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VIRAL DISEASES (TSWV/INSV) OF BEDDING PLANTS

Tomato spotted wilt virus (TSWV) and inpatients necrotic spot virus (INSV) are two important viruses that cause considerable losses to bedding plants in both greenhouse and field situations and pose a serious threat to the greenhouse industry. Both viruses have an extremely wide host range. TSWV can infect more than 900 plant species, while over 300 species are susceptible to INSV. However, rose and poinsettia are two of only

Figure 1. Mosaic and mottling on the begonia leaf infected with INSV

Figure 2. Mottling and necrosis of cineraria leaves infected with INSV

Figure 3. Ringspots (arrows) on the cyclamen leaf infected with INSV

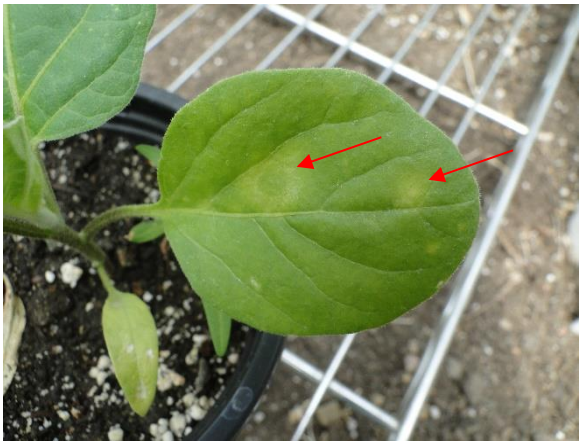

Figure 4. Ringspots (arrows) on the eggplant leaf infected with INSV

a few ornamental plants that are immune to the viruses.

SYMPTOMS AND DIAGNOSTICS

TSWV/INSV can induce a wide range of symptoms that include ringspots (chlorotic, yellow, necrotic, and zonate spots), streaking, stunting, mottling, and wilting in their host plants. However, symptoms can be variable among hosts and virus strains (Figures 1-10). When a plant is infected with TSWV and INSV simultaneously or asynchronously, symptoms may be different from a single strain infection (Figure 11). Environmental conditions and infection stages also affect symptom development. Occasionally, symptoms caused by TSWV/INSV resemble fungal and bacterial diseases. Therefore, it is difficult to diagnose viral diseases based solely on symptoms. Plants suspected with viral diseases should be submitted to plant clinics for serological diagnostic tests. A timely and accurate identification of plant viruses is essential to initiate proper management strategies.

DISEASE DEVELOPMENT

Both TSWV and INSV belong to the genus Orthotospoviruse. Viruses in this genus can be transmitted by various thrips species

Figure 5. Necrosis of tomato leaves (arrow) infected with INSV

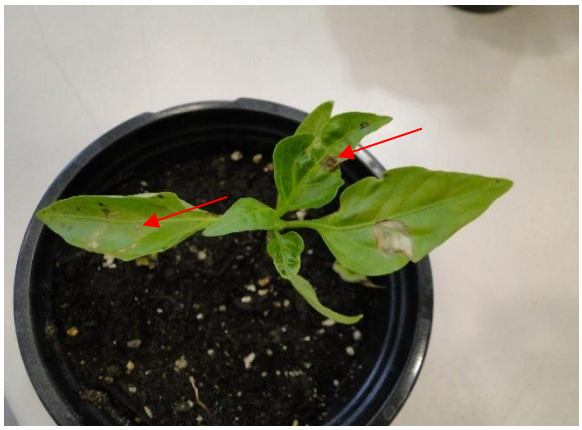

Figure 6. Necrotic spots (arrows) on pepper leaves infected with INSV

Figure 7. Necrosis of leaves and distorted new growth of a tomato seedling infected with TWSV

Figure 8. Mottling and distorted new growth of pepper plants infected with TWSV

Figure 9. Necrotic streaks on an iris leaf infected with TSWV

Figure 10. Necrosis of stems and wilting of chrysanthemum infected with TSWV

inlcuding the most common western flower thrips. Thrips lay eggs into leaf, bract, or petal tissues. After the larvae hatch from the eggs, they feed on the leaves or flowers. When a larval thrips feeds on the plant infected with TSWV or INSV, it can acquire the virus within 30 minutes, and then retains the virus in its body through pupae and adult stages, but it is not transmitted to eggs. When an adult thrips flies and feeds on host plants, it can spread the virus to the healthy plant. Only larval thrips can acquire TSWV/INSV, but only adult thrips can spread the virus to host plants. TSWV/INSV cause systemic infections and replicate themself in both vector thrips and host plants. When an infected plant is used as propagation stock, every cutting taken from the plant will be infected with the same virus. Movement of infected plant materials and thrips can result in a long-distance spread of TSWV/INSV.

Figure 11. Necrotic and stunted growth of lobelias with mixed infections of TWSV and INSV

Once TSWV or INSV is introduced to a greenhouse by propagated plant materials or transplants, thrips can spread the virus between plants in the greenhouse. TSWV/INSV also infect weeds and other

non-crop plant species that may serve as both a habitat for thrips and a reservoir for the viruses during the current or following year. TSWV/INSV cannot survive outside of their host plants and vector thrips.

MANAGEMENT

Cultural practice: Use virus-free plant materials including cuttings, plugs, transplants, and stock plants. Inspect all incoming plant materials for virus symptoms and the presence of thrips. Isolate all suspected plant materials, if possible, until a confirmatory diagnosis of TSWV/INSV is obtained. Avoid growing vegetables and ornamentals in the same greenhouse. Test propagation stock plants before making any cuttings from them. Scout plants for TSWV/INSV regularly and discard all infected plants once the virus is confirmed. Control weeds inside and outside the greenhouse to reduce reservoir hosts of the viruses and thrips.

Thrips control: Scout for thrips activities and populations by using yellow or blue sticky cards. Use effective registered insecticides that includes methiocarb, imidacloprid, novaluron, abamectin, acephate, bifenthrin, and cyfluthrin. Rotate or incorporate insecticides with different modes of action groups to prevent insecticide resistance in thrips populations. Neem oil, horticultural oil, and insecticidal soap can be used in thrips control programs. Use biological control agents for thrips management, such as predatory mites (*Neoseiulus cucumeris* and *N. swirskii* attack larval thrips), predatory beetle (*Dalotia coriaria* attack both larval and adult strips), and beneficial nematodes (*Steinernema feltiae* attack larval and pupal thrips in the soil). For optimum success, incorporate good cultural practices into an integrated thrips-management program. Always read the product label and follow the instructions.