

**BUCKEYE YARD AND GARDEN LINE 2003
SPECIAL EMERALD ASH BORER ISSUE**

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This is a special 2003 edition of the Buckeye Yard and Garden Line (BYGL) dedicated to providing information on the emerald ash borer.

BYGL is a service of OSU Extension and is aided by major support from the Ohio Nursery and Landscape Association (ONLA), with additional funding from the Ohio Chapter of the International Society of Arboriculture (ISA), to the OSU Extension Nursery, Landscape, and Turf Team (ENLTT). Any materials in this newsletter may be reproduced for educational purposes providing the source is credited.

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1. INTRODUCTION. In 2003, the non-native emerald ash borer (*Agrilus planipennis*) was found in 5 counties in Ohio. The most recent discovery was made in Franklin County. Although the BYGL is usually produced from April through October, the goal of the BYGL is to provide helpful, timely information. So, we decided a special edition of the BYGL dedicated to the emerald ash borer would be appropriate.

This issue includes a comprehensive article on the emerald ash borer, web resources, and a listing of upcoming training programs where the borer will be discussed. Additionally, we have provided an emerald ash borer diagnostic check-off list that can be copied and used for making field identifications of emerald ash borer infestations.

We encourage you to share this information on emerald ash borer with your employees, clientele, or others you know of who do not receive the BYGL. Feel free to copy and distribute the entire

BYGL, or sections. However, if you use this information in newsletters or in other publications, we ask that you please credit the source.

2. EMERALD ASH BORER ARTICLE. The following article will appear in the 2003 Extension / OARDC Special Circular, “Ornamental Plants Annual Reports and Research Reviews.” However, because it provides such a comprehensive overview of the emerald ash borer, we decided to include it in its entirety in this special edition of the BYGL.

Emerald Ash Borer: The Beginning of the End of Ash in North America?

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Introduction

Since its accidental importation from Asia, emerald ash borer (*Agrilus planipennis*) has infested and killed more than 6 million ash trees (*Fraxinus* spp.) in southeast Michigan woodlands, parks, urban forests, street tree plantings, landscapes, and nurseries. The core infestation of this exotic, invasive insect now extends across several thousand square miles in 13 counties in southeast Michigan and Windsor, Ontario.

All major North American ash species have been killed by emerald ash borer, which infests trees ranging in size from 1½ inch caliper nursery stock to fully mature trees in forests. While most native borers kill only severely weakened trees, emerald ash borer kills healthy trees as well, making it especially devastating. If it is not contained and eradicated, the impact of emerald ash borer on ash in North America will be similar to that of chestnut blight and Dutch elm disease, which devastated natural and urban forests in the twentieth century.

Emerald ash borer was unknown in North America until June 2002, when it was discovered killing ash trees in southeast Michigan and neighboring Windsor, Ontario. It is native to eastern Russia, northeastern China, Mongolia, Taiwan, Japan, and Korea, where it occurs on several species of ash. It was probably imported into Michigan via infested ash crating or pallets at least 10 years ago.

Localized infestations discovered in Ohio in 2003 in Lucas (February), Defiance (August), Paulding (August), Wood (September), and Franklin (November) counties have triggered ongoing eradication efforts in Ohio. In September 2003, an infestation was also confirmed in Maryland near Washington D.C. Artificial spread of the insect has been traced to movement of infested ash logs, firewood, and nursery stock.

Economic and Ecological Impact of Emerald Ash Borer

The economic and ecological impacts of emerald ash borer have already been substantial, and would be staggering if this exotic pest continues to spread. It clearly has the potential to virtually eliminate ash as a component of North American forests, which will have dramatic effects on ecosystem processes, as well as plant and animal communities.

Ash species, which inhabit a variety of soils and ecosystems, are dominant throughout the forests of eastern North America. An Ohio Department of Natural Resources study estimated there to be more than 3.8 billion ash trees in Ohio, with standing timber valued at more than \$1 billion. Furthermore, ash is one of the most important nursery and landscape species. According to the USDA, wholesale value of ash sold by Ohio nurseries exceeded \$20 million in 1998, a market threatened by emerald ash borer.

Michigan and Ohio have already experienced serious economic impacts. Ash has been one of the most commonly planted trees in landscapes and urban forests. In Michigan, emerald ash borer has already caused an estimated \$11.6 million of damage to landscapes and woodlots, and quarantines have restricted the sale of \$2 million worth of nursery stock. In addition, costs of removing dead and dying ash trees have overwhelmed municipal budgets in the affected counties, and private property owners must often pay in excess of \$1000 per tree for removal of large shade trees. A quarantine on ash timber has also had negative economic impacts on sawmills, tool handle factories, and firewood dealers in Michigan and Ohio.

Eradication costs for the localized emerald ash borer infestation in Lucas County, Ohio in April 2003 exceeded \$300,000, while projected costs of eradication in southeastern Michigan will exceed \$350 million over the next 10-13 years.

Taxonomy and Biology

Taxonomically, emerald ash borer is a beetle (Coleoptera) belonging to the family known as metallic wood-borers (Buprestidae). Adults of many species in this family are brightly colored with a metallic glint, making them favorites of collectors. Larvae of these beetles are known as flatheaded borers, deriving their common name from the larval stage, which appears to have a broadly flattened head (it is actually the thorax which mostly conceals the much smaller head). Emerald ash borer larvae are white with a long (about one inch when mature) narrow, segmented abdomen that is also flattened, which gives them the appearance of small tapeworms. Adults are elongate, one-half inch long beetles with striking, metallic green coloration.

Emerald ash borer belongs to the same genus (*Agrilus*) as bronze birch borer (*A. anxius*) and twolined chestnut borer (*A. bilineatus*), which are both native to North America. The biology of emerald ash borer is quite similar to its native relatives. There is one generation each year. Adults emerge from late May through early August, with emergence peaking in early July. As adults emerge, they leave small (1/8 inch), distinctly D-shaped exit holes in the trunk and main branches, which is a sure sign of infestation. Adults feed on foliage for 1-2 weeks prior to mating. Females produce about 50-100 eggs, which are laid individually on the bark surface, or within bark cracks and crevices. Observations indicate that upper portions of the trunk are

colonized initially, making it difficult to detect early infestations.

As larvae hatch, they tunnel into the tree, where they feed on the phloem and outer sapwood, excavating S-shaped, serpentine galleries just under the bark. Larvae continue to feed through summer and into the fall, with most completing their development prior to over-wintering in the outer bark or just under the inner bark, within the outer inch of sapwood. Pupation occurs in mid- to late-spring. Adults emerge soon thereafter to complete the one year cycle.

Diagnosing Emerald Ash Borer: Signs and Symptoms

Infestations of emerald ash borer are difficult to detect until they become severe, because larvae are hidden under bark, they colonize the upper portion of the trunk first, and symptoms resemble other causes of tree decline.

There are few external signs or symptoms of early infestations. When trees are still vigorous, small, vertical splits may form in the bark in response to the growth of wound-periderm (callus) tissue that forces out the bark as it forms over larval galleries in the phloem. To confirm the presence of emerald ash borer, one can widen the splits to reveal larvae and galleries under the bark. Larval galleries are distinctly S-shaped or serpentine, and are packed tightly with frass (mixture of sawdust and excrement). They are also visible on the inner surface of the outer bark when removed.

The presence of small (1/8 inch) D-shaped exit holes in the trunk or main branches by emerging adults is a sure sign of infestation. As infestations progress into the second year, the canopy will start to thin and branch dieback may occur. Decline accelerates rapidly, and trees are generally killed within 2-4 years of infestation. Epicormic shoots often sprout from the main trunk of declining trees. Woodpeckers are proving to be important predators of emerald ash borer. A noticeable increase in woodpecker activity on ash trees can provide an early indication of an infestation, especially during winter.

Distinguishing Emerald Ash Borer From Native Borers

Green Industry professionals and Extension personnel called to inspect declining ash trees may have the first opportunity to detect new emerald ash borer infestations before they become well established. However, there are several native clearwing and roundheaded borers that also commonly infest ash. Hence, the ability to distinguish emerald ash borer infestations from those of native borers is extremely important.

Among the most common of the native ash borers are the banded ash clearwing borer (*Podosesia aureocincta*) and ash/lilac borer (*P. syringae*), both of which are the larvae of clearwing moths. The banded ash clearwing borer has become especially common in Ohio's urban forests. Although many signs and symptoms of native borers resemble those of emerald ash borer, there are several important characteristics that are useful in distinguishing clearwing borer infestations from those of emerald ash borer.

In particular, the nature of the galleries and the shape of the exit holes are distinctly different

between emerald ash borer and the native borers. Clearwing larvae bore deep into the sapwood, while galleries of emerald ash borer are confined to the phloem tissue just under the bark. Clearwing borers expel their frass from the tree, which can accumulate in large quantities in bark crevices, branch crotches, and on the ground, providing a good sign of an infestation. Conversely, emerald ash borer larvae pack their frass tightly within their galleries as they feed. Upon emerging, clearwing borers leave behind a pupal case, which is sometimes found protruding from the emergence hole. Flatheaded borers, on the other hand, do not produce a pupal case.

The shape of adult emergence holes in the trunk is the most distinctive diagnostic guide. The emergence holes of emerald ash borer are distinctly D-shaped, while emergence holes of clearwing borers of ash are larger (1/4 inch diameter) and round. Because the galleries of clearwing borers penetrate into the sapwood, one can insert a thin wire through the emergence hole well into the tree. This is not possible with emerald ash borer exit holes, as the galleries wind just under the bark, and are plugged with frass. There is a native species of *Agrilus* that infests ash, and it probably also produces D-shaped emergence holes. However, it is much smaller than emerald ash borer, and colonizes only small branches and twigs.

Several species of roundheaded borers also infest ash, with the redheaded ash borer (*Neoclytus acuminatus*) being the most common in Ohio. Roundheaded borers are larvae of longhorned beetles (Order: Coleoptera; Family: Cerambycidae), which derive their name from the very long antennae of adults.

As their name implies, the larvae of redheaded ash borer and other roundheaded borers are round in cross section, in contrast to the highly flattened profile of flatheaded borers. Redheaded ash borer infestations can also be distinguished from emerald ash borer by the presence of large (3/8 inch wide), oval exit holes. Galleries initially form just under the bark and are packed with frass, as is the case with emerald ash borer. However, redheaded ash borer galleries are not nearly as serpentine. As larvae mature, they extend their galleries well into the sapwood, usually following the grain of the wood, while emerald ash borer galleries are restricted to the phloem. Furthermore, redheaded ash borer is restricted to severely weakened, dying, and freshly killed trees (e.g. freshly cut timber and firewood), while emerald ash borers colonize healthy trees.

In summary, the presence of serpentine galleries packed tightly with frass just under the outer bark, coupled with one-eighth inch diameter D-shaped emergence holes through the bark of the trunk and main branches, are sure signs of an emerald ash borer infestation.

Host Plants and Host Impact

Ash species known to be infested in Michigan include green (*Fraxinus pennsylvanica*), white (*F. americana*), black (*F. nigra*), and blue ash (*F. quadrangulata*), as well as horticultural cultivars of these species. Only living trees are colonized. Emerald ash borer will not colonize a dead tree. Native host plants in Asia also include ash species, with *F. mandshurica* (Manchurian ash) and *F. chinensis* being primary hosts.

In China, emerald ash borer is known only to colonize ash. In Japan, species of *Juglans* (walnuts and butternuts), *Ulmus* (elms), and *Pterocarya* (wingnuts) have also been recorded as hosts. However, emerald ash borer has not been well studied in Japan. Furthermore, host records for borers are notoriously unreliable. For example, host records for wood borers often include species from which adults were collected, even when they do not colonize that species in the larval stage. Research this past year at Michigan State University strongly suggests that walnut and elm are not viable hosts for emerald ash borer larvae.

Adult beetles feed on foliage, resulting in irregular, jagged-edged patches of missing tissue along the leaf margin, the impact of which is negligible. The larva is the damaging stage, girdling the tree as it tunnels under the bark where it feeds primarily on phloem tissue. This disrupts the flow of carbohydrates between the canopy and roots, which results in canopy thinning, branch dieback, and finally tree death, typically within 2-4 years of initial infestation.

Larvae also engrave the outer layers of the water-conducting sapwood (xylem) as they feed. This type of feeding actually causes relatively little harm to trees such as birches with a xylem anatomy known as “diffuse porous,” because water is conducted through a number of annual growth rings, most of which are not injured. Rather, flatheaded borers, such as bronze birch borer, tend to kill diffuse porous species gradually as girdling of phloem starves the roots.

On the other hand, “ring porous” trees, such as ash, can be killed rapidly by flatheaded borers. The functional xylem of ring porous trees is confined to the current growth increment just under the bark. Borers, such as emerald ash borer, that scar the surface of the xylem cause extensive damage to this very thin layer of water conducting tissue as they engrave the surface of the sapwood. This disrupts the transpiration stream, which can result in rapid decline and death of infested trees, especially during periods of drought.

OSU Research on Host Plant Resistance

In Asia, emerald ash borer does not devastate its native hosts. Reports indicate that outbreaks are isolated and associated with stress events such as drought. This suggests that in Asia, ashes may be generally resistant, and that emerald ash borer preferentially colonizes stressed trees. Thus, emerald ash borer seems to behave in Asia much as its close native relatives do in North America, including bronze birch borer and twolined chestnut borer, which also preferentially colonize stressed trees. Native trees may be more resistant to their native pests because of natural defenses that have evolved over eons. Hence, Asian ash trees may be a source of resistance genes.

Researchers at The Ohio State University including Daniel Herms, Department of Entomology, and Enrico Bonello, Department of Plant Pathology, are collaborating with colleagues at Michigan State University to investigate this possibility. An experimental ash planting was established in 2003 in Novi, Michigan, with trees donated by Bailey Nurseries, Inc., to compare resistance of native and Asian ashes to emerald ash borer, identify mechanisms of resistance, and determine the effects of drought and other stressors on borer susceptibility. The planting includes white ash, green ash, Manchurian ash, with which emerald ash borer shares an evolutionary history in Asia, and Northern Treasure ash (*F. x Northern Treasure*), which is a

hybrid between native black ash and Manchurian ash.

Our *a priori* hypothesis is that the Asian ash will prove to be most resistant because of natural defenses resulting from coevolution with the insect. The inclusion of the native-Asian hybrid may provide insight into patterns of inheritance of resistance genes, and facilitate their identification. Identification of resistant genotypes will be critical for reforestation, as well as maintaining market demand for ash in the nursery industry. Identification of resistance mechanisms and their relationship to whole tree physiology will facilitate screening, selection, and/or breeding of resistant trees, as well as cultural management of emerald ash borer in urban and natural forests.

The Plan to Eradicate Emerald Ash Borer

USDA-APHIS (Animal and Plant Health Inspection Service) and their Canadian counterparts are in the early stages of implementing a program to eradicate emerald ash borer from North America. The plan in the core infestation area of southeast Michigan, where millions of trees are already infested, is to first contain the pest, then reduce beetle density, and finally eradicate the insect.

There are so many infested trees in the core infestation zone in southeast Michigan that it will be physically impossible to remove them all before insects can emerge. Rather the core infestation is being managed following strategies similar to those used to manage large forest fires. A “fire-break” will be created around the core to contain the infestation. Once contained within the fire-break, the infestation should extinguish itself by killing all of its host trees, thereby starving itself out of existence. The plan is for the fire-break to be wide enough to prevent emerald ash borer from being able to cross it in search of new hosts. The fire-break will be constructed by removing ash trees in a zone around the periphery of the infestation, a task that will be facilitated by routing it through areas with naturally low densities of ash such as agricultural land, industrialized areas, and large bodies of water. Surveys and research are ongoing to determine just where the fire-break should be located, and how wide it should be.

Preventing the artificial spread of emerald ash borer to new areas is another major component of the eradication plan. Accordingly, quarantines have been placed on infested sites in Michigan and Ohio that prohibit movement of ash trees, logs, branches, firewood, and untreated lumber. In August 2002, in response to the discovery of several isolated infestations throughout the lower part of the state, Michigan also enacted a one year moratorium on the movement of all ash nursery stock from, into, and within Michigan’s Lower Peninsula. The Michigan Department of Agriculture, Ohio Department of Agriculture, and USDA-APHIS are conducting systematic surveys in order to rapidly detect any new outlier infestations.

Rapid elimination of these outlier infestations is also a critical aspect of the eradication plan. Isolated infestations that flare up when “sparks” jump the fire-break will be quickly extinguished before they can become well established. This is the situation in Ohio, where a small infestation was detected in Lucas County in February 2003. In response to this discovery, the Ohio Department of Agriculture, in accordance with their responsibility under Ohio Revised Code to protect Ohio’s plant industries from exotic pests, immediately initiated an eradication program

that was completed by the end April before any adult beetles could emerge and spread the infestation.

This program entailed removal and destruction of more than 8,000 ash trees in a radius extending 1/4 mile surrounding the known infestation. Since infested trees do not show external signs or symptoms of attack during the first year, there is no way to determine which trees in the vicinity of infested trees were themselves infested. However, the presence of D-shaped emergence holes on the obviously infested trees was evidence that females had emerged to lay eggs on other trees, making the existence of asymptomatic carriers a certainty. Consequently, it was necessary to cut even apparently healthy trees to destroy the insects lurking within before they could emerge to infest even more trees. Bark removed from some of these asymptomatic trees confirmed that they were in fact infested. To destroy the insects, felled trees were chipped and then incinerated at a co-generation power plant.

The assumption behind this strategy was that a cutting zone with a one-quarter (1/4) mile radius was sufficient to destroy the entire emerald ash borer population, including insects in trees that had yet to show symptoms of infestation. However, in the event that some emerald ash borer adults had dispersed beyond one-quarter (1/4) mile, all ash trees just outside the cutting zone were treated preventively with the systemic insecticide imidacloprid in April 2003. This treatment zone extended from the edge of the cutting zone out to one-half (1/2) mile from visibly infested trees. The strategy was that any adult that escaped the cutting program would lay their eggs in the adjacent zone of treated trees, where their offspring would be killed by the insecticide.

Treating already infested trees with insecticides as an alternative to destroying them was not a viable option, as it would not have prevented adults from emerging and spreading to other trees. Insecticides are effective against borers only when applied preventively, in advance of infestations, and have no impact on borers already in the tree. This is true even of the systemically-applied imidacloprid, which requires 6-8 weeks for uptake and distribution. Thus, it must be applied in early to mid-spring to impact newly hatched larvae in July. By late summer, many larvae have matured, ceased feeding, and moved to over-wintering sites in the outer bark, where they would not be exposed to insecticide. Furthermore, larval feeding injures the xylem and phloem, which disrupts uptake and distribution of systemic insecticides by infested trees.

Should Trees Outside of Eradication Zones Be Treated with Preventive Insecticide Applications?

Ohio State Extension personnel have received many questions from homeowners and Green Industry professionals wondering if preventive insecticide applications are necessary in Ohio to protect ash trees from emerald ash borer. Members of the OSU Extension Nursery and Landscape and Turf Team, in consultation with the Ohio Department of Agriculture officials, have developed the following recommendation:

Currently, we do not recommend that any ash trees in Ohio be treated with insecticides for emerald ash borer, even if the tree is in the immediate vicinity of a known infestation.

The logic behind this recommendation, which may seem counter-intuitive, is based on the interaction between the biology of the insect and regulatory issues associated with the program to eradicate emerald ash borer from North America. The situation is different in the quarantined counties in Michigan (for reasons discussed below), where many property owners within the core infestation zone are choosing to protect their trees with insecticides.

Emerald ash borer is an exotic insect that is currently regulated by USDA-APHIS, and is subject to eradication. Hence, if an infested tree is discovered in Ohio, it will have to be removed and destroyed. Female emerald ash borers are highly mobile and lay eggs on many trees. Infested trees do not show any external symptoms during the first year of the infestation. Therefore, in the vicinity of any tree showing visible signs of infestation, there will be many more trees that are infested but with no external symptoms (asymptomatic carriers). Since there is no way to tell if these trees are infested, all trees in the vicinity of the infested tree will have to be removed and destroyed, as per eradication protocols, before larvae mature and adults can emerge, even if they appear healthy. This will be true even if that tree has been treated previously with insecticide, as research has shown that no insecticide is 100% effective against emerald ash borer.

But What About Trees in the Immediate Vicinity of Known Infestations?

As of December 2003, infestations have been discovered in Ohio in Lucas, Defiance, Franklin, Paulding, and Wood Counties, and programs already have or soon will be implemented by Ohio Department of Agriculture to eradicate these infestations.

If the eradication programs are successful, it will not be necessary to treat nearby trees with insecticides. People near an eradication zone may be tempted to treat their trees as insurance in case an emerald ash borer escapes the eradication program. However, if a borer does escape, it is extremely unlikely that it will lay eggs only on trees that have been treated with insecticides, as they lay many eggs as they move from tree to tree. If it does lay eggs even on one untreated tree in the same neighborhood as the treated tree, eventually the untreated tree will show signs or symptoms of infestation, and will have to be destroyed. In this case, all trees in the vicinity of the infested tree will also have to be destroyed, even if they have been previously treated.

In the core infestation in southeast Michigan, the situation is different. Because there are too many infested trees to cut down as part of the eradication program (discussed above), and because property owners there are financially responsible for removal of dead trees on their property, many people in the core infestation zone are taking steps to protect their ash trees, including preventive insecticide applications.

In Closing

Emerald ash borer represents a lethal threat to ashes throughout their range in North America, and efforts to eradicate this invasive pest are under way in Ontario, Michigan, Ohio, and Maryland. Eradication is possible, but if these efforts are not successful, emerald ash borer will decimate ash in North America, with devastating economic and ecological impacts. The threat cannot be over-estimated.

References

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McCullough, D.G., and D.L. Roberts. 2002. Emerald ash borer. Pest Alert, USDA Forest Service State and Private Forestry Northeastern Area. NA-PR-07-02.

USDA-APHIS. Federal Register 68(198), Tuesday, October 14, 2003, Rules and Regulations, pp. 59082-59091. Emerald ash borer: quarantine and regulations.

3. Additional Emerald Ash Borer Resources on the Web. There are several good web sites that can provide more information and help regarding emerald ash borer. Check these out:

* USDA Forest Service Pest Alert - Emerald Ash Borer
http://www.na.fs.fed.us/spfo/pubs/pest_al/eab/eab.htm

* USDA Forest Service - North Central Research Station
<http://www.ncrs.fs.fed.us/4501/eab/>

* Ohio Department of Agriculture - Division of Plant Industry
<http://www.ohioagriculture.gov/pubs/divs/plnt/curr/eab/PLNT-eabindex.stm>

* North Central Pest Management Center
<http://www.ncpmc.org/NewsAlerts/emeraldashborer.html>

* Ohio State Experts on Emerald Ash Borer (Under "Headlines")
<http://www.oardc.ohio-state.edu/>

* OSU Extension Ohioline - It's New
Four new fact sheets on EAB will be posted here under "It's New" within the next couple of weeks. Check back for these sheets after about December 15.

4. Upcoming Programs on Emerald Ash Borer

A. Invasive Plants and Destructive Insects; Economic and Ecological Impacts - Saturday, January 10, 9 a.m.-12 noon. OSU Chadwick Arboretum

This program is open to the public as well as members of the green industry. Master Gardener volunteers who have specialized training will present programs on "Gypsy Moth" at 9 a.m. and

“Invasive Plants” at 10 a.m. At 11 a.m., Dr. Dan Herms, OSU/OARDC Entomologist, will present a program on “Emerald Ash Borer.”

This program will be held in the Kottman Hall Auditorium on the OSU Columbus campus. Parking on campus is not a problem on Saturdays, is free and is adjacent to the building. For a map to the building and parking lots, see <http://hcs.osu.edu/directions.html>. Fee of \$5.00 per person payable at the door (no pre-registration required). For questions, contact Mary Maloney at 614-688-3479 or Jane Martin at 614-247-6046.

B. OSU Short Course, Tuesday, January 27, 10:40 a.m. - Columbus Convention Center

Dr. Dan Herms, OSU/OARDC Entomologist, will present a program titled “Emerald Ash Borer: The Beginning of the End of Ash in North America?” For a Short Course program and registration form, see these web sites.

Short Course Schedule - <http://www.onla.org/shortcrssched.pdf>

Registration Form - <http://www.onla.org/04regform.pdf>

C. For OSU Extension Agents Only: Pesticide Applicator Training, Agent Inservice, Wednesday, January 7, 12:45 p.m. - Ag. Admin. Auditorium, OSU Campus

This program is for OSU Extension Agents, and is not open to the public. Dr. Dan Herms, OSU/OARDC Entomologist, will be presenting a program titled “Emerald Ash Borer Update.” Agents can register for the program at the following web site:

<http://pested.osu.edu/>

5. Emerald Ash Borer Diagnostic Check-Off List. The following is a list of signs and symptoms that will be helpful in diagnosing an emerald ash borer infestation. It is important to keep in mind that native ash borers are extremely common throughout the state, and the vast majority of borer-infested ash trees in Ohio are infested with native borers. Thus far, the very few emerald ash borer infestations found in Ohio are extremely small and very localized, infesting only a handful of trees.

Diagnostic signs and symptoms specific to emerald ash borer:

- Serpentine, S-shaped galleries tunneled just beneath the bark. The galleries are etched into the underside of the bark, and the outer sapwood. Galleries are tightly packed with fine sawdust-like frass. They do not extend into the sapwood, as do those produced by the common native clearwing or roundheaded borers that infest ash.
- D-shaped emergence holes, one-eighth inch in diameter, through the bark. This symptom is very clear – emerald ash borer exit holes are very distinct. If there is any doubt as to whether the holes are D-shaped, then it is not emerald ash borer. Exit holes of native borers are either round or oval, and much larger in diameter (one-quarter inch or greater).
- Legless, flattened, heavily segmented, white to cream-colored larvae (1 inch in length when mature) found beneath the bark of living trees. Each larval segment is almost bell-shaped. The long narrow shape, flattened appearance, and distinct segmentation cause the larvae to resemble small tapeworms.

Diagnostic signs and symptoms consistent with emerald ash borer, but could also be associated with other ash problems:

- Thinning canopy, top dieback, leading to the death of the tree within 2-3 years.
- Thin, relatively short (2-5 inches long) vertical splits through the bark of living trees.
- Unnatural epicormic shoots sprouting from the main trunk and/or from the base of the tree.
- Unusually heavy woodpecker activity on living trees, particularly in the winter.

Reporting Suspected Emerald Ash Borer Infestations:

The Ohio Department of Agriculture should be notified if the diagnostic check-off list provides strong evidence that an emerald ash borer infestation has been found. Strong support for an emerald ash borer diagnosis means that signs and symptoms specific to emerald ash borer were observed, including D-shaped emergence holes and serpentine galleries under the bark. An emerald ash borer diagnosis is not supported if the only signs and symptoms observed are those that can also be associated with other ash problems.

Contact Information for the ODA:

Special Emerald Ash Borer Hotline: 1-888-OhioEAB (1-888-644-6322)

Mailing Address:
Ohio Department of Agriculture
Plant Pest Control Section
Attn.: EAB
8995 East Main Street
Reynoldsburg, OH 43068

Where trade names are used, no discrimination is intended and no endorsement by Ohio State University Extension is implied. Although every attempt is made to produce information that is complete, timely, and accurate, the pesticide user bears responsibility of consulting the pesticide label and adhering to those directions.

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