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Aster Yellows

Aster Yellows is a disease commonly found on members of the Asteraceae (Compositae) family, including *Aster*, *Chrysanthemum*, marigold (*Tagetes*), *Zinnia* and coneflowers (*Echinacea*). However, you can find the disease on other plants such as carrots and onions.

Plants appear stunted and slightly yellow, but more importantly, the flowers are distorted, possibly highly branched, elongated and/or crested, commonly with green instead of brightly colored petals. Often, growers will think their plants have mutated or have been damaged with a growth-regulator chemical such as a herbicide. With the proliferation of new coneflower cultivars in a multitude of colors in a low-maintenance landscape, Aster Yellows has become more common.

While Aster Yellows appears virus-like, it's really caused by a phytoplasma. The disease isn't spread by spores like fungi or bacteria; instead the disease is spread by leafhoppers, a sucking insect which moves the disease from plant to plant. The insects, and by extension the disease, is more severe with cool wet weather than hot, dry conditions. As temperatures rise and rainfall or irrigation is minimal, leafhoppers aren't as active.

Unfortunately at the moment, we can't culture Aster Yellows at the UI Plant Clinic.

The best course of action is rogueing out the diseased plants and burying, actively composting, or discarding the plants in the trash. Simply deadheading the suspected flowers will not prevent its spread.

Weed control near planting beds is also recommended as the leafhoppers may feed on many weeds such as dandelions (a member of the Aster family) and plantain as they migrate from the south to the Midwest in early spring.

Spraying leafhoppers regularly with a recommended insecticide may be beneficial in a commercial planting. Buying disease-free stock is also recommended. (*David Robson*)

Rusts on Apple and Hawthorn

We're finally seeing some beautiful weather for this time of year, with days full of sunshine and moderate temperatures. We're not the only ones enjoying the outdoors; we share it with animals, insects, plants, and of course, plant pathogens. One common problem that's rearing its ugly head is rust on apple trees and hawthorns.

Rust diseases are caused by fungi, and affect a wide range of plants including field crops like corn and soybeans, fruits like raspberry, evergreens like junipers and white pines, ornamental plants like daylily and lily of the valley, turfgrass, and deciduous trees. Many rusts require two hosts to complete their lifecycle, and can produce up to 5 different types of spores in the course of one year. Rusts are complicated diseases that have been affecting humans since ancient times.

Rust lesions are a common problem on apple and hawthorn trees in Illinois every year. Most are caused by three different rust diseases: cedar-apple rust, cedar-hawthorn rust, and cedar-quince rust.

As the name suggests, cedar-apple rust affects apples and crabapples (*Malus* spp.) and eastern red cedar (*Juniperus*). Both the apple and the cedar hosts are necessary for the fungus (*Gymnosporangium juniper-virginianae*) to reproduce. On apples, lesions can occur on the leaves, fruits, and twigs of affected trees. First appearing as pale yellow spots on the upper surface of the leaf, as the lesions develop they become larger, with a dark orange-brown center. Eventually, the fungal infection reaches the underside of the leaf and small tube-like structures develop. These structures, known as aecia, release thousands of aeciospores to be blown by the wind, settle on a juniper plant, and begin infection of the new host. For ornamental apples and crabapples, the aesthetic impact of discoloring lesions on the leaves is the greatest problem. Severe infection can result in leaves becoming completely yellowed and premature defoliation of the tree.

Similar rust lesions are also developing on hawthorn trees at this time. These lesions are caused by a different rust fungus (*Gymnosporangium globosum*) which causes cedar-hawthorn rust. It can also infect others in the rose family including apple, crabapple, serviceberry, and pear. Once again, both the deciduous tree host and the cedar host are needed for the fungus to go through its entire lifecycle. As on apple, the first symptoms on hawthorn are small, pale yellow spots on the top side of the leaves which develop into larger, darker lesions surrounded by a yellow halo as the infection progresses. Aecia develop on the bottom surface of the leaves as the infection progresses, and the aeciaspores released will infect cedar plants. This pathogen can also cause leaf yellowing and premature defoliation on heavily infected trees. Certain species of hawthorn, including downy hawthorn seen below) are considered very susceptible and may incur heavy damage.

There is a third rust disease in Illinois that affects cedar, cedar-quince rust. This pathogen (*Gymnosporangium clavipes*) can affect numerous members of the rose family, including serviceberry, chokeberry, quince, hawthorn, and apple, among others. This fungus forms lesions along leaf petioles and leaf veins, and may cause damage to stems and fruits of susceptible hosts. This pathogen is the most damaging to the coniferous host, causing branch cankers that can cause severe dieback and death. Cedar plants should be scouted for rust-colored growths on branches in early spring, especially if dieback was noted the previous year.

Control for deciduous host rust symptoms include the use of a wide range of fungicides (the most common being chlorothalonil, myclobutanil, potassium

bicarbonate, and propiconazole). Chemical treatments need to be applied early in spring at the pink flower to bud stage, and are continued at the labeled interval for 1 to 2 weeks past petal fall. Resistant varieties are available, and should be considered for ornamental use. (*Diane Plewa*)

Tubakia Leaf Spot

Tubakia leaf spot has been observed on many oak samples this year. The disease is caused by the fungal pathogen, *Tubakia dryina*. All oak species are susceptible to this disease, but those within the red oak group are more commonly affected. This leaf spot is often associated with stressed trees, especially pin oaks with symptoms of iron chlorosis. Other potential hosts include maple, hickory, chestnut, redbud, ash, black tupelo, sourwood, sassafras and elm.

The symptoms of this disease appear similar to and often confused with those of anthracnose. As a rule of thumb, oak anthracnose symptoms usually appear earlier in the growing season (May-June), while tubakia leaf spot occurs as a later season disease with symptoms first appearing in July and August.

Tubakia leaf spot lesions will vary with host susceptibility and environmental conditions. The lesions start as small water soaked areas. They become evident as they enlarge and transition to a reddish brown color. Severe infections can cause premature leaf drop, a symptom which can be alarming to those scouting for oak wilt. The Tubakia pathogen is fairly easy to confirm in a diagnostic laboratory with the aid of a microscope. It produces a distinctive disc-shaped fruiting body called a pycnothyrium which is composed of mycelia and spores.

Moist, rainy weather and moderate temperatures promote infections and allow the spread of this fungus. The disease is much less common during years with predominately dry weather.

Tubakia leaf spot usually develops late enough in the season that there are no long-term adverse effects on tree health. As a result, treatment with fungicides is not usually recommended. Rake and remove fallen leaves to reduce disease occurrence during the following growing season, by reducing innoculum in the surrounding area. Promoting tree vigor and alleviating any potential stresses to the tree is also recommended. (*Travis Cleveland*)

Emerald Ash Borer

Emerald ash borer has been found in white fringetree in northern Illinois. Research conducted by Don Cipollini, Wright State University, Dayton, OH found characteristic exit holes, larval tunneling damage, or other symptoms in 7 of the 16 white fringetrees, *Chionanthus virginicus*, inspected at the Morton Arboretum on May 29, 2015. Dr. Cipollini conducted previous research in Ohio that proved by taxonomic examination and DNA analysis that emerald ash borer is able to infest and complete its life cycle in white fringetree.

He also conducted laboratory research on emerald ash borer attack. Emerald ash borer eggs hatch into larvae that proceed through four larval instars (stages) before forming prepupae, pu-

pating, and emerging as adults. He found that eggs produced larvae that, after 40 days of developing in white fringetree, weighed one-third as much as those from green ash.

He also tested the closely related Chinese fringetree, *Chionanthus retusus*, and devilwood, *Osmanthus americanus*, as potential hosts. Of the 42 eggs placed on Chinese fringetree, all of them hatched into larvae that penetrated the stem, but none survived 40 days. All of the larval tunnels were one inch or less in length before the larvae died. Of the 30 eggs placed on devilwood, 24 hatched into larvae that penetrated the stem, with three surviving 40 days. Those surviving larvae weighed one-seventh as much as those from green ash. Their larval tunnels averaged about 20 inches long.

Both *Chionanthus* and *Osmanthus* are closely related to ash, *Fraxinus*. Of the three non-ash species, white fringetree is the only one found to support complete development of emerald ash borer to the adult stage. Based on his research and observations, Dr. Cipollini surmises that white fringetree is attacked by emerald ash borer when most of the ash trees in an area are dead and dying. That white fringetree is attacked by beetles that cannot find suitable ash trees on which to lay their eggs. White fringetree is apparently attacked in desperation and is not a primary host.

The research paper will be published in the journal, Environmental Entomology, and has been released via advanced access. A release on the research is located at http://phys.org/news/2015-07-white-fringetree-emerald-ash-borer.html. (*Phil Nixon*)

White Grubs

Populations of adult Japanese beetle continue to be light in most of Illinois. Although leaf feeding damage on linden, crabapple, rose, and other trees and shrubs is obvious in some areas, the amount of damage is less than in most years and not as widespread.

The reduced number of adult beetles should translate into fewer eggs laid in turf. The combination of fewer eggs resulting in fewer white grubs and continued timely rainfalls in most of Illinois should result in less white grub injury to turfgrass this year. However, there will be spotty areas where white grub numbers are likely to be high enough to result in turf damage.

Now is the time to be scouting for white grubs throughout the state. The eggs hatch by early August so there are grubs to find, but they will be too small until mid to late August to eat enough roots to cause dieback.

Cut through the turf with a sturdy knife, I like to use a folding outdoor knife. Select an area where white grubs have been previously, areas that are damper, or the edges of brownish areas. Cut about a one-foot square on three sides, and pull back the sod. In moist soil, the white grubs will be obvious on the soil surface where they have been feeding on the roots of the grass. Look for grubs hanging onto the underside of the sod, and till the upper three inches or so of the soil with the knife blade to flip any deeper grubs onto the soil surface. In dry soil, the grubs will descend downward to where the moisture is located, so they are likely to be four to six inches deep.

Ten to twelve grubs per square foot are enough to cause damage. Heavily used turf is damaged by fewer grubs, about eight grubs per square foot. Lightly used turf can have fourteen or more grubs per square foot without showing die-back. Even one to three grubs per square foot are attractive enough to raccoons, skunks, and insectivorous birds to result in digging damage.

High grub numbers can still be reduced to non-damaging levels with an application of trichlorfon (Dylox) or chlorantroniliprole (Acelepryn). Imidacloprid (Merit), thiamethoxam (Meridian), and clothianidin (Arena) are also effective, but the grubs may not die for two to three weeks. All grub insecticides provide better control if watered in with at least one-half inch of water. (*Phil Nixon*)