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Managing Western Flower Thrips on Greenhouse Crops

Introduction

More than one dozen species of thrips feed on greenhouse-grown crops. One of the most important and difficult-to-control species is the western flower thrips (WFT), *Frankliniella occidentalis*. The greenhouse thrips *(Heliothrips haemorrhoidalis*), and the onion thrips (*Thrips tabaci*) may also be found on greenhouse crops. The chilli thrips, (*Scirtothrips dorsalis*) a foliage feeder, occurs in Florida and Texas and may be introduced into greenhouses on plant material. *Echinothrips americanus* is another leaf feeding species, which is easily identified by its black body with two distinct white spots on its wings.

Western flower thrips have spread throughout the horticulture industry on plugs, cuttings and plugs. 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. Their broad host range, high reproductive capacity, rapid life cycle, and resistance to insecticides make them difficult to control.

Feeding Damage

Thrips feed by piercing plant cells with their mouthparts and feeding on the exuded plant juices. This collapse of plant cells results in deformed flowers leaves and shoots. Silvery-flecked scars and small black "fecal" spots may be seen on the expanded leaves.

Western flower thrips have a broad host range and may feed upon greenhouse ornamentals, vegetables, herbs and herbaceous perennials. Some favorite hosts include *Asclepias*, basil, chrysanthemum, dahlia, eggplant, fuchsia, geraniums (ivy), gerbera daisy, *Ipomoea*, marigolds, New Guinea Impatiens, petunia, pepper, portulaca, primula, salvia, snapdragon, tomato, verbena, zinnia and many others.

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. The tospoviruses have one of the widest host ranges of any known virus. Over 600 plant species in 62 families are confirmed hosts. Losses have occurred for growers of garden impatiens, New Guinea impatiens, cyclamen, begonia, and primula. Almost all greenhouse crops with the exception of roses and poinsettias are susceptible. Infected plants show a wide range of symptoms depending upon the plant species or cultivar infected. Some of the more generic symptoms of tospoviruses include leaf spots, necrotic areas, mottling and ringspots. Young plants may be especially vulnerable to infection. There is no cure. As soon as tospoviruses are detected, rogueing of infected plant material must be combined with strict thrips management. See Some Virus Diseases of Greenhouse Crops for more information.

Virus Transmission

Only the first instar larval thrips acquire the virus. If infected as larvae, the adults can transmit the virus in their salvia as they feed upon plants. The winged adults are primarily responsible for viral spread, however, due to a midgut barrier; the adults cannot acquire the virus. The virus persists in the adult thrips for their entire life. Fortunately, the adults do not transmit the virus to their young. There is no transmission from adult to egg. Overlapping generations of thrips within a greenhouse may result in continuous or sporadic virus spread.

Life Cycle of Western Flower Thrips

Their life cycle consists of eggs, two nymphal stages, two pupal stages and adults. Adult females may live for approximately 30 to 45 days, feeding primarily on pollen. Females insert their saw-like ovipositors into plant leaves to lay eggs. During their lifetime, female thrips lay from 150 to 300 eggs that hatch in about one week. Eggs are laid on the upper surface or lower leaf surface depending upon the plant species. For example, eggs tend to be laid on the upper leaf surface on chrysanthemum but on the lower leaf surface on pepper plants. The first two larval stages remain protected in the tender young growth. They resemble adults but are wingless. After the second instar larvae stops feeding, it drops to the soil or growing media to pupate. Thrips may also pupate in open flowers. Adults may then emerge in about 6 days, depending upon temperature. Adults are weak flyers but are spread throughout the greenhouse on air currents.

The thrips life cycle is dependent upon temperature with development occurring between 50 F and 90˚ F. Thrips can survive cooler temperatures then 50˚ F, however, there is no development at that temperature. Their life cycle varies from seven to 14 days at fluctuating temperatures between 68 to 98˚ F that may be more common in the greenhouse environment (Table 1).

Table 1. Life Cycle of Western Flower Thrips (Robb, 1988)

Stage	***Approximate duration at temperatures between 68º and 98ºF***
Egg	**2-4 days**
1st instar (immature)	**1-2 days**
2nd instar	**2-4 days**
Prepupal	**1-2 days**
Pupal	**1-3 days**
Adult	**30-35 days**

In the greenhouse, thrips occur year-round whenever temperatures are favorable for their development and host plants (including weeds) are available for food. Many common greenhouse weeds such as redroot pigweed, chickweed, lambs quarters, bindweed, thistle, oxeye daisy, galinsoga and pineapple weed are suitable hosts for thrips to lay eggs and may carry tospoviruses and showing, few, if any symptoms.

Prevention

- Keep greenhouse free of weeds, pet plants, and media debris. See Greenhouse Weed Control for more information.
- Inspect incoming plants or cuttings.
- If possible, keep thrips-infected plants isolated in a separate area to avoid the spread of thrips.
- A weed-free barrier of at least 10 feet around the greenhouse may help to discourage thrips entry. When outdoor weeds desiccate or when weedy areas are mowed, thrips may enter the greenhouse to search for new hosts.
- Dispose of plant debris in tightly sealed containers. Do not allow open garbage bins in the greenhouse, as thrips may disperse from the plant material unto the crop.

Scouting
Early detection of western flower thrips is difficult due to WFT's high reproduction rate, rapid developmental time and tendency to hide in flowers and buds

Use yellow sticky cards to monitor for the adult thrips. Use a 10-20x-hand lens to distinguish the adult thrips from grains of peat moss or other debris. Weekly counts of thrips adults on sticky cards helps determine population trends and the effectiveness of pest management tactics. Tolerance levels depend upon the crop, its stage of growth and the customer's tolerance of pest damage. If plants become infected with the virus, the tolerance level for thrips is zero and strict thrips control is then needed. Gently blowing into open flowers agitates the thrips so they are easier to see.

Figure 1: Adult thrips will be one of the smallest insects caught on yellow sticky cards. Photo by L. Pundt

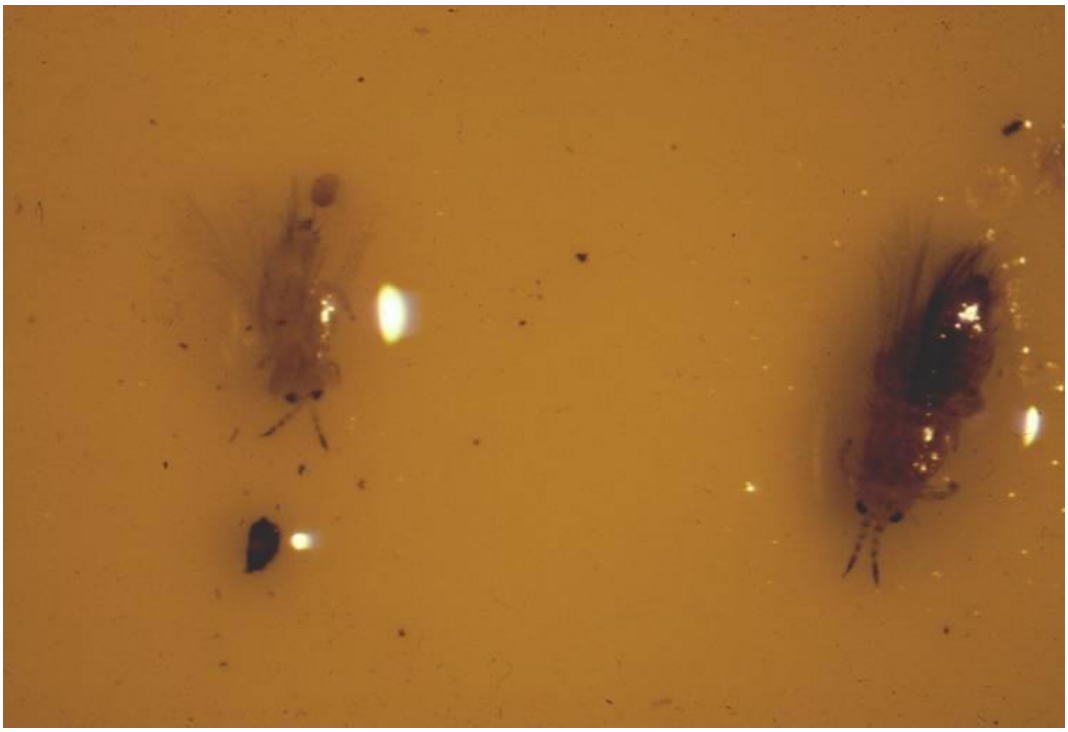

Figure 2: Smaller, male thrips (on left) compared to female adult thrips. Photo by L. Pundt

Growers may also gently tap plant foliage or flowers over a sheet of white paper to dislodge thrips.

Biological Controls

Due to resistance to many of the insecticides, more growers are using biological controls, especially during spring greenhouse production. Commercially available natural enemies include predatory mites *Neoseiulus cucumeris*, *Amblyseius swirskii*, predatory bugs (*Orius* species), rove beetles, insect killing nematodes and fungi. See Biological Control of Western Flower Thrips for more information.

Beneficial insect killing nematodes (*Steinernema feltiae*) that are used against fungus gnat larvae may also be effective against thrips pupae in the growing media. See Beneficial Nematodes, An Easy Way to Begin using Biological Controls for more information.

Chemical Controls
Insecticides with contact or translaminar activity are generally used against thrips. Preventive drench applications may also be used. Resistance has been reported to organophosphates, carbamate, pyrethroid, and macrocyclic lactone chemical classes. To delay the onset of insecticide resistance, rotate between insecticides with different modes of action every two to three weeks, or after one generation (depending upon temperature). Repeated applications two to three times every 3 to 5 days (depending upon temperature) may be needed to reduce thrips numbers.

Consult the most recent edition of the ***New England Greenhouse Floriculture Guide*** for more specific information. Available from Northeast Greenhouse Conference and Expo.

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