

**Bark Beetles**



**Wood Borers**



**Insects that Develop under the Bark of Trees, Shrubs**

**Tip Moths, Twig Borers**





## Wood Borers



# Extension Publications that Discuss Wood Boring Insects

## Shade Tree Borers

Fact Sheet No. 5.530

Insect Series | **Trees and Shrubs**

by W.S. Cranshaw\*

Several kinds of insects develop by tunneling in some manner within the branches, trunks or roots of trees and shrubs. The largest number of these are known as wood borers, which include various beetles, moths and an odd family of wood boring wasps (horntails).

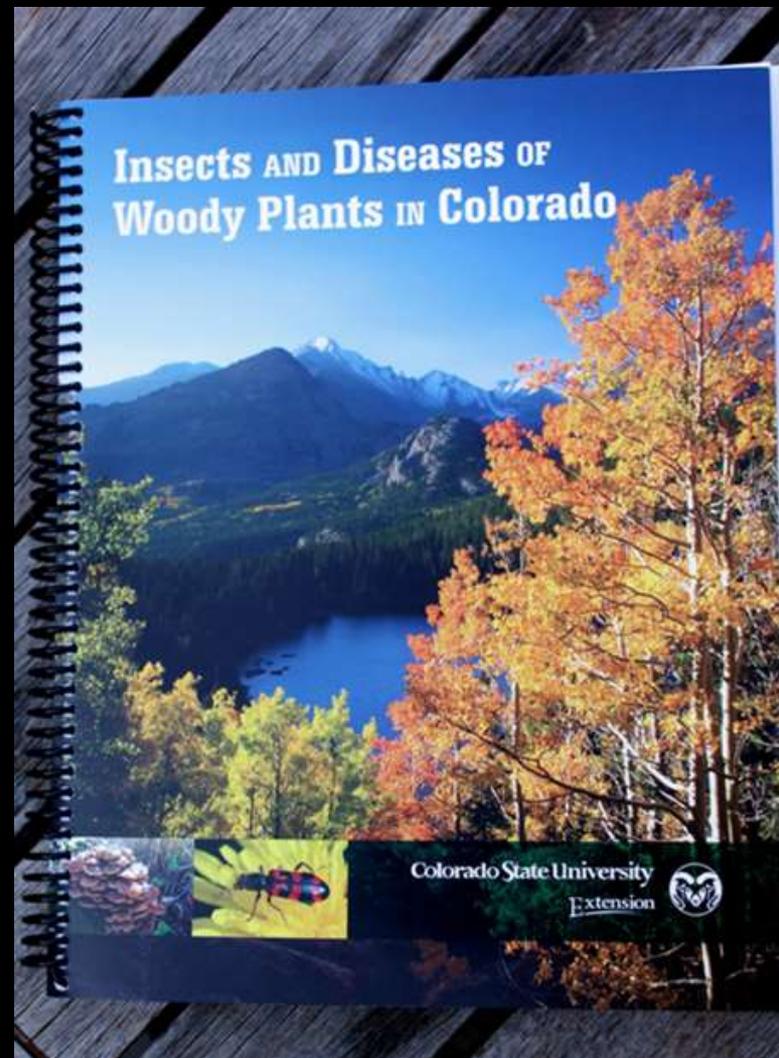
Most wood borers lay their eggs on the bark and the immature stage (larva) that follows chews into the plant to feed, tunneling or gouging areas within the plant as it develops. When they have completed their development, typically in one to two years, they transform to the adult form which then emerges from the plant to mate and lay the



**Figure 1:** Bronze birch borer laying egg under bark crevice. Photograph by David Shetlar, The Ohio State University.

**Fact Sheet 5.530**

**Bulletin 506A**



# Some General Features of Wood Borers

- Eggs are laid singly on, into, or just underneath the bark
- The larvae enter the woody parts of the plant (branches, trunk, roots) to feed
- Primary feeding sites vary by species
  - Cambium and associated Phloem, Xylem
  - Heartwood
  - Roots

# Several insects work as borers:

- **Some beetle larvae (Coleoptera)**
  - Flatheaded borers/Metallic wood borers
  - Roundheaded borers/Longhorned beetles
  - Weevils
- **Some moth larvae (Lepidoptera)**
  - Clearwing borers
  - Carpenterworms
  - Pyralid borers
- **Some wasp larvae (Hymenoptera)**
  - Horntails

# Flatheaded Borers/Metallic Wood Borers

Coleoptera: Buprestidae



# Flatheaded Borer



Larvae make meandering tunnels packed with fine grained sawdust





**Granular sawdust  
is typically excreted  
and packs the  
larval tunnels**



Many flatheaded borers are “non-aggressive” and limit their tunneling to areas of the trunk that were previously damaged or recently killed by pathogens



**Outbreak attacks by flatheaded borers can extensively destroy the phloem and outer xylem of trunks or limbs**



**On thin-barked hosts external evidence may be raised ridges of the bark where the tree has formed callus tissue in response to borer wounding**

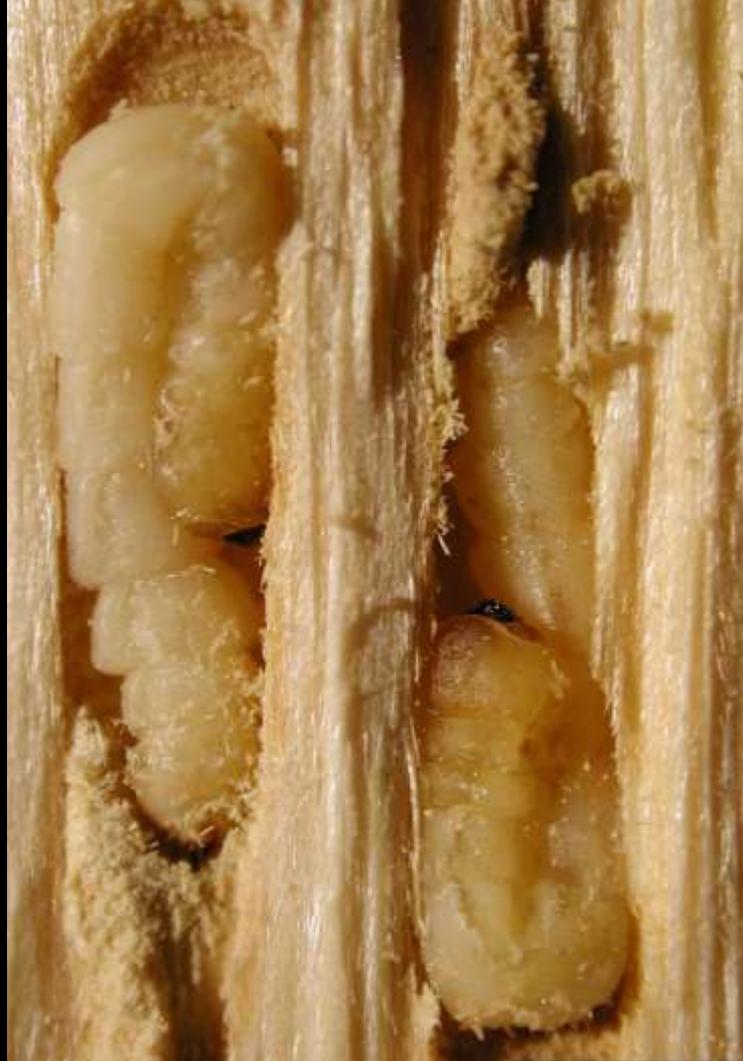




**Thinning of the crown is a common symptom of flatheaded borer infestation**

**This is the result of the cumulative effects from the larval tunneling.**

**After the larva is  
full-grown.....**



**....it will pupate under the bark.**

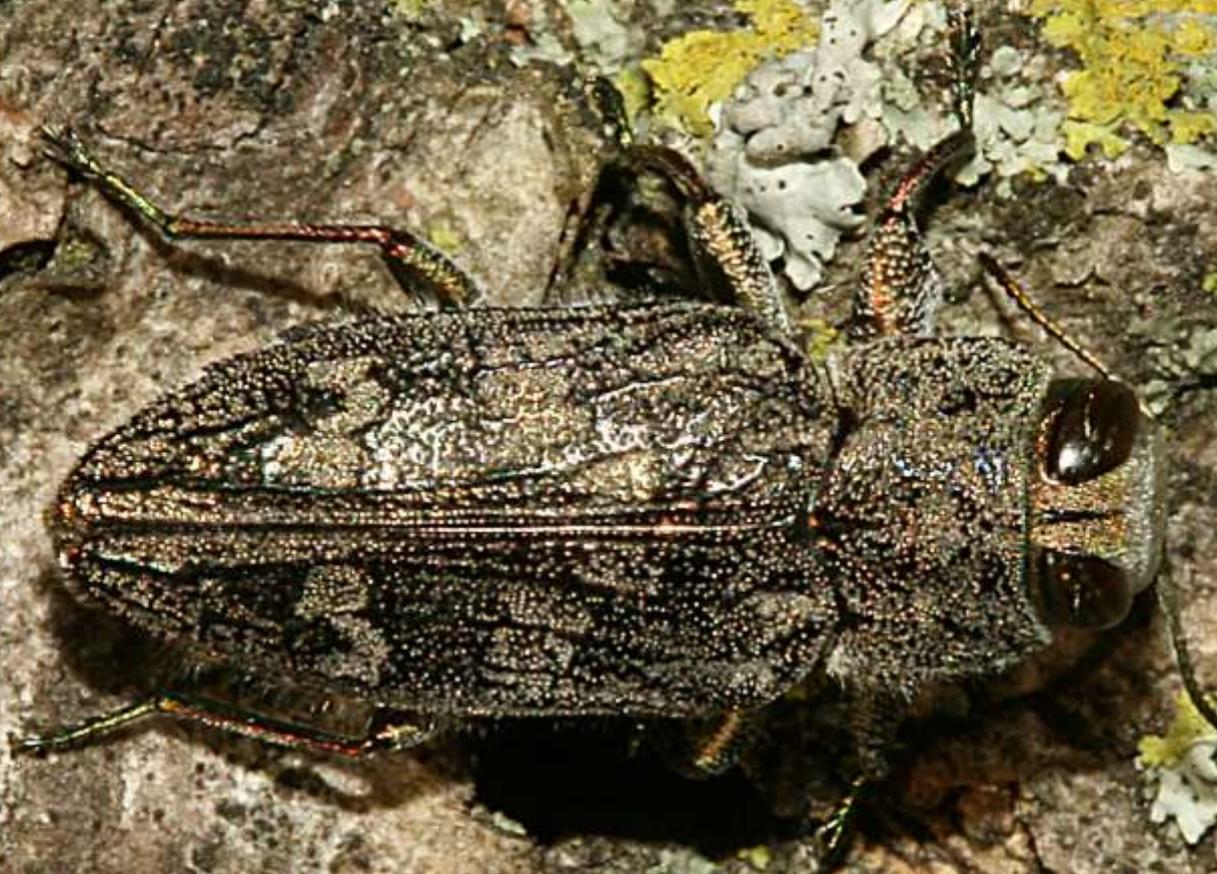
When the pupal stage is complete, an adult then works its way to the outside, chewing through the bark







Metallic wood borer - an adult of a flatheaded borer





**D-shaped exit holes made by flatheaded apple tree borer**

The emerging insect  
cuts an exit hole that is  
D-shaped

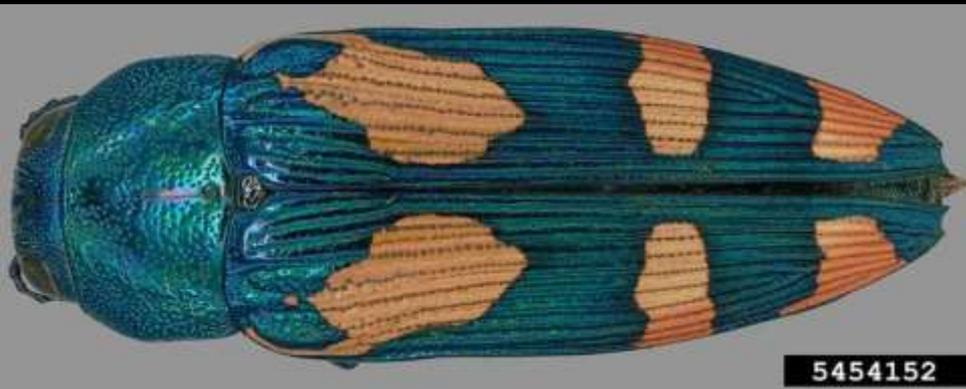


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**Metallic Wood Borer**  
**Adult form of a**  
**flatheaded borer**



**Some metallic wood borers have bright coloration**



Photographs on left courtesy of Steven Valley, Oregon Department of Agriculture

**Earrings made from wing covers of a metallic wood borer**



Photograph courtesy of David Shetlar



**Adults insert eggs into protected sites such as bark cracks and under flaps of loose bark**



Photograph courtesy of David DaCpaert

**Eggs on bark**



Photograph by Houping Liu, Michigan State University

**Egg shortly before hatch**

Bronze cane borer/  
Rose stem girdler



Gambel oak borer

**Four common *Agrilus* species  
metallic wood borers**



Bronze birch borer



Honeylocust borer

# Bronze birch borer

*Agrilus anxius*



**Affected birch trees may see progressive thinning of the canopy, branch dieback, and ultimately death of the tree**





A native species that causes little damage to its native host – Gambel oak

It is becoming a serious pest in some areas of English oak

**Gambel oak borer**

*Agrilus quercicola*



A flatheaded borer that is common – but minimally aggressive

## Honeylocust borer

*Agrilus difficilis*



Attacks are almost always limited to areas of the tree killed by sunscald, wounds or damaged by fungal cankers





Photograph by Debbie Miller

# Emerald ash borer

*Agrilus plannipennis*

**A non-native insect that is extremely aggressive. All species of ash (*Fraxinus*) are highly susceptible.**



Photograph by David Cappaert



**Eggs on bark**



**Egg shortly before hatch**

# Larvae tunnel under the bark girdling the cambium



UGA5016056



Photo by Edward Czerwinski

**Effects of larval tunneling are cumulative, and ultimately lethal to the tree. Most trees are dead within 5 years after the initial colonization.**



Photograph by Art Wagner



Photograph by MI Department of Agriculture



UGA5110034



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**EAB adults chew through the bark, producing D-shaped exit holes**

Photo by David Cappaert



**Damage potential to its host**

**10** – EAB now defines an aggressive tree killing insect in North America.



Photograph by Eric Day



# Colorado EAB Tree #1

Located near the  
intersection of 30<sup>th</sup>  
and Valmont, Boulder

September 23, 2013

*How did it get to  
Colorado?*

# Sixth Anniversary!

Emerald Ash Borer in Colorado



**2018 detection Lyons**

**2019 Detection SW of Berthoud**

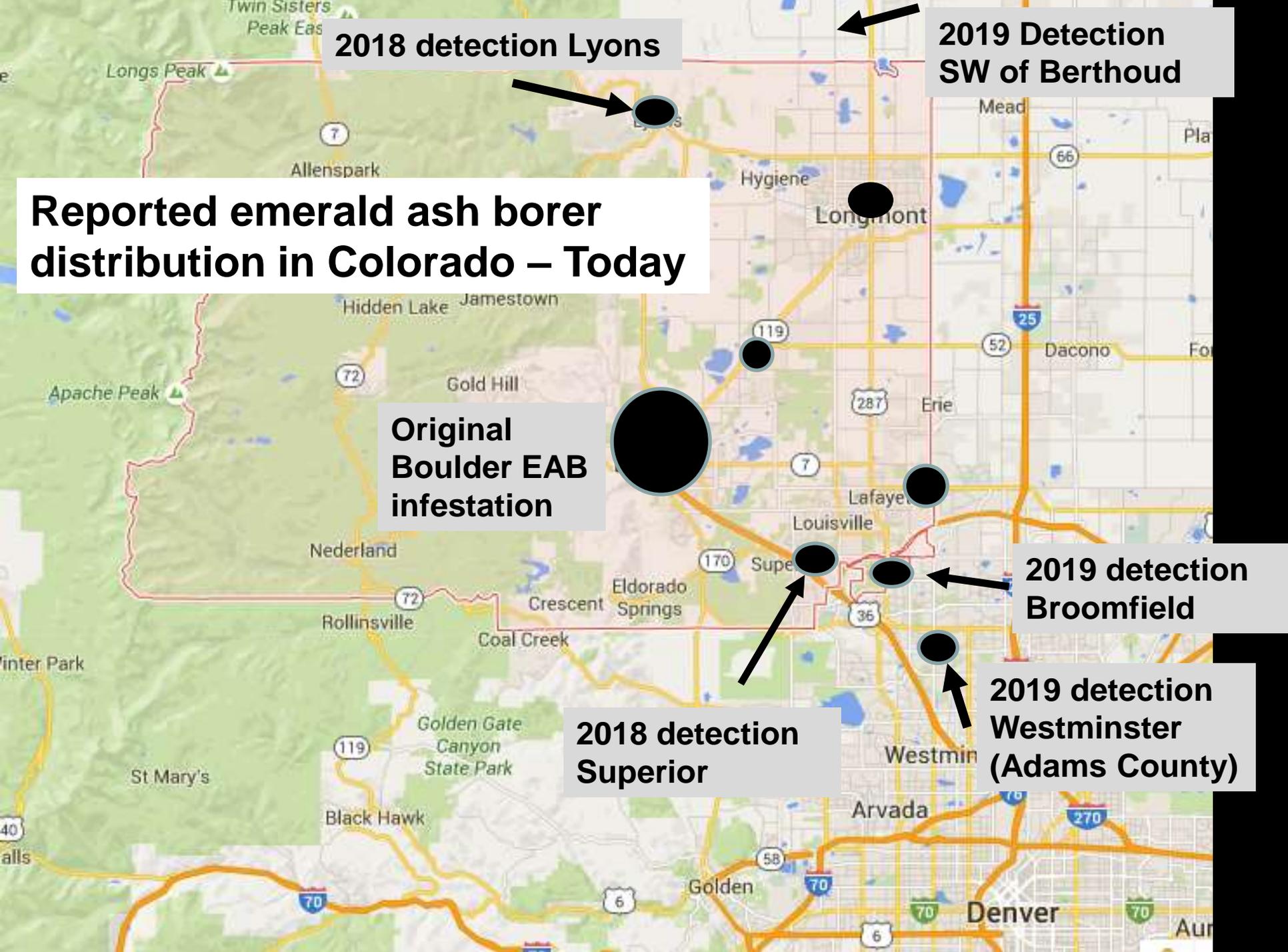
**Reported emerald ash borer distribution in Colorado – Today**

**Original Boulder EAB infestation**

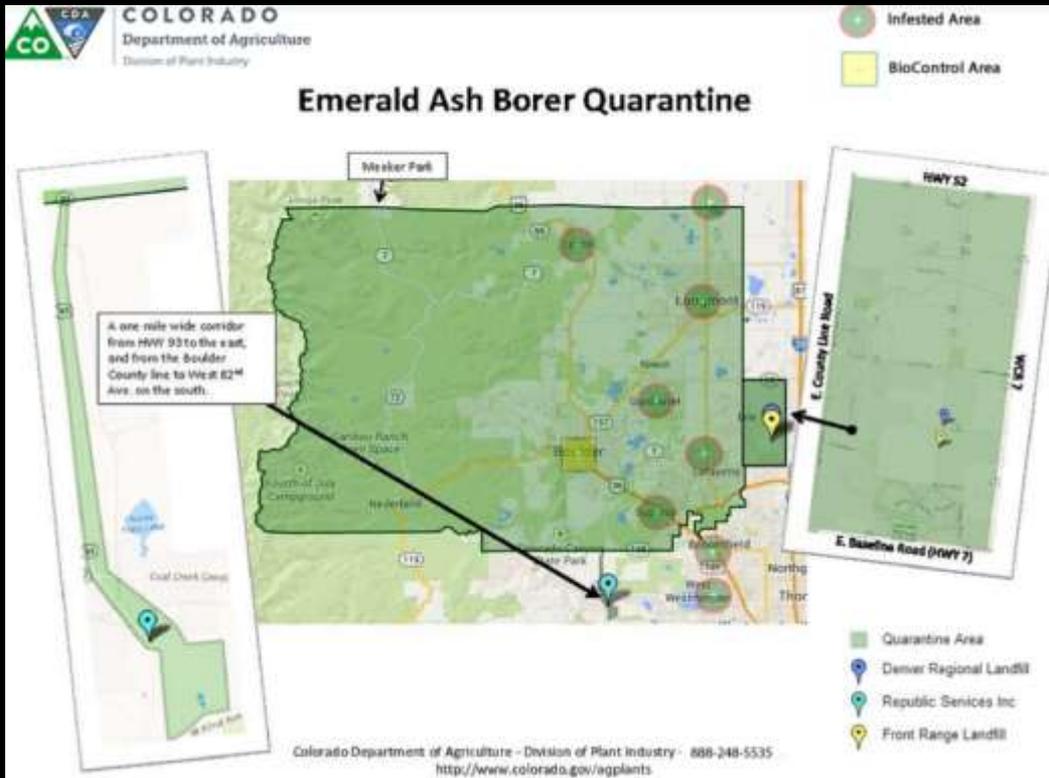
**2019 detection Broomfield**

**2018 detection Superior**

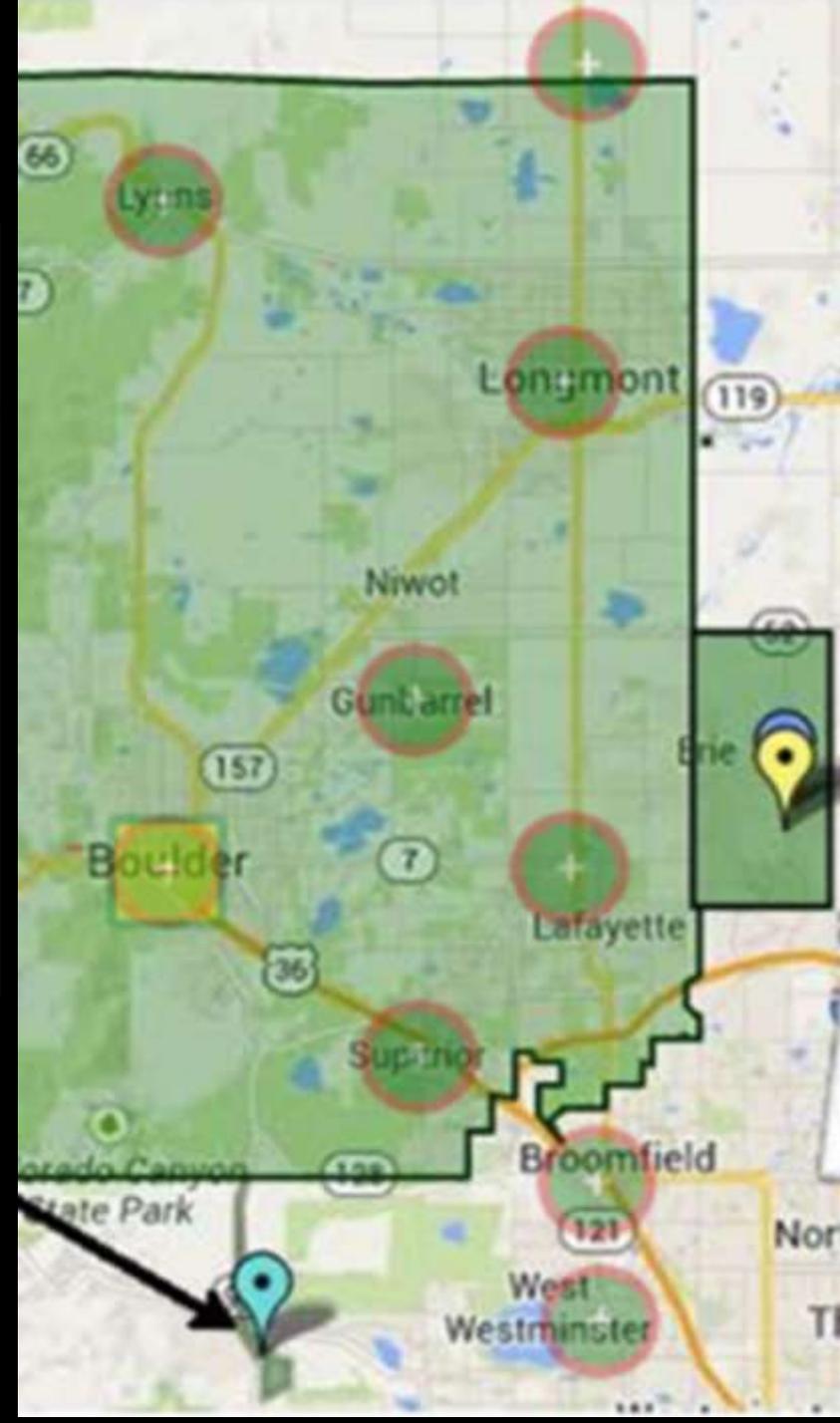
**2019 detection Westminster (Adams County)**



This is the map you can find of EAB distribution on the Colorado Department of Agriculture (CDA) Web Site



The newest findings are outside Boulder County, which has been an EAB quarantine zone since 2013



# **How will EAB spread once established?**

- **Wind-blown dispersal of adults**
  - **Peak period of adult dispersal is late May through late July**
- **Butt-heads that move wood containing developing stages**



**EAB likely will  
emerge sometime  
in mid-late May.**

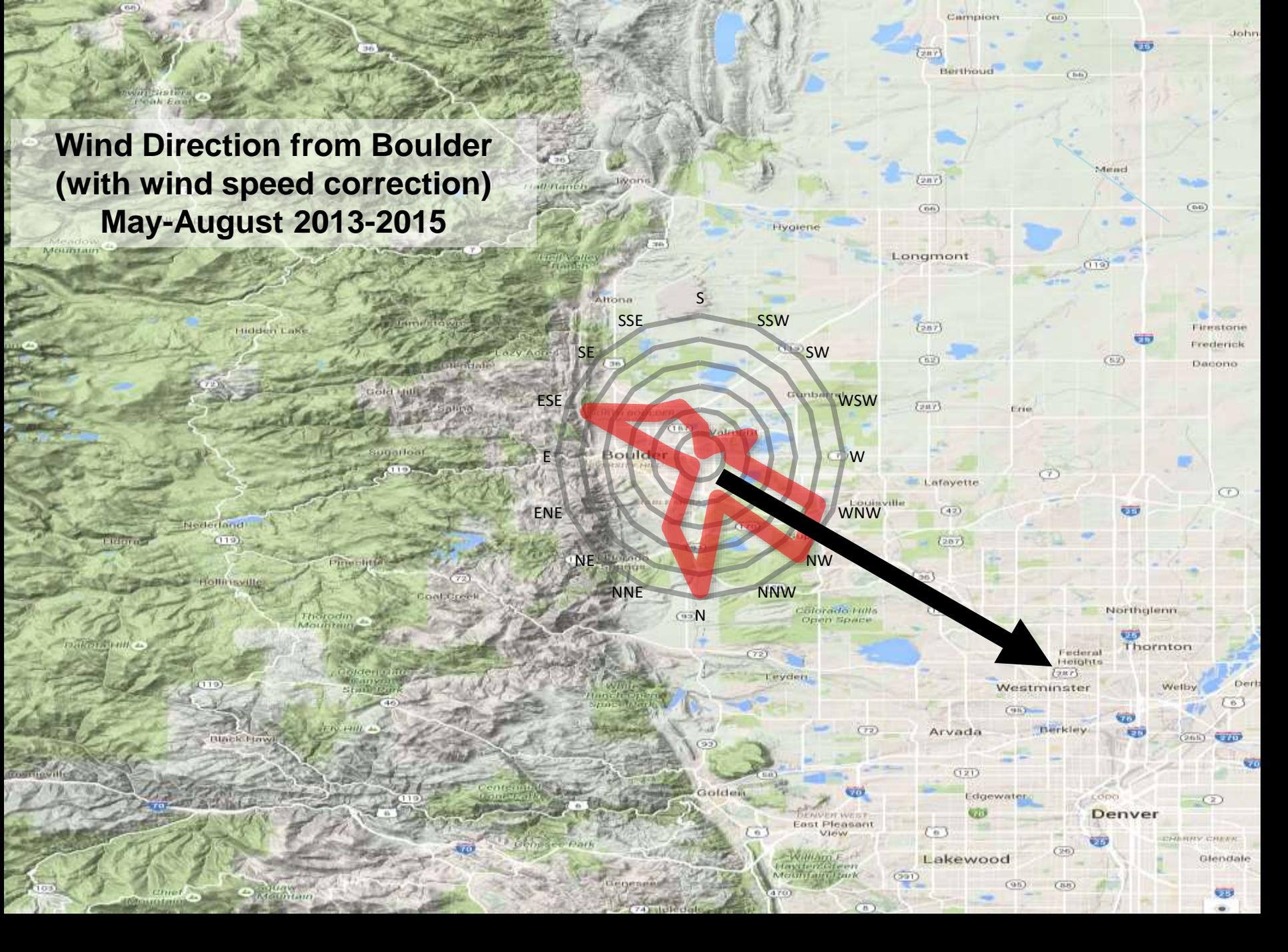
Photograph by David Cappaert

**Most eggs will  
be laid in June,  
egg laying will  
continue  
through summer**



Photograph by Dan Herms

# Wind Direction from Boulder (with wind speed correction) May-August 2013-2015



# How far away is emerald ash borer from your community?



# How far away is emerald ash borer from your community?



**One  
truckload**

# **Diagnosis – Flatheaded Borer Injury**

- **Meandering tunnels produced under the bark**
  - **Tunnels packed with fine sawdust**
- **Plant shows decline/thinning crown**
- **D-shaped exit holes in bark**

# Roundheaded Borers/ Longhorned Beetles

Coleoptera: Cerambycidae



**Adults – longhorned  
beetles – have long  
antennae**





When laying eggs, the female longhorned beetle first chews a pit in the bark. She later lays an egg into the pit.



The egg is inserted underneath the bark; it is not laid on the surface.



# Roundheaded Borer – the larval stage of a longhorned beetle





Much of the feeding by roundheaded borers is in the interior of the tree, producing a damage pattern that riddles the trunk





**The tunnels are generally oval in cross-section**

**The excreted sawdust can be either coarse and stringy, or finely grained**



# Coarse sawdust may be expelled from the tree by roundheaded borers



**After the roundheaded borer has completed feeding, it transforms to the pupal stage, a transition to the longhorned beetle adult form**



Pupae of roundheaded borers





**The adult longhorned beetle chews its way through the bark. An oval-round exit hole is produced.**





The adult longhorned beetle chews its way through the bark. An oval-round exit hole is produced.

Adults feed on foliage or twigs, but the resultant injuries that are rarely noticeable





# Pine Sawyers

*Monochamus species*

**Common borers that  
develop in dying,  
recently killed pines**





Two species of  
pine sawyers are  
present in  
Colorado

**Spotted pine sawyer**  
*Monochamus clamator*



**Whitespotted pine sawyer**  
*Monochamus scutellaris*



# Poplar Borer

**Hosts:** Mature aspens, poplars

**Note:** This species takes two years to complete its life cycle





**Brownish ooze is often produced at wound sites of the poplar borer on aspen**



**Locust Borer**

**Host: Black locust**



**'Purple Robe' locust is extremely susceptible to locust borer**



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A somewhat different pattern –  
**Blackhorned pine borer**



Larvae sculpt out areas underneath the bark of dead conifers

Sawdust is packed and usually granular



**Note: This insect only appears in trees that are dead or very, very near dead**

# **Diagnosis – Roundheaded Borer Injury**

- **Tunneling penetrates into heartwood of the tree**
  - **Riddling, structural weakening**
- **Coarse sawdust typically produced**
- **Oval-round exit holes in bark**

# Clearwing Borers

Lepidoptera: Sesiidae





**Adult clearwing borers are day-flying moths that mimic bees and wasps.**



# Some Common Clearwing Borers of the Region

- Peach tree borer (*Prunus* spp.)
- Lilac/Ash borer (ash, lilac, privet)
- Currant borer (*Ribes* spp.)
- Viburnum borer (*Viburnum* spp.)
- Raspberry crown borer (raspberry)
- Cottonwood crown borer (Cottonwood)



**Larvae chew, irregular gouging wounds under the bark.**

**Most larvae of clearwing borers feed at or below the soil surface – the crown area of the roots – and may be known as crown borers.**

**What kind of wood borer do you have?**

**Flatheaded borer?  
(Coleoptera)**



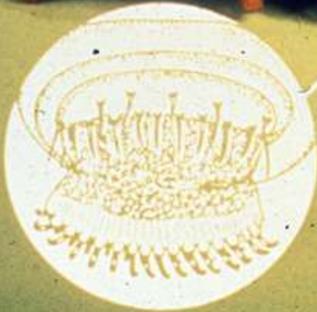
**Clearwing borer?  
(Lepidoptera)**



**Roundheaded borer?  
(Coleoptera)**



# LEPIDOPTERA



proleg with  
crochets

All larvae of moths and butterflies (Lepidoptera) have prolegs on the abdomen.

These legs are tipped with hooks, the crochets.

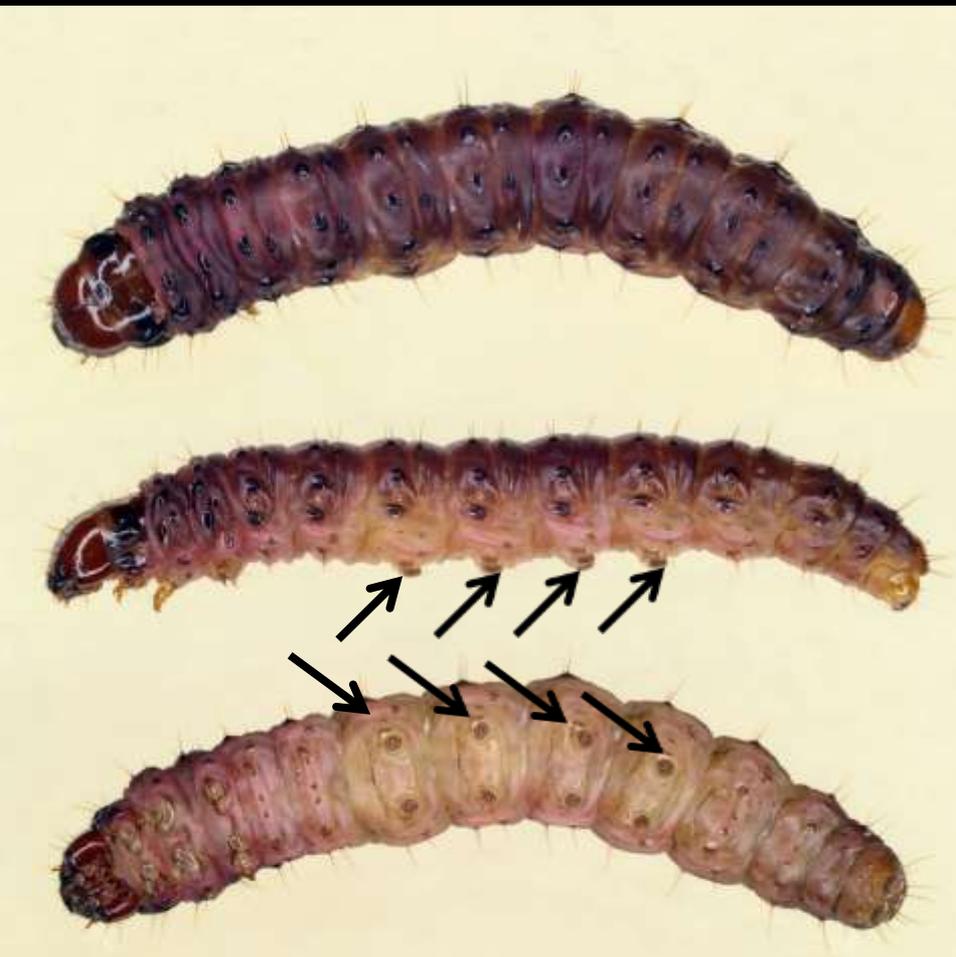


Top view of peachtree borer larva



# Prolegs on the abdomen, tipped with the crochets

Top (dorsal) side, and bottom (ventral view) of a Zimmerman pine moth larva



Photographs courtesy of David Shetlar, Ohio State University



Bottom view of peachtree borer larva

Photograph courtesy of Jim Kalisch, University of Nebraska

# Lilac/Ash Borer

*Podosesia syringae*





**Larvae of the lilac/ash borer are known to damage ash, lilac and privet.**

**In Colorado it has proven to be primarily an insect associated with ash trees in sites with some growing stresses**



# Lilac/ash borer injury to base of ash - exterior



Lilac/ash borer damage to base of ash -interior





**Ash trees are particularly susceptible during establishment and when bark is thin**





**Exit holes made by the adult moth upon emergence are slightly oval, nearly round**



**Lilac ash borer adults emerge early in the year  
– sometimes beginning in late April**





**Peachtree Borer**  
(aka Peach Crown Borer)

*Synanthedon exitiosa*

**Peach tree borer larvae feed at the crown area of the plant or on larger roots**



**The pupal skins  
may be observed  
around the base  
of infested  
plants.**



**Pupation occurs with a cocoon,  
covered with bits of wood chips,  
and is produced just beneath the soil line.**



**Upper left:** Peach tree borer female

**Upper right:** Peach tree borer male

**Lower left:** Pupal skin extruded from  
case of silk and wood fragments



**After mating, the females lay eggs on the surface of the bark, near the base of the plant**



# **Diagnosis – Clearwing Borer Injury**

- **Tunneling often concentrated at the base (root crown) of the plant**
- **Tunneling an irregular gouging**
- **Pupal skins often are pulled out upon adult emergence**

One last group of Wood Borers!

# Horntails

Hymenoptera: Siricidae





## Pigeon Tremex

*Tremex columba*



A wood boring wasp  
that attacks  
hardwood trees in  
advanced decline



Larva in  
wood



Adults emerge from perfectly round  
exit holes in early-mid summer

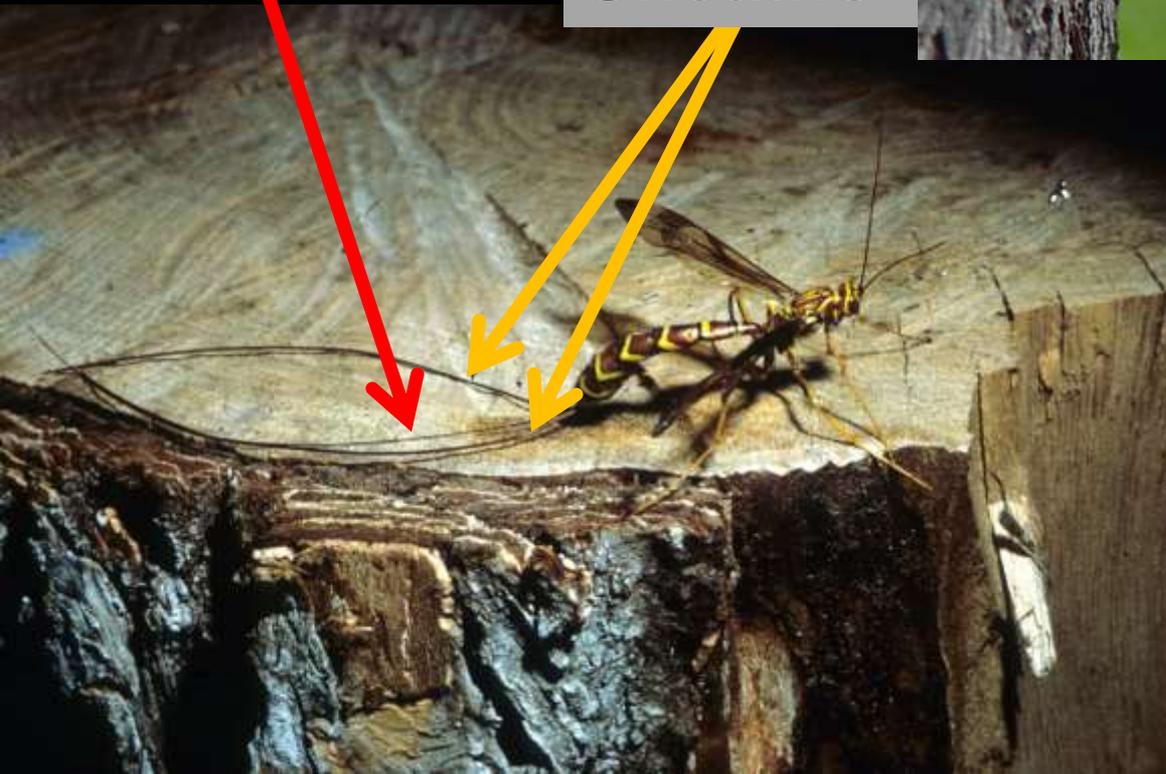




**Giant ichneumon  
wasp – a spectacular  
natural enemy of the  
pigeon tremex**

**Ovipositor**

**Sheaths**





# Pigeon Tremex and Giant Ichneumon Wasp

***Fact Sheet 5.604***

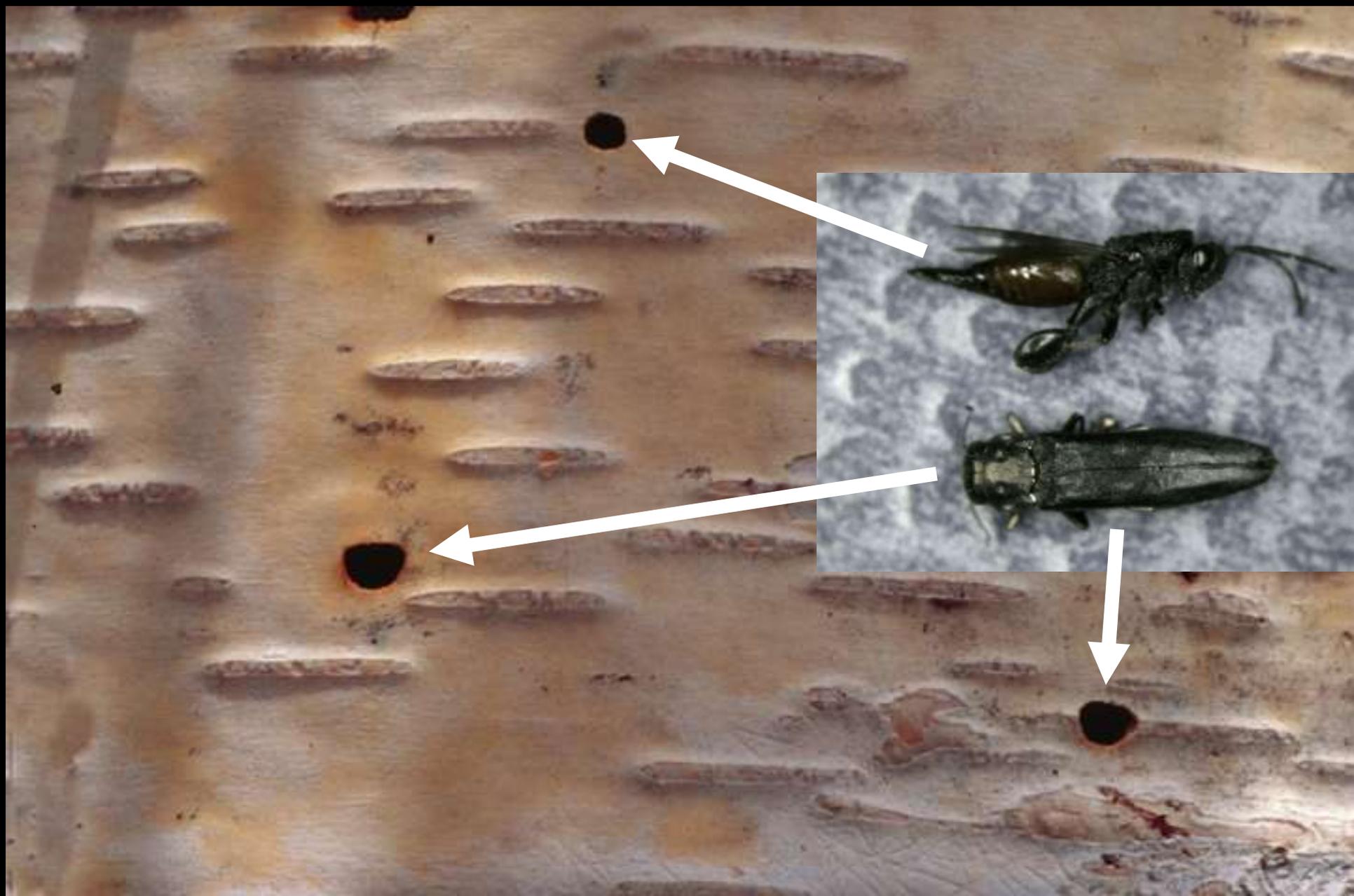
# Wood Borer Management

- **Biological Controls**
- **Cultural Controls**
  - Use resistant species/cultivars
  - Mulching, provision of even moisture
- **Chemical Controls**
  - Preventive trunk sprays
  - Systemic insecticides

**Adults chew their way through the bark, creating a D-shaped exit hole that is in the shape of their body**



**Bronze birch borers emerge from D-shaped exit holes; a natural enemy (parasitoid wasp) comes out of a round hole**

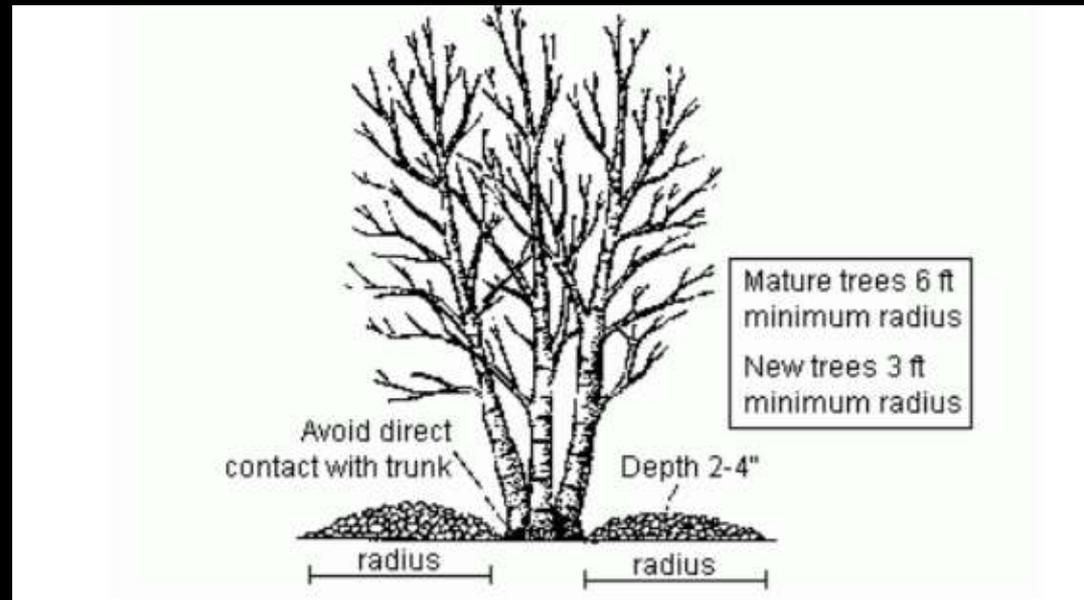


# Bronze birch borer has a range of aggressiveness, related to birch species

- **Highly Susceptible**
  - European white birch
  - Jacquemonti birch
- **Moderately Susceptible**
  - Paper birch
  - Yellow birch
  - Whitespire birch
- **Very Low Susceptability**
  - River/Red birch



Mulching a large area around the birch tree (more than shown on left) can reduce stresses by providing more even moisture to the roots



This increases tree vigor – and ability of the tree to resist bronze birch borer injury



Preventive insecticide sprays are standard for many types of wood borer (and bark beetles)

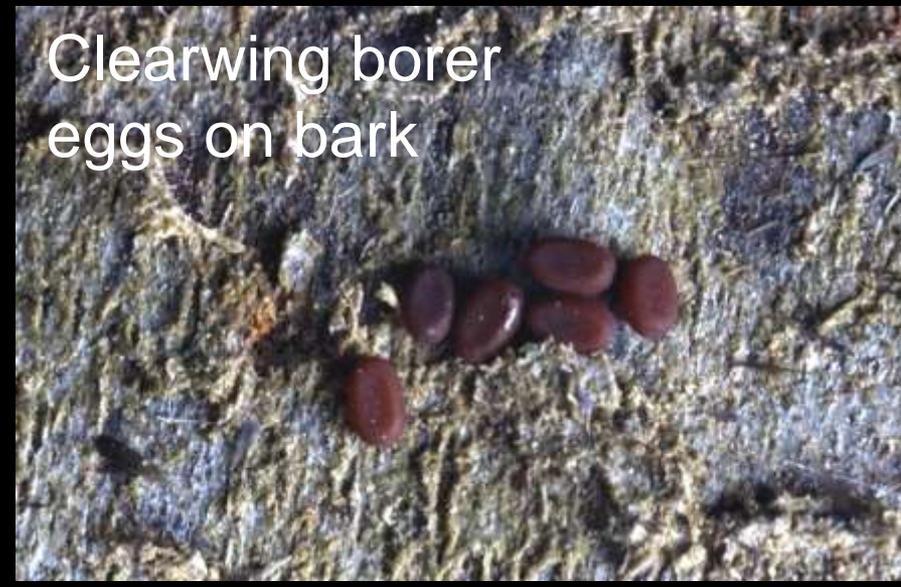
# Preventive Use of Insecticides

Treatments are not available *for most borers* currently in a plant



# Key Timing Point in Wood Borer Prevention

Target exposed life stages  
(Adults/Hatching Eggs)





**Trunk sprays of insecticides are timed to kill adults and newly hatching larvae**



# For most borers flight periods can be estimated

## Shade Tree Borers

Fact Sheet No. 5.530

Insect Series | Trees and Shrubs

by W.S. Cranshaw\*

Several kinds of insects develop by tunneling in some manner within the branches, trunks or roots of trees and shrubs. The largest number of these are known as wood borers, which include various beetles, moths and an odd family of wood boring wasps (horntails).

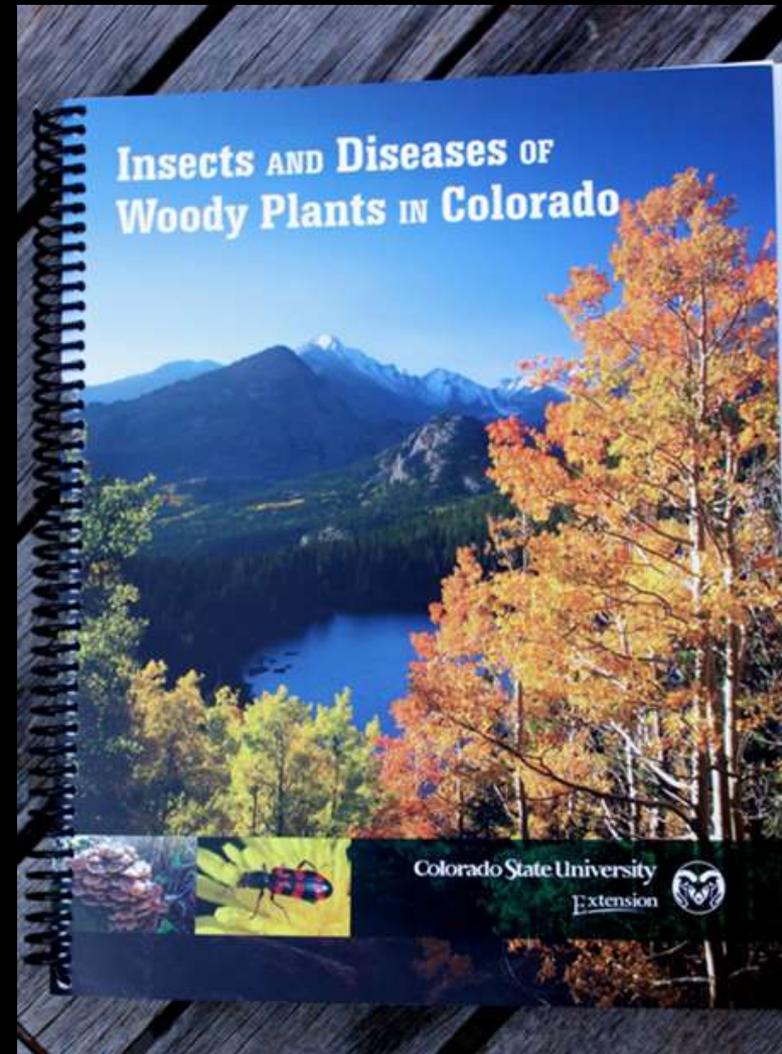
Most wood borers lay their eggs on the bark and the immature stage (larva) that follows chews into the plant to feed, tunneling or gouging areas within the plant as it develops. When they have completed their development, typically in one to two years, they transform to the adult form which then emerges from the plant to mate and lay the



**Figure 1:** Bronze birch borer laying egg under bark crevice. Photograph by David Shetlar, The Ohio State University.

Fact Sheet 5.530

Bulletin 506A



**Table 2.** Flight periods and host plants of common wood borers in Colorado

<b>Common Name (if any), Scientific Name</b>	<b>Common Hosts</b>	<b>Typical Flight Period</b>
<b>METALLIC WOOD BORERS</b> (Coleoptera: Buprestidae)		
<b>Flatheaded appletree borer</b> - <i>Chrysobothris femorata</i>	Apple, maple, oak, other hardwoods	June-August
<i>Chrysobothris texana</i>	Junipers	mid June-early August
<b>Emerald ash borer</b> - <i>Agrilus planipennis</i>	Ash	late May-early August
<b>Bronze birch borer</b> - <i>Agrilus anxius</i>	Birch	June-July
<b>Honeylocust borer</b> - <i>Agrilus difficilis</i>	Honeylocust	June-July
<b>Bronze poplar borer</b> - <i>Agrilus ligarus</i>	Aspen, other Populus	June-August
<b>Bronze cane borer</b> - <i>Agrilus cuprescens</i>	Raspberry, currant, rose	late May-June
<b>Gambel oak borer</b> - <i>Agrilus quercicola</i>	Oak	early June-late July
<b>LONGHORNED BEETLES</b> (Coleoptera: Cerambycidae)		
<sup>1</sup> <b>Cottonwood borer</b> - <i>Plectodera scalator</i>	Willows, poplars, cottonwoods	July-August
<sup>1</sup> <b>Locust borer</b> - <i>Megacyllene robiniae</i>	Black locust (Robinia)	August-September
<b>Poplar borer</b> - <i>Saperda calcarata</i>	Populus, willow	June-August
<b>Redheaded ash borer</b> - <i>Neoclytus acuminatus</i>	Ash, fruit trees, other hardwoods	April-June
<b>Pine sawyers</b> - <i>Monochamus</i> species	Pines, spruce, fir	May-October
<b>Blackhorned pine borer</b> - <i>Callidium antennatum</i>	Pines	May-June

# Approximate Periods when Adult Stages of Some Borers are Active

- **Lilac/ash borer** – late April-early June
- **Peachtree borer** – late June-early August
- **Emerald ash borer** – late May-July
- **Bronze birch borer** – late May-July
- **Zimmerman pine moth** – August-September
- **Locust borer** – August-September

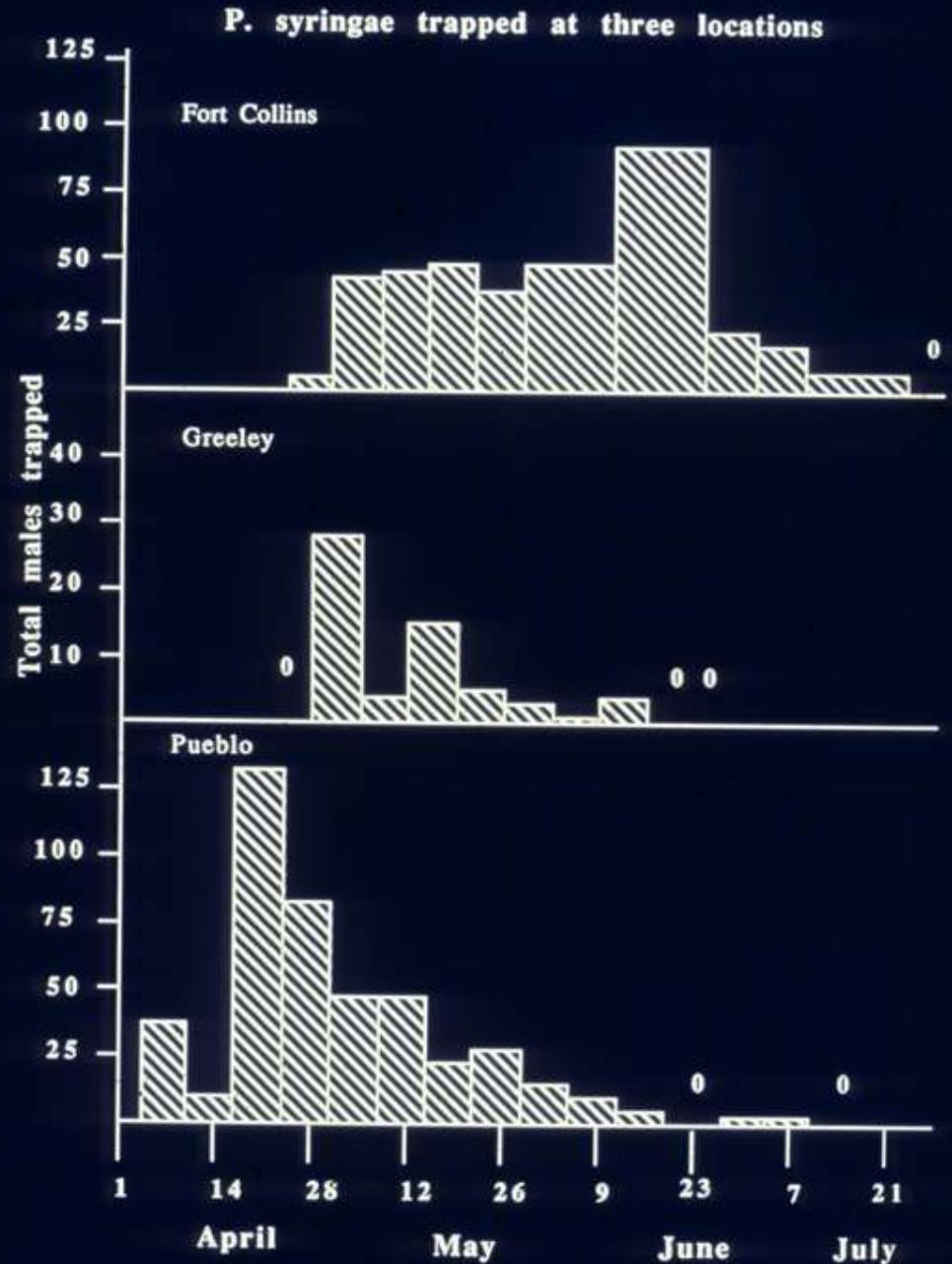
# Pheromone Traps – A tool for monitoring some insects







# Pheromone trap data for lilac ash borer





# Active Ingredients of Wood Borer Insecticides (Trunk Sprays)

- Permethrin (Astro, Permethrin, etc.)
- Bifenthrin (Onyx)





**Only One OTC product, containing permethrin, has a label and use rate that allows effective use against Borers and Bark Beetles!**

- Soil Insect And Termite Killer.
- Kills Home-Invading Pests (Outdoor).
- Controls Wood-Destroying Insects.

FOR OUTDOOR HOMEOWNER (RESIDENTIAL) USE ONLY.  
 FOR OUTDOOR HOMEOWNER POST CONSTRUCTION USE ONLY.

ACTIVE INGREDIENT:	
Permethrin*	38.0%
OTHER INGREDIENTS**	62.0%
TOTAL	100.0%

**KEEP OUT OF REACH OF CHILDREN**  
**CAUTION**

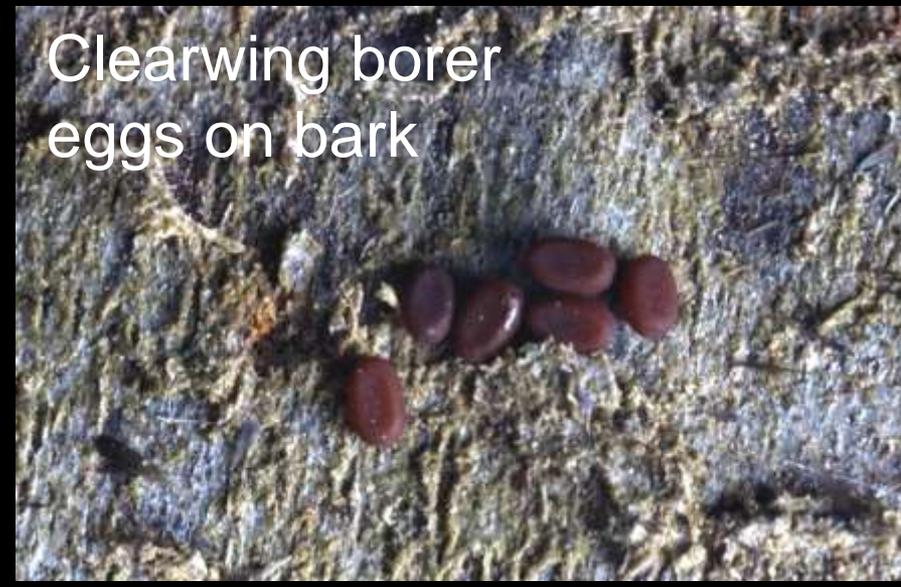
\*Active ingredient: Max 52% (s) cis and min. 45% (s) trans  
 \*\*Contains petroleum distillates.

See Back/Side Panel For Additional Precautionary Statements

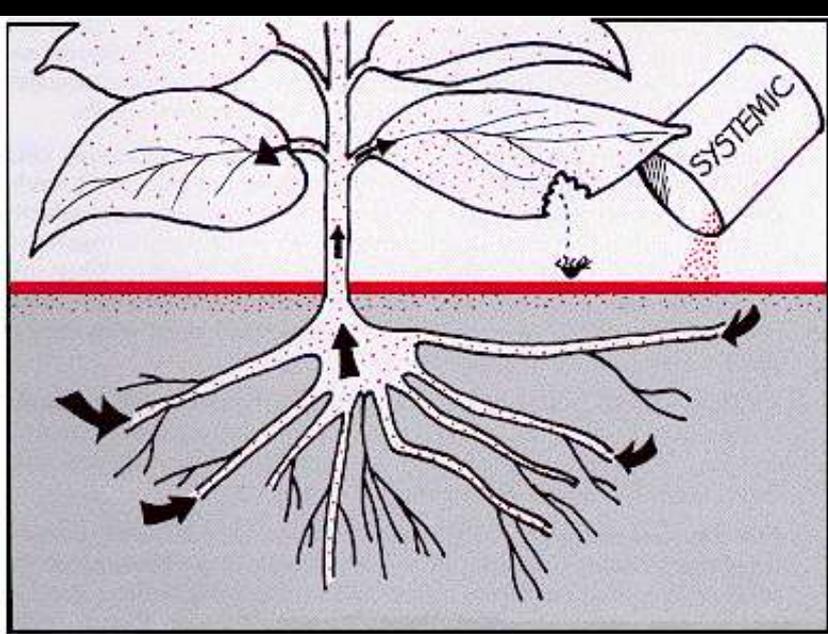
**NET CONTENTS ONE PINT (16 FL. OZS.)**

# Key Timing Point in Wood Borer Prevention

Target exposed life stages  
(Egg Laying/Egg Hatch)



# Systemic insecticides for wood borers?



# Imidacloprid for Borers?



**Yes.....but**



**Imidacloprid will not work well on borers that are the larval stage of moths**



**Imidacloprid** *will not*  
**work well** if the borer  
**spends much of its life**  
**in the heartwood of**  
**the plant**



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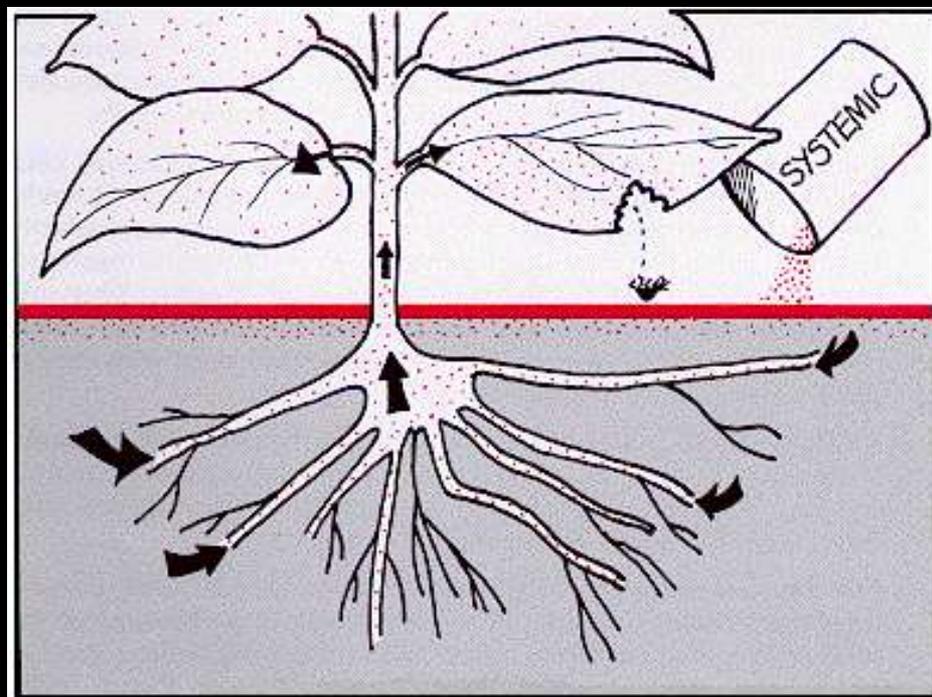
**Imidacloprid soil drenches *may work well* against flatheaded borer larvae (aka metallic wood borers)**





For prevention of damage by most wood boring insects persistent insecticides are applied as sprays to the trunk and limbs to kill wood borers before they enter the tree

To control flatheaded borers systemic insecticides can be used, usually applied either to the roots or injected into the lower trunk



# 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**
  - **azadirachtin**



**Adults as they feed  
on foliage**

**Young larvae that tunnel  
in the phloem and cambium**

**Target Life Stages  
for flatheaded  
borers using  
systemic  
insecticides**



UGA1460072

# Primary method of imidacloprid application – soil applications for root uptake



Photograph courtesy of Jeff Findlay, Iowa State University



# Applying systemic insecticides to the soil of trees

## Soil drench

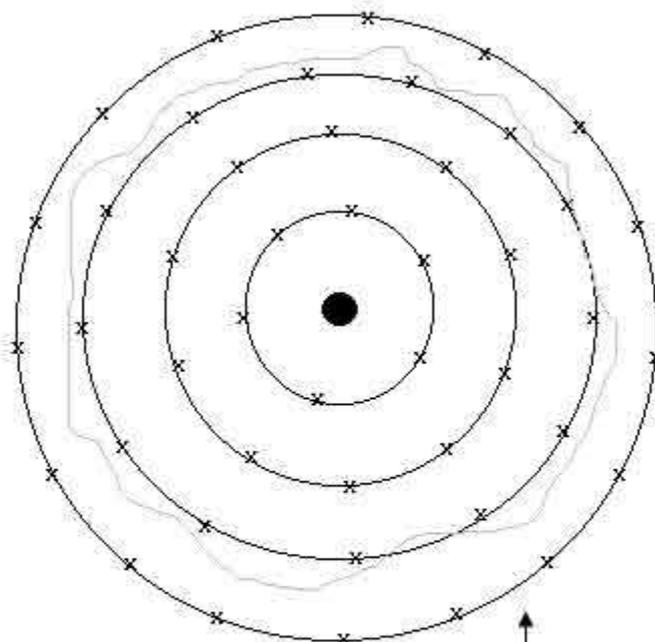


Photograph courtesy of David Cappaert

## Soil injection



## Soil Injection Patterns



**Circular Pattern**

Injections are made at each "X" spaced apart every 2.5-feet. Rings are also spaced apart by 2.5-feet.

\*\*\*\*\*

A circle of 40-ft diameter (i.e., 40-ft canopy spread) covers 1250 sq ft.



Bird's eye views from above the tree looking through the canopy to the ground. The dark spot represents the trunk, while the irregular grey line represents the border of the canopy (the drip line).



Photograph courtesy of Richard Cowles, University of Connecticut

The area around the base of a tree has many feeder roots that can allow good uptake of a soil applied systemic insecticide



# Imidacloprid Soil Drenches for EAB Control

- **Best applied in spring shortly after bud break (after flowering)**
  - **Fall applications are inefficient, waste chemical and provide reduced control**





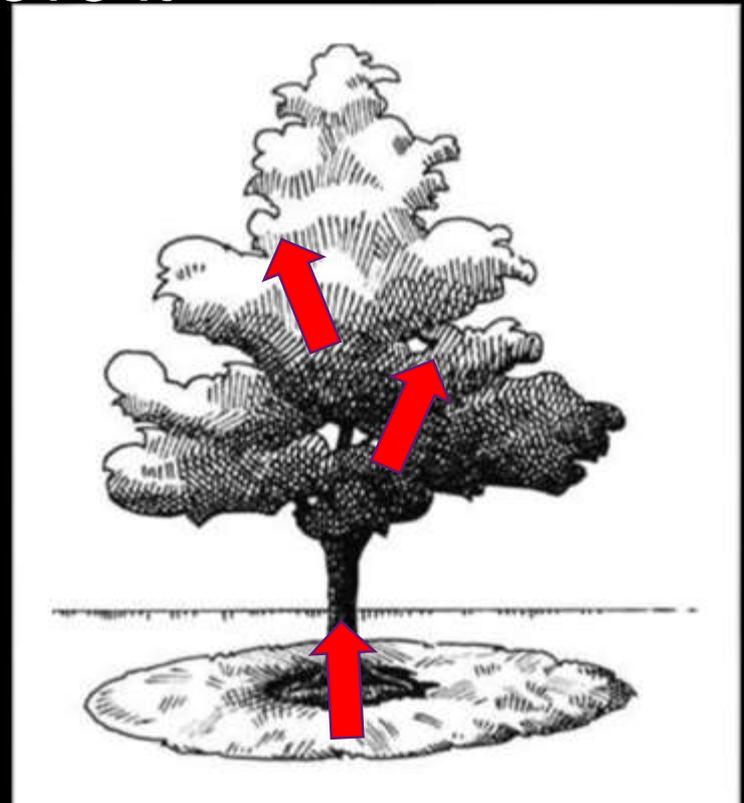
**Soil applications of systemic insecticides should not be made if there are flowering plants at the application site**



# Imidacloprid Soil Drenches for EAB Control

- **The site must be watered after application**
  - The soil must be kept moist for the roots to pick up the insecticide and move it

**Water moves the insecticide into the roots and allows transport of the insecticide through the tree**



# Trunk Injections



Probably not great on thin-barked trees such as birch.

This is a standard treatment for emerald ash borer



# Trunk injection with azadirachtin (TreeAzin, Azasol, AzaGuard, etc.)



# Trunk injection with emamectin benzoate



# Emamectin Benzoate for Wood Borers

- **Advantages**

- Active against both borers that are both beetles and moths/caterpillars
- Well established to provide high level of control for 2, likely 3, years
- Very little-no movement into pollen

- **Limitations**

- High cost, requires specialized equipment
- Trunk wounding associated with injection

# There is a section on emerald ash borer in the Colorado Insect Information Website

## Emerald Ash Borer Information

This is a listing of downloadable publications, web links and other resources related to the presence of emerald ash borer in Colorado.

### Information

[Colorado Emerald Ash Borer Response Team –Frequently Asked Questions](#)

[Questions and Answers about Emerald Ash Borer](#)

[Identification of Emerald Ash Borer and Insects of Similar Appearance](#)

[Wood Boring Insects of Ash Trees](#)

[Control Options for Emerald Ash Borer in Colorado](#)

[National Emerald Ash Borer web site](#)

[Colorado Department of Agriculture – Emerald Ash Borer Web Site](#)

[Insecticide Options for Protecting Ash Trees from Emerald Ash Borer, 3<sup>rd</sup> Edition](#)



# A webinar was produced for Master Gardeners on the subject of Emerald Ash Borer that you can review

September 19, 2019 ISA-RMC Annual Meeting (Westminster)

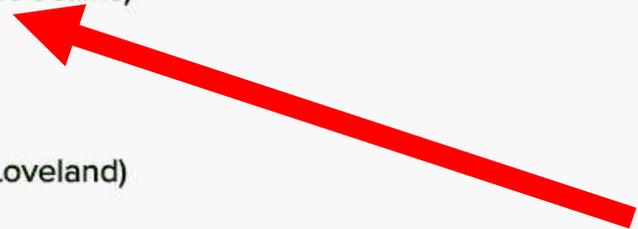
- [Changes in Insect Issues on Landscape Plants – A 35 Year Perspective](#)
- [Guess who came to dinner? Using insect feeding patterns and their “leavings” to better know your insect visitors](#)

November 1, 2019: Master Gardener Webinar, Emerald Ash Borer (Fort Collins)

- [Present situation with emerald ash borer in Colorado \(Video\)](#)
- [Present situation with emerald ash borer in Colorado \(PDF\)](#)

November 6, 2019: CSU Front Range Pest Management Workshop (Loveland)

- [Spiders and other Arthropods](#)
- [Indoor Flies \(and a few other things\)](#)





## **Emerald Ash Borer (EAB) Colorado Update**

This destructive insect is on the move in Colorado, now confirmed in four Front Range counties. Learn the latest on what EAB what can mean to you and your community, how to recognize if it is present yet, and what are the options for its management both before and after it has arrived in your neighborhood.

**Dr. Whitney Cranshaw,  
CSU Professor and Extension Specialist  
Nov 1, 2019 12:30-1:30PM MST**



**MASTER GARDENER**  
COLORADO STATE UNIVERSITY

