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PLANT DISEASES

Bacterial Leaf Scorch Testing Time

Here is a disease that you really ought to learn about if you are in the tree-care business. About midsummer, infected trees appear to have environmental leaf scorch. The same trees appear healthy again the next spring, but scorching returns each summer, becoming progressively worse over 5 or 6 years until the tree dies. The disease can kill mature trees.

Bacterial leaf scorch (BLS) is an infectious plant disease caused by a bacterium, *Xylella fastidiosa*. The pathogen is systemic, living in the xylem. The most frequent U.S. hosts include elm, oak, sycamore, mulberry, sweetgum, sugar maple, and red maple. In Illinois, we have identified the problem on oak. At the U of I Plant Clinic, we have confirmed it on pin, red, shingle, bur, and white oaks. Kentucky reports BLS on pin, red, scarlet, bur, white, willow, and shingle oaks; silver, sugar, and red maples; sweetgum, sycamore, planetree, hackberry, American elm, and red mulberry. Look for scorch symptoms that occur in early summer to midsummer, intensifying in late summer. The scorched leaf edges or tissue between veins may be bordered by a yellow or reddish brown color, but not in all cases. Symptoms occur first on one branch or section of branches and slowly spread in the tree from year to year. It is one of those situations that you hope will be better but gets worse.

There is no cure. Some have tried injections with oxytetracycline, but none have shown more than disease suppression with this antibiotic. Because the pathogen is in the xylem, cleaning pruning tools before moving to another tree is important to reduce spread of the disease. Xylem-feeding leafhoppers and spittlebugs are thought to spread the bacterium in landscape trees. It can also be transmitted between trees through root grafts.

The bacterial pathogen cannot be isolated in the lab as most other bacteria. It can be confirmed using serological techniques. ELISA (enzyme-linked serological assay) testing can be done in a day and is used to help identify the *Xylella* pathogen. The most reliable test results occur in August and September, possibly because the bacterial population in the tree is higher. The U of I Plant Clinic will test for this bacterial pathogen the week of August 20. If you have a sample you want tested for BLS, and you live in the state of Illinois, call (217)333-0519, and we will arrange to run an ELISA with the next batch of samples. It is not economical to run this test for only one sample, but the standard $12.50 Plant Clinic fee covers expenses when multiple samples are processed together. Testing for *Xylella fastidiosa* is done on new growth. Send 3 inches of twig tip and all leaves attached to it. Place three or four such tip cuttings in a zip-lock bag, label with the tree species, include a check ($12.50) payable to the University of Illinois and a completed specimen data form (http://plantclinic.cropsci.uiuc.edu/hortdf.pdf), and mail to the Plant Clinic (http://plantclinic.cropsci.uiuc.edu/). We can accept only Illinois samples at this time. *(Nancy Pataky)*

Galls: Black Knot vs. Cedar–Quince Rust

Sometimes similar-looking diseases can be confusing to the gardener or landscaper. A recent call reminded me of this fact. The call concerned a hawthorn tree that had blackened galls along stems and at the tips. The caller thought this was black knot. When the sample was sent to the Plant Clinic, we realized the actual disease was cedar–quince rust. Both diseases are caused by fungal pathogens. Black galls or knot on the stems are associated with both diseases.

Black knot galls (knots) are initially slight swellings on the stems. They are more visible the second year after infection, when they become hard, brittle, and coal black. These elongated, rough, black swellings may occur on twigs, branches, and sometimes the trunk. If growth of the fungus is on one side of the stem, the stem may be bent at the knot. If the knot girdles the stem, the stem beyond dies. Galls continue to spread in the branch and will be larger next year if they remain on the tree. Black knot galls may grow to a foot or longer. The disease does not typically kill a tree but causes deformed growth if left unchecked. About 24 species of *Prunus* are susceptible to this disease. Hosts include ornamental plums and cherries but not hawthorn. The fungus form spores on 1-year-or older knots, giving them a velvety green appearance. Removing knots controls the disease.

Cedar–quince rust was described in issues no. 1 and 9 of this newsletter. Cedar–quince rust is damaging to hawthorn because it affects fruit, stems, and petioles. The galls that form on hawthorn stems give the stem a roughened, swollen appearance that is much more

obvious when the orange masses of spores are visible. By mid- to late summer, the galls are black and roughened like black knot, but still not more than twice the normal stem diameter. They do not grow as large as black knot galls. The pathogen girdles twigs, causing tip blight on hawthorn. If you look closely at old cedar–quince galls, you will see some small, cuplike fungal structures on the galls. They are white.

Primary diagnostic differences between these diseases are the host, gall size, and type of fruiting structures. Black knot is found on Prunus species (ornamental or edible plums and cherries), cedar–quince rust on hawthorn, quince, and sometimes apple. Black knot galls are much larger, with green to brown sporulation on black. Fungal structures on cedar–quince rust are white.

For more information, refer to *Report on Plant Disease (RPD),* no. 802, "Rust Diseases of Apple, Crabapple, and Hawthorn," or *RPD*, no. 809, "Black Knot of Plums and Cherries," available on the Web at http://www.ag.uiuc.edu/~vista/horticul.htm. *(Nancy Pataky)*

Wetwood and Slime Flux

Bacterial wetwood and slime flux are conditions most apparent on species such as elms, poplars, and cottonwoods. There are many other susceptible species in our landscapes, as detailed in *Report on Plant Disease (RPD),* no. 656, "Bacterial Wetwood and Slime Flux of Landscape Trees," available on the Web at http://www.ag.uiuc.edu/~vista/horticul.htm. Older trees are most often affected. Wetwood and slime flux refer to the wet appearance of the wood and the exudate (flux) that appears on the outside of the trunk. The two conditions comprise the disease complex.

A wet or slimy exudate emerges from branch crotches, cracks in the bark, or points of injury on the infected tree. The liquid seeps down the outside of the tree, leaving a wet trail. Fluxing is not continual, so sometimes a dry, white streak is seen. Bacteria are associated with wetwood and may be present in a tree for years before symptoms are apparent. Usually the problem is not a structural problem but just unsightly. Seeping has been apparent lately, probably related to air temperatures. The flux occurs when internal gas pressure from the bacteria increases, as is more likely to occur in warm weather.

There is nothing that can or should be done to infected trees. Do not insert drain tubes into the wood because this may break the tree's barrier to the affected tissue, allowing decay fungi to enter. Proper pruning that allows quick callousing of wounds can help prevent infection by bacteria that may cause wetwood. Fertilization may also help tree vitality.

One concern with this disease is the presence of various insects in and around the flux. The insects are not a threat to the tree. The liquid is a food source to beetles, flies, butterflies, and moths. Scavanging insects may even lay eggs in the liquid. If wood rot occurs, insects may visit to feed on the rooting wood. *(Nancy Pataky)*

INSECTS

May Beetles

There have been several reports of large white grubs in turf areas, particularly in northern Illinois. The larvae being reported are over 1 inch long. These are probably the larvae of May beetles, also known as true white grubs or 3-year white grubs. These larger grubs are probably in the third year of their life cycle and will pupate later this fall. They could also be in the second year of their life cycle and will be back in these locations next year unless controlled.

Unlike other white grub species in turf, May beetle grubs tend to feed more on dead organic matter. They are commonly found in flowerbeds or other heavily mulched areas, causing no damage to the roots of plants in that bed. As far as root-feeding is concerned, they feed on other roots besides those of turf. For instance, they commonly damage potatoes and carrots.

Like other white grubs, the larvae of May beetles are white and C-shaped. Mature larvae may approach 1-1/2 inches in length. The raster pattern on the underside of the last abdominal segment appears as a zipper, being two parallel rows of thickened setae, or thin spines.

These large grubs are difficult to control. Perhaps the most effective control is insecticidal nematodes. *Heterorhabditis bacteriophora* is one nematode species that is effective and widely available. It should provide about 60% control if applied late in the day to wet turf that is immediately irrigated. Insecticides are not going to be very effective against these large white grubs. Trichlorfon (Dylox) is probably the most effective but considerably less effective than the insecticidal nematodes. Imidacloprid (Merit) and halofenozide (Mach 2) are likely to be even less effective than trichlorfon. *(Phil Nixon)*

Aphids

We have had several reports of aphids on trees from around the state. Aphids have been reported on yellow poplar (tulip tree, *Liriodendron),* sweet gum, red maple, and swamp white oak. There are about 50,000 aphid species worldwide, and most of them are somewhat host specific. An aphid species is likely to feed on only one tree species or a few closely related species during the summer. This reduces the likelihood of an aphid species spreading to other plants in the landscape. It also makes it unlikely that garden plants or other plants in the landscape are a source of infestation to trees and shrubs.

Aphids overwinter as eggs, typically on a plant other than the one where they are common during the sum-

mer. These eggs hatch into all wingless females that feed on the winter host and give birth to more aphids. Usually after two to three generations on the winter host, the aphids mature into winged adult females that fly to the summer host. On the summer host, up to 30 generations of aphids are produced, all of them being females that give birth to living young without fertilization. Generations are commonly produced weekly, resulting in huge populations building up.

Aphid nymphs in crowded conditions are frequently bumped and jostled by nearby aphids. These aphids will mature into wingless females that give birth to nymphs that will develop wings as they mature into adults, allowing them to fly to new, less infested hosts. Lengthening nights towards the end of the growing season cause females to give birth to nymphs that will mature as winged males and females that must mate to reproduce. The aphids fly to their winter host, where the females lay eggs that overwinter.

Aphids are soft-bodied, pear-shaped insects. There are many species of aphids, with adults ranging from pinhead-sized to 1/4 inch long. On trees, most are closer to pinhead-sized, but a common aphid on willow is one of the largest aphid species. Aphid species vary in color, with green being most common. Even a population of one aphid species on a plant may vary in color, apparently depending on factors such as temperature, crowding, and food quality. Aphids tend to have long, spindly legs and long, slender antennae.

Towards the posterior end of the abdomen, they have one pair of cornicles. Cornicles are elongated, tubelike structures on many aphids, although in other species they occur as merely bumps. They are commonly dark-colored to black but are the same color as the rest of the body in some species. Cornicles are used to expel pheromones, externally liberated chemicals that affect other members of that species or other animal species. Alarm pheromone is commonly liberated by an attacked aphid to warn others.

Aphids feed on the sap of plants, typically tapping a phloem vessel with their piercing–sucking mouthparts. Aphids take in huge quantities of sap but have a digestive shunt that removes the nitrogen and some of the water from the sap, bypassing most of the sap around to the anus. Insects tend to have high nitrogen requirements, and plant sap is very low in nitrogen. Research has shown that many aphid species increase dramatically in numbers on nitrogen-fertilized plants. Associated research has shown that reducing nitrogen fertilization keeps aphid populations smaller. Reducing nitrogen fertilization of plants is an important aphid-control tactic in greenhouses and other situations.

The concentrated sap or light syrup substance called honeydew is exuded from the aphids' posterior. Honeydew is highly sought by ants, parasitic wasp adults, and other insects as a food source. It is so highly valued by ants that some ant species farm aphids, moving them to uninfested areas of plants, moving them to other plants, and even carrying them underground into their nests for the winter and then bringing them out in the spring to place them on the proper plants. Perhaps you thought that only humans maintained livestock.

In the western United States, argentine ants are so aggressive in protecting their aphid "cows" that they kill and otherwise eliminate natural enemies that attack aphid infestations. In those areas, ant control is frequently needed to control the aphids. In Illinois, the common ants associated with aphids, such as carpenter ants, pavement ants, and acrobat ants, do not defend the aphids enough to seriously hamper control.

Aphids used to be a common problem in Illinois, but large numbers of aphids on trees almost ceased with the arrival of the multicolored Asian lady beetle throughout Illinois in the mid 1990s. The multicolored Asian lady beetle is the one that bites people and enters buildings in huge numbers in the fall. It is primarily an arboreal species, its orange and blue larvae that look like tiny alligators up to 1/4 inch long being common on tree foliage. The common native lady beetles in Illinois tend to be found primarily on herbaceous plants, which perhaps should be expected in a prairie state.

About 2 weeks after they become numerous, aphids that are exposed on the leaves and stems are usually controlled by natural enemies, making insecticide application unnecessary in most cases. Not only does the multicolored Asian lady beetle feed on aphids, but so do other lady beetle species, lacewings, syrphid flies, parasitic wasps, and other insects.

It is more common to control aphids due to their sticky honeydew coating sidewalks, cars, lawn furniture, and other objects under infested trees than to control tree damage. Aphids tend to feed near the tips of branches on the young leaves and stems. This feeding can cause the leaves to wrinkle, curl, twist, or become distorted in other ways. Similarly, young, green stems may curl or twist due to aphid feeding. If needed, contact insecticides such as insecticidal soap, summer spray oil, and pyrethroids are effective. The systemic insecticide, imidacloprid (Merit), is also effective against aphids. *(Phil Nixon)*

Whiteflies

Whiteflies are being commonly found on flowers and other herbaceous plants in Illinois. They are 1/16-inch-long insects with white, powdery wings. They sit on leaf undersides and fly off of infested foliage when disturbed. They are sucking insects, whose removal of sap can cause leaf distortion.

Three species of whitefly are common in Illinois. Perhaps most common is the bandedwinged whitefly. The adult has two dark bands on each front wing. It is hardy in Illinois, feeding primarily on velvetleaf, also known as buttonweed. This weed is common in agricultural and weedy land areas. Huge numbers of adults migrate to other plants, even flying in large numbers into greenhouses. Bandedwinged whitefly feed as adults on many plant species but does not reproduce heavily on them. Thus, bandedwinged whiteflies usually do not warrant control. An exception is attacks on flowering maple, *Abutilon,* which is the same genus as velvetleaf.

The other two common species are greenhouse whitefly and silverleaf whitefly. Silverleaf whitefly used to be known as sweet potato whitefly. They do not have dark bands on their front wings, being totally white. Neither of these species is able to survive Illinois winters. They are common pests in greenhouses and are apparently moved outdoors each spring on bedding plants. These whiteflies can build up in numbers through multiple generations through the growing season to be common on plants in late summer and fall. They reproduce on many plants and can increase enough to cause damage.

Damage appears as wrinkled, curled, cupped, or otherwise distorted leaves. Large amounts of honeydew, excreted from the nymphs and adults, make leaves glossy and sticky. Infestations may be first noticed by sidewalks and objects below infested plants becoming sticky from the honeydew. Black sooty mold grows on the honeydew and is another clue that an infestation is present. Sooty mold can reduce the amount of light reaching the leaf surface, resulting in reduced photosynthesis.

Another determination that greenhouse or silverleaf whiteflies are present is to look for nymphs and pupae. Insects with incomplete development go through egg, nymph, and adult life stages; and complete development insects have egg, larva, pupa, and adult life stages. Whiteflies, along with a few other insects, are thought to be somewhat transitional between incomplete and complete development. They are considered to have incomplete life cycles, but the last nymphal stage is called a pupa.

Whitefly nymphs and pupae appear as oval, clear to light yellow insects on the leaf undersides. Legs are not apparent. The pupae and older nymphs are about 1/16 of an inch long, 1 to 2 millimeters. They are most common on the older, lower leaves of the plant. Their small size and transparent qualities make them difficult to see. Adults and their eggs are most common on the younger, upper leaves of the plant.

Control of whiteflies is usually not necessary unless nymphs are present. Thorough coverage with sprays of insecticidal soap, summer spray oil, or pyrethroids should be effective. Apply weekly, two or three times. Imidacloprid (Merit) applied to the soil is also effective systemically on whiteflies. *(Phil Nixon)*

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