http://www.ojibway.ca/eab1.jpg

The Emerald Ash Borer in Michigan

It is believed that the Emerald Ash Borer (*Agrilus planipennis*) or EAB was introduced to Southeast Michigan six to ten years ago when it arrived from its native Asia in wood packing material on cargo ships and airplanes (3, 5). Since then it has been established in Ontario, Ohio (2003), northern Indiana (2004) and northern Illinois (2006) (3, 12) and has been observed in Maryland and Virginia (13, 12). Although some of this spread is attributable to natural dispersal of about one half mile annually, humans play a significant role in the spread of this pest by transporting infested firewood and large wood chips to other locations (4, 8, 9)

The Emerald Ash Borer is a beetle that is native across Asia including Russia, Northeast China, Mongolia, Taiwan, Japan and Korea (5). The adult is bright metallic green, one third inch long and one-sixteenth inch wide. It has a rounded abdomen and a flat back (4). (See Figure 1.) The larva is a creamy white color with a flattened segmented body about one inch long in the final instar (5). (See Figure 2.) The insect has a lifetime of about a year. In the summer months an adult female produces 50 to 100 eggs which she lays on the bark of all species, ages and sizes of ash trees (*Fraxinus*), often on higher limbs. After hatch, larvae tunnel through the bark and into the tree for food. Damage to ash trees is caused by caterpillars disrupting the flow of nutrients and water between the canopy and roots of the tree. Specifically, they disrupt the passages that transport the tree's nutrients (phloem tubes) and water (xylem tubes) (5) Feeding by juveniles continues until October. Fully grown

caterpillars spend the winter just under the tree's bark. In spring, they pupate then emerge as adults between May and June, leaving a characteristic D-shaped exit hole in the bark. (3, 5, 1). (See Figure 1.) Researchers have observed some deviation from this one year cycle, in which larvae take two and sometimes three years to grow before pupation. They also noted that two year larvae are often more prevalent in lightly infested areas. It has been speculated that these developmental differences area related to temperature or degree of infestation in a given area (2).

An initial infestation of Emerald Ash Borer is often undetected, but tree health declines rapidly with most trees dying within 1 to 4 years of infestation depending on size (11). Early signs of EAB infestation include increased woodpecker (predator) activity, vertical splits in the tree bark, and S-shaped channels under the bark caused by larvae. (See Figure 3.) Later signs include D-shaped exit holes from adults, secondary fungal infection, dieback of leaves in the upper third of the tree, and the appearance of new shoots on the tree's trunk (10, 4). (See Figures 4 and 5.)

Given the devastation caused by EAB, and to prevent total loss of ash trees, there have been efforts to control the insect's spread. Firebreak methods have been employed, in which a band of trees surrounding core infestation areas is removed, isolating the insect so that it will starve itself as it kills the remaining host trees. The firebreak method has been moderately successful but does not restrict human transport (5, 9). Other methods of EAB control include the quarantine of firewood, and wood chips and ash trees in nurseries. The success of these efforts depends heavily on public education and outreach efforts, so that people understand the importance of actions that might not initially be logical (i.e. removal of apparently healthy trees). Further methods, currently being researched, include biological controls such as the use of parasitoids (natural enemies) (8).

The economic impacts of the Emerald Ash Borer are huge, costing municipalities,

property owners, and nurseries 10's of millions of dollars (3). Estimates predict that more than 20 million ash trees have been killed in Ohio, Indiana and Michigan with most of the devastation occurring in southeast Michigan. Costs include the removal of trees and their stumps, replanting, and commercial losses. If the EAB continues to spread, these economic losses, as well as biological and emotional losses, can be expected to increase.

Unfortunately, further spread of the insect is likely, because the emerald ash borer is a non-native invasive species. As a result, North American trees have not developed the natural resistance to the insect that Asian ash trees have (6, 7). Additionally, the low genetic variability of ash trees in Michigan makes it unlikely that they will develop natural resistance quickly enough to stop the spread of EAB infestation. There are thought to be 8 billion ash trees in America (4). If the low genetic diversity of ash in Michigan cities is representative of urban forests in other parts of the country, the risk of damage by the Emerald Ash Borer is enhanced nation-wide (7). It is possible that the effects of EAB could eventually be comparable to the historical effects of Dutch Elm Disease (5). Paradoxically, many ash trees were planted to replace lost elm trees (7). Both of these large scale population losses demonstrate the importance of planting a wide variety of street tree species, so that the biological, economic and emotional effects of another disease or infestation will be less noticeable.

Figure 1. Adult emerald ash borer and D-shaped exit hole.

http://www.ojibway.ca/eab1.jpg

Figure 2. Larval emerald ash borer.

http://ceris.purdue.edu/napis/gif/eab-larva.jpg

Figure 3. S-shaped channels under ash bark caused by EAB larvae.

http://www.entomology.wisc.edu/emeraldashborer/images/EAB-larva-tunnels2.jpg

Figure 4. Vertical splits in ash tree damaged by EAB.

http://www.aphis.usda.gov/ppq/ep/eab/photo_gallery/images/Pict0222.jpg

Figure 5. Ash tree in late stages of decline following EAB infestation.

http://www.entm.purdue.edu/EAB/images/ashPage/damagedTree.jpg

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