How to *Beat* the Beetles

Tiny ambrosia beetles can damage healthy nursery stock, destroying branches or killing the trees. Here's how to identify two of the worst culprits—and how to stop them in their tracks.

By Steven Frank

Exotic ambrosia beetles have all the characteristics of a good pest. They sneak up on you. They attack hundreds of tree species and kill them quickly. And, you have no options for remedial control. Fortunately, we have learned a lot about the biology and management of these pests in the past several years. In this article you will learn what you can do to reduce damage to your trees.

Who are they?

There are several ambrosia beetle species in the eastern and Midwestern U.S. that attack nursery and landscape trees. The most common and damaging species are the granulate ambrosia beetle (*Xylosandrus crassiusculus*) and black stem borer (*Xylosandrus germanus*). Granulate ambrosia beetles (opposite, top) were first detected in South Carolina in 1972. They are the most common ambrosia beetles attacking nursery stock in the southeastern U.S.

Black stem borers (opposite, bottom) were first detected in New York in 1932. They are the most common ambrosia beetles attacking nursery stock in the northeastern and Midwestern U.S. Although both species have been in the U.S. for a long time, they have become important pests just in the past two decades. In their Asian homelands they attack unhealthy, dying trees. So why do they attack our "healthy" nursery and landscape trees here? No one knows for sure, but it seems many of our nursery trees don't smell that healthy to beetles. More on that later.

Modus operandi

Ambrosia beetles become active in early spring. In Southern states granulate ambrosia beetles typically become active before bud burst of most tree species. Female beetles bore into trees, excavate a gallery and lay eggs. They also inoculate trees with ambrosia fungus. The fungus grows within the gallery and is food for the larvae. Around 60 days later, adult females emerge from the galleries to find new trees and start a new generation.

Granulate ambrosia beetles and black stem borers attack more than 200 tree species, including many ornamentals. In nurseries, frequently attacked species include styrax, red bud, magnolia, red maple, dogwood, ornamental cherry and other fruit trees, Japanese maple, golden rain tree and oak. However, these pests are not very picky so any deciduous tree you grow could be susceptible. Ask your state extension personnel which species are preferred in your area.

Ambrosia beetles damage trees by boring into them (drilling holes into trees can never really help them) and by infesting them with the ambrosia fungus. Although not truly a plant pathogen, ambrosia fungus clogs tree vascular systems. Attacks usually occur on tree trunks within a meter of the ground. As beetles bore into trees they push out sawdust and frass in the shape of toothpicks that stick out of the trees (opposite). However, wind, rain and irrigation can remove the toothpicks

A "frass toothpick" structure created by ambrosia beetles as they bore into trees is a sure sign of infestation.

Photo courtesy of S.D. Frank, North Carolina State University

leaving just a 1 to 2 mm hole that is much harder to see. Unfortunately, there is no way to kill the beetles or fungus once they enter the tree. Infested trees die or become unmarketable due to holes or dead branches.

What to do?

Because there is no way to "cure" trees after attacks, growers need to prevent ambrosia beetle attacks. The first step in this direction is to reduce plant stress. Ambrosia beetles are more attracted to trees that are over-watered than trees that are watered appropriately. For example, last year at North Carolina State University we conducted an experiment in which we waterlogged some magnolias and dogwoods and watered others moderately—just enough to keep the soil moist. We discovered that waterlogged trees had an average of 13 attacks, whereas the trees watered properly experienced no attacks. Remarkably, the unaffected trees were just 3 feet away from the waterlogged trees. So, the beetles can really zero in on the most stressed trees. We don't know how other types of stress, such as drought and root pruning, affect ambrosia beetle attacks. But, these stresses do make trees more attractive to other borers.

The next step to reduce attacks is monitoring adult activity in spring. Monitoring traps can be made with 2-liter soda bottles. Cut two windows in the sides of the bottle and fill the bottom with soapy water. Soap breaks the surface tension so beetles sink quickly and can't climb out. Bait the trap with ethanol. This is the kind of alcohol you drink, not rubbing (isopropyl) alcohol. Attach a vial with high proof alcohol (as close to 200 proof as you can find) and a cotton ball wick inside the trap. Beetles, attracted to the ethanol, will fly into the bottle, bounce around and fall into the soapy water. Hang traps about 3 feet high near wood edges, since this is where the females probably overwinter, or near trees that have been attacked in the past. The most important thing is to hang traps where they won't fill up with water from overhead irrigation and where you will actually remember to look at them. Better to have them outside your office door than near a woodlot on the back forty where you never go.

So you caught some beetles—now what? There are many ambrosia beetle species, but only a few are pests. Unfortunately, they are all tiny and attracted to ethanol. In the South, if you were to learn only one beetle, it should be granulate ambrosia beetle, as they are most common. They are about 3 mm long with spines on their front legs and a rough, hairy patch on their backs. Northern and Midwestern growers should learn to identify black stem

Spines on the front legs of a granulate ambrosia beetle are out of view, but notice the rough, hairy patch on the back.
Photo courtesy of J.R. Baker and S.B. Bambara, North Carolina State University

Black stem borers are similar to granulate ambrosia beetles in size and shape, but are darker in color.
Photo courtesy of J.R. Baker and S.B. Bambara, North Carolina State University

borers first, but granulate ambrosia beetles are becoming more common in those parts of the country. Black stem borers are similar in size and shape but darker in color.

Time to treat

When you catch pestiferous beetles it is time to spray. Again, there is no way to kill beetles once they infest a tree. Larvae feed on fungus in the heartwood rather than in the vascular tissue, so systemic insecticides that kill other borers will not kill ambrosia beetles. Thus you need to prevent beetles from boring into trees with pyrethroid applications. We have found that permethrin applied every three weeks prevents most beetle attacks by killing or repelling beetles that land on treated trees.

Apply permethrin to tree trunks below the first scaffold branches. Most attacks occur within 3 feet of the ground so there is no need to spray the canopy. With inspiration from Richard Currin at Currin's Nursery in Willow Spring, N.C., we developed a dual-nozzle spray wand that makes manual application quick and effective. With two opposing nozzles you can cover all sides of a trunk with a single pass from top to bottom (page 22). It also provides more thorough and consistent coverage than an airblast sprayer. Because the dual-nozzle wand does not spray the canopy, you get many more natural enemies and half as many spider mites compared to airblast sprayers. So if you do use

How to Beat the Beetles

an airblast sprayer, try to aim at the trunks and reduce canopy coverage.

Ambrosia beetles may attack some trees despite your best efforts. Infested nursery stock should be left in place until after peak emergence, because these plants may serve as "trap trees" to attract beetles away from other trees. Burn or chip infested trees to prevent new adults from emerging.

Ambrosia beetles will attack landscape trees but much less frequently. Often landscapers report attacks on newly planted trees that have undergone transplant or other stress. Infested trees likely will die, but it is not worth making preventive insecticide applications to every tree in a landscape.

Although granulate ambrosia beetles and black stem borers have two to three generations per year, damage to nursery stock is most frequently caused by the first generation. In fact, growers do not typically monitor for ambrosia beetles or make preventive applications targeting any but the first generation.

Dual-nozzle spray wand being used to apply permthrin to a red maple trunk.
Photo courtesy of S.D. Frank, North Carolina State University

We don't know why first-generation beetles display this behavior, but I have a hypothesis: Early in spring, soil or potting media is wetter than any other time of year. It is cool outside so water is not evaporating from pots. Leaves have not opened so the trees are not transpiring. Therefore, when beetles become active, there are plenty of trees with wet roots.

I didn't mention it before, but waterlogged trees emit ethanol as a by-product of anaerobic respiration. Remember what we use to attract beetles to traps? That's right: ethanol. Later in the year water is moving out of pots as fast as you can irrigate, so trees should not be emitting ethanol and other stress signals that beetle home in on. Experiments are underway in my lab and other labs to understand this better, so stay tuned.

These exotic ambrosia beetles are not going away, and we are likely to get more species over time. They are very good at being pests but we are getting better at stopping them. So make some traps and don't let them sneak up on you next year.

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