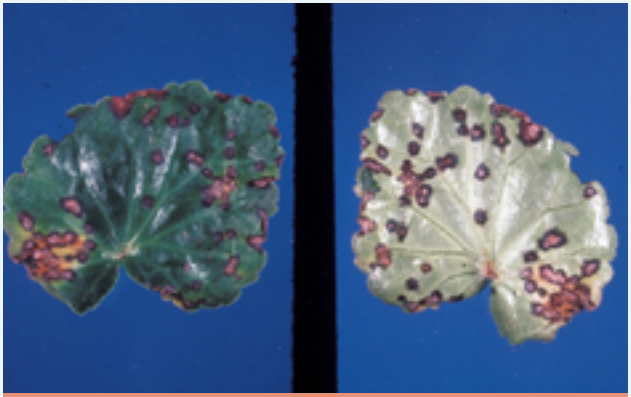
IPM Recommendations

- Rake and remove leaves in the fall.
- Apply fungicides and bactericides like copper to prevent the spread to uninfected leaves; these will not cure infected leaves.
- Avoid wetting leaves with irrigation.

Black spot on roses (Ward Upham, Kansas State University, Bugwood.org)



Septoria leaf spot (North Carolina State University Department of Plant Pathology, Bugwood.org)



Bacterial leaf spot on begonia (Department of Pathology, North Carolina State University, Bugwood.org)

Phytophthora Root & Crown Rot

Phytophthora spp.

Hosts, Symptoms & Signs

- many deciduous trees and shrubs; some conifers
- tree or shrub starts wilting, then dies
- rotten roots
- lower stem areas can be discolored and rotten
- motile spores can swim in a film of water to spread

Disease Cycle

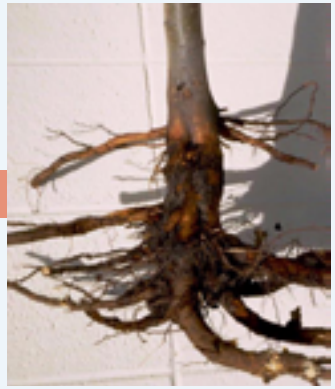
- soilborne pathogen; it can live in decaying matter until a suitable host is planted
- spores will swim to the roots, often being attracted by root exudates
- spores enter the root and colonize it; in the process they kill the roots and feed on the dead tissue
- spores formed in the dead roots are released as the roots decompose

IPM Recommendations

- Avoid introduction of pathogens into the garden by cleaning tools and planting healthy, disease-free plants.
- Plant trees and shrubs in well-drained soils.
- Plant Phytophthora-resistant plant species if the disease is present in the soil or where a plant has previously died from Phytophthora infection.
- Infected plants should be removed with as much of the roots as possible and disposed of in the trash.

Wilt from Phytophthora infection (Daren Mueller, Iowa State University, Bugwood.org)

Discoloration and rot of the crown (Ontario Ministry of Agriculture, Food and Rural Affairs, Queen's Printer for Ontario)



Root rot caused by Phytophthora (William M. Brown Jr., Bugwood.org)

Powdery Mildew

Many fungal species

Hosts, Symptoms & Signs

- many hosts; powdery mildew species are usually host- or group-specific
- white powdery growth on green plant tissue
- commonly occurs on the tops of leaves, but may be on the undersides of leaves, young stems, buds, flowers and young fruit

Disease Cycle

- overwinters on plant debris as survival fruiting structures (cleistothecia) or mycelia
- in spring, spores from overwintering cleistothecia are spread to new tissue via rain, irrigation, wind or insects
- young, succulent growth is most susceptible
- only moderate humidity is needed to germinate spores
- powdery mildews are common in warm, dry climates

IPM Recommendations

- Manage trees to improve or maintain overall health.
- Powdery mildew in ornamentals is an aesthetic problem; tolerate powdery mildew.
- Use powdery mildew-resistant plants.
- Avoid late summer nitrogen applications.
- Apply fungicides when the first small white spots are discovered. Once the entire leaf is colonized, fungicide applications will be less effective.
- Apply a fungicide (chlorothalonil; potassium bicarbonate; sulfur) to affected foliage. Note: Sulfur can only be applied at temperatures below 90°F; temperatures must stay below 90°F until the fungicide has dried.
- Test ornamental fungicides for phytotoxicity (plant damage) on a few leaves before applying fully.

Powdery mildew on dogwood (left) and powdery mildew on lilac (right) (Penn State Department of Plant Pathology and Environmental Microbiology Archives, Bugwood.org)

Powdery mildew on lilac (Whitney Cranshaw, Colorado State University, Bugwood.org)

Powdery mildew on lilac (Whitney Cranshaw, Colorado State University, Bugwood.org)

Pythium Root Rot

Pythium spp.

Hosts, Symptoms & Signs

- affects annual and perennial bedding plants
- wilting plants
- roots are brown or black and look rotten

Disease Cycle

- Pythium is common in many soils and only some species are pathogenic to plants under wet conditions
- Pythium spores are able to swim in a film of water toward a root
- Pythium spores enter the root, kill and feed upon it

IPM Recommendations

- Plant disease-free plants to prevent Pythium introduction.
- Clean tools to prevent moving Pythium from one part of the garden to another.
- Prevent excessive soil moisture or standing water as Pythium infects plants under those conditions.
- Remove diseased plants.

Overwatered plants infected with Pythium (Paul Bachi, University of Kentucky Research and Education Center, Bugwood.org)

Pythium root and stem rot symptoms (Howard F. Schwartz, Colorado State University, Bugwood.org)

Roots infected with Pythium (Donald Groth, Louisiana State University AgCenter, Bugwood.org)

Rose Mosaic

Prunus necrotic ring spot virus; Apple mosaic virus

Hosts, Symptoms & Signs

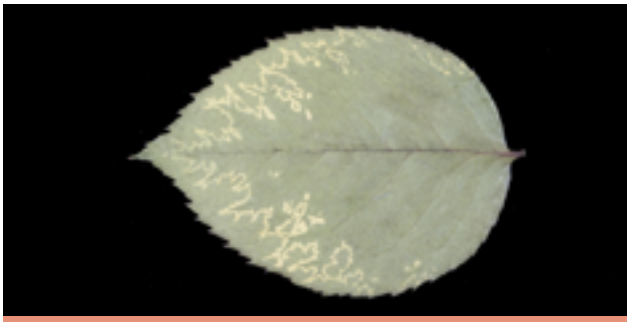
- caused by a complex of several viruses
- roses are the host
- spread by aphids
- leaves show a yellow irregular zigzag pattern

Disease Cycle

- aphids transmit the virus to roses while feeding on the plants
- symptoms develop about a week after infection
- aphids must feed on an infected plant to be able to transmit the virus again

IPM Recommendations

- The virus is primarily an aesthetic issue; tolerate leaf discoloration.
- Control with insecticides is very difficult. Aphids transmit viruses before death from insecticides occurs.
- Apply an insecticide (insecticidal soap; pyrethroid; systemic neonicitinoid) to reduce secondary spread to neighboring plants.



Rose mosaic symptom (Mary Ann Hansen, Virginia Polytechnic Institute and State University, Bugwood.org)

Rose mosaic symptom (Penn State Department of Plant Pathology and Environmental Microbiology Archives, Bugwood.org)

Rose mosaic (Penn State Department of Plant Pathology and Environmental Microbiology Archives, Bugwood.org)

Rusts

Many fungal species

Hosts, Symptoms & Signs

- many hosts; commonly seen on hollyhock, roses, hawthorn, flax, cottonwoods and fir (at higher elevations)
- rusts are very host specific and rarely kill the host plant
- orange blisters occur on plant tissue at infection points
- ruptured blisters release orange-colored spores that can cause new infections
- deformed growth in conifers
- early defoliation can occur in deciduous trees

Disease Cycle

- overwinter on living host material
- in spring, spores are wind dispersed over great distances
- the disease cycle is typically completed on one or two hosts
- rust is an obligate parasite and requires a living host

IPM Recommendations

- Manage trees to improve or maintain overall health.
- Use resistant plant varieties when available.
- Remove alternate hosts to break the disease cycle.
- Remove infected plant material to prevent spread to uninfected plants and to prevent overwintering.
- Plant farther apart to allow for air movement and a reduction in humidity.
- Apply a preventative fungicide (chlorothalonil; myclobutanil; tebuconazole) to protect healthy leaves.
- Leaves with fruiting structures (orange blisters) cannot be saved.

Top left: White pine rust on Ribes; Top right: Hawthorn rust (Robert L. Anderson, USDA Forest Service, Bugwood.org); Bottom right: Rust on hollyhock (Claudia Nischwitz, Utah State University Extension)

Top: Witches' broom on fir caused by rust (Joseph O'Brien, USDA Forest Service, Bugwood.org); Bottom: Rust on fir (Joseph O'Brien, USDA Forest Service, Bugwood.org)

Slime Flux

Many bacterial species

Hosts, Symptoms & Signs

- cottonwoods, ashes, elms and occasionally other trees
- caused by several species of bacteria
- two types of slime flux occur in Utah: infections of the heartwood and infections of the bark/cambial tissues
- general canopy dieback
- trunk has a wet spot and staining where bacteria are oozing from a fine crack
- slime flux infections of the cambium can kill trees within 1 - 2 years; trees with heartwood slime flux infections can live for a long time
- oozing from tree can kill turf or plants below

Disease Cycle

- bacteria enter the trunk through small wounds and feed on sap
- bacteria produce gases, such as carbon dioxide, that build up under the bark, creating pressure
- eventually the bark will crack and a bacterial ooze is released

IPM Recommendations

- Prevent tree stress. Trees stressed from drought, soil compaction, insect feeding or plant pathogens may die within a few years of slime flux symptoms appearing.
- Keep trees well watered and fertilized.
- Avoid damaging the trunk to minimize entrance points for bacteria.
- There is no cure for heartwood slime flux infections.
- Prune affected branches, etc., of trees with a bark/cambial infection. Pruning requires catching the disease early; advanced stages of cambial infection in the main stem cannot be reasonably removed without damaging the tree.
- Plant resistant trees.

Bacterial flux damage to tree (Utah State University)

Left: Slime flux in elm (Joseph O'Brien, USDA Forest Service, Bugwood.org); Right: White slime flux oozing from the bark of a willow (Sherman V. Thomson, Utah State University)

Sooty Mold

Many fungal species

Hosts, Symptoms & Signs

- any plant where aphids, soft scales, leafhoppers, whiteflies or mealybugs feed and honeydew is produced
- black fungal growth on leaves, fruit, branches and stems
- stunted growth or early leaf drop in severe cases
- causes indirect damage by reducing photosynthesizing leaf surface area

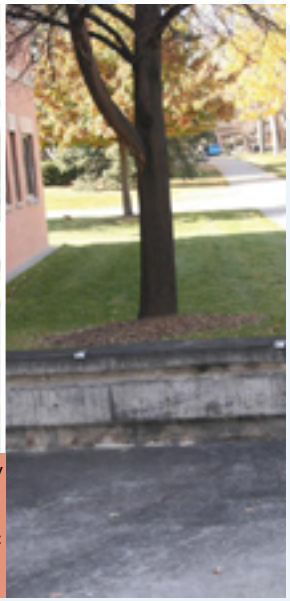
Disease Cycle

- sooty molds are not real pathogens; they colonize the honeydew excreted from aphids and other phloem-feeding, sap-sucking insects and feed on the sugary substance

IPM Recommendations

- Manage trees to improve or maintain overall health.
- Wash off aphids with a strong stream of water.
- Manage or exclude ants from trees to prevent them from protecting honeydew-producing insects.
- Wash sooty mold and honeydew from plants using water.
- Apply horticultural oils to overwintering aphid eggs and scales in spring prior to bud break.
- Apply an insecticidal soap or pyrethroid to nymphs, crawlers and adults when present.
- Apply a systemic insecticide (neonicitinoid) in the spring to target sap-sucking, phloem-feeding insects that produce honeydew.

Top: Sooty mold on leaf (Darin Mueller, Iowa State University, Bugwood.org); Left: Sooty mold on California laurel (Joseph O'Brien, USDA Forest Service, Bugwood.org)



Top left: Sooty mold on branch; Right: Sooty mold on cement below aphid-infested linden tree (Whitney Cranshaw, Colorado State University, Bugwood.org); Bottom left: Ants protecting aphids (David Cappaert, Bugwood.org)

Verticillium Wilt

Verticillium dahliae

Hosts, Symptoms & Signs

- many deciduous trees, shrubs and annual and perennial ornamentals
- herbaceous plants wilt during the hottest part of the day and recover in the evening; this pattern can continue for weeks
- some herbaceous plants may die; others will struggle
- plants are often yellow (nutrient deficiency as the struggling plant cannot take up enough water and nutrients) and may stay small depending on time of infection
- dark streaking in the sapwood
- leaf dieback

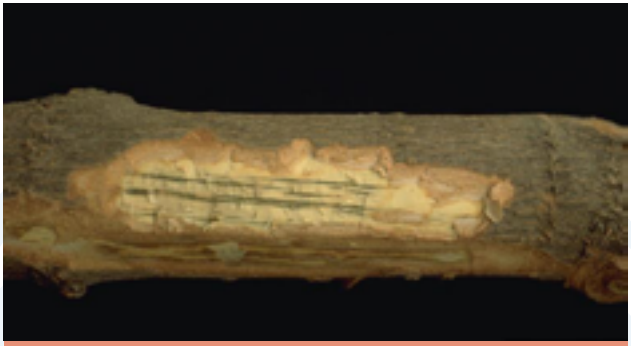
Disease Cycle

- soilborne pathogen; fruiting structure can survive in the soil for 10 or more years waiting for a suitable host to be planted
- small trees can die within a few months of infection; large trees often have only one limb at a time die back

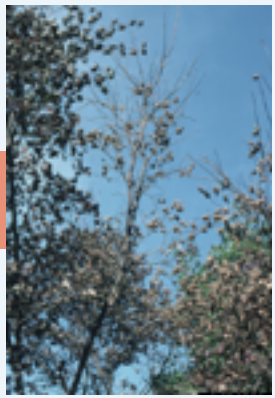
IPM Recommendations

- There are no chemical control options.
- After a plant is diagnosed with verticillium wilt, the best management option is to replace it with a resistant variety (if available) or resistant plant species.
- For a complete list of verticillium-resistant plants, visit: http://depts.washington.edu/hortlib/resources/ucdavis_verticillium.pdf.

Sunflower plants infected with verticillium wilt (Howard F. Schwartz, Colorado State University, Bugwood.org)



Vascular streaking caused by verticillium wilt (John Hartman, University of Kentucky, Bugwood.org)



Verticillium wilt on a Japanese maple (Penn State Department of Plant Pathology and Environmental Microbiology Archives, Bugwood.org)

Witches' Broom

Arceuthobium spp.; Candidatus phytoplasma; Chrysomyxa spp.

Hosts, Symptoms & Signs

- conifers and deciduous trees
- caused by dwarf mistletoes (Arceuthobium sp.) on conifers or several fungi on pine or deciduous trees; phytoplasma and eriophyid mites on some deciduous trees
- dense cluster of twigs on one or more branches
- to determine if the witches' broom is caused by mistletoe or a fungus, a broom needs to be cut down and inspected for mistletoe shoots; fungi causing witches' brooms may not produce fruiting structures for identification

Disease Cycle

dwarf mistletoe

- perennial, parasitic plants
- seed is forcefully shot off by the mistletoe, then germinates and colonizes the branch by tapping into the vascular system under the bark
- continues to grow under the bark and after 3 or 4 years sends up shoots through the bark that produce flowers and seeds

phytoplasma

- phytoplasma is introduced into the plant by leafhoppers
- colonize plant phloem
- leafhoppers become infected with the phytoplasma by feeding on an infected tree

IPM Recommendations

- In many cases, tree removal is the only solution as infected trees provide inoculum to infect healthy nearby trees.
- For dwarf mistletoes, if only one or two brooms are present, pruning may be an option. However, it takes about 3 to 4 years for mistletoes to emerge and brooms to develop, so asymptomatic branches may already be infected.

Left: Witches' brooms caused by dwarf mistletoes on Douglas-fir (Jane Taylor, USDA Forest Service, Bugwood.org); Right: Dwarf mistletoe shoots on pine; not all mistletoe shoots are this large (Brytten Steed, USDA Forest Service, Bugwood.org)

Witches' broom on ash caused by phytoplasma (Claudia Nischwitz, Utah State University Extension)

Witches' broom caused by eriophyid mites on hackberry (Whitney Cranshaw, Colorado State University, Bugwood.org)

Wood Decay Fungi

Many fungal species

Hosts, Symptoms & Signs

- all trees and shrubs
- wood decay fungi may form fruiting structures called conks on affected branches and trunks, but not always
- presence or absence of conks is not an indication of wood decay
- wood decay fungi can degrade wood strength leading to stem or branch failure

white rot

- caused by fungi that decompose most of the wood components
- the leftover material is very light

brown rot

- fungi causing a brown rot cannot decompose lignin, giving it a reddish-brown color
- limbs can die back, but in some cases wood decay fungi can hollow out branches and tree trunks and the tree will show no symptoms; these trees are prone to sudden breakage in storms

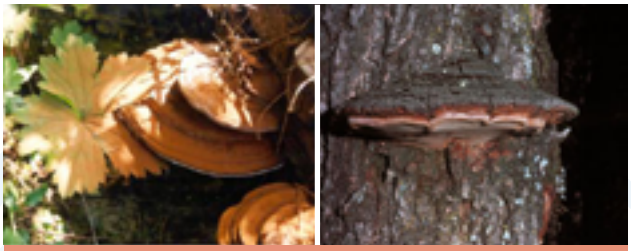
Disease Cycle

- spores of wood decay fungi enter through wounds caused by winter injury, lawn mowers, incorrect pruning or insect feeding, and start colonizing and decomposing the wood; this process can go unnoticed for years

IPM Recommendations

- Remove affected branches. If the trunk is affected, remove the tree.
- If unsure about the presence of wood decay, have a certified arborist evalutate the tree.

Left: Brown rot (Mätes, Wikimedia Commons); Right: White rot (Ryan Davis, Utah State University Extension)



Left: Ganoderma conk (Claudia Nischwitz, Utah State University Extension); Right: Phellinus conk (Robert L. Anderson, USDA Forest Service, Bugwood.org)

Toppled tree resulting from a wood decay fungus infection (Tortuosa, Wikimedia Commons)

Brown Garden Snail

Cornu aspersum

Pest Description

- ~1 1/3 inches long; whorled brown shell with orangish, tan and black markings
- immatures are smaller versions of the adults
- eggs are round, pearly white and laid in the soil

Host Plants, Diet & Damage

- many; boxwood, rose, hibiscus, and peach commonly damaged
- primarily chew on the foliage of host plants
- may cause minor damage to twigs and branches

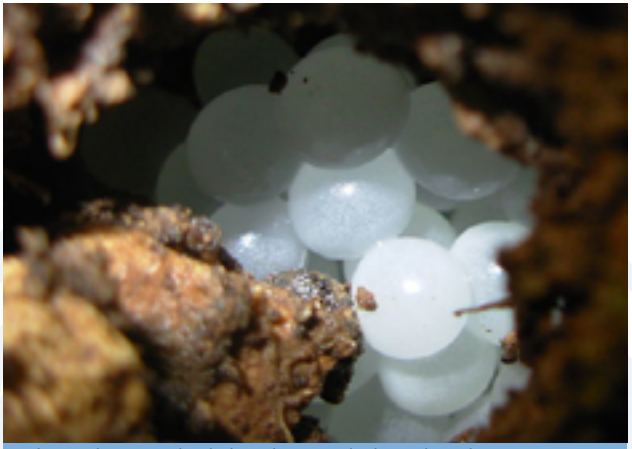
Biology, Life Cycle & Damaging Life Stage

- overwinter within shell around plantings
- become active in the spring, mate and lay eggs
- snails take 2 to 3 years to reach maturity
- mostly active at night
- immatures and adults are damaging

IPM Recommendations

- Control is difficult; manage numbers below threshold.
- Minimize soil moisture; increase time between watering.
- Choose resistant plants.
- Eliminate habitat that promotes protection and moisture.
- Handpick snails from vegetation.
- Use barriers such as copper strips.
- Use baited and unbaited traps to catch and remove or kill snails.
- Apply snail baits (iron phosphate; metaldehyde; sodium ferric EDTA; sulfur).

Adult garden snail (Joseph Berger, Bugwood.org)



Garden snail eggs inside a hole in the ground (Chai, Wikimedia Commons)

Overwintering garden snails (Roger Griffith, Wikimedia Commons)

Pocket Gophers

Geomyidae

Identification

- 6 – 13 inches long
- light brown to brownish-black fur
- short, hairless tails
- incisor teeth always visible

Nesting Habits

- construct underground burrows and leave fan-shaped mounds of excavated soil at the surface
- active year round
- usually only one individual per tunnel system except during mating season or when females have offspring

Diet

- prefer dandelion roots, alfalfa, grasses, shrubs, roots and trees

Significance

- damage lawns, gardens, sports and agricultural fields
- damage underground utility cables and irrigation pipes
- harm trees by stripping bark and chewing on roots

IPM Recommendations

- Trap pocket gophers using two-pronged pincer traps in lateral burrows and closed box-style traps in main burrows.
- Surround trees and shrubs with 3/8 inch hardware cloth.
- Consider flood irrigation to help control gopher populations, if applicable.
- Bait larger populations by placing bait directly into burrows.
- Monitor problem areas to assure trapping and baiting were successful and to quickly control new populations.
- Carefully read and follow the pesticide label when using rodenticides.

Pocket gopher (Ian Silvernail, Wikimedia Commons)

Pocket gopher mounds (USDA Forest Service, Bugwood.org)

Pocket gopher burrow entrance (Gerald Holmes, California Polytechnic State University, Bugwood.org)

Vertebrate Pests

Voles

Microtus spp.

Identification

- 3 – 6 inches long
- hairy tail with short hairs
- front of face more rounded than as seen on house mouse
- make runways/tunnels in turf, mulch, etc.

Nesting Habits

- burrow in the ground along runways and under plants in landscaped areas
- prefer areas of heavy ground cover or plants that provide protection

Diet

- plants, tubers, bark

Significance

- cause damage to turf and ornamental plantings
- occasionally enter buildings by accident, but do not become established indoors

IPM Recommendations

- Install tight-fitting door sweeps.
- Seal exterior cracks, crevices and areas around pipes and electrical conduits that enter buildings through walls.
- Reduce clutter indoors and outdoors.
- Keep all exterior doors closed.
- Use snap traps placed with triggers in vole runways.
- Eliminate weeds, ground cover, mulch and dense ornamental plantings that provide food and shelter during warm weather.
- Surround trees and shrubs with 1/4 inch hardware cloth.
- Aerate turfgrass on a regular basis and reduce mowing height.
- Rodenticides may be necessary for control in large areas.

Vole (Manuel R., Wikimedia Commons)

Vole damage to bark (USDA Forest Service, Bugwood.org)

Vole runways in turf (Ryan Davis, Utah State University Extension)

Vertebrate Pests

Annual Bluegrass

Poa annua

Description

- tufted; upright growth (up to 1 foot tall); leaves emerge from protective sheath with pointed and papery ligule
- narrow leaves (1 – 4 inches long, 1/16 - 3/16 inch wide); short flower heads (1 – 4 inches high) bear 3 to 6 seeds per branching stalk; light green in color

Location

- common in lawn areas and planting beds

Life Cycle

- winter annual or short-lived perennial grass
- seedlings germinate when soil temperatures are below 70°F in late summer, early fall or early spring
- plants flower within 8 weeks of germination and continue to flower and produce seed until the onset of hot temperatures in summer months
- dormant plants produce new blade growth during cool fall temperatures

IPM Recommendations

- Hand-pull plants prior to seed maturation.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Apply an appropriate pre-emergent herbicide prior to seed germination or spot treat foliage with an appropriate post-emergent herbicide.

Annual bluegrass growth habit (Rasbak, Wikimedia Commons)

Annual bluegrass (Rasbak, Wikimedia Commons)

Annual bluegrass seeds (James Lindsey, Wikimedia Commons)

Annual Kochia

Kochia scoparia

Description

- upright growth between 1 and 6 feet high with pyramidal shape to plant at maturity
- branched stems are green to red in color and sometimes striped
- small, linear-shaped leaves are alternately arranged on stems; leaf blades are pointed at tips and have three to five highly visible veins
- annual kochia foliage turns reddish brown in autumn and detaches from the root forming a tumbleweed

Location

- commonly grows in planting beds

Life Cycle

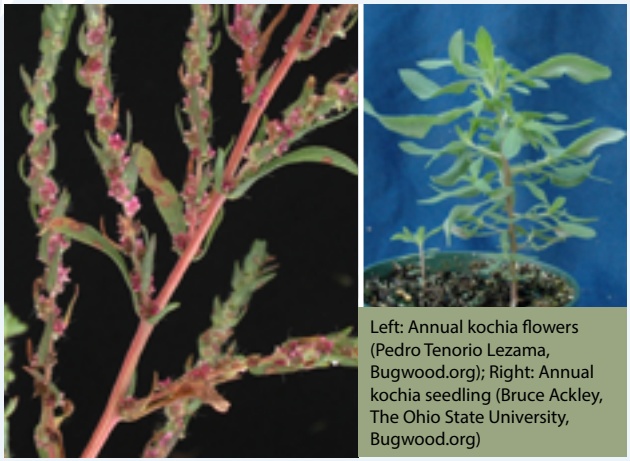
- summer annual that germinates when temperatures reach and exceed 40°F; germination occurs throughout the growing season
- seedlings first appear in early spring and plants mature by mid-summer
- flower and seed production occur from mid-summer to fall frost

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation.
- Shallow tillage or hoeing will control young plants in planting beds.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Apply an appropriate post-emergent herbicide directly to target weeds.

Annual kochia habit (Leslie J. Mehrhoff, University of Connecticut, Bugwood.org)

Left: Annual kochia habit (Leslie J. Mehrhoff, University of Connecticut, Bugwood.org); Right: Annual kochia seeds (D. Walters & C Southwick, Table Grape Weed Disseminule, ID, USDA APHIS ITP, Bugwood.org)



Left: Annual kochia flowers (Pedro Tenorio Lezama, Bugwood.org); Right: Annual kochia seedling (Bruce Ackley, The Ohio State University, Bugwood.org)

Annual Ryegrass

Lolium multiflorum

Description

- bunching growth habit growing 1 to 2 1/2 feet tall; clasping auricles
- leaves are 1/8 to 1/4 inch wide; rolled in the bud; dark green with prominent veins; base of stems are often purple

Location

- landscape, roadsides, open spaces, and occasionally lawns
- commonly planted in agricultural fields for weed suppression and included in lawn seed mixes as a temporary quick-establishing grass

Life Cycle

- annual germination in late summer and fall

IPM Recommendations

- Frequently hand-pull aboveground structures prior to seed maturation to prevent re-seeding.
- Apply an appropriate pre-emergent herbicide prior to seed germination.

Annual ryegrass growth habit (Harry Rose, Flickr.com)

Annual ryegrass clasping auricle (Syngenta Lda, Flickr.com)

Annual ryegrass seed heads (Harry Rose, Flickr.com)

Annual Sowthistle

Sonchus oleraceus

Description

- plant with upright growth between 1 and 4 feet in height
- hollow stems branch toward the sky and produce elongated Hershey kiss-shaped heads that open to yellow, dandelion-like flowers
- flowers mature to globe-shaped fluffy white seed heads
- each brown seed is carried in the wind by a tuft of white fluff
- leaves are green to bluish-green in color, toothed and have prickly margins

Location

- commonly grows in planting beds

Life Cycle

- annual with germination from spring to fall; peak germination occurs in late spring
- seedlings form a rosette 6 weeks post germination and produce flowers 9 weeks post germination
- flower heads continue to bloom from mid-summer to mid-fall; flowers open for 2 days and seed production occurs 1 week after blooms open

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation.
- Shallow tillage or hoeing will control young plants in planting beds.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Apply an appropriate post-emergent herbicide directly to target weeds.

Left: annual sowthistle leaves, flowers and seeds (Chris Evans, University of Illinois, Bugwood.org); Right: Annual sowthistle growth habit (Steve Dewey, Utah State University, Bugwood.org)

Left: Annual sowthistle flowers (Chris Evans, University of Illinois, Bugwood.org); Right: Annual sowthistle seedling (Lynn Sosnoskie, University of Georgia, Bugwood.org)

Annual sowthistle leaf (Chris Evans, University of Illinois, Bugwood.org)

Bermudagrass

Cynodon dactylon

Description

- creeping grass with spike-like appendages alternately arranged along a thick wiry stem overlaid with papery sheaths; produce stolons (aboveground stems) and rhizomes (underground stems)
- flowers and seeds are produced on whorled spikes (three to seven spikes per stalk) 1 – 2 inches long

Location

- forms weedy patches in lawn areas and plants; can invade planting beds

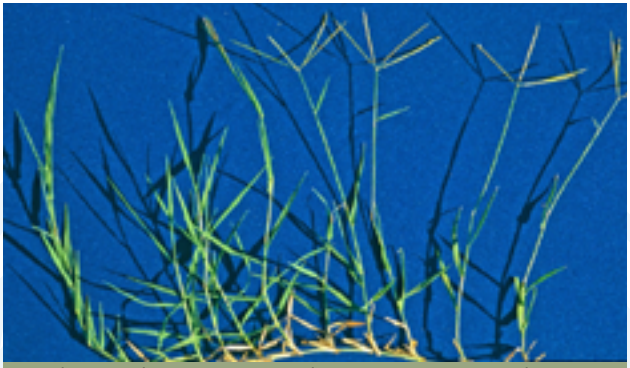
Life Cycle

- warm season perennial grass with spreading stems that root at nodes (growing points) to form new plants; rhizomes can grow 6 inches or deeper into underlying soil
- bermudagrass grows aggressively during summer months but is dormant from early fall until late spring
- patches are easy to spot in cool season turfgrass because bermudagrass foliage turns brown when dormant

IPM Recommendations

- Due to its aggressive spreading nature, use geotextile or plastic mulch to completely eliminate light to all plant parts; geotextile mulches can break down or tear, providing pathways for bermudagrass to escape.
- Apply an appropriate post-emergent herbicide directly to target weeds. More than one herbicide application may be necessary to kill all spreading structures.

Bermudagrass growth habit (Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org)



Bermudagrass stolon (Steve Dewey, Utah State University, Bugwood.org)

Left: Bermudagrass stem and flowers (Steve Dewey, Utah State University, Bugwood.org); Above: Bermudagrass flowers (Pedro Tenorio-Lezama, Bugwood.org)

Bittersweet Nightshade

Solanum dulcamara

Description

- climbing vine with alternately arranged lance or heart-shaped leaves; rhizomes (underground stems) are produced by the plant
- star-shaped flowers with purple petals that curve away from a yellow conical center
- clusters of round berries change color from green to yellow to orange to red as they mature
- all plant parts are toxic

Location

- climbing and twining through small trees and shrubs or up structures such as fences

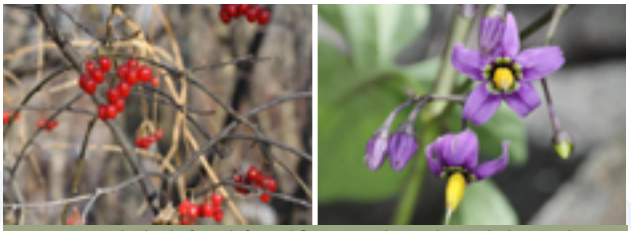
Life Cycle

- perennial; seedlings germinate in early spring
- flowers appear late spring to early fall
- berries are produced late summer until late fall

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation and manually remove underground structures to prevent re-sprouting.
- Spot treat foliage with appropriate post-emergent systemic herbicide when plants are actively growing.

Bittersweet nightshade (Leslie J. Mehrhoff, University of Connecticut, Bugwood.org)



Bittersweet nightshade fruit (left) and flowers (right) (Rob Routledge, Sault College, Bugwood.org)

Left: Bittersweet nightshade leaves (Mary Ellen Harte, Bugwood.org); Right: Bittersweet nightshade growth habit (Steve Dewey, Utah State University, Bugwood.org)

Black Medic

Medicago lupulina

Description

- low, spreading habit; stems grow from 4 inches to 2 feet; looks similar to other clover-like plants
- leaves have three small oval leaflets that are finely toothed on the edge
- yellow flowers in small rounded bunches
- small (1/8 inch) bean-shaped pods replace flowers after pollination

Location

- landscape, lawn and open spaces

Life Cycle

- annual or short-lived perennial
- reproduces via seeds that germinate in spring and fall
- flowers appear April through September

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation.
- In severe infestations, apply an appropriate pre-emergent herbicide prior to seed germination in spring or an appropriate post-emergent herbicide to target weeds in fall.

Black medic (Karan A. Rawlins, University of Georgia, Bugwood.org)

Black medic (Bruce Ackley, The Ohio State University, Bugwood.org)

Black medic habit (Forest and Kim Starr, Starr Environmental, Bugwood.org)

Broadleaf Plantain

Plantago major

Description

- low-growing, densely matted plant with dark green egg-shaped leaves that radiate away from a central point
- large leaves (3 – 7 inches long and 1 – 2 inches wide) with prominent veins and long stalks
- flower stalks are long (4 – 15 inches) and grow upright; the flower/seed head portions of the stalks have a tail-like appearance
- as flower/seed stalks mature, their color turns from greenish yellow to brown

Location

- commonly grows in lawn areas but may also invade adjacent planting beds

Life Cycle

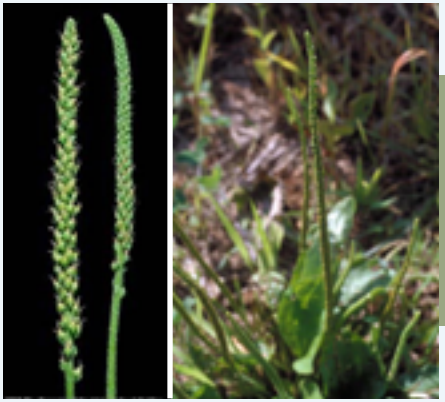
- perennial that spreads by seed; seedlings germinate when soil temperatures reach 50°F and continue through the growing season
- flowers are produced 8 to 15 weeks after germination and plants continue to flower and produce seed from late spring to early fall

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Apply repeat applications of an appropriate broadleaf herbicide (2,4-D is most effective on mature plants) and over-seed areas with exposed soil.
- Spot treat foliage with an appropriate post-emergent herbicide.

Broadleaf plantain growth habit (Lynn Sosnoskie, University of Georgia, Bugwood.org)

Broadleaf plantain growth habit (John Cardina, The Ohio State University, Bugwood.org)



Left: Broadleaf plantain flowers (Joseph M. DiTomaso, University of California - Davis, Bugwood.org); Right: Broadleaf plantain flowering structures (Ohio State Weed Lab, The Ohio State University, Bugwood.org)

Bur Buttercup

Ceratocephala testiculata

Description

- low-growing plant (1/2 inch to 5 inches tall); light green, antler-looking leaves covered with white hairs
- small, bright yellow flowers singly produced on the tips of leafless stalks and grow taller than the leaves
- flowers are succeeded by oval-shaped, spiny burs 1/2 to 3/4 inch long; each bur produces 5 to 80 seeds

Location

- commonly grows in planting beds and lawn areas

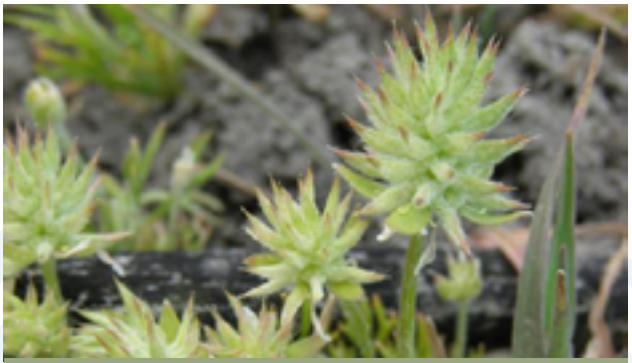
Life Cycle

- summer annual with germination in early spring when temperatures reach 41°F
- flowers are produced within 3 weeks of germination followed by burs
- plant foliage dries, turns brown and becomes brittle by early summer

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation.
- Shallow tillage or hoeing will control young plants in planting beds.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Apply an appropriate post-emergent broadleaf herbicide directly to target weeds.

Bur buttercup growth habit (Bonnie Million, National Park Service, Bugwood.org)



Bur buttercup fruits (Bonnie Million, National Park Service, Bugwood.org)

Left: Bur buttercup lateral habit (USDA Forest Service, Wikimedia Commons); Right: Bur buttercup fruit (Curtis Clark, Wikimedia Commons)

Canada Thistle

Cirsium arvense

Description

- broadleaf weed with spiny oblong leaves and tufted purple flowers
- stems can be up to 1 – 4 feet tall, however it will continue to grow if mowed or cut

Location

- landscape, lawn and open spaces

Life Cycle

- perennial with extensive underground roots
- flowering occurs June through August

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation; use caution when digging out plants since underground roots that are missed can quickly regrow.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- If Canada thistle becomes established, post-emergent herbicides are effective, particularly with several repeat applications.

Canada thistle seedling (Phil Westra, Colorado State University, Bugwood.org)

Canada thistle flowers (Leslie J. Mehrhoff, University of Connecticut, Bugwood.org)

Canada thistle (Leslie J. Mehrhoff, University of Connecticut, Bugwood.org)

Common Chickweed

Stellaria media

Description

- dense, low-growing plant with branched and slender stems that grow 4 – 20 inches long; roots at nodes
- leaves are fleshy and elliptical with pointed tips, oriented opposite one another on stems; up to 1 1/2 inches long
- small white flowers are star-shaped (1/4 inch wide); each flower deeply separated (like rabbit ears) and shorter than sepals; five visible green sepals

Location

- commonly grows in planting beds and occasionally in lawns

Life Cycle

- summer or winter annual with peak germination in fall and early spring
- thrives in temperatures between 53-68°F
- seedlings grow vigorously, flower and set seed within 5 weeks of germination; mature seeds immediately viable

IPM Recommendations

- Effective control must target both aboveground and underground plant structures.
- Hand-pull plants in planting beds prior to seed maturation.
- Shallow tillage or hoeing will control young plants in planting beds; this control method is most effective when underlying soil is dry.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Apply an appropriate pre-emergent herbicide prior to seed germination or an appropriate post-emergent herbicide directly to target weeds.

Common chickweed growth habit (Hugo.arg, Wikimedia Commons)

Left: Common chickweed fruit and seeds (Roger Culos, Wikimedia Commons); Right: Common chickweed flowers (Ryan Kaldari, Wikimedia Commons)

Common chickweed (Rebekah D. Wallace, University of Georgia, Bugwood.org)

Common Groundsel

Senecio vulgaris

Description

- upright growth (6 inches – 1-1/2 feet tall) with fleshy, ribbed stems that are often purplish
- stems are hollow and leaves are arranged alternately along stems; mature leaves are deeply lobed and fleshy
- flowers are long and cylindrical; yellow petals peak out of vase-shaped green sepals like a tube of lipstick
- sepals peel back to reveal a dandelion-like, globe-shaped seed head

Location

- commonly grows in planting beds but can sometimes be found in lawn areas

Life Cycle

- winter annual with seeds that germinate in early to mid-spring and again in autumn
- flower production occurs 5 to 6 weeks after germination and seeds mature 5 to 11 days after flowering; mature seeds are immediately viable

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation.
- Shallow tillage or hoeing will control young plants in planting beds.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Apply an appropriate post-emergent broadleaf herbicide directly to target weeds.

Common groundsel (Robert Videki, Doronicum Kft., Bugwood.org)

Left: Common groundsel seeds (Carol, Wikimedia Commons); Right: Common groundsel leaf (Ohio State Weed Lab, The Ohio State University, Bugwood.org)

Common groundsel seedling (Bruce Ackley, The Ohio State University, Bugwood.org)

Common Lambsquarters

Chenopodium album

Description

- upright, upward-branching plant growing 4 inches to 6 feet tall
- leaf shape varies from coarsely toothed with shallow lobes (lower leaves) to narrow and linear shaped (upper leaves) and range in size from 1/2 inch to 3 inches in length
- inconspicuous small clumps of flowers
- can produce up to 72,000 seeds per plant

Location

- landscape, lawn, cropland and open spaces

Life Cycle

- annual; germinates primarily in late spring
- produces flowers and seed in late summer and fall
- seeds can remain viable for over 20 years

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation.
- Maintain healthy, competitive desirable vegetation.
- Seed populations can be reduced by soil solarization.
- Apply an appropriate pre-emergent herbicide prior to seed germination or an appropriate post-emergent herbicide directly to target weeds.

Common lambsquarters leaves (Robert Videki, Doronicum Kft., Bugwood.org)

Common lambsquarters (Left: Robert Videki, Doronicum Kft., Bugwood.org; Right: The Ohio State University, Bugwood.org)

Left: Common lambsquarters flowers (Mary Ellen Harte, Bugwood.org); Above: Common lambsquarters seedling (Phil Westra, Colorado State University, Bugwood.org)

Common Mallow

Malva neglecta

Description

- low-growing (4 inches – 2 feet high) matted plant with deep branched taproot
- coin-shaped leaves are 1/2 – 1 1/2 inches in diameter, have wavy margins and one deep lobe that extends to thick hairy stem
- flowers are white to pink in color and have five petals and a funnel shape; fruit is shaped like a cheese wheel and houses 10 to 12 seeds

Location

- commonly grows in planting beds and bare patches in lawn areas

Life Cycle

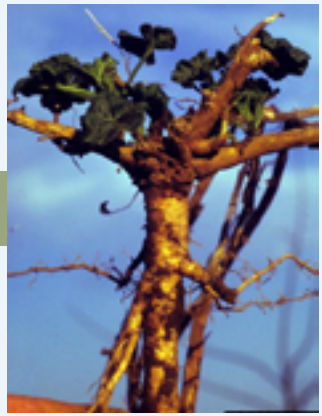
- common mallow can be an annual, biennial or perennial based on growing conditions
- seeds germinate throughout the growing season with adequate moisture (mid-spring to early autumn)
- flowers and fruit are produced from early summer to mid-fall and mature plants may stay green throughout winter

IPM Recommendations

- Effective control must target both aboveground and underground plant structures.
- Hand-pull plants in planting beds prior to seed maturation.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Maintain healthy, competitive desirable vegetation.
- Apply an appropriate post-emergent broadleaf herbicide directly to target weeds.

Common mallow growth habit (Howard F. Schwartz, Colorado State University, Bugwood.org)

Common mallow seedling (left) and common mallow flowers (right) (Ohio State Weed Lab, The Ohio State University, Bugwood.org)



Common mallow taproot (Ohio State Weed Lab, The Ohio State University, Bugwood.org)

Common Purslane

Portulaca oleracea

Description

- low-growing plant with thick succulent leaves and stems; stems radiate out from a central point
- teardrop-shaped leaves are green with reddish margins; stems turn pink to red in color
- bright yellow flowers have five petals

Location

- commonly grows in landscape beds

Life Cycle

- summer annual that germinates in late spring when soil temperatures reach 60°F; seedling germination is rapid after irrigation events
- flowers appear several weeks after germination and seeds are produced within 3 weeks of flowers
- flower and seed production continues throughout the growing season until fall frost

IPM Recommendations

- Effective control must target both aboveground and underground plant structures.
- Hand-pull plants in planting beds prior to seed maturation.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Apply an appropriate pre-emergent herbicide prior to seed germination or apply an appropriate post-emergent herbicide directly to target weeds.

Common purslane growth habit (Lynn Sosnoskie, University of Georgia, Bugwood.org)

Left: Common purslane seedling (Phil Westra, Colorado State University, Bugwood.org); Right: Common purslane flowers (Utah State University, Bugwood.org)

Common purslane growth habit in onions (Howard F. Schwartz, Colorado State University, Bugwood.org)

Common Yarrow

Achillea millefolium

Description

- low-growing plant with soft, feather-shaped leaves and upright flower stalks
- umbrella-shaped flower clusters contain five ray flowers surrounded by 10 to 20 disk flowers
- plants produce rhizomes (underground stems)

Location

- commonly grows in lawn areas but may also invade adjacent planting beds

Life Cycle

- spreading herbaceous perennial with flower production from mid-summer to early fall
- seeds mature by mid-autumn and are immediately able to germinate, particularly if temperatures are between 65-75°F
- flower stalks dry and leaves are dormant in winter months
- rhizomes resume growth in spring

IPM Recommendations

- Effective control must target both aboveground and underground plant structures.
- Frequently hand-pull aboveground structures prior to seed maturation to prevent re-seeding; mechanical removal of aboveground foliage will not kill underground plant parts.
- Manually remove underground structures to prevent re-sprouting.
- Spot treat foliage with appropriate post-emergent systemic herbicide when plants are actively growing. More than one herbicide application may be necessary to kill all spreading structures.

Common yarrow growth habit (Theodore Webster, USDA Agricultural Research Service, Bugwood.org)

Top left: Common yarrow with white flowers (Mary Ellen Harte, Bugwood.org); Above: Common yarrow foliage (Steve Dewey, Utah State University, Bugwood.org); Bottom left: Common yarrow yellow flowers (John Ruter, University of Georgia, Bugwood.org)

Creeping Woodsorrel

Oxalis corniculata

Description

- creeping plant with 4-inch-tall hairy stems (although stems can grow to as long as 20 inches)
- leaves are often purplish and stalks are tipped with three heart-shaped leaflets; leaflets have hairy undersides and fold down on stems at night or when plants are stressed
- stem tips have one to five bright yellow flowers with five petals each
- flowers produce ribbed, lantern-shaped seedpods that are long, green and hairy

Location

- commonly grows in lawn areas and planting beds

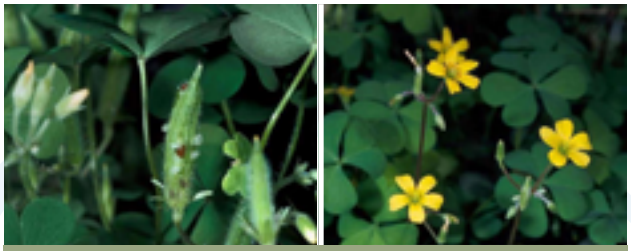
Life Cycle

- perennial; germinates at soil surface when temperatures are between 60-80°F
- seedlings grow vigorously and plants produce flowers and seeds throughout the remainder of the growing season; mature seeds are immediately viable

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation.
- Shallow tillage or hoeing will control young plants in planting beds.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Apply an appropriate pre-emergent herbicide prior to seed germination or apply an appropriate post-emergent herbicide directly to target weeds.

Creeping woodsorrel growth habit (Joseph M. DiTomaso, University of California, Bugwood.org)



Creeping woodsorrel fruit (left) and flowers (right) (Joseph M. DiTomaso, University of California, Bugwood.org)

Creeping woodsorrel seedling (Joseph M. DiTomaso, University of California, Bugwood.org)

Dandelion

Taraxacum officinale

Description

- low-growing plant with deep taproot
- leaves are long (2 – 12 inches) and a quarter as wide and radiate away from a central point; leaf margins are lobed and wavy
- flower stalks are hollow and bear a flower head with bright yellow petals; flowers mature to produce delicate, globe-shaped seed heads comprised of many seeds
- each brown oblong seed is attached to a tuft of white fluff

Location

- commonly grows in lawn areas and planting beds

Life Cycle

- perennial; germination throughout growing season
- flower production begins in mid-spring and continues throughout the growing season, although peak flowering occurs at temperatures between 60-70°F
- seed heads develop within 2 weeks of flowering and seeds are immediately viable
- new plants can grow from sections of taproot as short as 1 inch long

IPM Recommendations

- Effective control must target both aboveground and underground plant structures.
- Hand-pull plants in planting beds prior to seed maturation and manually remove underground structures to prevent re-sprouting.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Apply an appropriate post-emergent herbicide directly to target weeds.

Dandelion growth habit (Howard F. Schwartz, Colorado State University, Bugwood.org)

Dandelion flower (left) and seeds (right) (Chris Evans, University of Illinois, Bugwood.org)

Dandelion leaves (Lynn Sosnoskie, University of Georgia, Bugwood.org)

Downy Brome (Cheatgrass)

Bromus tectorum

Description

- grass with upright growth (up to 2 feet tall) and flat blades that are hairy on both sides; ligules are membranous and ragged
- bristle-like flower/seed heads with soft, feathery appearance
- foliage changes color from green to purple to light brown as plant matures and available moisture declines in summer months

Location

- planting beds and other under-maintained areas including lawn areas

Life Cycle

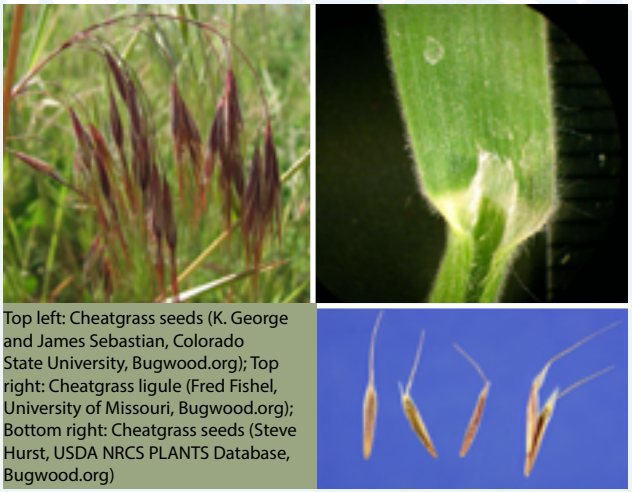
- winter or summer annual; seedlings germinate primarily in autumn (or when sufficient moisture is present) and grow rapidly in spring
- seeds are produced by late spring

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Apply an appropriate post-emergent herbicide directly to target weeds.

Cheatgrass growth habit (Chris Evans, University of Illinois, Bugwood.org)

Cheatgrass growth habit (Tom Heutte, USDA Forest Service, Bugwood.org)



Top left: Cheatgrass seeds (K. George and James Sebastian, Colorado State University, Bugwood.org); Top right: Cheatgrass ligule (Fred Fishel, University of Missouri, Bugwood.org); Bottom right: Cheatgrass seeds (Steve Hurst, USDA NRCS PLANTS Database, Bugwood.org)

Field Bindweed

Convolvulus arvensis

Description

- climbing or creeping vine with long twirling stems that can exceed 3 feet in length
- arrow-shaped leaves alternately arranged on stem; plants also produce extensive network of rhizomes (underground stems)
- white to pink funnel-shaped flowers (1 inch in diameter)

Location

- climbing up or matting on adjacent plants or structures in lawn areas, planting beds or support structures such as fences

Life Cycle

- non-woody perennial vine with seedling germination from early spring to late fall
- peak growth rate occurs when temperatures reach 57°F; aboveground shoots die back to ground in fall
- flowers last for 1 day and produce seed that can remain viable for up to 60 years

IPM Recommendations

- Effective control must target both aboveground and underground plant structures.
- Frequently hand-pull aboveground structures prior to seed maturation to prevent re-seeding; mechanical removal of aboveground foliage will not kill underground plant parts.
- Spot treat foliage with appropriate post-emergent systemic herbicide when plants are actively growing. More than one herbicide application may be necessary to kill all spreading structures.

Field bindweed growth habit (Steve Dewey, Utah State University, Bugwood.org)

Field bindweed growth habit (Howard F. Schwartz, Colorado State University, Bugwood.org)

Left: Field bindweed leaves (Robert Videki, Doronicum Kft., Bugwood.org); Right: Field bindweed flowers (Phil Westra, Colorado State University, Bugwood.org)

Green Foxtail

Setaria viridis

Description

- clump-forming; growth height from 4 inches to 3 feet
- short, fringed ligule; leaf buds rolled lengthwise in a protective sheath
- cylindrical, "foxtail-like" seed head with densely clustered floret
- produces 5,000-12,000 seeds per plant which can remain viable for 6 years
- tolerant of dry conditions

Location

- lawns, gardens, cropland and open spaces

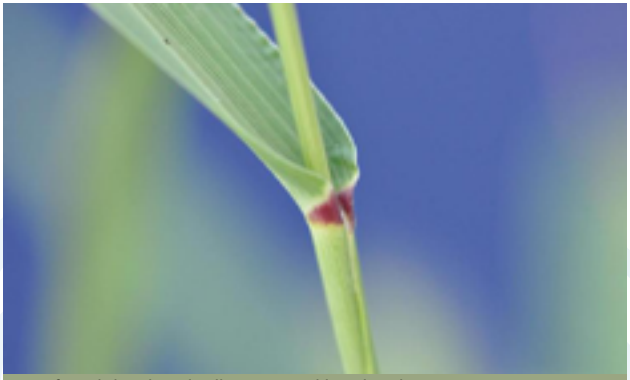
Life Cycle

- annual; germinates in spring or anytime temperatures are above 59°F
- seeds are able to germinate 2 to 4 months after maturing

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation.
- Maintain healthy, competitive desirable vegetation.
- Apply an appropriate pre-emergent herbicide prior to seed germination in early spring and again in mid-summer.
- Selective herbicides containing quinclorac are also effective, but only within 2 to 3 weeks after germination.

Green foxtail (Steve Dewey, Utah State University, Bugwood.org)



Green foxtail sheath and collar (Bruce Ackley, The Ohio State University, Bugwood.org)

Green foxtail (Wendy Vandyk Evens, Bugwood.org)

Henbit

Lamium amplexicaule

Description

- plant grows 4 – 12 inches tall and is sparsely covered in fine hairs
- stems are square, purplish and branch at the base
- leaves are round or heart shaped, arranged in pairs and have rounded teeth margins
- prominent veins are recessed in leaf blades
- flowers are small, dark pink and circle upper leaf axils
- if studied carefully, flowers resemble tiny orchid blooms with a white face and dark red spots

Location

- commonly grows in planting beds and lawn areas

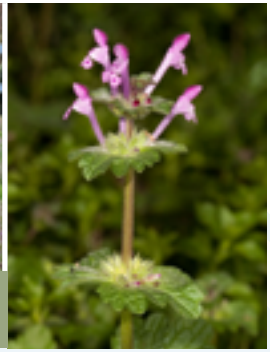
Life Cycle

- a winter annual with seeds that germinate in the fall, although a lesser portion of seeds may also germinate in early spring
- seedlings appear in early spring and flowers are produced by mid-spring to early summer (although some plants may flower in the fall)
- foliage dies in hot summer temperatures

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation.
- Shallow tillage or hoeing will control young plants in planting beds.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Apply an appropriate pre-emergent herbicide prior to seed germination or apply an appropriate post-emergent herbicide directly to target weeds.

Henbit growth habit (Steve Dewey, Utah State University, Bugwood.org)



Above: Henbit (Nancy Loewenstein, Auburn University, Bugwood.org); Right: Henbit flowers (Ryan Kaldari, Wikimedia Commons)

Henbit seedlings (Left: Steve Dewey, Utah State University, Bugwood.org; Right (Ohio State Weed Lab, The Ohio State University, Bugwood.org)

Hoary Cress

Cadaria draba

Description

- plant with upright growth up to 2 feet in height and oblong to lance-shaped leaves
- stems are slightly hairy and leaves are bluish-green in color and are directly attached to stems (no petiole)
- white flowers are small and grow in dense clusters
- seeds are produced inside inflated, heart-shaped pods
- plants produce rhizomes

Location

- commonly grows in planting beds

Life Cycle

- herbaceous perennial with early spring growth
- rosettes and flowers produced by late spring
- seeds mature by mid-summer; plants can flower and produce seed again by late summer
- fall frost will kill the aboveground portion of the plant

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation.
- Effective control must target both aboveground and underground plant structures; manually remove underground structures to prevent re-sprouting.
- Shallow tillage or hoeing will control young plants in planting beds. Do not till established plants; root fragments will produce new plants.
- Apply an appropriate post-emergent herbicide directly to target weeds.

Left: Hoary cress (Mark Schwarzlander, University of Idaho, Bugwood.org); Right: hoary cress foliage (Pedro Tenorio-Lezama, Bugwood.org)

Hoary cress (Steve Dewey, Utah State University, Bugwood.org)

Left: Hoary cress (Joseph DiTomaso, University of California - Davis, Bugwood.org); Right: Hoary cress foliage (K. George Beck and James Sebastian, Colorado State University, Bugwood.org)

Large Crabgrass

Digitaria sanguinalis

Description

- clumping grass with horizontal growth (when mowed) or upward growth up to 2 feet tall (when un-mowed)
- coarse and hairy leaf blades commonly tinged with purple; ligule is very short, jagged and membranous
- flowers and seeds are produced on whorled spikes (2 to 16 spikes per stalk) and are 2 – 6 inches long

Location

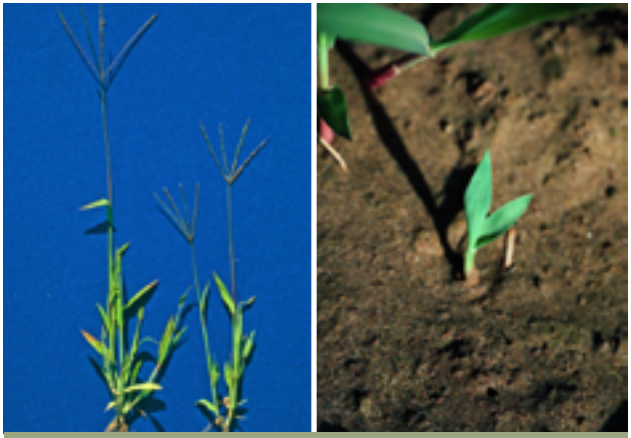
- commonly grows in lawn areas and planting beds

Life Cycle

- summer annual, warm season grass; seedlings germinate when temperatures reach 55°F and continue to germinate throughout the growing season
- flowers and seeds appear from mid-summer to first frost

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Apply an appropriate pre-emergent herbicide prior to seed germination.



Left: Large crabgrass (Steve Dewey, Utah State University, Bugwood.org); Right: Large crabgrass seedling (Charles T. Bryson, USDA Agricultural Research Service, Bugwood.org)

Large crabgrass growth habit (Doug Doohan, The Ohio State University, Bugwood.org)

Large crabgrass growth habit (Rebekah D. Wallace, University of Georgia, Bugwood.org)

Persian Speedwell

Veronica persica

Description

- small, low-spreading annual covered in short hairs
- leaves are rounded with three lobes and toothed margins
- small flowers (1/4 – 1/2 inch) have four petals and are light blue with a white center appearing lightly striped
- fruits are heart shaped and hairy

Location

- gardens, lawns, cropland and open spaces

Life Cycle

- summer or winter annual
- germinates primarily in early spring, but can germinate anytime through fall
- seeds are able to germinate immediately after maturing

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation.
- Maintain healthy, competitive desirable vegetation.
- Apply an appropriate pre-emergent herbicide prior to seed germination or apply an appropriate post-emergent herbicide directly to target weeds.

Persian speedwell growth habit (Joseph M. DiTomaso, University of California - Davis, Bugwood.org)

Persian speedwell leaves (Joseph M. DiTomaso, University of California - Davis, Bugwood.org)

Persian speedwell (Robert Videki, Doronicum Kft., Bugwood.org)

Pineappleweed

Matricaria discoidea

Description

- small (6 – 12 inches high) herbaceous annual with lacey leaves and a pineapple smell when disturbed
- seedlings grow as a rosette, then the plant branches upward into a small bush
- thrives in harsh soil conditions such as compacted soils and high traffic areas, but not shade
- will tolerate mowing

Location

- gardens, lawns, cropland and open spaces

Life Cycle

- summer annual; germinates in early spring and continues to germinate throughout the year
- flowers can be present all year beginning in late spring

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation.
- Maintain healthy, competitive desirable vegetation.
- Pre-emergent herbicides may not be effective since pineappleweed germinates year round.
- Apply an appropriate post-emergent herbicide directly to target weeds.

Pineappleweed growth habit (John D. Byrd, Mississippi State University, Bugwood.org)

Top left and top right: Pineappleweed growth habit (Mary Ellen Harte, Bugwood.org); Bottom left: Pineappleweed (Bonnie Million, National Park Service, Bugwood.org)

Prickly Lettuce

Lactuca serriola

Description

- tall (1 – 5 feet); thick stem; branches occur toward top of plant when flowering
- mature leaves have a wavy appearance with deep lobes attached tightly to the stem
- the underside of the leaf midrib and stem have prickly hairs, giving the plant a "sticky" feel
- when broken, the plant exudes a milky substance
- light yellow flowers give rise to seed clusters with white fluffy plumes that help the seeds float to a new location

Location

- gardens, cropland and open spaces

Life Cycle

- biennial or winter annual; reproduces only by seed
- most seedlings germinate in the fall in a rosette form with a long taproot that overwinters
- some seedlings emerge in spring
- stem development and flowering happens mid-summer to late fall, then the plant dies

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation.
- Maintain healthy, competitive desirable vegetation.
- Apply an appropriate post-emergent herbicide directly to target weeds.

Prickly lettuce growth habit (Left: John M. Randall, The Nature Conservancy, Bugwood.org; Right: Tom Heutte, USDA Forest Service, Bugwood.org)

Prickly lettuce flowers (Ohio State Weed Lab, The Ohio State University, Bugwood.org)

Left: Prickly lettuce growth habit (Ohio State Weed Lab, The Ohio State University, Bugwood.org); Right: Prickly lettuce leaf with spines (Steve Dewey, Utah State University, Bugwood.org)

Prostrate Knotweed

Polygonum aviculare

Description

- low-growing plant with wiry stems that radiate out from a central point and grow up to 2 feet in length
- small leaves join the stems at enlarged "joints" that are covered in a papery sheath
- tiny white or pink flowers have five petals and green centers

Location

- commonly grows in planting beds but can sometimes be found in lawn areas

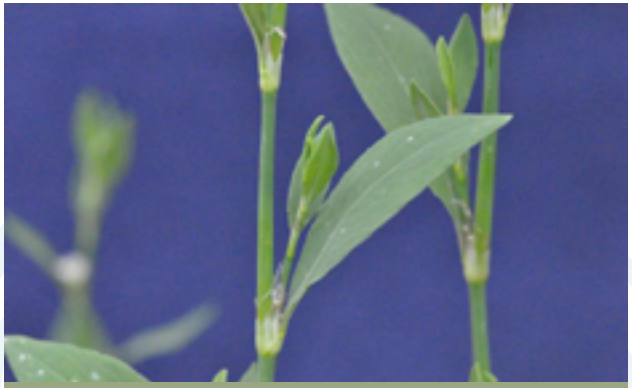
Life Cycle

- summer annual with seedling germination in early spring; seedling growth is slow
- flowers and seeds are produced mid-spring to fall frost

IPM Recommendations

- Hand-pull plants prior to seed maturation.
- Prostrate knotweed thrives in compacted soil; avoid or reduce soil compaction by aeration or preventative methods.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Apply an appropriate pre-emergent herbicide prior to seed germination or post-emergent herbicide to young seedlings (less than 3 inches wide).

Prostrate knotweed (Robert Videki, Doronicum Kft., Bugwood.org)



Prostrate knotweed (Bruce Ackley, The Ohio State University, Bugwood.org)

Prostrate knotweed flower (Bruce Ackley, The Ohio State University, Bugwood.org)

Puncturevine

Tribulus terrestris

Description

- low-growing matted plant with tan-colored stems that radiate out from a central point
- leaves are opposite and compound, with four to eight pairs of oval-shaped leaflets
- bright yellow flowers have five teardrop-shaped petals; flowers are up to 1/2 inch in diameter
- spiny seedpods change color from green to brown as they mature

Location

- commonly grows in planting beds

Life Cycle

- summer annual that germinates late spring to early summer and produces flowers within 3 to 4 weeks followed by seedpods 2 weeks after flowers
- flowers only open in the morning
- puncturevine continues to produce flowers and seeds until fall frost; seeds remain dormant at least 1 year

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation; rake or sweep up any dropped burrs (seedpods).
- Puncturevine thrives in compacted soil; avoid or reduce soil compaction by aeration or preventative methods.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Apply an appropriate pre-emergent herbicide prior to seed germination or apply an appropriate post-emergent herbicide directly to target seedlings in planting beds.

Puncturevine seedling (Phil Westra, Colorado State University, Bugwood.org)

Puncturevine (Howard F. Schwartz, Colorado State University, Bugwood.org)

Puncturevine seedpods (Forest and Kim Starr, Starr Environmental, Bugwood.org)

Purple Deadnettle

Lamium purpureum

Description

- produces square-shaped stems that grow 4 – 16 inches tall; stems are branched at the base and purplish in color
- leaves are hairy, arrow shaped and oppositely arranged on stems; leaves have prominent veins that are recessed on blades; leaf margins are toothed
- leaves are clustered around stem tips and the uppermost leaves are smaller and reddish purple in color
- flowers are small, purple and circle upper leaf axils; flowers resemble tiny orchid blooms with a white face and purple spots

Location

- commonly grows in planting beds and lawn areas

Life Cycle

- winter annual with seeds that germinate in the fall; a lesser portion of seeds may germinate in the spring; seeds do not germinate during hot summer temperatures
- purple deadnettle plants complete their life cycle before hot temperatures set in and seeds can germinate immediately as long as temperatures are not too high

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation.
- Apply an appropriate pre-emergent herbicide prior to seed germination or apply an appropriate post-emergent herbicide directly to target weeds.

Purple deadnettle growth habit (Left: Robert Videki, Doronicum Kft., Bugwood.org; Right: Charles T. Bryson, USDA Agricultural Research Station, Bugwood.org)

Purple deadnettle foliage and flowers (Left: Ansel Oommen, Bugwood.org; Right: Chris Evans, University of Illinois, Bugwood.org)

Purple deadnettle seedlings (Bruce Ackley, The Ohio State University, Bugwood.org)

Quackgrass

Elymus repens

Description

- spreading habit; up to 1 – 3 feet tall if uncut
- thick, rolled leaves; blue green in color; clasping auricle similar to annual ryegrass
- spreading underground rhizomes
- appears to have a thicker blade growing slightly faster than common Kentucky bluegrass
- may be more prevalent in low-fertility and/or heavy clay or compacted soils

Location

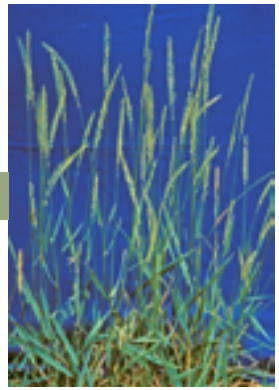
- landscape, lawn and open spaces

Life Cycle

- aggressive perennial reproducing by seed or spreading by thin underground rhizomes

IPM Recommendations

- Effective control must target both aboveground and underground plant structures.
- Hand-pull plants in planting beds prior to seed maturation.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Cultivation/tillage is not a good option since rhizomes will continue to grow after being cut.
- If quackgrass is aggressively competing with desirable plants, apply an appropriate post-emergent systemic herbicide when plants are actively growing.



Quackgrass, Steve Dewey, Utah State University, Bugwood.org)

Clasping auricle and rolled leaf on quackgrass (The Ohio State University, Bugwood.org)

Quackgrass rhizomes (Steve Dewey, Utah State University, Bugwood.org)

Redroot Pigweed

Amaranthus retroflexus

Description

- upright plant 1 – 6 feet tall with thick stems and a taproot
- lower stems are often reddish or red striped
- leaves are oval with a tapering point, occasionally tinted red
- densely clustered flowers appear on a spike at the tip of branches
- flowers are green with a pinkish tint

Location

- gardens, cropland and open spaces

Life Cycle

- summer annual; germinates primarily in summer, and anytime when soil moisture is sufficient
- plants produce tens of thousands of seeds that stay viable up to 10 years or more

IPM Recommendations

- Seed populations can be reduced by soil solarization.
- Competition for light from taller desired vegetation can help control weedy patches.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Pre-emergent herbicides are not always effective since germination can take place year-round.
- Apply an appropriate post-emergent herbicide directly to target weeds.

Redroot pigweed (Howard F. Schwartz, Colorado State University, Bugwood.org)

Redroot pigweed foliage (Mary Ellen Harte, Bugwood.org)

Redroot pigweed flowers (Joseph M. DiTomaso, University of California - Davis, Bugwood.org)

Redstem Filaree

Erodium cicutarium

Description

- low-growing, densely matted plant with fern-like leaves that grow in a rosette form
- leaves have reddish stems and are covered in fine hairs
- flower stalks support two to twelve vibrant pink/purple flowers with five petals and a long, beak-like fruit
- other common names for redstem filaree include cranesbill, heronsbill and storksbill due to the resemblance of the flower and fruit to a bird's head

Location

- commonly grows in planting beds and lawn areas

Life Cycle

- winter annual or biennial that germinates in moist soil at temperatures between 40-70°F (spring to fall)
- seedlings that germinate late in the year remain dormant as a rosette during winter months
- growth resumes in early spring, and plants flower from mid-spring to mid-summer

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation.
- Shallow tillage or hoeing will control young plants in planting beds.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Competition for light from taller desired vegetation can help control weedy patches.
- Apply an appropriate pre-emergent herbicide prior to seed germination or apply an appropriate post-emergent herbicide directly to target weeds.

Redstem filaree growth habit (Joseph M. DiTomaso, University of California - Davis, Bugwood.org)

Left: Redstem filaree foliage (Bonnie Million, National Park Service, Bugwood.org); Right: Redstem filaree growth habit (Forest and Kim Starr, Starr Environmental, Bugwood.org)

Left: Redstem filaree flowers and fruiting stems (Joseph Berger, Bugwood.org); Above: Redstem filaree flowers (Joseph M. DiTomaso, University of California - Davis, Bugwood.org)

Shepherd's-Purse

Capsella bursa-pastoris

Description

- small herbaceous plant with erect stems 1 – 20 inches tall
- most of the leaves are arranged in a rosette at the base of the plant
- small white flowers with four petals grow at the tips of branches
- after the flowers fade, stalks elongate, producing a flat purse-shaped seedpod

Location

- gardens, lawns, cropland and open spaces

Life Cycle

- summer or winter annual
- germination takes place primarily in spring and fall, but can take place throughout the year
- flowering and seed production can take place anytime April through September

IPM Recommendations

- Seed populations can be reduced by soil solarization.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Maintain healthy, competitive desirable vegetation.
- Cultivation is important in the fall to remove overwintering rosettes that would produce seed the following spring.
- Pre-emergent herbicides are not always effective since germination can take place year round.
- Apply an appropriate post-emergent herbicide directly to target weeds.

Shepherd's-purse (Mary Ellen Harte, Bugwood.org)

Shepherd's-purse seedlings (Steve Dewey, Utah State University, Bugwood.org)

Shepherd's-purse seedpods (Steve Dewey, Utah State University, Bugwood.org)

Siberian Elm

Ulmus pumila

Description

- tree (up to 70 feet) with elliptical-shaped green leaves; leaves are arranged alternately on stems
- leaves have serrated margins and pointed tips; leaf veins have a distinctive fishbone pattern
- flowers are green, form in clusters (6 to 15) and are 3/16 inch long
- seeds are housed in flat, coin-shaped fruit equipped with a papery wing that turns from green to straw color as it matures

Location

- commonly grows in planting beds and in and amongst other trees, shrubs, perennials and along fences

Life Cycle

- long-living perennial (deciduous tree) that flowers from early to mid-spring
- flowers are produced before leaves expand; seed production immediately follows leaf emergence
- seeds ripen by late spring and can germinate immediately; leaves turn yellow in fall

IPM Recommendations

- Hand-pull elm seedlings in planting beds prior to seed maturation and manually remove underground structures to prevent re-sprouting.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- For control of small plants, spot treat with appropriate post-emergent systemic herbicide. For control of larger plants, cut stem or trunk and immediately paint the outside circumference (just inside bark) with concentrated systemic post-emergent herbicide.
- Fall (close to fall color and leaf drop) is an effective time for chemical control.

Siberian elm seedlings (left) and mature Siberian elm (right) (John M. Randall, The Nature Conservancy, Bugwood.org)

Siberian elm leaves (Steve Dewey, Utah State University, Bugwood.org)

Siberian elm seeds wrapped in fruit (USDA NRCS PLANTS Database, Bugwood.org)

Spotted Spurge

Chamaesyce maculata

Description

- low-growing densely matted plant (up to 2 feet in diameter) with bright green opposite leaves
- small elliptical-shaped leaves have an irregular-shaped purple spot in the center of each blade
- several pink stems radiate from a center point and, when snapped in two, the stems exude a thick milky substance
- plants grow a somewhat shallow underground taproot

Location

- commonly grows in planting beds but can occasionally be found growing in lawn areas

Life Cycle

- warm season annual with seedling germination between the temperatures of 60-100°F (early summer until early fall); peak germination occurs mid to late summer
- rapid growth in warm temperatures with two to three generations per growing season
- seeds mature within 5 weeks of germination and seed production continues until fall frost

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation and manually remove underground structures to prevent re-sprouting.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Apply an appropriate pre-emergent herbicide prior to seed germination or apply an appropriate post-emergent herbicide directly to target weeds as they are actively growing.

Spotted spurge (USGS Bee Survey Inventory and Monitoring Lab, Flickr.com)

Spotted spurge (F.D. Richards, Flickr.com)

Spotted spurge (Forest and Kim Starr, Wikimedia Commons)

Star of Bethlehem

Ornithogalum umbellatum

Description

- plant with long, slender, smooth, fleshy, hollow, dark green leaves; leaves resemble chives
- produces white bulbs buried deep in the soil profile
- flower stalks are 6 – 9 inches tall, leafless and smooth
- delicate white flowers are star shaped with six petals and yellow/green centers; blooms measure 1 inch in diameter; petals are oval shaped with pointed tips; petal undersides have a wide green stripe running down the middle

Location

- commonly grows in lawn areas and planting beds

Life Cycle

- a bulb-forming perennial; leaves emerge by mid-spring
- flowers produced by late spring; blooms last about 2 weeks; flowers open on sunny mornings and close by sunset
- after seedset, foliage dies back to the bulb by mid-summer

IPM Recommendations

- Carefully dig out and remove bulbs and bulblets from planting beds.
- Apply an appropriate post-emergent herbicide directly to target weeds.
- Apply herbicide to foliage in early spring when temperatures are at least 50°F and again in the fall for at least 2 consecutive years.

Left: Star of Bethlehem growth habit (Richard Gardner, UMES, Bugwood.org); Above: Unopened flowers (Leslie J. Mehrhoff, University of Connecticut, Bugwood.org)

Star of Bethlehem flowers (top), seedlings (bottom left) and bulbs (bottom right) (Leslie J. Mehrhoff, University of Connecticut, Bugwood.org)

Western Salsify

Tragopogon dubius

Description

- plant with upright growth and long slender leaves that grow 2 – 12 inches long and 1/4 inch wide
- flower stalks are hollow and grow 1 – 3 feet high
- a yellow, starburst-shaped flower head forms at the tip of each stem; green sepals extend beyond ray flowers and stems are enlarged directly below flower heads
- flower heads mature to large white, globe-shaped fluffy seed heads
- each brown seed is carried in the wind by a parachute of white fluff

Location

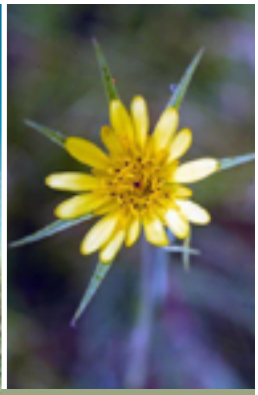
- commonly grows in planting beds

Life Cycle

- biennial that produces grass-like rosette the first year and stalks and flower heads the second year
- foliage dies back to the ground with fall frost
- flower production occurs mid-spring through early fall; blooms are open during sunny mornings and close by afternoon

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation.
- Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.
- Apply an appropriate post-emergent herbicide directly to target weeds.



Left: Western salsify growth habit (Dave Powell, USDA, Forest Service, Bugwood.org); Above: Western salsify flower (Ohio State Weed Lab, Ohio State University, Bugwood.org)

Above: Western salsify growth habit (Howard F. Schwartz, Colorado State University, Bugwood.org); Left: Western salsify flower seeds (Karan A. Rawlins, University of Georgia, Bugwood.org)

White Clover

Trifolium repens

Description

- dense creeping plant with 3 – 14-inch-long stems; stalks tipped with three round leaflets marked with white V-shape on the upper leaflet surface
- flowers are 3/4 inch wide, white to pink in color and sphere-shaped
- as flowers dry out, 1/4 inch long seedpod covered in a brown husk of spent petals are formed

Location

- commonly grows in lawn areas

Life Cycle

- cool season perennial that germinates in the spring when temperatures reach 50°F; peak growth rate occurs between temperatures of 64-86°F
- flower production occurs by mid-spring and continues through the rest of the growing season
- as seeds ripen, flowers brown and droop downward and drop seeds 3 to 4 weeks after flower production

IPM Recommendations

- Hand-pull plants in planting beds prior to seed maturation.
- Adjust fertilization program to include more nitrogen and less phosphorus when a soil test indicates low nitrogen and high phosphorus levels.
- Apply an appropriate post-emergent herbicide directly to target weeds in planting beds; 2,4-D is not effective for control since it will only injure clover plants.

Left: White clover leaflet (Bruce Ackley, The Ohio State University, Bugwood.org); Right: White clover flower (David Cappaert, Bugwood.org)

White clover seeds (Bruce Ackley, The Ohio State University, Bugwood.org)

White clover growth habit (Chris Evans, University of Illinois, Bugwood.org)

GLOSSARY

Abdomen: the last of three body segments of an insect (rear); the other two body divisions are the head (first segment) and thorax (middle segment).

Annual: a plant with a life cycle completed in one year or less (seed to seed).

Auricle: an appendage that projects on either side of the collar on many grasses.

Biennial: a plant that lives longer than one season but fewer than two years.

Cambium: plant tissue from which the phloem and xylem are produced.

Clutch: a group of eggs that are laid by an insect at the same time.

Collar: a thin band of growth tissue located where the grass blade meets the sheath.

Cover Spray: a protective pesticide application applied to the leaves.

Frass: debris or excrement produced by insects.

Fruiting Bodies: fungal structures that contain spores for reproduction.

Galleries: impressions or tunnels produced by larval insect feeding under the bark, and visible on or within the xylem; galleries may be diagnostic of the pest involved (e.g., bark beetles).

Girdling: occurs when the phloem layer is severed around the whole circumference of the plant; girdling leads to plant death.

GLOSSARY

Heartwood: the older, nonliving inner layer of the xylem.

Instar: the growth stage between two immature insect molts.

Larva: the immature stage of insect that undergoes complete metamorphosis; the larval stage follows the egg stage and precedes the pupal stage.

Leaf Sheath: lower part of the grass leaf that wraps around the stem covering the internode.

Ligule: membranous or hairy projection at the point where the grass leaf blade grows out of the leaf sheath.

Mycelium: the vegetative part of a fungus made up of a network of threadlike filaments (hyphae).

Nymph: the immature stage of an insect that undergoes incomplete metamorphosis. The nymphs stages occur between the egg and adult stage.

Overwinter: the life stage in which an insect, disease, weed, etc., survives during the winter.

Ovipositor: a specialized tube-shaped organ in female insects used to lay eggs.

Paper Test: a pest monitoring method that can be used to determine the presence of mites or other small arthropods on plants. To conduct the test, hold a white sheet of paper under affected branches and shake vigorously. Tiny specks moving around on the paper indicate the presence of mites.

Perennial: a plant that lives longer than two growing seasons and renews growth year to year from the same root system.

Pheromone: chemical released by insects for communication, often for mating; pheromone lures and traps that contain pheromones can be used to monitor specific insects.

Glossary

GLOSSARY

Phloem: plant tissue in vascular plants that transports food downward from the leaves and throughout the plant; phloem is a thin, soft layer just beneath the bark.

Pupa: stage of insect development between the larva and adult in insects with complete metamorphosis.

Pupate: for insects with complete metamorphosis, this is the process in which an insect larva develops into the pupa stage eventually transforming into an adult.

Rhizome: underground, horizontally growing stem that produces new plants.

Sapwood: the living outer layer of the xylem; sapwood transports water from the roots throughout the plant.

Sessile: fixed in one place; immobile.

Stippling: insect feeding damage to foliage that gives leaves a yellow or brown speckled appearance.

Stolon: aboveground, horizontally growing stem that produces new plants.

Systemic Insecticide: insecticide that is translocated within a plant via root uptake, injection, or absorption through the bark or leaves.

Xylem: plant tissue in vascular plants that transports water upward from the roots and provides structural support for the plant; comprised of the sapwood and heartwood.

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For help with your pest-diagnostic needs, please contact the Utah Plant Pest Diagnostic Lab at 435-797-2435 or utahpestlab@gmail.com.

EXTENSION

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