The western flower thrips (WFT), *Frankliniella occidentalis*, is of increasing concern to growers in Connecticut. Western flower thrips have spread throughout the industry on plugs, cuttings and small plants. WFT's small size and tendency to hide in enclosed places makes it difficult to detect the thrips before severe feeding damage is evident. Early thrips detection by using sticky cards is essential to limit their feeding damage and possible transmission of tomato spotted wilt virus (TSWV) to uninfected plants.

**Thrips Damage**

Thrips feed by piercing plant cells with their rasping mouth parts. Plant cells collapse, which results in deformed flowers and leaves. On expanded leaves, silvery, flecked areas and black "fecal" spots may be seen. Thrips feeding on greenhouse-grown tomato leaves causes brown lesions that may be easily confused with Septoria leaf spot. No black fruiting bodies (pycnidia) characteristic of Septoria will be seen on the thrips-damaged leaves.

**Thrips and TSWV**

WFT is the most efficient thrips vector of TSWV. Only the larval thrips can acquire the virus, and the winged adults are primarily responsible for viral transmission. TSWV persists in the adult thrips for their entire life, and the virus particles multiply in the thrips.

**Life cycle of thrips**

The life cycle of thrips from egg to adult is dependent upon temperature and varies between seven to 14 days at fluctuating temperatures (Table 1).

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**Using Sticky Cards to Monitor for Insects**

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Yellow sticky cards (YSC) will trap western flower thrips (WFT), whiteflies, fungus gnats, shoreflies and winged aphids in the greenhouse. Sticky cards can help growers detect early pest infestations more effectively than will intensive plant sampling. By using sticky cards, growers can keep track of insect population trends and make more informed and timely pest management decisions. However, growers should supplement the information gained from sticky card counts with visual monitoring of their crops.

**Suggestions on Using Sticky Cards**

Use at least one card per 1,000 sq. ft., plus additional cards near doors, vents and over insect-sensitive plant species or cultivars. Experiment to see if more cards will help in gathering information at your production range.

Use a 10x-15x hand lens to see the identifying characteristics of insects caught on the cards. With practice, it becomes much easier to distinguish a shorefly from a fungus gnat or a thrips from a grain of peat moss (see Figure 1. *Insects Frequently Found on Sticky Traps in Greenhouses*).

**Figure 1. Insects on Sticky Traps**

(Continued on next page.)

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to the monitoring of handlers and training duties for early-entry workers. WPS provisions that do apply to owners and members of their immediate family include employer information exchange (i.e. what is being used, where it is being used, what is the REI, etc), the use of PPE and any other attire listed on the label, all REI and noncontact provisions and any restrictions during application designed to prevent exposing anyone to a pesticide.

In this article, I have tried to give an overview of the WPS and the types of actions growers will need to take to comply. A more detailed account of this standard is available through the state DEP. Contact Debbie Catuccio at the DEP Pesticide Management Division (203-566-5148) and ask for the How to Comply manual (copies are available on a limited basis). Copies can also be obtained, in newsprint form from Gempler's Inc. (1-800-382-8473). Gempler's is an agricultural safety company. They will send a free copy of the How to Comply manual along with their 1994 catalog. Gempler's will be a good source for training materials, PPE and other compliance support materials.

Growers need to start thinking about compliance now before the mandatory compliance date arrives. Worker and handler training will have to occur immediately and, for a greenhouse business, it will be hard to find time to learn about WPS in April and May.
workers and pesticide handlers. It will also specify requirements for training, decontamination, notification and emergency assistance. Specific instructions and any exceptions pertaining to personal protection equipment, notification of workers and Restricted-Entry Intervals will also be listed. It is not yet known what specific information each product label will contain.

The REI or Restricted-Entry Interval is the time immediately after a pesticide is applied, when entry into the treated area is restricted. This provision may have a great impact on how growers coordinate crop care, manage labor and time pesticide applications in the greenhouse.

There are some exceptions to the REI. These include reentry for agricultural emergencies and for early-entry workers. In both cases no reentry is allowed within four hours of the application and until the inhalation exposure level listed on the pesticide label has been reached.

Agricultural emergencies involve only a few exceptional circumstances. Poor management or poor planning will not qualify for an agricultural emergency. Early-entry workers require special training and special equipment and are only allowed to work a limited number of hours in the treated area. Personal Protection Equipment for early-entry workers is listed on the pesticide label in the Directions for Use Section.

The WPS lists special restrictions for both nurseries and greenhouses. For the purposes of WPS, a greenhouse is any enclosed structure used for agricultural crop purposes and big enough for a person to work in (so, hoop houses and other enclosures would be included). The WPS definition of a nursery would include any operation that produces or propagates plants outdoors for use at another location or for cuttings. Therefore, most commercial greenhouse operations will need to pay attention to the special restrictions for both nurseries and greenhouses.

There are exceptions to the WPS for owners and members of their immediate families. These individuals do not need to comply with the provisions covering information at a central location, pesticide safety training, decontamination sites, emergency assistance, notice about pesticide application, PPE handling and care, equipment safety and other provisions related
It was then suggested that growers only need to count a one-inch-wide vertical column in the center of each card to estimate the total numbers of insects caught. Growers can then greatly reduce the time spent counting insects and reduce their monitoring costs. The researchers concluded, however, that growers should not cut their cards to a 1" by 5" size. Larger cards tend to catch a greater diversity of insects than smaller cards, and trap catches tend to increase with size.

**Thrips**

Light blue cards are more effective in trapping WFT and may be used over thrips-sensitive plants such as roses or African violets. Yellow cards are more effective for general pest monitoring, and adult thrips may be easier to see on a yellow card compared to a blue card. Use a hand lens to distinguish adult thrips from grains of peat moss and other debris. WFT adults are narrow, 0.04 to 0.08 inches long, with two pairs of fringed wings that are held parallel over their body. Females tend to be dark brown and slightly larger than the small, tan or yellow males. Dark brown to black onion thrips may occasionally be caught on cards as they enter the greenhouse from outside.

Cards should be placed just above the crop canopy (1" to 2") to most effectively trap thrips. Placing cards at bench level tends to catch more thrips compared to card placement at hanging basket or floor levels. Card counts may be higher at the ends of the greenhouse, where the passively-carried thrips tend to drop out of air circulation patterns. Under mist propagation, fewer thrips will be caught on sticky cards, as adults are less able to fly, due to the water on their fringed wings. In February, it may be helpful to place cards just above the floor level to detect any early emerging thrips that have overwintered in the greenhouse.

Tolerance levels will vary depending upon the crop, potential damage, time in the production cycle and whether Tomato Spotted Wilt Virus (TSWV) is present. Many growers use a "working tolerance level" of less than 10 thrips per card per week. If TSWV is present, the threshold is as close to zero as possible.

5. notify workers about treated areas so they can avoid inadvertent exposure to pesticides.

6. protect pesticide handlers during pesticide handling tasks. Protection requirements include monitoring handlers while highly toxic pesticides are being used and duties related to the correct use of PPE.

If you hire pesticide handlers, you are required to routinely clean and maintain the PPE they use. If you hire people to clean and care for PPE, they, too, will require special training and instruction.

The third key area of compliance involves mitigation. Employers must take specific steps to mitigate the exposure that employees do receive. WPS requires you to provide decontamination sites for employees and to provide emergency assistance if required. Decontamination sites must provide handlers and workers an ample supply of water, soap and towels for both routine washing and emergency decontamination. Emergency assistance includes making transportation available to a medical care facility if an agricultural worker or handler has been poisoned or injured by a pesticide. It also requires you to provide information about the pesticide or pesticides to which the individual was exposed.

Certain key details of the WPS are specific to each pesticide used. These very specific details will appear on the label of each pesticide. However, this information is not yet available. You will know that WPS applies when the label states, in the Directions for Use section, "Agricultural Use Requirements—use this product only in accordance with the WPS, 40 CFR Part 170".

Pesticide labels bearing the WPS "Agricultural Use Requirements" will specify what is required to protect agricultural
early-entry workers access to labeling information, and you must maintain a list of pesticide usage at a central location on your establishment.

Pesticide safety training is a key part of WPS. The state of Connecticut will allow any certified applicator (including private applicators) to work as a trainer. In addition, people designated by the state may train, and people attending a designated DEP "train the trainers" program may function as trainers. WPS is specific as to the information that a trainer must provide and how training is to be conducted. In most cases, trainers will want to attend a DEP or an Extension sponsored training session to understand this aspect of compliance.

Note: Training your workers and handlers cannot wait. Starting April 15, 1994 all handlers will need to be trained before they handle any pesticide and workers will need to be trained before they accumulate a total of 15 days working in any treated area in your establishment. (A treated area is any area where a pesticide has been used within the last 30 days.)

WPS mandated protection is designed to ensure that agricultural employees and handlers are not exposed to pesticides. WPS compliance requires employers to:

1. prohibit handlers from applying pesticides in a way that will expose workers (or other persons) to these chemicals.
2. exclude workers from areas being treated with pesticides.
3. exclude workers from areas that are under a restricted-entry interval (REI). There are special exceptions for so called early-entry workers,
4. protect early-entry workers (those permitted to do tasks in treated areas during REI). To protect early-entry workers, you are required to provide special instructions and perform certain duties related to the proper care and correct use of personal protection equipment (PPE).

Fungus gnats
Fungus gnat adults are delicate insects with longer legs and antennae than shorefly adults. Adult fungus gnats have a distinctive "Y" shaped vein on their wings (see Figure 1). Horizontal placement of cards just above the soil surface is more effective than vertical placement just above the crop canopy. In one study, red cards were found to be more effective than yellow, blue, white or green cards.

Tolerance levels will vary depending upon the crop, soil mix and time in the production cycle. Earlier detection of low population levels makes it easier for growers to use beneficial nematodes or Gnatrol with greater success. Some growers use a working tolerance level of five to ten fungus gnats per card per week using horizontal card placement.

Shoreflies
Shorefly adults are more robust with shorter antennae than fungus gnat adults. Adult shoreflies have five clear spots on their wings. Horizontal card placement is more effective in detecting shorefly adults than vertical card placement.

Whiteflies
Whitefly (WF) populations tend to be aggregated and not uniformly distributed within the greenhouse. Growers may want to use more cards near whitefly-favored plant hosts such as lantana, flowering maple, hibiscus, rosemary, tomato, chenille plant and regal geraniums. WF adults lose their white color and develop an orangish caste when trapped on the cards. In addition to greenhouse and sweet potato whiteflies, growers may occasionally see banded winged whiteflies. Banded winged whiteflies have a grayish tinge when trapped on cards caused by the two distinct zigzag black bands on their forewings. A few banded winged whiteflies have been caught on cards in Connecticut in the early fall (late August to September). They tend to enter greenhouses from outside (ragweed is a host) but cause no damage on poinsettia plants.

Winged Aphids
Yellow cards will only catch winged aphids. Therefore, plant and weed inspection is needed for the early detection of young aphid nymphs. Aphids will have two distinct dark spots on their wings and two cornicles or "tailpipes" at the rear of their abdomen. It is more difficult to monitor for
melon aphids, which are smaller than green peach aphids and less likely to form winged adults.

Parasitic Wasps

Small parasitic wasps may occasionally be caught on sticky cards, especially in greenhouses where there are fewer spray applications. Parasitic wasps usually have elbowed antennae (like ants) and only one vein on their forewings.

In summary, sticky cards can be an effective tool to aid growers in their pest management decision making.

Some Suppliers of Sticky cards and/or handlens

IPM Laboratories
P.O. Box 300
Locke, NY 13092

W H Milikowski, Inc.
75 Chestnut Hill Road
Stafford Springs, CT 06076
(YSC only)

Olson Products, Inc
P.O. Box 1043
Medina, OH 44258

Pest Management Supply, Inc.
P.O. Box 938
Amherst, MA 01004

Whitmere Research Laboratories, Inc.
3568 Tree Court Industrial Blvd.
St. Louis, MO 63122 (1-800-325-3668)

References


