An Introduction to the Emerald Ash Borer

Photograph by Steven Valley
Emerald ash borer (EAB) is a green-colored beetle...

...that develops in ash trees (Fraxinus species)...

Emerald ash borer (EAB) is a green-colored beetle......
......and is Native to Asia

Native range of Emerald Ash Borer in Asia.

Presence of emerald ash borer has also been reported in adjacent Mongolia and Russia.
Emerald ash borer was accidentally introduced into and has since spread through North America.
Emerald ash borer is devastating to all species of ash that are native to North America.
Chestnut blight – Devastated American chestnut in early 1900s, caused by a fungus

Dutch elm disease – Devastated American elm in mid century. Caused by a fungus, vectored by a bark beetle
Emerald ash borer
*Agriius plan nipennis*

Order Coleoptera (beetles)
Family Buprestidae (metallic wood borers, flatheaded borers)

Photograph by David Cappaert

Photograph by Debbie Miller
Several *Agrilus* species of flatheaded borers (metallic wood borers are already present in CO)
Bronze birch borer

*Agrilus anxius*
Larvae make meandering tunnels under the bark.
Honeylocust borer
*Agrilus difficilis*

Gambel oak borer
*Agrilus quercicola*
Emerald ash borer has complete metamorphosis
Adults cut through the bark to emerge in mid to late spring.

After emergence they feed on ash foliage for a period and eggs mature.
When are emerald ash borer adults first active?

Typically late May. Flight appears to coincide with peak bloom of black locust.
After mating females lay eggs on the bark
Upon egg hatch the larvae enter the trunk to feed and grow

Photograph by Houping Liu

Photograph by David Cappaert
Larvae make meandering tunnels under the bark

Photograph by David Cappaert
As an EAB infestation progresses, the phloem, cambium and outer sapwood is progressively destroyed.

Photograph by James W. Smith
When full grown the larvae tunnel into the sapwood to produce a cell within which they will pupate.

Photograph by David Cappaert

Photograph by D.B. Lyons
Adults emerge the following spring.

One year life cycle with one generation/year is the norm.
Identifying an EAB-affected tree
Meandering tunnels underneath the bark that are produced by the larvae
D-shaped hole produced by adults as they exit
A generalized, progressive thinning of the crown – ultimately leading to death - is the primary external symptom of EAB infestation.
Flatheaded appletree borer – A flatheaded borer that will infest ash limbs that are in decline
Lilac/Ash Borer does not equal Emerald Ash Borer!

Lilac/ash borer, a clearwing borer moth

Emerald ash borer, a metallic wood borer/flatheaded borer
Emerald ash borer larvae create meandering tunnels in the phloem and outsapwood that produce girdling wounds.

*Note:* Initial attacks may be concentrated in the crown of the tree.
Lilac/ash borer larvae create irregular gouging wounds that extend often into the heartwood.

Attacks are concentrated at the lower trunk of the tree.
Control difference – Imidacloprid is only effective against flatheaded borers – not clearwing borers.
EAB adults chew through the bark, producing D-shaped exit holes
Lilac/ash borer emerges from irregularly round holes. The pupal skin is pulled out when the adult emerges.
Adults of the lilac/ash borer are present in mid-late spring. Most eggs are generally laid in May through early June.
EAB likely will emerge sometime in mid-May. Before eggs are laid it will feed on leaves of the tree canopy.

Eggs will be laid in June, perhaps into early July.
Eggs of both species are laid on the back of the host tree.
Damage potential to its host

10 – EAB now defines an aggressive tree killing insect in North America.
Damage potential to its host

2, maybe 3 – Lilac/ash borer has far lower ability to seriously damage its host
EAB Will Kill All Unprotected Ash

These trees can’t be saved. They are already dead.
Emerald Ash Borer is an Introduced Species Native to Asia
Why is EAB so destructive to ash trees in North America?

NA ash species lack ability to resist EAB
EAB Invasion Wave and Protection Needs

* Assumes doubling of affected ash and EAB yearly during growth
Colorado EAB
Tree #1

Located near the intersection of 30th and Valmont, Boulder
Present distribution of EAB in North America
Example for discussion: Let’s assume that the area of Boulder within the circle is the limit of current infestation
Where are we now with the EAB in Boulder?

* Assumes doubling of affected ash and EAB yearly during growth.
Main Points About Emerald Ash Borer in Colorado

• Known infestation presently confined to areas within Boulder City limits
  – In time will spread throughout South Platte drainage
  – Other areas of the state are at no greater risk than before detection

• Treatments are available that will protect individual trees
  – Each treatment option involves decisions balancing costs, environmental hazards, effectiveness and ease of application
Unlike states to the east, Colorado is highly compartmentalized due to its geography.

The current infestation is an infestation of the South Platte River drainage, not the State of Colorado.
Emerald Ash Borer has become established within in the South Platte River Drainage of Colorado – not the entire state of Colorado!
Within the next five years, emerald ash borer will move out of Boulder into the surrounding counties.
Over time the South Platte River Drainage will be colonized by emerald ash borer
Unlike states to the east, Colorado is highly compartmentalized due to its geography.

The current infestation is an infestation of the South Platte River drainage, not the State of Colorado.
Most of Colorado is no more – nor less – at risk of infestation by Emerald Ash Borer. EAB will be a problem due to Boulder infestation.
How far away is emerald ash borer from your community?
How far away is emerald ash borer from your community?

One truckload
Control Options for Management of Emerald Ash Borer
Emerald Ash Borer Control Options

• Soil applications with systemic insecticides
  – imidacloprid, dinotefuran

• Non-invasive trunk sprays of systemic insecticides
  – dinotefuran

• Trunk injections of systemic insecticides
  – Emamectin benzoate (Tree-Age), azadirachtin (Treeazin), imidacloprid
Target Life Stages for EAB Treatments

Adults as they feed on foliage

Young larvae that tunnel in the phloem and cambium
Trunk and foliar cover sprays targeting adults and newly hatched larvae.

*Not the optimal treatment available for this insect.*
Emerald Ash Borer Insecticides

- **Imidacloprid** (Merit, Xytect, Criterion, etc.)
  - Soil drench, possible trunk injection
- **Dinotefuran** (Safari, Zylam)
  - Basal trunk spray, possible soil drench
- **Emamectin benzoate** (Tree-Age)
  - Trunk injection only
- **Azadirachtin** (Treeazin)
  - Trunk injection only
Target EAB Life Stages of Systemic Insecticide Treatments

Larva shortly after egg hatch

Adult feeding on foliage
When are emerald ash borer adults first active?

Typically late May. Flight appears to coincide with peak bloom of black locust.
Soil application option – imidacloprid applied as drench or injection
Over-the-Counter Imidacloprid Formulations
Primary method of imidacloprid application – soil applications for root uptake
Optimal Application – Soil drench within 18-24 inches of the Trunk

Yes

No?
Use of High or Low Rates of Imidacloprid?

Low Rates (1X, 1/2X)
- Smaller trees
- EAB populations low, moderate
- Spring applications

High Rates (2X)
- Large trees
- High EAB populations present (peak outbreak phase)
- Fall applications
Imidacloprid Soil Treatments

Advantages
• Ease of application
• Low cost
• Wide availability
• Does not require tree wounding

Disadvantages
• Requires annual application
• Some lag in uptake
• Poor public perception (neonicotinoid insecticide)
• Total use limit/acre
Basal trunk spray with dinotefuran (Safari, Xylam)
Soil drench with dinotefuran (Safari, Xylam)
## Dinotefuran Trunk Sprays

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
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<tr>
<td>• Ease of application</td>
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<tr>
<td>• Does not require tree wounding</td>
<td>• Use likely limited to trees without thick bark</td>
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<td>• Rapid uptake following application</td>
<td>• Higher cost</td>
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<td>• High leaching potential</td>
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Trunk injection with emamectin benzoate (TREE-age)
**TREE-age Trunk Injections**

**Advantages**
- Can consistently provide 2 years control
- Provides lilac/ash borer control
- Applications can be made at many times during the season
- No maximum use/area limitation

**Disadvantages**
- Involves trunk wounding
- Requires skill in proper application
- High cost
- Restricted Use Pesticide
Trunk injection with azadiractin (TreeAzin)

Some efficacy and tree wounding issues are unresolved at present
TreeAzin Trunk Injections

Advantages
• Natural product with low environmental impact and good public perception
• No maximum use/acre limitation

Disadvantages
• Involves trunk wounding
• Likely requires annual application
  – Some evidence of 2\textsuperscript{nd} year activity
• High cost
All Systemics Need Water

- Soil drench
- Trunk sprays
- Trunk injection

Water carries the pesticide
What to Do in 2014?

• Boulder residents in High Risk areas need to make EAB treatment decisions now

• Everyone in Colorado should renew vigilance in detection of EAB infestations

• Communities within the South Platte drainage need to make long-term plans for EAB management now

• Revisit the Colorado situation this time next year (and every year)
This presentation will be saved on the

CSU Insect Information Web Site

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* Department of Bioagricultural Sciences and Pest Management