Colorado State University Extension

Colorado Master Gardener[sm] Program

CMG GardenNotes #119

Lab Worksheet: Pest Management Options

Small Group Activity

Discuss the following situations from a *Plant Health Care* perspective, including the following PHC questions.

1. What is the plant?
2. What is the pest(s)?

3a. Does it cause damage?
3b. Under what situations would management efforts be warranted?
3c. Are management efforts warranted for this situation?

4. What issues/options play a role in management of this pest? [Note: be complete in your evaluation.]

   a. Weather factors
   b. Soil, water, irrigation
   c. Mechanical methods (i.e., traps, barriers, removal, etc.)
   d. Preserving and importing bionaturals

IF an insecticide is warranted:

5a. What organic insecticides are effective on this pest?
5b. What manufactured insecticides are effective on this pest?
5c. What health risks are associated with each insecticide?
5d. What environmental risks are associated with each insecticide?
5e. When are they applied to be most effective?
5f. How are they applied to be most effective?
5g. What is the re-entry period?

Summary

6. Summarize recommended strategies for this situation.

Situation 1
Willow Aphids

In late August as the early arrivals for the White family reunion came to help Grandma set up under the large old willow trees down by the pond, they notice problems. The twigs and leaves of the trees are covered with pea size, oval shaped, soft-bodies insects (giant willow aphids). When squished, they look like a small "pool of blood". Twigs and leaves are sticky and dripping. Yellow jackets are swarming in the trees.

Five generations will be arriving for a picnic lunch at 12 noon and a relaxing afternoon with the family under the shade of these old trees. Families have been talking about the family reunion "back at the family farm" for more than a year. Over 100 family members will be attending ranging in age from mid-90s down to infants. The farm location is especially important to Grandma since Grandpa proposed to her under these willow trees some 60 years ago.

Grandma is very upset. Do these insects feed on blood? Will they harm the children? What about the sticky honeydew dripping onto the tables and guests? What about the yellow jackets? What can they do?

Grandpa said he has several old insecticides in the barn that "will fix anything". But Grandma is worried about the safety of the children. The daughter has suggested a quick spray with insecticidal soap. Will this correct their problems?

Explain options for 1) aphids and 2) yellow jackets and discuss how each option will or will not be practical for this situation.

References: CSU Extension Fact Sheets
#5.511, *Aphids*
#5.525, *Wasps and Bees*

Situation 1
Willow aphids and yellow jackets

1. What is the plant?	**Willow**	**Willow**
2. What is the pest(s)?	**Willow Aphids**	**Yellow Jackets**
3a. Does it cause damage?		
3b. Under what situations does the pest warrant management efforts?		
3c. Are management efforts warranted for this situation?		
4a. Weather factors		
4b. Soil, water, irrigation		
4c. Mechanical methods (i.e., traps, barriers, removal, etc.)		
4d. Preserving and importing bionaturals		
5a. What ORGANIC insecticides are effective on this pest?		
5b. What MANUFACTURED insecticides are effective on this pest?		
5c. What health risks are associated with <u>each</u> insecticide?		
5d. What environmental risks are associated with <u>each</u> insecticide?		
5e. When are they applied to be most effective?		
5f. How are they applied to be most effective?		
5g. What is the re-entry period?		
6. Summarize recommended strategies <u>for this situation</u>.		

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Aphids on Shade Trees and Ornamentals

Fact Sheet No. **5.511** Insect Series | **Trees and Shrubs**

by W.S. Cranshaw*

Aphids are the most common insects found on trees, shrubs, and garden ornamental plants. Over 350 different aphid species occur in the state but most can feed on only a few species of plants. However, with so many kinds of aphids, few plants grown in Colorado do not support at least one aphid. Most species rarely injure plants or even attract attention, but a few aphid species do cause problems (Table 1).

Aphids feed by sucking sap from plants. When the number of aphids on a plant are very high for an extended period, their feeding can cause wilting and sometimes even dieback of shoots and buds. Some aphids can cause leaf curling when the insect infests emerging leaves.

Sometimes problems with aphids do not primarily involve plant injury but instead their production of sticky honeydew. Honeydew is the waste material excreted by aphids and certain other phloem-sucking insects (e.g., soft scales, whiteflies, some leafhoppers). It may cover leaves, branches, sidewalks and anything that lies beneath a infested plant material. Gray sooty mold grows on the honeydew, further detracting from plant appearance. Ants, yellowjacket wasps, flies, and bees are usually attracted to plants that are covered with honeydew.

Life History and Habits

Aphids are small insects and few exceed 1/8-inch when full grown. They tend to have an oval body form and a pair of pipe-like cornicles usually can be seen protruding from the back of the body. Colors are widely variable among the different aphid species - ranging from very pale yellow to dark, nearly black. Most have shades of green or orange and a few species are even bright red. Upon close inspection, many aphids can be seen to have intricate body patterning.

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Figure 1: Adult aphids – winged and wingless.

Figure 2: Black cherry aphid colony.

Some aphids obscure their body by covering themselves with waxy threads. These are known as "woolly aphids." Woolly aphids are most commonly seen associated with pines or other conifers, lining the needles. However, the woolly apple aphid is a common woolly aphid that clusters on the limbs of apples and crabapples. Aphids that cluster within leaves that curl, such as the leafcurl ash aphid, are wax covered as are most aphids that live on plant roots.

Colonies of aphids often consist of a mixture of winged and wingless forms. The great majority of aphids usually develop into the wingless form to remain and reproduce on the plant. More winged forms tend to be produced when colonies get overcrowded, plants decline in quality, or environmental cues favor dispersal to new plants.

Essentially all aphids, regardless of their form, are females. Males, if they do occur, are

Quick Facts

- Aphids are found on almost all types of plants and a few species can cause plant injury.
- Some aphid species can curl the new leaves of some types of plant.
- Feeding aphids excrete honeydew, a sticky fluid that can cause nuisance problems.
- Natural enemies of aphids include lady beetles, flower fly larvae, lacewing larvae, and parasitic wasps.
- Exposed aphids can be controlled by insecticides, insecticidal soaps and sometimes with a strong jet of water.

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Table 1. Some common aphids associated with trees, shrubs and ornamentals in Colorado. Those marked with an * commonly cause leaf curling distortions in new growth.

***Scientific name* (Common name)**	**Host plant**
Acyrthosiphum pisum (Pea aphid)	Sweet pea, other legumes
**Aphis helianthi* (Sunflower aphid)	Red twig dogwood, many flowering plants in summer
Aphis nerii (Yellow milkweed aphid)	Milkweeds *(Asclepias)*
**Aphis spiraecola* (Spirea aphid)	Spirea
**Aphis viburnicola* (Snowball aphid)	Snowball viburnum
**Brachycaudus helichrysi* (Leafcurl plum aphid)	Plum
Caveriella aegopodii (Willow-carrot aphid)	European willows
Chaitophorus populicola	*Populus*
Chaitophorus populifolii	*Populus*
Chaitophorus viminalis	Willow
Cindara spp. (Giant conifer aphids)	Pines, juniper, spruce
**Cryptomyzus ribis* (Currant aphid)	Currant
**Dysaphis plantaginea* (Rosy apple aphid)	Apple
**Dysaphis tulipae* (Tulip bulb aphid)	Dutch iris, tulip
Eriosoma lanigerum (Woolly apple aphid)	Elm, apple, crabapple
**Eriosoma americanum* (Woolly elm aphid)	Elm, amelanchier
Essigella spp.	Pines
Eulachnus spp.	Pines
**Hyadaphis tataricae* (honeysuckle witches' broom aphid)	Tatarian honeysuckle
Hyalopterus pruni (Mealy plum aphid)	*Prunus*
Macrosiphum rosae (Rose aphid)	Rose
Macrosiphum euphorbiae (Potato aphid)	Rose, many flowers
Macrosiphum albifrons (Lupine aphid)	Lupine
Monellia caryae (American walnut aphid)	Walnut
Myzocallis tiliae (Linden aphid)	Linden
Myzocallis alhambra (Western dusky-winged oak aphid)	Bur oak
Myzocallis ulmifolii (Elm leaf aphid)	Elm
**Myzus ceraki* (Black cherry aphid)	Tart Cherry
**Myzus persicae* (Green peach aphid)	Peach, apricot, other *Prunus*
**Nasonovia aquilegiae* (Columbine aphid)	Columbine
**Nearctaphis bakeri* (Shortbeaked clover aphid)	Hawthorn
Periphyllus lyropictus (Norway maple aphid)	Norway maple
**Prociphilus franxinifolii* (Leafcurl ash aphid)	Green ash
Pterocomma bicolor	*Populus*
Pterocomma smithiae (Black willow aphid)	Willow
Rhopalosiphum cerasifoliae (Chokecherry aphid)	Chokecherry, pin cherry
Rhopalosiphum nymphaeae (Water lily aphid)	*Prunus*, various aquatic plants
Tuberolachnus salignus (Giant willow aphid)	Willow
Uroleucon sp.	Many flowers

present in late summer during only one of the many generations that are produced during a growing season. The normal habit of aphids is for a female to give live birth to a genetically identical daughter aphid through asexual reproduction (parthenogenesis). The newly born aphid can develop rapidly, typically becoming full-grown in about 10 to 14 days. Adults usually can produce three to five young per day over the course of their lifetime, which may extend to about a month but is usually shortened by natural enemy activities.

There is a shift in the life cycle of aphids to handle the challenge of winter, when plants are not active and cold temperatures would be lethal. At the end of the summer, different forms of aphids are produced, including special sexual form males and females. After mating, a special egg-producing aphid is produced that lays egg in protected crevices, often around buds. This egg is the stage that the aphid normally survives winter during outdoor conditions in Colorado. Eggs hatch the following spring, shortly after bud break, and the normal life cycle resumes.

Figure 3: Giant conifer aphids on juniper.

Figure 4: Leafcurl plum aphid injury.

Figure 5: Leafcurling produced by green peach aphid.

Figure 6: Spirea aphid colony.

Figure 7: Overwintering eggs of rose aphid.

Figure 8: Pea aphid colony with a syrphid fly larvae (lower left).

Figure 9: Winged aphids giving birth on aspen stem.

Table 2. Some common Colorado aphids that alternate between woody and herbaceous hosts.

Aphid	Overwintering host	Summer host
Black cherry aphid	Cherry, plum	Wild mustards
Currant aphid	Currant	Motherwort, marsh betony
Green peach aphid	Peach, plum, apricot	Peppers, cabbage, potato, many garden plants
Leafcurl plum aphid	Plum	Various aster-family plants, clover, vinca, thistle
Mealy plum aphid	Plum	Cattail, reeds
Potato aphid	Rose	Potatoes, tomatoes and many other garden plants
Rosy apple aphid	Apple, pear, mountain-ash	Plantain
Shortbeaked clover aphid	Hawthorn	Legumes
Sunflower aphid	Dogwood	Sunflower, yucca, parsley, cilantro, pigweed, many other herbaceous plants
Water lily aphid	Plum, other *Prunus*	Water lily and many other aquatic plants
Willow-carrot aphid	Willow	Carrot, parsley, dill
Woolly elm aphid	American elm	Amelanchier (roots)

Some aphids have even more complicated life cycles that involve alternating among host plants. With these species, eggs are laid on a tree or shrub in the fall and they develop on the plant in a normal manner the following spring. However, in late spring they all leave their winter host and establish colonies on entirely different plants. Some common Colorado aphids that alternate hosts are listed in Table 2.

Management

Natural Enemies

Aphids are quite defenseless and there are numerous insects that feed on them (Fact sheet 5.550, Beneficial Insects and other Arthropods). The best known of these natural enemies are lady beetles, with lady beetle larvae being particularly voracious predators of aphids. Other common aphid predators include the larvae of green lacewings and flower (syrphid) flies.

Several species of minute stingless wasps parasitize aphids. These wasps insert their eggs into the body of the aphid and the larvae consume it internally. Aphids that have been killed by parasitic wasps have a conspicuous appearance, turning light brown or black and becoming bloated. Aphids killed by parasitic wasps are known as "aphid mummies."

Physical and Cultural Controls

On shrubs and garden plants, aphids can sometimes be managed by simply washing them off of plants with a forceful jet of water. Hosing plants can lethally injure aphids and very few surviving aphids that are knocked to the ground can successfully find their way back onto their host plant.

Some flowers that are perennial but dieback to the ground in fall, have problems with aphids in the spring. Columbine, lupines and perennial asters are examples. With these plants the eggs of the aphids are laid on the stems in fall, near the point where new shoots will emerge the following spring. Spring problems with these aphids can be prevented by removing the old top growth that contains the eggs before plants emerge in spring.

Chemical Controls

Insecticides are a useful means for controlling aphids when natural enemies are not sufficient (Table 3). Some insecticides act by contact action and these must contact the body of the aphid to work. This includes insecticidal soaps (Fact sheet 5.547, Insect Control: Soaps and Detergents), a popular option for aphid control but one that requires sprays to cover the aphid during application. Other insecticides have some persistence on the foliage and may be able to kill aphids for

a day or two if they contact the aphid. Contact insecticides can be effective against exposed aphids but are ineffective against species that develop within the protection of leaf curls.

A few insecticides have the ability to move within a plant, spreading in the sap. These are known as systemic insecticides and they can control aphids that occur within leaf curls. Some formulations of systemic insecticides are designed to be applied as sprays and these are absorbed by leaves and then move in the plant. Others can be applied to the soil where they are taken up by the roots and translocate to leaves, particularly young leaves.

Horticultural oils (Fact sheet 5.569, Insect Control: Horticultural Oils) have a special place in aphid control. These act largely by smothering insects and are particularly effective for control of aphids that spend the winter as eggs on the tree or shrub, then curl leaves the following spring. They are most widely used for aphid control on stone fruits (Prunus spp.), such as peach, apricot, and plum. Horticultural oils are applied before bud break, during the dormant season.

Figure 10: Tulip bulb aphids. (Parasitic mummy is lower left.)

Figure 11: Woolly apple aphid colony on crabapple twig.

Table 3. Insecticides for control of aphids on shade trees and ornamentals.

Contact Insecticides without Residual Activity: insectical soaps, pyrethrins

Contact Insecticides with Residual Activity: acephate, bifenthrin, beta-cyfluthrin, estenvalerate, permethrin, lambda-cyhalothrin

Systemic Insecticides: acephate, imidacloprid, dinotefuran

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Nuisance Wasps and Bees

Fact Sheet No. **5.525** Insect Series | **Home and Garden**

by W.S. Cranshaw*

Wasps and bees can be a serious nuisance problem throughout Colorado, particularly late in the summer when certain yellowjacket wasps forage at garbage and outdoor food areas. In overall balance, however, these insects are beneficial in their activities, particularly as predators of pest insects and as pollinators. It is important to distinguish between the various wasps and bees because their potential as problems and their control differ.

Social Wasps

Several wasps are social insects that produce a colony. Colonies begin anew each spring, initiated by a single fertilized female (queen) that has survived winter. The social wasps construct their nest of paper, which they produce by chewing on wood, scraps of paper and cardboard.

Social wasp colonies are very small early in the season, but expand rapidly through the summer as more wasps are raised that assist in colony development. By the end of summer, a colony may include dozens, or even several hundred, individuals. Some wasps reared at the end of the season are fertile females (potential queens) and a few males. In fall, colonies are abandoned, never to be reused, and the fertilized females scatter to find protection during winter. The remaining members of the colony perish with cold weather.

Most social wasps rear their young on a diet of live insects. Several types of social wasps are important in controlling insect pests such as caterpillars. An exception to this is the western yellowjacket, which primarily scavenges dead insects, earthworms and other carrion, including garbage. This scavenging habit is usually why yellowjackets become serious nuisance problems. Male wasps occasionally visit flowers to feed on nectar, however, social wasps are generally not important plant pollinators.

Figure 1: Yellowjacket entering nest underneath wall.

Figure 2: Baldfaced hornet.

All social wasps are capable of producing a painful sting but none leave the stinger embedded, as do honey bee workers. Most stings occur when the colony is accidentally disturbed.

Yellowjackets (*Vespula* spp.) are banded yellow or orange and black and are commonly mistaken for honey bees, but they lack the hairy body and are more intensely colored. Yellowjackets typically nest underground using existing hollows. Occasionally nests can be found in dark, enclosed areas of a building, such as crawl spaces or wall voids.

Nests are enclosed in a paper envelope, but they are not exposed nor observed unless excavated. The nest entrance is small

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Quick Facts

- Most wasps develop by feeding on insects. Bees develop on a diet of nectar or pollen.
- Almost all insect stings result from yellowjackets and an insect newly established in the state, the European paper wasp.
- Yellowjackets, hornets and paper wasps make nests of paper. Honey bees and bumblebees make nests of wax. Solitary bees and wasps nest in holes in the ground, rotten wood or natural cavities. Some wasps even make mud nests.

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Figure 3: Western yellowjacket.

Figure 4: Baldfaced hornet nest cutaway to expose paper comb.

Figure 5: The western paper wasp, a native species of paper wasp.

Figure 6: European paper wasp.

and inconspicuous. Colonies are readily defended and yellowjackets will sting when the nest area is disturbed.

The **western yellowjacket** (*V. pensylvanica*) is, by far, the most important stinging insect in Colorado. Late in the season, when colonies may include up to 200 individuals, they become serious nuisance pests around outdoor sources of food or garbage. The western yellowjacket is estimated to cause at least 90 percent of the "bee stings" in the state.

Hornets (*Dolichovespula* spp.) produce large, conspicuous grayish paper nests in trees, shrubs and under building eaves. The most common species is the **baldfaced hornet** (*D. maculata*) which is stout-bodied and marked with dark and white striping. Hornets feed their young live insects and do not share the scavenging habit of yellowjackets. Nests often attract attention because of their large size, but hornets rarely sting unless the colony is seriously disturbed.

Paper wasps (*Polistes* spp. and the western paper wasp, *Mischocyttarus flavitarsus*) make paper, open cell nests that are not covered by a papery envelope. Often these nests are produced under building overhangs. However, a new species to Colorado, the **European paper wasp** (*Polistes dominula*), will also nest in small cavities in the sides of buildings, within metal gutters and poles, outdoor grills, and similar items. Paper wasps are more slender-bodied than other social wasps. Most native paper wasps are reddish-brown and marked with yellow, but the European paper wasp is marked with shiny black and yellow, allowing it to be easily mistaken for a yellowjacket.

Paper wasps are beneficial predators of caterpillars and other insects and do not scavenge. However, the habit of the European paper wasp to nest in many locations around a yard has greatly increased the incidence of stings associated with this group of wasps.

Control of Social Wasps

Many concerns with social wasps occur late in the season when colonies grow large and the above-ground nests of hornets and paper wasps become apparent. If the wasps are not causing a problem, the best solution is to wait until the nest is abandoned in the fall. The nest can be safely removed in the winter or, if left alone, will break up during late fall and winter.

Reducing paper wasps nesting sites is possible before the colonies become established in early spring. This is done by sealing all openings that allow access to hollow tubing or similar materials. The interior of many kinds of children's playground equipment are suitable nesting sites by this wasp and should be given special attention.

Active nests causing problems can be destroyed with an insecticide. Insecticide applications are best made during late evening or cool periods in early morning, when the wasps do not readily fly and most foragers have returned to the colony. A variety of insecticides are currently sold for this purpose with active ingredients including permethrin, deltamethrin, tralomethrin, bifenthrin, tetramethrin, allethrin, and esfenvalerate. Many of these are combination products that include a fast-acting, short-lived ingredient (e.g., allethrin, tetramethrin) with an insecticide that is more persistent in ability to control wasps (e.g., permethrin).

For exposed nesting species, such as paper wasps, insecticides can easily be applied directly to the nest and control should be excellent. However, ground nesting yellowjackets with only a small external entrance can be much more difficult to control since the nest may actually be some distance from the opening. Repeated insecticide applications are often required to destroy existing yellowjacket nests.

Social wasps nests are more easily controlled early in the season when colonies are small.

Nuisance problems with scavenging yellowjackets are difficult to manage unless all the nests are found and destroyed. However, nests are inconspicuously located and the wasps may fly as far as 1,000 yards from the colony while foraging, so complete control is difficult.

Commonly sold wasp traps only are effective for yellowjackets. They are not attractive for paper wasps or hornets and will not assist in control of these types of wasps.

Table 1. Physical description of the most common bees and wasps.

Honey bee (*Apis mellifera*): Very hairy. General color orange or yellow-orange, sometimes with dark gray. Individuals collecting pollen will pack it into clumps in special structures (pollen baskets) on the hind legs.
Bumble bees (*Bombus* spp.): Very hairy and stout bodied. Black and yellow markings on all species but many are marked with orange or orange-red on the abdomen.
European paper wasp (*Polistes dominulus*)**:** Not hairy. General color black and bright yellow. Overall body form more elongate than the other species. Hind pair of legs long and trail conspicuously when flying.
Western yellowjacket (*Vespula pensylvanica*): Not hairy. General color black and bright yellow. Overall body form slightly more compact than European paper wasp.
Baldfaced hornet (*Dolichovespula maculata*): Not hairy. General color is black and creamy white. Overall body form similar to yellowjacket, but larger.

Figure 7: Yellowjacket traps.

Yellowjackets will regularly return to sites where food and water sources are available. Therefore, it is important to deter yellowjackets from visiting an area by eliminating all food sources (e.g., open garbage cans, pet foods). Water sources around the yard may also attract yellowjackets during hot, drought-stricken periods.

There has been some success using baits and traps for control of yellowjackets. The western yellowjacket is attracted to the chemical heptyl butyrate, which is included as a lure in many wasp traps. Such traps can be helpful when used early in the season, June and early July, when the number of yellowjackets is small and the colonies are struggling to become established. However, these traps **will not** attract European paper wasp and are worthless for control of this species.

Solitary Wasps

Many kinds of wasps do not produce a colony, including the **hunting wasps** (Sphecidae family) and **spider wasps** (Pompilidae family). Instead the female wasp constructs some sort of nest and provisions it with prey.

Nesting habits vary with the different hunting wasps. Some excavate nests in soil, others dig out chambers in the pith of plants, or use existing holes. Some even construct nests made of mud. Perhaps the best known of these is the **mud dauber**, which makes a series of elongate cells, each of which is then packed with paralyzed crab spiders on which their young develop.

Some solitary hunting wasps may have a fearsome appearance but they are non-aggressive and sting only if directly handled or accidentally trapped. With the exception of spider wasps, the sting is quite mild compared to that of social wasps.

An unusual wasp common in prairie areas are the **velvet ants**. Females are wingless, hairy, extremely active and possess a painful sting. Velvet ants develop as parasites on ground-nesting bees.

Another important group of wasps are the **parasitic wasps**. These wasps lay their eggs in other insects and the developing wasp larva slowly consumes and ultimately kills the host insects. Parasitic wasps are non-aggressive, only sting when handled, and are considered beneficial for their role in controlling a wide variety of pest insects. They are discussed further in fact sheet 5.550, *Beneficial Insects and other Arthropods*.

Social Bees

Bees differ from wasps in many respects, most fundamentally in their diet. Whereas developing wasps feed on insects and other materials of animal origin bees develop on nectar and pollen.

The **honey bee** (*Apis mellifera*) is the only bee, or wasp, that produces a persisting perennial colony. During winter, honey bees survive clustered together within their hive. The queen, the only fertile female, begins to lay eggs in late winter and the young are fed on stored pollen and nectar. At midwinter the size of the colony may only number around 10,000, but numbers increase with the presence of flowering plants that provide food.

The majority of bees in the honey bee colony are workers – females that are infertile solely because their diet during development was insufficient for them to mature into a fertile queen. All of the bees – workers, the queen, and the few males

Figure 8: Mud dauber.
(Photo from the K. Gray collection.)

Figure 9: Mud dauber building nest.
(Photo by H. Evans.)

Figure 10: The honey bee is an important and beneficial insect due to its production of honey and other products, as well as pollination of plants.

Figure 11: Bumble bee queen.

Figure 12: A small, midsummer bumble bee worker.

Figure 13: Leafcutter bee collecting pollen.

(drones) – are dependent on each other and can not survive for long outside the colony.

In this sense, a honey bee colony is often described as being a "super organism" where all the individual insects have essential roles on which the entire colony depends. As a result, reproduction of honey bees is different and requires that the colony periodically subdivide, a process known as *swarming*. During swarms about half the colony leaves the hive along with the queen and attempts to establish a new colony. The remaining bees then rear a new queen, who may begin to lay eggs 3 or 4 weeks after a swarming event.

Most honey bee swarms occur on sunny afternoons in May and June. Immediately after leaving the colony the swarm usually settles nearby clustered on a branch. They then send out bees to scout for suitable nest sites—hollow trees or hives of beekeepers. Once a location is found, the swarm departs to the new home. On the rare occasions when a new nest site is not found, honey bees will begin to produce a wax comb where they originally came to rest. During the summer these types of colonies may expand greatly but invariably are killed out during winter due to exposure.

Sometimes honey bee colonies are located within wall voids of buildings. When this occurs the colony must be eliminated as soon as possible. If allowed to develop, large amounts of wax and honey can be produced which ultimately damages the building when the hive dies out or when the combs melt due to extreme heat.

Honey bees are not aggressive insects, although they will readily defend the colony. Most stings occur when people step barefooted on bees visiting ground covers or when they accidentally are trapped in clothing. The foraging bees seen visiting flowers do not attack.

Unlike other bees and wasps, the stinger of the honey bee is barbed and embeds into the skin. When the bee withdraws the stinger the poison sac is left behind. The bee subsequently dies.

In Colorado, the honey bee is important to the agricultural economy. They are exceptional pollinators and many crops are dependent on them for production including apples, pears, peaches and melons. The value of pollination alone typically exceeds $20 million annually and several million dollars of honey and beeswax products are also produced.

Unlike the honey bee, **bumble bees** (*Bombus* spp.) are native to Colorado. Up to two dozen species are present in the state. All are heavy bodied, quite fuzzy and banded orange or yellow and black.

Bumble bee colonies are produced annually. Fertilized queens survive the winter and attempt to establish colonies in spring. Oftentimes bumble bee nests occur in abandoned rodent burrows, but they may also occur in other small hollow spaces, particularly if there is insulating debris available.

The size of bumble bees varies with the season. Large queens are observed first, followed by the tiny workers she has reared. As the colony increases, the size of the bumble bees that are produced also increases. New queens and males develop by the end of the summer.

A strain of the honeybee, known as the ***Africanized honey bee***, has received considerable attention due to its tendency to readily sting when nests are disturbed. This is a tropical strain of bee that is poorly adapted to areas of cool weather. It does occur in parts of the southwestern United States but is unlikely to ever establish in Colorado.

Solitary Bees

The majority of bee species do not produce a colony. These solitary bees include **leafcutter bees**, **digger bees**, **acute-tongued burrowing bees**, and **sweat bees**. These bees use existing holes, excavate nests in rotten wood and plant stems, or dig burrows in the ground. Within these nests they create a series of cells for rearing the young. One group of these, the leafcutter bees (fact sheet 5.576, *Leafcutter Bees*), line the nest cells with cut fragments of leaves and flower petals. All solitary bees, however, pack the nest cells with nectar and pollen. Although these solitary bees individually produce nests, sometimes many will nest in close proximity. This is particularly common with digger bees.

Solitary bees are not aggressive and stings are quite mild. Most solitary bees can be closely observed and will elicit no defensive behaviors. Perhaps the most common stings that occur are when the sweat bee, which is attracted to moisture, stings when swatted. Males of some solitary bees – which can not sting – sometimes will make aggressive-looking bluffing flights when defending a territory.

Control of Bees

Insecticides used for control of wasps can also be used to kill bees.

Local beekeepers will often collect honey bees that have just swarmed. Collecting swarms typically involves shaking the swarm into a suitable hive box. They will all remain together if the queen is collected. The swarm is then removed at night after the foraging scout bees have returned. Many Colorado State University Cooperative Extension county offices carry lists of local beekeepers that may be willing to collect honey bee swarms.

Honey bees that are already established behind a wall of a building produce special problems. If there is an extensive wax comb and honey, an area of the wall will need to be removed to extract this material. If old combs are left in place after a honey bee colony dies, the wax and honey will melt and flow causing damage. Rodents and insects will also become attracted to this site. It is rare to find beekeepers willing to collect bees that are established behind the walls.

Solitary bees can be difficult to control with insecticides since there are multiple nest entrances and multiple rearing cells within each nest. Often only a portion of the nest is killed and the surviving young emerge the following season.

Where large numbers of digger bees nest in close proximity, the permanent control solution is to modify the soil surface. Incorporate soil amendments (e.g., compost, peat moss), establish a plant cover, change the slope or change the watering habits to disturb digger bee nesting sites. The following season, they will move to a new location. Fortunately, these bees are mild tempered. All solitary bees should be conserved whenever possible.

Table 2. Comparison of habits of common Colorado bees and wasps.

Feature	Honey bee	European paper wasp	Western yellowjacket	Baldfaced hornet
Nest construction	Wax comb	Paper comb, no envelope	Paper comb covered with paper envelope	Paper comb covered with paper envelope
Nest location	Large hollows, hives	Under eaves, in small voids	Usually underground, rarely wall voids	Above ground in trees, shrubs, under eaves
Colony permanence[1]	Perennial	Annually produced	Annually produced	Annually produced
Peak colony size	>10,000	<100	100s	100s
Food habits	Nectar, pollen, some sweet foods	Live insects	Dead insects, garbage, meats, sweet foods	Live insects
Stinger	Barbed, left during stinging	Not barbed	Not barbed	Not barbed
Attraction to wasp trap	No	No	Yes	No

[1]Perennial colonies of honeybees persist from season to season intact, with egg laying suspended during fall and early winter. Annual colonies are abandoned at the end of the season and fertilized females scatter to protected locations for winter. Colonies are initiated each spring.

First Aid for Stings

Honey bees – but not other bees or wasps – generally leave the stinger embedded in the skin. Remove the stinger as soon as possible since some additional venom may be pumped by the venom sac. Honey bee stings are best removed by scraping (not crushing) the stinger with a finger nail or knife blade.

Localized swelling and pain are typical reactions to a sting by a wasp or bee. In most people, these symptoms gradually disappear within a few hours. Some swelling, itching and pain are all normal reactions and *do not* necessarily indicate a systemic reaction to the venom of the sting.

Treat the sting site with an antiseptic to prevent possible infection. Cool lotions or compresses can help relieve pain and swelling. Various materials applied to the sting site may also reduce pain – crushed aspirin, meat tenderizer and urine are among those that have been suggested. If many stings are received oral antihistamines can sometimes reduce swelling and itching.

A small percentage of the U.S. population (approximately 1 percent) develops hypersensitivity to either bee or wasp venom following repeated stings. A systemic allergic reaction can involve difficulty in breathing, dizziness, nausea and development of hives. These symptoms may require immediate medical attention from a physician.

CMG GardenNotes #109

Lab Worksheet: Pest Management Options

Situation 2 – Spider Mites on Pine

Mid-summer, several sprays of the insecticide Sevin (carbaryl) have not given control of spider mites on a row of non-irrigated pines. The trees line the dirt road entrance of Mrs. Red's home near a Colorado mountain community and are covered with dust from the road. In this hot dry summer (no rain), the trees are looking rather stressed and brownish, and appear as if they are dying.

She has been reading about commercially available predatory mites to control spider mites.

- Will the commercially available predatory mites solve the problems? Explain your answer.
- What other factors and management options play into this situation?

Reference: CSU Extension Fact Sheet #5.507, *Spider Mites*

If you want more details about the situation, ask your instructor.

1. What is the plant?	**Pine**
2. What is the pest(s)?	**Spider Mites**
3a. Does it cause damage?	
3b. Under what situations does the pest warrant management efforts?	
3c. Are management efforts warranted for this situation?	
4a. Weather factors	
4b. Soil, water, irrigation	
4c. Mechanical methods (i.e., traps, barriers, removal, etc.)	
4d. Preserving and importing bionaturals	
5a. What ORGANIC insecticides/miticides are effective on this pest?	
5b. What MANUFACTURED insecticides/miticides are effective on this pest?	
5c. What health risks are associated with each insecticide/miticide?	
5d. What environmental risks are associated with each insecticide/miticide?	
5e. When are they applied to be most effective?	
5f. How are they applied to be most effective?	
5g. What is the re-entry period of each insecticide?	
6. Summarize recommended strategies for this situation.	

Colorado State University
Extension

Spider Mites

Fact Sheet No. **5.507** Insect Series | **Home and Garden**

by W.S. Cranshaw and D.C. Sclar*

Spider mites are common pest problems on many plants around yards and gardens in Colorado. Injury is caused as they feed, bruising the cells with their small, whiplike mouthparts and ingesting the sap. Damaged areas typically appear marked with many small, light flecks, giving the plant a somewhat speckled appearance.

Following severe infestations, leaves become discolored, producing an unthrifty gray or bronze look to the plant. Leaves and needles may ultimately become scorched and drop prematurely. Spider mites frequently kill plants or cause serious stress to them.

Spider mites are classed as a type of arachnid, relatives of insects that also includes spiders, ticks, daddy-longlegs and scorpions. Spider mites are small and often difficult to see with the unaided eye. Their colors range from red and brown to yellow and green, depending on the species of spider mite and seasonal changes in their appearance.

Many spider mites produce webbing, particularly when they occur in high populations. This webbing gives the mites and their eggs some protection from natural enemies and environmental fluctuations. Webbing produced by spiders, as well as fluff produced by cottonwoods, often is confused with the webbing of spider mites.

The most important spider mite is the **twospotted spider mite** (*Tetranychus urticae*). This mite attacks a wide range of garden plants, including many vegetables (e.g., beans, eggplant), fruits (e.g., raspberries, currants, pear) and flowers. The twospotted spider mite is also the most important species on house plants. It is a prolific producer of webbing.

Evergreens tend to host other mites, notably the spruce spider mite (*Oligonychus ununguis*) on spruce and juniper, *Oligonychus subnudus* on pines, and *Platytetranychus*

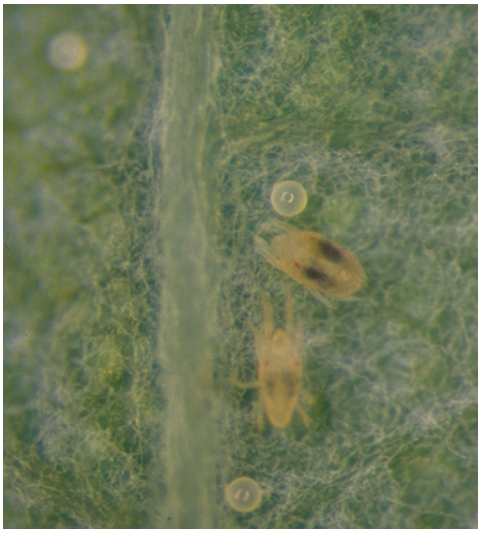

Figure 1: Honeylocust spider mites, with eggs.

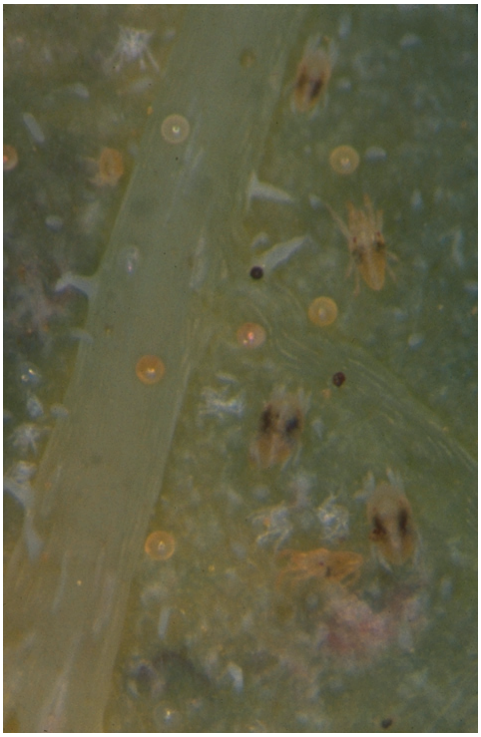

Figure 2: Twospotted spider mites, with eggs.

*W.S. Cranshaw, Colorado State University Extension entomologist and professor, and D.C. Sclar, research assistant; bioagricultural sciences and pest management.
11/2006

Quick Facts

- Spider mites are common plant pests. Symptoms of injury include flecking, discoloration (bronzing) and scorching of leaves. Injury can lead to leaf loss and even plant death.
- Natural enemies include small lady beetles, predatory mites, minute pirate bugs, big-eyed bugs and predatory thrips.
- One reason that spider mites become a problem is insecticides that kill their natural predators.
- Irrigation and moisture management can be important cultural controls for spider mites.

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Table 1: Pesticides useful to control spider mites in yards and gardens.

Active Ingredient	Trade Name(s)	Comments
acephate	Orthene, certain Isotox formulations	Insecticide with some effectiveness against spider mites. Systemic.
abamectin	Avid	For commercial use only on ornamental plants. Primarily effective against twospotted spider mite; less effective against mites on conifers. Limited systemic movement.
bifenthrin	Talstar, others	Insecticide with good miticide activity.
hexythiazox	Hexygon	For commercial use only on ornamental plants. Selective miticide that affects developing stages and eggs only. One application per season label restriction.
horticultural oils	Sunspray, others	Used at the "summer oil" rate (2 percent), oils are perhaps the most effective miticide available for home use.
insecticidal soap	several	Marginally effective against twospotted spider mite and where webbing prevents penetration. Broadly labeled.
spiromesifan	Forbid	For commercial use only on ornamental plants. Selective against mites and conserves natural enemies.
sulfur	various	Generally sold in dust formulation for control of various fungal diseases and some mites on some ornamental and vegetable crops.

libocedri on arborvitae and juniper. Honeylocust, particularly those in drier sites, are almost invariably infested with the honeylocust spider mite (*Platytetranychus multidigituli*). Other mites may affect shade trees such as elm, mountain ash and oak.

Another complex of mites is associated with turfgrass, including the clover mite and Banks grass mite. These are discussed separately in fact sheet 5.505, *Clover and Other Mites of Turfgrass.* Clover mites also are the common mite that enters homes in fall and spring, sometimes creating significant nuisance problems in the process.

Life History and Habits

Spider mites develop from eggs, which usually are laid near the veins of leaves during the growing season. Most spider mite eggs are round and extremely large in proportion to the size of the mother. After egg hatch, the old egg shells remain and can be useful in diagnosing spider mite problems.

There is some variation in the habits of the different mites that attack garden plants, trees and shrubs. Outdoors, the twospotted spider mite and honeylocust spider mite survive winter as adults hidden in protected areas such as bark cracks, bud scales or under debris around the garden. Other mites survive the cool season in the egg stage. As winter approaches, most mites change color, often turning more red or orange. This habit may be why they are sometimes called "red spiders."

Most spider mite activity peaks during the warmer months. They can develop rapidly during this time, becoming full-grown in as little as a week after eggs hatch. After mating, mature females may produce a dozen eggs daily for a couple of weeks. The fast development rate and high egg production can lead to extremely rapid increases in mite populations.

Other species of spider mites are most active during the cooler periods of the growing season, in spring and fall. This includes the spruce spider mite and most of the mites that can damage turfgrass. These cool-season spider mites may cease development and produce dormant eggs to survive hot summer weather.

Dry conditions greatly favor all spider mites, an important reason why they are so important in the more arid areas of the country. They feed more under dry conditions, as the lower humidity allows them to evaporate excess water they excrete. At the same time, most of their natural enemies require more humid conditions and are stressed by arid conditions. Furthermore, plants stressed by drought can produce changes in their chemistry that make them more nutritious to spider mites.

Control

Biological Controls

Various insects and predatory mites feed on spider mites and provide a high level of natural control. One group of small, dark-colored lady beetles known as the "spider mite destroyers" (*Stethorus* species) are specialized predators of spider mites. Minute pirate bugs, big-eyed bugs (*Geocoris* species) and predatory thrips can be important natural enemies.

A great many mites in the family Phytoseiidae are predators of spider mites. In addition to those that occur naturally, some of these are produced in commercial insectaries for release as biological controls. Among those most commonly sold via

Figure 3: Twospotted spider mite injury to eggplant.

Figure 4: "Spider mite destroyer" lady beetle.

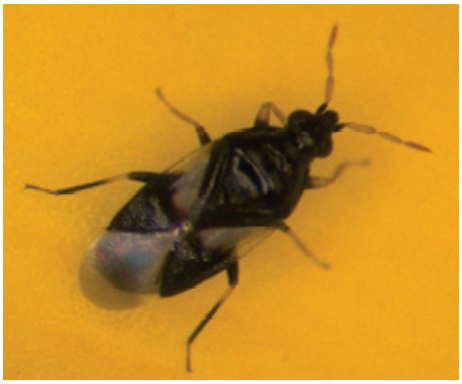

Figure 5: Minute pirate bug.

mail order are *Galendromus occidentalis*, *Phytoseiulus persimilis*, *Mesoseiulus longipes* and *Neoseiulus californicus*. Although these have been successful in control of spider mites on interior plants, effective use outdoors has not been demonstrated in Colorado. Predatory mites often have fairly high requirements for humidity, which can be limiting. Most suppliers provide information regarding use of the predator mites that they carry.

One reason that spider mites become problems in yards and gardens is the use of insecticides that destroy their natural enemies. For example, carbaryl (Sevin) devastates most spider mite natural enemies and can greatly contribute to spider mite outbreaks. Malathion can aggravate some spider mite problems, despite being advertised frequently as effective for mite control. Soil applications of the systemic insecticide imidacloprid (Merit, Marathon) have also contributed to some spider mite outbreaks.

Water Management

Adequate watering of plants during dry conditions can limit the importance of drought stress on spider mite outbreaks. Periodic hosing of plants with a forceful jet of water can physically remove and kill many mites, as well as remove the dust that collects on foliage and interferes with mite predators. Disruption of the webbing also may delay egg laying until new webbing is produced. Sometimes, small changes where mite-susceptible plants are located or how they are watered can greatly influence their susceptibility to spider mite damage.

Chemical Controls

Chemical control of spider mites generally involves pesticides that are specifically developed for spider mite control (*miticides* or *acaricides*). Few insecticides are effective for spider mites and many even aggravate problems. Furthermore, strains of spider mites resistant to pesticides frequently develop, making control difficult. Because most miticides do not affect eggs, a repeat application at an approximately 10- to 14-day interval is usually needed for control. Table 1 includes a summary of pesticides that may be useful for managing spider mites.

Control of Spider Mites on House Plants

Control on house plants can be particularly frustrating. There generally are no biological controls and few effective chemical controls (primarily soaps and horticultural oils).

When attempting control, treat all susceptible house plants at the same time. Trim, bag and remove heavily infested leaves and discard severely infested plants. Periodically hose small plants in the sink or shower. Wipe leaves of larger plants with a soft, damp cloth. Reapply these treatments at one- to two-week intervals as long as populations persist.