



## **Some Virus Diseases of Greenhouse Crops**

### **Introduction**

Viruses are very small, submicroscopic particles that cause plant disease. There is no control for plants infected with a virus. Some of the more common viruses that may infect greenhouse crops include (but are not limited to): impatiens necrotic spot virus (INSV) and tomato spotted wilt virus (TSWV) which are also known as tospoviruses, tobacco mosaic virus (TMV) and cucumber mosaic virus (CMV).

### **Symptoms**

Symptoms vary depending with the type of virus, the host plant, how long the host plant has been infected, the strain of the virus, and environmental conditions. Symptom expression can be temperature sensitive – some viruses are expressed at high temperatures whereas others are expressed at lower temperatures. Viral symptoms can also be masked when the plants are growing vigorously. Sometimes, symptoms may only be apparent when multiple infections are present or when plants become stressed. Viruses rarely kill their hosts but they alter the host plants appearance. Some virus-infected plants are grown and propagated because of their attractive appearance. For example, the variegated foliage in flowering maple is due to the abutilon mosaic virus.

Some of the symptoms of virus infection include:

- Stunting
- Mosaic (a variable pattern of chlorotic and healthy tissue on the same leaf)
- Distortion of leaves or growing points
- Yellow or chlorotic streaking
- Yellow veins, or vein clearing
- Ring spots, or unusual line patterns
- Dead brown areas (necrosis),
- Bronzing or reddening of leaves or flowers
- Curling of leaves or leaf margins

Virus symptoms often resemble nutritional disorders, chemical spray injury, herbicide spray injury, fungal or bacterial pathogens or injury from fumes from a faulty furnace. Infected plants may also show only mild symptoms or symptoms may be latent. Serological techniques such as ELISA (enzyme-linked immunosorbent assay) can be used to confirm infection by a particular type of virus. Growers may purchase immunostrip tests from [agdia](#) or submit samples to their laboratory for screening for the more common viruses affecting the particular plant they are producing.

### **What is a Virus?**

Viruses are ultra-microscopic particles that infect living cells and alter their host's development. They consist of nucleic acids (genetic material) surrounded by a protein coat. Viruses are completely dependent upon the host plant for their reproduction. They usually begin infection through a wound, often from insect feeding or by mechanical transmission. Once a plant is infected, the virus spreads systemically within the plant. There is no cure for virus-infected plants. Plant viruses are often named based on the symptoms they caused on the first detected host plant. For example, a virus causing light and dark green areas (mosaic patterns) first observed on tobacco was named "tobacco mosaic virus."

### **How are Viruses Spread?**

Viruses can be transmitted by insects, primarily thrips, aphids and whiteflies. Mites, leafhoppers and nematodes occasionally transmit viruses. Viruses are often spread by the propagation of infected plant parts (cuttings, grafting, bulbs, and sometimes seeds) and some can also be spread by mechanically in plant sap on workers hands or tools.

Many common weeds can become infected with viruses without showing symptoms and be a favored host of the insect vector.

Some of the more common viruses affecting greenhouse crops include: (but are not limited to): impatiens necrotic spot virus (INSV) and tomato spotted wilt virus (TSWV) which are also known as tospoviruses, cucumber mosaic virus (CMV), and tobacco mosaic virus (TMV).

### **Tospoviruses**

Tospoviruses including impatiens necrotic spot virus (INSV) and tomato spotted wilt virus (TSWV) have a very wide host range of over 600 hosts including begonia, campanula, cyclamen, garden impatiens, New Guinea impatiens, pepper, phlox, primula, tomato and many others. Infected plants may show stunting, necrotic and chlorotic spotting, stem cankers, line patterns and ringspots.

Tospoviruses are spread by thrips. Thrips cannot transmit the virus unless they acquire it as first instar larvae when they feed upon infected plants (including weeds). Winged adults are primarily responsible for viral spread. Tospoviruses are also spread in plant sap when cuttings are taken from infected plants.

Rogue and destroy infected plants. Use sticky cards to monitor for thrips and promptly begin a strict thrips management program. When tospoviruses are present, the threshold level for thrips is zero.



Figure 1 & 2 : Ringspots, line patterns and stunting characteristic of INSV on garden impatiens (left) and round brown thumbprints characteristic of INSV on cyclamen (right). Photos by L. Pundt



Figure 3 & 4: Mosaic patterns characteristic of INSV on Begonias and Ringspots on Lobelia, Photos by L. Pundt

### **Tobacco mosaic virus (TMV)**

Tobacco mosaic virus has a wide host range but is especially a concern on Solanaceous crops. TMV has been reported on ajuga, calibrachoa, cyclamen, epimedium, gerbera, helianthus, impatiens, lisianthus, lysimachia, New Guinea impatiens, nicotiana, pepper, petunia, penstemon, tomato and torenia.

Symptoms include yellow mottling, mosaic, upward leaf curling, flower color breaking, necrotic lesions, and overall stunting. Some infected plants may not show any symptoms at all. Symptoms vary depending upon the particular virus isolate, temperature, light levels and cultivar infected. Multiple infections can also occur. Plants can also be infected and not show any symptoms.





Figure 5 & 6: TMV symptoms on Streptocarpus and pepper. Photos by L. Pundt

TMV is a very stable virus that can survive for years on tools or plant surfaces where plant sap has dried. It is spread mechanically in plant sap on workers hands or tools after they handle infected plant material or tobacco products. TMV is not transmitted by insects! Workers can easily spread this virus when they handle plants or when cutting tools become contaminated. TMV can persist in dried tobacco leaves, and tobacco products can also be a source of TMV.

Discard infected plants including roots. Disinfect hands by washing with milk, or tri-sodium phosphate and then thoroughly with soap and water. Smokers need to wash their hands before entering the greenhouse to reduce the potential of infecting healthy plants. Smoking should not be allowed in greenhouses. Hard surfaces such as doorknobs, or flats can become contaminated after handling virus-infected plants and remain a source of infection. Thoroughly disinfect the growing area with a commercially available disinfectant. Control perennial weeds in the Solanaceous family such as ground cherry and horsenettle that could be reservoirs of TMV.

#### **Cucumber mosaic virus (CMV)**

Cucumber mosaic virus has a wide host range of over 400 species of plants. CMV has been reported on ajuga, aquilegia, campanula, delphinium, dahlia, liliun, petunia and phlox. Infected plants may show mild mosaic patterns and mottling, flower color breaking, flecking, and fern leaf distortion.

CMV is primarily spread by aphids that can acquire the virus in as little as 5 to 10 seconds. Aphids then move the virus from plant to plant for a few hours. There are a large number of aphid vectors, including greenpeach aphids and melon or cotton aphids. CMV is also spread mechanically in the plant sap when cuttings are taken from infected stock plants. CMV is also both seed and pollen transmitted in petunia where symptoms develop in very young plants.

Rogue and destroy diseased plants. Control aphids. Eliminate weeds such as common pokeweed, chickweed, field bindweed, yellow rocket, and bittersweet nightshade that may be reservoirs of CMV.

### **Management**

The best way to control viruses is to keep them out of production areas. All viruses can be spread in plant sap during vegetative propagation.

- **Prevention** is the grower's first line of defense against virus infection.
- **Purchase clean, virus-free seed, cuttings, seed and stock plants from a reputable supplier.** Virus-indexed plant material may be available for certain crops. If unsure, isolate incoming plants in quarantine type area until you have determined that they are virus-free.
- **Don't rely on visual diagnosis** to determine whether or what type of virus is present. You may not become aware of a problem until it is widespread. Routine testing of plants showing symptoms and those not showing symptoms is needed, especially before taking vegetative cuttings. Serological techniques such as ELISA (enzyme-linked immunosorbent assay) are available to identify different types of viruses. On-site grower kits using this same technology are also available from companies such as [Agdia](#), which can help you identify a particular virus.
- **Do not take cuttings from infected stock plants.** Many viruses are spread mechanically in the sap that contaminates worker's hands or cutting tools. To remove contamination of most viruses from tools, they can be soaked in commercially available disinfectants such as quaternary ammonium compounds or hydrogen dioxide. Soak the tools for at least one minute. Propagators need to soak their cutting tools on a regular basis, after use on each stock plant or defined area.
- **Control insect vectors.**
- **Keep growing areas weed-free.** Weeds can be reservoirs both of viruses and their insect vectors.
- **Discard and destroy virus infected plants.** Do not compost.

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