



Phytoseiulus persimilis

Spider Mite Predator

Adapted from the Applied Bio-Nomics Manual

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***Phytoseiulus persimilis* Two-Spotted Mite Predator (Acarina: Phytoseiidae)**

Common Name: Persimilis

Target pest

Two-spotted spider mite (*Tetranychus urticae*)

Description

Persimilis is a tropical predatory mite that was one of the first greenhouse biological control agents available commercially.

- Eggs are oval and <1/50 inch (0.3 mm) long, oval shaped; pale translucent yellowish pink color; deposited near spider mite populations and about 3 times larger than spider mite eggs.
- Larvae are inactive, a pale salmon color and have 6 legs.
- There are two nymph stages; both are a pale salmon color, have 8 legs, and are very active predators.
- Adults are bright reddish orange, with long legs and pear-shaped bodies, 1/50 inch (0.5 mm) long.

Both adult and immature predators move rapidly over the leaves and both feed on two-spotted mite eggs, nymphs, and adults. Unlike its prey, Persimilis does not spin webbing.

Use in Biological Control

- Persimilis is very effective against two-spotted spider mites in greenhouse vegetables and ornamentals, interior plantscapes, and conservatories. It is also used in mild climates on field crops, such as strawberries, melons, cucumbers, vegetables, mint and hop.
- Optimum conditions are 68-81°F (20-27°C) and relative humidity over 60%.
- At temperatures of 64-81°F (18-27°C), the predators reproduce faster than spider mites. At warmer or cooler temperatures, however, the spider mites reproduce faster.
- At temperatures warmer than 86° F, the growth rate does not keep up with the spider mite growth rate because the eggs dry out.
- At 68°F Persimilis breeds twice as fast as TSSM.

Monitoring Tips

- Persimilis are usually easy to tell from their prey, which are slow-moving, pale green mites with two darker spots on their sides.
- In winter, some two-spotted mites turn a reddish color, but they can still be distinguished from the predators by the pair of dark spots on their sides and slow movements.
- Weekly inspections of leaves to determine ratio of predators to spider mites can be done along with pruning or picking. It is difficult to estimate numbers due to a clumped distribution.
- Spider mites can easily increase ten-fold to threatening levels before they are detected, predators purchased, and the pests controlled.
- The best method is to count the mites on random leaves or leaflets to determine numbers and whether they are going up or down
- Time of day can affect counts as the spider mites move up and down.

Life Cycle

A complete life cycle takes from 5 days at 86°F (30°C) to 25 days at 59°F (15°C).

- There are 4 times more females in the population than males (a sex ratio of 4:1).
- Females lay 2-3 eggs per day for an average of 60 eggs over their 35-day lifetime. The eggs hatch in 2-3 days. They are oval and twice the size of two-spotted mite eggs.
- Newly hatched predators do not eat, but later stages and adults feed on all stages of prey. Each predator consumes between 5-30 prey (eggs or mites) per day.
- Adults may live for 30-35 days at cooler temperatures and deposit 30-60 eggs. Adult *Persimilis* feeds on all stages of target pest, consuming 5-30 target pest/day, and rather than eating all spider mite eggs, females lay their eggs amid spider mite eggs to assure survival and wide distribution
- *Persimilis* does not diapause, therefore remains active year-round in greenhouses.

Product Information

Persimilis is sold either in a granular carrier (usually vermiculite) or on bean leaves. Both formulations should be applied the same day they are received as the quality of the product drops with storage. If *Persimilis* must be stored, hold only at 50-59°F (10-15°C). Temperatures above or below that range cause mortality. Release predators in areas with highest pest densities.

Using the vermiculite product

When *Persimilis* are refrigerated they tend to clump together. If the package is cold, lay the container on its side at room temperature (out of direct sunlight), for 15-20 minutes, to allow the mites to warm up and move apart.

- Check the product by sprinkling some of the vermiculite onto a sheet of white paper; the active predators should be easy to see.
- Gently rotate the bottle to mix the mites with the carrier and distribute the contents over the plants.
- Avoid placing the predatory mites in direct sunlight. If transporting in a hot vehicle we suggest keeping the mites inside an insulated chest with cool pack until ready for release.

Using the bean leaf product

- Place leaf pieces from the container onto each infested leaf of crop plants. The bean leaves eventually dry out and become inconspicuous.
- Advantages of this product are that all life stages are present, which introduces all ages of predators into a crop. It provides ideal humidity and a food supply for the predator in transit.
- It can be used in interior plantscapes where the vermiculite carrier would be unsightly.

Note that although the bean leaves contain a few two-spotted mites, this does not add to the pest problem because the predators quickly eliminate them. The presence of this food enables *Persimilis* to start reproducing immediately, which improves biological control.

Introduction Rates

Persimilis is most effective when applied at the very first suspicion of the presence of two-spotted mites. Because of its high reproduction rate, *Persimilis* usually exhausts its food supply and eventually dies out, therefore repeated introductions are recommended until all sites with spider mite infestations have *Persimilis* present. General releases to achieve a high enough predator to prey ratio are more effective than fixed rates per unit area. A general fixed rate can be from five to twenty predators per plant or from 20,000 to 80,000 per acre.

General Introduction Rates

- 5 *Persimilis*/10 ft² (m²) or 20 *Persimilis*/infested leaf, weekly, as needed. Apply predators to each infested plant.

Field strawberries, melons, cucumbers, vegetables, mint, hops

- 1 *Persimilis* to 10 spider mites including eggs, or 8000 per acre (20,000 per ha), or 4-5 *Persimilis* per 10 ft² (m²) will yield control in 14 days at less than 86°F and above 60% humidity

Deciduous fruit trees

- Provide a complex of natural enemies controls spider mites except when trees are over-fertilized, over-pruned, and sprayed with non-selective pesticides that kill all the natural enemies. When the ratio of predators to pests is too high, selective acaricides can be used that do not harm the non-mite natural enemies.

General Greenhouse Rates

- Releases are made by a slow-release system early in the season or by simultaneous uniform distribution of spider mites and *Persimilis*. *Persimilis* disperses in 18 days to every spider mite colony from a release onto every tenth plant

Specific Crop Programs

- Greenhouse cucumbers — 6 *Persimilis*/10 ft² (m²) or 100 *Persimilis*/infested plant, weekly or as needed. For larger areas use 60,000 / hectare (24,000 / acre). *Persimilis* works well because cucumbers can tolerate up to 30% damage of leaf area. If too hot, *Persimilis* hides beneath the lowest leaves, leaving spider mites at the growing tops
- Greenhouse tomatoes — Apply at a ratio of 1 predator to 10-20 spider mites. The glandular hairs on tomato leaves are toxic to *Persimilis* so females will lay fewer eggs than on other crops. For best results, use the predators shipped on bean leaves as these are more easily to apply to tomato leaves than vermiculite.

When its food becomes scarce, *Persimilis* disperses throughout the crop. The predator moves better within a crop when the leaves of adjacent plants are touching. It tends to moves upward on plants, so it can be applied to the trunks of large plants in interior plantscapes.

When predators are found on each infested leaf it usually means that the biological control program will be successful. It may take another 2-6 weeks for new plant growth to show improvement, depending on growth rates.

For Best Results

- Be very proactive and preventive and do not let spider mites become a problem.
- If spider mite numbers are high with visible webbing and clusters of mites stringing down from leaves, knock them down with a compatible pesticide before releasing predators. Organic options are GCMite or other OMRI listed insecticidal soap and/or light horticultural oils that may have neem oil added. Fenbutatin oxide (Vendex[®]) will also reduce pest numbers.
- *Persimilis* needs relative humidities greater than 60% to survive, particularly in the egg stage. In low humidity conditions, raise the humidity by lightly misting plants or wetting walkways.
- Where humidity above 60% RH can be maintained, the predator *Feltiella acarisuga* can also be used with *Persimilis*.
- Where humidity is below 60% RH, the predatory beetle *Stethorus punctillum* can be used with *Persimilis*. *Stethorus* feeds on all stages of spider mite and is effective at detecting individual mite colonies.
- If average temperatures are often below or above the 68-81°F (20-27°C) range for optimum use of *Persimilis*, introduce *Amblyseius fallacis* along with *Persimilis*.

Program Success

Predatory mites require proper conditions such as adequate humidity and compatible management practices to be effective. Start with clean plants and use good sanitation practices to avoid spreading mites. Carefully inspect new plant material with a 10X to 15X hand lens before bringing it into the greenhouse; disinfest plants if they harbor mites.

Cultural Controls

- High foliar nitrogen levels can favor outbreaks of some mites. Do not apply more nitrogen than necessary, and when possible use less soluble forms.

- Bending rose canes to increase flower production increases humidity within the lower canopy, providing a more favorable environment for predatory mites than in traditional trellis production.
- Pest mites thrive under hot dry conditions; properly watering plants dislodges some mites and slows pest mite dispersal.
- When using predatory mites, regularly monitor pest and mite populations to evaluate control efficacy and to determine whether predatory mite releases or other control methods are warranted.
- Control dust around crops; use plastic dust barriers, impose speed limits on dirt roads, and cover bare soil.
- If there was a severe infestation which was not controlled by early September, it is likely that an early attack by overwintered mites will occur the following season. Some pest mites can overwinter at ground level and will emerge the following spring from between the overlaps of floor coverings or backs of rows, roof supports, at purling, etc. Treat these areas in fall with predators.
- Remove piles of plant debris, especially heavily infested plants. Reduce potential overwintering sites, such as pots and covers.
- Check regularly for signs of an early attack, concentrating on patches where the damages was seen last season, and near possible overwintering places. Release *Phytoseiulus persimilis* near TSSM infestations and repeat weekly until each leaf has predators.
- As soon as you observe any damage by spider mites, introduce predators. If the initial damage is severe or caused by the red overwintered population, the spider mite numbers must be reduced with a suitable pesticide.

Organic Pesticide Controls

- Apply OMRI or NOP listed oil, soap, or other miticide with relatively low impact on predators to reduce pest populations, and then introduce predators after leaves dry.
- Insecticidal soap, horticultural oil, and essential oils have low residual toxicity and provide control if applied thoroughly on plants where mites are feeding.
- Essential oil products, such as GCMite (containing cottonseed, clove and garlic oils) Ecotrol (rosemary, peppermint, and wintergreen oils) may work better than less expensive soap and oil treatments because of their multiple modes of action in controlling mites and other pests in 3 – 5 days, allowing the beneficial insects to come back quickly.
- Oil has little impact on predatory mites and can be a good choice if spraying is needed when natural enemies are present. For crops and growing situations where phytotoxicity is a concern, reduced rates (1% soap or 0.25-0.5% oil) can provide control.
- The habit of *N. fallacis* to overwinter in crevices can be used to advantage in the early spring with a pre-bloom horticultural oil application. This greatly reduces the number of European red mite eggs while not affecting predatory mite populations.
- Avoid using persistent pesticides for at least several weeks before releasing of predator mites.

Conventional Pesticide Controls

For effect of pesticides on *Persimilis*, see Pesticide Toxicity Chart.

- To reduce mortality of predatory mites from pesticides, find out the length of residual harm on the Pesticide Toxicity Chart before releasing predators.
- Hot Pepper Wax and IGRs are effective low risk controls with no residual harm to predators. Cinnamaldehyde may have a little or no residual. Abamectin has a two-week residual.
- Fenbutatin oxide (Vendex[®]) is sometimes used on hot spots in a *Persimilis* program but it is a Pesticide Action Network Bad Actor Chemical. It does not harm *Persimilis*, but avoid over spraying, which reduces the predator's food supply and their ability to reproduce.
- Spreader-stickers, supreme oils and soaps are harmful to predators contacted by the spray, but have little residual activity.
- Overuse of mist-applied sulfur can suppress predator reproduction and reduce effectiveness and may have some residual effect on predators.
- A single application of a chemical considered highly toxic to *Persimilis* at any time during the season will have a large negative impact on its abundance.