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Recognizing Viral Diseases

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☒ The ornamental industry sells beauty. And plant diseases affect bedding plants by altering their most important aspect—the visual appeal. Among the microorganisms that cause plant diseases, viruses are particularly important. In this article we will present information on the most important viral diseases, including visual symptoms, how they are spread in a greenhouse, and how to best manage viral diseases in order to produce high-quality bedding plants.

The most important viruses

There are dozens of bedding plant species and almost the same number of plant viruses that infect those species. The list of virus groups that infect bedding plants includes *carlavirus*, *carmovirus*, *cucumovirus*, *geminivirus*, *nepovirus*, *potexvirus*, *potyvirus*, *tobamovirus*, and *tospovirus*. We will concentrate on the four groups that encompass the most common and economically important viruses: the *tobamovirus* (Tobacco mosaic virus, Tomato mosaic virus), *tospovirus* (Impatiens necrotic spot virus, Tomato spotted wilt virus), *cucumovirus* (Cucumber mosaic virus, Tomato aspermy virus), and *potyvirus* (Bean yellow mosaic virus, Potato virus Y, Tobacco etch virus).

Spreading the disease

Unlike other plant pathogens, viruses require a wound in order to infect a plant. The wound can be the result of general plant handling, pruning, propagation, insects and nematode feeding activities, root growth, wind, contact between plants, etc. In a greenhouse operation, the *tobamoviruses* are spread by contact between plants, contaminated tools used for pruning or propagation, a worker's hands and clothes, and soil contaminated with debris from infected plants. *Tospoviruses* are spread by thrips, while *cucumoviruses* and *potyviruses* are spread by aphids. Most importantly, all of the viral groups listed above are transmitted by vegetative propagation of infected plant material, making this the main pathway for introduction into a greenhouse.



left:

A calibrachoa with calibrachoa mottle virus showing necrotic spots.

Symptoms

Virus disease symptoms on bedding plants may be observed on any part of the infected plant, from root to flower. The symptoms are the result of the 3-way interaction involving host (species, age and variety), virus (strain) and environment (light, temperature, humidity, soil fertility and pH). Consequently, the same virus may cause different symptoms or different viruses may produce the same symptoms, depending on how the three factors listed above interact. For that reason, symptoms have limited application when it comes to identifying the virus causing the disease.

The symptom may be local, meaning that the virus stays at or near the point of entry and does not spread throughout the plant; or systemic, when the virus moves throughout the entire plant. A virus-infected plant can exhibit an array of symptoms that may vary from severe external alteration to total absence of symptoms. A word of caution: asymptomatic hosts are not any less important as it may serve as the source of virus for other crops growing nearby. Furthermore, an apparently healthy plant may exhibit severe symptoms under stressed conditions. For instance, a healthy-looking, virus-infected orchid may exhibit flower break due to the stress caused by the flowering stage. Symptoms can be intensified due to an infection caused by more than one virus.

Symptoms are the effects of viral infections on plant growth, development and aesthetics. The most common viral symptoms on bedding plants are: alteration in the normal color such as chlorosis (yellowing evenly distributed on the entire plant or leaf); mosaic (mixture of light and dark green areas on leaves); mottle (mosaic-like with borders better defined, sometimes with blisters associated with the dark green areas); ringspots; necrotic and chlorotic spots; flecks; blackening; browning; variegation (irregular foliar discoloration); streaking (foliar discoloration on monocotyledons or stems); flower break (irregular flower color); deviation in the normal growth such as flower deformation; leaf curling; rugosity; rosetting; leaf rolling; stunting; water deficiency such as wilting; and canker (necrotic area on the stem).

How to avoid viral diseases

Greenhouse conditions are not only conducive to disease epidemics but also provide the opportunity to manage them using the two most effective control methods: keeping it out of the operation by planting virus-free plant material and preventing entry of insects carrying the virus. Once a virus is introduced into an operation, aggressive measures should be put into place to eliminate the source. Because there is no cure for viral diseases, discarding and destroying the infected plants is imperative. One can do this by destroying and discarding infected plants while making sure to disinfect and sterilize tools. If insects are present they should also be controlled.

Disease identification

Often virus disease symptoms are difficult to identify since they can look like nutritional deficiencies, pesticide injury, genetic disorder, air pollution, cold, heat, fertilizer toxicity, or insect damage. Before any action is

taken, it's recommended to test the plant for the presence of the viral pathogens. Samples may be sent to commercial or public laboratories for diagnosis. Another option is to use commercially available, do-it-yourself tests. These tests can be completed in the greenhouse, are affordable, easy to use and provide reliable answers within 5-30 minutes. With early detection, one can prevent the spread of disease and the crop loss associated with it.

Disease management

Each of the four viral groups we've talked about requires specific management practices; therefore, the correct virus identification is necessary for proper disease management. Viruses within the *tobamovirus* group are very contagious and can spread very fast. *Tobamovirus* management may require the destruction of the entire crop, depending on the relative number of infected plants and the virus distribution within the greenhouse. Early detection is very important, as well as immediate elimination of the infected plants, including those surrounding them, which may be infected but not yet showing symptoms.

Tospoviruses (thrips), *cucumoviruses* (aphids), and *potyviruses* (aphids) may be contained by elimination of infected plants, effective insect control and sanitation. Other measures that can help manage viral diseases in general include the use of resistant cultivars and species not affected by common virus; regular plant inspection and removal of infected plants; control of insect vectors; removal of weeds from surrounding greenhouse areas; inspecting incoming plants before introducing into the greenhouse (use commercially available on-site tests); and implementing strict sanitation protocols for equipment and greenhouse tools (strong soap or detergent solution, quaternary ammonium, chlorohexidine, bleach).

With many ornamental growers adding vegetables to their list of crops, new viral diseases come with them. All the recommendations listed above should also be followed for vegetable crops. **GT**

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