

# RESEARCH LABORATORY TECHNICAL REPORT

## Emerald Ash Borer (EAB)

By The Bartlett Lab Staff

Directed by Kelby Fite, PhD

Emerald ash borer (*Agrilus planipennis*) was first discovered in southeastern Michigan in 2002. Accidentally introduced on solid wood packing material from Asia, EAB has since spread to nearly all states within the native North American range of its preferred tree host, ash (*Fraxinus* spp.) (Figure 1). Further range extension is anticipated. Hundreds of millions of native ash trees, all species of which are susceptible, have succumbed to the feeding of the immature stage of this small, green beetle. Trees often die within one to three years following initial attacks. Economic and social costs due to this invasive species are historically significant.

### Identification

Emerald ash borer, a so-called flatheaded borer, has a similar appearance and life cycle to native *Agrilus* spp.

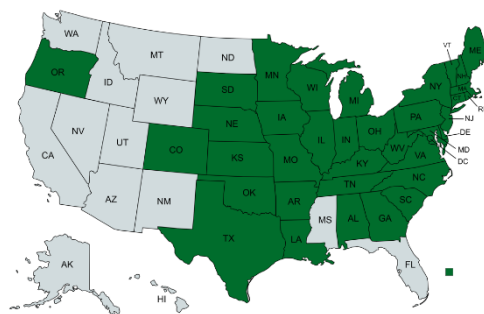
Figure 2: EAB adult



Figure 3: EAB larva



Figure 1: States in green have confirmed EAB infestations (as of early 2024)



beetles such as the bronze birch borer and the two lined chestnut borer that infest oak and beech. Adult beetles are emerald green and approximately ½ inch long (Figure 2). Larvae are segmented, cream-colored, flattened grubs that can reach 1 inch in length (Figure 3).

### Biology

Adults emerge from infested wood from small, inconspicuous “D”-shaped exit holes (Figure 4) and mate after ash leaves have expanded in spring (early May to mid-June). Over a three-to-five-week period, females may be observed feeding on the edges of leaves.

Figure 4: “D”-shaped exit hole



Tree defoliation is minimal but numerous notched leaf margins may be apparent. After a minimum requisite feeding period of two weeks, females lay 40–70 small, individual eggs in bark cracks, crevices and under bark flakes. Egg laying typically begins at the topmost stems and branches of the canopy. Larvae hatch from the eggs within approximately two weeks and bore through the bark and into the sapwood. Larvae complete their growth and pupation in “S”-shaped galleries chewed in the phloem and cambium (Figure 5). The EAB life cycle typically takes one year, but may take as long as two years.

**Figure 5: “S”-shaped galleries chewed by larvae in phloem and cambium**



## Symptoms

When larval populations in attacked trees are high, water and nutrient transport is significantly disrupted, leading to individual branch dieback or whole tree death. Tree symptoms such as yellowing, wilting and crown dieback are early indications that this invasive pest is present. Later in an infestation, heavily attacked trees will exhibit extensive branch death, bark cracking and abundant epicormic shoot growth. It may take several years before a tree finally succumbs completely. Birds, such as downy and hairy woodpeckers, are adept at finding trees with relatively low larval populations.

Therefore, increased woodpecker activity in the tops of ash trees, as well as distinct bark ‘blonding’ caused by the bird’s bark-flaking foraging behavior, is an important cue to look more closely for further evidence of an EAB infestation.

## Management

### Chemical Treatment

Early preventative treatment with insecticides is a highly effective strategy for protecting and preserving ash trees. There are multiple application methods and chemical options available depending on the level of pressure due to beetle population density. Once an ash shows greater than 40% crown decline, however, treatment efficacy is significantly impaired. Recovery, even after effective treatment, may not become apparent until the second year. Trees with greater than 50% dieback should be scheduled for removal as soon as practical to prevent hazardous conditions due to the brittle nature of dead ash wood.

Since it is challenging to detect trees with low larval densities, but undesirable to apply insecticides before EAB invades an area, treatments should ideally begin when EAB is found within 10-15 miles of an ash tree’s location. Research has shown that management techniques change as population levels build. Emerald ash borer population dynamics typically follow a pattern:

Early Stage (*Cusp of invasion*) - Over three to four years, populations slowly build; losses from EAB are less than 8% of the total ash tree population. Annual preventive treatments with soil-applied imidacloprid will protect ashes during this stage.

Peak Stage (*Crest of tree mortality*) - By year five of an infestation, EAB populations are very high. Most unprotected ash trees will be killed over the next four to five years. During this stage, root flare injection with emamectin benzoate every other year has been shown to be the most effective treatment to protect ash trees from the severe pressure presented by this pest.

Late Stage (Core infestation) - By this stage, most unprotected ashes have been killed and beetle populations are declining. Annual preventative treatments with soil-applied imidacloprid will again protect ash trees at this stage.

### **Sanitation**

Removal and destruction by chipping, burial, or burning is recommended for all heavily damaged ash. Wood should not be stored as firewood through the winter months and firewood should not be transported from areas known to be infested with emerald ash borer.

### **Cultural Practices**

Maintain the health of ash trees with good cultural practices including pruning, fertilization, proper mulching and irrigation during dry periods. This will reduce stress and improve the tolerance of trees to borer attacks.

### **Safety**

Trees infested by EAB may become weak and brittle rapidly. This loss of structural integrity can occur before advanced decline in the overall canopy is evident. This weak condition can lead to excessive danger for arborists when removing ash trees infested with EAB. For this reason, it may be recommended to proactively remove ash trees that are not going to be preventatively treated for EAB before decline begins.



**Founded in 1926, The Bartlett Tree Research Laboratories is the research wing of Bartlett Tree Experts. Scientists here develop guidelines for all of the Company's services. The Lab also houses a state-of-the-art plant diagnostic clinic and provides vital technical support to Bartlett arborists and field staff for the benefit of our clients.**