

## 24. Two-Spotted Spider Mite (HortReport, August 2002)

The two-spotted spider mite is widely distributed and a common pest of many plant species in greenhouses, nurseries, high tunnels, orchards, and field crops. Hot and dry environmental conditions, such as a drought, enhance spider mite development, necessitating the need for early weekly plant inspection.

Most of the difficulty in controlling this pest is initial detection. Since there is no winged stage, sticky traps are ineffective, hence, plant inspection is the only method to assess if mites are present. It is important that one recognize the early signs of mite feeding, which is the stippling or speckled effect that initially appears on the foliage while it is still green. In addition, it is essential that one uses a good hand lens to view populations of mites in egg, nymph, and adult stages.

Plant damage is caused by larvae, nymphs and adults piercing the plant cells and sucking out the contents. The damaged cells appear as yellowish white spots – chlorophyll is destroyed – on the upper surface of the leaf. As populations increase, the whole leaf will eventually turn yellow. Crop losses may occur when about 30% of the leaf surface is damaged.

In greenhouses or high tunnels, mites usually develop on the undersides of leaves and are often found near certain spots in the greenhouse (vents, doors, heaters). These areas have a more favorable climate for development (dry, warm). If you have difficulty detecting mites on leaves, tap the leaves over a sheet of white paper. This technique dislodges mites and provides for easier identification.

In a field situation, initial infestations tend to occur in fields bordering grassy areas. Field perimeters and corners tend to exhibit the earliest symptoms of infestation. Dispersal over a wide area occurs when spider mites are carried on a balloon of their webbing by the wind.

### Life Cycle

Two-spotted spider mite has five life stages, egg, larva, first nymphal stage (protonymph), second nymphal stage (deutonymph), and the adult. The female deposits round eggs on the underside of the

leaf. These eggs hatch into larvae with six legs that begin feeding immediately. After they have eaten, their color changes and two dark spots appear in the middle of the body. The larvae take in enough food before they settle on the leaf with their legs drawn in until they develop into the protonymphs. After a period of feeding the protonymphs develop into the deutonymphs. The two body spots are very visible on these two stages compared to the larvae. The total development time varies with temperature, humidity and the host plant. Approximate development time (egg to adult) at 86°F is 7 days. Nymphs and adults produce webs and if populations are high the plant can be completely covered with webs. At this point, obtaining control is difficult and biological (or chemical) control may be ineffective.

Remember to maintain broadleaf weed control inside the greenhouse and at least 20 ft around the outside. In many cases, spider mite infestations develop from weeds left in the greenhouse from the previous crop season. Remove the weeds and destroy!

### Control

Few chemical options are available for minor crops such as greenhouse vegetables and herbs. Ultra-fine horticultural oil and insecticidal soap are low residual toxicity pesticides that provide control when applied thoroughly to cover plants where mites are feeding. Oils have little or no impact on natural enemies and can be incorporated into a biocontrol program.

### Biological Control

The spider mite was the first greenhouse pest to be controlled by a commercial application of natural enemies. Several predators are commercially available from biocontrol suppliers.

### *Phytoseiulus persimilis* – predatory mite

*Phytoseiulus* – the mainstay in spider mite control, can be used on many crops including tomato, pepper, cucumber, squash, beans, and flowers. It can also be an effective predator in field crops such as strawberries and other small fruits.

***Amblyseius californicus* – predatory mite**

This predatory mite is used in crops where high temperatures and/or relative humidity variations occur. *Amblyseius* can survive for a long period of time without eating and can be used on a preventative basis when it is very hard to detect mites.

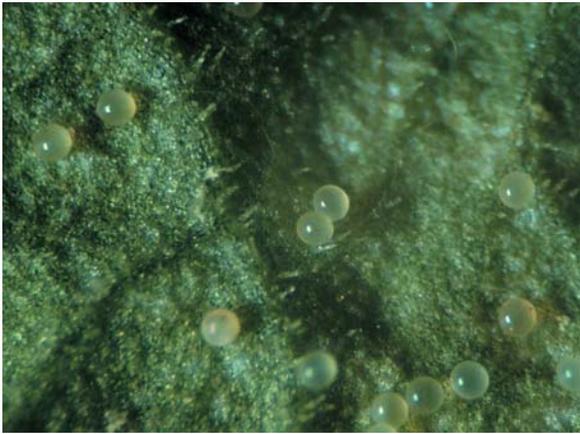


Figure 19. Spider mite eggs.

***Feltiella acarisuga* – predatory midge**

*Feltiella* is a gall midge that is used especially when spider mites occur in colonies. It should be used in conjunction with a predatory mite. The gall midge larva feeds on spider mite eggs.

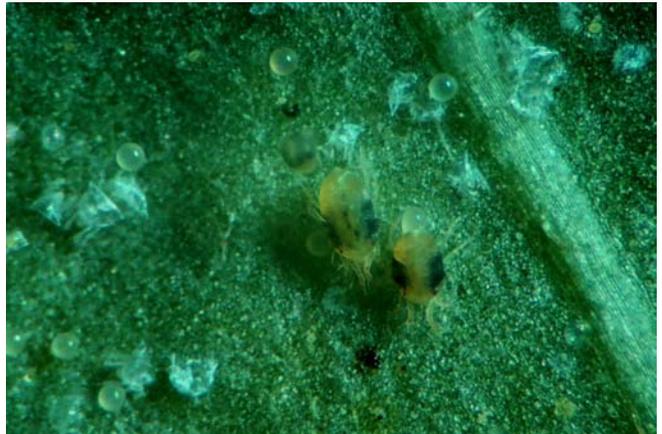


Figure 20. Adult two-spotted spider mite and eggs.



Figure 21. Spider mite damage.

## 25. Biological Control of Two-Spotted Spider Mite (HortReport, July 2001)

A population of two-spotted spider mite (*Tetranychus urticae*) can increase rapidly especially during hot, dry periods. Whether you are using chemical or biological control, treatment must start at low densities for effective control. Two-spotted spider mite, the most economic spider mite in greenhouse crops, can infest many crops including tomatoes, peppers, eggplants and ornamental plants. Most of the difficulty in controlling this pest is initial detection. Since there is no winged stage, sticky traps are ineffective, hence, plant inspection is the only method to assess if mites are present. Damage is caused by larvae, nymphs and adults piercing the plant cells and sucking out the contents. The damaged cells appear as yellowish white spots (chlorophyll is destroyed) on the upper surface of the leaf. As populations increase, the whole leaf will eventually turn yellow. Crop losses may occur when about 30% of the leaf surface is damaged.

### Life Cycle

Two-spotted spider mite has five life stages, egg, larva, first nymphal stage (protonymph), second nymphal stage (deutonymph), and the adult mite. The female deposits round eggs on the underside of the leaf. These eggs hatch into larva with six legs that begin feeding immediately. After they have eaten, their color changes and two dark spots appear in the middle of the body. The larvae take in enough food before they settle on the leaf with their legs drawn in until they develop into the protonymph. After a period of feeding, the protonymph develops into the deutonymph. The two body spots are very visible on these two stages compared to the larvae. The total development time varies with temperature, humidity and the host plant. Approximate development time (egg to adult) at 86° F is 7 days. Nymphs and adults produce webs and if populations are high the plant can be completely covered with webs. At this point, obtaining control is difficult and biological control is not effective.

### Monitoring

Mites usually develop on the undersides of leaves and are often found at certain spots in the green-

house. These areas have a more favorable climate for development (dry, warm). Inspect plants for mite development near heaters, doors and vents. It is important to have at least a 16x hand lens to monitor for this pest. If you have difficulty detecting mites on leaves, tap the leaves over a sheet of white paper. This technique dislodges mites (and other pests) and provides for easier identification.

Remember to maintain broadleaf weed control inside the greenhouse and at least 20 feet around the outside. In many cases, spider mite infestations develop from weeds left in the greenhouse from the previous crop season. Remove the weeds and destroy!

### Biological Control

The spider mite was the first greenhouse pest to be controlled by a commercial application of natural enemies. Several predators are commercially available.

*Phytoseiulus persimilis* – predatory mite.

*Phytoseiulus* – the mainstay in spider mite control, can be used on many crops including tomato, pepper, cucumber, squash, beans, flowers and strawberries. It can also be an effective predator in field crops such as strawberries and other small fruits.

*Amblyseius californicus* – predatory mite.

This predatory mite is used in crops where high temperatures and/or relative humidity variations occur. *Amblyseius* can survive for a long period of time without eating and can be used on a preventive basis when it is very hard to detect mites.

*Feltiella acarisuga* – predatory midge.

*Feltiella* is a gall midge that is used especially when spider mites occur in colonies. It should be used in conjunction with a predatory mite. The gall midge larva feeds on spider mite eggs.

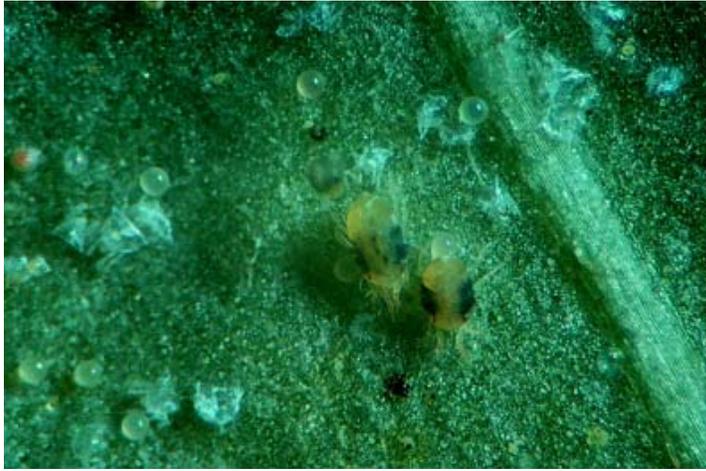


Figure 12. Adult stage of two-spotted spider mite.

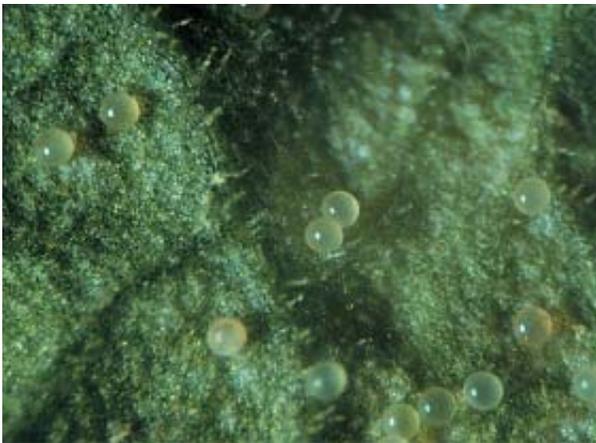


Figure 13. Egg stage of two-spotted spider mite.



Figure 14. Two-spotted spider mite damage on tomato leaves (yellowing or bronzing).

## 26. Using *Phytoseiulus persimilis* to Control Two-Spotted Spider Mite (HortReport, August 2001)

Two-spotted spider mite (*Tetranychus urticae*) can increase rapidly especially during hot, dry periods. Most of the difficulty in controlling this pest is initial detection. Since there is no winged stage, sticky traps are ineffective, hence, plant inspection is the only method to assess if mites are present. Larvae, nymphs and adults piercing the plant cells and sucking out the contents cause damage. The damaged cells appear as yellowish white spots (chlorophyll is destroyed) on the upper surface of the leaf. As populations increase, the whole leaf will eventually turn yellow. Crop losses may occur when about 30% of the leaf surface is damaged.

### Biological Control

The spider mite was the first greenhouse pest to be controlled by a commercial application of predatory mites. *Phytoseiulus persimilis*, a predatory mite and mainstay in spider mite control, can be used on many crops including tomato, pepper, cucumber, squash, beans, flowers and interiorscapes. It can also be an effective predator in field crops such as strawberries and other small fruits.

### Life Cycle

The adult mite is pear shaped and shiny orange, while the nymphal stage is pale salmon. Predatory mites have longer legs than the pest mites. A *Phytoseiulus* adult deposits her eggs (oval shaped compared to round spider mite eggs) near spider mite colonies. The larval stage is followed by the protonymph, deutonymph and adult stage. Development time from egg to adult is 5 days at 86° F. Usually, *Phytoseiulus* will develop faster than the spider mite if the temperature is below 86° F and humidity above 60%. At low humidity, the egg of the predatory mite will die. Creating high humidity by spraying water through a fine nozzle and high pressure can extend the activity of *Phytoseiulus*.

The adult mite will feed on all stages of spider mites, while the nymphs will feed only on eggs, larvae or protonymphs. Upon finding their prey, *P. persimilis* will kill the mite and consume the body contents. If spider mite populations are high and webbing is evident, reduce populations with

compatible soft pesticides before introducing predatory mites. Consult your supplier for information on compatible compounds.

### Application

- Start early to control spider mite populations since spider mites reproduce faster than predatory mites at high temperatures and low humidity.
- Scout crop and flag active spider mite colonies. Return to these flagged areas to monitor the effectiveness of the introduction. A 10x hand lens is required when inspecting for spider mites life stages.
- Shake the tube to mix the predatory mites equally in the carrier before application.
- Concentrate predator introductions at spider mite hot spots (flagged areas) as soon as possible after delivery. Introduce predators weekly for at three weeks or until desired control is achieved.
- Consult biocontrol supplier for rate information.
- Monitor for effectiveness by inspecting plants for dead spider mites that appear as tiny black dots on plants. Inspect spider mite colonies for the oval predator mite eggs and the adult predator mite.
- Spider mite colonies should clean up within 2 – 3 weeks. If control is not achieved, increase the rate of predatory mites.
- *Phytoseiulus persimilis* is supplied in tubes of 1000 – 2000 adults mixed with vermiculite or wood chips.

### Products

Product names from major suppliers of *Phytoseiulus persimilis*:

Biobest: **Phytoseiulus system**, Phone: 303-661-9546, <http://www.biobest.be> or <http://www.bugsandbees.com>

Kopperts: **Spidex**, Phone: 734-641-3763, <http://www.koppert.nl>

Syngenta: **Phytoline**, Phone: 805-986-8265, Fax: 805-986-8267, email: [info@syngentabioline.com](mailto:info@syngentabioline.com)

This predator can be obtained through most biological control distributors.

**Benefits**

- Active year round – no diapause.
- Feeds on spider mite eggs, larvae, nymphs and adults.
- Reproduction is faster than spider mite at 86° F.
- Can be used on a variety of vegetable crops and ornamental plants.

## 27. Managing Two-Spotted Spider Mite With the Predatory Midge *Feltiella acarisuga* (HortReport, September 2001)

Two-spotted spider mite (*Tetranychus urticae*) populations can increase rapidly especially during hot, dry periods. Most of the difficulty in controlling this pest is initial detection. Since there is no winged stage, sticky traps are ineffective, hence, plant inspection is the only method to assess if mites are present. Damage is caused by larvae, nymphs and adults piercing the plant cells and sucking out the contents. The damaged cells appear as yellowish white spots (chlorophyll is destroyed) on the upper surface of the leaf. As populations increase, the whole leaf will eventually turn yellow. Crop losses may occur when about 30% of the leaf surface is damaged. (See pages 24 to 27 for more information on managing the two-spotted spider mite)

The most commonly used biocontrol for two-spotted spider mite is the predatory mite, *Phytoseiulus persimilis*. A natural enemy that can be used with predatory mites is the predatory midge, *Feltiella acarisuga*. *Feltiella* is good at finding hot spots, so the two predators are complementary. *Feltiella* can be an effective year-round predator and is particularly useful on hairy leaved plants (such as tomatoes). This is a predator that you might see naturally in your greenhouses (and garden) if spider mite densities are high and you are not using pesticides.

### Life Cycle

The adult is a delicate, pink-brown fly, only about 1 mm long, with long legs. They do not feed and only live 3-4 days after emerging from the cocoon. High humidity improves midge emergence. Optimal conditions for *Feltiella* are 68-81° F and relative humidity greater than 60%, although larvae can tolerate a wider range of conditions than the adult. Adults actively search for spider mite colonies. Each female lays an average of 30 shiny yellow eggs near high densities of mites, usually where webbing occurs. The tiny eggs hatch in 5-7 days. The brownish yellow midge larvae grow to about 2 mm long. Upon hatching they move to a spider mite, sink their mandibles in, and suck out the contents. They can consume over 300 mite eggs as they complete their development in about a week in the greenhouse. Under

cooler conditions the larval stage may take up to a month to complete. They then spin fluffy white cocoons on the underside of leaves, usually along a leaf vein, in which to pupate. The pupal stage lasts approximately one week in the greenhouse, but longer under cooler conditions.

### Application

- Start early to control spider mite populations since spider mites reproduce quickly at high temperatures and low humidity.
- Always use *Feltiella acarisuga* in conjunction with a predatory mite such as *Phytoseiulus persimilis*.
- *Feltiella* larva feeds on eggs, nymphs and adults of two-spotted spider mites.
- Monitor for predator activity by checking spider mite colonies for larval development and for shriveled mites that have been fed upon. Monitoring should be done once a week, consistently.
- Concentrate predator introductions at spider mite hot spots as soon as possible after delivery.
- Open the box containing predators in the greenhouse and place as close as possible to spider mite infestations. Let the box stand for at least one week until adults have emerged.
- Consult your supplier for rates and introduction schedule.
- *Feltiella acarisuga* is shipped to the grower as pupae on leaves in units of 250.

### Products

Product names from major suppliers of *Feltiella acarisuga*

Biobest: ***Feltiella*-system (*Therodiplosis persicae*-system)**, Phone: 303-661-9546, <http://www.biobest.be> or <http://www.bugsandbees.com>  
Kopperts: **Spidend**, Phone: 734-641-3763, <http://www.koppert.nl>

This predator can be obtained through most biological control distributors.

## Benefits

- The adult midge is capable of flying and locating colonies of spider mites.
- Applicable in crops where scouting is difficult (ie. ornamentals).
- Can and should be introduced with predatory mites such as *Phytoseiulus persimilis*.
- Active in cold and dark weather in spring and fall.
- Provides long lasting protection with several introductions.

## 28. Managing Two-Spotted Spider Mite With the Predatory Mite *Neoseiulus californicus* (HortReport, October 2001)

Two-spotted spider mite (*Tetranychus urticae*), the most common spider mite species found in PA greenhouse vegetable and herb production, can increase rapidly especially during hot, dry periods. Most of the difficulty in controlling this pest is initial detection. Since there is no winged stage, sticky traps are ineffective, hence, plant inspection is the only method to assess if mites are present. Damage is caused by larvae, nymphs and adults piercing the plant cells and sucking out the contents. They are usually found on the underside of the leaves, and sometimes with silken webbing at high populations. The damaged cells appear as yellowish white spots (chlorophyll is destroyed) on the upper surface of the leaf. As populations increase, the whole leaf will eventually turn yellow. Crop losses may occur when about 30% of the leaf surface is damaged.

There are a limited number of pesticides available for treatment of this pest in greenhouse vegetable and herb production; therefore an integrated approach using biological controls in conjunction with compatible biorational materials is needed. Some materials that can be used with biocontrols to treat hot spots or reduce populations before introducing biocontrols include ultra-fine oils, neem oil, insecticidal soap, and the entomopathogenic (insect killing) fungi, *Beauveria bassiana*. Biological control options include predatory mites, and predatory midges.

The most commonly used predatory mite is *Phytoseiulus persimilis*. This is used in many vegetable and ornamental crops for quick knock-down of spider mites. The predatory midge, *Feltiella acarisuga* is also effective in reducing high populations of spider mites. Both of these natural enemies require prey to persist and relative humidity above 60% for reproduction.

If the environmental situation has high temperatures and variation in humidity (below 60%), an alternative biocontrol option would be the predatory mite, *Neoseiulus (Amblyseius) californicus*. In crops where it is hard to detect spider mite populations, this mite can be introduced on preventative basis since it can survive in the absence of prey.

### Life Cycle of *Neoseiulus californicus*

The five different stages of this mite are the egg, larva, protonymph, deutonymph and adult.

The adult predatory mite lives about 20 days and can lay up to 3 eggs a day. It is able to consume 5 adult spider mites daily in addition to feeding on eggs and larvae. The life cycle can be completed within 4 days with high temperatures.

### Application

- Start early to control spider mite populations since spider mites reproduce quickly at high temperatures and low humidity.
- If used on a curative basis, introduce *N. californicus* with *Phytoseiulus persimilis* to clean up hot spots.
- Concentrate predator introductions at spider mite hot spots as soon as possible after delivery.
- Monitor for predator activity by checking spider mite colonies for larval development and for shriveled pest mites that have been fed upon. Monitoring should be done once a week, consistently to determine if future introductions of predatory mites are needed.
- Can be used on outdoor crops.
- *N. californicus* also attacks the broad mite (*Polyphagotarsonemus latus*) and the cyclamen mite (*Tarsonemus pallidus*).
- *N. californicus* is shipped to the grower as mobile stages.

### Products

Some product names from major suppliers include:

Biobest: Californicus-system, Phone: 303-661-9546, <http://www.biobest.be> or <http://www.bugsandbees.com>

Kopperts: Spical, Phone: 734-641-3763, <http://www.koppert.nl>

Syngenta: *Neoseiulus californicus*, Phone: 805-986-8265, Fax: 805-986-8267, email: [info@syngentabioline.com](mailto:info@syngentabioline.com)

This predator can be obtained through most biological control distributors.