Asian LONGHORNED Beetle:

The Threat in Black and White

By Joe Boggs and Amy Stone

On Friday, June 17, 2011, life changed for the residents of the Village of Bethel, a small Ohio town in Tate Township, Clermont County, located about 25 miles east of Cincinnati. On that day, the United States Department of Agriculture, Animal and Plant Health Inspection Service (USDA APHIS) and the Ohio Department of Agriculture (ODA) jointly announced that an Asian longhorned beetle (ALB) (*Anoplophora glabripennis*) infestation had been found near Bethel.

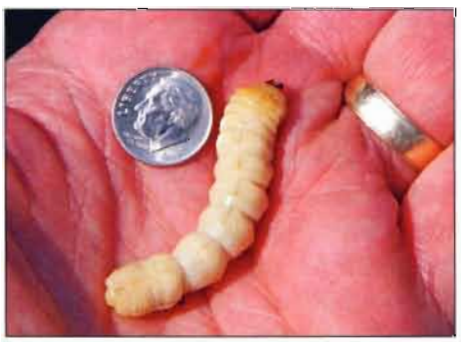
The announcement on that black (and white) Friday also affected the lives of tree care professionals working in southwest Ohio, foresters with the Ohio Department of Natural Resources (ODNR), educators and specialists with Ohio State University Extension, and, most of all, key ODA personnel as well as USDA APHIS program specialists who converged on Bethel to battle this potentially devastating non-native intruder. This was the first ALB infestation to be found in trees in Ohio. The state joined four others where ALB has been found in the U.S.: New York (Brooklyn, 1996); Illinois (Chicago, 1998); New Jersey (Jersey City, 2002); and Massachusetts (Worcester, 2007). ALB was also discovered in 1998 in Toronto, Ontario.

If there was a silver lining in Ohio, it came in the form of the USDA APHIS; they have been waging war against ALB since 1996. Much has been learned over the past 15 years and several battles have been won – ALB has been eradicated in Chicago and in several locations in New York and New Jersey.

Background and impacts

ALB is native to China and Korea. The beetle is a major pest in its home territory causing widespread mortality to poplar, willow, elm and maple. Much of the damage in China occurs on street trees, trees in windbreaks and hedgerows, and trees in man-made forests and plantations. Many of the plantations are dedicated to growing trees that are processed into wood packing material including crates and pallets. It is now well known that the beetle is capable of hitch-hiking across the globe as larvae, pupae, and newly developed adults inside the wood of such packing materials. Thankfully, regulations to prevent the import of this and other non-native plant pests and diseases now have a much greater "bite" in terms of fines and penalties.

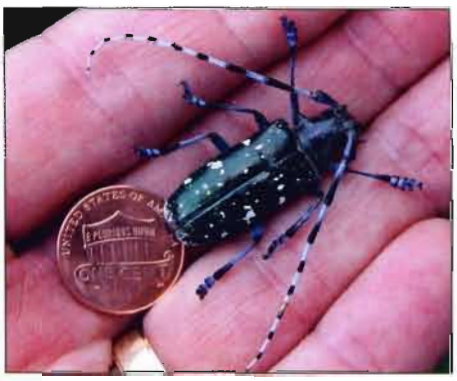
ALB has the potential to cause an unprecedented catastrophic loss of trees in North America. Unlike other devastating pests and diseases of non-native origins such as emerald ash borer (*Agrilus planipennis*) (EAB), Dutch elm disease, and chestnut blight that kill members in one plant genera, ALB kills trees belonging to 13 plant genera. These include: *Acer* (all maple species); *Aesculus* (horsechestnuts and buckeyes); *Ulmus* (elms); *Salix* (willows); *Betula* (birches); *Platanus* (Sycamore/Planetrees); *Populus* (Poplars); *Albizia* (Mimosa); *Cercidiphyllum* (Katsura); *Fraxinus* (ashes); *Koelreuteria* (goldenraintree); *Sorbus* (mountainash); and *Celtis* (Hackberry). While the first six



Full-grown ALB larva. All photos courtesy of Joe Boggs, unless otherwise noted.

in this list of genera are generally considered the trees most commonly attacked by ALB, all of the trees in this list can be attacked and killed by ALB; trees in the first group are like "steak" to ALB while trees in the second group are like "hamburger." All are considered hosts!

ALB produces a single generation per season. Adults have been reported to emerge in other infestations in North America from July to October; however, adults were found in the Ohio infestation in late-May. No clear phenological indicators have been published for beetle emergence; however, anecdotally in Ohio, it appears that the first bloom of Goldenraintree (*Koelreuteria paniculata*) and the full bloom of Bottlebrush Buckeye (*Aesculus parviflora*) may coincide with adult emergence.



ALB adult. The shiny black beetles are covered with numerous irregularly-shaped and -sized white spots.

The beetle can successfully spend the winter in all stages (egg, larva, and pupa) except the adult stage; adults are killed in the fall with the first substantial freeze. The immature stages are found inside infested trees, which is why it is important to avoid moving wood (e.g. firewood, logs, etc.) outside ALB quarantine zones; moving infested wood moves the beetle!

ALB diagnostics

Much has already been written about how to detect ALB, including an in-depth article in *TCI Magazine* (April 2010). However, given the history of ALB detections in North America, it's always important to review key diagnostic features. ALB has usually been found in multiple locations within a region. There were five infestations in the Chicago area and after being discovered in Brooklyn, N.Y., ALB was eventually found in Manhattan, Queens, and on Long Island. All of the localized infestations are linked; they all arose from only a few beetles. Indeed, even the New Jersey infestations were found to be associated with introductions that led to the New York infestations.

In fact, a second, much smaller ALB infestation has already been found in Ohio near the original infestation. The second infestation was found to be connected to the first with firewood having been moved prior to the discovery of ALB in Ohio. The take-home message for readers is to never assume ALB is "somewhere else." The Ohio infestations illustrate how this beetle may pop-up where least expected: Bethel is a rural community located far from major transportation hubs.

Given the proximity of the ALB infesta-

ALB photo at left courtesy of pennstatelive@flickr.com

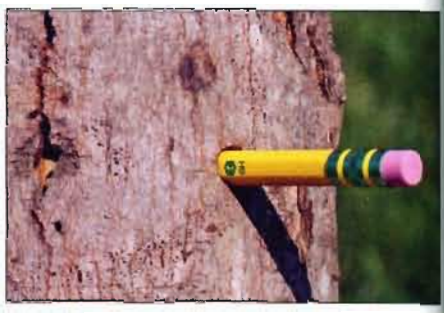
tion to densely forested areas to the east and a major metropolitan area to the west (Cincinnati), OSU Extension in partnership with ODA, USDA APHIS, ODNR and others have been providing "crash courses" on ALB for the public as well as tree care professionals. Since June 2011, 207 training programs have been presented, reaching 10,143 individuals. These programs have included both "classroom" as well as "hands-on" training such as a training event held for tree care professionals in September where two infested trees were taken-down to show up-close the key diagnostic features. The overarching goal is to make certain any additional infestations are quickly exposed – successful eradication depends on rapid detection of ALB.

Key diagnostic features

The Beetle: Many of the North American infestations, including the Worcester, Mass., infestation, were discovered by people finding beetles rather than diagnosing infested trees. ALB is a large, striking looking beetle; adults measure 1-1½ inches in length. The beetle belongs to the family Cerambycidae; beetles in this family are commonly called "longhorned" because of their extremely long antennae. The antennae of ALB have alternating bluish-black and white bands and are longer than the length of the beetle's body. The bullet-shaped, shiny black beetles are covered with numerous irregularly-shaped and -sized white spots; the spots look like someone has tried to dab white paint onto the beetle using a frayed paint brush. One of the Chinese common names for the beetle translates to the descriptively named "starry night beetle."

Big Emergence Holes – "Pencil Test": Adult emergence holes are ⅜-½ inches in diameter and the holes extend deep into the xylem. The holes are large enough to easily insert a #2 pencil and this "pencil test" is

ALB emergence hole.



ALB pencil test.

effective in separating phloem feeding borers from ALB; emergence holes of phloem feeders are much shallower. Of course, ALB holes are on living, healthy branches and trunks; there are a number of native longhorned beetles that infest dead or dying stems.

ALB oviposition pits.

Oviposition Pits: Every ALB infestation starts with female beetles chewing circular to oblong-shaped pits, around ½ inch in diameter, through the bark and down to the white wood of host trees. Pits remain obvious for about a year until wound tissue seals the pit. They are often made more obvious in the spring and fall by sap oozing out of the wound and running down the bark. The beetles will only lay eggs (produce pits) on LIVING stems; new pits will not appear on firewood. Beetles will lay eggs throughout the tree; pits are as likely to be seen at eye-level as they are to be found high in the tree. Trees of all sizes are selected: as long as stem size can support complete larval development.

Coarse Frass: ALB frass consists of very obvious wood shavings; it looks like "wood wool," or excelsior packing material. The distinctive ALB frass collects on the bark, falls into branch forks, and drops onto the ground around the base of an

infested tree trunk.

Branch Breakage: Late instar ALB larval feeding activity into the white wood (xylem) causes substantial structural weakening of infested branches, leading to branch breakage. Always look at the ends of broken branches to see why the branch broke! Look for heavy tunneling across the rings of the white wood. In fact, one of the Worcester infestations was discovered by USDA APHIS personnel examining the ends of branches broken after an ice storm.

ALB larval tunneling damage in white wood.

Heavy Woodpecker Damage: ALB larvae bore into the white wood (xylem); woodpeckers must excavate deeply to extract these larval meat morsels.

Tree Dieback and Death: ALB infestations eventually kill trees; however, death comes very slowly. While infested trees will show canopy thinning, this symptom on maple sometimes does not occur until the main stem is riddled with emergence holes. Canopy decline is not a reliable indicator of an ALB infestation.

ALB traps

Detecting ALB infestations by solely relying on key diagnostic features is a hit or miss proposition. Every ALB infestation in North America was brewing for years before being detected; beetles were chomping on Ohio trees for at least seven years before they were discovered. ALB traps would provide an obvious advantage in detecting new infestations.

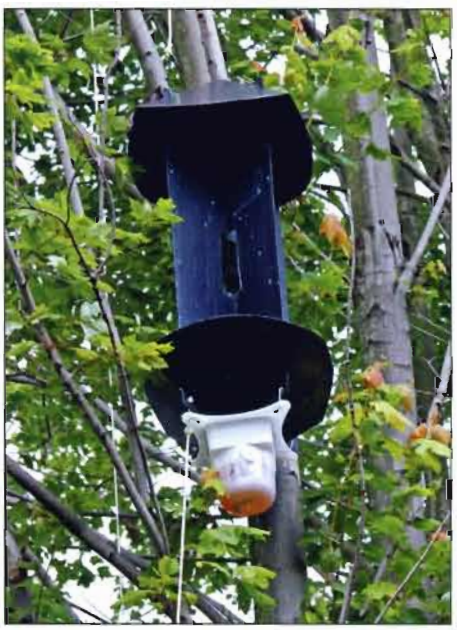
Several research teams are working on ALB attractants as well as trap designs. A team that includes researchers from the U.S. Forest Service Northern Research Station and Penn State University recently announced that they had made a major step forward in being able to detect the beetle. Traps baited with a combination of green

ALB woodpecker damage.

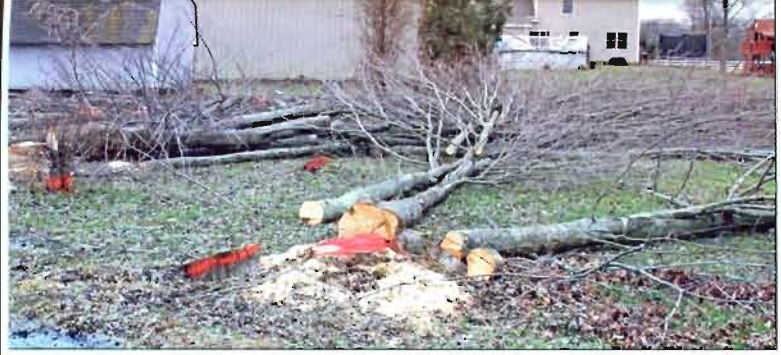
maple leaf volatiles and male pheromones have been tested for three years in the Worcester, Mass., ALB infestation and traps caught beetles each year. New infestations were also found based on the locations where traps caught beetles. Research continues and while no attractant/trap combinations have yet been released for use with ALB detection, effective ALB traps may be just around the corner.

ALB myths and misconceptions

As with any new discovery that finds its way into the news media, science sometimes takes a back-seat to opinions formed out of rampant speculation. The discovery and management of ALB in North America is no exception. Some misconceptions arise from the fact the science is an ever-advancing enterprise based on new discoveries made through research; what we think is true today may be proven untrue tomorrow. (Pruning paint is a perfect example) Other misconceptions about ALB stem from well-intended efforts by non-tree care professionals to understand sometimes complex arboricultural and



ALB trap being tested.



Myth 3: "Insecticides are highly effective in controlling ALB." Unfortunately, the most effective eradication tool remains the chain saw, with trees being cut down and destroyed.

pest-host concepts. It's similar to the challenge non-accountants have with understanding tax codes; even tree care professionals may panic each April!

Following are five myths and misconceptions gleaned from Web postings and news reports in southwest Ohio. Most of the misconceptions are directly related to the occurrence of EAB in southwest, Ohio. Understandably, non-professionals may believe all tree borers are equal; a perspective tree care professionals know is not true. Unfortunately, these misconceptions have gained some "traction" based on appearing in multiple venues. As William James said, "There is nothing so absurd that it cannot be believed as truth if repeated often enough."

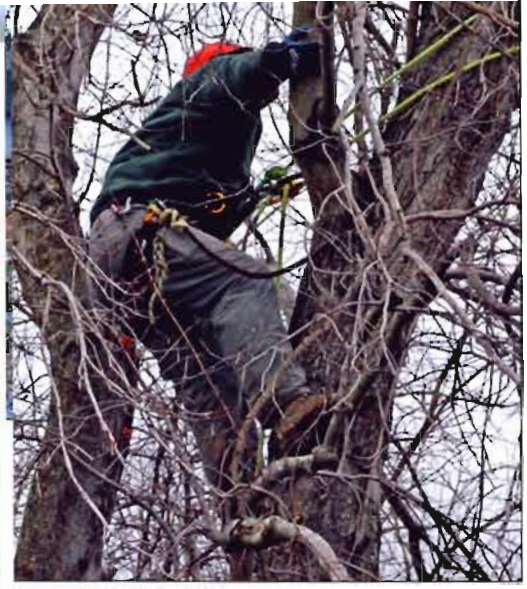
1) Myth: "ALB does not kill trees" – This myth most likely arose from a misunderstanding based on local citizens observing the rapid tree-killing behavior of EAB. EAB attacks ash trees, which are "ring porous;" water and nutrients are only transported through the outermost xylem ring. EAB is a phloem feeder; however, as the larvae gain size, they start etching the outermost xylem ring. Consequently, trees may die quickly as EAB larvae girdle trees by consuming the phloem and etching the single functioning xylem ring.

ALB infests some ring-porous trees, however, maples are most commonly attacked and maples are "diffuse porous;" water and nutrients are carried by four to five of the outermost xylem rings. Although ALB larvae bore into the xylem, their tunneling causes less disruption of the xylem vascular flow compared to damage caused by EAB in a ring-porous tree. In the end, the ALB larval damage does kill trees, but infested trees may linger for many years, giving the false impression that they are not being killed. Of course, as they linger, the trees are a constant source of new beetles.

2) Myth: "Asian longhorned beetles behave exactly like emerald ash borers" – As noted above, the two beetles are like apples to oranges. The much smaller EAB adults are very good fliers and they easily disperse. While ALB adults are relatively good fliers, they take flight much less frequently compared to EAB, perhaps because their large bodies require much more energy to launch and remain airborne. Thus, ALB tends to stay and continually re-infest trees until the trees die and are no longer able to support a new generation. As a result, ALB does not spread very fast from tree to tree compared to EAB.

EAB is now found in multiple locations in very large populations in Ohio; the beetle represents a clear and present danger to ash trees throughout the state. ALB has only been found in distinct and mostly small populations; it was first found in North America in 1996 and even now infestations remain confined. Thus, the management strategy for ALB is eradication with the overarching goal to eliminate ALB from all of North America. Eradication of ALB has been successful elsewhere; however, there is no hope for eradicating EAB.

3) Myth: "Insecticides are highly effective in controlling ALB: they make treated trees immune to the beetle" – Although EAB is not targeted for eradication, ash trees can be successfully treated to maintain full canopies. EAB larvae feed exclusively on the phloem and this tissue is highly effective in transporting systemic insecticides. Adult EAB beetles are also killed when they feed on the leaves of systemically treated trees. Systemic insecticide treatments are highly effective in EAB suppression; however, the overarching management goal is very different from ALB. Maintaining a full canopy does



ALB detection – A USDA climber.

not require 100 percent efficacy; every EAB beetle does not need to be killed!

Eradication using insecticides means the treatments must be 100 percent effective. While ALB larvae start out feeding on the phloem, they quickly bore into the xylem. Unfortunately, this places the larvae out of the reach of systemic insecticides. If a tree already has ALB larvae in the xylem, those larvae will successfully complete their development and new adults will emerge even if the tree is treated. Insecticides do not make trees "immune."

Insecticides have been used in ALB eradication programs in North America, but the primary target is the adult beetles rather than the larvae. The beetles spend time feeding on the phloem tissue of twigs and small branches prior to laying eggs; this is called "maturation feeding." While ALB adults are susceptible to systemic insecticides during maturation feeding, achieving high adult mortality is challenged by the extended period of time that adults are active during the season, limitations associated with product label restrictions, and the fact that size matters: efficacy is uncertain on large trees. This is why insecticides have always been used in conjunction with other eradication tools. Unfortunately, the most effective eradication tool remains the chain saw, with trees being cut down and destroyed.

4) Myth: "ALB in Ohio is very different from ALB found elsewhere in North America" – This myth is related to a misconception regarding the true nature of the genetic testing used to reveal that ALB infestations in the five states where ALB has been discovered came directly from Asia. As with all ALB infestations in North America, the Ohio infestation most likely started with only a few beetles, thus all the progeny are closely related. However, this genetic bottleneck produced by the "founder effect" imparts only slight genetic variability; about the same that is used to determine paternity in humans! The variability is not large enough to produce truly different beetles.

5) Myth: "Infested trees are easy to detect" – Damage found on heavily infested trees is easy to detect; the large oviposition pits and emergence holes are hard to miss. However, detecting ALB infections on lightly infested trees is a different matter. Remember that a single oviposition pit means the tree is infested. Imagine spotting a ½-inch diameter pit in the bark high in the canopy of a 70-foot sugar maple... even using good binoculars! In fact, research has shown that well-trained "ground spotters" will only be about 30 percent effective in detecting ALB infestations in lightly infested trees. The detection rate of well-trained tree climbers is around 70 percent. This means that under the best of circumstances, there is a detection error rate on lightly infested trees of around 30 percent.

Successful eradication means 100 percent destruction of the beetles. This is the reason one method for sure-fire eradication is to remove all potential ALB hosts within a prescribed distance of trees that are known to be infested. Confining tree removal to trees that are obviously infested means multiple tree-cutting trips as lightly infested trees eventually become obviously infested. Of course, beetles are continually being produced from the lightly infested trees until they are discovered and removed.

How do we avoid falling into the trap of believing these and other ALB myths and misconceptions? First, keep yourself informed and updated; never miss attending training programs on ALB. Second, always consider the source of your information; does your source have an alternate agenda? Finally, always separate facts from opinions. Daniel Patrick Moynihan said it best: "Everyone is entitled to their own opinions, but not their own facts."

Joe Boggs is an assistant professor with Ohio State University Extension and the OSU Department of Entomology. He works as a commercial horticulture educator for OSU Extension, Hamilton County (Cincinnati). This article was based in part on his presentations, "Diagnostic Dilemmas" and "Top 10 Tree Pests in 2011," both presented at TCI EXPO 2011 in Hartford. To listen to the audio recording of either presentation, visit www.tcia.org and click on Podcasts on the homepage. Or, in the digital version of this issue of TCI Magazine, *click here.*

Amy Stone is a horticulture educator and county director with OSU Extension, Lucas County (Toledo). She is the statewide coordinator for the OSU Extension, EAB/ALB Team. Amy can be reached at stone.91@cfaes.osu.edu.

Update On ALB in Ohio

Asian Longhorned beetles were first detected in Ohio June 17, 2011. Removal of infested trees in Clermont County began on November 14, 2011. The following numbers pertain to the infested tree removals and surveys being conducted as of February 25, 2012:

4,684 – Number of ALB infested trees removed (since removals start November 14)

6,740 – Number of ALB infested trees confirmed (since detection on June 17)

90,754 – Number of trees surveyed (since surveys began on July 1, 2011)

56 – Square miles under regulation; see "Regulated Area" map:

Residents in ALB regulated areas established within Clermont County cannot move firewood or wood debris outside of the regulated area, and are discouraged from moving firewood and wood debris inside the regulated area. The quarantine restricts the movement of hardwood logs, firewood, stumps, roots and branches and also restricts the sale of nursery stock, green lumber, and logs of: maples, horse chestnut, buckeye, mimosa, birch, hackberry, ash, golden raintree, katsura, sycamore, poplar, willow, mountain ash, and elms.

For more information or to report suspected ALB infestations, visit www.BeetleBusters.info.

Online Resources

USDA ALB information site: www.BeetleBusters.info
www.aphis.usda.gov/newsroom/hot_issues/alb/alb.shtml
ODA ALB info: www.agri.ohio.gov/TopNews/asianbeetle/
ODNR ALB info: www.dnr.state.oh.us/health/asianlonghorned/tabid/5197/Default.aspx
OSU Clermont County Extension: http://clermont.osu.edu/
Clermont County ALB pg: http://bugs.clermontcountyohio.gov/
Firewood Outreach & Education: http://dontmovefirewood.org/