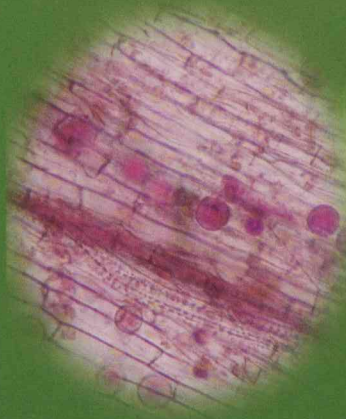
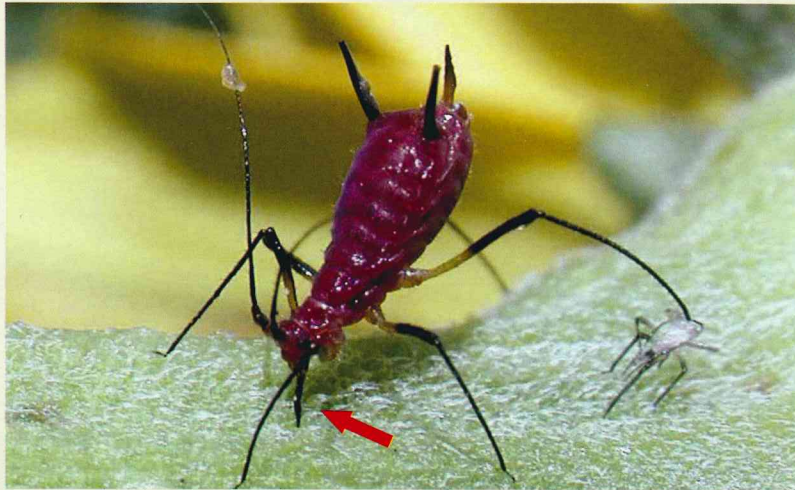


# INSECT AND MITE PESTS COMMONLY FOUND IN GREENHOUSES



Aphids on a rose bud

## INSECT MOUTHPARTS



*Aphid showing stylets inserted into plant tissue.*

Insects and mites have different mouthparts, depending on the group to which they belong. Some have mouthparts that cannot cause damage to your plants. For example, moths and butterflies have coiled mouthparts that are designed to suck nectar and fluids from flowers. Determining the type of mouthpart present on a specimen is useful for identifying it, and evaluating its damage potential. About 90% of the insect damage in your greenhouse is caused by insects with either piercing and sucking or chewing mouthparts. Insects with piercing and sucking mouthparts are often also able to transmit viruses.

Insects with piercing and sucking mouthparts have slender needle-like stylets to pierce the plant cell and suck up plant sap and the fluid inside cells. Aphids, thrips, mites and true bugs have piercing and sucking mouthparts or slightly modified ones.

Insects with chewing mouthparts have mandibles that are jaw-like structures with teeth. They tear off and chew plant tissue or tunnel within stems or between leaf tissues. Caterpillars and beetles have this type of mouthparts.

## LIFE STAGES OF AN INSECT

During its life cycle, an insect goes through several developmental stages, which may look very different. Moths, butterflies and beetles have four stages: egg, larva, pupa and adult. Some stages of a particular pest may damage greenhouse crops and others do not. For example, the immature stage (larva) of the cabbage looper is commonly found damaging chrysanthemum foliage and flowers. It has chewing mouthparts. The adult is a moth with coiled sucking mouthparts that will not cause damage. It is important to be able to recognize both the immature and adult stages of the common pests. The presence of a non-damaging adult may provide a clue to the damage that is, has been, or will be caused by the immature insect. The different types of developmental stages among greenhouse insect pests and their groups are listed below:

### Gradual change

*egg, nymph, adult*

Examples: Aphids, true bugs, stink bugs, grasshoppers

*Note:* Mites are not insects, but have a similar life cycle.

### Intermediate change

*egg, larva, prepupa, and/or pupa, adult*

Examples: Thrips, whiteflies

### Complete change

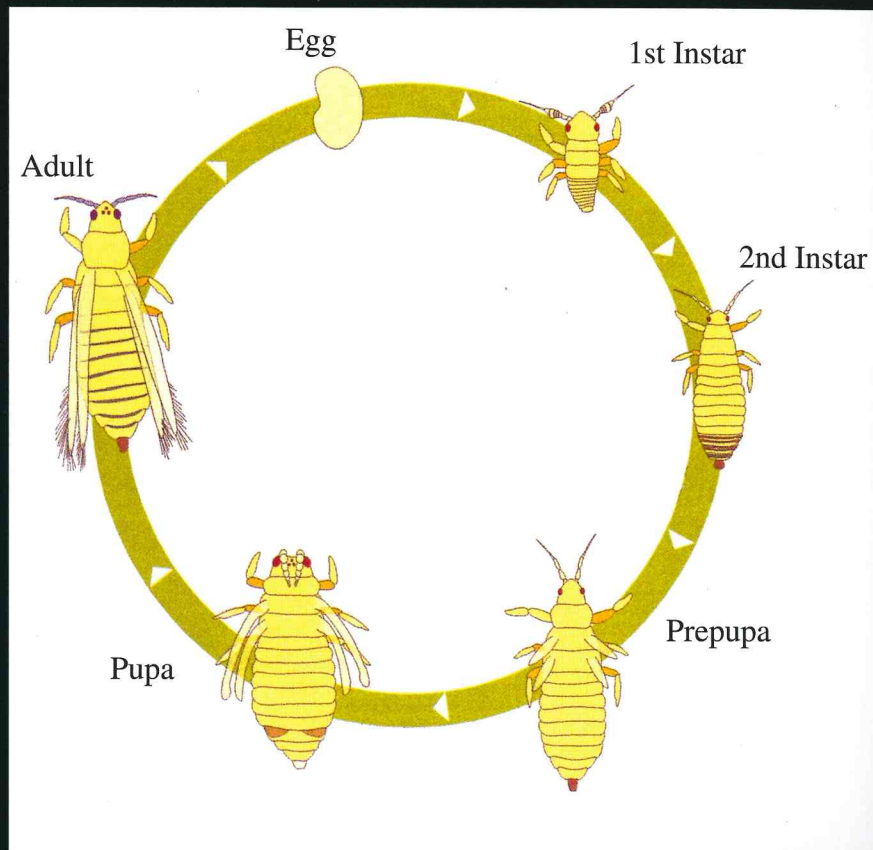
*egg, larva (caterpillar or grub), pupa, adult*

Examples: Butterflies and moths, beetles, flies, bees, wasps, and sawflies

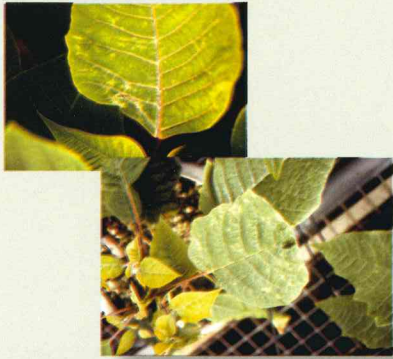


*Banded wing whitefly undergoes intermediate change.*

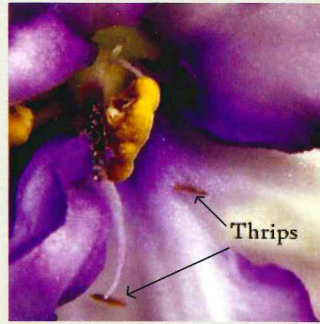
# LIFE CYCLE OF THRIPS



**Your GOAL: thrips-free plants with IPM**



*Thrips damage on poinsettia: deformed, stunted leaves.*



*Thrips hiding within an African violet flower.*



*Thrips damage on impatiens: stunted, deformed leaves.*



*Western flower thrips adult (top) and larva (bottom.)*



*Thrips damage: white feeding patches on upper leaf surface with black droplets. These are the excrement left by thrips.*



*Thrips damage on cineraria: cupped deformed leaves with white patches.*

## WESTERN FLOWER THRIPS<sup>1</sup>

### Damage symptoms

Early signs include scarred, stunted and/or distorted foliage or flowers. Whitish, sunken patches on the upper leaf surfaces or flower petals, sometimes with black droplets, are also signs of thrips. Growers should also look for symptoms of virus infection because this species transmits viruses (on page 41).

### Plants commonly attacked

Many ornamentals are attacked, in particular chrysanthemum, cyclamen, African violet, portulaca, cineraria, impatiens, ivy geranium.

### General characteristics **Mouthparts:** Modified piercing/sucking

The yellowish to brown adults are tiny, slender, fast moving insects, about the size of a flea. They often hide within leaf crevices or deep in the flower and are hard to see without a hand lens. Thrips have several generations each year, and populations increase quickly when temperatures are high. Eggs are laid in plant tissue and thus pesticides are not effective against this life stage.

### Where to find thrips: USE A HAND LENS

Adults and immatures can be found in flowers, on the undersides of leaves along leaf veins or within leaf crevices. Knock a flower against your open palm or onto a white paper. They will be seen crawling around. Hold a flower in your cupped hand and breathe on it to force thrips out with CO<sub>2</sub>. Flying thrips will also be caught on sticky cards.

### Management

- ✓ Inspect plants and cards for thrips to detect infestations early.
- ✓ Monitor crop plants and/or use indicator plants.
- ✓ Remove all weeds in and around the greenhouse.
- ✓ Consider using biological control. See page 60.
- ✓ Adults are most active in the early morning and evening. Apply insecticides at these times to maximize exposure.
- ✓ To ensure an infestation is eliminated, make 3 applications, 7 days apart in cool weather, 5 days apart when it is warm.
- ✓ Rotate class of insecticides used regularly as indicated on label.

<sup>1</sup>*Frankliniella occidentalis* [Thysanoptera: Thripidae]. Other species are found in greenhouses, including *Frankliniella tritici* (eastern flower thrips), and *Thrips tabaci* (onion thrips). These cause similar damage, but are usually less serious pests in greenhouses.



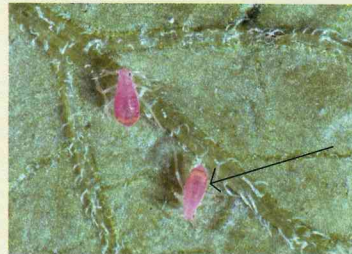
Green peach aphid on a rose bud.



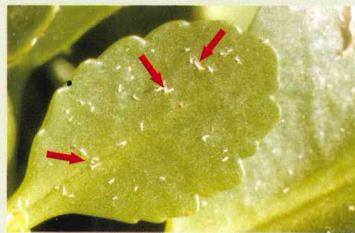
Adult potato aphid.  
Arrow points to cornicle,  
a feature for identification.



Aphids on underside of a leaf.



Immature potato aphids.



Cast skins of aphids.



Aphids feeding within  
flower cluster.



Honeydew excreted by aphids  
makes leaf surface shiny. Sooty  
mold often grows on the honeydew.

## APHIDS<sup>2</sup>

### Damage symptoms

These insects suck sap, causing stunted and distorted plant tissue. New foliage and flowers are often malformed. Plant growth is stunted when populations are high. Some species transmit viruses, including the mosaics. Aphids exude a sweet, sticky, honeydew substance, which gives leaves a shiny appearance. Black sooty mold may grow on this honeydew, covering the plant surfaces.

### Plants commonly attacked

A wide variety of plants, too numerous to list.

### General characteristics

Aphids have soft, round, or oval bodies, about  $\frac{1}{8}$ <sup>th</sup> inch long. At the tail end are two slender tubes called cornicles. Adults and immatures live and feed together and look similar except immatures are smaller and are always wingless. Most species do not lay eggs, but give birth to live young. The life cycle is completed rapidly and populations can increase quickly because aphids reproduce asexually. Aphids cannot be identified based on their color alone.

### Mouthparts: Piercing/sucking

### Where to find aphids

Aphids can be on any part of the plant but are often on the undersides of leaves feeding along the vein or on the leaf surface. Some species are found on the succulent new growth, while others prefer the lower part of the plant. Look carefully for aphids as they are small and sometimes secretive and their color blends in with the plant. Small white flecks are the remains of the insects' cast skin, left after molting. Don't mistake them for live ones when scouting. Plant inspection is essential because sticky cards catch only the winged forms.

### Management

- ✓ Identify the species, because some reproduce more rapidly than others.
- ✓ Treat aphids early before populations increase and spread.
- ✓ Parasites, predators and insect-killing fungi are available.
- ✓ Several biorational insecticides are also effective.

<sup>2</sup> Several species are important pests including: *Myzus persicae* (green peach aphid), *Aphis gossypii* (cotton aphid), and *Macrosiphum euphorbiae* (potato aphid) [Homoptera: Aphidae]. Send to a specialist for species identification if necessary.

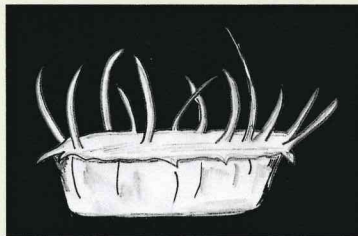
## WHITEFLY SPECIES DIFFERENCES



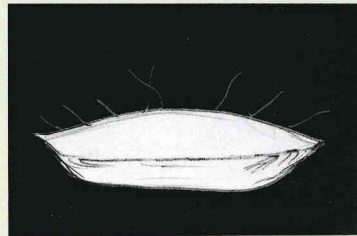
Adult greenhouse whiteflies hold their wings flat and parallel to the leaf.



Silverleaf whitefly adult. Adults hold their wings roof-like over their body.



Greenhouse whitefly pupa.



Silverleaf whitefly pupa

## WHITEFLIES<sup>3</sup>

### Damage symptoms

Leaves turn yellow and eventually drop off. If infestations are heavy, growth is reduced and plants may wilt. In some cases only the veins of the leaves remain green. Some whitefly species secrete honeydew, leaving a shiny residue on the leaf. Sooty mold may grow on the leaf surface. Some whitefly species transmit viruses (see page 41).

### Plants commonly attacked

Poinsettia, hibiscus, lantana, geranium, gerbera, verbena, and other bedding plants.

### General characteristics

Adults are about 1/8<sup>th</sup> inch long with white wings. Eggs are tiny and laid on the undersides of the leaves, often in a circle. Immatures are oval, flattened and are a translucent white or yellowish color. Early immature stages crawl about the leaves looking for a suitable feeding place, but later stages are non-mobile. The shape of the pupal stage is used to identify the species. Two common species are the silverleaf whitefly and greenhouse whitefly<sup>3</sup>.

### Mouthparts: Piercing/sucking

### Where to find whiteflies

Adults will fly around if leaves are disturbed. Immatures are on the undersides of leaves. Especially note the appearance of the white powdery material - a significant indicator of the pest's presence.

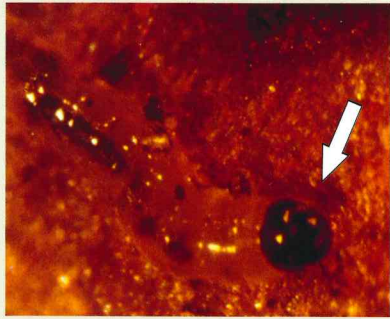
### Management

- ✓ Accurate species identification is important for effective control.
- ✓ Several methods of biological control (parasites, predators, and fungi) are available.
- ✓ Biorational insecticides are available.



*Bemisia tabaci* (sweet potato whitefly)

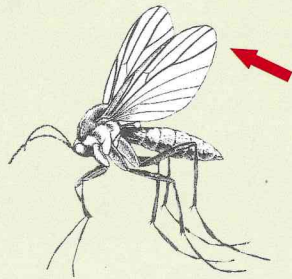
<sup>3</sup> Several species are greenhouse pests: *Bemisia argentifolii* (silverleaf whitefly) and *Trialeurodes vaporariorum* (greenhouse whitefly) [Homoptera: Aleyrodidae].



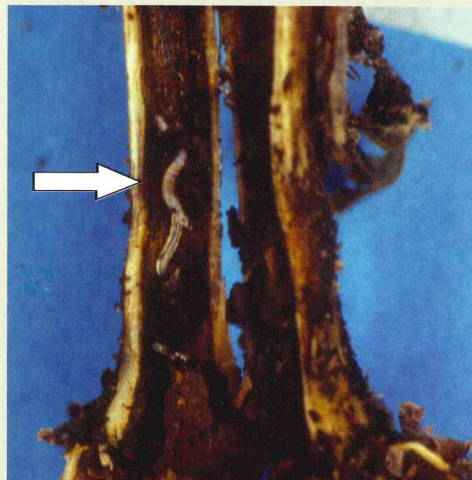
Arrow indicates black head capsule of fungus gnat larva (greatly enlarged).



Poinsettia damaged by feeding of fungus gnat larvae.



Adult fungus gnat. Note the long legs and antennae, and Y of the wing vein, indicated by arrow.



Fungus gnat larva tunneling in the stem.

## FUNGUS GNATS<sup>4</sup>

### Damage symptoms

Larvae feed on root hairs and tunnel into plant stems, which provide entry points for plant pathogens (*Pythium*, *Fusarium*, and *Verticillium*). Adult fungus gnats carry plant pathogen spores on their bodies and serve as a source of infection for clean plants. Root feeding and tunneling disrupts normal nutrient and water uptake resulting in wilted or yellowish plants.

### Plants attacked

Many greenhouse plants, in particular geranium and poinsettia.

### General characteristics

Adults ( $\frac{1}{8}$ <sup>th</sup> inch long) do not cause damage but may transmit fungal diseases. Larvae feed in stems or on roots and rotting vegetation at or below the soil surface. Low light, soil high in organic matter and wet warm conditions favor population increase. Adults are weak fliers. They resemble mosquitoes with dark bodies, relatively long legs, and long antennae. There is a distinct Y-pattern formed by veins in the wing visible with a hand lens. Larvae (about  $\frac{1}{4}$ <sup>th</sup> inch long) are whitish or transparent with a black head. The life cycle can be completed in 12 to 27 days depending on temperature.

### Mouthparts: Chewing (larvae)

### Where to find fungus gnats

Adults usually rest on the soil surface of pots or plants. If disturbed they will fly around. Larvae are found burrowing in plant stems or on or beneath the soil surface. Potato wedges can be used to monitor for larvae and sticky cards for adults.

### Management

- ✓ Reduce organic matter in potting mix.
- ✓ Monitor adult and larval populations and treat promptly.
- ✓ Use potato wedges to scout for larvae.
- ✓ Several biological controls are commercially available, including predatory mites, nematodes, *Bacillus thuringiensis*.
- ✓ Insecticides can be used as a drench against larvae or as a spray, fog or aerosol for adults.
- ✓ Several biorational insecticides are also effective.

<sup>4</sup>*Bradysia coprophila* and *Bradysia impatiens* [Diptera: Sciaridae].



*Shore fly larva with yellowish body. Note that it lacks the black head capsule found on fungus gnats.*



*Flower pots on a greenhouse bench covered with algae.*



*Standing water on greenhouse floor. Algal growth on floors and walls are ideal breeding grounds for shore flies.*



*Algae growing on greenhouse floor.*

## SHORE FLIES<sup>5</sup>

### Damage symptoms

Rather than causing damage directly to plants, shore flies transmit fungal diseases around the greenhouse and are a nuisance because they fly around plants. Larvae feed on decayed plant matter and algae.

### Plants commonly attacked

They are found in greenhouses in damp areas where algae grow.

### General characteristics

**Mouthparts:** Chewing (larvae)  
Shore flies in the genus *Scatella* are small ( $1/12^{\text{th}}$  inch), black flies with reddish eyes and gray wings with clear spots.

### Where to find shore flies

They usually are found swarming in moist areas where a mat of algae is growing. They are caught on sticky cards, and should be distinguished from fungus gnats, which definitely injure plants.

### Management

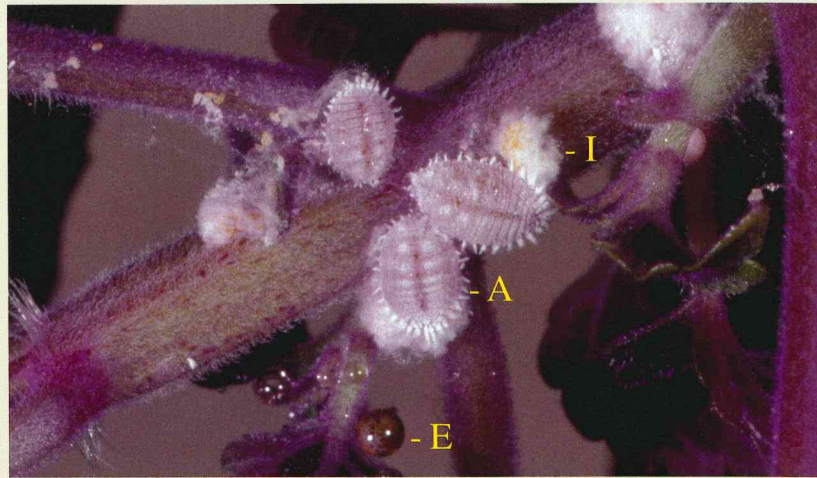
- ✓ Monitor populations on sticky cards.
- ✓ Eliminate leaks that produce wet areas.
- ✓ Treat floors and benches to eliminate algae.



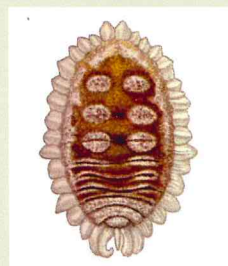
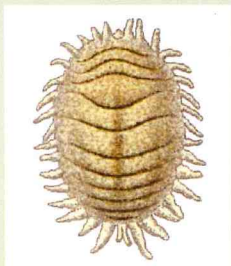
*Adult shore flies, note the dark body and white spots on the wings.*

<sup>5</sup>*Scatella stagnalis* [Diptera: Ephydriidae].





Mealybug infestation on the stem, note that all life stages are present within the colony (A=adult, I=immature, E=egg sac).



Drawing of an adult mealybug, upper (left) and lower (right) view of the body.



Damage by mealybug.

## MEALYBUGS<sup>6</sup>

### Damage symptoms

Mealybugs feed by sucking sap from the plant. Light infestations weaken plants and high populations may kill them. The leaves appear chlorotic, and with time will dry and drop off. They secrete honeydew on leaf surfaces, on which black sooty mold will grow.

### Plants attacked

Mealybugs have a wide host range and are often brought in on plant material originating from tropical areas.

### General characteristics

These pests are soft-bodied scales ( $\frac{1}{8}$  -  $\frac{1}{4}$  inch long) that produce a white waxy, cottony material that covers their bodies. Depending on the species they may also have rather long filamentous waxy projections from the body. Eggs are laid under this waxy material. Newly hatched individual crawlers move over the plant to find a suitable place to settle, where they insert their mouthparts, feed and move little for the rest of their lives. In greenhouses there may be six generations per year. Ants, which feed on honeydew, may carry mealybugs from plant to plant helping to spread the infestation.

### Mouthparts: Piercing/sucking

### Where to find mealybugs

Search the plant for small cottony blotches. Large colonies may form around plant nodes or where branches meet the main stem. With a blunt piece of wire or the rounded end of a needle, carefully peel back the cotton mass and a soft bodied mealybug will be seen. Mealybugs also infest roots and thus infestations may be present under the soil surface. Inspection of the roots of symptomatic plants is necessary.

### Management

- ✓ Early detection is critical to avoid population increase and spread.
- ✓ Control with insecticides is difficult because adults are protected under a cottony covering. Systemic compounds are most effective. Crawlers can be targeted but repeat applications are necessary.
- ✓ Biological control (parasites and predators) is available.

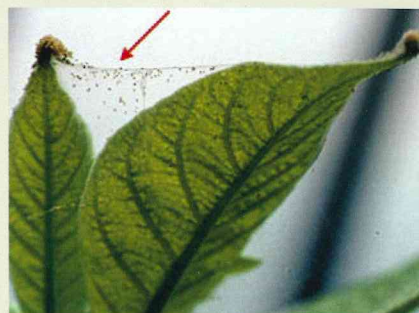
<sup>6</sup> Several species are often found in greenhouses: *Planococcus citri* (citrus mealybug); *Pseudococcus longispinus* (longtailed mealybug) and *Rhizoecus* sp. (root mealybug) [Homoptera: Pseudococcidae].



Typical colony of mites. Spheres are eggs on the underside of a leaf.



Two-spotted spider mite adult.



Leaf damage: Stippling (left) and red arrow depicts webbing (right).



Top: Healthy leaves. Bottom: Leaves with mite damage. Note the yellowing and blotchy appearance.

## TWO-SPOTTED SPIDER MITES<sup>7</sup>

### Damage symptoms

Spider mite damage is distinguished from thrips damage by the presence of fine webbing on leaf undersides and/or a silver sheen on damaged surfaces and by the absence of fecal deposits. Damage may appear as tiny yellow dots or stippling on the leaves. In severe infestations, leaves are covered with a fine webbing, turn yellow, and drop off. The pest overwinters in crevices in the greenhouse.

### Plants attacked

Damage can seriously reduce crop quality on chrysanthemums, mini roses, and a wide range of ornamental plant types.

### General Characteristics

On emerging from diapause in the spring, mites will immediately begin feeding on plants and lay up to 120 round, translucent eggs over a period of 3 weeks. These eggs hatch at summer greenhouse temperatures, producing six-legged immatures that develop into eight-legged adults. In late summer, two-spotted spider mites will turn red and go into diapause.

### Mouthparts: Piercing/sucking

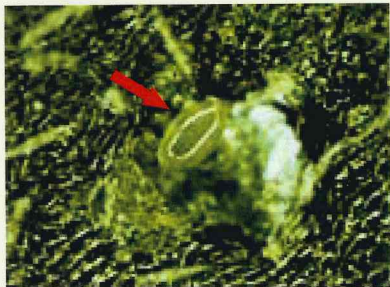
### Where to find mites

Initial infestations may occur anywhere on the plant but are usually on undersides of leaves. Mites feed on the underside of leaves, sucking out the green cell contents, leaving a mottled appearance. As populations increase, the greatest damage is generally on the young canopy leaves because adults tend to move upward in the plant. The life cycle of mites is completed faster in the upper canopy where temperatures are usually higher.

### Management

- ✓ Sanitation is particularly important to prevent mite infestations. Spraying a pesticide for mites in the winter will reduce the chance of infestation the following spring.
- ✓ The predatory mite, *Phytoseiulus persimilis*, is an effective biological control agent. To ensure success, it must be introduced when the pest population is low. Predators can be introduced on young plants.
- ✓ Outbreaks can be controlled with miticides, but treat when populations are low. All leaf surfaces must be covered for good control.

<sup>7</sup>*Tetranychus urticae* (two-spotted spider mite) [Arachnida: Acari:Tetranychidae].



Leafminer egg.



Larva.



Pupa.



Adult.



Tunneling damage made by larva.

## LEAFMINERS<sup>8</sup>

### Damage symptoms

Eggs are laid in the leaves and oviposition punctures called 'stipples' can be seen. After 2-3 days, the eggs hatch. The larvae produce whitish tunnels under the epidermal layer of the leaf. Female leafminers puncture leaves and feed on plant sap.

### Plants attacked

Mining damage is common on the leaves of ageratum, aster, calendula, chrysanthemum, dahlia, gerbera, gypsophila, marigold, petunia, snapdragon, zinnia, and several others.

### General characteristics

#### Mouthparts (immatures):

chewing  
There are two common species of leafminers which attack ornamentals in northern New England. Identification of these species may be difficult because they look and act very similar. The adults of these two species are similar in appearance with varying degrees of black and yellow markings. Management options are the same for both species.

### Where to find leafminers

Larvae tunnel within the leaf tissue forming the characteristic mines, then cut a semi-circular opening in the tissue and drop to the soil to pupate. If temperatures are warm, larvae can reach maturity in 4-6 days, followed by the pupal stage, which lasts another 4-7 days during the summer. Pupae can survive in the soil for up to 90 days when temperatures are cool or host plants are not available.

### Management

- ✓ Remove and destroy infested leaves.
- ✓ Remove all plant debris and weeds from the greenhouse.
- ✓ Avoid growing chrysanthemum varieties that are highly susceptible to leafminers.
- ✓ Rotate the crop within a greenhouse.
- ✓ Cover soil under plants with plastic mulch to prevent leafminer larvae from reaching the soil to pupate.

<sup>8</sup> The two common serpentine leafminer species are *Liriomyza trifolii* and *L. brassicae* [Diptera: Agromyzidae].