The Plant Doctor's LANDSCAPE TIPS

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PHYTOPATHOLOGY 101: FOLIAR DISEASES

TRUE OR FALSE?

Tar Spot on Norway Maple, Scab on Crabapple and Trellis Rust on Bradford Pear are running rampant on trees at the estate of Bob Seger. The Pinnacle Professional Tree Care Company (a fictitious name, gulp, I hope) proposes that three sprays of fungicides, one in May, one in June and one in July, will control all three diseases (answer at the end of this article).

INTRODUCTION

Phytopathology (aka Plant Pathology) is the study of Plant Diseases. In the past several years, I have encountered a variety of misunderstandings about specific diseases from the general public and professional plant health care providers, alike. There seems to be a plethora of what might be termed "Fake News" on the web regarding the introduced, invasive Trellis Rust. And, I think there is sometimes a general lack of understanding about the characteristics and nuances of Trellis Rust and other foliar diseases. Hence, I thought it might be useful to describe several common examples of ***types*** of foliar diseases that we in this fine industry of ours try to manage. These examples are Tar Spot on Maple, Trellis Rust on Pear, Scab on Crabapple, Rhizosphaera Needlecast on Spruce and Powdery Mildew on Lilac, Phlox, etc. Please forgive me if the following information is more than you ever wanted to know about Plant Diseases . . . but, if nothing else, this will be a good article to keep by your bedside as a sleep aid.

FIRST, SOME TERMS

In order to better understand plant diseases and their management, it is important that we review some basic terminology regarding the field of Plant Pathology. I hope readers' eyes do not glaze over when reading and comprehending a few of these basic scientific terms.

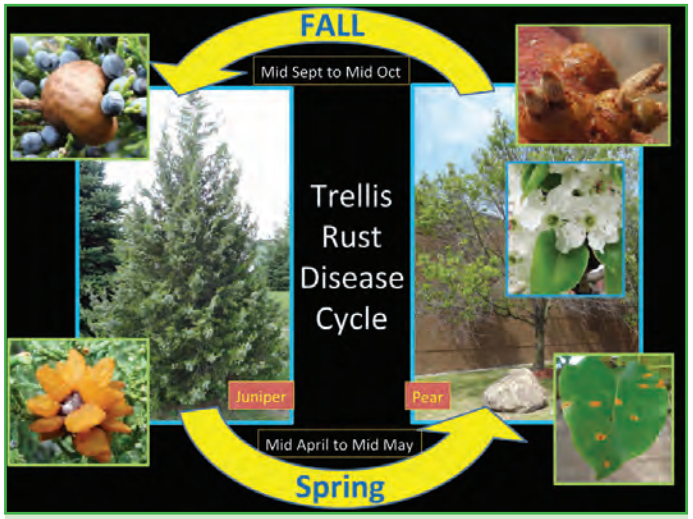
Plant Pathogen: An organism (usually microorganism) that causes ***infectious*** Plant Disease. These microbes are typically fungi, bacteria, viruses, nematodes and phytoplasmas.

Obligate Parasite: A plant pathogen that must be able to attack and survive on a living host plant. Such a microbe is "obligated" to survive on a living host plant, not on dead plant material as a saprophyte might.

Facultative Saprophyte: A plant pathogen that attacks a living host plant but which can spend part of its life/disease cycle living on dead plant material as a saprophyte rather than a parasite.

Monocyclic: A disease that has one cycle per year. Usually, such diseases begin in the spring by attacking newly emerging foliage from overwintering structures residing on dead or living plant material.

Multi-cyclic: A disease that typically has a repeating phase of attacking plant tissue during the same year.



Schematic #1: Disease Cycles are often summarized in a schematic such as denoted here for Trellis Rust.

Fungicide Mode of Action: Although there are a variety of modes of chemical fungicide action, in a general sense, fungicides (despite the "cide" = death) protect the foliage from infection and do not kill the fungal pathogens, per se.

Disease/Life Cycle: Disease and/or life cycles portray what the plant pathogen does throughout the year. Cycles may be single or multiple each year depending on the characteristics of the disease agent and the disease it causes (see Disease Cycle for Trellis Rust, Schematic #1).

Photo 1: It is not unusual for trees in our landscapes to be attacked by multiple diseases and/or pests. In this case, Maple is affected by Tar Spot (monocyclic, facultative saprophyte) and powdery mildew (multi-cyclic, obligate parasite).

SPECIFIC DISEASES, THEIR CYCLES AND THEIR MANAGEMENT

The following comprise a mix-mash of diseases that can serve as representatives of some of the various disease characteristics and cycles that we may encounter in the landscape and nursery. On some occasions, two or more diseases may occur on the same plant (Photo 1).

Continued on page 18

The Plant Doctor's LANDSCAPE TIPS

PHYTOPATHOLOGY 101: FOLIAR DISEASES

Continued from page 17

Tar Spot: Facultative Saprophyte, Monocyclic (Schematic #2)

As with many other disease, the Tar Spot fungus (Rhytisma) attacks from overwintering structures on dead leaves on the ground as the new foliage is emerging on maple trees in the early spring. Typically, smallish yellow spots are the first symptom noted. As the season progresses, the spots continue to enlarge and become very dark in color due to fungal material. Each spot arose from one spore infection in the early spring. In contrast to scab on Crabapple, there are no repeating phases of infection through the summer with Tar Spot. Hence, although not often recommended because the fungus is not that detrimental to its primary host trees (Silver and Norway Maples), the only time in which fungicides may protect the foliage from infection is in the early spring, not after the initial infections and spots have appeared.

Schematic #2: Tar Spot is a mono-cyclic disease. The fungus (Rytisma sp.) attacks Maple leaves in the early spring near budbreak. Each yellow spot that develops in the early summer (later expanding to large dark spots) is the result of one spore infection.

Schematic #3: The disease cycle of Trellis Rust is also briefly summarized here in the major events of the fungus' life cycle in relation to its two host plants. While the fungus attacks Pear trees during the warm season, it over-winters on junipers. The fungus does not overwinter on fallen Pear foliage as many articles on the web suggest.

Trellis Rust: Obligate Parasite, Monocyclic (Schematic #3)

Rust fungi are typically considered obligate parasites because they cannot obtain their nourishment from dead organic matter or dead plant material. They are obligated to attack and survive only on living plant material. Trellis Rust, caused by Gymnosporangium sabinae, attacks Pear trees from "blooming galls" on its alternate host, Juniperus, in the spring . . . generally from mid-April through mid-May, depending on weather conditions in the spring. The fungus causes spots on the Pear foliage, and later in the fall, releases spores from the undersides of the Pear leaves that attack and cause overwintering galls on Junipers. As a monocyclic disease, the only opportunities for control are in the spring on Pear trees (mid-April through mid-May, typically) and in the fall on Junipers (mid-September through mid-November, typically). Applying fungicides outside of these two windows will have no activity for disease management.

Scab of Apple & Crabapple: Facultative Saprophyte, Multi-Cyclic (Schematic #4)

Scab, caused by Venturia inequalis, typically affects newly emerging foliage in the spring from overwintering structures on dead leaves. Once the fungus causes scab lesions on the new foliage in the spring and early summer, the fungus continues to infect new and older foliage causing more and more lesions as the

season progresses . . . entering into a "multi-cyclic" phase. Although fungicide applications are preferred in the early spring to inhibit the first infections, which also subsequently inhibits the repeating phase, fungicide applications may also be beneficial in early to mid-season to lessen the disease buildup over the summer.

Powdery Mildew: Obligate Parasite, Multi-Cyclic (Schematic #5)

There are a variety of powdery mildew (PM) diseases that are generally specific for their host plants. PM also typically attacks newly emerging foliage from overwintering structures on foliage that was shed the previous fall. PM is considered an obligate parasite because it cannot gain nourishment or continue to develop on dead foliage. Unlike Tar Spot and Trellis Rust, the powdery mildew fungus is capable of producing spores (conidia) that can be wind-borne to new foliage throughout the summer season, representing a multi-cyclic disease. Later in the season, the fungus produces specialized structures (cleistothecia) that enable the fungus to survive on the dying, shedding foliage in the fall and winter. As an obligate parasite, the fungal cleistothecia simply use the dead foliage as a surface to release spores the following season (it does not use the dead foliage as a food substrate).

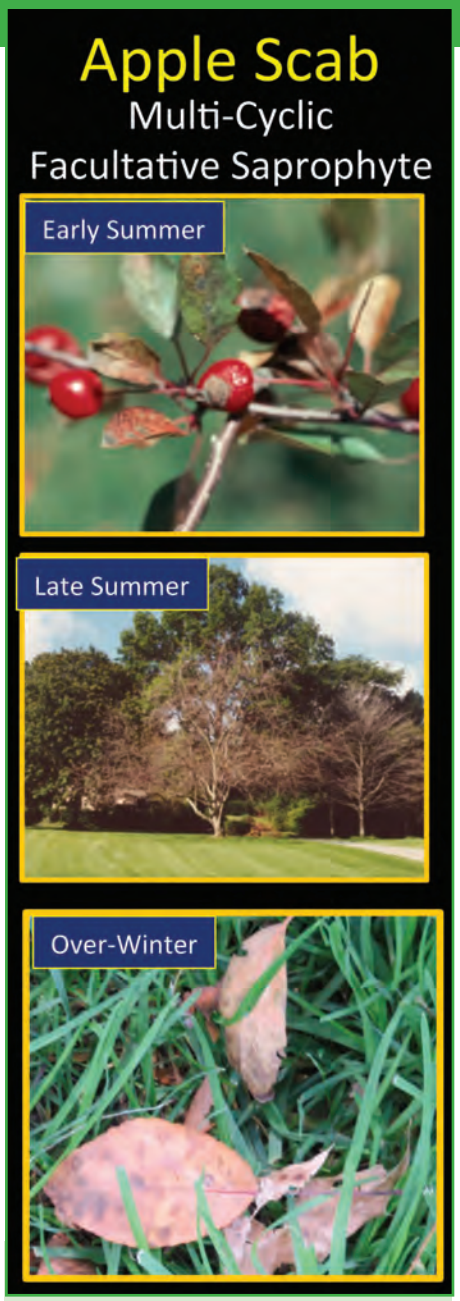
Rhizosphaera Needlecast of Spruce: Facultative Saprophyte, Multi-Cyclic (Schematic #6)

Rhizosphaera survives overwinter on fallen foliage (needles) beneath Spruce trees and typically attacks previous years' needles in the spring, often before the new growth emerges. The primary infection usually takes place as a "mono-cyclic" disease in the spring but on occasion, when environmental conditions are favorable, the fungus may attack Spruce foliage at other times of the growing season, essentially making it a potential multi-cyclic disease.

Importance of Foliar Diseases

Foliar diseases rarely cause serious harm to trees or woody shrubs. If we miss the opportunity for control this year, we typically have other opportunities in succeeding years. Possible exceptions to this rule are invasive foliar diseases. Invasive, introduced problems such as Dutch Elm Disease, Emerald Ash Borer, and Dogwood Anthracnose for example, tend to be more devastating if not lethal

Continued on page 20



Schematic #4: Scab of Crabapple and Apple initially attacks in the early spring and subsequently produces spores on those freshly attacked leaves that can spread to other foliage in a repeating phase throughout the warm season. The fungal pathogen overwinters on dead, fallen leaves.

Schematic #5: As an obligate parasite and like most obligate parasites, the powdery fungus is specific for its host plant. In other words, there are many different species or strains of the fungus, each of which only recognizes its specific host plant. During the summer, the white mold contains spores that may blow around and infect new foliage (Top photo, Tall Phlox). As its host plant's foliage senesces in the fall, specialized overwintering structures (cleistothecia, note tiny, barely visible flecks on birch, late summer, middle photo) are formed that utilize the falling, dying leaves as a surface, from where the fungus releases spores the following spring to attack newly emerging foliage of its host plant. Bottom sketch is of an artist rendering (facsimile) of an enlarged, overwintering cleistothecium.

The Plant Doctor's LANDSCAPE TIPS

PHYTOPATHOLOGY 101: FOLIAR DISEASES

Schematic #6: Like many other foliar diseases, Rhizosphaera (needlecast of Spruce) attacks previous years' foliage in the spring from previously fallen needles (bottom photo: note dark fungal reproductive structures on brown needles from beneath spruce trees). Note browning older foliage in the upper photo. Cast needles often results in primarily new unaffected growth (middle photo). Depending on weather/environmental conditions, the fungus may subsequently attack again at other opportunities during the growing season.

Continued from page 19

than similar acting native issues. The same is true for foliar diseases such as the introduced, invasive Trellis Rust.

Composting & Foliar Diseases

There are an astonishing number of web sites suggesting that leaves infected with Trellis Rust should not be placed in the compost pile. Of the five foliar diseases discussed in this article, Trellis Rust, because it is an obligate parasite that survives overwinter on Junipers and not on fallen Pear leaves, is by far the safest disease to be composted. In general, thorough compositing will destroy most foliar disease agents trying to survive overwinter in plant refuse . . . to infect trees in the following spring. The heating and intense microbial activity of good composting lessens the chances of foliar disease pathogen survival. Even if thorough composting is not attained, a pile of leaves, for example Crabapple leaves infected with the scab fungus, will release far fewer spores than leaves scattered throughout the landscape (leaves buried in a compost pile cannot release spores in the spring to infect newly emerging foliage compared to composting foliage on the surface of the compost pile).

GENERAL DISEASE MANAGEMENT

While the objectives of this article are to relate various disease cycles and the most efficacious time for treatments by fungicides, we must remember that there are a multitude of techniques that can be applied in an integrated approach for foliar disease management. Using genetically resistant plants, employment of biological or "organic" control products, modification of the environment through cultural practices such as irrigation adjustments, nutritional inputs, etc. are just a few of the alternative practices that may be adopted in lieu of reaching for that pesticide as the first choice for disease management.

ANSWER TO TRUE OR FALSE: FALSE!!

If the first treatment for the above mentioned plant diseases is in May, then it is very possible that the treatments will miss the initial infection periods for most of these diseases, which typically take place at or near budbreak. As we understand in this article, missing the initial infections of many diseases, especially the monocyclic ones, will not result in satisfactory disease control if the treatments are administered too late. L

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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