EXTENSION
College of Agriculture,
Biotechnology & Natural Resources

Special Publication 06-08

Identification of Common Landscape Pests and Beneficial Organisms in Nevada

Cover Photographs

Jeff Knight, State Entomologist,
Nevada Department of Agriculture

Center Right - Leaf-footed Assassin Bug
Lower Right Corner - Jerusalem Cricket **ALERT!**
Lower Left Corner - Mormon Crickets
Center Left - Praying Mantis
Upper Left Corner - Green Lacewing Larva

Red = pests, Blue = beneficial organisms, and Black = a species that may be neither a pest nor a benificial organism or may be one or the other depending upon the plants and site conditions involved. **ALERT!** = a reportable organism for quarantine or research purposes.

Identification of Common Landscape Pests and Beneficial Organisms in Nevada

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Contents Page

Introduction

Integrated pest management (IPM) starts with proper identification and the understanding of what is and is not a pest. This pocket-guide was produced to help people realize not all insects are pests (greater than 95% are not), and that beneficials are available naturally or can be introduced into the landscape to manage pest species. Even non-insects, spiders and scorpions, are great predators of common garden pests. It is hoped that the guide will help reduce the use and dependency on pesticides and the use of poisons in landscapes where people work and play. It is designed to assist homeowners and landscape professionals in the initial identification and familiarization of common pests and beneficial organisms.

Several organisms herein are designated with highlighted "**ALERT!**" on a yellow background. They are not presently found in Nevada or are under scientific study. If found, these should be reported to the State Entomologist, see page 3. They are an economically or ecologically important threat and are 1) quarantined by another state or are 2) quarantined by Nevada. As such, they should be prevented from entering the state and if discovered, reported. This protects producers, homeowners, and the environment from loss.

This guide describes the organisms, indicates if they are a pest or beneficial, and if they are under "alert" status. It also gives their associated signs and symptoms, and suggests general management for each. Common outdoor pests and beneficials of Nevada or commerce are discussed, but not indoor or structural pests such as termites, most ants, and cockroaches. Moths and butterflies, which are excellent pollinators of flowers, are not discussed, unless their larvae are pests. Common beneficial arthropods (insects and spiders) are mentioned herein so that they will not be thought a pest and killed. Many beneficial organisms are not described. These include *Bacillus thuringiensis* (Bt), viruses, fungi, birds, predator snails, nematodes, etc., all of which can play an

important role in integrated pest management. For more information, read "Natural Enemies Handbook, the Illustrated Guide to Biological Control," UC Press, Berkeley, Pub 3386.

Three indices are included, an alphabetical index of common names (page 6), an "alert" index of organisms that should be reported to authorities for specific action to be taken (page 9), and an index describing benefical organisms (page 10), pests and their damage to plants (page 11), and organisms that may be either (page 10). In the third index, the pest is categorized by the damage to the plant it produces or the location on the plant where it is found, e.g., leaves, buds, trunk, roots, and whether the plant part is dehydrated, distorted, chewed, or bored into with holes. Familiarize yourself with these heading descriptions. Organisms are listed by their generic classifications e.g., San Jose Scale is found as Scale, San Jose.

To ensure a positive identification, samples of organisms should be taken or sent to a local University of Nevada Cooperative Extension (UNCE) office (see page 120) or to Jeff Knight, State Entomologist, at the Nevada Department of Agriculture (NDOA, see page 3), before control measures are initiated—they may not be necessary! As well, it is important that authorities document where pests are occurring in the state and if a new potential pest is entering the state. They may have to establish a quarantine to prevent a pest's spread and an eradication program to eliminate those present.

Seasonal scouting of landscapes can establish treatment thresholds for pests on each property. Thresholds, the point at which action should be taken to avoid unacceptable damage by pests, should be understood before control is started. The economic threshold, used mostly in agriculture, is the level of the pest population at which the associated cost of the treatment is equal in value to the expected increase in crop yield. This is seldom used in landscapes where an aesthetic threshold, the appearance of the property or a plant, reflects the economic

tolerance of the property owner to pest damage. The cost of the control is often secondary to keeping the landscape pest-free and beautiful. This threshold varies with each person and their available resources. There is also an emotional threshold that may be important where money is not a factor. For example, people fearful of pests never want to see one or they want to protect their favorite plant, maybe at all costs.

Once it is determined that management methods should be implemented, there are many choices among cultural, physical, mechanical, chemical, and biological controls. Cultural control involves adjustments of normal plant care activities, such as water management, crop rotation, and the amount of fertilizer applied. Physical controls are used to indirectly influence the environment by changing temperature, light, and humidity to curtail or prevent pest activity. Mechanical methods include labor, machinery, and materials other than pesticides that are used to exclude, reduce, or kill pests directly. Pesticides may be applied for control, but must be chosen and used carefully. The use of beneficial organisms to control pests is biological control, and may be successful in controlling insects and mites.

The Animal and Plant Health Inspection Service (USDA-APHIS) maintains a list of beneficial biological control agents. The introduction of biological control agents into the state is monitored. Distributors, nurseries, farm, and internet suppliers must work carefully with state and federal agencies when supplying biological control agents. The purchase or distribution of biological control agents into Nevada must be cleared with Jeff Knight, State Entomologist, Nevada Department of Agriculture, 350 Capitol Hill Avenue, Reno, NV, 89502, (775) 688-1182, extension 245, or jknight@agri.state.nv.us. "Alert" pests should also be reported to the State Entomologist when found.

Careful handling, release, and management ensures beneficial organisms become established and are effective

in their new environment. Remember, biological control organisms are live animals and need to receive gentle care at all times.

Purchase: A permit, USDA-APHIS-PPQ Form 526, is required to move biological control agents into the state. The supplier should provide this service. For additional assistance and regulatory information, contact Jeff Knight, State Entomologist, NDOA (see page 3).

Collection: Make sure you correctly identify the biological control agent you are collecting. Contact UNCE, NDOA, or USDA-APHIS for assistance. Always get written permission if you are collecting on private or protected land.

Transportation: Quick transport and care upon receipt is essential. Some predators may require specific control of temperature, relative humidity, and light during transport and handling. Not all insects travel well, a limited time in captivity is best. Properly pack organisms to ensure survival, especially if shipping long distances by commercial carriers. As a minimum, a sturdy, breathable, escape-proof container, a damp cotton ball or sponge, and material to walk on (plant material or tissue paper) should be provided. Temperature control is extremely important during transport and after receipt. Cool, dark conditions are best during most insect life cycles.

Depending upon the insect and the stage of its life cycle when it is collected, extended periods of complete dark, or even in some cases only short periods of light each day, will initiate diapause. Diapause is a period of arrested development (enforced dormancy) between periods of normal activity. An insect forced into diapause would not be active upon release and may or may not survive its new environment.

Release: Species should be selected based on their ability to survive and reproduce in the release environment. Quick release upon receipt will aid success. Make sure current environmental conditions protect the release organism from stresses including temperature extremes,

drought, traffic, grazing, fertilizer or chemical sprays, and other predators. Only release beneficials when food sources and foliage for protection are available. Avoid dry, hot, rainy or cold, windy conditions.

Biological control can be successfully used in greenhouses, but it may need to be done over many crop cycles. A crop cannot be removed from the greenhouse all at once, doing so may remove the beneficial's food source or all of the beneficial organisms themselves.

Distribution: Once established, redistribute a few organisms to several new locations to prevent the colony from being destroyed all at once if something happens to the original area of release.

Improvements may not be noticeable the first season after release. Populations of beneficial organisms must build before becoming effective. Additional help is available from personnel and resource guides at UNCE, NDOA, and federal agencies. Use these to assist you in developing your management plan to successfully include biological control agents.

Act wisely!
Protect predators of pests, pollinators, our environment, and ourselves from the misuse of pesticides. Identify the organism first and then, if it is a pest of importance, choose the least toxic way to manage it.

Alphabetical Index[1]

1. Pests are in red, beneficials are in blue, and species that can be both are in black. Report organisms designated ALERT! to the State Entomologist, see page 3.

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ALERT! Organism Index[1] Page

With the exception of Jerusalem cricket, these insects have not been reported in Nevada. Scientists are studying the population dynamics of Jerusalem cricket and ask that when found, it be captured and sent live to the State Entomologist (see page 3). The rest of these organisms pose a great economic or environmental threat to crops, fruits, ornamentals, lawn grasses, and native plants. If any of these are found in Nevada, collect a sample and send it to the State Entomologist (see page 3). These pests may be subject to quarantine and certainly should be eradicated to protect crops, landscape plants, livelihoods, commerce, and Nevada's native plants.

ALERT! Organisms:

1. Pests are in red, beneficials are in blue, and species that can be both are in black. Report organisms designated ALERT! to the State Entomologist, see page 3..

Organism Benefit/Damage Index[1] Page

This index is organized by the benefit or damage caused by organisms. Beneficial organisms, predators of pests, are listed first. Species that can be either beneficial or a pest are listed next. Pests are listed last and are categorized by the damage they cause to plants and where on the plant they feed or are found—on seedlings, fruits, flowers, buds, twigs, trunks or roots.

Beneficials:

Organisms that May Be Either a Beneficial or a Pest:

1. Pests are in red, beneficials are in blue, and species that can be both are in black. Report organisms designated **ALERT!** to the State Entomologist, see page 3.

Organism Benefit/Damage Index[1] Page

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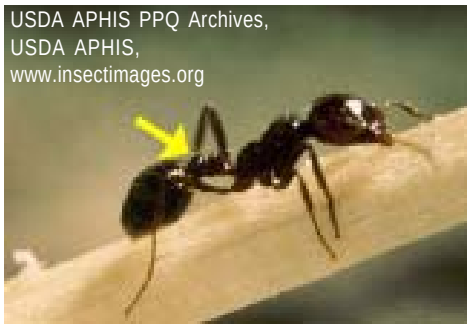
Red Imported Fire Ant (RIFA) ALERT!


USDA APHIS PPQ Archives,
USDA APHIS,
www.insectimages.org

Description: Worker ants are 1/16 to 3/16 inch long and dark reddish brown. Queen ants are about 3/8 inch long and lose their wings after mating. RIFA's pedicel (waist) consists of two segments (pictured) and their mandible has four distinct teeth. Their antennae are ten-segmented, ending in a two-segmented club. They have a stinger at the tip of their abdomen.

Damage: Mounds no larger than 18 inches in diameter are built of soil. When a mound is disturbed, the fire ants emerge aggressively. Sterile females can sting repeatedly, holding onto the skin with their jaws and injecting venom. Red imported fire ants can damage crops by feeding on seeds, seedlings, and developing fruit.

Asian Longhorned Beetle ALERT!


Linda Haugen,
USDA Forest Service,
www.insectimages.org

Description: This large beetle is 3/4 to 1 1/4 inches long and shiny black with irregular white spots. Their antennae are black and white striped and longer than their body—nearly twice as long for the male.


Dennis Haugen,
USDA Forest Service,
www.insectimages.org

Damage: Asian Longhorned beetles feed on many species of hardwood trees, eating the water and food conducting tissues, which can kill the tree over a couple of seasons.

ALERT! Citrus Longhorned Beetle

Description: This shiny black beetles is 1 to 1½ inches long with 10 to 12 irregular white blotches on its wing covers. Antennae are white or blue and black banded, slightly longer than their body for females, but twice as long for males.


Washington State Department of Agriculture Archives, www.insectimages.org


Washington State Department of Agriculture Archives, www.insectimages.org

Damage: Adults emerge from trunks in late summer to mate. Females lay over 200 eggs on the bark of over 40 species of hardwoods. They hatch, the larvae bore into the trunk, feed—removing water and nutrient conducting tissue, killing the tree.

ALERT! Japanese Beetle

Description: Less than ½ inch long, this beetle has shiny brown wing covers over a metalic green body. Tufts of white hairs rim each side of its body sticking out from under the wings. Small, white grubs have a brown head and a dark tail end.


Clemson University-USDA Cooperative Extension Slide Series, www.insectimages.org


Clemson University-USDA Cooperative Extension Slide Series, www.insectimages.org

Damage: Adults chew flowers, leaves, and fruits of hundreds of ornamental and fruit-producing plants. Their larvae feed on roots of most plants, seriously damaging many, e.g., lawns, pastures, flower beds, etc.

Emerald Ash Borer **ALERT!**

Description: Adults have metallic, iridescent green wing covers and a coppery red or purple abdomen. They are 3/8 to 5/8 inch long and appear May through early September, mostly in mid-summer.

Damage: Larvae feed beneath the bark of ash trees, making serpentine galleries that interfere with water and nutrient movement. This kills leaves first, then whole limbs, and finally the tree.

Apple Curculio **ALERT!**

Description: Adults are 1/5 inch long. They have a reddish brown snout and four humps on their backs. Their long, slender snouts are almost the length of their bodies. Nymphs are similar, but smaller and without wings.

Damage: Apple, pear, peach, sometimes cherry, and plum fruit are deformed becoming small and knotty. Adults eat small holes, close together in apples, causing the surrounding tissue to turn hard. Heavy feeding disfigures the entire surface of the apple making it unattractive and unpalatable. Eggs are laid in the small holes and sealed with excrement that turns black.

ALERT! Plum Curculio

Description: Adults are small snout beetles spotted with black, gray, and brown. They have four humps on their wing covers and a long, curved snout.


Clemson University-USDA Cooperative Extension Slide Series, www.insectimages.org


Clemson University-USDA Cooperative Extension Slide Series, www.insectimages.org

Damage: Eggs are laid in cavities of the crescent-shaped, feeding scars they make in the fruit. Their feeding also produces knobby, gnarled, and scarred fruit that may drop prematurely.

ALERT! Jerusalem Cricket

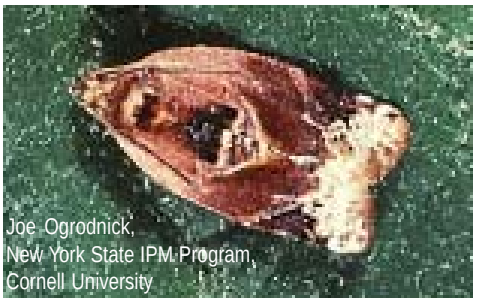
Description: Jerusalem crickets can reach 2 inches in length and have a large, distinctive, bald head. The head, thorax, and legs are generally amber yellow, but the head may be rust to brown to tan in color. Its large eyes are far apart, just beneath its long antennae. Males are larger than females, who have a smaller head and thorax, but a larger abdomen.

Benefit/Damage: Jerusalem crickets are not poisonous and will not bite unless provoked. They do chew roots, tubers, vegetables, and fruits. They also feed on insects and meat, and may help in reducing other soil-borne pests in gardens.


Wayne S Johnson, University of Nevada, Reno

Redbanded Leafroller ALERT!

Description: Adult moths are reddish brown with silver-gray and orange bands. They have a reddish brown band across the forewings. Larvae are small, 1/2 to 3/4 inch long, unmarked, greenish caterpillars.


Joe Ogrodnick,
New York State IPM Program,
Cornell University


Clemson University-USDA
Cooperative Extension Slide Series,
www.insectimages.org

Damage: Redbanded leafrollers feed on a wide variety of plants, injuring foliage and fruit. Larvae feed on the underside of leaves causing them to look skeletonized. They also web leaves together and make shallow cavities in young fruit.

Apple Maggot ALERT!

Description: Adult flies are about 1/4 inch long, have clear wings with bold black bands shaped as an "F", and a pronounced white spot on their backs. Larvae are cream-colored, tapered maggots with two black mouth hooks.


University of California
Statewide IPM Project


Whitney Crenshaw,
Colorado State University,
www.insectimages.org

Damage: In soft-fleshed apples, a small, dark, decayed spot occurs at the egg-laying site producing a dimple of hard flesh. Larvae tunnel through the fruit's flesh, leaving small, brown, thread-like trails. Internal rotting occurs, causing fruit to drop prematurely.

ALERT! Pink Hibiscus Mealybug

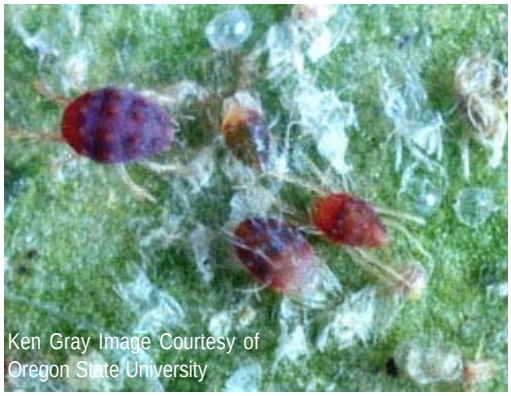
Description: Adults are 1/8 inch long, pink, and covered with white, cottony wax, which becomes a large mass as colonies form on plants. Females are wingless, but males are winged and have two, long, waxy tails.

Damage: A pest to ornamentals, fruit crops, and vegetables, this mealybug sucks the sap from plants causing stunting, poor or no fruiting, and sometimes death, especially in stressful environments. Infested plants and fruit are unmarketable.


David Hall, www.ars.usda.gov

ALERT! European Red Mite

Description: Adults are very tiny, bright red, and have a few long hairs on their backs with white dots at their bases. Bright red, globular eggs are laid on bark or leaves.


Ken Gray Image Courtesy of Oregon State University

Damage: European red mites feed on foliage with their piercing mouthparts and remove cell contents. They cause stippling on the upper surface of leaves. Leaves may bleach and burn at the tips. High populations may cause leaves to turn bronze and drop.


Ken Gray Image Courtesy of Oregon State University

Gypsy Moth ALERT!

Description: Males are grayish brown and can fly, females are white with black marks and larger. Egg masses laid on trunks are 1 1/2 inches long and covered with soft hair. Young caterpillars are up to 2 inches long, black, and hairy with 11 pairs of bumps, the first five are blue and the last six are red.

Damage: Gypsy moths defoliate hundreds of species of plants, particulary oaks and poplars—aspen. Successive years of defoliation may kill the plant, especially when other stresses occur.

Oriental Fruit Moth ALERT!

Description: The adult moth is small, 1/4 inch long with a 1/2 inch wing span, and is charcoal-colored. Its wings are banded light and dark, which makes it appear spotted. The 5/8 inch long caterpillar is white or pink with a brown head.

Damage: Caterpillars bore into twigs and cause wilting and "flagging" (dried and bent over leaves and stem tips on upper shoots). Larvae bore into the center of green and ripening fruit to feed around the pit. Entry holes, plugged by hardened gum, are infested with sooty mold, turning the area black.

ALERT! Asian Cycad Scale

Description: White armored scales cover the orange body of this tiny (less than 1/16 inch long) scale insect, which lays yellow eggs. Infesting cycads, a family of plants that includes sagos, cycad scales spread rapidly. Insect numbers are greater on the underside of the leaves, where they may form a cluster of scales.

Damage: These scales suck plant juices from all parts of cycads, including the roots. Feeding produces stippled, yellow foliage and stunted plants. Heavily infested plants may die.

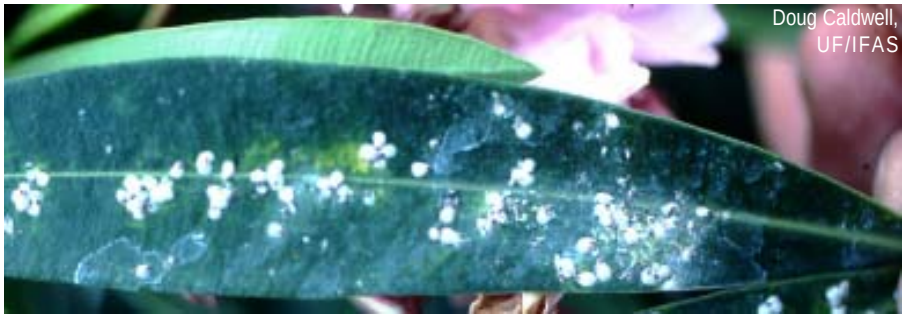

H. Glenn, UF-IFAS

ALERT! Magnolia White Scale

Description: Also known as false oleander scale, this armored scale is about 1/16 inch long and shiny white. The small males may have a yellow tinge and may cluster together on a leaf.


Doug Caldwell, UF/IFAS

Damage: This scale feeds on mature leaves of over 100 plant species. Feeding causes yellow spots on the leaf, and with heavy feeding the leaf withers and drops.


Doug Caldwell, UF/IFAS

Diaprepes Root Weevil ALERT!

Description: This weevil is large, 3/8 to 3/4 inch long, and may be striped black to gray to yellow or orange. Larvae are legless, white, less than 1 inch long, and have a dark head.


Keith Weller, www.ars.usda.gov


University of Florida IFAS, edis.ifas.ufl.edu/IN14

Damage: Adults chew irregular notches in the margins of young leaves of citrus and many ornamentals. Larvae feed on roots, eventually girdling the crown and killing the plant.

Sirex or European Woodwasp ALERT!

Description: Woodwasps or horn-tails are 1 to 1 1/2 inches long with a spear-shaped plate on the end of their their metalic blue/black abdomen. Females have a long egg ovipositor.


David R. Lance, USDA APHIS PPQ, www.insectimages.org


Dennis Haugen, www.insectimages.org

Their legs are yellow with black feet. Males have a black hind leg. Legless larvae have a dark spine.

Damage: They attack living pines exclusively. Their tunneling in the trunk disrupts water and nutrient flow. Needles turn yellow, point down, and turn red. Egg laying may cause pitch beads to run down the bark. Adults emerge through round holes in the bark.

Ground Beetle

Description: Shapes and colors of ground beetles vary, but they are typically shiny and black or dark reddish. They dwell on the ground, have long legs, and are fast runners. Larvae, which live in soil or litter, are long with large heads and distinct mandibles (jaws). Both adults and larvae are predatory.

Benefit: Ground beetles feed on many serious lawn, vegetable, and field crop pests including armyworms and cutworms. They also feed on snails, slugs, root feeding insects, and many other insect larvae and pupae.

Management: Provide permanent, undisturbed beds and perennial plants to protect and attract ground beetles. Supply shelter by establishing permanent, plant-covered pathways. They are attracted to clover, camphorweed, pigweed, low plants, and logs.

Louis-Michel Nageleisen,
Departement de la Sante des Forets, France,
www.forestryimages.org

Larvae use pincher-like mandibles to eat soil-dwelling insects (below), while adults use their well-developed mandibles to prey on other insects (left).

Edward L. Maniqault
Clemson UniversityDonated Collection
www.insectimages.org

Ladybird Beetle

Description: Ladybird beetles (ladybugs) are common beneficial insects. They may have several or no black spots on their orange, red, yellow, or black wing covers. Larvae are elongated, somewhat flattened, and covered with spines. Many larvae are dark or black with bright colored spots or bands, while others are cream colored. Some look like mealybugs because they are covered with a white secretion.

Benefit: Larvae and adults feed on soft-bodied pests: aphids, scale insects, mealybugs, and mites. One larva may eat 200 to 500 aphids before becoming an adult, which takes about a month after hatching.

Management: Purchased ladybird beetles often fly outside the yard they are placed into to seek food. Adults are attracted to flower nectar and pollen. Keep them in the landscape by planting flowers to appeal to the adults. Do not use pesticides that may kill them.

This convergent ladybird beetle is red with black spots (left).

Spined larvae are usually 3/8 inch long (right).

Whitefly Predatory Beetle *Delphastus pusillus*

Description: This member of the ladybird beetle family is small ($^1/_{20}$ inch), shiny, and dark brown to black. Males have a brown head, while heads of females are black. Eggs are clear and twice as long as they are wide. Larvae are long and pale yellow.

Benefit: It attacks the two-spotted spider mite, broad mite, and all stages of the sweet potato whitefly and greenhouse whitefly.

Delphastus pusillus can consume several hundred whitefly eggs and nymphs daily (left).

Predatory Mite *Phytoseiulus persimilis*

Description: *P. persimilis* is very small (only slightly larger than its prey) and fast moving. It is orange to bright reddish orange with long legs and a pear-shaped body. Eggs are oval, and immatures are a pale salmon color.

Benefit: *P. persimilis* is a predatory mite that feeds on mite pests. It develops faster and lives longer than its prey, making it a very effective predator.

Phytoseiulus persimilis feeding on an egg of the two-spotted spider mite (right).

Assassin Bug

Description: Assassin bugs are long-legged predators that may be brown, black, or brightly colored, and are about 3/4 inch long. Their heads are long and narrow with a curved, needle-like beak, and their long, slender antennae have four segments. They have sticky pads with thousands of tiny hairs on their front legs that hold their victims. Their eggs are laid in clusters on the undersides of leaves. Nymphs resemble the adults, but are wingless.

Benefit: Nymphal and adult assassin bugs feed on pests and beneficial insects, snails, and spiders. They effectively eat caterpillars, nymphs, and other immature insects.

Management: If handled carelessly, assassin bugs may inflict a painful bite. They are not poisonous, but the wound may be infected if bacteria from their beak is left behind. Wear gloves for protection. Assassin bugs are attracted to light.

Adults are larger than most other predaceous bugs (right).

John Ruberson,
The University of Georgia,
www.insectimages.org

Nymphs have five growth stages and resemble the adults (left).

Big-eyed Bug

Description: Big-eyed bugs are usually black with silver wings. They have prominent eyes on the sides of their heads and are about 1/8 inch long. Eggs develop a distinctive red spot just after they are laid. Nymphs resemble adults, but lack fully developed wings. Found on plant foliage and on the soil surface, these small bugs are easily mistaken for chinch or false chinch bugs.

Benefit: Big-eyed bugs prey on small caterpillars, mites, thrips, whiteflies, aphids, and other soft-bodied insects. They suck plant juices, but are not considered harmful to plants.

Management: They are attracted to alfalfa, solonaceous crops (potato, tomato, egg plant), beets, and subterranean clover. Flowers that produce nectar appeal to them as they eat nectar from flowers when prey is scarce.

Conspicuous large eyes are characteristic of this small bug (right).

Big-eyed bug nymphs do not have fully developed wings, but otherwise resemble adults (left).

Damsel Bug

Description: Damsel bugs are small, yellowish to brownish, predaceous insects with prominent eyes. They resemble other plant bugs that feed on crops, but their head is longer and more narrow than most. They have long antennae, piercing – sucking mouthparts, and thickened forelegs for grasping prey. Nymphs resemble the adults, but are smaller and lack wings.

Benefit: Both adults and nymphs feed on a wide variety of insects including aphids, leafhoppers, plant bugs, mites, and small caterpillars.

Management: Damsel bugs favor low growing plants in garden flower beds. They are attracted by cover crops or borders of legumes such as alfalfa, clovers and vetch, and strawberries.

Damsel bugs can be yellowish to brownish and are about ½ inch long (left).

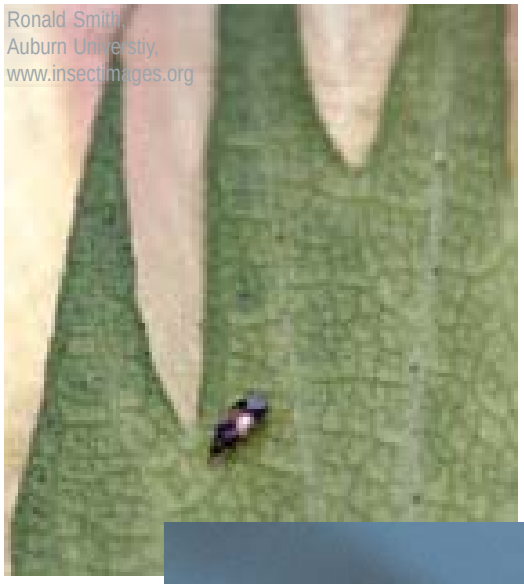
Damsel bugs have thickened forelegs for grasping prey (above).

Minute Pirate Bug

Description: Adult minute pirate bugs have triangular heads and are black with white markings at the base of their front wings. Only 1/8 inch long, this predator is often overlooked. It preys on insects by inserting its sucking mouthparts into its prey and removing body fluids. Nymphs, also predaceous, are wingless, orange, and teardrop-shaped.

Benefit: Nymphs and adults prey on aphids, chinch bugs, whiteflies, spider mites, and other arthropods. They are particularly attracted to colonies of thrips. About 70 species exist in North America, one of which feeds on the eggs and larvae of the corn earworm.

Management: This beneficial bug can be attracted by willows, buckwheat, corn, daisies, nectar, and pollen.



Minute pirate bugs are found on all above ground parts of plants (left).

White markings at the base of the front wings make their body appear band-like when wings are at rest (below).

Damselfly

Description: Damselfly adults (smaller than dragonflies) and nymphs are predatory. They have four, large, clear wings and slender, brightly-colored bodies. Their heads are oblong with prominent eyes and short antennae. Immature damselflies are aquatic, have long legs, and three appendages on their tail.

Benefit: Nymphs live in water and feed mostly on mosquito and midge larvae. Adult damselflies feed on adult mosquitoes and other aquatic insects.

Management: Damselflies are attracted to wildflowers and water. They can be encouraged to frequent or set up residency near bird baths, landscape ponds, and other water features that are near the ground and surrounded by flowers.

Damselflies have four, large, clear wings, and slender, brightly-colored bodies (above).

At rest, a damselfly folds its wings over its body, a dragonfly's wings remain open (left).

Dragonfly

Description: Dragonflies, there are many species, are predaceous as nymphs and adults. Adults are relatively large, 1/2 to 6 inches long, with two sets of translucent, net-veined wings and a long abdomen. They live near ponds, wetlands, and other slow-moving waters. Females lay eggs on or near water.

Benefit: Dragonflies are very important in reducing the number of mosquitoes and other aquatic flies. Nymphs live in water where they feed on mosquito larvae, other aquatic insects, and even small fish. Adults prey on mosquitos, flies, midges, and gnats.

Management: Provide a bird bath, landscape pond, or other water feature to keep dragonflies around. They also like to rest and sun themselves on wooden stakes and can be attracted to a yard having three-foot tall, small diameter (preferably less than 1/2 inch) poles or bamboo garden stakes in sunny parts of the yard.

Dragonflies have translucent, net-veined wings (right).

Arnold T. Drooz, USDA Forest Service, www.insectimages.org

David Cappaert, www.insectimages.org

Adult dragonflies have a long, narrow abdomen (left).

Brown Lacewing

Description: Brown lacewings resemble the green species, but are about half the size, brownish, and less common. Their eggs are oblong and laid singly on plants. Flattened larvae have a tapered tail, distinct legs, and tubular sucking mouthparts. They are smaller and more slender than the larvae of the green species.

Benefit: Adults and larvae are predaceous, feeding on mites and soft-bodied insects including aphids, mealybugs, scales, and whiteflies. Larvae of some species of brown lacewing are called trashbugs because they cover themselves with debris and the skins of their victims.

Management: Brown lacewings are attracted to nectar, pollen, and honeydew. A garden with flowers all season long provides a good habitat for this predator.

The pupal stage is short in the summer, allowing adults to emerge and produce more generations before the season ends. Pupae formed in the fall will overwinter (below).

Brown lacewing adults are 3/8 to 5/8 inch long (above).

Green Lacewing

Description: Green lacewing adults have four, pale green, see-through wings with net-like veins. Their 1/2 inch long, slender bodies are light green to pale yellow. They deposit their eggs at the end of a long, hair-like stalk attached to the underside of leaves. Larvae are flat and tapered at the tail, with distinct legs and long, curved mandibles. Their soft bodies are about 1/4 inch long and covered with raised bumps and long hairs.

Benefit: Adults feed on pollen or other insects and are found on crops, weeds, and landscape plants. Larvae are ferocious predators that attack soft-bodied pests (aphids, mealybugs, and whiteflies) and their eggs. They are one of the best insect predators in Nevada. They may have five or six generations per year.

Management: Nectar, pollen, and honeydew encourage green lacewings to live in a landscape. They are attracted to goldenrod, dandelions, yarrow, and wild carrot, as well as bright lights at night. Providing water during dry periods may also increase their stay and predation.

Larvae use their sickle-shaped mandibles to grasp prey (right).

David Riley,
University of Georgia,
www.forestryimages.org

Joseph Berger,
www.insectimages.org

Green lacewing adults have transparent wings (left).

Praying Mantis

Description: Praying mantises may be green, brown, or a mottled color. They have a free-moving, triangular head. Without a larval stage, the young look like miniature adults. Their eggs are deposited in a distinctive pattern on twigs or stems as a frothy mass, which hardens as a protective layer. The females are bigger than males and have a larger abdomen. They have wings, but they usually walk.

Benefit: Praying mantises feed on a variety of insects including moths, crickets, grasshoppers, and flies. They do not discriminate between beneficial and harmful insects, and they will eat each other.

Management: Pesticides significantly reduce the number of praying mantises in an area. Use as few pesticides as possible to protect this predator.

Adults may be up to six inches long. Their front legs are used to grab and hold prey (above).

Praying mantis egg cases may hold more than 200 eggs (above).

Spiders

Description: All spiders are predaceous. Only a few, such as the black widow, brown recluse, and hobo spider are dangerously venomous to man. Spiders are usually 1/4 to 1 1/2 inches long and shy, immediately retreating or hiding when disturbed. Black widow spiders, or hourglass spiders, have a prominent hourglass-shaped spot on the underside of their abdomen. Very shy, they spin irregular webs in crevices and other dark, protected, moist spots. Newly hatched black widow spiders are whitish and darken gradually, passing through stages of mixed white, yellow and red spots and bands. Brown recluse spiders, not found in Nevada (unless imported), are characterized by a distinct violin-shaped patch on their head and midregion. Unlike most spiders, they have three pairs of eyes. They spin small, loose webs with irregular strands. Wolf spiders resemble a brown recluse, but are not harmful to man. Wolf spiders do not construct webs, but live in burrows and wait for prey. Jumping spiders do not spin webs, but are skilled hunters, especially of the many insects that live or move on the soil surface. Large garden or orb weaver spiders are common in Nevada. They spin large, patterned webs to catch flying insects. One, the cat-face spider, is about the size of a quarter and cream-colored with tan and brown markings. Its abdomen has two bumps and dark markings that resemble a cat's face. Harmless to humans, it builds an orb web near lights, eves and overhangs around homes, barns, and out buildings. There are several species of funnel spiders in Nevada that construct webs above ground with a funnel-shaped opening at the bottom where they lie in wait for flying insects to get trapped. One, the hobo spider is found in northeast Nevada and may be transported into other areas of Nevada. An aggressive predator, when threatened, this poisonous spider has attacked humans. It builds a funnel web in corners, under furniture, and protected sites. It may be found inside or outside a home, but may not persist, particularly outside, because of Nevada's hot, dry climate.

Spiders

Benefit/Damage: Spiders are predators of pest insects, but they may bite if disturbed by humans. Seek medical attention if bitten by a brown recluse, hobo, or black widow spider. Black widows do not often bite, but if they do it can be painful and, in rare cases, fatal. An antivenim (Lyovac) is available, and pain medication will probably be needed. Hospitalization is advised for high risk persons—babies, the elderly, hypersensitive individuals, the sick, and those sensitized by earlier spider bites. While the effects of a black widow bite are often felt immediately, other spider bites may be painless until three to eight hours later. Bites may become inflamed, hard, scabbed, ulcerated, and slow to heal over weeks to months. Headaches, dizziness, fatigue, vomiting, and diarrhea may result from a bite. If bitten, collect the spider for positive identification and seek medical attention. Apply antiseptic solution to prevent infection.

Management: Spiders are not aggressive to humans and usually only bite when crushed, handled, or disturbed. Control when necessary by treating outbuildings, under porches, around foundations, in basements, or other places likely to harbor spiders with an approved pesticide. To make the environment less attractive to spiders, eliminate clutter in basements, closets, and attics. Webs and egg sacs can be removed with a vacuum or broom. Most spiders, however, should not be killed because they are great predators and efficient control agents of insect pests.

Female black widows are shiny black with a red hourglass-shaped marking on the underside of their abdomen (right).

Clemson University-USDA Cooperative Extension Slide Series, www.insectimages.org

Spiders

Brown recluse spiders, not commonly found in Nevada, are dark cream to dark brown with a darker abdomen (above).

Female wolf spiders carry their white, round egg sacs around with them (left).

Bold jumping spiders do not live in webs, but are active predators, usually hunting during daylight (right).

Spiders

Garden or orb weavers spin large, circular webs in areas with lots of insects (right).

Leon Higley,
Department of Entomology,
University of Nebraska-Lincoln

Joseph Berger,
www.insectimages.org

Cat-face spiders have two bumps and dark markings on their abdomen that when viewed as a whole looks like a cat's face (left).

Funnel spiders spin funnel-shaped webs and wait for prey at the bottom (right).

Wayne S Johnson,
University of Nevada, Reno

Jim Kalisch,
Department of Entomology,
University of Nebraska-Lincoln

Hobo spiders, more often found in the Northwest and Utah, are also found in northeast Nevada (left).

Syrphid Fly

Description: Syrphid flies, also known as flower or hover flies, are predators that commonly hover around flowers feeding on pollen, nectar, and honeydew. Syrphid flies may vary greatly in color and size, but most have striped black, brown, and yellow banded abdomens and are about 1/4 to 3/4 inch long, similar to bees and wasps. Larvae or maggots are about 1/4 inch long, legless, wrinkled, fleshy, and usually greenish, but may be white or brown.

Benefit: Syrphid fly maggots are predators of aphids, scale insects, and thrips. One maggot can consume 400 to 500 aphids in its lifetime. They have three to seven generations per year.

Management: Attract syrphid flies by planting pollen or nectar rich flowers. They must feed on pollen before they can reproduce. They prefer wild carrot and yarrow flowers.

Syrphid flies may resemble wasps or bees, but they do not sting (right).

Maggots are great predators of aphids (left).

Five-banded Tiphiid Wasp

Description: Five-banded tiphiid wasps are parasitic wasps that are about $1^{1}/_{8}$ to $1^{3}/_{8}$ inches long. Adults are black with yellow on their head and thorax. They have yellow bands around each segment of the abdomen and yellow legs. Their antennae are black.

Benefit: Larvae are parasites of May beetle, scarab beetle, and tiger beetle larvae. Female wasps lay eggs on burrowing larvae in the soil. Larvae penetrate the host and feed until the host is eventually killed. Adults feed on nectar.

Management: Commonly found in southern Nevada, homeowners may find five-banded tiphiid wasps in or around their home in the fall and winter. If disturbed, the wasps may sting. Five-banded tiphiid wasps are not harmful, if they are found in your yard, encourage them to stay.

This wasp is black with yellow markings. Five-banded tiphiid wasp larvae are parasites to many landscape-damaging insects. Encourage them to stay in your yard.

Paper Wasp

Description: Paper wasps are 3/4 to 1 inch long and black, brown, or reddish with yellow markings. Their nests resemble upside-down umbrellas of cells and are often found under eaves, in attics, trees, and on other structures.

Benefit: Paper wasps are primarily predators of caterpillars, which they sting and paralyze, but they also prey on other insects such as flies and beetle larvae.

Management: To remove a paper wasp nest from eaves, spray it with a high pressure stream of water from a distance. However, do not remove a nest unless absolutely necessary. The wasps are very aggressive if their nest is threatened and will sting whomever disturbs it. Left alone, they are not a threat.

There are 22 species of paper wasps in North America.

Their nests and long, narrow bodies distinguish paper wasps from yellow jackets (right).

Parasitic Wasps

Description: Parasitic wasps are very small (less than 1/8 inch long) and often go unnoticed. They vary in shape and color, but are usually black with long antennae. Larvae are usually cream-colored, legless, and tapered at both ends.

Benefit: Parasitic wasps lay eggs on or in the body of host insects. After hatching, larvae feed on the host, eventually killing it. Many harmful insects such as aphids, whiteflies, scales, leafminers, and caterpillars are parasitized. Emergence holes in the dead insect are a sign of the parasitism. Parasitic wasps do not injure plants or other beneficial insects.

Management: Encourage them to stay in the landscape by planting wildflowers, particularly from the daisy and carrot families. Have water readily available too.

R.J. Reynolds Tobacco Company Slide Set,
R.J. Reynolds Tobacco Company,
www.insectimages.org

Wasp larvae construct small, white cocoons outside the body of the host (above).

Parasitic wasps have long antennae and are generally black (below).

John H. Ghent,
USDA Forest Service,
www.insectimages.org

John H. Ghent,
USDA Forest Service,
www.insectimages.org

Adult parasitic wasps leave small holes as they emerge from a parasitized sawfly cocoon (left).

Trichogramma Wasps

Description: As many as 145 species of *Trichogramma* wasps occur naturally and are adapted to most habitats. These wasps are difficult to identify due to their small size ($^1/_{50}$ inch) and the large number of species. They resemble larger wasps in appearance, but are harmless to humans.

Benefit: *Trichogramma* wasps parasitize insect eggs, mainly those of butterflies and moths, including pest species. Adult females search for suitable hosts by odors released by the host themselves. Once a host egg is located, she deposits two to three of her eggs inside of it. There, the wasp larvae hatch and consume the developing host embryo. Pupae pupate inside the host egg turning it a dark color. When the pupal stage is completed, adult wasps chew a hole in the host egg and emerge to breed and start the cycle again.

Management: Avoid using broad spectrum pesticides that may kill natural enemies of pests such as the *Trichogramma* wasp. These wasps may be purchased and released into the landscape. Research which species are available and purchase those best suited to the area of release—climate, pest host, etc.

Paul W. Flinn, USDA-ARS

There are many species of Trichogramma wasps. Research is being conducted using the Trichogramma deion wasp, left, in warehouses for control of the Indiameal moth, which infests stored packaged goods such as cereal.

An egg cluster parasitized by a Trichogramma wasp turns black (right).

USDA Forest Service, Rocky Mountain Region Archives, www.insectimages.org

Wind Scorpion

Description: Wind scorpions, also known as sun spiders and solifugids, are not true scorpions, but belong to the *Arachnida* class. They are often mis-named vinegaroons in Nevada; vinegaroons occur in the Middle East. They have two distinct body regions and large pincers on their heads. They are called wind scorpions because they appear to run as fast as the wind. They are brown or yellowish and can grow to two inches long.

Benefit: Wind scorpions prey on insects and small vertebrates. If provoked, they can bite, but they do not have venom glands and are harmless to humans. The wound may become infected if it is not treated properly.

Management: If a wind scorpion is found, leave it alone; it will not harm you. If in the home, collect it carefully and place it outside.

Wind scorpions can grow to 2 inches long, and get their name because they appear to run as fast as the wind. They are not actually harmful, but may bite if provoked.

Carpenter Ant

Description: Carpenter ants are general insect predators that are large (1/4 to 1/2 inch long) and usually black or cinnamon, but can be bicolored. The queen ant and winged ants are larger (up to 3/4 inch long). Their oval, cream-colored eggs are about 1/8 inch long. Larvae are legless and grub-like.

Benefit/Damage: Carpenter ants are general predators and they protect aphids and mealybugs for their honeydew. They also bore through wood to make nests. They are most active at night. Unlike termites, they do not feed on wood and the wood damaged by them will not contain mud-like material. They eject sawdust-like debris (frass) from their tunnels.

Management: Find and destroy the nests. Treat wall voids and other hidden places where ants are entering by carefully drilling a series of small holes and puffing boric acid or other registered products into the suspected nest areas. If the nest is in a wall, drill and treat at least three to six feet on either side of where the ants are entering so as to maximize the chance of contacting the nest. Also treat behind pipe collars and behind the junction box for electrical switches. Moist wood provides the ideal environment for carpenter ants, so correct any moisture problems and remove water-damaged wood.

Carpenter ants are usually black and about 1/4 to 1/2 inch long (below).

Clemson University-USDA Cooperative Extension Slide Series, www.insectimages.org

Edward H. Holsten, USDA Forest Service, www.insectimages.org

Boring dust is left near wood damaged by carpenter ants (above).

Harvester Ants

Description: Many species of harvester ants are found in the United States, some like the red harvester ant, are native to the desert southwest. They are 1/4 to 1/2 inch long, and orange to reddish to dark brown to brownish black. Larvae are white and legless. Winged harvester ants swarm and mate, after which the male soon dies. Females drop their wings and dig burrows to start new colonies. Harvester ants nest deep in the ground, building a mound around the entrance and clearing a three foot (or larger) radius of vegetation from around the nest. Small pebbles are left by worker ants near the entrance.

Damage/Benefit: Aggressive in defending their nest, harvester ants bite and sting intruders, including humans. They do not invade homes, but can damage lawns, golf courses, and parks with their nest building. Forage yields in heavily infested crop and range lands are reduced. They are seed eaters, eating the seeds of many weeds. They also eat insects.

Management: These ants are generally not considered a problem, unless they build their nest in an undesired location. In fields, regular discing and mowing may eliminate them. Pesticides are available, use them during the hot part of the day when the ants are in their nest. Baits are also effective.

Harvester ants may build a mound around the enterance of their nest, clearing vegetation away from it (right).

Jeff Knight,
Nevada Department of Agriculture

Herbert A. "Joe" Pase III,
Texas Forest Service,
www.insectimages.org

Red harvester ants can be aggressive when disturbed and will bite and sting (left).

Bees

Description: Bees are essential pollinators in natural ecosystems, horticulture, and agriculture. Seed, fruit, and vegetable producers rely on bee pollinators, and without them yields plummet. Honey is a natural sweetener used all over the world. Recently, native and domesticated bee hives have been devastated by varroa and tracheal mites. Care must be taken to protect bees from these mites and the misuse of pesticides, which kill bees. **Mason bees** are small, shiny black, and easy to handle. A bee sting from a mason bee is rare because they are non-aggressive by nature. The **honey bee** is about $^{2}/_{3}$ inch long and has black or brown bands across the abdomen. They are often confused with some wasps, but honey bees are not aggressive and sting only for self-protection. The more aggressive and dangerous **Africanized bees** cannot be visually differentiated from commercial honey bees, and require an expert to make a positive identification. **Alkali bees** are slightly smaller than the honey bee with yellow or green iridescent bands on the abdomen. **Leafcutting bees** are black with white or silvery hairs, and are about $^{2}/_{5}$ to $^{4}/_{5}$ inch long. Most leafcutting bee species are solitary.

Benefit/Damage: Honey bees have become prime pollinators of crops. They also provide honey, royal jelly, beeswax, and propolis. Mason bees are native pollinators of early spring flowers. More efficient than the honeybee, mason bees visit an average of 1600 flowers a day, pollinating over 90% of the blooms. Alkali bees and leafcutting bees are effective alfalfa pollinators. Leafcutting bees occasionally cause damage to some ornamental plants if large numbers of females are nesting in one area, but the damage is usually slight and temporary. Margins of leaves or petals will have large semicircular holes. Africanized bees defend their colonies very vigorously. They are dangerous because many bees participate in a stinging and they continue to attack for a long time and over a great distance.

Bees

Management: Entice mason bees into your landscape by creating nesting sites for them. This can be done by drilling holes in blocks of wood or setting out bunches of unwrapped, paper soda straws (do not use plastic). Encourage growth in populations in early spring when bees are active by providing holes for bee nests near fruit producing crops. Honey bees can be kept where there are flowering plants that produce nectar and pollen. Choose a place for bee hives that is sheltered from winds and partially shaded. Avoid low spots in a yard where cold, damp air accumulates in winter. Provide a water source in your yard with floating wood or styrofoam chips to keep the bees from drowning. Look for cracks and holes in houses and structures that may lead to wall voids. Caulk these so that honey and Africanized bees will not move in.

Africanized bees are great pollinators, but too aggressive for the safety of other animals. If you discover a bee colony, contact trained personnel to remove it. If stung, run to a car or building and stay there enclosed even if some bees come with you. Do not jump in water because Africanized bees will still be there when you come up for air. Once safe, quickly remove stings from your skin with a credit card or other scraper (tweezers may inject more venom) to reduce the amount of venom injected.

An artificial nesting bed can be made where alkali bees are desired. These bees prefer to nest in an area of silt loam soil. Leafcutter bees, like mason bees, are great pollinators that nest in holes. Artificial nests can be made with drilled wood or bunches of paper straws. Place nests in protected sites in the landscape or garden.

Be cautious using pesticides, most pesticides kill bees. Do not apply pesticides while plants are actively flowering. Apply pesticides before the plant begins to flower or after it has finished flowering. Read product labels, select the least toxic pesticides to bees, and follow label directions when managing pests.

Bees

Stephen Bambara,
North Carolina State University

Mason bees are shiny  *black pollinators of early spring flowers. They can be attracted to your landscape by providing nests, such as a bunch of unwrapped, paper soda straws opened*

Honey bees travel from flower to flower to collect nectar (right).

Carl Dennis,
Auburn University,
www.insectimages.org

Africanized bees look just like honey bees. In the picture to the left, Africanized honey bees surround a European honey bee queen that has been marked with a pink dot.

Bees

Alkali bees have yellow bands on their abdomen (above).

Leafcutting bees cut leaf fragments, but usually cause little damage (right).

Lately, varroa mites have devestated many bee hives. In the picture to the left, varroa mites can be seen attached to honey bees.

Rose Cane Borers

Description: A number of insects infest rose canes, including sawflies, horntails, carpenter bees, and rose cane borers, which are predatory wasps. They make holes in canes or use cut ends of pruned canes in which to lay eggs. Their larvae burrow into the center of the cane. The wasps may make only a broad chamber for their young as they collect aphids to feed their young.

Benefit/Damage: Rose cane borers usually do not cause serious injury beyond aesthetic damage; however, stem tips and leaves wilt and individual canes die back. They will leave round holes in the center of cut canes. Larvae of some borers eat the inside tissue leaving the canes hollow, while others tunnel in a spiral under the bark. Some wasps are beneficial insects as they reduce aphid populations.

Management: Prevent rose cane borer damage by sealing canes with white glue immediately after pruning. Prune affected canes to the next leaf or until there is no longer a hole in the stem. Remove and dispose of infected canes and seal each cut with glue. Insecticides are not effective except in reducing aphid populations which may decrease the number of rose cane borers in your garden.

These wasps bore into roses through the ends of pruned canes (right). Larvae of some borers eat the inside tissue leaving canes hollow (below).


Wayne S Johnson,
University of Nevada, Reno


Jeff Knight,
Nevada Department of Agriculture

Stem tips and leaves wilt and individual canes die back (right).


Wayne S Johnson,
University of Nevada, Reno

Stink Bugs

Description: Stink bugs are shaped like a 1/2 inch long shield and have a large triangle on their backs. They vary in color and size, but are most commonly green or brown. They have five-jointed antennae and long, piercing-sucking mouthparts. The name stink bug comes from the foul smelling substance many species give off when disturbed. Their eggs are barrel-shaped with circular lids. They are laid in masses of 10 to 50 eggs on leaf surfaces. Nymphs are brightly colored and mimic adults.

Benefit/Damage: Some stink bugs are predators, but many attack a variety of fruits and vegetables. The adults cause more damage than the nymphs. Damage includes blemishes, discolored depressions, and brown drops of excrement. They produce white, pithy areas inside fruit, which turns brown when the fruit is peeled. Except for the fruit, woody plants are not harmed by their feeding, but vegetables are.

Management: Controlling host weeds will help manage stink bugs. Parasitic wasps attack stink bug eggs and parasitic flies attack the nymphs and adults. When populations are small, the eggs and bugs may be picked off by hand. Insecticides may be effective.

Stink bugs feed on a peach causing discolored blemishes on the outside and white, pithy areas inside the fruit (right).

Gary Bernon, USDA APHIS, www.insectimages.org

David R. Lance, USDA APHIS PPQ, www.insectimages.org

This shield-shaped stink bug is brown (left).

European Earwig

Description: European earwigs are 3/4 inch long, elongated, slender, shiny, reddish brown insects. The front pair of wings is thickened and very short, and the hind pair is membranous and much folded. They have chewing mouthparts, and a pair of pincer-like cerci. The male's pincers are larger and curved, while the females are smaller and nearly straight. Young are similar in appearance to the adults.

Benefit/Damage: Earwigs feed nocturnally on pest insects and mites, as well as growing shoots of plants. Seedlings may be missing all or parts of their leaves and stem. Mature leaves will have many irregular holes or be chewed around the edges. Flower buds and flowers are chewed and grow distortedly.

Management: Earwigs can be controlled in gardens by setting cans filled halfway with vegetable oil and a drop of bacon grease or tuna fish oil as traps. A rolled-up newspaper, bamboo tube, or short piece of hose may also be used as a trap. They inhabit moist, dark organic debris and trash, remove such.

Right, a female European earwig (top) and a smaller male European earwig (bottom).

Male European earwigs have large, curved pincers (left).

Bark Scorpion

Description: Bark scorpions are 2 to 3 inches long, including the tail, and range from light yellow to reddish tan. More delicate looking than other scorpions, bark scorpions have long slender tails, often longer than their body, and thin claws. The stinger is at the end of the tail. Bark scorpions live for about five years.

Benefit/Damage: Bark scorpions, found in southern Nevada, are the only scorpion species considered seriously poisonous in the state. Pain from stings is usually felt right away. The area around the sting may feel numb or weak. Other symptoms are hyperactivity, anxiety, profuse salivation, dizziness, respiratory distress, and convulsions. Seek medical attention if this occurs. Swelling and discoloration do not occur. Death is rare, but possible. Insectivorous, it kills many pests.

Management: Find scorpions by using a blacklight at night. Scorpions will fluoresce a light yellow-green color. Physically kill the scorpions or spray them with an approved pesticide, which is most effective when sprayed directly on the scorpion. Spraying infested areas with a residual spray may have some effect in controlling bark scorpions. Portable blacklights can be obtained through rock shops and larger light bulb supply houses.

Bark scorpions are yellow to reddish tan and have long slender tails (right).

In southern Nevada, bark scorpions are found in rock outcroppings and behind tree bark, especially on palms (left).

Crickets

Description: **Field crickets** are flat-backed with a reddish brown to black body and large hind legs. They are 9/16 to over 1 inch long. Females have a sword-like egg laying structure (ovipositor) and two cerci that come out of the back of their abdomens. Nymphs resemble adults, but are smaller and wingless. Males make a chirping sound to attract females. **House crickets** are similar to field crickets, but are only about 3/4 inch long and are yellowish brown with three dark bands on the head and prothorax. **Mormon crickets** are not true crickets, but resemble large, black, wingless grasshoppers. They can be up to 2 1/2 inches long as adults, and females have a long ovipositor for laying eggs at the end of the abdomen. Mormon crickets cannot fly.

Damage: Field crickets can cause serious damage to garden and field crops. Symptoms of cricket damage may occur at any time in the growing season on a variety of plants. Crickets cause damage to roots and stems, eat seeds and seedlings, and chew holes in stems of larger plants. Turf roots and shoots are also eaten. Some field crickets are beneficial because they eat the seeds of pesky weeds, including crabgrass and pigweed. House crickets are bothersome when they enter dwellings and eat holes in clothes and furniture. Mormon crickets destroy plants on rangeland, cropland, and in vegetable gardens. After the food supply is exhausted, they migrate to other areas.

Management: If field crickets become a problem, clean up your garden and thin out plantings to make the area less desirable. Protect plants with cones or rowcover. Baited traps may also be helpful. Some birds and predatory wasps eat crickets. Metal, screen, or tarpaper cylinders sunk into the ground can help protect individual plants. Insecticides are available for use on turf. Carbaryl bait, usually oatmeal coated with carbaryl, is an effective way to reduce Mormon cricket populations. Dimilin is also available as a spray. House

Crickets

crickets, a minor nuisance, can be eliminated by treating window screens, basement window frames, and places around the foundation with insecticides.

Female field crickets have two cerci that extend from the back of the abdomen (left).

No control is usually necessary for harmless, yellowish brown house crickets (right).

Mormon crickets resemble fat, black grasshoppers and cannot fly (left).

Cutworms

Description: Cutworms are dull brown caterpillars with light colored stripes and smooth skin. When disturbed, they curl up into a C-shape. Their dome-shaped eggs are laid on stems and leaves near the ground. Adults are moths.

Damage: Cutworms attack most garden crops and many other plants. They clip seedling stems near or just below the soil's surface. They migrate to other plants once the food supply is exhausted. Cutworms also climb on foliage and chew holes in the leaves.

Management: Look for cutworms at night when they are most active. Destroy crop residues and surrounding weeds. Keep the garden free of weeds and sod in winter. Seedlings can be protected with cardboard collars, screens, or protective cloth placed around them. Using insecticide baits before there is serious damage provides control.

Cutworms are smooth-skined, dull brown caterpillars (right).

Cutworm larvae chewed the stem of this corn plant. Cutworms curl into a C-shape when disturbed (left).

Adelgids

Description: Adelgids are small, dark, soft-bodied, aphid-like insects that suck plant juices. They form galls on spruce, but alternate hosts include Douglas-fir, fir, hemlock, and larch. The insects may look different depending on the host. Most species overwinter as eggs under cottony masses or as early-stage immatures under bark or bud scales.

Damage: Adelgid colonies of females produce a cottony white or grayish material on the trunk, limbs, cones, twigs, or needles. Heavily infested trees may seem to be covered with snow. Cone-shaped galls or swollen twigs may also appear on infested spruce or fir. Large populations of adelgids cause needles to turn yellow and drop early and terminals to droop and dieback. Large populations of adelgids in stages that do not form galls can slow development of, or kill trees.

Management: Many predators, including ladybird beetles and lacewings, feed on adelgids. Adelgid galls on spruce are generally harmless, but young trees or trees with large quantities of galls may have problems. Clip and discard infested foliage when the galls are green and insects have not yet emerged. Do not use excessive amounts of fertilizer or quick release formulations, and substitute spruce with other tree species. A strong stream of water aimed at the cottony masses on conifers displaces and kills many adelgids. Applications of horticultural oil (caution – changes blue leaf color to deep green) or a broad-spectrum insecticide in the spring can be effective.

Whitney Cranshaw, Univ. of Colorado, www.insectimages.org

Adelgids may overwinter as eggs under cottony masses (left).

Large populations cause terminals to droop and die back (right).

MN Dept. of Ntrl. Res. Arch., www.insectimages.org

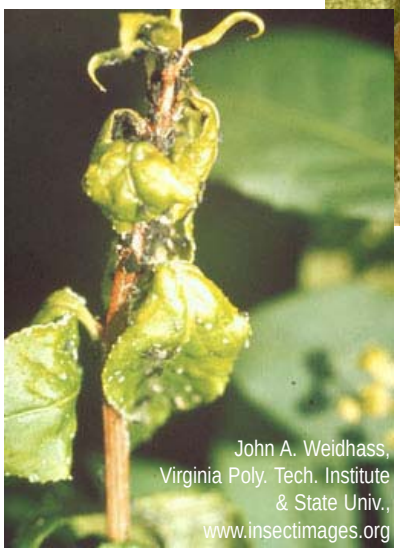
Aphids

Description: Aphids can be green, yellow, brown, red, blue, or black and are about 1/10 inch long. This small, pear-shaped pest has long legs and antennae, and a pair of cornicles (tubelike structures) projecting out of the back of its body. Adults may be winged or wingless. Females give birth to live young that begin feeding on plants right away.

Damage: Aphid feeding may cause curled, yellowed, and deformed leaves, as well as stunted shoots. Sticky honeydew may also be secreted attracting ants and turning black with sooty mold fungus. Some aphid species inject a toxin into plants, that produces distorted leaves. Many transfer viruses from plant to plant.

Management: There are insecticides available to control aphids, but do not spray with chemicals if aphid mummies (parasitized bodies) are present. Allow beneficial insects (syrphid fly larvae, lacewings, ladybird beetles, parasitic wasps) to continue to kill the aphids. Control ant populations, prune areas with aphids, and avoid using high levels of nitrogen fertilizer. Washing aphids from plants with a forceful stream of water obtains good, short-term control. Repeat as necessary.

John A. Weidhass, Virginia Poly. Tech. Institute & State Univ., www.insectimages.org



John A. Weidhass, Virginia Poly. Tech. Institute & State Univ., www.insectimages.org

Aphids are usually found sucking plant juices on new growth (above). Deformed, curled, yellowed leaves are evidence of aphids (left).

Apple Aphid

Description: Adult females are pear-shaped and light green, sometimes with yellow bodies in spring. The less numerous males are smaller and yellowish brown with black antennae. Nymphs are wingless females that become stem mothers, which give birth to live young without mating. Winged apple aphids (the true sexual forms) mate and lay oval, green eggs on twigs. The eggs eventually turn black.

Damage: In mild climates, apple aphids live all year in the tree, reproducing continuously. Damage is similar to that caused by rosy apple aphids. Apple aphids cause the foliage to curl. They also produce honeydew, upon which grows a black fungus that discolors the leaves and apples. Damaged apples will be dwarfed and appear puckered at the blossom end.

Management: A lack of pruning will encourage aphid colonies. Apply dormant oil at leaf emergence to smother eggs. Pre-blossom applications of aphicides are effective. Foliar applications of systemic compounds in early season through summer kill aphids, particularly if done prior to leaf curling when the aphids are exposed.

Apple aphids cause leaf curling (left).

Adult winged apple aphid (right).

Green Peach Aphid

Description: In spring and fall, deep pink stem mother females bear live young. Pear-shaped adults develop from stem mothers. They are yellowish green with a median and two lateral dark green stripes over their abdomen. The young nymphs are yellowish green with darker green lines on their back.

Damage: Green peach aphids feed early in the season on a variety of plants. When they feed on leaves and extract sap, the leaves turn yellow and drop. Honeydew is excreted and a black, sooty fungus develops. Green peach aphids also transmit virus diseases.

Management: Green peach aphid is resistant to many pesticides and is difficult to control. Delay the use of chemicals to allow predators and weather to reduce the population. When using a pesticide, make sure to cover the plant thoroughly, particularly the undersides of leaves. Use dormant oils in winter and ultrafine horticultural oils in summer.

Whitney Cranshaw,
Colorado State University,
www.insectimages.org

Feeding by green peach aphids causes leaves to turn yellow (left).

Nymphs and a winged adult, which forms when populations are dense (right).

Whitney Cranshaw,
Colorado State University,
www.insectimages.org

Rosy Apple Aphid

Description: Adults are rosy brown with a powdery covering. Nymphs are wingless females that become stem mothers, which give birth to live young without mating. Winged rosy apple aphids (the true sexual forms) mate and lay oval eggs on twigs. The eggs change from bright yellow, to greenish yellow, to black.

Damage: Young rosy apple aphids feed on and around the opening buds of apples and other hosts, including ornamentals. They also suck sap from leaves, stems, and young fruits. Feeding causes leaves to curl, which provides protection for the aphids. The leaves may also turn bright red. Feeding results in bunching, stunting, and malformation of fruit. Large populations secrete much honeydew, upon which a sooty fungus grows. Toxin in the saliva of rosy apple aphids prevents fruit from falling at the normal time.

Management: Keep trees trimmed so insects and birds that feed on rosy apple aphids and their eggs can find them. Pre-blossom applications of contact or systemic aphicides may be effective. Use ultra-fine horticultural oil and soaps early. It is hard to obtain control with pesticides after leaf curling has occurred.

Adults are pinkish due to a powdery covering (left).

Feeding by rosy apple aphids results in bunching, stunting and malformation of fruit (right).

Woolly Apple Aphid

Description: The adults are purplish and almost entirely covered by a woolly mass of waxy fibers. The males are smaller and olive-yellow. The eggs are oval and cinnamon-colored. Wingless females (stem mothers) birth live young without mating. Winged woolly apple aphids (the true sexual forms) mate in fall and lay overwintering eggs.

Damage: White, cottony masses can be found above ground on pruning wounds and new growth, or on large knots on the roots and crown. Branches will have gall-like formations and there will be swollen enlargements on the roots. Trees infested with woolly apple aphids will have short, fibrous roots. These aphids prevent healing and cause the roots to decay. Foliage will turn yellow. Woolly apple aphids may transmit apple canker.

Management: Pyrethroid and carbamate pesticides kill natural predators causing outbreaks of aphids and mites. Apply other aphicides to control woolly apple aphids in tree tops. Dormant oils and soap are not effective. Underground aphids are harder to control. Select trees with resistant rootstocks.

Underneath the woolly mass of waxy fibers, woolly apple aphids are purplish (left).

Cottony masses can be found on new growth (right).

Boxelder Bug

Description: Adults are about 1/2 inch long and brown-black with three red stripes behind their head and at the base of their wings. The abdomen is bright red under the wings. Red eggs are laid in crevices of bark in the spring. Nymphs are gray and bright red, developing black markings and wings when mature.

Damage: Boxelder bugs feed by sucking sap from leaves, tender twigs, and developing seeds. This causes leaf stippling, without significant plant damage. Boxelder bugs can be an annoyance because they travel in large numbers. If they enter a home, they may stain walls, curtains, and furniture with spots of excrement.

Management: Female boxelder trees support boxelder bugs, so remove these trees or avoid planting them. Eliminate debris or litter around homes because it serves as shelter. Spray water or insecticides on congregating masses. To prevent bugs from entering a home, seal exterior cracks and screen windows and doors. Bugs found in a home can be vacuumed up. Seal and dispose of the vacuum bag in the trash.

Boxelder bugs are brown-black with three red stripes (left).

Boxelder bugs aggregate in groups (right).

Squash Bug

Description: Squash bugs give off an unpleasant odor when crushed. Adults are about 5/8 inch long and flat-backed. They are brownish, grayish, or dark gray with orange or orange and brown striped edges on the abdomen. They are often densely covered with black hairs. Orange-yellow to bronze eggs are laid on stems or on the undersides of leaves. Young bugs are pale green to nearly white and wingless.

Damage: Squash bugs feed on leaves of curcubits, causing small specks which turn yellow and then brown. Vines wilt and affected parts become black and crisp. Small plants may be killed, large plants fruit poorly. They also transmit bacterial and virus wilt diseases.

Management: Remove all plant debris and trash. Squash bugs can be trapped by placing boards around and within the garden or problem area and later, turning them over and killing or vacuuming up the bugs that have collected. Applying insecticides will only reduce populations for a few weeks. Apply them early to kill overwintering bugs. A strain of the tachinid fly, *Trichopoda pennipes,* attacks squash bugs in the eastern United States and has been successfully introduced into California.

Grayish squash bugs feeding on a pumpkin (right).

Bronze eggs on the underside of a damaged leaf (left).

Tarnished Plant Bug

Description: Tarnished plant bugs are oval, flattened, and about 1/4 inch long. They can be brown, yellow, or green and have darker markings. They have a small, distinct, yellowish triangle on their back just behind their head. Nymphs look similar to adults, but are wingless, greenish, and marked with black spots behind their heads.

Damage: Tarnished plant bugs inject toxic saliva into the plants when they feed causing yellowish spotted or distorted leaves. Their feeding causes buds to secrete a sticky liquid and shrivel up. Fruit falls early or becomes dwarfed and pitted. Twigs and branches of young peach trees will wilt and die, causing the tree to look bushy or scrubby.

Management: Remove weeds and trash that could provide overwintering sites. Hang unbaited, nonreflective, white, sticky boards low in the trees to monitor their presence. Chemical control is difficult due to the mobility of the bugs.

Scott Bauer,
USDA Agricultural
Research Service,
www.insecimages.org

This tarnished plant bug is green with darker markings (left). Tarnished plant bugs go through five growth stages (below).

University of Gerogia Archives,
The University of Georgia,
www.insectimages.org

False Chinch Bug

Description: False chinch bugs are often confused for chinch bugs, but have a shorter, more narrow body. Adults are grayish brown, 1/8 inch long, and have transparent wings with a series of black dots or dashes on the bottom half. Pink, crescent-shaped eggs are laid in cracks in the soil or on plants and hatch in four days. Nymphs are stubby and gray with red markings.

Damage: False chinch bugs feed with sucking mouthparts. Large numbers congregate on alfalfa, potatoes, beets, cabbage, corn, grapes, and sorghums. Symptoms are a general wilting of the plant. Heavy feeding may turn leaves brown and even kill the plant. The bugs will migrate when plants become less succulent. Often found on weeds, especially mustards, the bugs will swarm.

Management: Eliminate weed hosts. Make sure there are no cracks around structures which false chinch bugs can enter. Insecticides can be temporarily effective, but do not prevent re-infestation of migrating bugs. They are easily drowned.

False chinch bug adults are grayish brown with transparent wings (right).

The feeding by high populations causes plants to wilt and turns leaves brown (left).

Cicadas

Description: Adult cicadas are 1 to 2 inches long, stocky, and usually green with red and black markings. They have large eyes and semitransparent wings with darker veins. Immature cicadas are wingless, pale white, and spend their entire life underground.

Damage: Male cicadas make a piercing, high-pitched sound. The most significant damage is from females who puncture limbs and twigs of ornamentals when laying eggs. Twigs and small branches will wilt, and may die and break off. Nymphs cause minor damage by feeding on roots and removing nutrients, but adults do not feed at all.

Management: Birds eat many cicadas and the cicada killer, a large wasp, paralyzes and lays eggs on them. Cover young trees during emergence, late May and June, and egg-laying.

Adult cicadas have large eyes and clear wings (right).

Kenneth M. Gale, www.insectimages.org

Lacy L. Hyche, Auburn University, www.insectimages.org

Females slit the bark of trees and lay eggs in the interior (left).

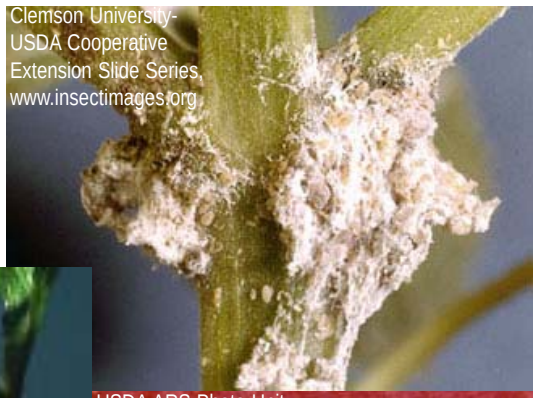
Mealybugs

Description: Mealybugs are soft, egg-shaped, segmented insects that grow about 1/20 to 1/5 inch long. They are usually covered with a white or gray, mealy wax. Males are yellow or red with two, long, whitish tails. Females are grayish, wingless, and move slowly. They lay tiny, yellow eggs in a mass intermixed with white wax.

Damage: Mealybugs suck sap from stems, leaves, and shoots, turning leaves yellow and distorting new growth. They produce large amounts of wax and honeydew that attract ants and is often followed by a black sooty mold fungus. White, cottony masses on plants may also be a sign of a large infestation.

Management: Chemical control is difficult. Natural enemies, including parasitic wasps, ladybird beetles, lacewings, and syrphid flies, often control mealybugs. An introduced predator beetle, *Cryptolaemus montrouzieri*, is available for release. Control ant populations that guard mealybugs for honeydew.

White cottony masses are a sign of a large mealybug infestation (right). Mealybugs produce honeydew, which attracts ants (below).



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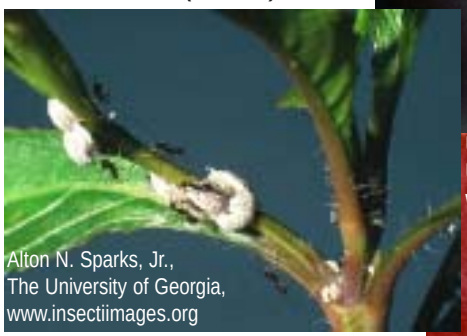


Alton N. Sparks, Jr.,
The University of Georgia,
www.insectiimages.org

USDA ARS Photo Unit,
USDA Agricultural Research Unit,
www.insectimages.org

Mealybugs are covered with a white, mealy wax. When disturbed they secrete a red liquid as a means of defense. (right).

Cyclamen Mite

Description: Cyclamen mites are tiny, about $^{1}/_{100}$ inch long, so only their damage can be seen with the naked eye. They are clear-bodied in immature stages, but are pinkish orange and shiny as adults. The hind legs of females are thread-like, while the male's are pincer-like. Eggs are smooth, oval, and about half the length of the adults. They prefer cool, moist conditions.

Damage: Cyclamen mites badly damage many plants, especially strawberries, as they feed on young leaves at the crown of the plant where they lay their eggs. Common symptoms are curled leaf margins and distorted young leaves. Serious infestations cause the whole plant to be dwarfed, leaves to turn brownish green, and fruit to be small, dry, and withered.

Management: Remove and destroy infested plants immediately. Introducing predaceous mites may also be effective. Chemical control is difficult because the mites reside within unfolded leaves of plants.

Cyclamen mites are too small to be seen, but cause damage to young strawberry plant leaves (left).

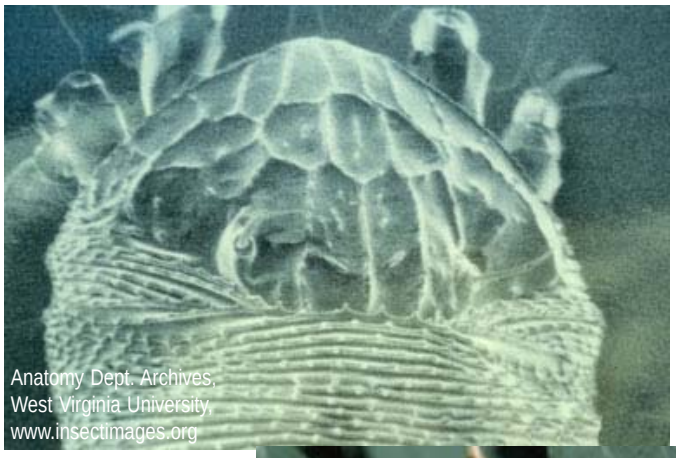
Three strawberry leaves damaged by cyclamen mites are stunted in comparison to a normal strawberry leaf (right).

Eriophyid Mite

Description: Eriophyid mites are very small (average length is about $^{1}/_{16}$ inch), torpedo-shaped, tan to colorless, and slow. Their four legs look like they are coming out of their heads, and their long abdomen has many transverse ridges or rings.

Damage: Eriophyid mites commonly feed in buds or distorted plant tissue. They distort, stunt, and discolor leaves, terminals, or buds, which often drop early. Infested conifers develop deformed, stunted, yellowish needles on new growth. Distorted, woody galls form on branchlets of poplars, ash, and oaks. Symptoms may look like herbicide damage.

Management: These mites feed protected within plant tissue, making them difficult to control. Good sanitation is important. Damage is irreversible and it may be necessary to dispose of infested plants.



Anatomy Dept. Archives,
West Virginia University,
www.insectimages.org

Eriophyid mites are so small that they can only be seen under a microscope (left).

Eriophyid mites cause significant damage to plants, such as discoloration of leaves and leaf curl (right).

Whitney Cranshaw,
University of Colorado,
www.insectimages.org

Pear Leaf Blister Mite

Description: Adults are white or light red with a long body that narrows in the back and has about 80 narrow rings when seen through a microscope. They have two pairs of legs just behind their head that have long hairs on them. There are also long hairs on the sides of their body. The larvae look like the adult mites, except they are smaller. Eggs are dull white and oval, they are laid in galls produced by feeding.

Damage: Damaged leaves will have brownish blisters on the undersides. The blisters on pear are small, greenish swellings that turn reddish and then brown. Apples will have pale yellowish blisters. The blisters might be in masses to where they almost cover the surface. Feeding on developing fruit causes brown, oval, sunken spots. The fruit may also be deformed and misshapen.

Management: Small infestations can be dealt with by simply removing the leaves. Thoroughly apply prebloom sprays to prevent an infestation. Inspect the undersides of leaves for blisters.

Feeding on developing fruit causes brown, oval, sunken spots. Blisters on leaves and fruit turn brown.

Two-spotted Spider Mite

Description: Two-spotted spider mites are small with an oval body, eight legs, and two red eyespots near their head. Many long bristles cover their legs and body. Eggs are spherical and clear, becoming cream-colored before they hatch. Spider mites spin webs, distinguishing them from all other mites. Generally found on the undersides of leaves, they are also found in cracks, crevices of soil, under bark, and on structures. They proliferate during warm to hot, dry, dusty conditions.

Damage: Spider mites suck cell contents from leaves. The damage initially appears as speckles, but leaves turn yellow and drop off as feeding continues. A fine covering of webbing is a sign of a heavy infestation.

Management: Natural enemies of spider mites will generally keep them in check. Most pesticides are not effective and if used, kill natural enemies. Soaps and summer oils are recommended. Prevent dusty, dry conditions, provide sufficient irrigation, use overhead sprinklers, and irrigate often.

Louis Tedders,
USDA Agricultural Research Srv.,
www.insectimages.org

Two-spotted spider mites are only 1/50 inch long and spin fine webs (left).

Two red eyespots are visible in this electrom micrograph of a two-spotted spider mite (right).

Photo by Eric Erbe,
Digital colorization by Chris Pooley,
USDA-ARS Image Gallery,
www.ars.usda.gov

Armored Scales

Description: Armored scales are less than 1/8 inch long, circular to irregular, and flattened. They are usually seen as grayish, brownish, or yellowish encrustations on plants. They secrete a waxy covering over their bodies to protect them as they suck plant juices. Armored scales do not produce honeydew. Oystershell, magnolia white, and California red scale damages ornamentals in Nevada.

Damage: Heavily infested trees will often appear water stressed. The leaves turn yellow and drop, twigs and limbs may die, and the bark may crack and produce gum. Leaves or fruits may also be attacked, leaving blemishes and holes on fruit. This pest transfers plant diseases and can kill trees.

Management: Armored scales can be controlled by natural enemies, such as lady beetles and parasitic wasps. Using insecticides may kill these natural enemies, horticultural and dormant oils are less toxic to predators.

Female magnolia white scale is about 1/8 inch long and pear-shaped (above). This scale feeds on foliage and causes chlorotic spots. Heavy infestations cause leaves to turn yellow and drop prematurely.

European Fruit Lecanium

Description: Adult females of this soft scale are 1/8 to 1/4 inch in diameter, brown, with smooth, soft, plastic bodies that become hard, brown shells at death. Loosely fastened to the bark, its scale serves as a covering for several hundred white eggs. Adult males are small, brown, and gnat-like, and they only live a short time because they cannot feed. Immature scales are light brown, smaller, and more flat than the females.

Damage: Large infestations of European fruit lecanium kill small branches, stunt tree growth, and devitalize the tree until it is subject to attack by borers, diseases, and other stresses. A large amount of honeydew may also be present on leaves or surroundings.

Management: Inspect new plants for scales. Discard infested young plants. Parasitic wasps are natural enemies and may help reduce populations. Insecticides are available.

At death, the hard, brown shell of the adult female serves as a covering for their eggs. Large infestations of European fruit lecanium weaken trees making them suseptible to attack by borers, diseases, and other stresses.

Oystershell Scale

Description: Oystershell scale is an armored scale. The larvae, also called crawlers, have six legs and are small and white. They form a waxy scale coating over their bodies. The scales are gray to dark brown and look like oysters. They can be found on the bark, usually in clusters. Adult males are small with wings. The females are cream-white colored and have no legs or antennae. Grayish white eggs can be found under each female scale.

Damage: Scale insects eat by sucking plant juices. Feeding by oystershell scale weakens plants and can damage fruit. Leaves may turn yellow and dry up. Heavy infestations can kill branches and cause tree decline.

Management: Some scales can be scrubbed off trees. Birds, mites, and wasps are predators of this scale. Branches that are heavily infested should be pruned out. Insecticidal soaps are effective and conserve beneficial species. An oil spray will be most effective in the spring when crawlers are active. Dormant sprays are not effective.

This aspen tree is infested with oystershell scales. This pest sucks plant juices and can transfer plant diseases that kill trees (right).

Oystershell scales are flat and brown (left).

San Jose Scale

Description: Crawlers (young nymphs) are small, orange-yellow, oval, and have two antennae and six legs. Adult females are nearly round with a raised nipple in the center. Except as crawlers, their entire lives are spent under scale coverings. The oval males have a raised dot near the larger end of the scale. They emerge to mate as a small, yellow, winged insect.

Damage: San Jose scale feeds on the sap of apples and other plants, from twigs, leaves, and fruit. Fruit and young bark produce red spots from feeding. The scales multiply rapidly and will eventually kill the plant if not controlled.

Management: Natural enemies do not control San Jose scale. Placing pheromone traps in the tree at the pre-pink stage of apple flowering will trap emerging males. Trap crawlers by placing black tape around infested branches about seven to ten days after petal fall. After the first crawler is trapped, immediately apply a pesticide. Applying superior oil in the prebloom stage is effective. For large infestations, apply an insecticide at early petal fall.

The nearly round scales have a raised nipple in the center (right).

Ken Gray Image Courtesy of Oregon State University

Ken Gray Image Courtesy of Oregon State University

Damaged fruits have red spots (left).

Soft Scales

Description: Soft scales are about 1/4 inch long with antennae and black and brown color variations. They excrete honeydew, and their covers may be smooth, such as the brown and hemisperical scales, or cottony, such as the cochineal scale of cactus.

Damage: Many species occur in Nevada and cause serious damage in nurseries and landscapes. Heavily infested plants appear unhealthy and produce little new growth. Soft scales secrete an abundance of honeydew, which attracts ants and helps produce black, sooty mold on trees and shrubs. Ants protect soft scales from natural enemies and are a sign of infestation.

Management: Control of soft scales can be achieved by natural enemies, such as lady beetles and parasitic wasps. Using insecticides may kill these natural enemies, horticultural oils are less toxic. Control ants, which are attracted to the honeydew and protect the scale from predators.

Hemispherical scales are soft scales about 1/8 inch in size. Adults and several crawlers that have not yet formed their smooth coverings are visible in the picture below.

Cottony cushion scales are 1/8 to 1/4 inch in size (above).

Thrips

Description: Thrips are tiny (less than $^{1}/_{20}$ inch long), slender, yellowish or blackish insects common to many farm, garden, and greenhouse crops. They may be carried over long distances by wind. Adults can be identified by the long fringes on the margins of their wings. Larvae are small, translucent white to yellowish, and wingless. Western flower thrips are common in Nevada on crops and ornamentals.

Damage: Larvae and adults suck plant sap from buds, flowers, and leaves, resulting in distorted or discolored flowers and silvery, stippled leaves. Damage is not noticeable right after feeding. In heavy infestations, the plant parts or the entire plant dries and withers away. Black spots on leaves, which are actually feces, are a sign of thrips activity. Thrips spread incurable viruses to healthy plants they feed on.

Management: Thrips are hard to control because a large portion of their life cycle is protected by soil or plant parts. Chemical control is difficult and not recommended. Insecticidal soaps will reduce populations, but effects are only temporary. Plants may outgrow the damage if they are well irrigated.

Jack T. Reed,
Mississippi State University,
www.insectimages.org

Adult thrips keep their wings folded over their backs (left).

Larvae and adults suck plant sap resulting in dry, silvery, stippled leaves (right).

Whitney Cranshaw,
Colorado State University,
www.insectimages.org

Whiteflies

Description: Found in vegetable and ornamental plantings, whiteflies are tiny, sap-sucking insects with yellowish bodies and whitish wings. They disperse as a cloud of insects when disturbed. Eggs are deposited on the undersides of leaves. Nymphs look like tiny scale insects.

Damage: Whiteflies cause leaves to turn yellow, look dry, and drop prematurely. Leaves may be sticky because of the honeydew produced, and later be covered with a black sooty mold fungus. The honeydew also attracts ants.

Management: Predators include lacewings, big-eyed bugs, and minute pirate bugs. Eggs and pupal stages are difficult to control with pesticides, but parasites and predators attack both. A parasitized whitefly may often appear brown instead of white. Hand remove leaves heavily infested with larvae and pupae stages. Control levels of dust and ants, which encourage them. Insecticidal soap, ultrafine horticultural oil, and syringing with high pressure water are effective.

Adult whiteflies are about 1/32 inch long (left).

Nymphs remain attached to the underside of leaves until they mature (right).

Foliage Eating Pests

Description: Common foliage eating insects in Nevada include caterpillars, sawflies, leaf and flea beetles, and weevils. **Caterpillars** (larvae) of moths and butterflies are long, often multicolored, and may be hairy, bristly, or as in the case of loopers have smooth skin. Their first three thoracic segments after the head have a pair of legs each (six legs total), the next two abdominal segments are legless, and then some of the other abdominal segments have two prolegs—stubby hold fasts. Adult butterflies usually have brightly colored wings, a dark body, two antennae, and may be relatively large as an insect. They do not chew on plants, but may suck nectar from flowers. Fortunately, tussock moths (rarely) and the European gypsy moth are not ornamental pests in Nevada. Leafrollers, loopers, occasionally tent caterpillars, and webworms occur. **Sawfly** larvae are relatively long and narrow, have a distinctly dark or colored head, and they have true legs on the three thoracic segments and a pair of prolegs on the rest of the abdominal segments. Adults resemble true flies with clear wings. The principle sawflies feed on conifers, pears, roses, and junipers. In contrast, **leaf beetle** larvae have no legs or prolegs on their abdominal segments after the three pairs of legs on the thoracic segments. They may be variously colored and often small, less that 1/4 inch long. Adults are small, rounded beetles that may have black or brightly colored, shiny wing covers. Many **leaf** and **flea beetles** exist, but most do little damage to healthy ornamentals. The elm leaf beetle is an annual pest on elms and in severe cases may nearly defoliate a tree, which will survive even with heavy feeding. **Weevil** larvae are small, white, and often feed on roots. Adults have a long snout with chewing mouth parts at the end. The black vine, rose (both of which attack many fruits and ornamentals), and conifer weevils feed on roots and leaves as larvae and foliage as adults.

Foliage Eating Pests

Damage: Caterpillars chew irregular holes along the edges of leaves and may consume the entire leaf. Adult moths and butterflies have sucking mouth parts and only take nectar and reproduce. Some caterpillars build silken tents, webs, or bags as protection from predators. Sawfly larvae feeding creates holes in leaves. Pine sawfly larvae often consume all of last years needles, but not the current year's. Adults do not feed on plants. Leaf and flea beetle feeding may have a distinct pattern. Larvae may skeletonize a leaf (eat only the soft tissue of the leaf, leaving the veins, usually from the underside) while adults eat holes in the leaves. Leaf and flea beetles are comparatively small. Many weevil larvae feed on the roots of plants and adults eat the leaf. Adult weevils eat small irregular notches out of the margin of leaves. Leaf beetles and weevils usually do not devour the entire leaf.

Management: Caterpillars and sawfly larvae have many natural predators including birds, parasitic wasps, and even natural diseases that keep them in check. Commercially available *Bacillus thuringiensis* (Bt) attacks caterpillars and leaf beetle larvae. Tent and bag caterpillars and sawflies may be pruned out and destroyed. Application of a pesticide in a soil drench may be effective for weevils, along with a spray in the evening when adults are actively feeding. Pesticides are also available for tent and bag caterpillars, but are less effective. Refer to the discussions of these pests for more information.

Tent caterpillars are multi-colored and bristly.

Jerald E. Dewey,
USDA Forest Service,
www.insectimages.org

Foliage Eating Pests

Linda Haugen,
USDA Forest Service,
www.insectimages.org

Fall webworm larvae build webs on the ends of branches (left).

Arnold T. Drooz,
USDA Forest Service,
www.insectimages.org

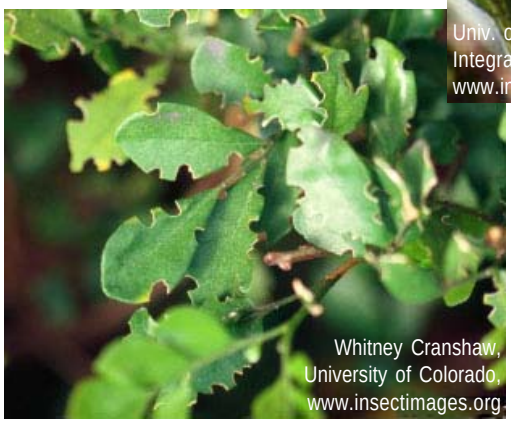
Pine sawfly larvae feeding on last year's growth (right).

Whitney Cranshaw,
Colorado State University,
www.insectimages.org

Elm leaf beetle larvae feeding skeletonizes leaves (left).

Univ. of Illinois, Urbana-Champaign Archives,
Integrated Pest Management,
www.insectimages.org

Flea beetles are a pest to ornamentals and vegetables, including corn (right).



Whitney Cranshaw,
University of Colorado,
www.insectimages.org

Adult root weevils eat notches along leaf edges (left).

Beet Armyworm

Description: Beet armyworms are 1 1/4 inches long and green with light stripes and smooth skin. Commonly, they have a black spot on the segment above the second leg. Eggs are laid in masses covered with hairlike fluff on crowns of seedlings and on leaves of older plants.

Damage: They eat all parts of the plant, but prefer leaves and flowers and damage nearly all greenhouse and bedding plants. They skeletonize leaves and make shallow gouges in tomato fruits. Signs of infestations are egg masses and parasitized armyworms.

Management: Viral diseases, parasites, and general predators can naturally control beet armyworms. The fluff covering the eggs protects them from parasites. Handpicking can be an effective control.

Eggs are laid in fluffy masses on leaves (right).

Beet armyworms skeletonize leaves (left).

Mature beet armyworm caterpillars have smooth skin (right).

Elm Leaf Beetle

Description: Adult elm leaf beetles are 1/4 inch long, and yellow to olive-green with a black stripe along the margin of each wing cover. On the underside of leaves, 5 to 25 yellowish to gray eggs are laid in double rows along veins. Females lay up to 400 eggs. There are two to three generations a year. Immature larvae are black. They are a dull yellow or greenish with rows of tiny, dark tubercles that form two black stripes down their back when mature.

Damage: Elm leaf beetles feed on elms and zelkova. Larvae skeletonize the leaf surface causing the leaf to die and drop prematurely. Adults eat small holes in leaves. Heavy defoliation weakens trees, making them more susceptible to attacks by bark beetles, borers, and diseases.

Management: The black tachinid fly (*Erynniopsis antennata*), a tiny wasp (*Tetrastichus brevistigma*), and an egg parasite (*Tetrastichus gallerucae*) are effective when used with other management methods. Give elms proper irrigation and prune dying branches during late fall and winter. Bark band trees and apply foliar sprays of selective or low residual toxicity insecticides that conserve natural enemies. Chemical control can be obtained by spraying when the eggs are hatching, usually in late May.

Adults are yellow with a black stripe along the margin of each wing cover (left). Elm leaf beetle larvae skeletonize leaves (above).

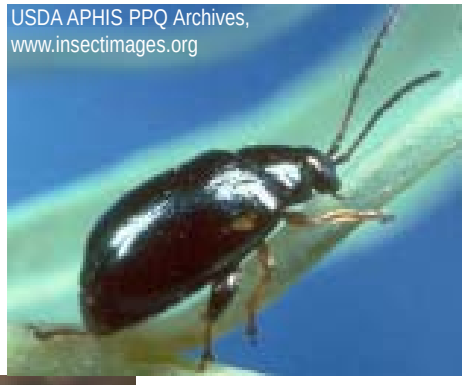
Flea Beetle

Description: Flea beetles are small and shiny with enlarged back legs used for jumping. All species are oval in shape, but they vary in color, size, and pattern. The early life stages of flea beetles occur underground, so only adults are commonly seen. Tiny, white eggs are laid near the base of the plant on or in the soil. The larvae are white, slender worms.

Damage: Flea beetles are mainly a problem to corn and plants of the Solanaceae family: tobacco, potato, tomato, eggplant and petunias. Feeding on leaves by adults results in tiny pits or tiny holes. If many beetles are feeding, the leaves may be covered with bleached, pitted areas, or ragged holes. Larvae feed on roots of plants, but rarely cause serious injury.

Management: Control weeds and remove any debris or trash that might be used as shelter. Older plants can tolerate feeding by flea beetles and seedlings can be protected with protective cloth or other coverings. Insecticides may be effective.

Flea beetles have enlarged back legs used for jumping (right).



Adults feeding on this potato leaf have left it with tiny holes (left).

Shothole Borer

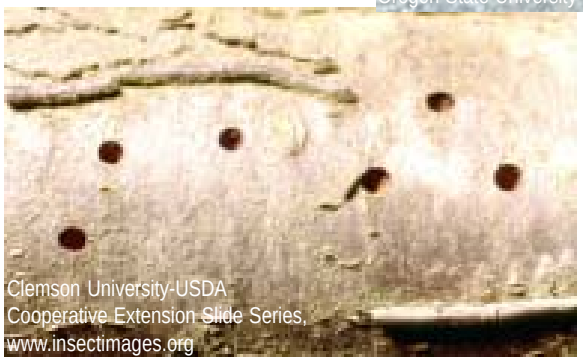
Description: Adults are 1/10 inch long, brown-black with red on their wing covers and legs, and sparse, yellow hairs on their bodies. The wing covers have depressions fitted with lines of tiny punctures. The posterior margins of the wings have a saw-toothed edge. Larvae are whitish, legless grubs with a pink tint and a yellowish head.

Damage: Weakened trees are most susceptible. The beetles attack the trunk, branches, and twigs of stressed fruit and ornamental trees. Larvae burrow between the bark and sapwood creating brood chambers parallel to the length of the tree and galleries at right angles. The burrowed area is filled with dust-like, reddish brown frass. Round entrance holes in the bark are created for females to deposit their eggs. Similar holes are also made for beetles to emerge from after the pupal stage.

Management: Trees must be kept healthy to avoid attack by shothole borers. Use fertilizer and proper irrigation to help restore weakened trees. Remove and burn infested or diseased branches or trees during winter. Parasitic chalcid wasps are an important natural enemy. Apply pesticides when the beetles are active.

Adult shothole borers have short snouts (right).

Ken Gray Image Courtesy of Oregon State University



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Beetles create small, round exit holes in the bark (left).

Leaf-footed Bug

Description: Adults are 5/8 to 3/4 inch long, chestnut brown with some orange on the dorsal abdomen that is visible when the wings are raised. They have a flattened, leaf-like area on their hind legs and four-segmented beaks, which is a distinguishing characteristic. Nymphs have a similar shape as the adults. Golden brown eggs are laid closely together in a row or chain along a stem or leaf midrib.

Damage: In Nevada, leaf-footed bugs are a problem on pomegranates, but this bug also attacks other crops and ornamentals. The adults puncture fruit, causing it to split, rot, and drop.

Management: Hand picking, cultural methods, and insecticides can be used to control leaf-footed bug. Removing the infected fruits should prevent infestation in other plants. The polyphagus tachinid fly (*Trichopoda pennipes*) can be used for biological control. Birds, spiders, assassin bugs, and other predators are natural enemies.

Nymphs are similar shape to adult leaf-footed bugs (left).

Adults have flattened, leaf-like areas on their hind legs (right).

Corn Earworm

Description: Corn earworm moths are about 3/4 inch long with a wing span of 1 to 1 1/2 inches. They are olive-green to tan, or dark reddish brown and are very active during the night. Eggs are laid on the foliage throughout the sweet corn growing season. The larvae are about 1 1/2 inches long and vary in color from pale green or pinkish brown to nearly black. They usually have lengthwise stripes and a lighter underside.

Damage: Corn earworm larvae prefer to feed within the ears, but also feed on leaves, tassels, and the whorl. Symptoms are feeding damage to kernels, and extensive excrement at the ear tip. Young larvae feed on corn silks, clipping them off, and moving into the ear where they continue feeding until they leave to pupate in the soil.

Management: Many predators and parasites, including lacewings, minute pirate bugs, and damsel bugs, attack corn earworm eggs and small larvae. Parasitized eggs usually turn black. Deep cultivation in spring exposes or kills pupae. Control can be obtained using insecticides and oils. Repeated applications may be necessary.

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Larvae damage young corn by feeding within the ears (left).

Steve L. Brown, The University of Georgia, www.insectimages.org

Corn earworm moths have a wing span of 1 to 1 1/2 inches (right).

Rose Curculio

Description: Rose curculio is a 1/4 inch long, red to black weevil with a distinctive, narrow snout. The larvae are small and whitish.

Damage: The rose curculio produces ragged blossoms and holes punched in flowers and canes. It punctures roses with its beak to feed. Adults make small, round holes in the flower buds and lay eggs. They also feed on the floral parts within the buds, causing them to never open or appear ragged as they develop. Larvae feed on reproductive parts of the flower, seeds, and petals.

Management: Yellow and white roses are preferred by rose curculio. Netting can be used to protect rose bushes by letting sunlight and water in, but not the insects. Handpick adults and remove any damaged buds and spent blooms before larvae emerge. When disturbed, rose curculios drop and play dead. Place a container of soapy water below where they are feeding, shake the plant, and they will fall into the water and drown. Minute pirate bugs prey on them. Pesticides may be used for severe infestations.

Rose curculio damage to fruit (right).

Ken Gray Image Courtesy of Oregon State University

Ken Gray Image Courtesy of Oregon State University

Adult rose curculio with its distinctive snout (left).

Grasshoppers

Description: Grasshoppers are 1/4 to 3 inches long, brown or green with some darker markings. They have big hind legs used for jumping, and two pairs of wings. Eggs are deposited in late summer in elongated masses or pods inserted into the soil. The young hatch in spring and after molting five or six times, the adults appear, feed, and mate.

Damage: Grasshoppers feed on nearly any kind of vegetation, particularly grasses. High populations can cause serious damage to young trees or to fruit, foliage, and new growth on older trees. They chew holes in leaves and fruit.

Management: Blister beetles, ground beetles, anthomyiid flies, and bee flies reduce grasshopper populations by laying their eggs in the soil near or in the egg pods. Tilling egg beds kills the eggs. Applying recommended pesticides to hatching areas is effective. Birds, mammals, and predatory insects feed on grasshoppers. Under favorable conditions, the fungi *Beauveria bassiana* and *Entomophthora grylli* cause grasshoppers to become diseased and die. *Nosema locustae,* a disease-causing protozoan, can be used as bait for controlling grasshoppers in rangeland when free moisture is present.

Whitney Cranshaw, University of Colorado, www.insectimages.org

The twostriped grasshopper is a major crop pest in the less arid parts of Nevada (left).

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Grasshoppers chew holes through leaves, like this redlegged grasshopper found throughout Nevada (right).

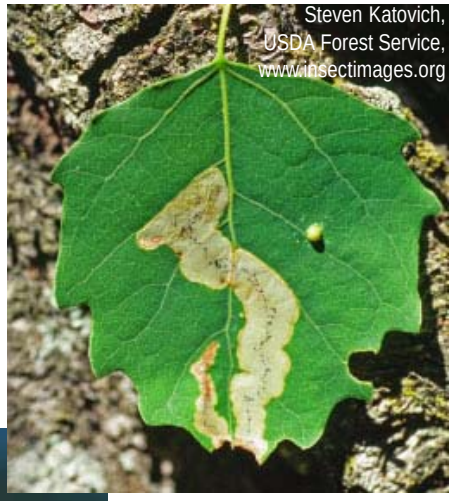
Blotch Leafminer

Description: Blotch leafminers are small, shiny, black flies with clear wings. Larvae are yellowish white.

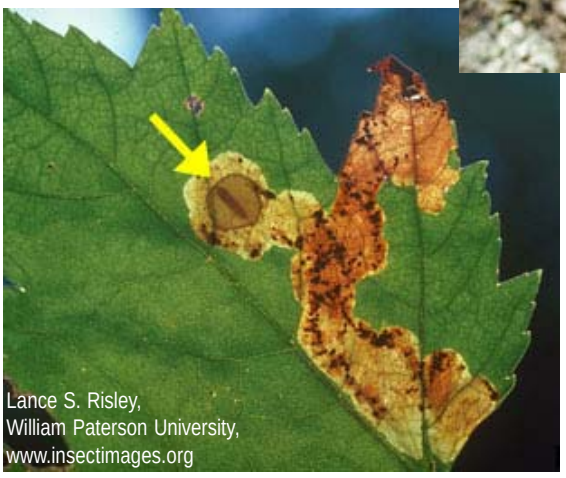
Damage: Females puncture leaf surfaces of trees, shrubs, and vines to feed on sap and to deposit eggs, turning foliage white and giving it a stippled or speckled appearance. Larvae mine inside leaves, causing blotches or irregular tissues and making leaves unattractive and unmarketable. Flowers may also be mined during heavy infestations. The poplar blotch miner attacks the leaves of poplars and cottonwoods across Nevada.

Management: Get rid of infested plants and control host weeds. Avoid continuous cropping and excess fertilization. Pesticides will only provide control if combined with other efforts. Nematodes may control leafminers under dark and moist conditions. Parasitic wasps control leafminers in natural habitats.

Larvae mine inside leaves causing blotches (right and below).



Steven Katovich,
USDA Forest Service,
www.insectimages.org



Lance S. Risley,
William Paterson University,
www.insectimages.org

Blotch leafminer larva visible inside mine (left).

Serpentine Leafminer

Description: Adult serpentine leafminers are 1/8 inch long flies with a yellow and black upper body and a black head. Females lay tiny eggs in leaves. Larvae are yellow-green, legless maggots that feed beneath the leaf surface. Pupae are oblong and brown to gold.

Damage: Serpentine leafminers mine the middle tissue layer of leaves of vegetables, flowers, and fruits. Narrow mines produced near the leaf margin are unattractive, but rarely kill the plant. Characteristic white, winding trails are left across leaves, especially in grapes.

Management: Get rid of infested plant leaves and control host weeds. Avoid continuous cropping and excess fertilization. Pesticides will not provide long-term control unless combined with cultural practices.

Maggots feed beneath the leaf surface and are 1/8 inch long (right).

Serpentine leafminers leave white, winding trails on leaves (left).

Fruittree Leafroller

Description: Eggs are laid in June in irregular masses on twigs and branches. They overwinter and then hatch in February or mid-March. Caterpillars have green bodies and shiny black heads. Mature larvae pupate within leaf rolls or in thin cocoons on branches or the trunk. Moths emerge after 8 to 11 days. They have brown forewings with gold and white spots, hind wings are smoky gray.

Damage: Fruittree leafrollers mostly feed on fruit and shade tree leaves, but may feed on blossoms, flower buds, and fruit. Larvae often roll and tie leaves, and sometimes fruit, together with silken threads. They eat fruit, causing deep cavities. Fruits may fall, become misshapen, or develop deep bronze-colored scars with roughened net-like surfaces.

Management: Search for egg masses and destroy them. Predators such as lacewings and ladybird beetle larvae feed on fruittree leafroller larvae. Handpick and destroy rolled leaves or webbed plant parts. Apply an oil spray in late winter and mid-January and February before buds begin to open. Be sure to spray all egg masses and smaller twigs.

Fruittree leafroller larvae feed on leaves (right).

Fruittree leafroller moths have brown forewings with gold and white spots and smoky gray hind wings (left).

Obliquebanded Leafroller

Description: The adult moths are 3/8 to 1/2 inch long and tan with an oblique, chocolate brown band across their forewings. Greenish eggs are laid in oval masses on the upper surface of leaves. Mature larvae are dark green with a brown to black head capsule and thoracic shield.

Damage: Larvae feed on flower parts, leaves, and young fruit of tree fruits and weeds early in the season. Leaves or flower parts may be webbed together and fruit may drop or be deformed. Feeding in the summer results in shallow tunnels under the skin of fruit, and young larvae chew small holes in the fruit.

Management: Use pheromone traps to monitor a population. There are several biological control agents that may provide control, including parasitic wasps and a tachinid fly. It is easiest to control obliquebanded leafrollers with insecticides early in the season. Broad spectrum pesticides will control this pest in larval and adult stages. Obliquebanded leafrollers have become resistant to some pesticides.

Adult moth (left).

Obliquebanded leafroller larvae are green with a dark head and thoracic shield (right).

Lesser Appleworm

Description: Adults are small moths, only about 1/4 inch long. They are dark with gold on their wings and head. Larvae hatch from white eggs with yellow in the center. They look very similar to oriental fruit moth larvae. Mature lesser appleworm larvae are pinkish and have a dark brown head.

Damage: Lesser appleworm mainly attacks apples, plums, and cherries. Damage is very similar to that done by codling moths. Larvae mostly feed on fruit, but also eat twigs and shoots. They mine under the outer skin of apples, producing a visible twisted tunnel. The blotchy mine is very shallow, rarely deeper than 1/4 inch. Infested twigs will have wilted leaves that eventually turn brown and die.

Management: Pheromone traps can be used to monitor the presence of lesser appleworms. Spray applications should be made before eggs are laid and when larvae hatch. Control measures used for codling moth will also control lesser appleworm.

Lesser appleworm larvae are pinkish with dark heads (above). Adult moths are dark with gold on their wings (left).

Honeylocust Pod Gall Midge

Description: These small (less than 1/8 inch long), black or brown flies lay microscopic clusters of red eggs on new leaf buds in early spring. Eggs hatch in two days. The cream-colored larvae feed on new leaflets, producing galls. Larvae pupate inside the gall, once they emerge the gall dies and drops, leaving bare leaf stalks. Midges overwinter in cocoons in the soil near the base of trees. Midges have multiple generations per year and are most active on new shoot growth until midsummer.

Damage: New leaflets develop unnaturally into brown, green or reddish galls. Heavy infestations destroy the new leaflets, which causes leaves to turn brown and drop prematurely, leaving branches bare. Twig dieback may occur. Leaflets that have fully expanded at the time of infestation are not affected.

Management: Several predaceous and parasitic wasps feed on this midge. Interval spraying with superior or supreme horticultural oil to cover branch terminals as leaflets emerge reduces damage. Chemical controls are available, but pod gall midges can become resistant. Plant alternative species or green-leaved, not yellow-leaved cultivas of honeylocust that are susceptible to attack.

The less than 1/4 inch larvae are cream-colored (above).

The tiny flies are inconspicuous and usually go unnoticed (above) until deformed leaves and pod galls appear (left).

Pear Psylla

Description: Pear psylla can only complete its development on pear trees, but may be found on other hosts. The adults are small with brown to reddish bodies and a dark spot on the top middle edge of both transparent wings. They lay tiny, yellowish orange eggs on or near fruit spurs. There are five immature stages.

Damage: Pear psylla spreads a phytoplasma that causes pear decline, which reduces tree vigor and produces poor fruit set, small fruit size, and tree death. Pear psylla also causes blackening and burning of foliage because it injects a toxin into the tree tissue as it feeds. High populations feeding for several seasons may cause psylla shock, which is a yellowing of the foliage in spring and premature redding and defoliation in the fall. Nymphs produce honeydew as they feed. A black, sooty fungus grows on the honeydew.

Management: Predators and parasites of pear psylla are minute pirate bugs, green lacewings, brown lacewings, ladybird beetles, predaceous mirids, spiders, and small parasitic wasps. Dormant sprays can be applied to reduce the populations and are most effective when used before egg laying begins. Ultrafine horticultural oil can then be applied to keep populations low.

Clear-winged adult pear psylla (left).

Pear psylla leaf damage (right).

Pear Sawfly or Pear Slug

Description: Young larvae are pale with a light brown head. Particles of leaf tissue can be seen within their nearly transparent bodies as they eat. Pear sawfly is also known as pear slug because the larvae exude olive-green slime over their bodies. Mature larvae are orange-yellow and about 1/2 inch long. Adult pear sawflies are black and yellow with four wings. They are only slightly larger than the common housefly. There are two generations per year.

Damage: Larvae feed on leaf tissue in a circular pattern. They skeletonize leaves, leaving only the veins. They do not attack fruit.

Management: Washing an infested tree with a forceful stream of water will remove the slugs. There are many parasites and predators that attack pear sawfly and help manage the species. If a fruit tree is treated for other insects with a pesticide, pear sawfly will most likely not be a problem. Populations in neglected or unsprayed trees, however, can increase rapidly.

Larvae look like slugs. They skeletonize leaves (left).

Adult pear sawflies are a little larger than the common housefly (right).

Pine Sawfly

Description: There are many species of pine sawflies. Adults are brown to black, similar in size to common houseflies, and have two pair of wings. They emerge from cocoons in late summer to early fall, mate, and lay eggs in current-year pine needles. Eggs overwinter and larvae emerge in the spring. Larvae grow to 1 inch long, are grayish green to yellowish brown with dark stripes along their side and back, and have a black head. Unlike caterpillars, appendages are noticeable on each body segment. They finish feeding in mid to late summer, spin cocoons, and pupate. Only one generation is produced a year.

Damage: Trees are rarely killed by the feeding of pine sawflies. Larvae feed on older foliage, seldom consuming current-year needles. They move in colonies from one branch to another and then onto adjacent trees. Moderate to severe defoliation can occur, reducing tree growth. Repeated defoliation causes trees to weaken and become more susceptible to other stresses.

Management: Pine sawflies have many natural enemies to keep populations in check. They are killed by natural occurring diseases, fungal and bacterial pathogens, parasitic wasps, birds, shrews, mice, ants, and other insect predators. Unfavorable weather, such as late spring frosts, also keep them under control. Prune out infested branches or, if necessary, spot treat branches with pesticides in order to preserve natural enemies.

Adult fly (below).

Louis-MichelNageleisen, Departement de la Sante de Forets-France, www.insectimages.org

E. Bradford Walker, Vermont Department of Forests, Parks and Recreation, www.insectimages.org

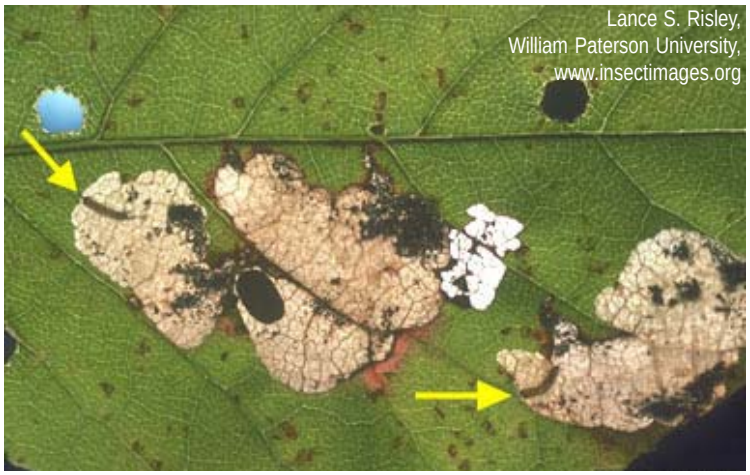
Larvae have noticeable appendages on each body segment (above).

Shield Bearers

Description: Shield bearer moths, several species live in Nevada, are leaf miners as larvae. Mature larvae are about $^{1}/_{10}$ inch long, legless, and brownish orange.

Damage: The larvae feed on the middle tissues of leaves, causing translucent, brown patches in the leaves. If an infected leaf is held up to the light, the larvae can be seen. Full grown larvae cut oval sections out of the upper and lower leaf epidermis, web them together with silk, and drop out of the leaf on a silken thread. The shields may be noticed as they hang for a while before reaching the ground. Damaged leaves will drop prematurely from the tree, but permanent damage to the tree does not usually occur. They commonly attack poplars, cottonwoods, oaks, manzanita, and fruit trees.

Management: Reduce other stresses on infested trees as much as possible through adequate irrigation and fertilizer application. The shield bearer will not be a big problem if the tree is in good health. Chemical control is difficult because larvae live inside leaves. Spraying is not recommended for shield bearer control.



Shield bearers are leaf miners as larvae and feed on the middle tissues of leaves causing translucent, brown patches. Larvae are visible when the leaf is held up to the light .

Tomato Hornworm

Description: Larvae are 3 1/2 to 4 inches long and pale green with white and black markings. A red or black spine-like horn on the rear of this caterpillar gives the insect its name. Adults are large, grayish sphinx moths with a wing span of 4 to 5 inches.

Damage: Larvae feed on the leaves and stems of tomatoes, leaving dark green or black droppings that are easier to spot than the insect. The foliage will have large, ragged holes, and entire leaves may be stripped to the veins or gone. They also attack the foliage of potatoes, eggplants, and green peppers. Parasitized hornworms will be covered with white bumps, and should be left alone.

Management: Handpicking and destroying tomato hornworms is effective. Natural enemies, such as the parasitic wasp, should be left so they can parasitize the hornworms. The bacteria *Bacillus thuringiensis* is very effective in controlling tomato hornworms.

Adults are grayish moths with large wing spans (right).

Jim Occi, BugPics, www.insectimages.org

Robert L. Anderson, USDA Forest Service, www.insectimages.org

The spine-like horn on the catepillar's rear gives this insect its name. (left).

Black Vine Weevil

Description: Black vine weevils are oval and about 1/2 inch long. They are slate gray to black and have a short snout with elbowed antennae. The weevils have wings that are covered with many small pits and patches of short hairs, but they cannot fly. Larvae are C-shaped, legless grubs that are white with a brown head.

Damage: Black vine weevils are pests of over 100 landscape plants. The grubs cause the most severe damage by feeding on the roots and underground stems. Adults eat notches out of leaf margins, but their feeding rarely impact the health of the plant. Symptoms of black vine weevils include stunting and yellowing. Root injury may stunt new growth and even result in death.

Management: Pit fall traps or beating sheets can be used to monitor the activity of adult weevils. Nocturnal adults begin feeding at dusk. Hand remove adults on single plants or in small plantings. Application of an insecticide before eggs are laid may be effective. Insect parasitic nematodes may control larvae if temperatures are warm enough and there is adequate soil moisture.

Peggy Greb,
USDA Agricultural Research Service,
www.insectimages.org

Grubs cause damage by feeding on roots and underground stems (left).

Joseph Berger,
www.insectimages.org

Black vine weevil adults have elbowed antennae (right).

Hollyhock Weevil

Description: Hollyhock weevils are very small (1/8 inch long), slim, gray to blackish beetles with conspicuous snouts. Snouts of males are about half as long as their bodies, and those of females are even longer. Females lay eggs in developing flower buds. Larvae are white and legless. They feed on the developing seed embryos and pupate within the seed, emerging later as adults through holes they eat in the seed pod.

Damage: Hollyhock weevils feed on seeds, buds, and leaves of hollyhock. Damage on leaves looks like small, round holes. Feeding by larvae reduces the seed production by destroying seeds.

Management: To control hollyhock weevils, remove and destroy the infested seed pods before the larvae emerge. Shaking the hollyhock plant over a sheet will cause the adults to drop. Application of an insecticide to hollyhock leaves may reduce damage.

Hollyhock weevil larva develop within the flower bud (left).

Hollyhock weevils have prominent snouts (right).

Strawberry Root Weevil

Description: Adult strawberry root weevils are about 1/5 inch long, light brown to black, with many rows of small pits or punctures along their back. They have a long snout, and cannot fly. Tiny, pearly white eggs are laid in the soil around the base of plants throughout the summer. Larvae are white, C-shaped, legless, and about 1/4 inch long.

Damage: Larvae tunnel in the roots and crowns as they feed on strawberry, lilac, mock orange, and other ornamental plants, causing stunting and darkening of plants. The leaves of injured plants are closely bunched, dark, and blue-green. This serious damage may weaken the plant so much that it dies. Adults eat small, irregular notches from the edges of leaves, but do not otherwise seriously damage woody shrubs.

Management: To prevent insects from establishing in adjacent areas, plow under or till old strawberry beds immediately. Plant unsuitable hosts, such as corn, pumpkins, and perennial flowers, for at least two years. Fall plow infested planting beds, and move new plantings away from infested sites. Treat the surface soils with chemicals when adults begin to emerge. Soil drenches may reduce larval numbers.

Adult strawberry root weevils have small pits along their backs (above).

Adults eat small notches from the edges of leaves. Characteristic black spots, fecal matter, is left on leaves (below).

Codling Moth

Description: Adults are 3/8 inch long, gray, mottled moths with a 1/2 to 3/4 inch wing span and dark brown wing tips. White, disk-shaped eggs are laid singly on fruits, nuts, leaves, or twigs. Codling moth larvae are 1/2 to 1 inch long, white to pink caterpillars with mottled brown heads. In early spring, larvae pupate in silken cocoons.

Damage: Codling moths attack apples, pears, walnuts, and plums. Larvae chew through the fruit's skin or bore into the flesh, leaving a small scar. Larvae also bore to the core and feed in the seed cavity. The surface of the fruit may have small holes covered with frass. As pears near maturity, a syrupy substance may exude from exit holes.

Management: Pheromone traps can be used to monitor codling moths. Trapping larvae in a trunk band can be effective. Enclosing fruit on the trees in bags will prevent accessibility. Some control may be obtained if the egg parasite *Trichogramma* spp. is mass-released during peak egg laying time and combined with other control methods. Insecticides must be applied just as eggs are hatching to be effective.

Codling moth larvae bore into the flesh of fruit and feed in the seed cavity (left).

Adults are gray, mottled moths with dark brown wing tips (right).

Dendroctonus Beetles

Description: Adults are stout, 1/8 to 1/4 inch long, cylindrical, dark reddish brown to black beetles. They work in pairs, boring through the bark and extending an egg gallery between the bark and wood. Egg galleries are packed with boring dust, except the portion where beetles are working, distinguishing them from most other bark beetle groups. Problem bark beetles in Nevada are the Douglas-fir beetle (*D. pseudotsugae*), Jeffrey pine beetle (*D. jeffreyi*), mountain pine beetle (*D. ponderosae*), and spruce beetle (*D. rufipennis*). The round-headed pine beetle (*D. adjunctus*) and the western pine beetle (*D. brevicomis*) are also found in Nevada.

Damage: A tree infested by Dendroctonus beetles may have pitch tubes (strings of sap) on its trunk and red boring dust in bark crevices and on the ground. Foliage will be discolored, and the wood of attacked trees may become blue-stained by fungi. Each species produces a uniquely shaped gallery. Western pine beetles galleries are much branched and wind laterally and longitudinally, crossing in a maze-like pattern. Mountain pine and Jeffrey pine beetle galleries are long and perpendicular with short bends at the bottom. Douglas-fir beetles have perpendicular, straight, or somewhat winding galleries. Spruce beetle egg galleries are vertical and usually filled with pitchy frass (wood dust). Round-headed pine beetle egg galleries are horizontal but then they wind longitudinally.

Management: Reduce the threat of Dendroctonus beetles by thinning, watering, and fertilizing your trees. Healthy trees resist egg laying by exuding pitch and the eggs through the hole in which the eggs were laid. Under stress, a tree reaches a threshold where not enough pitch can be produced to eliminate the eggs. Remove and dispose of any infested trees or infested tree parts on the ground. Burning or chipping kills bark beetles. Debark wood of infested trees to destroy the galleries with eggs and larvae. Insecticides can be applied to the bark of the trunk and large branches of uninfested trees to protect them.

Dendroctonus Beetles

Douglas-fir beetle galleries are mostly in the inner bark and only slightly etched in the sapwood (below).

Adult Douglas-fir beetles are only 1/4 inch long (above).

Mountain pine beetles deposit their eggs in long, perpendicular egg galleries (below).

Mountain pine beetles are stout, black, cylindrical beetles (above).

Spruce beetle galleries are vertical, and eggs are laid in long grooves on alternate sides (below).

Spruce beetles are dark brown to black and hairy (above).

Ips Beetles

Description: Ips beetles, or engraver beetles, are 1/8 to 3/8 inch long and reddish brown to black. A pronounced cavity at their rear is lined with three to six pairs of toothlike spines. Ips beetles make galleries just under the bark of trees. This borer does not pack its tunnels with boring dust. They construct a central nuptial chamber from which several egg tunnels radiate outward at right angles. Ips species found in Nevada are *Ips woodi*, *I. pilifrons*, and *I. confusus*.

Damage: Ips predominantly attack pines and spruces. Foliage will change from green to yellow, and eventually a reddish brown. The tops of trees die back, a severe infestation kills the entire tree. They leave a yellow or reddish boring dust (frass) in bark crevices, in small piles around entrance holes in the bark, or on the ground. Pitch tubes (sap from the tree) are not usually formed.

Management: These bark beetles attack in the spring with the coming of warm weather. They rarely attack healthy trees, so use practices that promote vigorous tree growth. Freshly pruned limbs and wood piles are usually infested. Newly transplanted trees, trees with root injuries, drought-stressed trees, and trees surrounded by large populations of Ips beetles are at the most risk of attack. Preventive insecticides can be applied on the trunks and large branches of trees prior to an adult beetle infestation.

A cavity at their rear is lined with three to six spines (left).

Foliage on attacked trees changes from green to yellow (above).

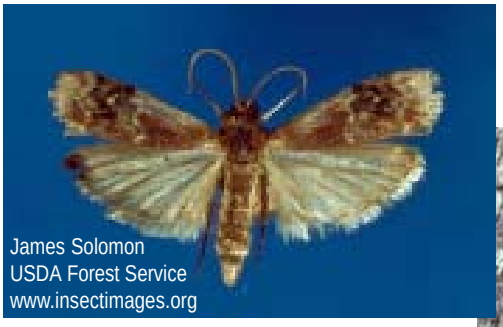
Boring dust can be found on the ground around attacked trees. (right).

American Plum Borer

Description: American plum borers are 1/2 to 1 inch long, grayish brown moths with reddish brown forewings marked by wavy, black and brown vertical bands. Hind wings are pale brownish gray with darkened margins. Larvae are grayish green to grayish purple and pass through seven instars. Pupae are tan to dark brown with black eyes and are found under the bark in white, silken cocoons surrounded by reddish frass.

Damage: American plum borers are pests of commercially grown nut and fruit trees and many ornamentals. Larvae enter the cambium layer through openings created by mechanical damage, diseases, sunscald, etc. They feed horizontally, which girdles the tree. Damage is not seen on the outer surface. American plum borers can also spread plant pathogens.

Management: Birds, particularly woodpeckers, feed on the larvae. Parasitic wasps, predatory insects, and spiders are also natural enemies. Fungi of the *Hirsutella* spp. attack the larvae. Insecticides can be used. Apply an effective pesticide when the first generation adults are emerging in spring and summer.



Adult American plum borers are moths (left).

American plum borer mine cavity. Note the larvae and silken cocoon (right).

Bronze Birch Borer

Description: Adults are about 1/2 inch long, hard-shelled, and slender. They are brown with a greenish tinge. The creamy white larvae are slender and flattened. The larvae pupate within the trunk and large limbs. They emerge as adults through 1/8 inch wide, D-shaped holes cut in the bark.

Damage: Bronze birch borer attacks all species of birch. Larvae bore into the cambium, creating long, winding galleries. Feeding can result in raised bumps or welts on the bark's surface. Yellowing and thinning of leaves may occur in the upper crown. Leaves may show marginal burning or browning on affected branches. Larval feeding stops the flow of water and nutrients when vascular tissue is severed, eventually leading to the death of the tree.

Management: Maintain healthy trees to avoid bronze birch borer attack. Mulch landscape birch trees to moderate soil temperature and conserve soil moisture. Destroy (chip or bury in a landfill, do not save as fire wood unless debarked) infested trees before adults emerge in spring. Woodpeckers and a chalcid wasp (*Phasgonophora sulcata*) are natural enemies. Pesticides may be applied to kill egg-laying adults or larvae before they enter the bark. A soil drench of a systemic insecticide around the base of the tree controls the larvae. Use as a preventive each spring.

A slender adult and two D-shaped exit holes (above). Feeding results in raised welts on the bark's surface (right).

Giant Palm Borer

Description: The adult is a large, 3-inch, dark brown to black beetle. It emerges at night 10 to 15 feet below the bud from the trunks of palms. After a short period, it flies to a nearby palm, mates and lays up to 450 eggs in a chamber beneath the bud. The giant larvae are 3/4 inch in diameter and 3 inches long.

Damage: First signs of beetle damage are off-colored leaves, then the death of the bud, leaves, or entire crown from the feeding, tunneling and egg laying of the females. After the eggs hatch, larvae tunnel and feed within the trunk for several months. They then pupate in a chamber near the outside of the trunk where they emerge as adult beetles to mate and initiate the cycle again. The 3/4 inch diameter tunnels greatly weaken the tree. The more tunnels there are, the more weak and hazardous the tree becomes. Feeding damage is found in many palms, but the California Fan Palm, *Washingtonia filifera*, the Mexican Fan Palm, *W. robusta*, and the Date Palm, *Phoenix dactylifera,* are most often attacked.

Management: Require a certificate of inspection stating that the palms you buy are borer-free. Inspect all palms for feeding damage, frass (sawdust-like debris) and a large egg-laying chamber at the base of the bud. A stethoscope may be used to listen for the gnawing of larvae near the bud end of the palm. Reject or destroy infested trees. Burn, chip, or bury them in a landfill. No chemicals are registered for control.

Jeff Knight,
Nevada Department of Agriculture

Adult beetles are dark brown or black (above).

Larva are tan to orange and 3 inches long (below).

Jeff Knight,
Nevada Department of Agriculture

Jeff Knight,
Nevada Department of Agriculture

Large feeding tunnels damage palm trunks (above).

Locust Borer

Description: Adults are slender beetles about 3/4 inch long with long, black antennae. Their bodies are black with yellow bands and reddish legs. Their wing covers form a W-shaped band. Eggs are laid in bark crevices and around wounds on the trunk and large branches of trees. Mature larvae are legless, about 1 inch long, and have a reddish brown head. Pupae are creamy white and about 3/4 inch long. The larval and pupal stages take place within the tree.

Damage: Locust borers only attack black locust and its cultivars. Larvae tunnel into the trunk and branches, causing broken limbs and knotty swellings on the trunk. In early spring, a symptom of borer attack is wet spots on the bark. In late spring or early summer, white wood dust can be seen on the bark as they burrow into the heart wood. Later in the summer the boring dust will be yellow.

Management: Trunks and large limbs of black locust shade trees can be sprayed with carbaryl for protection. Repeat applications are necessary. Thinning will be beneficial on moderate to lightly injured stands of trees. There is less injury when black locust is grown with other tree species. Remove older trees under stress with dying tops and plant mixed stands of trees.

Locust borer adults are black with yellow bands (right). Adults leave exit holes in the stems of trees (below).

Clemson University - USDA Cooperative Extension Slide Series, www.insectimages.org

James Solomon, USDA Forest Service, www.insectimages.org

Peachtree Borer

Description: Adults are steel blue to black moths with yellow or orange markings. Males have clear wings with several narrow, yellow bands on their abdomen, while females have metallic blue scales covering their wings and a broad, orange band on their abdomen. Larvae are light brown or pinkish with a darker head. They have one generation each year and survive winter in tunnels they make at the base of trees. In spring, they spin silken cocoons covered with sawdust borings and soil fragments.

Damage: Peachtree borers damage the limbs and trunks of deciduous stone fruit, nut, and ornamental trees. Larvae feed just below the bark of the trunk near the ground and burrow up into the tree. Gum is exuded and piles of reddish brown frass are left at the entrances of the tunnels.

Management: Pheromone traps can be used to detect peachtree borers. In the spring, check the soil line for frass, holes and webbing. The insect parasitic nematode *Steinernema carpocapsae* can be effective if applied in mid to late summer. Spraying insecticides when adults are present may control them.

Adult peachtree borers. A male on the left and a female on right (above).

Larvae feed near the ground, just below the bark of the trunk and gum is exuded (right).

Fungus Gnat

Description: Fungus gnats are delicate, mosquito-like flies that are dark brown or black and about 1/4 inch long. They have long legs, large clear wings, and long antennae. They can occur outdoors, but are more often a pest of indoor plants. Adult females lay tiny eggs in clusters in moist potting media. Larvae develop through four stages in the media.

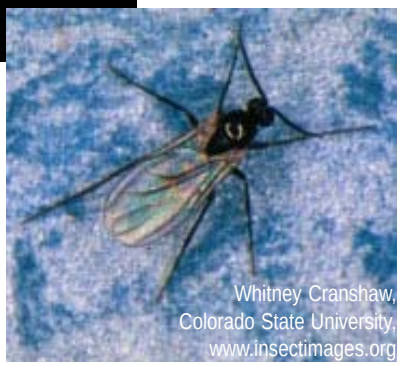
Damage: Soil borne larvae are pests of seedlings and cuttings, but may also damage older plants. They reduce germination, stunt growth, and cause foliage to wilt and turn yellow by feeding on roots and lower stems or leaves. Injury to the roots provides a possible entry point for plant diseases, which the flying adult gnats may carry to other plants. Groups of larvae may leave slime trails in moist conditions.

Management: Cultural control, sanitation, and exclusion can effectively control fungus gnats. Yellow sticky traps catch adults. Water management is important because they thrive under moist conditions. Allow potting media to dry out between waterings. Use an inorganic potting media (vermiculite, perlite, calcined clay) to reduce the larvae population. Good sanitation helps prevent diseases. Natural predators and insecticides are available.

Gerald J. Lenhard, www.insectimages.org

Larva have a shiny black head capsule and a worm-like body (left).

Adult fungus gnats are weak flyers and do not go far from the breeding site (right).



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White Grubs

Description: White grubs are the larvae of several large beetles. They are fat, white, C-shaped, and about 1 inch long when mature. They have brown heads and three pairs of legs. They are not an annual, but a cyclic problem.

Damage: Damage appears as a yellow to brown mosaic throughout healthy lawns. Grasses are attacked. The grubs feed on the roots of bluegrass, timothy, corn, soybeans, and other crops and on the tubers of potatoes. They may become serious pests of lawns and nursery plantings. The most severe damage occurs to crops that follow grass sod, turfgrass, or are grown as containerized plants.

Management: Populations of white grubs can be reduced by planting deep-rooted legumes, such as alfalfa, sweet clover, or other clovers, in rotation with more susceptible crops, such as timothy and small grains. Late summer or early fall plowing destroys many larvae, pupae, and adults in the soil and exposes them to predators. Chemical control may be necessary.

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White grubs feed on the roots of crops causing damage as with these corn seedlings (left).

Fat, C-shaped grubs are white with brown heads and three pairs of legs (right).

Alton N. Sparks, Jr.,
The University of Georgia,
www.insectiimages.org

Biological Control Internet Sources

ARBICO Organics. Tuscon, AZ. store.arbico-organics.com.

Association of Natural and Biocontrol Producers. Tustin Ranch, CA. www.anbp.org.

Beneficial Insectary. Redding, CA. www.insectary.com.

Bio-Integral Resource Center (BIRC). Directory of Least-Toxic Pest Control Products. Berkeley, CA. www.birc.org.

Buglogical Control Systems, Inc. Tucson, AZ. www.buglogical.com.

Environmental Protection Agency. Washington, D.C. www.epa.gov.

Gardens Alive! Lawrenceburg, IN. www.gardensalive.com.

Green Fire. Chico, CA. www.greenfire.net.

Greenbook. Lenexa, KS. www.greenbook.net.

Harmony Farm Supply and Nursery. Sebastopol, CA. harmonyfarm.com.

Natural Pest Controls. Orangevale, CA. www.natpestco.com.

Peaceful Valley Farm and Garden Supply. Grass Valley, CA. www.groworganic.com.

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