Emerald Ash Borer

K·STATE Research and Extension

The emerald ash borer (EAB), *Agrilus planipennis* Fairmaire, is a metallic wood-boring beetle that threatens native ash trees in Kansas. Its confirmed presence in Wyandotte, Johnson, and Leavenworth counties and potential losses to valuable landscape and municipal trees have prompted state agencies to join a national effort to monitor and stop the spread of this damaging pest. This publication is intended to help homeowners and landscape managers identify emerald ash borer and its damage and to present treatment options.

North America Emerald Ash Borer Invasion

Emerald ash borer originated in northeast China, eastern Russia, and the Korean peninsula. In their native range, EAB outbreaks destroyed native ash species subjected to environmental stresses. Under normal conditions, natural defense mechanisms provide protection, assisted by parasitic wasps and other naturally occuring predators.

Although officially confirmed in North America in 2002, emerald ash borer arrived at least a decade earlier. A lag between the actual introduction and detection of a destructive invasive species is common. Initially pest numbers are low and confined to a small area. Emerald ash borers were not noticed until numbers increased and populations expanded over a larger area. As trees declined and died, landscape managers and the public began to notice. EAB were found to be the cause of the damage.

EAB were introduced unintentionally through increased trade with Asia. Ash, which is relatively inexpensive, is commonly used in the construction of solid wood packing materials (crates and pallets) and for cargo support beams. Wood infested with EAB larvae inevitably reached foreign ports. After arriving in North America, beetles emerged and located ash trees on which to feed and deposit eggs. Lacking resistance to these pests, North American ash species became nurseries and populations grew to overwhelming and destructive levels.

Distribution in the U.S.

Consistent with this account, USDA maps show earliest detections of EAB in port cities along the St. Lawrence Seaway, Great Lakes coastlines, and on large navigable rivers (notably the Mississippi and the Ohio). Later maps show borers spreading to adjacent counties following natural population diffusion patterns. Detections in remote locations beyond EAB flight capabilities also increased, linking their dispersal to the movement of infested nursery stock, lumber, and firewood.

Arrival in Kansas

Early national media reports of EAB activities raised little concern in Kansas, mainly because of the vast geographic buffer separating the state from the waterways where the pest was first established. In 2008, EAB was confirmed at Lake Wappapello State Park in southeast Missouri, only 237 miles from the Kansas town of Galena, which prompted federal and state agencies to monitor for EAB in Kansas. With no detections further west for several years, Kansans remained relatively complacent until July 2012 when authorities announced the discovery of EAB in Parkville, Missouri, which borders Wyandotte County. Based on damage to the infested tree, it was estimated that EAB had been present for 6 to 8 years.

Collin Wamsley, Missouri Department of Agriculture

Figure 1. Emerald ash borer infestation.

Because of Parkville's proximity, the Kansas Department of Agriculture, USDA Animal and Plant Inspection Service (APHIS), Kansas Forest Service, and K-State Research and Extension agents surveyed areas within a 5-mile radius of Wyandotte County Lake. On August 9, a branch section from a tree near Wyandotte County Lake's Shelter 11, was sent to the EAB laboratory in Michigan where a larva was recovered. The sample was forwarded to the main USDA facility in Maryland, which confirmed the larva's identity. Emerald ash borer was officially confirmed in Kansas on August 29, 2012.

-Erin Stiers, USDA, APHIS, PPQ - Topeka, KS

Figure 2. Inspection of an infested tree near the Kansas border.

Status as of 2014

Since 2008, USDA's Plant Protection and Quarantine program and KDA have been participating in a national trapping survey, deploying sticky purple prism traps baited with attractive aromatic lures at detection points in Kansas such as rest areas, nurseries, camping sites, pallet remanufacturers, raceways, forest debris sites, sawmills, and military bases. No emerald ash borers were recovered between 2008 and 2012. In 2013, five beetles were found at four trap sites near the same location: one beetle at site A, two beetles at Site B, and one each at sites C and D.

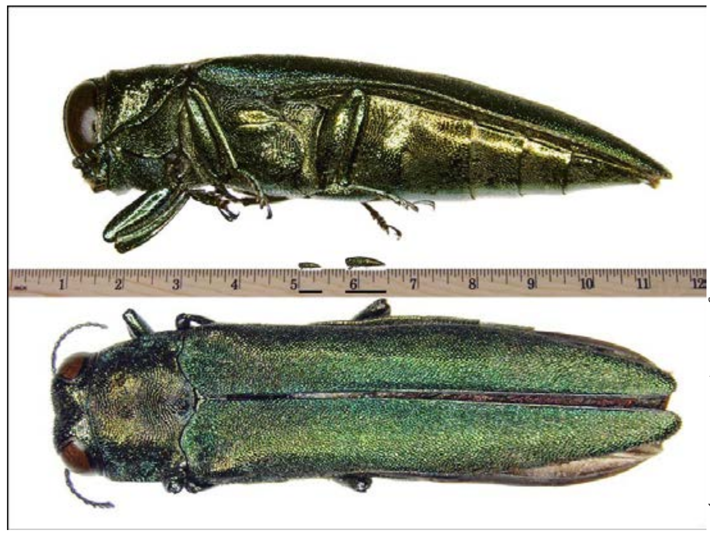
Collin Wamsley, Missouri Department of Agriculture

Figure 3. Traps placed in trees to detect emerald ash borer.

Larvae were recovered from three of seven girdled trees used as trap trees, two at the north end of Wyandotte County Lake and one at Providence Medical Center. Detection (of a larva or a beetle) prompted KDA to issue quarantines for Wyandotte and Johnson counties. In July 2014, two EAB beetles were recovered from trap trees in Leavenworth County, prompting a quarantine of that county as well.

Description

The emerald ash borer beetle's metallic sheen varies depending on pigmentation and the angle and intensity of reflected light. Although predominantly emerald green, the beetle's cuticle (outer shell) may show blue, brass, copper, and red hues. Beetles are relatively small, between ⅜ and ⅝-inch long and ⅛-inch wide. Foliage feeding damage is inconsequential.



Greg Zolnerowich, Kansas State University

Figure 4. Typical specimen is emerald green with a metallic sheen.

The larva's flattened shape conforms to its habitat beneath the outer bark where it feeds on new vascular tissue (sapwood). Emerald ash borer larvae can be distinguished from other native *Agrilus* species by the shape of abdominal segments A-2 through A-8. Distinctive lateral lobes culminate with the bell-shaped appearance of segments 7 and 8. Mature larvae measure approximately 2.5 inches in length. Another unique feature of the EAB larva is the sinuous S-shaped gallery with frass accumulations that widens to accommodate the growing larva.

Seasonal Life History

The emerald ash borer's developmental cycle is one year in Kansas. They overwinter as prepupae, with actual pupation occurring the following mid-April into May, followed by initial beetle emergence in late May and early June. After flights peak in late June-early July, they dwindle and cease by the beginning of August.

Newly emerged adults feed on foliage for about a week before mating. Females continue to feed for a short time

Pennsylvania Department of Natureal Resources

Figure 5. Bell-shaped abdominal segments distinguish the larva.

David Cappaert, Michigan State University

Figure 6. S-shaped gallery widens as the larva grows.

before depositing eggs in bark cracks and crevices. After hatching, larvae bore through the bark to feed and develop in the sapwood. By October or November, mature larvae cease feeding. They create an overwintering chamber, then transform into the overwintering prepupae.

Damage: Beetle foliar feeding is inconsequential. Larval feeding is responsible for tree damage and destruction. Feeding galleries sever vascular elements, disrupting transport of essential nutritional liquids and water. While the damage attributed to a single larva is negligible, the cumulative damage of many larvae over several seasons contributes to the decline of once-healthy trees. Initial attacks are focused on smaller wood, causing smaller branches and limbs in tree canopies to appear wilted and brown. As beetle populations increase over subsequent seasons, more eggs are deposited on larger limbs and trunks. Cumulative damage results in tree decline and eventual death.

Treatment: News coverage of the emerald ash borer offers a gloomy outlook for survival of native ash species in North America. Municipalities will address the problem individually, according to plans developed by local agencies. Concerned homeowners who want to save their trees should first determine whether the tree is an ash. Next, they will need to know whether the tree is located in a quarantined county or within 15 miles of a site where the borer has been documented. The third step is for the homeowner to place a monetary value on the tree, which is based on benefits to the overall property, i.e., adding shade to reduce air conditioning and cooling costs, aiding in the capture of storm water, reducing airborne pollutants, and other ecosystem benefits.

The best candidates for preventive treatments are trees that appear healthy and do not show signs of borer activity such as a thin canopy, dying branches, water sprout growth, bark splits, D-shaped beetle emergence holes and woodpecker damage. Unfortunately, these abnormalities become evident only after several years of feeding by emerald ash borer larvae. Trees showing these signs of irreversible damage are less likely to be saved.

Lynn Loughary, CEA Horticulture, Wyandotte County, Kansas

Figure 7. Irreversible damage in the tree canopy.

If a tree is healthy and the decision is to treat, the homeowner should consider whether to tackle the job alone or hire a professional. Treatment options for homeowners are systemic insecticide products that contain the active ingredient imidacloprid or dinotefuran. Different manufacturers may use the same active ingredients to formulate products, which are marketed under specific brand names. Consumers should look for products containing these active ingredients at local retail stores.

Soil drench treatments may seem quick and straightforward, but for treatment to be effective, the homeowner must read, **understand,** and adhere to instructions on the product label (including site preparation, proper dose, and application timing). Even when instructions are followed precisely, treatments are not guaranteed to work. In trials adhering to strict treatment protocols, performance of imidacloprid was shown to be inconsistent, with excellent to poor results. Trees with a breast-high diameter of less than 15 inches showed best chance for treatment success. Results comparing imidacloprid with dinotefuran were not available because granular formulations were not tested. Dinotefuran granular formulations currently available for homeowner use include Ortho Tree and Shrub Insect Control Granules, and Greenlight Tree and Shrub Insect Control With Safari 2G. Once initiated, it is recommended that drench treatments be reapplied annually throughout the life of the tree.

Contracting with a commercial tree service to provide treatment offers several advantages. Contact several service providers to compare assessments and costs for treating particular trees. Treatment considerations include recommended insecticides, application methods (likely soil or trunk injections), follow-up inspections and posttreatment product evaluations, plans for scheduled retreatments, and total treatment costs. Professional applicators are certified to use three active ingredients in various formulations. These include soil injections of imidacloprid and dinotefuran that can be placed directly into root zones for quicker uptake and circulation through vascular systems; trunk injections of imidacloprid or emamectin benzoate, which are immediately available for uptake and rapid distribution throughout vascular systems of actively growing trees. Research has shown Emamectin benzoate to provide a least two years of effective control against EAB.

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Figures 1, 3 - Collin Wamsley, Missouri Department of Agriculture

Figure 2 - Erin Stiers, USDA, APHIS, Plant Protection and Quarantine (PPQ), Topeka, Kansas

Figure 4 - Greg Zolnerowich, Kansas State University

Figure 5. Pennsylvania Department of Natural Resources

Figure 6. David Cappaert, Michigan State University

Figure 7. Lynn Loughary, Horticulture Agent, Wyandotte County Kansas

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