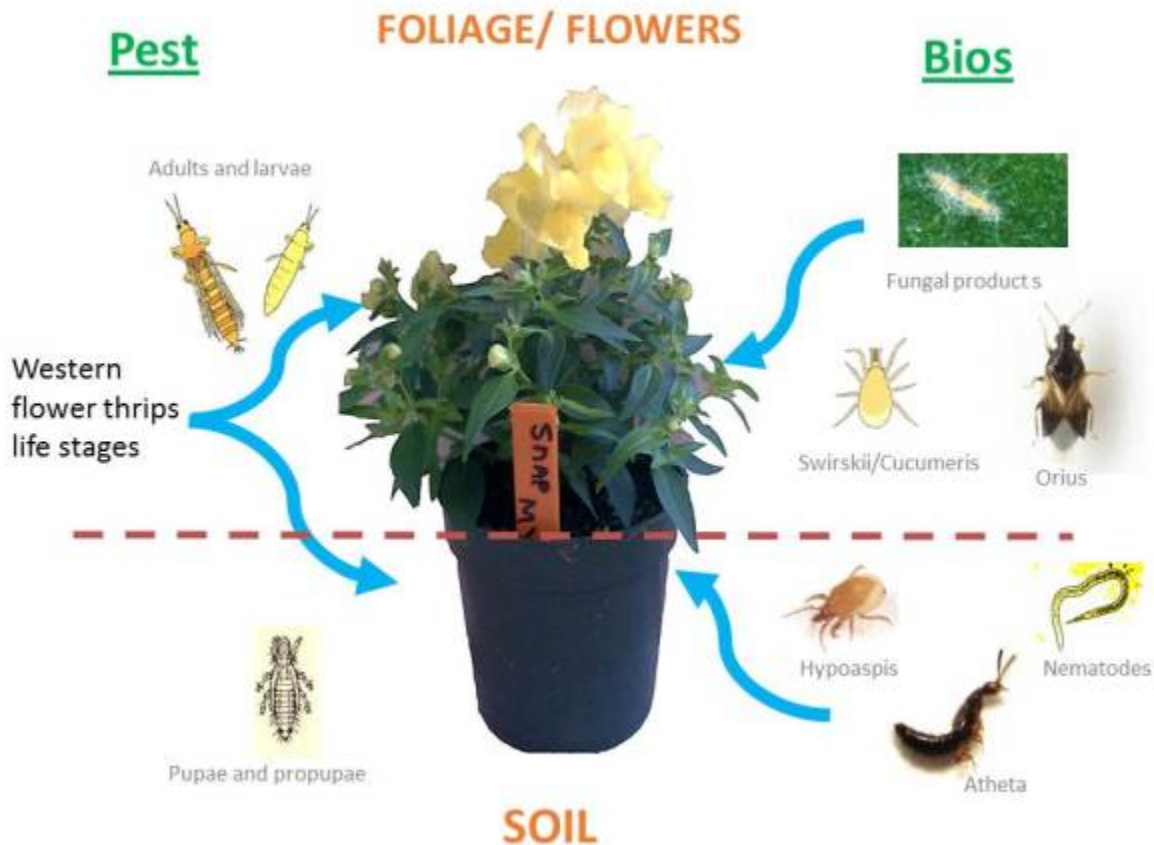


2017 Manage thrips with biocontrol and biorational insecticides when pest numbers are low and with conventional insecticides when pest numbers are high



Graphic from: 2015 Thrips Control: Unleash the Arsenal
Rick Yates <http://www.ballpublishing.com/GrowerTalks/ViewArticle.aspx?articleid=21442>

Biocontrol for thrips

Use of biological control methods should only be implemented as part of a well-planned IPM program. Biological control methods, should not be used when either TSWV or INSV is already present in the greenhouse. In all crops, soil drenches of nematodes such as *Steinernema feltiae* may be directed against western flower thrips pupae and prepupae in the soil. Note that *Amblyseius cucumeris* is available in two formulations, sachets (packets of mites and prey in bran that act as slow release systems) and bulk formulation of mites on bran. The bulk release formulation is more effective than sachets, however, some growers found that sachet packets provide more protection to the the mites.

Biological Controls Switching to *Swirskii*

- Though *Swirskii* are 2-3x more expensive than *Cucumeris*, they seem to be worth the cost in summer. Being from a warmer climate, research has shown they provide better thrips control than *Cucumeris* when average temperatures are above 25C⁵.

- predacious mites such as *Amblyseius cucumeris* (also known as *Neoseilus*) and *Hypoaspis miles* that feed on thrips larvae,
- predacious bugs such as *Orius insidiosus*,
- beneficial nematodes such as *Steinernema feltiae*,
- entomopathogenic fungi, such as *Beauveria bassiana*, that attack all WFT life stages and kill in two to 14 days.

Including Orius and Banker Plants in Biological Control Program

Orius insidiosus (Pirate bug) is a generalist predator feeds upon thrips, spider mites and pollen. Because *Orius* is slow to establish in the greenhouse, different types of banker plant systems have been investigated to encourage this predators development and establishment in the greenhouse. They are used in biocontrol programs when the weather warms in spring and beyond, in addition to other biocontrol agents already being used.

Pirate bugs are released onto ornamental pepper plants that are in flower which serve as a banker plant attracting the thrips and harboring the predators. The following *Orius* program is suggested by Syngenta and Griffin Greenhouse Supply. As the weather warms, make 3-4 weekly releases of 1 *Orius* per 10 sq. feet. Release in an around blooming plants. *Orius* will feed on pollen in the absence of thrips and also other small pests such as spider mites and caterpillar eggs. Release *Orius* late in the day when the louvers are closed and thrips are active.

Ornamental pepper plants have been used in spring crops as banker plants at a rate of one plant per 1,000 sq. ft of growing area. Recent research in Canada reported that the cultivar "Purple Flash" was more effective as a banker plant than the ornamental pepper variety "Black Pearl" which has been used over the past few years for this purpose.

About 60-80 pirate bugs can be released per flowering pepper plant. The *Orius* will lay eggs in the same area where thrips lay eggs, usually in or near flowers. Pepper plants attract the thrips and also serve as indicator plants for early detection. As long as the pepper plants are in flower and producing pollen, the minute pirate bugs will reproduce on the banker plants. The adults will move across the greenhouse and kill first and second instar thrips larvae and adult thrips. Usually one release onto the banker plants is all that is needed.

The drawback to using ornamental pepper plants is that the peppers need to be removed to keep plants continually flowering which is necessary to maintain the *Orius* population. Because of this, growers and researchers have been experimenting with the use of habitat planters for natural enemies.

It has observed that the Cosmos "Sensation White" has been especially helpful in encouraging their *Orius* populations. Their habitat planters have also included Achillea, lantana, alyssum, catmint, dill and African marigolds. They release *Orius* on and around these planters. It has also been suggested to add a breeder pile of the predatory mite *Amblyseius cucumeris* to habitat planters to feed on the thrips attracted to the the pollen source while *Orius* populations grow.

Canadian researchers also looked at castor beans, feverfew, gerbera, Lemon Gem marigold and sunflowers as potential banker plants. They reported that Lemon Gem marigold would not be acceptable as banker plants because very few of the *Orius* nymphs reared on this marigold

developed into adults. This was also true for sunflowers, which were also susceptible to powdery mildew as well as thrips damage.

Insecticides (active ingredient/MOA) to us to manage adult and larval thrips

- Distance/Talstar applied as a soil drench it will reduce the number of thrips adults emerging from pupae in the soil. Will kill *Hypoaspis* mites in the soil.

- **Pylon (chlorfenapyr/13)** ; Foliar applications are typically made twice, seven days apart before rotating. Certain fruiting vegetables are on the label. A total-release aerosol version is now available. Both formulations are for greenhouse use only. Will kill biocontrol agents.

- **Avid (abamectin/6)** ; Tank mixed with a neem-based insect growth regulator (IGR)—such as Azatin O, AzaGuard or Molt-X—and applied as a foliar application is effective when applied two times, seven days apart. Will kill biocontrol agents.

- **Overture (pyridalyl/UN)**; A slower-acting insecticide, taking up to seven days to see significant reductions in adult thrips populations from a foliar application. Growers often use this product after faster-acting options have reduced the population. Greenhouse use only. Will kill biocontrol agents.

- **Kontos (spirotetramat/23)**; Drench applications show very good results, though they're slow to take full effect (up to three weeks). Several weeks of control have been noted. GGSPRO has developed a drenching calculator to accurately determine stock solution recipes and drench volumes. Foliar spray applications have given variable results and aren't recommended for thrips control. Geraniums and dracaena are among crops damaged by Kontos.

- **Nematodes** ; *Steinernema feltiae* have been assisting growers to control the pupal stages of WFT. Applications to the media every two to three weeks is recommended to augment other control efforts. This approach adds excellent fungus gnat control at the same time.

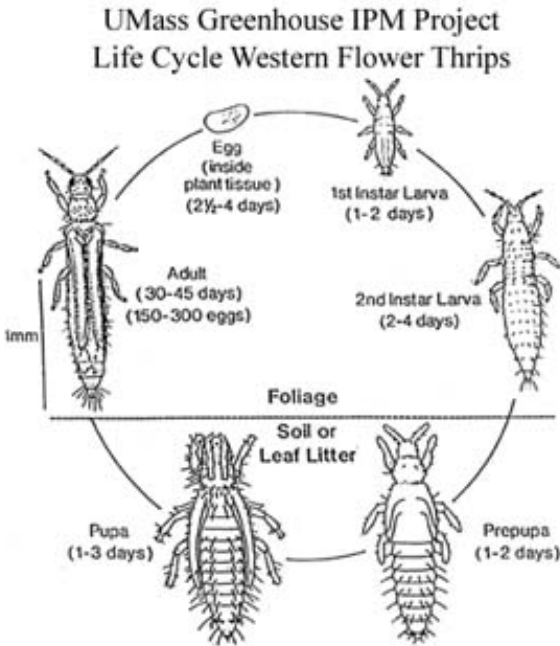
- **Microbial insecticides**; BotaniGard provides good results when applied frequently as foliar applications. Met52 EC and Preferal are newer products, so we have less experience with them. In addition to foliar applications, media treatments of these two products may control the pupal stage of thrips. More research is needed to confirm the effectiveness of media applications. All of these microbial products have certain edible crops on their labels.

- **IGRs**; Pedestal has long been a part of thrips-control programs, causing death at the point of molting. Enstar AQ (s-kinoprene) is also labeled for thrips. IGRs are generally used in combination with adulticides or after a good knockdown has been achieved with other products.

- **Others**; Certain neonicotinoid/4 insecticides—such as Flagship (thiamethoxam), Safari (dinotefuran) and Tristar(acetamiprid) already heavily used for a variety of other greenhouse pests, so they typically are not recommend them for thrips. For many years, Mesuro (metiocarb/1A) was one of the more effective products for thrips control, but results have been more inconsistent in recent years. Aria (flonicamid/29) is a feeding blocker that's labeled for thrips suppression, but won't provide an immediate knock-down.

- **Latest introductions** Mainspring (**cyantraniliprole** /28) has a brand new MOA and has activity against thrips from a spray or a drench.

Western Flower Thrips, Management and Tospoviruses



Graphic from: <https://ag.umass.edu/greenhouse-floriculture/fact-sheets/western-flower-thrips-management-tospoviruses>

Western flower thrips (WFT) *Frankliniella occidentalis* continues to be a serious pest of floriculture crops. WFT damage plants directly by feeding, and indirectly by acting as vectors for the tospoviruses impatiens necrotic spot virus (INSV) and tomato spotted wilt virus (TSWV).

Appearance

Adult WFT are about 1/16th of an inch long, and are long and narrow shaped, like grass seed. Adults have two sets of narrow, clear, nearly veinless wings that have dark, hairy, fringes. Adult male WFT are light yellow, while adult female WFT are a little larger than the males and vary in color from light yellow, yellow with brown splotches, to dark brown. WFT is the most prevalent species of thrips in greenhouses. Larvae resemble adults, but are wingless.

Biology, Life Cycle, and Behavior

Depending on environmental conditions and nutrient levels, WFT females lay 150-300 eggs during their lifetime. Eggs are inserted in leaves, bracts, and petals and hatch in about a week into larvae, which feed in flower buds or terminal foliage. The eggs of WFT are well protected and in general, pesticide sprays are ineffective against them. The first larval stage lasts one to two days and second larval stage, two to four days. Toward the end of the second larval stage, the thrips stops feeding and drops or enters the soil or leaf litter and becomes a prepupa, which is a nonfeeding stage that lasts one or two days before pupation. Winged adults then emerge from

the pupal stage in one to three days, depending upon temperature. Because the prepupae and pupae are mostly in the soil, these stages are not affected by insecticides applied to the foliage. Currently there are no recommendations for soil drenches aimed at thrips pupae. The life cycle is completed in two to four weeks.

Plant Damage

Thrips feed by piercing plant cells with their mouthparts and sucking out their contents. Damaged plant cells collapse, resulting in deformed plant growth, flower deformation, or silvered patches and flecking on expanded leaves. If thrips feed within developing buds, the damaged cells fail to grow as the leaf or flower expands, resulting in deformed leaves or flowers. Sometimes flower buds abort. Silvery leaf scars and specks of black feces are a good way of diagnosing the presence of WFT on plants. WFT feed on a broad range of plants including impatiens, fuchsia, chrysanthemum, ivy geraniums, marigolds, hibiscus, verbena and petunia. WFT will also eat mite eggs, adult mites, other thrips.

In addition to direct feeding injury, WFT vector two tospoviruses, the impatiens necrotic spot virus (INSV) and the tomato spotted wilt virus (TSWV), both of which can be identified using on-site test kits. Of the ten known types of tospoviruses, only two-TSWV and INSV-infect ornamental plants, but both infect over 600 species of ornamental plants. Almost all greenhouse crops are susceptible except for poinsettias and roses. Thrips transmit both types of viruses in greenhouse and field crops. Seven species of thrips are vectors for TSWV, but the only confirmed vector for INSV is WFT. TSWV is a problem mostly on vegetable plants such as tomatoes and peppers, while INSV is the predominant tospovirus found in ornamentals.

Plant Virus Transmission

During feeding, saliva is injected into the plant cell and the contents withdrawn. When tospoviruses are present in the saliva, these are transmitted to the plant during the feeding process in as little as 15-30 minutes. Only the two larval instars of WFT can acquire the virus. Adult WFT do not acquire the virus from tospovirus-infected plants because tospoviruses pass right through the gut and do not enter the salivary fluid. Once thrips acquire INSV or TSWV, virus multiplies within the salivary glands and other tissues of the thrips and is later transmitted to new plants by the feeding of the infected thrips after it has reached the adult stage. Adults however, do not transmit the virus to their young and there is no transmission from adult to egg. Overlapping generations of thrips within a greenhouse may result in continuous virus transmission.

Tospovirus Symptoms in Plants

It is difficult to diagnose tospovirus infections of greenhouse plants using visual symptoms alone. Symptoms vary depending on plant species, cultivar, developmental stage of the plant, and environmental conditions. Tospovirus symptoms often mimic symptoms caused by other problems such as nutrient deficiencies. General symptoms include leaf spots, necrotic areas, mottling and ringspots or target marks. Some plant species die from the virus, while others survive, but are unsalable. Young plants are especially vulnerable to infection. There is no cure.

Tospovirus infections may be systemic (i.e., virus symptoms occur throughout the plant) or non-systemic (i.e., the virus symptoms are confined to a specific part of the plant). Tospoviruses,

however, may be present even though the plant shows no symptoms. One problem with testing for viruses is that some host plant species do not express TSWV or INSV symptoms until long after the initial infection. Cyclamen, for example, can show no symptoms for up to two months after infection

Using On-Site Test Kits to Detect Tospoviruses

On-site test kits can be used to determine whether or not tospoviruses are present in greenhouse plants. If a plant is suspected of being infected with a tospovirus because the plant is showing symptoms of virus infection, a tissue sample can be collected from those parts of the plant showing symptoms. Even, when plants are systemically infected, tospoviruses do not spread evenly throughout the plant, so careful selection of tissues is crucial to the success of the test. Collect a sample from the part of the plant showing symptoms, including green or chlorotic tissues adjacent to the necrotic area. Thrips can also be collected from sticky traps and tested using the test kits.

Companies that manufacture test kits available for on-site testing. Both companies have separate kits available for testing for INSV and TSWV. ImmunoStrips from Agdia Inc 30380 County Rd. 6 Elkhart, Indiana 46514 www.agdia.com

Another option for detecting tospoviruses is to send a plant sample to a plant disease diagnostic clinic. Samples may be sent to the <https://pdc.umn.edu/> , University of Minnesota Plant Disease Clinic, 495 Borlaug Hall, 612.625.1275 (a fee will be charged).

Monitoring and Indicator Plants

Early detection is critical to the control of WFT and to the prevention of tospovirus infections. Indicator plants and sticky cards are the best available means of providing early warning of thrips and TSWV/INSV in greenhouse production areas. Petunia plants (*Petunia x hybrida*) are excellent early indicators for the presence of WFT feeding and the transmission of tospoviruses because petunias are not systemically infected with either TSWV or INSV. The following petunia cultivars are excellent indicator plants for the detection of tospoviruses: Calypso, Super Blue Magic, Blue Carpet, Cascade Blue, Summer Madness, Burgundy Madness, Red Cloud, Super Magic Coral. Fava bean plants can also be used as an indicator plant. However, the virus is systemic in fava bean plants and once infected, plants should be discarded immediately so as to not serve as a source of infection. Check indicator plants for virus symptoms, which appear as dark-ringed lesions that develop around thrips feeding scars.

To set up a monitoring program using petunias, first remove flowers. Thrips will preferentially feed on flowers, but flowers do not show virus symptoms and will attract WFT away from the leaves. Use a blue non-sticky card to attract thrips to indicator plants since WFT are more strongly attracted to blue than to other colors. Check plants each day, looking for WFT feeding scars, which are whitish and have an irregular outline. Brown or black-edged lesions will develop on the edges of thrips feeding scars within three days if a tospovirus has been transmitted. Control measures include removal of infected plants and WFT control measures, such as spraying, or exclusion of thrips. Infected plants should be placed in a closed plastic bag at the bench to avoid spreading virus-containing thrips to other areas of the greenhouse during the removal process.

Use sticky cards to monitor adult thrips. Blue sticky cards are more effective in detecting thrips than yellow sticky cards. Therefore, blue cards are best used in thrips-sensitive crops. Yellow sticky cards are best used for general pest monitoring because they are also attractive to whiteflies, winged aphids, leafminers, fungus gnats and shoreflies. A 10 or 20x hand lens will help to distinguish adult thrips from pieces of peat moss or other debris. Attach cards to a stake with a clothespin so that cards may be raised as the plants grow. Place the cards just above the crop canopy in an even pattern throughout the entire greenhouse. Use a rate of at least one card per 1,000 sq.ft. with additional cards placed near the doors, vents and thrips-sensitive plants. Thrips will move on air currents. Visual inspections can be improved by blowing lightly into the blossoms or growing points. The carbon dioxide will bring thrips out of their protected areas. Flowers and plant tips can be shaken over a piece of paper for additional monitoring. Thrips populations will be highest when plants are flowering.

Trap Counts and Tolerance Levels

Trap counts and keeping records are meaningful in two ways. Keeping records over time will provide information on what direction the population is changing and at what rate. This information is useful in determining the efficacy of a treatment or control measure. Tolerance levels or damage thresholds determine the damage that is likely to occur at a particular population level. Tolerance levels will vary depending upon the crop, its stage of growth, local market standards and whether or not either INSV or TSWV are present at the site. Record thrips counts on cards and correlate this information to the damage you see on your crops. Different crops have different susceptibilities. For example, Saintpaulia is very susceptible and treatment thresholds are lower than 5-10 thrips/trap/week. Begonias and poinsettias are much less susceptible to damage and thresholds are much higher. Also, plant propagators will have a lower tolerance threshold for thrips than finished plant growers. Some growers use a general tolerance level of 5-10 thrips per card per week. However, if INSV or TSWV is present, the tolerance levels for thrips is zero and a strict thrips control program should be implemented.

Managing WFT and Tospoviruses

The spread of WFT and TSWV or INSV from grower to grower is caused in two ways: by shipping tospovirus-infected plants (both propagative and pre-finished) and by shipping plant materials infested with tospovirus-carrying WFT. Growers are encouraged to choose plant vendors with care. The first step in managing thrips is to prevent thrips from entering the greenhouse. Monitor for thrips as soon as plants or cuttings are received. Keep thrips-infected plants isolated in a separate area to prevent them from moving throughout the range. Winged adults are weak fliers but may be carried on air currents and employee's clothing. Remove "pet" plants and avoid keeping leftovers such as holiday cacti and cyclamen. Remove all plant debris on benches and floors. If soil is present under greenhouse benches, treat the soil with a pesticide to eliminate the developmental stages of WFT. To accelerate the development of WFT pupae in the soil, and eliminate the emerging adults, close greenhouse vents and keep the house heated and empty for a week or more between crops. Note that one week may not be enough time. The use of yellow sticky traps will help to detect emerging adults. Use an insecticide to knock-down emerged adults.

WFT prefer to feed on flowers, so the longer a crop can be grown without flowering the lower the thrips population will be. Keep flowers off of plants as long as possible to reduce populations.

Screening can be used to mechanically exclude WFT. However, the screening material for WFT is so fine that proper ventilation is a challenge and this limitation should be considered. Also, screening will only be helpful if the source of infestation is from thrips migrating in from the outside and not from infected plant material within the greenhouse, which is most common. Weeds serve as host for WFT and INSV and managing weeds inside and outside the greenhouse is critical for thrips management. Maintain a 15 foot weed-free barrier around the greenhouse to help reduce thrips entry. A contact insecticide such as horticultural oil can be used outside the perimeter of the greenhouse prior to mowing or using herbicides. This will kill thrips on outdoor weeds and prevent them from entering the greenhouse to search for new hosts when weeds are mowed. Good sanitation controls Tospoviruses.

Chemical Control

There are many insecticides registered for WFT, but overuse of pesticides can lead to resistance in the WFT populations you are trying to control. While resistance is of concern, failure of chemical control is most often due to poor timing, poor coverage or other factors and these causes should be considered before assuming resistance.

Most insecticides and miticides affect insects and mites in specific ways. These ways may be called the pesticides "mode of action". The Insecticide Resistance Action Committee (IRAC) is an organization of chemical companies and researchers that has classified insecticides and miticides into different modes of action groups. Each MoA group is assigned an Insecticide Resistance Action Committee Group number (IRAC code). Mode of action is the way a chemical works, so chemicals in different chemical classes may have the same or similar modes of action and be causes of pesticide resistance. MOA group numbers are found on many pesticide labels and are listed below for selected materials listed for managing WFT.

Table 1. Pesticides labeled for WFT in greenhouses.

Mode of Action Group Numbers	Common Name	Trade Name
18B	azadirachtin (neem)	Aza-Direct, Azatin XL, Neemix 4.5, Ornazin, Molt-X
3 & 27A	pyrethrins and PBO (piperonyl butoxide)	Pyrethrum TR, Pyronyl Crop Spray
1A	methiocarb	Mesurool 75-W
4A	imidacloprid	Marathon II, 1% Granular, 60 WP and many others
Desiccator or membrane disruptors	horticultural oil	Ultra-Pure Oil
15	novaluron	Pedestal
7A	kinoprene fenoxycarb	Enstar AQ Preclude TR

Mode of Action Group Numbers	Common Name	Trade Name
6	abamectin	Avid 0.15EC, Abamectin E pro, Flora-Mek 0.15 EC and others
Unclassified (beneficial fungus)	<i>Beauveria bassiana</i>	Botanigard ES, 22WP
5	spinosad	Conserve SC
1B	acephate	1300 Orthene TR, Orthene TT&O, Orthene TT&O 97
1B	chlorpyrifos	DuraGuard ME
1B & 3	chlorpyrifos and cyfluthrin	Duraplex TR
3	bifenthrin	Talstar Select, Attain TR
3	cyfluthrin	Decathlon 20 WP
Desiccators or membrane disruptors	insecticidal soap	M-Pede

Mention of a pesticide does not constitute an endorsement of any product and any omission from this list is unintentional. The pesticide label is the ultimate authority for pesticide use.

[*New England Greenhouse Floriculture Guide, A Management Guide for Insects, Diseases, Weeds and Growth Regulators.*](#)