The Plant Doctor's LANDSCAPE TIPS

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PLANT VIRUSES

INTRODUCTION:

Our landscape plants can be afflicted by a variety of issues, ranging from diseases and pests to cultural and environmental issues. One type of culprit not often considered is that known as a plant virus. While our society commonly uses the term virus (ex. viral infection) to refer to the common cold or AIDS or a computer glitch, we don't often consider virus as a cause of plant disease … yet there are many viruses capable of affecting our plants. In my experience, there appear to be far more viruses affecting herbaceous plants (Photo 1) than woody plants (Photo 2). Nevertheless, it may be wise to consider viruses when we encounter unknown problems in our landscapes and nurseries.

WHAT ARE VIRUSES?

Viruses are some of the simplest entities on this planet. Viruses are comprised of a nucleic acid (either DNA or RNA) and a protein coat. The protein coat is apparently designed to protect the nucleic acid. Scientists have debated for decades whether viruses are "living" or "dead". After all, viruses contain no organs or cellular organelles or other structures that we commonly associate with other living creatures. Viruses by their very nature are "obligate" parasites (or pathogens) because they cannot reproduce or multiply without a living host. They reproduce by taking over their host's machinery and forcing the host to manufacture more virus particles. Another similar entity is a Viroid, which is simply a virus (nucleic acid) without a protein coat. Viroids attack plants and cause problems similar to viruses.

A VERY BRIEF HISTORY OF VIRUSES:

While viruses have probably been with life on Planet Earth since life began, their existence was not known or understood until relatively recently. The discovery of various organisms is almost always correlated with their size. Bacteria were first discovered and believed to be the cause of plant disease in the mid to late 1800s. The invention of the light microscope enabled scientists to actually see bacteria for the first time. With the invention of bacteria-proof filters, scientists knew that something way smaller than bacteria was capable of being transmitted in sap to infect healthy plants. It wasn't until the invention of the electron microscope in the 1940s that humans could actually see viruses for the first time (Photos 3 and 4A, 4B and 4C).

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Photo 1: More viruses seem to infect herbaceous plants than woody plants. This is Impatiens Necrotic Spot Virus (INSV) on gloxinia.

Photo 2: This Spirea is infected with the Spirea Leaf Spot Virus (SLSV).

Photo 3: The invention of the Electron Microscope in the 1930s and 40s greatly aided our ability to see small objects such as viruses. The author in his younger years with Dr. Karen Klomparens.

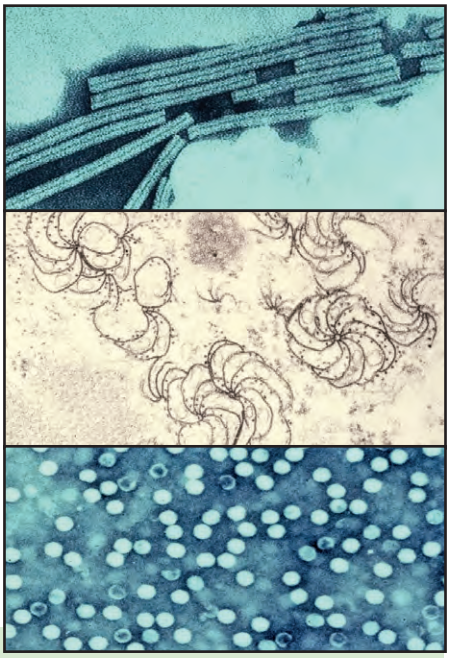

Photo 4A, 4B and 4C: Tobacco Mosaic Virus (TMV) exhibits its rod shaped virus particle structure (A) while other viruses exhibit widely diverse structures such as pinwheels (B) and polyhedrals (C).

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SYMPTOMS CAUSED BY VIRUSES:

A virus takes over its host machinery for its reproductive objectives, thereby upsetting the physiology of the host, whether it is the common cold (sniffles, fever, and congestion) in humans or sickly appearing foliage in plants. A variety of symptoms may be elicited when viruses infect plants, and hence, plant cells. The classic symptoms of virus infections in plants include mosaic or mottling patterns in the leaf (Photo 2). Viruses may also cause a wide range of other symptoms: necrosis (death), wilt, ring spots, chlorosis (yellowing), tissue distortion and so forth. Symptoms caused by viruses may be mistaken for other plant issues such as Phytoplasma infections (aster yellows and related complexes), herbicides (Photo 5), nutritional deficiencies, downy mildew, etc.

Photo 5: Herbicide injury can appear very similar to virus infections. This is herbicide injury on wisteria. (Photo Credit: Denise Schroeder, University of Michigan)

Photo 6: Trees with foliar disease caused by fungi (example: Phyllosticta leaf spot on Maple) shed their infected foliage every fall; hence, the trees start anew with unaffected foliage every spring. By contrast, viruses generally infect plants systemically for life.

DIAGNOSIS/DETECTION OF VIRUSES:

In the old days (only 3 or so decades ago) plant virology involved identification methods based on the reaction of certain indicator plants to sap transmission from the diseased plant. As one might guess, this was quite laborious and tedious. Today, we have much more specific methods for identifying viruses that include immunology (antigen and antibody) and PCR (Polymerase Chain Reaction). The latter DNA technology is utilized not only on our cops and robbers TV shows but in real life with forensic work. Electron microscopy is also still used to great advantage for the detection of viral diseases in plants.

THE TRANSMISSION OF VIRUSES:

In understanding how to manage plant viruses, one of the more crucial factors is to know how viruses are transmitted

Photo 7: Due to the "infected for life" nature of viruses many of these Spirea affected by the Spirea Leaf Spot Virus will likely be destroyed.

from plant to plant. Viruses have no means of locomotion, nor are they blown around in the wind. TMV (Tobacco Mosaic Virus-Photo 4A), one of the most studied viruses, is transmitted by physical contact. When one plant touches another, TMV may be transferred. Likewise, humans may spread TMV by simply touching plants. Incidentally, TMV may also be picked up in tobacco leaves and tobacco smoke and spread to plants-another reason to give up smoking. Other viruses cannot be spread through physical contact but must be transferred via an insect vector. Aphids and leafhoppers are common vectors of viruses.

MANAGEMENT OF PLANT VIRUSES:

Management of diseases caused by viruses is very difficult. Viruses that infect plants are not only obligate parasites (must exist within a living host for "life" and reproduction) but they usually become systemic within the plant. By systemic, it automatically implies that once a plant is infected by a virus, it is infected for life. Other diseases, especially fungal incited diseases such as scab on apple and crabapple, tar spot on maple (Photo 6), cedar apple rust, needlecast diseases on conifers, etc., shed their infected foliage each year allowing new unaffected foliage to emerge for a chance of a healthy life ... until disease cycles are repeated during optimal conditions that favor disease development. In most viral infections, the plant can never "shed" the infectious organism. Complicating the systemic infection is that there are no good anti-viral chemicals for use on plants. Hence, one of the most effective (but unfortunate) methods of viral disease management is to destroy infected plants; obviously this can be rather distressing and costly if large numbers of plants are diseased (Photo 7). Another technique to manage virus infections is to control the means of transmission. So, for example, if aphids are known to transmit a particular virus, it is often beneficial to suppress the aphid population with insecticides. L

For more information, please feel free to email David Roberts at robertsd@msu.edu or contact a professional plant health care provider. The author, MSU and MGIA do not endorse any particular products. If using pesticides, be sure to read and follow label directions.

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