The Plant Doctor's LANDSCAPE TIPS

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INVASIVE DISEASES AND PESTS: NUANCES OF INTEREST

Photo 1A: White pine is not only Michigan's state tree but this species is a valuable component of our landscapes and woodlands. White pines in forests offer great value in timber.

Photo 1B: It's hard to believe that a tiny, introduced fungus such as the cause of White Pine Blister Rust can destroy such a large, handsome tree. In this photo, note the "Rust" blisters on the trunk of the white pine; those blisters will eventually girdle and kill the tree. Also note the tiny yellow lesions on the adjacent alternate Ribes host plant, which is needed to complete the disease cycle.

INTRODUCTION

Invasive pests and diseases tend to be more destructive and difficult to manage than their native counterparts. For example, while the Dutch Elm Disease fungus (Ophiostoma ulmi) is present in Asia and North America, it is highly destructive on elm trees (Ulmus sp.) in the United States but far less aggressive on elm trees in Asia. The most plausible explanation for this differential activity in geographic locations is due to the evolution (natural selection) of the fungus and its host plant in Asia, where elm species and the fungus have evolved over millennia to adapt to one another. When the causal fungus was introduced into North America in the early 1900s, our native elm populations had no natural defense . . . many/most have succumbed to the destructive nature of the fungus. Over long periods of time, we might expect American elms to develop resistance. However, there is not a strong selection pressure for this to happen because elms often germinate and reach seed bearing age before succumbing to the disease. It is a common observation that various disease microbes and pests are often inconspicuous or of minor importance in their native habitat, but reach destruction of highest order when introduced into new geographic areas.

In this article, I wanted to review some of the major diseases and pests that have been introduced and that are forever changing the urban and natural forest ecosystems in North America. Knowing some of the important nuances or attributes might help us better understand how to prevent and better manage them.

WHITE PINE BLISTER RUST

It is widely believed that Cronartium ribicola, the cause of White Pine Blister Rust (WPBR), was probably introduced into New England from Europe on White Pine nursery stock in the late 1800's (Photos 1A & 1B). By 1910, the disease had spread to Minnesota and south to North Carolina. Also, the disease was introduced on nursery stock at about the same time into British Columbia from France. Like some other macrocyclic rust diseases, WPBR requires two different host plants to complete its disease cycle. Some cultivated and wild Ribes sp. (currant) serve as the necessary alternate host plant for this disease. Although many criticize our U.S. Government for its bureaucracy, one of the more successful programs for WPBR management began during the Great Depression when FDR organized the Civilian Conservation Corps (CCC) and sent hordes of (unemployed) people trampling throughout the North American Forests to try to eradicate or decrease the population of Ribes in these forests to save the valuable white pine timber resource. Although the disease has caused millions if not billions of dollars in timber value losses, the losses would have been more astronomical without the efforts by the CCC.

CHESTNUT BLIGHT

Caused by the fungus, Endothia parasitica, Chestnut Blight (CB) was initially discovered in New York in 1904. The fungus is disseminated as spores by air currents and by animals such as birds. The fungus is capable of attacking healthy chestnut trees by simply infecting and

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Photo 2: The Chestnut Blight was so efficient at eliminating American Chestnuts from American Forests and landscapes that virtually none remain. The fungus spreads extremely efficiently by wind-borne spores. Every once in a while, a rare, isolated chestnut is found such as this one in Bloomfield Hills, MI.

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Photo 3A: This is not winter! The time period is the summer of 2013 and the foliage on these trees in a park in SE Michigan has been decimated by the Gypsy Moth. Typically, trees such as these will take at least one or two defoliations before being seriously harmed.

Photo 3B: Despite the aggressive attack by Gypsy Moth on the trees in Photo 3A, the insects are already starting to die in great numbers as the "natural" (actually introduced) parasites and pathogens are killing larvae by the millions.

Photo 4: The Hemlock Woolly Adelgid has decimated eastern forests. Recently, the insect has been found in western Michigan in an expanding area making eradication virtually impossible. (Photo Credit: Connecticut Agricultural Experiment Station, Bugwood.org)

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causing cankers on branches. No wounds are needed. Prior to introduction of CB, chestnut trees comprised a significant proportion of North American forests. Old stumps of the killed trees can still be found; many send up shoots, which are usually attacked again by the lethal fungus. Most chestnut trees are long gone but some "escapees" are occasionally found (Photo 2). There are a number of active groups that are trying to revitalize this species of tree as a once again prominent member of our natural forest.

GYPSY MOTH

The Gypsy Moth (Lymantria dispar) is considered one of the most destructive forest pests in North America. The insect had evolved in Europe and Asia for many thousands of years before being introduced into Boston around 1868 by Leopold Trouvelot. How would you like your name associated with the introduction of a pest that would cause billions of dollars in forest damage? Not me!!! Repeated defoliation of trees by the insect accompanied by environmental and human-induced stresses has resulted in significant tree mortality. The gypsy moth occasionally flares up in Michigan communities but because of introduced natural predators, parasites and pathogens (eg. Entomaphaga fungus from Japan), the insect is not nearly as devastating as it used to be (Photos 3A & 3B). Populations often crash soon after they begin to explode.

HEMLOCK WOOLY ADELGID

The Hemlock Wooly Adelgid (HWA= Adelges tsugae) is native to Asia. Although known on the U.S. west coast since 1920s, it was first found on the east coast in the 1950s near Richmond, Virginia. By 2005, the insect had spread to more than 16 states ranging from Maine to Georgia. Hemlocks in the Appalachian and Smokey Mountain ranges have been decimated. Although the invasive insect has been introduced into Michigan several times in past decades, it has usually been successfully eradicated with aggressive "slash and burn" methods. Unfortunately, in 2016, a large outbreak was noted on the western coast of Michigan and, hence, the pest is here to stay. The insect kills by literally sucking the life out of the trees (Photo 4). It spreads as immature nymphs on air currents and by transportation on animals (as well as nursery trees and tree products). The pest is relatively easy to manage with insecticides on Hemlocks in the landscape; however, it is another of those problems that requires pesticides when many of us are trying to minimize pesticide usage. Regrettably, trees of lower value such as those in woodlands and forests will succumb to the destructive invasive.

EMERALD ASH BORER

Discovered by the author in 2002 in SE Michigan, the Emerald Ash Borer (Agrilus planipennis=EAB) has spread wide and far in the past 16 years (Photos 5A & 5B). Compared to many disease agents which

Photo 5A: The Emerald Ash Borer (EAB) kills ash trees by feeding on the rich nutritional sources of the cambium tissues. Note that this tree exhibits intermediate symptoms: thinning and decline in the top of the tree with epicormics shoot development on the trunk.

Photo 5B: This adult EAB has just emerged from the D-shaped hole. As a larva, it does the severe damage to trees by tunneling in the cambium regions while the adult has virtually no impact on ash trees.

are passively carried by air currents or by other means such as insect or animals, the EAB flies throughout our landscape, countryside, state and regions to seek out ash trees to infest . . . and ultimately to destroy. Of course, the EAB can be transported long distances in nursery stock or wood products such as firewood. The EAB is a prime example of the native vs. introduced phenomenon – the insect is largely inconspicuous in Asia from whence it came, but highly destructive and lethal in North America where ash trees have not developed defenses to the insect over the millennia.

BEECH BARK DISEASE

Beech Bark Disease (BBD) is a collaborative venture between several species of introduced Beech Bark Scale (BBS) insects and several introduced and native species of the fungal pathogen, Nectria. The scale insects colonize the beech trees in great numbers (Photo 6); that colonization results in numerous tiny wounds created by the piercing/sucking mouth parts of the scale. With such extensive wounding, Nectria fungi, which are considered wound pathogens, invade the branches and trunk of the tree, causing cankers and . . . eventually causing "beech snap" (structural failure). The author has found astonishing long-erm control of the BBS with high rates of Talus and/or trunk injections using imidacloprid (Pointer). Compared to other invasives discussed in this article, it turns out that a small percentage of native beech trees appear to be less affected or unaffected by BBD. These unaffected trees may help eventual recovery of Michigan and U.S. forests.

Photo 6: This American beech tree is heavily colonized by the Beech Bark Scale and is ripe for invasion by the deadly Nectria fungus.

DUTCH ELM DISEASE

The disease, caused by Ophiostoma ulmi (formerly Ceratocystis ulmi) gets its name because it was first reported in the Netherlands, even though it's a native of Asia. Asian species of trees such as Siberian elm and Chinese elm are largely resistant. The disease was first found in Europe in 1920, causing severe damage on native elms there, especially in Holland. The disease was first found in the U.S. in Ohio in 1930. In the subsequent three years, the disease was also found in New York, New Jersey and Connecticut. An American quarantine had been in place for almost two decades before the disease was introduced, yet it was still introduced from a foreign country! It was discovered that elm logs had been imported from Europe for veneer several years prior to the discovery of the disease in the U.S. Ports of entry include the Atlantic Ocean and the Gulf of Mexico, from where the logs were shipped overland on open railroad cars, sometimes several hundred miles to their destination. Imagine the disease "leaping off" the logs as they were being transported around the U.S to veneer mills. Overland spread of the disease depends on transmission by feeding injury by native and introduced elm bark beetles. As with Oak Wilt, the disease may also be spread "underground" through root grafts between nearby trees. We still have some large elms left in Michigan that escaped the epidemics of the 1950's-1970's (Photo 7 & Inset).

OAK WILT

Oak Wilt (OW), caused by the fungus Bretziella fagacearum (formerly known as Ceratocystis fagaceraum), was first discovered in Wisconsin in 1944. There were scientific descriptions of oak tree death mimicking OW dating back to the late 1800's; hence, it was likely spreading in the U.S. long before it was discovered. DNA technology has recently disclosed that OW is an introduced disease. Like DED, OW is transmitted overland by insects and underground through root grafts to nearby trees. Oak Wilt is gradually expanding in Michigan in large part to human activity. If we humans would stop wounding trees and stop transporting firewood, we could slow its rate of progress dramatically (Photo 8).

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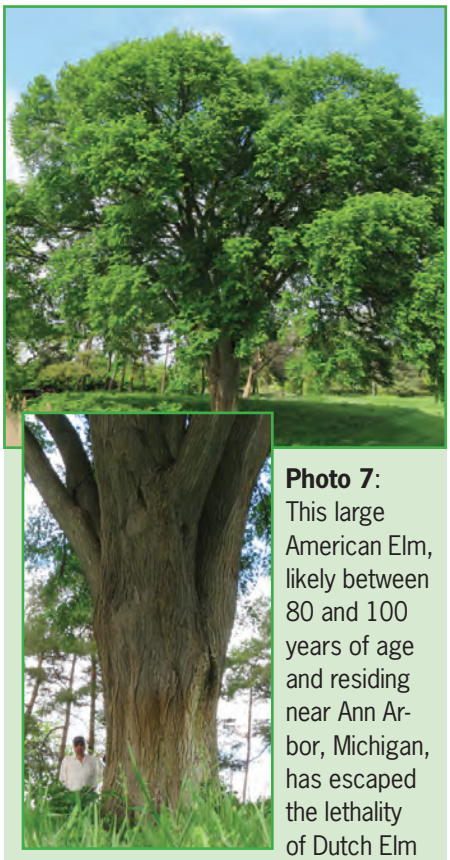

Photo 7: This large American Elm, likely between 80 and 100 years of age and residing near Ann Arbor, Michigan, has escaped the lethality of Dutch Elm Disease (DED) all these years, especially when the major wave of DED went through Michigan in the 1950s-1970s. Note that the trunk is over 4 feet dbh in this self-portrait by the author (Inset).

Photo 8: This epicenter of Oak Wilt developed in Traverse City after power line clearing operations in November of 2014, well outside the April 15-July15 window when trees are believed to be of highest risk from injury such as pruning or storm damage.

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TRELLIS RUST

Also known as European Pear Rust, Trellis Rust (TR) was imported from Europe. Requiring an alternate host plant (Juniperus sp.) to complete its disease cycle, it is similar to some of our native rust diseases such as cedar-apple, cedar-quince and cedar-hawthorn rust. However, because it is an introduced disease, we can expect it to be more devastating to our native Pyrus trees . . . and it is (Photo 9). The disease is expected to worsen in the coming years as it spreads across Michigan from SE Michigan.

NUANCES OF INTEREST

Invasive pests and diseases are generally much more devastating to our native trees than native pests and diseases. The scientific explanation for this is "Evolution". In their native ecosystem, plants, pests and diseases evolve together over many thousands (millions) of years. In fact, one can almost be assured of the origin of a pest or disease by its effect on trees in various countries on various continents. For example, the EAB is almost harmless in Asia and is often considered a background insect pest there . . . attacking severely stressed or declined Fraxinus sp. DED does not appear to be very aggressive on

Photo 9: Trellis Rust is an introduced disease that requires juniper as its alternate host to complete its life cycle. This tree is starting to show some decline from the disease. Note that the juniper directly beneath the tree will ensure an epidemic of the disease within a couple of years, not only for this landscape but for the community as well. Photo Credit: Gary Olgart

Siberian and Chinese elm, indicating the likely origin. It is of particular interest to note that invasives tend to affect whole genera of plants, for example, the EAB attacks all native species of Fraxinus in North America. Native pests and diseases tend to be less broad ranging.

Another area of interest is the manner of spread and transmission of invasive pests and diseases. Most are spreading through the landscape, countryside, state and nation by flying, in the case of insects, or by spore dispersal, in the case of (fungal) diseases. Obviously, invasives can be spread much more quickly and far greater distances by human activity such as transportation of infested/infected plants or parts of plants. Although each invasive pest and disease has its own particular nuances, Oak Wilt stands out as different in a significant manner from the rest. In order for overland transmission to occur, oaks must be injured. The EAB, TR, WPBR, etc. do not need wounding of their host plants to infect/infest them. DED does require wounding but by the bark beetles that feed on the trees. The primary overland transmission of OW is via sap beetles, which cannot wound oak trees, per se. Sap beetles require the injury of oak trees by some other mechanism: pruning, storm injury, etc. Therein lies the secret to OW management. Stop wounding oaks during the transmission period by pruning, disc golf, lawn mowers, weed trimmers, etc.!!! And in the case of storm injury, implement prompt storm repair damage techniques.

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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