



Biological Control of Western Flower Thrips

The western flower thrips (WFT), *Frankliniella occidentalis*, is a difficult to control pest for greenhouse growers. Their small size (1/16 inch) and tendency to remain hidden in flower buds makes it difficult to detect the thrips before severe feeding damage is evident. Thrips feed by piercing plant cells with their mouthparts and feeding on the exuded plant juices. This collapse of plant cells may result in deformed flowers, leaves and shoots. Silvery-flecked scars or small black "fecal" spots may be seen on the expanded leaves. In addition to direct feeding injury, WFT may vector (spread) two closely related tospoviruses; impatiens necrotic spot virus (INSV) and tomato spotted wilt virus (TSWV), to uninfected plants. Rapid development of resistance to many commonly used insecticides has also made thrips difficult to control.

Figure 1: Thrips feeding damage. Photos by L. Pundt



Scouting

A regular monitoring program is needed to insure the success of a biological control program. Use sticky cards to monitor for adult thrips. Check cards weekly. See: [Identifying Some Pest and Beneficial Insects on Your Sticky Cards](#) on the UConn Greenhouse IPM website.

Cultural Controls

Biological controls are more likely to be successful if combined with proper cultural controls such as providing proper irrigation and fertility for the plant species grown. Prevent pest infestations on incoming plant material by establishing a quarantine area. Dispose of infected plant material into tightly covered garbage cans. If garbage cans are not tightly covered and removed, infested plant material can be a source of thrips, as well as adult whiteflies and fungus gnats. Thorough weed control (weeds are a source of thrips and tospoviruses) both inside and outside the greenhouse is vital. See [Greenhouse Weed Control](#) for more information. Insect screening may also reduce the influx of thrips from outside; however, careful design and maintenance is

needed to avoid reduction in airflow. See [Insect Screening Can be an Important Pest Management tool](#) for more information.

Biological Controls

Predatory mites, predatory bugs, entomopathogenic nematodes and entomopathogenic fungi can all be used in your biological control program. *Dalotia coriara* and *Stratiolaelaps scimitus* that are used against fungus gnat larvae will also feed upon thrips pupae found in the growing media. See [Biological Control of Fungus Gnats](#) for more information.

Neoseiulus (Amblyseius) cucumeris

Neoseiulus (Amblyseius) cucumeris is a small, generalist predatory mite that feeds upon young 1st instar thrips larvae. Second instar thrips are too large for the predatory mites to kill. However, recent research has shown that the second instar thrips spend less time feeding (about 30% in this one study) so that thrips-feeding damage to plants was reduced.

Because *N. cucumeris* only preys on the young thrips larvae, it is important to start releases preventively, at planting, before thrips are detected. *N. cucumeris* also eats pollen, or they may prey upon spider mites or spider mite eggs as well as broad or cyclamen mites. Adult predatory mites live for about 3 weeks. Their development from egg to adult takes 8 days at 77 °F and 11 days at 68 °F. Optimum conditions are temperatures between 75 and 85° F and relative humidity levels greater than 65% (ideally 75%).

N. cucumeris is available as nymphs and adults mixed with a carrier or in slow release sachets. Slow release sachets consist of bran, whitish storage mites (that feed upon the bran), and *N. cucumeris* which prey upon the storage mites. Predatory mites should emerge from the sachets for 4 to 6 weeks onto the crop.

Mini-sachets are now available that can be placed onto individual hanging baskets. Place 1 mini-sachet per hanging basket or 1 to 4 mini-sachets per shuttle tray.

Recent research has shown that these mini-sachets are best placed in the plant canopy where they are protected from bright sunlight. If the mini-sachets are placed in bright sunlight, high temperatures and low relative humidity in the sachets adversely affects the reproduction and egg hatch of the predatory mites. (Eggs will shrivel and die at low relative humidity). If mini-sachets are placed within the plant canopy, the temperature peaks less, with higher relative humidity needed for the reproduction of these predatory mites.



Figure 2: Mini-sachets placed in hanging baskets so they are shaded from full sun. Photo by L. Pundt



Figure 3: Slow moving food storage mite. Photo by L. Pundt

N. cucumeris is also available in bulk with a bran carrier that can be placed on the foliage or with a vermiculite carrier so that the mites can be blown onto the foliage with a mite blower in propagation houses.

Tips for Using *Neoseiulus (Amblyseius) cucumeris*

- If using mites with a carrier, turn and shake tube slightly to distribute the mites evenly in the bran before release.

- If using sachets check periodically for living predatory mites (*N. cucumeris* will be tan in color. The storage mites will be white).
- Place mini-sachets in the plant canopy so they are shaded.
- Optimum conditions are temperatures between 75 and 85° F and relative humidity levels greater than 65% (ideally 75%).
- Consult with your supplier for information on recommended release rates.



Figure 4: Broadcasting *cucumeris* on gerbera daisy and breeding piles of *N. cucumeris*. Photos by L. Pundt

Amblyseius swirskii

The generalist predatory mite, *Amblyseius swirskii*, feeds upon thrips and whiteflies as well as eriophyid mites, broad mites, spider mites and pollen in the absence of prey. Both *A. swirskii* and *N. cucumeris* feed upon first instar thrips larvae, however, *A. swirskii* is more expensive than *N. cucumeris*. Recent research compared releases of *N. cucumeris* to *A. swirskii* and found that during the winter conditions (short days) both species reduced thrips and controlled heavy thrips feeding damage on chrysanthemum. Therefore, researchers concluded it was more economical for growers to use *N. cucumeris* under winter conditions.

During the summer with higher temperatures, light intensity and long days, releases of *A. swirskii* resulted in more predation and egg laying of the Swirskii mite than *N. cucumeris*. Consider releases of *A. swirskii* during summer

conditions, as it is most effective at warmer temperatures (70 °F to 80° F) and a relative humidity of 70 %. This generalist predatory mite is available in an inert carrier, in a breeding system with an inert carrier and storage mites, as individual sachets or as sachets in ribbons or strips. *A. swirskii* can be used in a variety of crops but they are not suitable for use on greenhouse tomatoes. Consult with your supplier for recommended release rates.

Stratiolaelaps scimitus

Stratiolaelaps scimitus is a soil dwelling predatory mite that feed upon pupal stages of thrips in the soil as well as fungus gnat larvae. A single preventive release to the media at planting is generally recommended to supplement control with *N. cucumeris*.

Minute Pirate Bugs

Orius species commonly known as minute pirate bugs feed upon both larval and adult thrips as well as aphids, spider mites and other small arthropods. Minute pirate bugs need pollen as a food source and can be slow to establish (up to 8 to 10 weeks) limiting their effectiveness in shorter-term ornamental crops. *Orius* have been successfully used in a variety of crops but they are not suitable for use on greenhouse tomatoes.

Both adult and nymphs are predacious and eat all stages of thrips. Look for the orange to brown nymphs on plant leaves and adult *Orius* on open flowers. All life stages move quickly. The adults are good flyers and can move throughout a greenhouse to locate their prey. In April, start checking thrips banker plants to see that the minute pirate bugs are reproducing. Tap plants over a white sheet of paper, to look for the bright orange nymphs on the banker plants.

Orius is most effective at temperatures between 68 and 85 °F. *Orius* species are commercially available as adults and nymphs mixed with inert materials that can be shaken over plants. Some species enter diapause (a resting period) during shorter daylights, but not others. *Orius* can be used in combination with *N. cucumeris* but they do prey on the predatory mites.

Tips for Using *Orius*

- Available as adults and nymphs in an inert carrier mixture.
- Shake over plants, especially in hot spots of thrips activity and over banker plants.
- Release in the early morning or late evening, when greenhouse vents are

closed.

- Avoid releases in bright sunlight.
- Consult with your supplier on recommended release rates

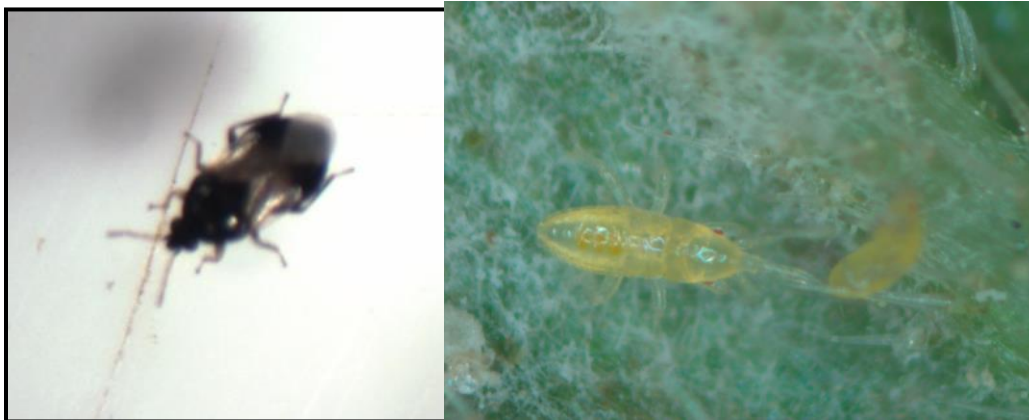


Figure 5: Minute pirate bug adult (left). Photo by L. Pundt and *Orius* nymph Photo by J. Allen

Steinernema feltiae

Drench applications of this beneficial nematode against fungus gnat larvae can also be used against thrips pupae in growing media. Start with a drench application to the growing medium followed by weekly spray or sprench applications. Apply nematodes in the early morning or late evening to avoid desiccation (from ultra-violet light) and when thrips mobility is generally slow. Use blackcloth curtains to minimize ultra-violet (UV) light and heat exposure and turn-off artificial lights for at least two hours after applying the nematodes.. See [Beneficial Nematodes: An Easy way to Begin Using Biological Control in the Greenhouse](#) for specific tips on their use.

Entomopathogenic Fungi

Beauveria bassiana is a commercially available entomopathogenic (insect-killing) fungus. Entomopathogenic fungi work by contact; directly penetrating the insect's cuticle. The fungus then uses the insect as a food source consuming its internal contents and eventually killing it. Once it has killed its host, the fungus emerges and sporulates, covering the insect in a white mold (if conditions are humid enough). Insects may also acquire lethal doses of fungal

spores from the surface of a treated leaf. *Beauveria bassiana* is a naturally occurring fungus found in soils. *Beauveria* sold under the trade names of BotaniGard®, Mycotrol (OMRI approved product). This fungus works best with a relative humidity >90%.

It also may be more useful to apply *Beauveria* early in the cropping cycle before plants flower and produce pollen. (Thrips derive nutrients from the pollen, which increases their egg laying and reproduction.) Plants will also be smaller, so it will be easier to obtain more thorough spray coverage. Due to tendency of thrips to hide in protected places, thorough spray coverage to growing points, flowers and underside of leaves is needed. Repeated applications are also often necessary.

Tips for Using *Beauveria*

- Begin applications early in production, at first sign of thrips.
- Thorough spray coverage is essential, directing sprays at terminals and buds.
- Spray to thoroughly wet but not to runoff.
- Multiple applications at repeated intervals every 3 to 5 days are often needed.
- Do not apply through a thermal pulse fogger.
- Check with your supplier for pesticide compatibility information
- Not compatible with *Hippodamia convergens* (ladybird beetles)

For information on compatibility of pesticides with natural enemies, consult the following databases or consult with your biological control supplier.

Pesticide Compatibility Databases:

Refer to online databases or apps such as those maintained by:

- Koppert's online interactive database:
<https://www.koppertus.com/side-effects-database/>
- Biobest: <https://www.biobestgroup.com/en/side-effect-manual>
- Bioline Agrosciences <https://www.biolineagrosciences.com/> (download Bioline app)
- BASF: <https://betterplants.basf.us/> (click on Solutions, Biological Controls, Nemasys Chemical Compatibility Guide”).

In summary, predatory mites, predatory bugs, entomopathogenic fungi and entomopathogenic nematodes may be incorporated into a biological control program for thrips.

By Leanne Pundt, UConn Extension, 2007, Revised 2019

References

Buitenhuis, R. 2013. A Novel Approach to Controlling Thrips, Vineland Research and Innovation Center.

Buitenhuis, R. 2014. Grower Guide: Quality Assurance of Biocontrol Products: Vineland Research and Innovation Centre
<https://www.vinelandresearch.com/wp-content/uploads/2020/02/Grower-Guide.pdf>

Buitenhuis, R., E. Glemser and A. Brommit. 2014. Practical placement improves the performance of slow release sachets of *Neoseiulus cucumeris*. *Biocontrol Science and Technology*. 24(10): 1153-1166.

Gillett-Kaufman. 2013. Swirski mite: *Amblyseius swirskii* Athias-Henriot in Featured Creatures: University of Florida: Entomology and Nematology/FDACS/DPI/ EDIs
http://entnemdept.ufl.edu/creatures/BENEFICIAL/swirski_mite.htm

Greenhouse Scout™ Cornell University (iTunes)
Summarizes information on biocontrol of common greenhouse insect pests and an interactive interface for collecting, organizing, and presentation of scouting data, and product application for insect management.

James, R.R. and B. Lighthart. 1994. Susceptibility of the convergent lady beetle (*Coleoptera: Coccinellidae*) to four entomogenous fungi. *Environmental Entomology* 23:190-2.

Jandricic, S. and S. Frank. 2014. Too scared to eat: non-consumptive effects of predatory mites reduce plant damage by Western flower thrips larvae. *IOBC-WPRS Bulletin* 102: 111-115.

Raudales, R. (Ed). 2019-2020. New England Greenhouse Floriculture Guide. New England Floriculture Inc. and the New England State Universities. Available from [Northeast Greenhouse Conference and Expo](#).

Robb, K.L. 1988. *Analysis of Frankliniella occidentalis (Pergande) as a Pest of Floricultural Crops in California Greenhouses*. PhD. dissertation, University of California, Riverside. 135 pp.

Van der Ent, S., M. Knapp, J. Kkapwijk, E. Moerman, J. van Schelt, and S. deWeert. 2017. *Knowing and recognizing the biology of glasshouse pests and*

their natural enemies. K Girard and K. Strooback (Eds). Koppert Biological Systems, The Netherlands. 443 pp.

Van Driesche, R. 1998. Western Flower Thrips in Greenhouses: A Review of its Biological Control and Other Methods. Prepared for web by Mark Hoddle. <http://biocontrol.ucr.edu/wft.html>

Disclaimer for Fact Sheets The information in this document is for educational purposes only. The recommendations contained are based on the best available knowledge at the time of publication. Any reference to commercial products, trade or brand names is for information only, and no endorsement or approval is intended. UConn Extension does not guarantee or warrant the standard of any product referenced or imply approval of the product to the exclusion of others which also may be available. The University of Connecticut, UConn Extension, College of Agriculture, Health and Natural Resources is an equal opportunity program provider and employer.