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# THE PURDUE LANDSCAPE REPORT

In This Issue



## Revisiting Ash Tree Protection

*(Bob Bruner, rfbruner@purdue.edu)*

Recently, there has been an uptick in questions related to one of Indiana's most notorious invasive pests: the emerald ash borer. Homeowners, businesses, even professionals have asked if ash trees are still present in Indiana, and if the insect is still a threat to our ecosystem. Emerald ash borer wreaked significant havoc among Indiana's hardwoods, and a person could be forgiven for believing that there are no ash trees at all in our state, but this is simply not true. Ash still survives in Indiana and can be found both as ornamental plantings and in untended woodlots; unfortunately, emerald ash borer is also still present and just as deadly to them as ever. The question of protecting ash versus removal them is complex, but entomologists and tree specialists have learned from this insect's invasion.

Figure 1. Side view of EAB, John Obermeyer

The emerald ash borer (*Agrilus planipennis*), a wood-boring insect native to Asia, is responsible for decimating ash (*Fraxinus* spp.) throughout the United States and elsewhere. In Indiana, this insect's presence was confirmed in 2004, though it had probably been in the state for some time before then. Since its arrival, Hoosiers have been forced to watch as ash trees have rapidly declined and died due to the insect's feeding and life cycle. The insect lays its eggs in crevices in the bark of an ash that is 8 to 10 years old, and after hatching, the new larvae begin to bore through the tree's cambium tissue. The tree relies on its cambium tissue to transport water and nutrients and supply cells for new growth. Often, the only signs of the insect's presence are a reduction in canopy coverage and D-shaped exit holes in the bark, indicating adult emergence. As time goes on, however, the tree will continue to lose canopy, experience limb death, and often have large chunks of bark detach. Unprotected trees will typically die within 2 to 5 years of infestation. Dead and dying ash trees represent a serious hazard to health and property as infestation will leave them extremely brittle. Brittle ash will often fall during weather events or even collapse over time as limbs fall off.

While emerald ash borer did significant damage to ash tree populations in Indiana, they did not destroy the population entirely. While virtually all untreated trees will eventually become infested, saplings with a trunk diameter of ½ to 1 inch will remain untouched, allowing annual replacement of trees to continue. Since the initial invasion killed so many trees, the borer's populations have been proportionally reduced as well due to a lack of a food source. This combination of factors has created a cycle of growth and infestation that allows both populations to survive, but at significantly lower levels as compared to the period of the initial infestation. Unfortunately, this also means that emerald ash borer is now a permanent fixture in the hardwood ecosystem in Indiana.

While many may believe ash trees are a total loss, there are still options to protect ash tree and even rescue ash that have already been infested. The first step in this process is to determine the extent of damage in a given tree. As the cambium tissue is consume by ash borer larvae, the tree will experience a steady loss of canopy and limb death. The proportion of lost canopy makes a great indicator for treatment viability. For example, a tree that has only lost 10% of its canopy will normally respond well to treatment. As more canopy is lost, recovery is more challenging, until the tree has lost %30 of canopy coverage. After that point, there is very little chance that a rescue treatment will be successful, and removal will most likely be necessary. It is also important to remember that limb death may occur; these limbs will not recover and will need to be removed to avoid any potential hazards.

There are several insecticides with varying ranges of efficacy that can be used to manage emerald ash borer. These include imidacloprid, dinotefuran, azadirachtin, and emamectin benzoate.

Several studies have been conducted to find the best combination of chemical and application type, such as the difference between using a soil drench compared to a trunk injection. While all of the above chemicals can be effective against the insect, the combination of emamectin benzoate applied through a trunk injection offers the best, longest lasting protection from infestation. This combination has a durable effect lasting for two years under dense infestations. However, the reduction in emerald ash borer populations have spread the distribution of the insect thinner, and longer intervals between treatments are possible. A ten-year study conducted by Purdue University demonstrated that treating trees once every three years provided sufficient protection from the beetles, while also showing that 4 to 5 years after last treatment coincided with an increase in damage to the trees. This same study also found that by six years post-treatment, the trees would decline to the point of making removal a necessity. This research concluded that increasing time between intervals after three years increased the risk of catastrophic damage due to emerald ash borer activity, thus the recommendation for three-year intervals.

Figure 2. This photo illustration shows three ash trees in Bloomington, Indiana, with different levels of canopy lost to the emerald ash borer. (Purdue Tree Doctor app illustration/Cliff Sadof)

Ultimately, many will see this as a financial issue: the cost of treatment over time against the cost of removal to avoid potential damages. The above study estimated the cost of treating a single tree with an emamectin benzoate injection at $300 per treatment. Since treatment only needs to happen once every three years, the cost per year per tree would be $100, approximately. Tree removal was estimated between $1800 and $3600, depending on tree location and other factors. Also consider replacement costs if you wanted to continue to grow ash in that area, and how long the tree would need to grow to match the size of the tree you just replaced. Additionally, add in any treatment costs to make sure it survives infestation. When looked at from this angle, maintaining regular treatment on rescuable trees would appear to be the most cost-effective route for managing ash. Any treatment plan should be discussed with a professional, such as a certified arborist.

Even though emerald ash borer is here to stay, we can still keep small populations of ash safe from infestation with monitoring and proper treatment. Check the resources below to get more information and help with identification and management of emerald ash borer and other pests.

Special thanks to Dr. Cliff Sadof

**Resources**

Purdue Plant & Pest Diagnostic Laboratory:

https://ag.purdue.edu/department/btny/ppdl/

Purdue Entomology's Emerald Ash Borer Info Page:

https://extension.entm.purdue.edu/EAB/

ReportINvasive:

https://ag.purdue.edu/reportinvasive/

Emerald Ash Borer University:

https://Emeraldashborer.info

# Hypoxylon Canker of Hardwoods

*(John Bonkowski, jbonkows@purdue.edu)*

Hypoxylon canker is a common disease of mature hardwood trees both in landscapes and in natural wooded areas. The disease, caused by the wood decay fungus *Biscogniauxia* (formerly *Hypoxylon*), is most frequently observed in oak tree species, but can also cause dieback in pecan, hickory, golden rain tree, sycamore, maple, beech, birch, elm, willow, basswood, hornbeam, and others.


Figure 1: Significant bark loss of a mature oak tree due to Hypoxylon canker. Photo Credit: Purdue PPDL

Figure 2: Stroma of Biscogniauxia developing on wood below the bark. The color of the stroma is white to gray initially. Photo Credit: Terry S. Price, Georgia Forestry Commission, Bugwood.org

The fungus  may colonize tree bark and sapwood months before symptoms develop, though it is regarded as a weak pathogen and does not cause disease in healthy, vigorous trees due to the natural defenses present. Stress, in the form of excessive heat, drought, root damage, chemical injury, or insect injury, is necessary before *Biscogniauxia* starts to cause disease symptoms. Initially, individual branches or sections of the canopy may begin to turn yellow or die back, but as the summer progresses, foliage may fall prematurely.


Figure 3: A Biscogniauxia stroma turns from white to a rusty-brown color over time. Photo Credit: Purdue PPDL

Figure 4: A mature stroma of Biscogniauxia will eventually turn black. Photo Credit: USDA Forest Service – Region 8 – Southern , USDA Forest Service, Bugwood.org

As it continues to grow within the tree, pressure develops within the bark, which cracks and eventually falls from the tree, exposing the fungal growth below and creating a pile of bark at the base of the trunk. In severely affected trees bark may be lost from most of the tree. If the fungus surrounds  the main trunk it can girdle it, eventually killing the tree. The exposed fungal growth initially appears white which will turn to gray, red-brown, then black as time progresses. *Biscogniauxia* produces dry, dusty spores which are spread primarily by wind. It is an internal wood decay fungus and will reduce the overall integrity of the tree, especially when located on the main trunk. Once found, we recommend evaluating the structural stability of the tree as it will be more prone to failure and wind throw.

There are no fungicides labeled to manage Hypoxylon canker and it would be impossible to try and manage for the pathogen itself since it is already widespread in the natural environment. Avoiding damage from Hypoxylon depends on stress mitigation, including providing supplemental water during hot and dry periods, mulching the root zone to prevent soil moisture loss (and to avoid competition for water by turfgrass), and providing adequate plant nutrition.

## Hornbeam Rust: An emerging rust disease in the US

*(Will Drews, WDrews@dnr.IN.gov)*

During a nursery inspection in Owen County in 2024, I noticed an unusual yellowing of the leaves on some American Hornbeam (*Carpinus caroliniana*) trees (Fig 1). A look at the underside of the leaves revealed yellow-orange pustules, suggesting a rust fungus. After help from the Purdue Plant & Pest Diagnostic Lab, this fungal pathogen was confirmed to be hornbeam rust (*Melampsoridium asiaticum*), a relatively new emerging rust

disease in the US.

Figure 1: Yellowing lower leaves on a young American hornbeam caused by hornbeam rust. Photo by Willem Drews, IDNR.

Figure 2: Underside of American hornbeam leaf with rust pustules. Photo by Willem Drews, IDNR.

Hornbeam rust can be identified by its yellow-orange raised bumps, called pustules, on the underside of the leaves of susceptible hosts (Figs 2 and 3). As these pustules develop, corresponding yellow leaf spots  form on the upper side of the leaves (Fig 4). If there is a severe pustule load on the undersides, the yellowing pattern on the upper sides of the leaves may coalesce and appear as larger yellow patches (Fig 5). A highly magnified view of the rust spores is shown in Figure 6. As multiple leaves become infected the tree may exhibit yellowing in some areas and possible early defoliation. The samaras (fruit structures) may also become infected with hornbeam rust.

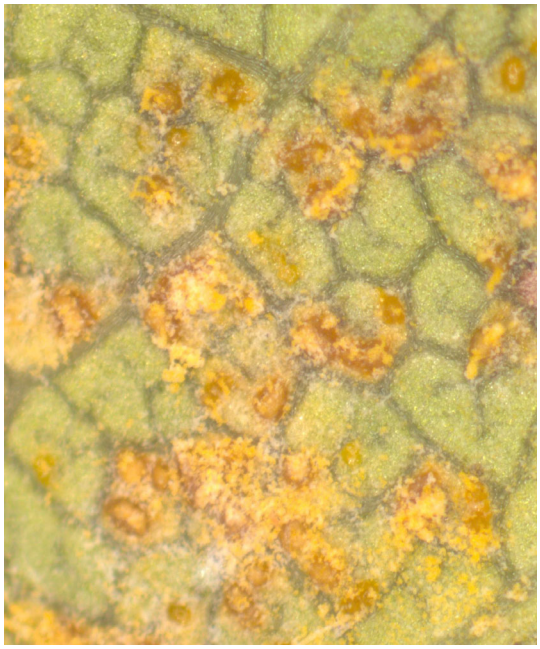

Figure 3: Magnified view of American hornbeam leaf with rust pustules and rust spores. Photo by Purdue PPDL.

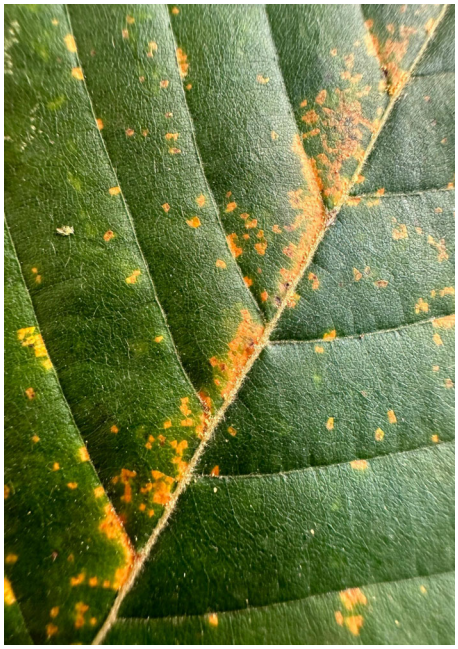

Figure 4: Yellow-orange spots on upper leaf surface of rust infected American hornbeam. Photo by Willem Drews, IDNR.

Hornbeam rust originates from Japan and China and was first detected in the US in Florida in the fall of 2018. In 2019, similar rust reports were made in Georgia, South Carolina, North Carolina, Tennessee, and Texas. The new find in Owen County, IN was the first detection of Hornbeam rust in Indiana and is likely the northeastern most report in the country to date. We don’t know how this rust got to Indiana but, as with many disease and insect problems, the shipment of infected plants from other regions is a likely pathway.

Figure 5: Rust infected American hornbeam leaves showing severely infected leaf with coalescing spots (left), and moderately infected leaf (right). Photo by Willem Drews, IDNR.

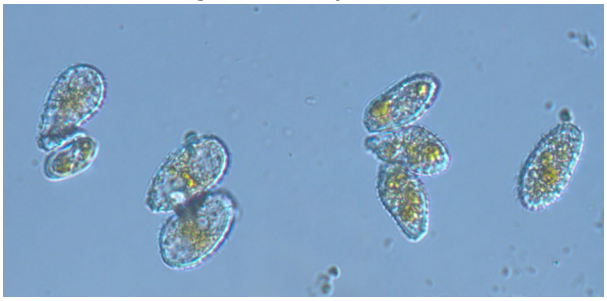

Figure 6: Magnified spores of Melampsoridium asiaticum. Photo by Purdue PPDL.

Hornbeam rust has been documented to occur on American Hornbeam, European Hornbeam (*Carpinus betulus*), and Hophornbeam (*Ostrya virginiana*) trees. Unlike several other common rusts, such as cedar apple rust which alternates between two very different hosts (apple and redcedar), hornbeam rust appears to stay on one host throughout its life cycle.

Because of its recent discovery, not much is known about spread and control. Fungicide management in trees is usually impractical but sprays may be needed to protect young trees in the nursery or until established in the landscape. If you think you have some rust infected *Carpinus* or *Ostrya* trees, please contact a nursery inspector here, or send a sample to Purdue PPDL (information on sending samples here).

The Indiana Department of Natural Resources, Division of Entomology and Plant Pathology, publishes weekly reviews throughout the growing season written by the nursery inspectors. To receive the Weekly Review, visit: https://www.in.gov/dnr/entomology/entomology-weekly-review/

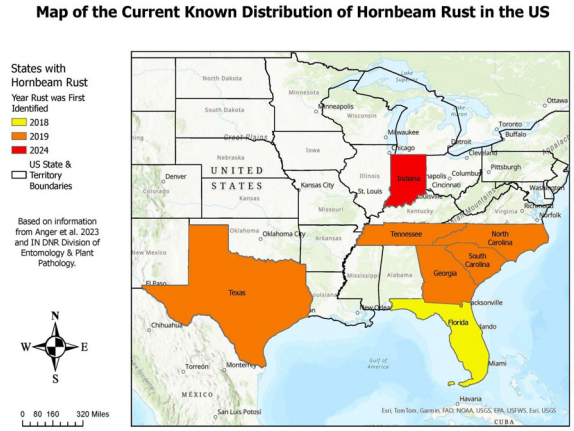


Figure 7. Map of the current distribution of hornbeam rust in the US. Map created by Will Drews, IDNR with information from Anger et al., 2023.



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