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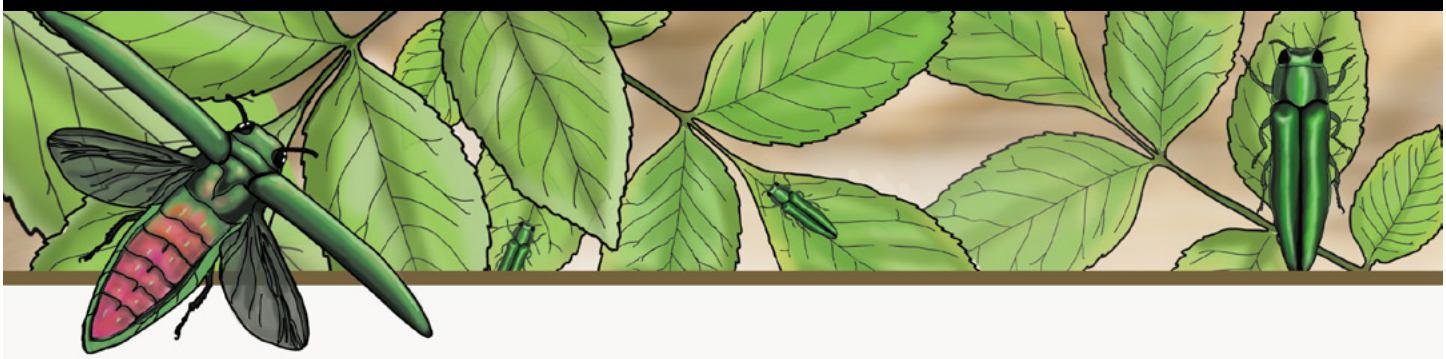

Emerald Ash Borer in Georgia

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INTRODUCTION

The invasive emerald ash borer (EAB; *Agrilus planipennis*) is a beetle in the metallic (or jewel) wood-boring beetle family (Buprestidae) (Figure 1). Buprestids are also known as flat-headed borers. Adult EAB is approximately 1/2 inch long with a shiny, green body. EAB is native to Asia and was detected in Michigan in 2002 but had likely been in North America since the mid-1990s.[1] It was likely accidentally brought to North America within wood pallets where bark had not been removed.

Figure 1: ***EAB adult feeding on an ash leaf.***
Photo credit: David Cappaert, Bugwood.org

In Asia, ash trees have increased resistance to EAB. There are also natural enemies and pathogens helping control EAB populations. However, North American ash are very susceptible to EAB, and native predators and pathogens do not feed enough on EAB to substantially reduce their populations. Ash trees often die within 3-5 years after EAB infests the tree. EAB has killed hundreds of millions of ash trees in North America. All ash species native to North America are susceptible, including: green, white, pumpkin, blue, and Carolina ash. EAB now has populations in most Eastern US states, and its range is moving westward. Ash mortality can affect residential areas financially and aesthetically, and forests are being impacted aesthetically and ecologically.[2] In Georgia, ash is most common in bottomland hardwood forests where it is important for water quality and soil stability. The Georgia Forestry Commission (GFC) began trapping to detect EAB presence in 2005, and it was found in Georgia in 2013. As of 2023, EAB is in 48 counties in the northern part of Georgia, and the range continues to expand.

EAB LIFE CYCLE

EAB adults emerge from trees in late-spring. They chew a 1/8 inch wide D-shaped exit hole as they emerged (Figure 2). This D-shaped exit hole is one of the most obvious external signs of an EAB infestation.

Adult beetles feed on ash foliage for several weeks before mating and laying eggs on the bark of nearby ash trees. Females can lay up to 200 eggs that hatch into larvae after 7-10 days. Newly-hatched larvae (Figure 3) chew through the bark and begin feeding on the inner bark. While feeding, larvae create serpentine or "S"-shaped galleries (Figures 4). The EAB galleries damage tree tissues in a process called "girdling", which limits the ability of the tree to transport water and nutrients and ultimately leads to tree death. Larvae feed throughout the summer and, in Georgia, overwinter as pre-pupae, and then pupate in the early-spring. EAB completes its life cycle in one year in southern climates, but the life cycle can take up to 2 years in colder, more northern climates.

Figure 2: *D-shaped exit hole of EAB.*
Photo credit: Bre Aflague, University of New Hampshire

Figure 3: *Mature EAB larvae.*
Photo credit: David Cappaert, Bugwood.org

Figure 4: *Larval galleries of EAB under bark.*
Photo credit: Bre Aflague, University of New Hampshire

EFFECTS OF EAB FEEDING

EAB infestations start high in the canopy of large trees, and stems as small as 1 inch in diameter may be attacked. As the infestation spreads, it moves downward to the trunk of the tree. Because they infest the upper canopy first, signs such as the D-shaped exit holes may not be easily observed until later in the infestation. Galleries under the bark are a sign EAB feeding that occurs inside the tree. On the outside, EAB infestations lead to dead and dying branches in the canopy, splits in the bark, and leafy sprouts on the trunk called epicormic shoots (Figure 5).[3] In addition, woodpeckers may knock bark off of the tree in efforts to get EAB larvae, revealing lighter colored tissues under the bark. This process is called "blonding" or "flecking" (Figure 6). Unfortunately, these outward signs and symptoms can appear 1-3 years after the tree is initially infested with EAB, and infestations are often more advanced when people notice a problem. Efforts to "save" an ash tree with an advanced EAB infestation may not succeed.

Figure 5: ***Epicormic sprouting due to larval EAB feeding.***
Photo credit: Bre Aflague, University of New Hampshire

EAB MANAGEMENT

The first step to managing EAB is learning to identify ash trees and the signs of an EAB infestation. EAB management should be approached two ways - by reducing the likelihood of infestations and treating individual trees with insecticides.

Reducing spread: EAB in infested firewood and timber products can spread EAB hundreds of miles. Inspection and local sourcing for ash products is an important avenue to protecting trees from EAB.

Prior to 2021, a federal EAB quarantine restricted moving hardwood firewood and ash wood products from infested areas to uninfested areas. Federal and state quarantines started in Georgia in 2013, when EAB was first detected in the state. The quarantines were lifted when the federal government de-regulated EAB in 2021. Moving firewood and wood products can still introduce EAB and other invasive species to new areas and further its spread. When traveling, it is a good practice to only purchase local firewood and not transport your own firewood. Using local firewood reduces the chance that you will transport EAB (as well as other pests) to new areas.

Insecticides: Systemic insecticides can effectively protect ash trees from EAB.[4] Systemic insecticides are either directly injected or applied to the trunk or soil around a tree and are then moved throughout the tree by its vascular system. This distributes the insecticide throughout the entire tree. Insects feeding on the tree ingest the insecticide directly from tree tissues.

Figure 6: ***Blonding or flecking of ash bark.***
Photo credit: Bre Aflague, University of New Hampshire

In the United States, there are four different insecticides labeled for systemically treating ash trees (Table 1). Depending on the product, these may be applied by soil drench, soil injections, slow release pellets in the soil, bark sprays, or trunk injections. Soil drenches and injections involve pouring or injecting the insecticide into the soil, where it is absorbed by the tree roots and moved upward through the tree. Bark sprays require use of a sprayer to spray insecticide on the trunk of the tree, where insecticide is absorbed through the bark. Trunk injections require specialized equipment and a trained applicator to inject insecticide into the vascular tissue of the tree trunk. Systemic insecticides are effective for 1-3 years, depending on the product used.[6] See Table 1 for product and application details.[5]

Table 1: Insecticides used to manage EAB infestations[a]

Insecticide	How to apply?	When is best to apply?	How frequently to apply?	Is a professional required for applications?
imidacloprid	soil drench, soil injection, bark spray, slow release pellets, trunk injection	spring	annually	no, except for trunk injections
dinotefuran	soil drench, soil injection, bark spray, trunk injection	spring	annually	no, except for trunk injections
emamectin benzoate	trunk injection	mid-late spring	every 2-3 years	yes[b]
azadirachtin	trunk injection	mid-late spring	every 2-3 years	yes[b]

[a]Table modified from Hermes et. al (2019) and Cranshaw (2020). Carefully read the insecticide label before making an application. See the Georgia Pest Management Handbook: Commercial Edition (Forestry and Christmas Trees Chapter) for annually updated EAB insecticide information.

[b] Trunk injections require specialized equipment and a trained applicator.

Often insecticide treatments occur in ornamental/landscaping settings. Insecticide use is not cost effective for hardwood timber production, however, sometimes it is used for forest conservation purposes. Please contact your UGA County Extension agent for EAB guidance and *carefully follow all insecticide labels*. Forest landowners may conduct pre-infestation harvest of any ash trees in EAB-infested areas to get value for their trees before they become too damaged.

Long-term Management: Using insecticides is currently the only route to protect individual ash trees from EAB infestations, but research for long-term management is currently underway. EAB biological control (or biocontrol) involves releasing specialized insect parasites collected from EAB's native range.[7] Although research surrounding biological control seems promising, biocontrol is still in the development phase and is not available for general use. Investigations into ash resistant, either by identifying survivor trees or by hybridizing trees, is also being conducted.

Warning: Remove dead and dying trees that have been attacked by EAB. These trees can be hazards to people and property. As an example, a dead ash tree near a home or driveway may fall and cause harm. Please contact a certified arborist about tree removal.

Please contact your UGA County Extension agent for additional information and guidance on EAB. Find your county Extension Office: *https://extension.uga.edu/county-offices.html*

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