

PLANT MATERIALS TECHNICAL NOTE

Emerald Ash Borer (EAB) *Agrilus planipennis*

Joseph D. Scianna, Research Horticulturist
Robert Logar, State Forester

Introduction: Emerald ash borer (EAB) *Agrilus planipennis* is a devastating insect pest of ash *Fraxinus* species first discovered in the United States in 2002. Native to eastern Russia, northeast China, Mongolia, Taiwan, Japan, and Korea, it was accidentally imported into the U.S. through infested ash crating or pallets at least 10 years ago. It is capable of killing numerous ash species including green ash *Fraxinus pennsylvanica*, a species used extensively in the central and western U.S. for windbreaks, shelterbelts, living snowfences, woody draw restoration, urban forests, native landscaping, xeriscapes, and other conservation plantings. This Technical Note provides information that can be used to detect and limit its spread in the northwestern U.S.

I. CURRENT U.S. DISTRIBUTION: As of 2004, EAB has not been reported in Montana, Wyoming, Idaho, Washington, Oregon, Nevada, Utah, North Dakota, South Dakota or any other locations in the northern Great Plains or Rocky Mountains. The current zone of EAB infestation includes southeast Michigan; Windsor, Ontario; Ohio; Indiana; and Maryland near Washington, D.C. Human spread has been traced to movement of infested logs, firewood, and nursery stock.

II. SUSCEPTIBLE HOST SPECIES: All native species of ash, including green ash *Fraxinus pennsylvanica*; white ash *F. americana*; black ash *F. nigra*; and blue ash *F. quadrangulata* are susceptible to EAB. Many introduced ash species are also likely to be susceptible: Manchurian ash *F. mandshurica* and Chinese ash *F. chinensis* are known hosts. The susceptibility of other native deciduous trees is unknown at this time.

III. IDENTIFYING AN INFESTED TREE: Early detection (Year 1 or 2) of infested trees is difficult since the larvae remain hidden under bark and symptoms resemble other causes of tree decline. Look for following visual symptoms:

- 1) serpentine (S-shaped) galleries or tunnels beneath the bark* (see FIGURE 1)
- 2) small (1/8-inch) D-shaped exit holes in the trunk or main branches* (see FIGURE 2)



Image courtesy of David L. Roberts, Michigan S.U.

FIGURE 1

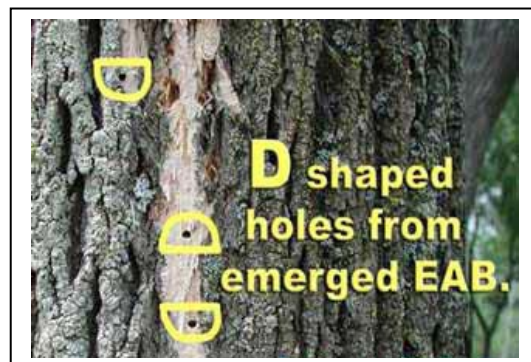


Image courtesy of David L. Roberts, Michigan S.U.

FIGURE 2

- 3) vertical splits in the bark
 - 4) thinning canopy and branch die-back with tree mortality within 2 to 4 years of initial infestation
 - 5) epicormic sprouts arising from the main trunk
 - 6) increased woodpecker activity
 - 7) irregular, jagged-edged patches of missing tissue along the leaf margin
- * Specific symptom of EAB.

IV. IDENTIFYING THE PEST: EAB is a beetle (Coleoptera) in the metallic wood-borer (Buprestidae) family. Adults are elongated, ½-inch long metallic green beetles (see FIGURE 3). The larvae of these beetles are known as flat-headed borers. Mature EAB larvae are white with a 1-inch long, narrow, segmented abdomen that is flattened (see FIGURE 4). The bell-shaped abdominal segments on the late



Image courtesy of David Cappaert, Michigan S.U.

Adult Emerald Ash Borer

FIGURE 3



Image courtesy of David Cappaert, Michigan S.U.

Larval Stage of Emerald Ash Borer

FIGURE 4

instar larvae are fairly unique to this species. It should be noted that there are several native borers that infest ash species that may be confused with EAB. These include the banded ash clearwing borer *Podosesia aureocincta* and the ash/lilac borer *P. syringae*, both classified as clearwing moths. See Table 1 for distinguishing features of pests of ash species in the U.S. that may be confused with EAB.

Table 1. Characteristics of select pests of ash species in the United States.

Pest Characteristic	Insect Species			
	EAB	Clearwing Moth Larvae ³	<i>Agrilus</i> Sp.	Red-Headed Ash Borer
Depth of Boring	serpentine galleries in phloem just below bark	galleries deep into sapwood	-	non-serpentine galleries; initially just under bark, later into sapwood
Frass	tightly packed in gallery ¹	readily expelled from tree; can accumulate on bark and ground ²	-	tightly packed
Pupal Case	no pupal case	leave a case upon emerging	-	-
Adult Emergence Hole	1/8"; D-shaped; trunk/main branches	1/4"; round shape; trunk/main branches	very small, D-shaped holes only in small branches/twigs	3/8"; oval exit hole

¹- Thin wire cannot be readily inserted into an exit hole or gallery.

²- Thin wire can be readily inserted into an exit hole or gallery.

³- Includes the larvae of both the banded ash clearwing borer and ash/lilac borer.

V. INSECT LIFE CYCLE: EAB has one generation per year. Adults emerge from late May through August, with peak emergence in early July. Emerging adults leave 1/8-inch, distinctly D-shaped exit holes in the trunk and main branches. Adults feed for 1 to 2 weeks on foliage prior to mating. Females lay eggs on the bark surface or within bark cracks and crevices. The upper trunk is typically colonized first, making early detection difficult. Hatching larvae tunnel into the tree, feeding on phloem and outer sapwood just under the bark. Larvae over-winter in the outer bark or just under the inner bark. Pupation occurs in mid- to late spring, with adult emergence soon thereafter.

VI. WHAT TO DO IF YOU SUSPECT EAB: Contact your local Animal and Plant Health Inspection Service (APHIS) – Plant Protection and Quarantine (PPQ) officer or State Plant Health Director (<http://www.aphis.usda.gov/ppq/sphd/index.html>) or State Regulatory Official (<http://www.aphis.usda.gov/npb/npbmemb.html#Members>) immediately. Check current state and APHIS regulations and restrictions for quarantine information.

VII. PROPER COLLECTION OF SAMPLES: In non-quarantined areas (currently all north western states), insect samples should be placed in 70% or stronger rubbing alcohol in a sealable, non-breakable container while at the collection site. Properly containerized samples may be frozen until needed. Do not move any live insect samples (eggs, larvae, pupae, adults) or any potentially infested plant parts, from the potential infestation site. If safe transport of samples cannot be guaranteed (i.e., only non-living adult insects, larvae, pupae, eggs, etc.), do not attempt to transport samples from the field. In all cases, call APHIS immediately. If EAB should be confirmed in any northwestern state and quarantine sites established, check current APHIS and state regulations concerning the inter- and intra-state transport of EAB materials (insects, plant parts, etc.).

VIII. CONTROL OF EAB: At this time, treatment of infested trees (i.e., at known infestation sites) is by eradication (removal and burning) only. Application of preventative insecticides outside of eradication zones is not recommended. Since preventative insecticides are not 100% effective, and because quarantine protocols mandate the eradication of all ash species within the vicinity of infested trees (possibly ¼ mile or greater radius from infestation site), applications of insecticides are not recommended at this time. Trees treated with insecticide prior to an infestation would still have to be removed as per eradication protocols if an outbreak occurs in the vicinity.

IX. MANAGEMENT AND USE OF ASH SPECIES IN CONSERVATION PLANTINGS: Green ash and other appropriate ash species may continue to be used in conservation plantings until further notice. When possible, and appropriate for the design, consider including other well-adapted species for diversity. In the Intermountain West and Northern Great Plains, medium-sized deciduous trees that may be used with, or in lieu of green ash, include bur oak *Quercus macrocarpa*, hackberry *Celtis occidentalis*, box elder *Acer negundo*, and honeylocust *Gleditsia triacanthos*.

REFERENCES: Adams, D.G. 2004. Personal Communication (technical review). State Plant Health Director, USDA, APHIS, PPQ. Helena, Montana.

Buckeye Yard and Garden Line. 2003. Special Emerald Ash Borer Issue. December 5, 2003, URL: <http://bygl.osu.edu/eab/eab.PDF>

Denke, P. 2004. Personal Communication (technical review). State Entomologist, Montana Department of Agriculture, Helena, Montana.

Haack, R.A., E. Jendek, H. Liu, K.R. Marchant, T.T. Petrice, T.M. Poland, and H. Ye. 2002. The emerald ash borer: a new exotic pest in North America. Michigan Entomological Society Newsletter 47(3-4):1-5 (Sept. 2002). Accessed at URL: <http://www.ncrs.fs.fed.us/pubs/viewpub.asp?key=1858>

Holzworth, L. 2004. Personal Communication (technical review). Plant Materials Specialist, USDA-NRCS, Bozeman, Montana.

Knudson, M. 2004. Personal Communication (technical review). Forester, USDA-NRCS, Bismarck, North Dakota.

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, Revised December 2002. Accessed at URL http://www.na.fs.fed.us/spfo/pubs/pest_al/eab/eab.htm

Ogle, D. 2004. Personal Communication (technical review). Plant Materials Specialist, USDA-NRCS, Boise, Idaho.

Shambaugh, B. 2004. Personal Communication (technical review). State Plant Health Director, USDA, APHIS, PPQ. Cheyenne, Wyoming.

St. John, L. 2004. Personal Communication (technical review). Plant Materials Center Manager, USDA-NRCS, Aberdeen, Idaho.

USDA-APHIS. 7 CFR Part 301 [Docket No. 02-125-1] Emerald Ash Borer; Quarantine and Regulations. Federal Register Volume 68, No. 198, pp. 59082-59091. Tuesday, October 14, 2003. Accessed at URL <http://www.aphis.usda.gov/ppd/rad/webrepor/ppq.html>



Visit the Plant Materials Program website at:

<http://Plant-Materials.nrcs.usda.gov>

PLANT SOLUTIONS FOR CONSERVATION NEEDS

The USDA is an Equal Opportunity Employer