

# Bugs That Bore Us



*Emerald ash borer*



*Two-lined chestnut borer*



*Southern pine beetle*

*Damage from the southern pine beetle.*

by Lee Townsend and Lynne Rieske-Kinney

Kentucky's woodlands are under constant pressure from both native and exotic invaders that threaten forest health and forest sustainability. While we typically think of an "invasive species" as being a non-native exotic, it can be simply and broadly defined as one that is likely to cause economic or environmental harm. To further complicate matters, not all exotic species are invasive! Under the right conditions or circumstances, a number of native species can act as aggressively and destructively as any exotic invasive.

Several invasive insects (see Table 1) have recently caused particular concern for Kentucky's natural resources, either because they're new to our area and/or because they're capable of having a significant detrimental impact on the environment. Borers may very well top the list of invasive species in terms of their potential for destruction. These insects feed hidden from view for much of their life cycle. In the immature (larval) stage, they tunnel beneath the bark to feed on vascular tissues, disrupt water and nutrient flow, and bore into the tree stem, where they can cause extensive, irreparable structural damage before signs of their presence become obvious. Initial symptoms include wilted or fading foliage and branch dieback that may be attributed to drought stress or injury. Significant limb dieback or tree death may occur before landowners notice increased bird activity around infested trees, which occurs because the immature insects are an excellent food source.

Discovery and diagnosis may identify the culprit, but there may be few practical measures to take beyond assessment and salvage because there is no quick, viable means of managing the pest population. Initial efforts generally involve a survey to determine the boundaries of the infestation area and taking steps to limit the spread. While a

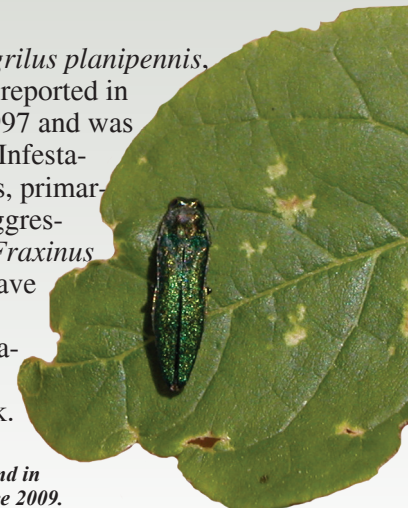
*Photos courtesy above: Southern pine beetle damage: Ronald F. Billings, Texas Forest Service, Bugwood.org; Two-lined chestnut borer: USDA Forest Service - Northeastern Area Archive, USDA Forest Service, Bugwood.org; EAB: David Cappaert, Michigan State University, Bugwood.org; Southern pine beetle: David T. Almquist, University of Florida, Bugwood.org*

preventive insecticide application may be an alternative in landscape settings or for specimen trees, it is rarely possible in woodlands. In the long term, biological control may provide a sustainable and economical approach. However, it is not a strategy that can be implemented quickly, even if native beneficial insects or pathogens are available.

Some of these points can be illustrated by three borer species that have or are currently impacting Kentucky woodlands and forests—the emerald ash borer, an exotic invasive insect, and two native species—the two-lined chestnut borer and the southern pine beetle.

## Emerald Ash Borer

The emerald ash borer (EAB), *Agrilus planipennis*, is a native of China that was first reported in North America in Michigan in 1997 and was discovered in Kentucky in 2009. Infestations have been found in 15 states, primarily in the upper Midwest. EAB aggressively attacks all species of ash, *Fraxinus* spp. Since North American ash have no resistance to EAB, attacks are normally fatal. Blue ash, the signature species of Kentucky's Bluegrass region, is particularly at risk.



*The EAB has been found in 14 Kentucky counties since 2009.*

*Photo courtesy: Lee Townsend*



EAB produces one brood per year. Adults are ¾" long, metallic green beetles that are present May through June. Beetles are most active on warm, sunny days, and they feed on ash leaves, making irregular notches along leaf margins. Each female lays approximately 75 eggs in bark crevices. These eggs hatch, and larvae bore through the bark and into the inner bark. Larvae form extensive "switchback" galleries beneath the bark as they feed, destroying the tissues that transports sugars produced by the leaves. Development occurs slowly over the year. Adults emerge the following summer by chewing through the bark, leaving a characteristic D-shaped exit hole visible on the bark.

EAB populations in a newly invaded area appear to peak within five to seven years after initial infestations are discovered. The peak lasts for about four years, and then borer numbers begin to decline as host trees die.

Some EAB mortality by native beneficial insects (about 1%) and pathogens (2%) has been documented, but the

level is too low to suppress borer populations. Three species of beneficial wasps that attack EAB larvae have been discovered in the natural range of the pest. This discovery is encouraging, but before releases can be made, much work must be done to develop efficient rearing methods and to assess potential impacts of these species on native borers and natural enemies.

Photo courtesy: Joe Collins



*EAB traps are placed around the state to monitor where the insect is located. Robert Arrington, a certified arborist, is shown hanging an EAB trap last year.*

In the meantime, widespread ash mortality continues to occur wherever EAB has become established. Efforts in Kentucky have focused on monitoring the spread of the population through surveys with the now-familiar purple prism traps and slowing the spread through education and quarantines.

Salvage operations associated with EAB mortality generate infested logs that are easily transported to uninfested areas. Inadvertent movement of infested firewood and unprocessed ash logs has contributed substantially to new infestations. The most current information on EAB in Kentucky is available at <http://pest.ca.uky.edu/EXT/EAB/welcome.html> along with links to quarantine and compliance documents.

## Two-lined Chestnut Borer

Closely related to EAB, the two-lined chestnut borer (TLCB), *Agrilus bilineatus*, is a native species found throughout eastern North America. American chestnut was its main host until it was ravaged by the chestnut blight fungus. With the decline of American chestnut, the TLCB shifted its attack to oaks, *Quercus* spp., in both the red and white oak groups. The insect produces one generation each

year, with timing similar to that of EAB.

Unlike the exotic EAB, the TLCB only attacks declining trees that are under stress from drought or other factors; however, females may lay eggs on broken branches of healthy trees. Urban trees are particularly at risk, since they're often suffering from soil compaction, root or trunk injury, or chemical exposure. Trees that have been defoliated by other insects are also at risk. Because much of our standing oak is stressed due to recurring drought, ice storms, and defoliation events, the TLCB is a frequent problem in Kentucky's forests and may be a major mortality factor for oaks.

The first recognizable signs of TLCB infestation appear around mid-July as foliage on infested branches turns reddish-brown while the remaining foliage remains a healthy green. Leaves on infested branches often remain attached beyond normal fall leaf drop. Surrounding adjacent trees are often attacked by the borer and *Armillaria* root rot, producing pockets of dead trees.

As it is a native insect, there are native beneficial wasps that, along with woodpeckers, cause TLCB mortality and provide some natural control. Felling infested trees prior to July will cause many borer larvae to die before they can complete their development. However, transporting infested felled logs can contribute to spreading infestations.

## Southern Pine Beetle

The southern pine beetle (SPB), *Dendroctonus frontalis*, is an aggressive phloem-feeding bark beetle that attacks mature and over-mature pine, *Pinus* spp., primarily loblolly, *P. taeda*, and shortleaf, *P. echinata*. SPB is the most serious native insect pest of southern pines. Infestations are characterized by trees with reddish brown crowns surrounded by trees with green needles. Obvious signs of infestation include pitch tubes, running pitch, sawdust at the base of the tree, numerous small emergence holes in the bark, and increased woodpecker activity.

Although the adult insect itself is very small, it occurs in large numbers and attacks the host plant *en masse*. Because it must kill its host to successfully reproduce, SPB kills thousands of pines each year. SPB-caused mortality causes billions of dollars in economic loss, catastrophically alters forest structure, and drastically alters the trajectory of forest succession. Poorly managed pine stands and abiotic factors, such as weather, enhance destruction. Lack of proactive forest management creates stressed, dense stands that are

Photo courtesy: Steven Katovich, USDA Forest Service, Bugwood.org



*The two-lined chestnut borer is a common pest of stressed oak trees.*



*The southern pine beetle does its damage under the bark of mature and over mature pine trees.*

*Photo courtesy: David T. Almquist, University of Florida, Bugwood.org*

primed for beetle outbreaks. Drought, lightning strikes, ice, and physical damage can further increase the susceptibility of a tree or stand to SPB attacks.

In the Deep South, SPB outbreaks typically occur every 8 to 12 years and persist for two to three years. During outbreak years, complete pine mortality is not uncommon, and extensive economic losses occur. Secondary effects include hydrologic changes; shifts in wildlife distribution patterns, including loss of habitat for pine-dependent wildlife; and reduced aesthetics and recreational use. In Kentucky our outbreak frequency is 25-30 years, primarily because it takes that long for replacement forests to mature. While the SPB outbreak of 1999-2002 did not kill all of the southern pine trees in Kentucky, it did cause almost complete loss of the shortleaf pine forest type. Pine-dependent wildlife was threatened, and the endangered red cockaded woodpecker was lost from the state.

Invasive borers can and do change the landscape. Occasionally, native species can overwhelm tree defenses weakened by stress, while exotics devastate trees that are not equipped to ward off their attack. Research helps us to predict how woodlands may respond, to evaluate options that may mitigate the damage or the pest's spread, and to identify silviculture practices that aid in recovery. Healthy, diverse forests are much less susceptible to borer damage. Proactive management approaches, including appropriate site and species selection, thinning, and monitoring, help reduce losses. Boring bugs are not boring; they are formidable challenges to forest health.

*Pitch tubes are a defensive mechanism of pine trees. When pine trees are attacked by bark beetles they will force pitch (or pine sap) out of the hole made by the attacking beetle. The central American pine tree shown in this image is under serious attack from southern pine beetle. Please note that southern pine beetle is not the only bark beetle to induce this response in pine trees.*

*Photo courtesy: Ronald F. Billings, Texas Forest Service, Bugwood.org*



**Table 1 – A comparison of important Kentucky borers**

Borer	Hosts	Adult Flight Period	Galleries	Emergence Holes	Generations per year
<b>Emerald ash borer</b>	Ash ( <i>Fraxinus</i> ) Healthy and stressed	Early May – June	Back and forth, switchback appearance	D-shaped ~ 1/8" diameter	1
<b>Two-lined chestnut borer</b>	Red and white oaks <i>Quercus</i> spp Usually stressed	Early May – June	Zigzag or wandering	D-shaped ~1/5" wide	1
<b>Southern pine beetle</b>	Southern pines ( <i>Pinus</i> ) > 15 yrs	Late spring through fall	Curved or S-shaped	Round ~1/16" diameter	3+

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