

Plant Pathology Fact Sheet

Control of Tomato Spotted Wilt and Impatiens Necrotic Spot Viruses and Their Vectors, Western Flower Thrips, in Greenhouse Crops

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Diseases caused by tomato spotted wilt virus (TSWV) and impatiens necrotic spot virus (INSV) have caused losses in Kentucky greenhouse crops. Although the viruses are easily acquired and thrips (the disease vector) are common, growers who aggressively attack the problem can avoid crop losses by controlling thrips and the viruses it spreads.

Tomato Spotted Wilt Virus and Impatiens Necrotic Spot Virus

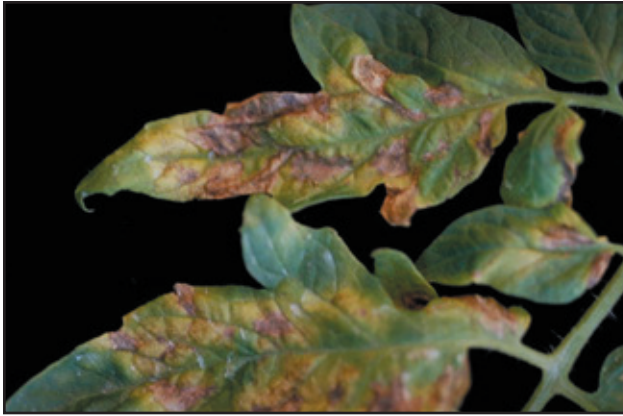
There are two different but closely related viruses causing greenhouse crop symptoms, both with a very wide host range. TSWV and INSV are transmitted from plant to plant primarily by western flower thrips (there are several other species of thrips which can also transmit these viruses). Thrips acquire the virus as larvae and only transmit during the adult stage.



TOMATO SPOTTED WILT VIRUS ON GLOXINIA

An adult thrips can infect a plant with the virus after feeding for only 30 minutes.

The most common and dramatic problems of greenhouse ornamentals in Kentucky have been due to INSV, previously known as TSWV-I. This virus is usually the one



IMPATIENS NECROTIC SPOT VIRUS ON TOMATO

causing problems on impatiens, New Guinea impatiens, begonias, snapdragons, cyclamen, cineraria and gloxinia. INSV can infect tobacco seedlings but does very little damage, because this virus apparently does not become systemic in most tobaccos.

TSWV is very damaging to tobacco, tomatoes, and peppers. Known in the past as TSWV-L, it also attacks some ornamentals, most often dahlias imported from overseas, and chrysanthemums and (rarely) ivy geraniums.

VIRUS DISEASE SYMPTOMS

TSWV/INSV causes a wide variety of symptoms including wilting, stem death, stunting, yellowing, poor flowering; and sunken spots, etches, or ring spots on leaves. Symptoms are not very specific or consistent, and merely tell the grower that there is something wrong with the plant. Many other diseases and plant problems can cause symptoms that resemble TSWV/INSV. Virus symptoms may depend on time of year, type of plant, age of plant, plant physiological state, growing conditions at the time of infection, and strain of virus.

Positive diagnosis is made by submitting a plant to a plant disease clinic that uses either inoculation of special indicator plants or chemical tests to determine if the virus is

present. In the U.K. Plant Disease Diagnostic Laboratory, separate tests are run to look for both TSWV and INSV. A plant may have either or both viruses.

DISEASE MANAGEMENT

- Inspect incoming plant material for signs of thrips feeding injury, or for symptoms indicative of TSWV or INSV infection. Most plant materials coming from suppliers are not guaranteed to be disease free; thus your inspections are most important. Insist on good thrips control from your plant suppliers.

- Isolate incoming plants from all other plants in the greenhouse until certain they are free of the viruses. Hang yellow sticky traps vertically above the new plants to monitor for adult thrips.

- Separate cutting crops from seedlings. The disease frequently enters the greenhouse within vegetatively propagated plant material. Hanging baskets of infected cutting crops over seedlings can lead to bedding plant losses, since the young seedlings are highly susceptible.

- Immediately discard plants showing distinctive TSWV/INSV symptoms. Early destruction of a few infected plants may prevent an epidemic through all the susceptible plants in the greenhouse. If in doubt, throw them out. Infected plants cannot be cured.

- Do not vegetatively propagate infected plants. The virus can still be maintained in a crop through vegetative propagation even in the absence of western flower thrips.

- Be especially careful when producing vegetable transplants; tomato and pepper, in particular, may be severely affected by TSWV/INSV. The disease may cause subsequent death or yield losses in the

field. Be careful of TSWV when producing tobacco transplants.

- Plants may act as reservoirs of the virus. Flowering pot plant crops such as cyclamen can serve to carry the disease over from the fall to the following bedding plant season, as might weeds left under the benches. Eliminate weeds in and near the greenhouse which may harbor thrips and/or the virus.

- Consider using petunia plants as indicators to monitor for TSWV/INSV and thrips feeding injuries; 'Calypso', 'Super Blue Magic' or Summer Madness' petunias may all be used as indicators of TSWV/INSV. Use a yellow (NON-sticky) card to help attract the thrips to the petunias.

- Losses have been greatest with gloxinia, double flowered impatiens, New Guinea impatiens, begonia and cyclamen crops. Be particularly careful to keep these crops isolated from potential sources of virus.

Western Flower Thrips

Adult western flower thrips (*Frankliniella occidentalis*) are less than 2 mm long. Males are pale yellow and females are two-toned, with a yellow to orange-brown head and thorax, with a brown abdomen. Thrips lay their eggs inside the plant tissue (where the eggs are protected from insecticides) until they hatch and emerge 2 to 4 days later.

The first stage instar larva is clear. The second stage larva is yellow at first. Both the first and second larval stage hide among the bud and flower parts of the plant. The second stage larva turns white just before it molts and moves to the soil or leaf litter where it enters the pupal stage and undergoes metamorphosis to an adult. Adults emerge from the soil 2 to 5 days later and may be yellow or dark brown. They hold their four hair-fringed wings flat over their backs.

Adults can live 30 to 45 days.

Thrips feed by piercing plant cells with their mouthparts and sucking out the cellular contents.



ADULT WESTERN FLOWER THRIPS

The damage to plant cells caused

by thrips feeding can result in deformation of flowers, leaves and shoots. There is often silvery streaking and flecking on expanded leaves. Thrips often deposit tiny greenish-black fecal specks on leaves when they feed.

THRIPS MANAGEMENT

Thrips management involves early detection and identification of the insect, followed by a vigorous control program.

Detection of thrips activity

- Inspect all incoming plants for thrips. Tap the plant with a pencil while holding a sheet of white paper to catch any falling insects. Check white and yellow flowers with a hand lens. Remove and destroy heavily infested flowers.

- Isolate incoming plants from all other plants in the greenhouse until certain they are free of thrips.

- Use traps to monitor presence of thrips in the greenhouse. Since thrips are very small and stay hidden most of the time, they are difficult to detect. Yellow or blue sticky cards (available from most greenhouse supply companies) placed at or just above crop height are excellent for monitoring thrips. Blue is effective for thrips but is not a good all around color for other insects. One to three cards per 1,000 square feet is recommended. Trapping efficiency depends on the number used per square foot and placement rather than the size of the card. Place some near

vents, doors, and other openings. Change the cards once a week. Wrap each card in one layer of cellophane for ease of handling.

Record the number of thrips trapped to determine if the population is increasing or decreasing. Count and change cards weekly, noting upward population trends that signal the need for treatment. More than 10 western flower thrips per card per week is a threshold value some growers have found useful. A hand lens will be needed to recognize the thrips on the traps.

If you are uncertain of the identity of the insects you have trapped, contact your county extension agent for assistance.

Controlling the thrips

- Understand thrips biology (see above).
- Use available chemical controls. A single application of an insecticide is not adequate. Applications are made at 5-day intervals unless otherwise stated on the insecticide label.
- Use one insecticide for one generation of thrips. That means, apply one insecticide

two to three times over 14 to 15 days. The first insecticide application kills winged adults while the second and third kills newly emerged wingless individuals. Then switch to a different class of insecticide.

- Rotate insecticides between chemical classes every 3 to 4 weeks to discourage the development of pesticide resistance in the thrips population. Do not use tank mixes of different materials since this tends to foster the development of insecticide resistance in thrips.

- Thorough coverage is required. Alternate between fogging and spraying methods of application to achieve good coverage.

- Be certain the insecticide is registered for use in the greenhouse and that the names of the plants to be treated are on the chemical label. Materials that have been used to control thrips are listed in Table 1, below.

Pyrethroids are said to agitate the thrips and get them to move out where they are exposed to other pesticides. However, agitated thrips

TABLE 1. MATERIALS THAT HAVE BEEN USED TO CONTROL WESTERN FLOWER THRIPS ON GREENHOUSE CROPS

CHEMICAL CLASS	TRADE NAME
Organophosphates	Dibrom, Malathion, Orthene
Chlorinated hydrocarbon	Thiodan
Macrocyclic lactone	Avid
Pyrethroid	Bifenthrin, Decathlon, Mavrik, Pounce, Scimitar, Talstar, plus various formulations of natural pyrethrins.
Botanical	Aza-Driect, Azatin, Margosan-O
Spinosyn	Conserve SC
Miscellaneous	M-Pede insecticidal soap, SunSpray Ultra Fine Oil

may move from plant to plant more than normal and could, theoretically, lead to greater spread of the virus if not killed quickly.

- Predatory insects (biological control) for release into the greenhouse are under development.
- Maintain strict thrips control on all plants kept in the greenhouse.
- Eliminate all weeds and all plants not being carefully tended from inside the greenhouse. Such plants may harbor both the thrips and the virus.
- Consider screening the vents where western flower thrips may be entering from outside (fall and spring, especially). Microscreening (100 to 1000 holes per square inch) reduces air flow, so vent area must be increased by 4 or 5 times.
- TSWV and thrips may follow the crop out of the greenhouse. Western flower thrips are not known to survive the winter outdoors in Kentucky.
- Nurserymen, garden center operators, and others serving the plant industry need to understand how the virus/thrips problems arise in the greenhouse. Plants are purchased from many different sources and shipped from greenhouse to greenhouse. If the supplier of the original plants has a problem with a disease, insect, or mite, it should not be surprising that those problems accompany the plants they sell.

- Thrips problems can develop very rapidly, even where an operation may have never had thrips. From one infested plant, western flower thrips can suddenly be found on almost any green plant in the house. With the thrips-infested plants comes the virus. The rapidly spreading thrips carry the virus from plant to plant.

- Although plants produced outdoors may not be subject to such explosive and dramatic outbreaks because of a less favorable environment and the presence of natural biological controls, it is always possible to introduce a new pathogen or insect into the outdoor production area when purchasing and planting new material.

Additional comments to growers

Perennial plant growers need to aggressively attack TSWV and western flower thrips in both greenhouse and outdoor plantings, and must be aware that plants originating from greenhouse production but now planted outdoors may carry the virus. Even if the thrips do not overwinter in Kentucky, vegetatively propagating infected plants will maintain and spread the virus.

Garden center operators must also be aware of the biology of TSWV and western flower thrips, especially if they keep herbaceous plants all year. Many perennials are susceptible to the virus and thrips. An infected perennial will retain the virus until that plant dies.

(Revised 5/05)