# Insect Update

## 207 Credit – Ornamental Insects

Whitney Cranshaw
Colorado State University

Photograph by David Leatherman

A native insect acting badly

# Gambel oak borer

*Agrilus quercicola*

Gambel oak borer is in the same genus (*Agrilus*) as many of the flatheaded borers one can find in shade trees (e.g., bronze birch borer, honeylocust borer, emerald ash borer)

The adult emerges from a **D-shaped exit hole**, as do other metallic wood borers

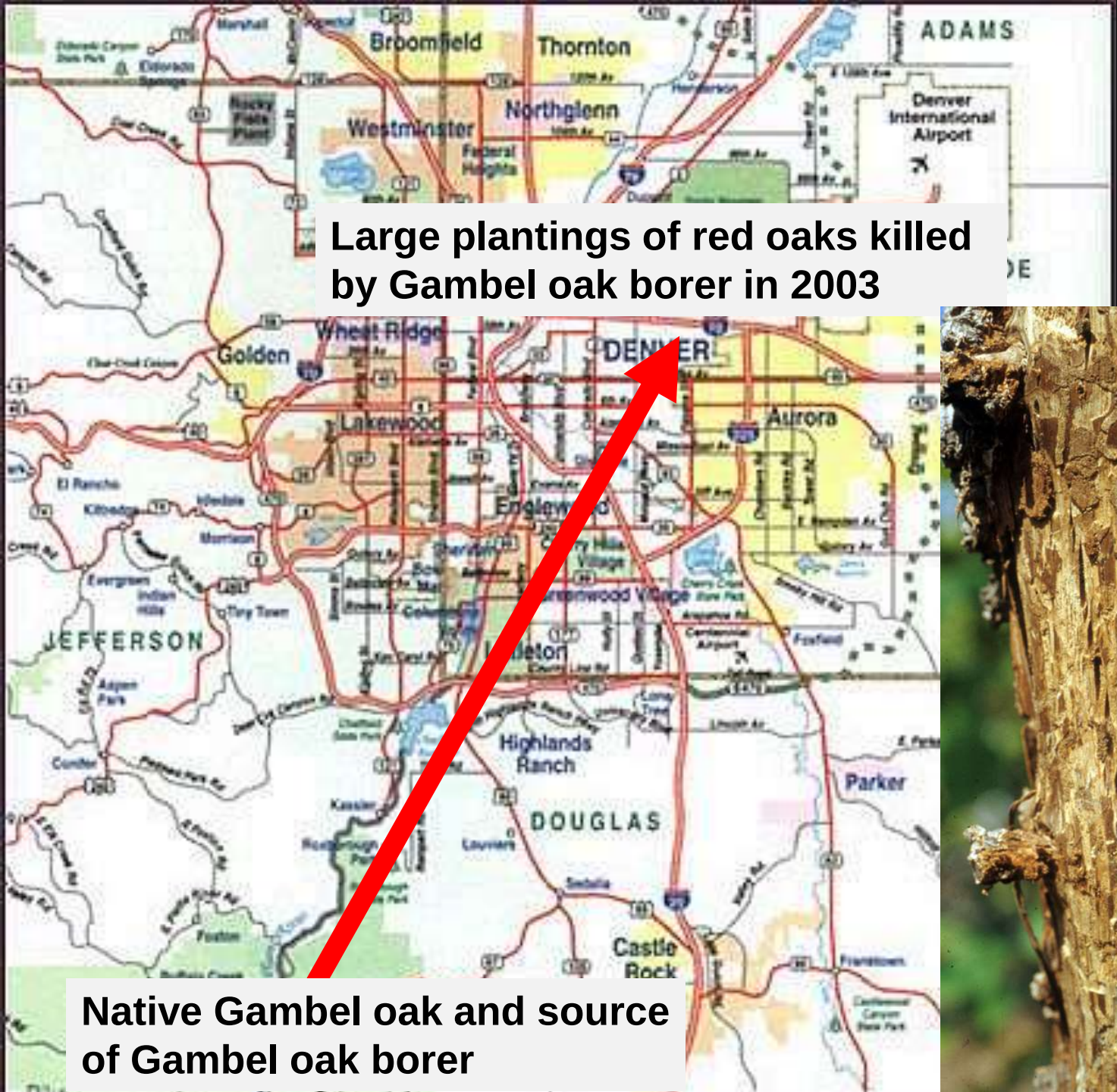
A native insect acting badly

# Gambel Oak Borer

This insect is native to Gambel oak but had never been reported to cause injury.

Populations exploded during the 2001-2003 drought years.

In 2003 a massive flight of adult insects colonized and killed red oak trees that were at least 30 miles away.




Large plantings of red oaks killed by Gambel oak borer in 2003

Native Gambel oak and source of Gambel oak borer

# Gambel oak borer – Postscript

**Return of rains in 2003 brought outbreak to an end**

**The 2003 outbreak in the Denver metro area was thought to be a “one of” event**

**With the return of rains and end of drought the problem disappeared by 2004**

Photographs by David Leatherman

# Gambel oak borer – Postscript

**Reemerged since 2017 as a pest of English oak**

**Several reports of declining English oak, associated with a flatheaded borer, were first received in 2017.**

**It proved to be Gambel oak borer.**

Reports since then extend Gambel oak borer damage to English oak as far as Jefferson and Boulder counties

# Will Gambel oak borer develop as a persistent pest of English oak?

# Gambel Oak Borer In English Oak

- Cultural Controls
  - Provide adequate watering to plants
- Biological Controls
- Insecticidal Controls

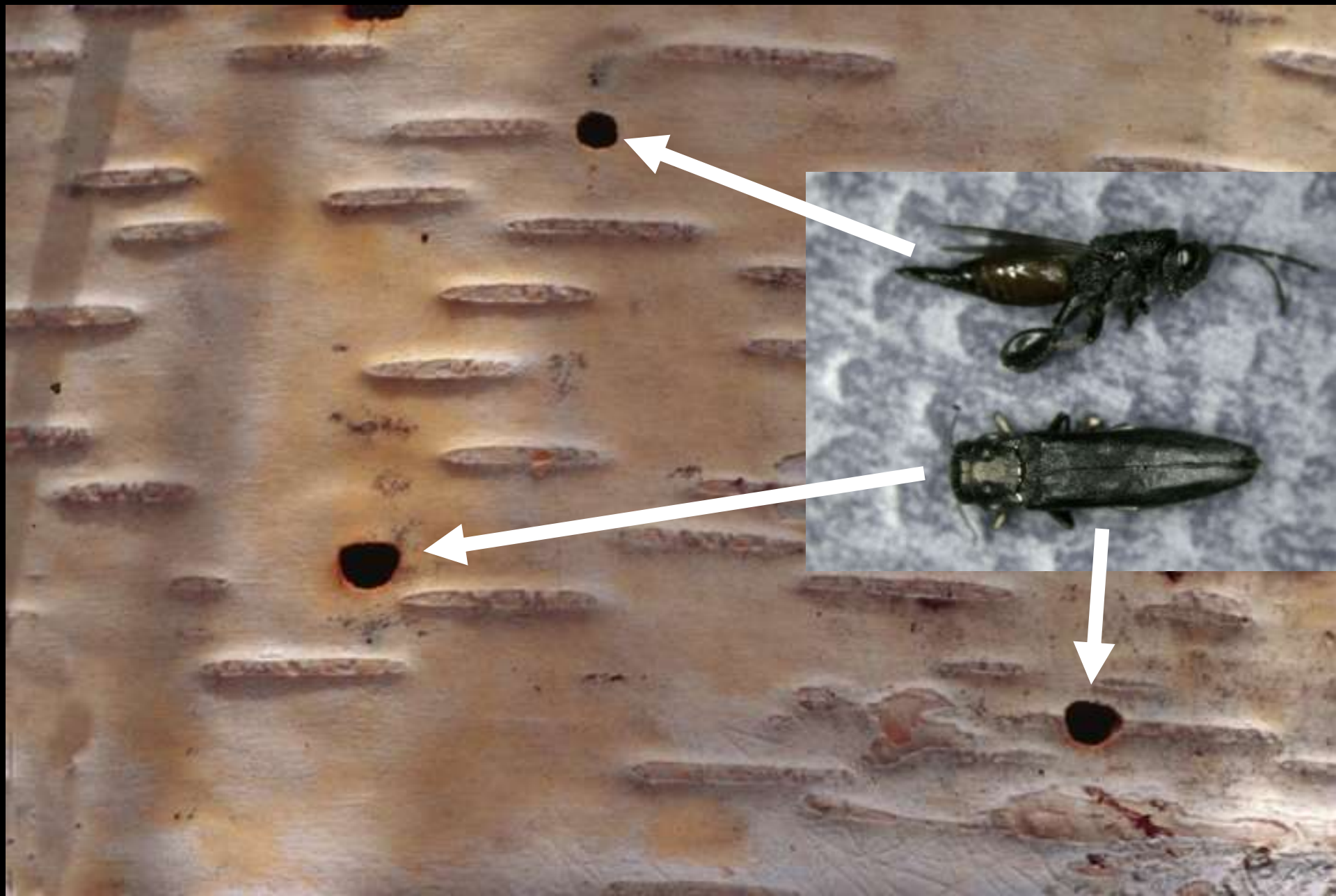
# Gambel Oak Borer In English Oak

- Cultural Controls
  - Provide adequate watering to plants
- Biological Controls
- Insecticidal Controls

***Phasgonophora sulcatus*** – a wasp that kills the larvae of Gambel oak borer (and other borers)

Note: The wasp emerges from a round exit hole

# Metallic wood borers emerge from D-shaped exit holes; a natural enemy (parasitoid wasp) comes out of a round hole



# Gambel Oak Borer In English Oak

- **Insecticidal Controls**
  - –Preventive sprays of permethrin, bifenthrin
    - **In place before egg laying (mid June)**
  - –Trunk sprays of dinotefuran
    - **June**
  - –Imidacloprid soil drench/injection
    - **Applied shortly before adults emerge (late May)**


Photograph by Debbie Miller

# Emerald ash borer

***Agrilus plannipennis***


Photograph by David Cappaert

**Order Coleoptera (beetles)**

**Family Buprestidae (metallic wood borers, flatheaded borers**

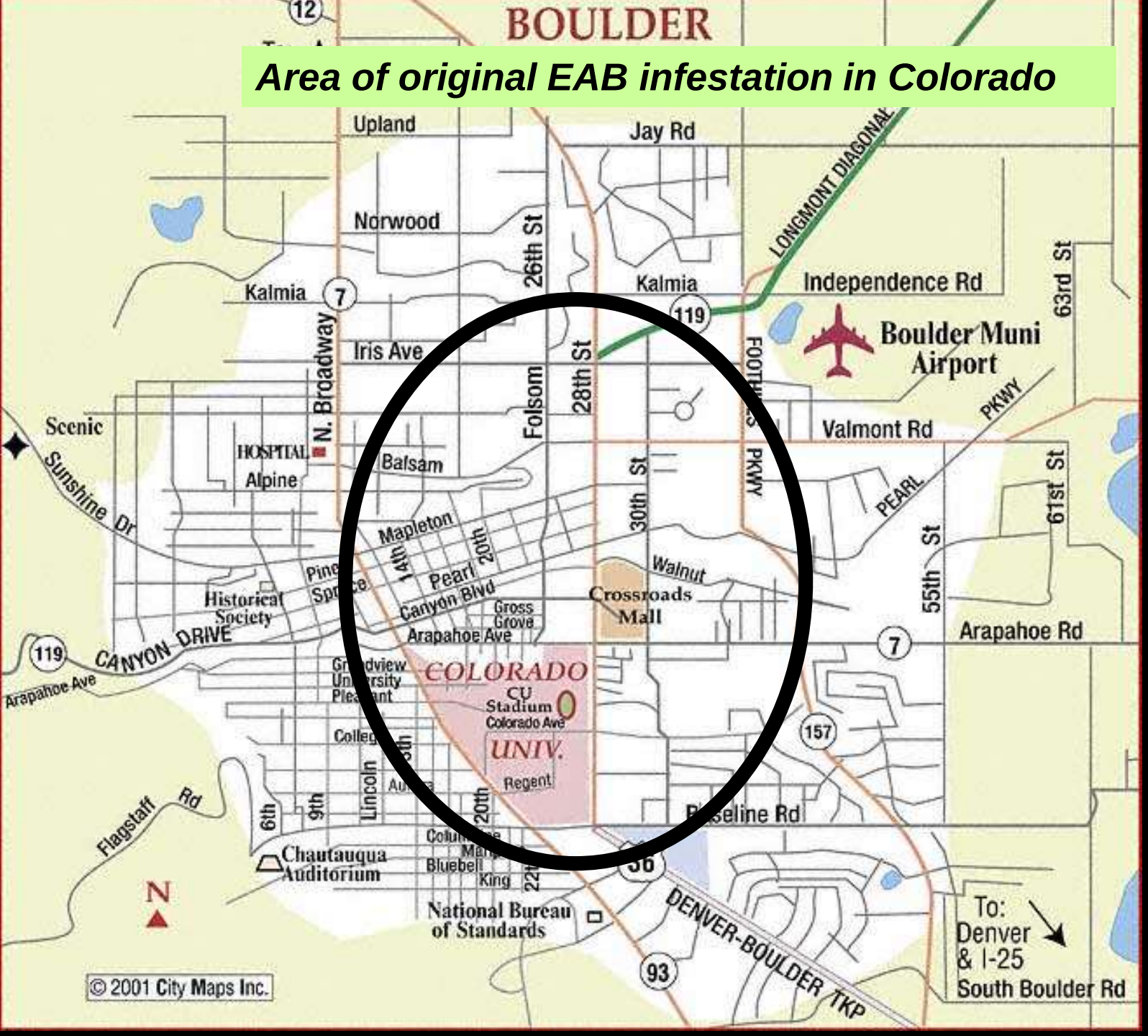
# Sixth Anniversary!

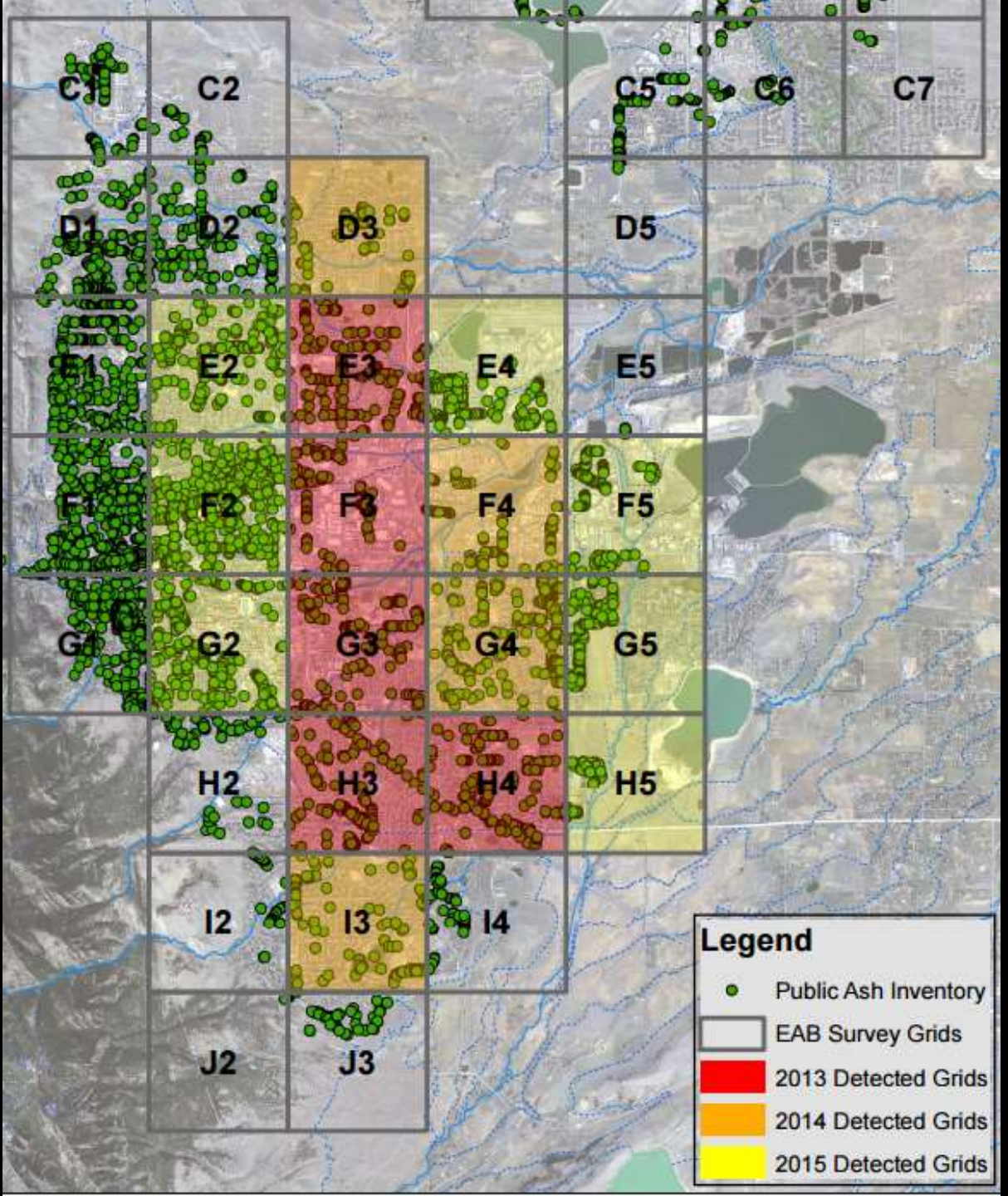
## Emerald Ash Borer in Colorado

# Colorado EAB Tree #1

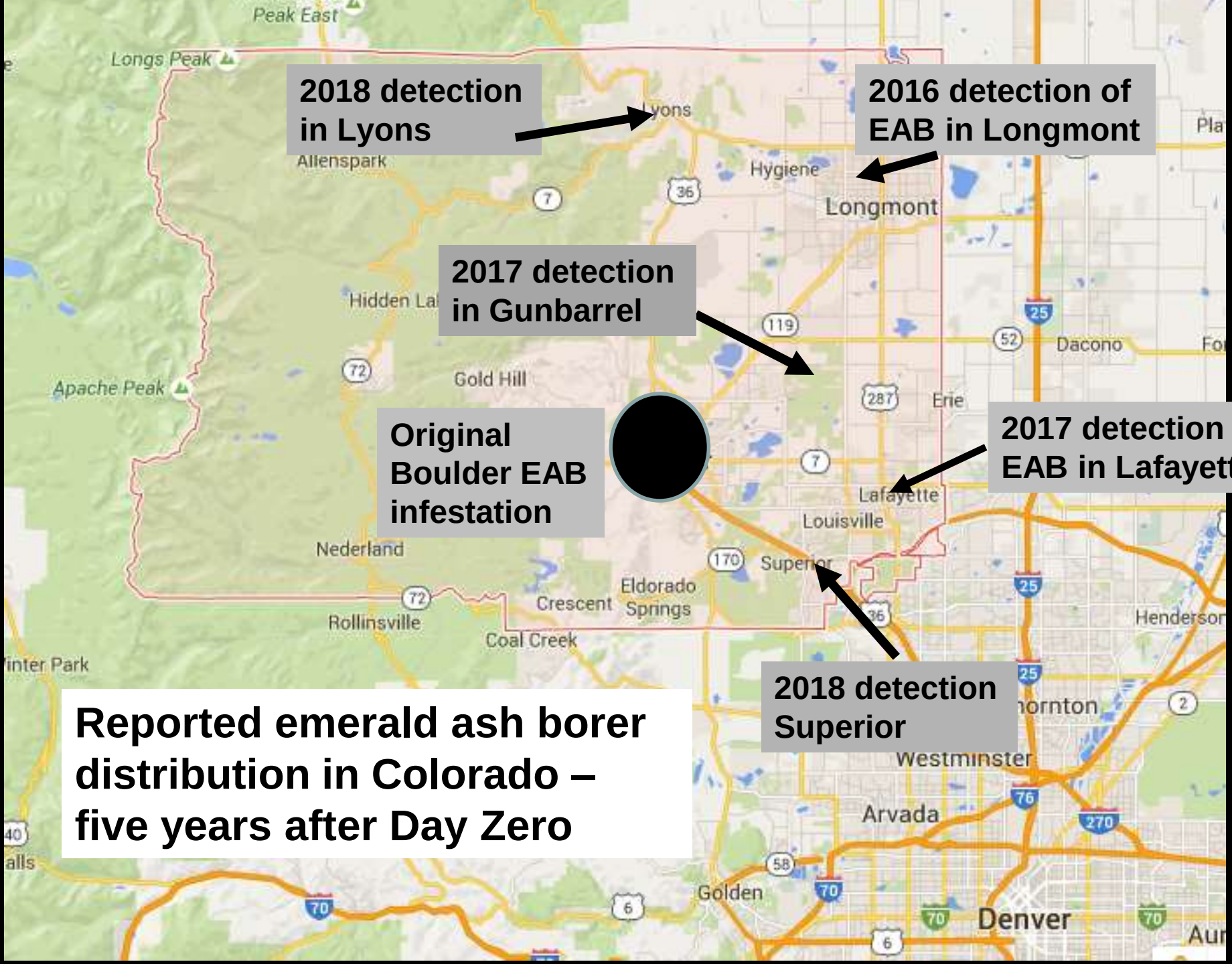
**Located near the intersection of 30th and Valmont, Boulder**

**September 23, 2013**


Area of original EAB infestation in Colorado
BOULDER
Upland
Jay Rd
LONGMONT DIAGONAL
Norwood
26th St
Kalmia
Kalmia
Independence Rd
63rd St
Boulder Muni Airport
Iris Ave
N. Broadway
Folsom
28th St
FOOTHILLS PKWY
Valmont Rd
PEARL PKWY
Scenic
Sunshine Dr
HOSPITAL
Alpine
Balsam
30th St
61st St
Mapleton
14th
20th
Pearl
Canyon Blvd
Walnut
Crossroads Mall
55th St
Historical Society
Gross Grove
Arapahoe Ave
Arapahoe Rd
CANYON DRIVE
Arapahoe Ave
COLORADO
CU Stadium
Colorado Ave
UNIV.
Regent
Lincoln
6th
9th
20th
Flagstaff Rd
Pleasant
Chautauqua Auditorium
Bluebell
King
National Bureau of Standards
DENVER-BOULDER TKP
To: Denver & I-25
South Boulder Rd
N
© 2001 City Maps Inc.

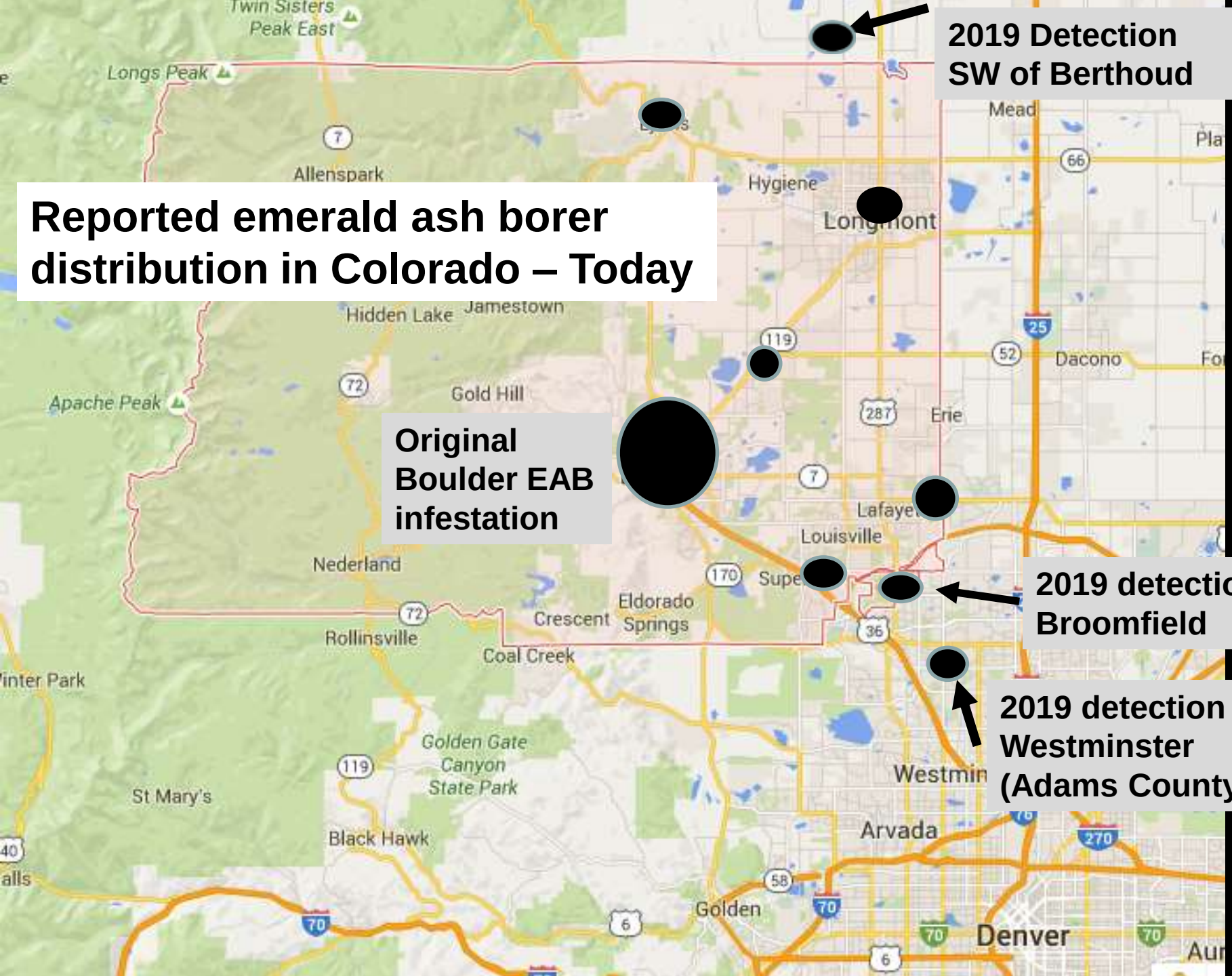



**Areas known to be infested with emerald ash borer in Boulder (original site of Colorado establishment)**

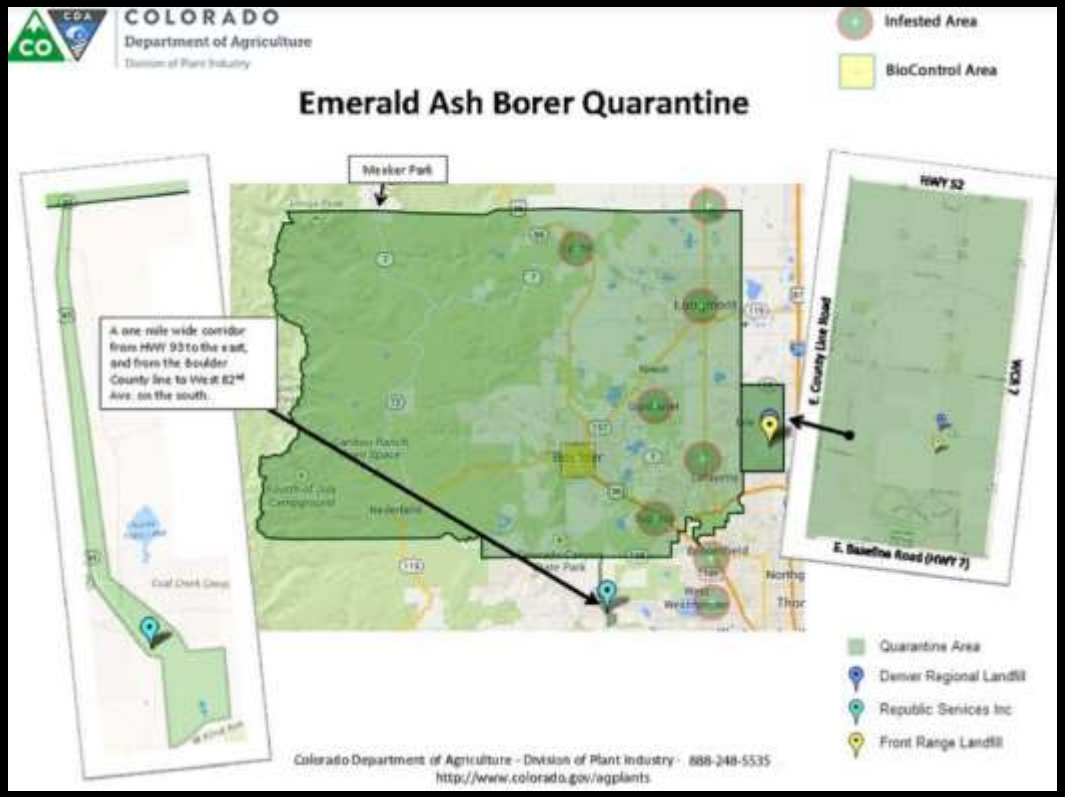

2018 detection in Lyons
2016 detection of EAB in Longmont
2017 detection in Gunbarrel
Original Boulder EAB infestation
2017 detection of EAB in Lafayette
2018 detection Superior
Reported emerald ash borer distribution in Colorado – five years after Day Zero
Peak East
Longs Peak
Lyons
Allenspark
Hygiene
Longmont
Hidden Lake
Gold Hill
Apache Peak
Erie
Dacono
Lafayette
Louisville
Nederland
Superior
Eldorado Springs
Crescent
Rollinsville
Coal Creek
Westminster
Arvada
Golden
Denver

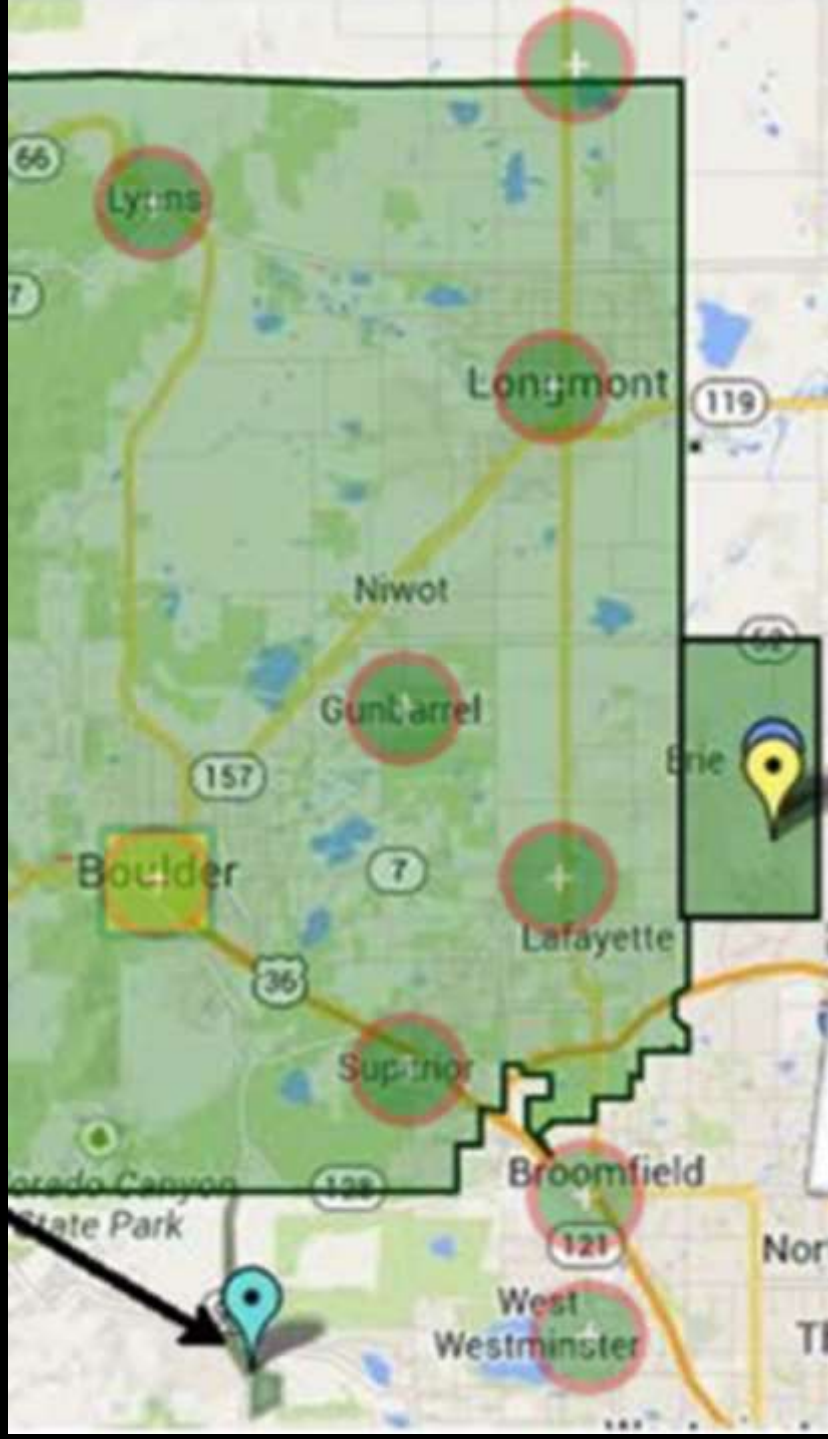
# Sixth Anniversary!

## Emerald Ash Borer in Colorado


Reported emerald ash borer distribution in Colorado – Today
2019 Detection SW of Berthoud
Original Boulder EAB infestation
2019 detection Broomfield
2019 detection Westminster (Adams County)
Twin Sisters Peak East
Longs Peak
Allenspark
Hygiene
Longmont
Mead
Hidden Lake
Jamestown
Gold Hill
Apache Peak
Erie
Dacono
Lafayette
Louisville
Nederland
Eldorado Springs
Crescent
Rollinsville
Coal Creek
Golden Gate Canyon State Park
St Mary's
Black Hawk
Westminster
Arvada
Golden
Denver

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

Photograph by David Cappaert

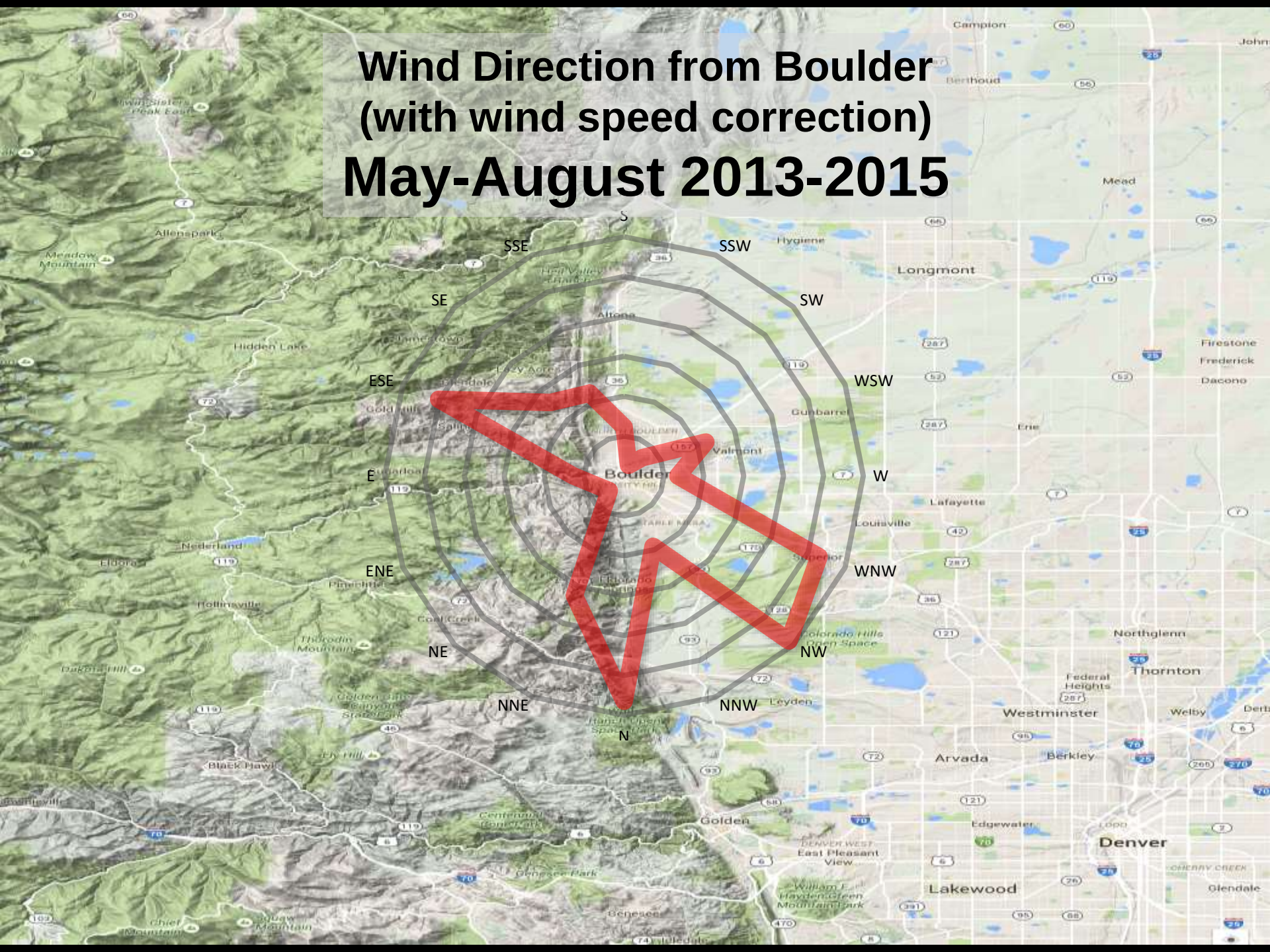
**EAB likely will emerge sometime in mid-late May.**

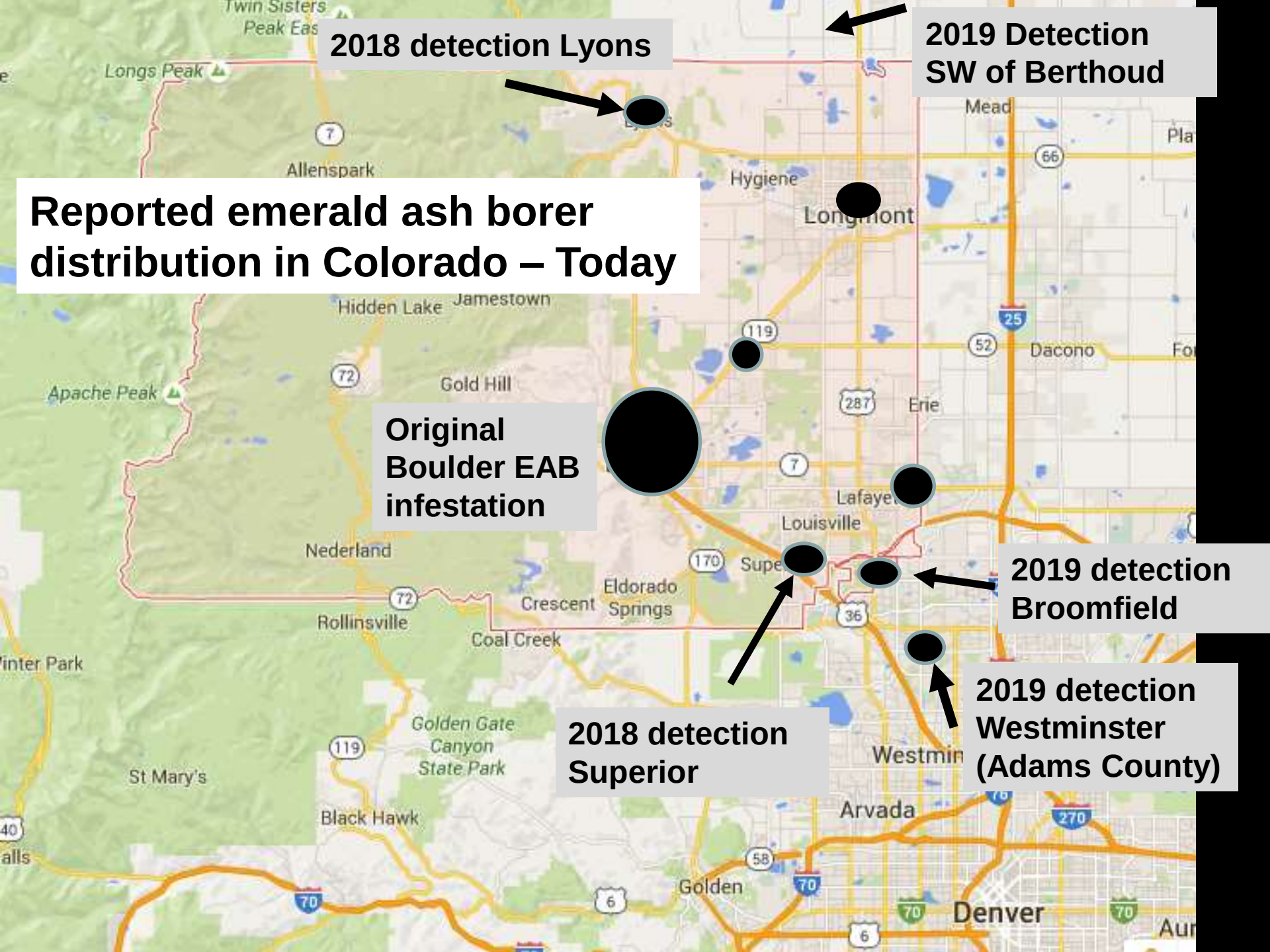
**Most eggs will be laid in June, egg laying will continue through summer**

Photograph by Dan Herms

# Wind Direction from Boulder (with wind speed correction)

# May-August 2013-2015

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St Mary's
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Denver

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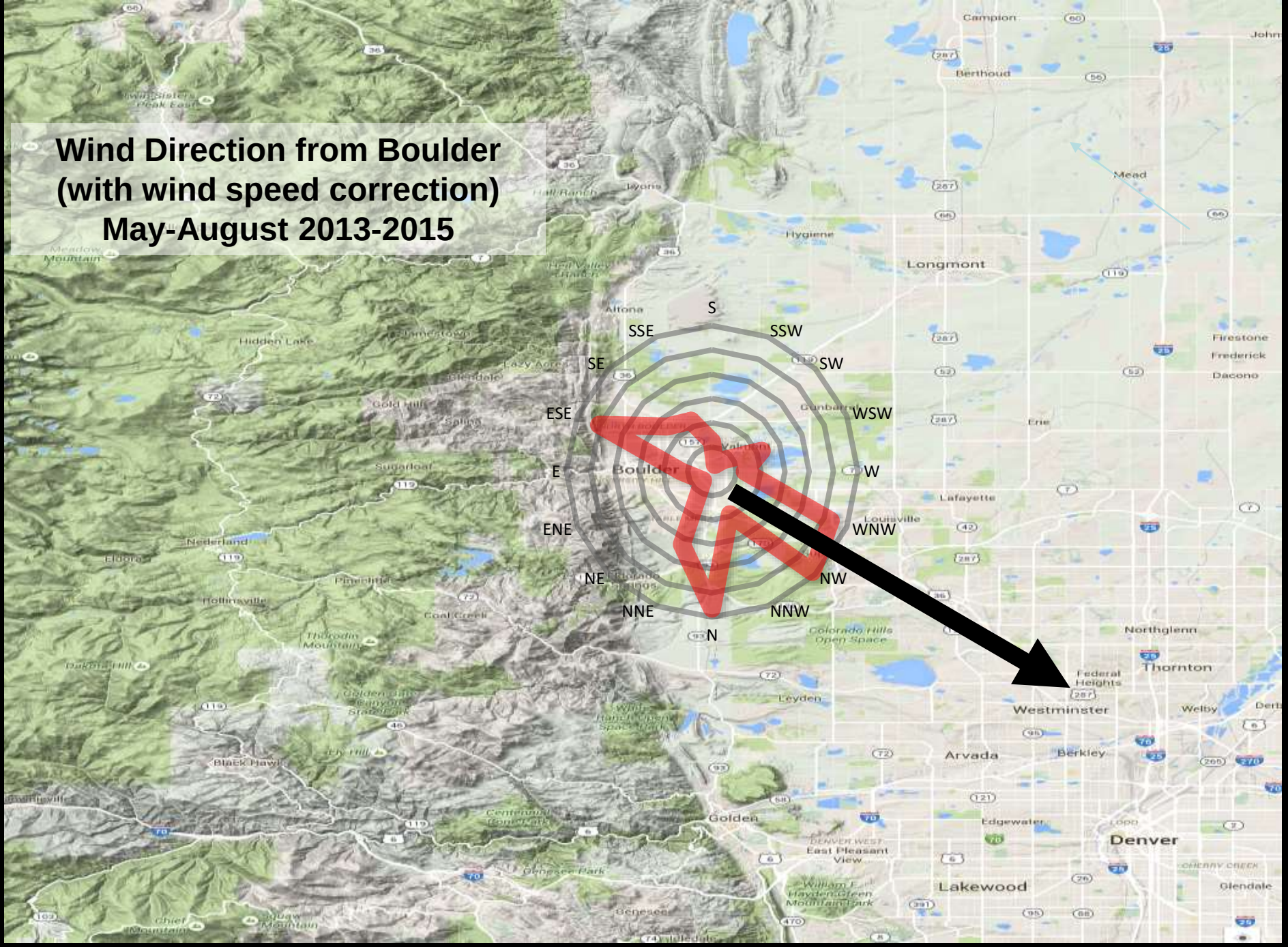


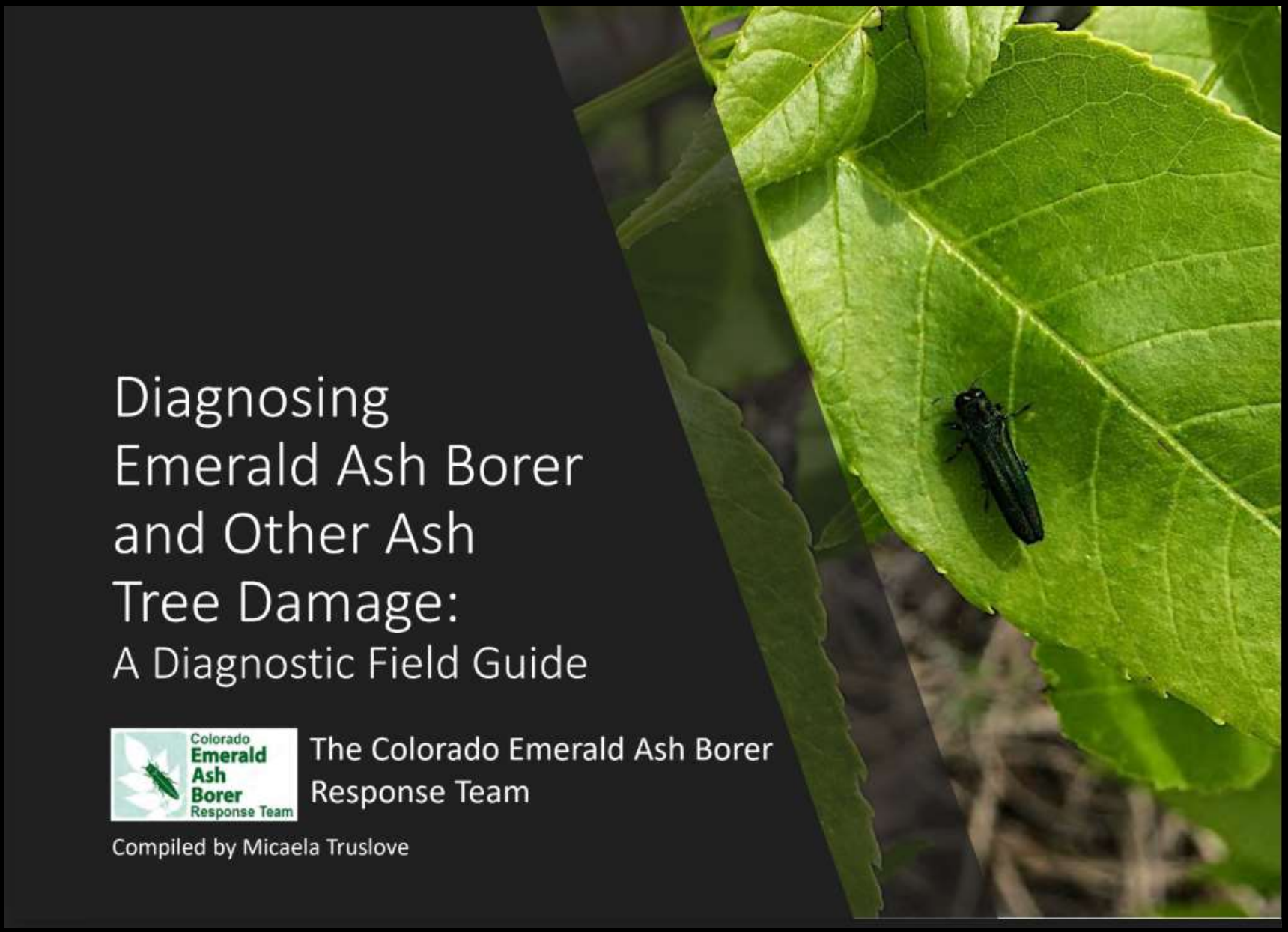
# How far away is emerald ash borer from your community?

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

**One truckload**

# Detecting Emerald Ash Borer

# A Guide for Diagnosing EAB in Colorado



# An Extension Fact Sheet to help differentiate EAB from other wood boring Insects found in Colorado Ash Trees

COLORADO STATE UNIVERSITY
EXTENSION

## Recognizing Wood Boring Insects of Ash Trees in Colorado

Fact Sheet No. 5.620 | Insect Series | Crops

by W.S. Cranshaw*

Ash is one of the most widely planted trees in Colorado, with most plantings involving various cultivars of green ash (*Fraxinus pennsylvanica*) or white ash (*F. americana*). Several insects are associated with these plants, including leafcurling aphids, various caterpillars and sawflies that chew the leaves, and wood borers and bark beetles that develop within the trunk and limbs of the tree.

### Quick Facts

- Being able to recognize the wood boring insects found in a tree is essential when making informed decisions on the need for control.
- In most of Colorado, the most

# A sheet that distinguishes EAB from other insects found in Colorado that have similar appearance

## Emerald Ash Borer and Colorado Insects of Similar Appearance

Adults of the emerald ash borer (*Agrilus plannipennis*) have an elongate, rather bullet-form body, typical of most beetles in the metallic wood borer/flatheaded borer family Buprestidae. Emerald ash borer is about 9-13 mm in length, large for members of the genus *Agrilus*, but mid-sized for most other members of this insect family.

Emerald ash borer. Photograph by Pennsylvania Department of Natural Resources

Perhaps the most conspicuous feature is that the emerald ash borer has uniformly green bright, metallic wing covers, sometimes with slight purplish hues. The thorax may be more metallic brown and underneath the wing covers the abdomen is purple. Adults are active between late May to midAugust and almost always they would be found on the leaves or bark of an ash tree.

**Many metallic colored beetles occur in Colorado that may be mistaken for emerald ash borer**

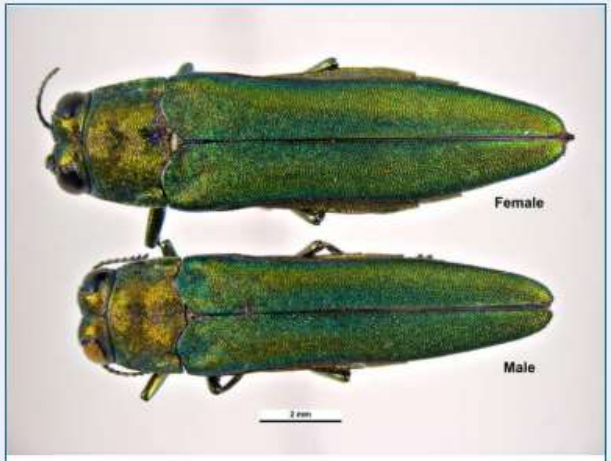
If EAB is suspected to be present in a new area, ***the specimen must be submitted to the Colorado Department of Agriculture***. There is a formal process of confirming the identification that must be followed before there is any release of public information on the finding.

COLORADO
Department of Agriculture

Home | Animals | Brands | Conservation | ICS | Labs | Markets | Plants | State Fair

Plants › Pest Survey › EAB Identification and Reporting

# EAB Identification and Reporting




USA. Michigian State University, East Lansing Michigian, June 2008, Judy King, reared ex Fraxinus logs det. J King 2008

Ken Walker
Museum Victoria

**Effects of larval tunneling are cumulative, and ultimately lethal to the tree. Insecticides can interrupt the progress and even allow recovery, if damage is not too far advanced.**

Photograph by Art Wagner

Photograph by MI Department of Agriculture

**Recovery is possible** with some insecticides (emamectin benzoate) if EAB-induced canopy **thinning has not progressed beyond 30 percent**

**30 percent EAB-induced canopy thinning. Photos from Michigan State University**

In the Boulder EAB trials, started in 2014, EAB canopy thinning has not yet hit 30 percent in the untreated checks

Note: Most trees at this site have been treated for EAB; herd immunity effects are present

# Pigeon Tremex

## *Tremex columba*

A wood boring wasp that develops in dying, near-dead hardwoods (maples, elms, ash)


Pigeon tremex is a type of insect known as a **horntail**.

Females have a spike on the end of the abdomen which houses the **ovipositor**.


Photographs courtesy of **David Shetlar**,
The University of Ohio

Females insert eggs into trees using their ovipositor.

They select trees that are in end stage decline and of low moisture content.

A fungus, a type of white rot, is injected into the tree along with the egg.

Photograph courtesy of **David Shetlar**, The Ohio State University

# Sometimes dead females can be found still stuck in the tree

Photograph by **Mark Overland**

Larva in wood

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

**The most spectacular natural enemy of the pigeon tremex is the giant ichneumon wasp**

# Giant Ichneumon Wasp

*Megarhyssa macrurus*

Photograph by David Leatherman

Parasitoid of the pigeon tremex larva

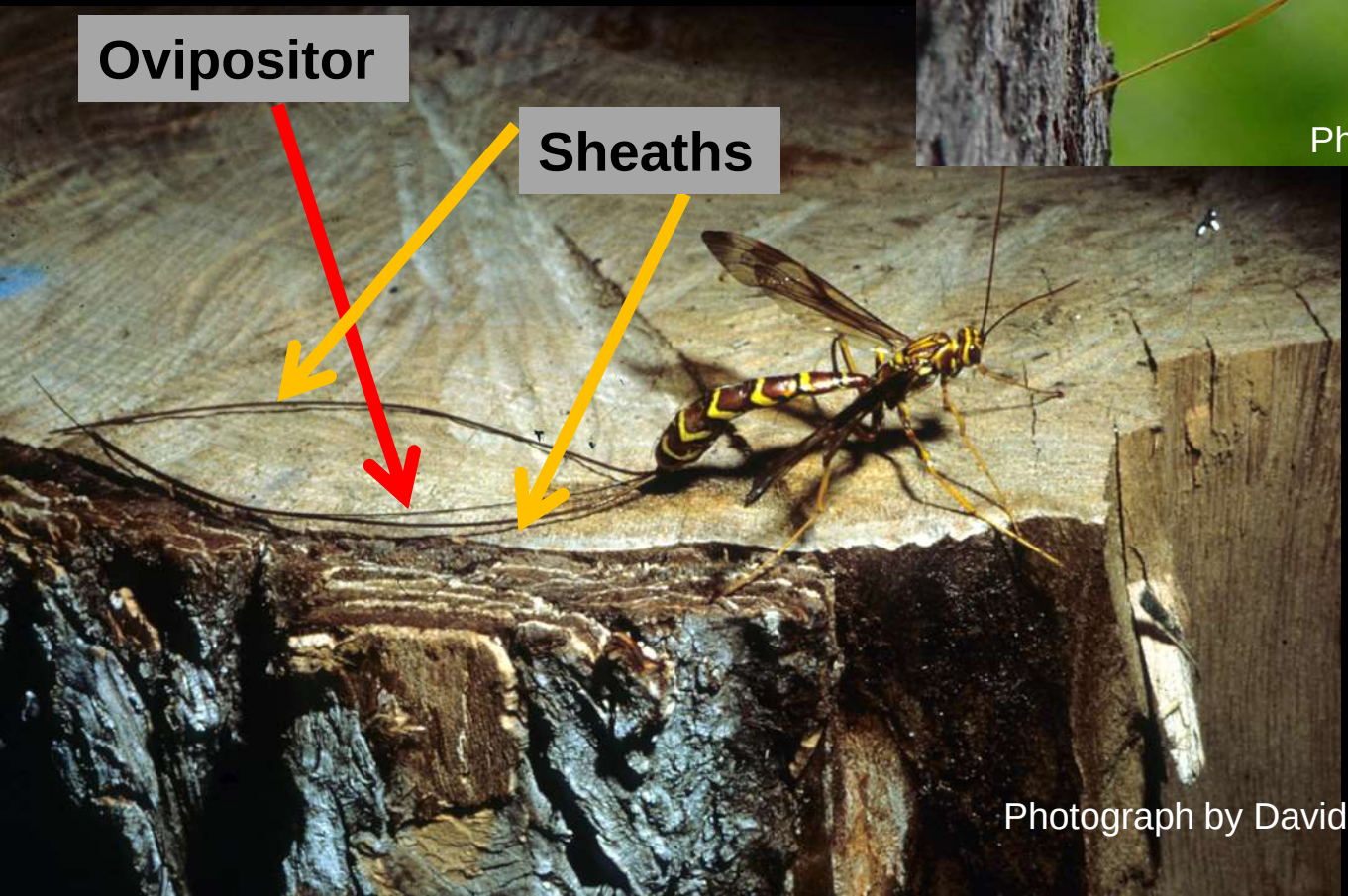
A photo from a Denver MG, Linda Coyle, I got last year

A photo from an Arapahoe County MG, Mark Overland, received this year

Photographs courtesy of Mark McMillan

The female giant ichneumon wasp can detect the presence of a developing pigeon tremex larva – and drills to it with her ovipositor

Photograph by Mark McMillan




Photograph by David Leatherman

Colorado State University

Extension

# Pigeon Tremex Horntail and the Giant Ichneumon Wasp

Fact Sheet No. **5.604** Insect Series | **Home and Garden**

by W. Cranshaw*

Two large and bizarre looking insects are commonly associated with dying branches and trunks of several commonly grown hardwood trees. One of these is an insect that develops as a borer within the tree – the **pigeon tremex horntail** (*Tremex columba*). The other is the most common natural enemy of this insect, the **giant ichneumon wasp** (*Megarhyssa macrurus*).

**Figure 1:** Pigeon tremex.

## Quick Facts

- The pigeon tremex is a type of non-stinging wasp, known as a horntail.
- The giant ichneumon wasp is the most common natural enemy of the pigeon tremex.
- Pigeon tremex are not considered serious pests

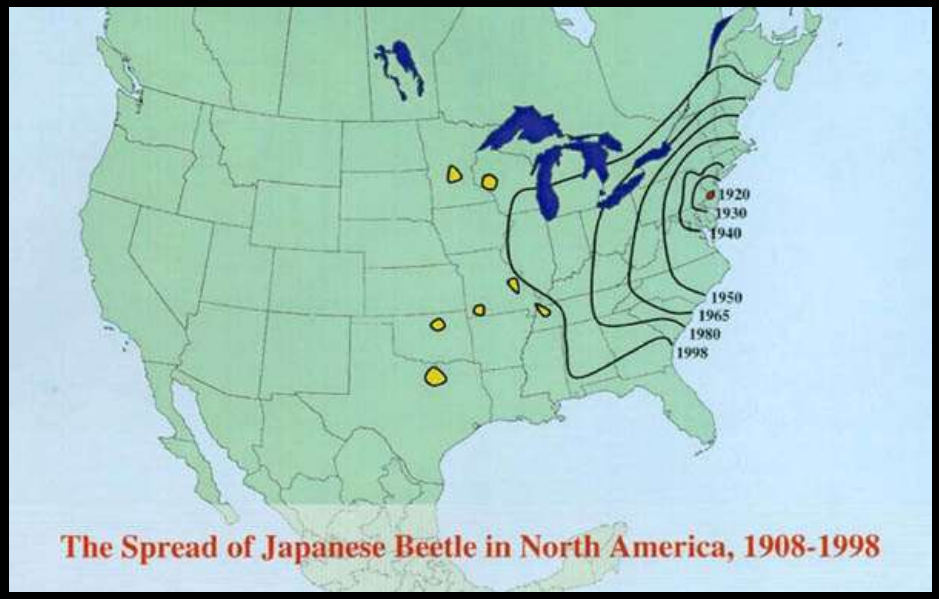
## Pigeon Tremex Horntail

# Japanese beetle

*Popillia japonica*

Coleoptera: Scarabaeidae

First U.S. detection – **1916** near Riverton, New Jersey



**Japanese beetle damages plants in** ***two distinct ways***

**Japanese beetle adults chew on leaves and flowers of many plants**

**Japanese beetle larvae (grubs)** – ***among the most damaging turfgrass insects in the US***

**Japanese beetle affects yard/garden plants *in two distinct ways***

**Question: Does control of larvae in a yard affect the number of adults in a yard?**

????????

**Answer: Very likely, NO**

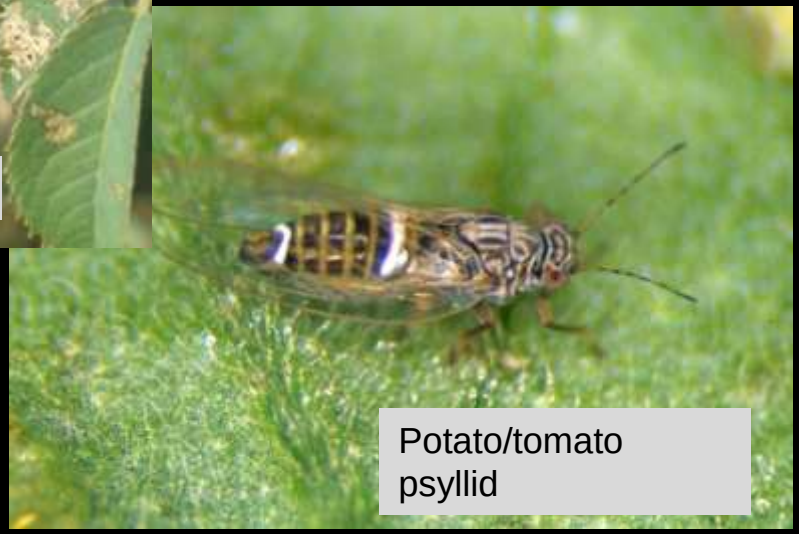
# Some Highly Mobile Insects

Corn earworm (adults)

Japanese beetle (adults)

Grasshoppers

Crucifer flea beetles



Potato/tomato psyllid

**Adult beetles** feed on both flowers and leaves of many ornamental plants as well as garden vegetables and herbs

**Skeletonizing injuries produced by Japanese beetle adults feeding on leaves**

**Flowers are often a favored plant part targeted by adult Japanese beetles**

**Issue of unusually important concern with Japanese beetle**

**Overlap of adult feeding on flowers –**
***and use of those flowers by pollinators***

# *Uber*-host Plants Favored by Japanese Beetle Adults in CO

- Roses (most)**
- Linden (most)*
- Virginia creeper*
- Silver lace**

# Other Plants Commonly Grown in CO that are Highly Favored by Japanese Beetle

## Ornamentals

- Hollyhock*
- Gaura**
- Rose-of-Sharon**
- Crabapple
- Canna lily**
- Japanese maple
- Peking cotoneaster

## Food Crops

- Beans (green, edamame)
- Basil
- Raspberry*
- Grape

- * JB populations overlap with flowering
- ** JB populations overlap >*alot*< with flowering

# The curious phenomenon of geranium toxicity to Japanese beetle

# Geranium Toxicity to Japanese Beetle

- Beetles become paralyzed within a couple of hours after feeding on flowers of zonal geraniums
  - Often recover in lab, rarely outdoors
- Toxin is present in flowers, but not leaves

# Recommendations for Japanese Beetle Adult Control

- Physical/Cultural Controls
  - Traps
  - Hand Picking
- Chemical Controls

# Japanese beetle controls

## Hand Picking

## Primary benefit from handpicking

**Reduction in volatile attractants produced by plant wounding**

**Handpicking may be more effective for infestations on foliage versus flowers**

**Some flowers (e.g., rose) *can produce high levels of volatile attractants - without wounding* - and may possess attractive colors**

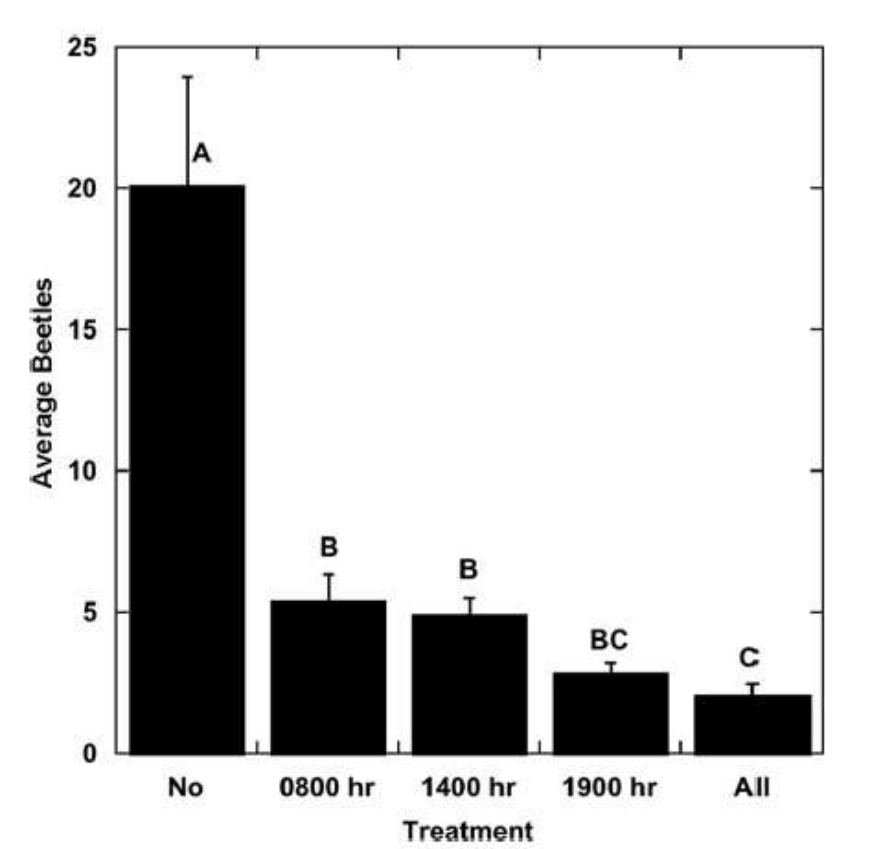
Effectiveness of Hand Removal for Small-Scale Management of Japanese Beetles (Coleoptera: Scarabaeidae)

PAUL V. SWITZER[1] AND RYAN M. CUMMING

Department of Biological Sciences, Eastern Illinois University, Charleston, IL 61920

**Can time of day when you hand pick have effects for JB management?**

**Possibly yes.** It may be more effective to *handpick in the evening* than at other times of the day for reducing numbers of beetles on the plants.



**Japanese beetle traps are excellent for detecting presence of the insect in an area**

**Japanese beetle traps *are minimally useful - at best* - for control of existing Japanese beetle infestations!**

# *If you insist* on using a Japanese beetle trap

- Do not place them anywhere near (at least 30 feet away from) any plant on which Japanese beetles feed
- Avoid placing them in a site where they are likely to draw beetles from long distances

# *If you insist* on using a Japanese beetle trap

- Do not place them anywhere near (at least 30 feet away from) any plant on which Japanese beetles feed
- Avoid placing them in a site where they are likely to draw beetles from long distances

***….and preferably give the trap to your neighbor!***

# Do you have >alot< of Japanese beetles in your trap??


There are about 836 Japanese beetles per cup



# Citronella candles attracting Japanese beetle to a final end

Photographs courtesy of JoAnne Henson!

# Chemical Controls Most Effective for Control of Japanese Beetle Adults

- Most pyrethroids (e.g., cyfluthrin, permethrin, bifenthrin)
- Carbaryl
- Acetamiprid
- Imidacloprid
- Chlorantraniliprole

Do not treat plants with flowers in bloom!

**Overlap of adult feeding on flowers – *and use of those flowers by pollinators***

***Never apply persistent insecticides to plants that are in flower and attractive to pollinators!!***

# Chemical Controls Most Effective for Control of Japanese Beetle Adults

- ~~Most pyrethroids (e.g., cyfluthrin, permethrin, bifenthrin)~~
- ~~Carbaryl~~
- ~~Imidacloprid~~
- ~~Acetamiprid~~
  - ~~Ortho Rose and Flower Killer~~
- Chlorantraniliprole
  - Acelepryn

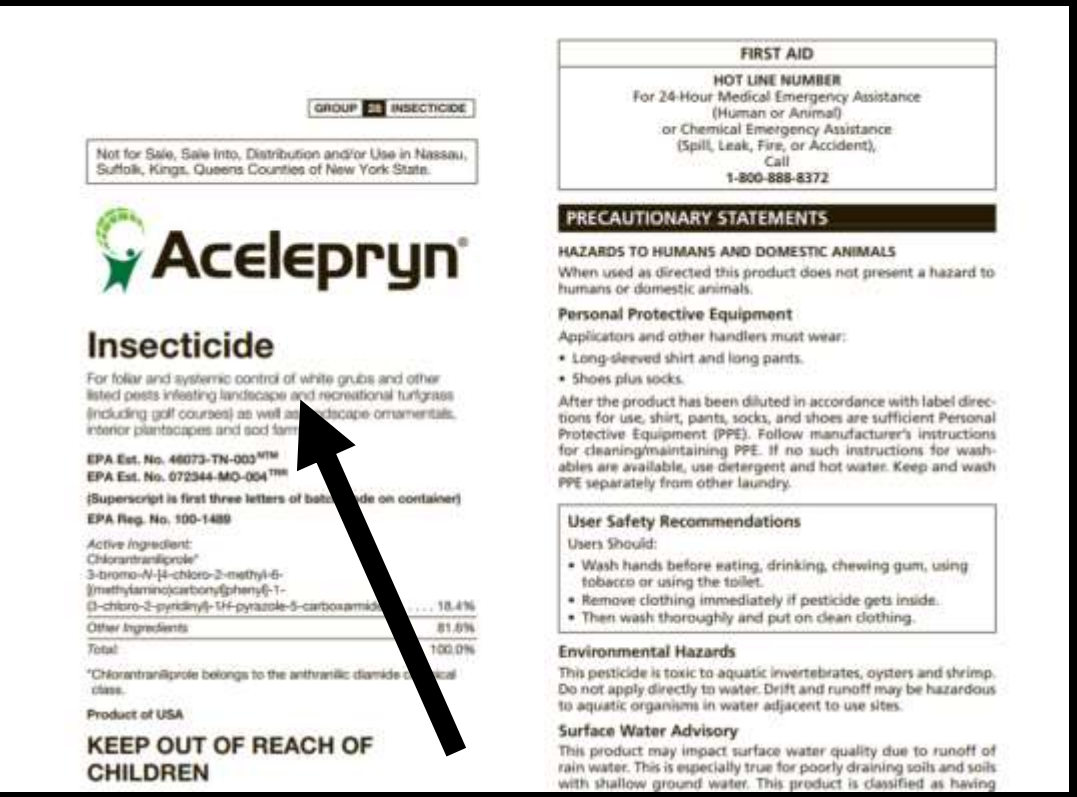
Do not treat plants with flowers in bloom!

Pollinator hazard warning statement regarding use of Tristar 8.5 SL (acetamiprid)

**ENVIRONMENTAL HAZARDS**

This product is toxic to wildlife. This product is toxic to bees and other pollinating insects exposed to direct treatment. Do not apply this product while bees or other pollinating insects are actively visiting the treated area. Risk to managed bees and native pollinators from contact with pesticide spray or residues can be minimized when applications are made at dawn or dusk or when temperature is below 55°F at the site of application. Do not apply directly to water, or to

This type of warning statement allows use of this product on a plant in flower *only during times of day when pollinators are not visiting the plant*



GROUP 28 INSECTICIDE

Not for Sale, Sale Into, Distribution and/or Use in Nassau, Suffolk, Kings, Queens Counties of New York State.

Acelepryn®

## Insecticide

For foliar and systemic control of white grubs and other listed pests infesting landscape and recreational turfgrass (including golf courses) as well as landscape ornamentals, interior plantscapes and sod farms

**EPA Est. No. 46073-TN-003**[NTM]
**EPA Est. No. 072344-MO-004**[TMR]
**(Superscript is first three letters of batch code on container)**
**EPA Reg. No. 100-1489**

*Active Ingredient:*
Chlorantraniliprole*
3-bromo-N-[4-chloro-2-methyl-6-[(methylamino)carbonyl]phenyl]-1-(3-chloro-2-pyridinyl)-1H-pyrazole-5-carboxamide ..... 18.4%
*Other Ingredients* 81.6%
*Total:* 100.0%

*Chlorantraniliprole belongs to the anthranilic diamide chemical class.

**Product of USA**

**KEEP OUT OF REACH OF CHILDREN**

**FIRST AID**

**HOT LINE NUMBER**
For 24-Hour Medical Emergency Assistance
(Human or Animal)
or Chemical Emergency Assistance
(Spill, Leak, Fire, or Accident),
Call
**1-800-888-8372**

**PRECAUTIONARY STATEMENTS**

**HAZARDS TO HUMANS AND DOMESTIC ANIMALS**

When used as directed this product does not present a hazard to humans or domestic animals.

**Personal Protective Equipment**

Applicators and other handlers must wear:

- Long-sleeved shirt and long pants.
- Shoes plus socks.

After the product has been diluted in accordance with label directions for use, shirt, pants, socks, and shoes are sufficient Personal Protective Equipment (PPE). Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables are available, use detergent and hot water. Keep and wash PPE separately from other laundry.

**User Safety Recommendations**

Users Should:

- Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.
- Remove clothing immediately if pesticide gets inside.
- Then wash thoroughly and put on clean clothing.

**Environmental Hazards**

This pesticide is toxic to aquatic invertebrates, oysters and shrimp. Do not apply directly to water. Drift and runoff may be hazardous to aquatic organisms in water adjacent to use sites.

**Surface Water Advisory**

This product may impact surface water quality due to runoff of rain water. This is especially true for poorly draining soils and soils with shallow ground water. This product is classified as having

**Environmental hazards statements do include warnings for aquatic organisms.**

***They do not have any pollinator warning statements***

Labeled for use on turfgrass and landscape ornamentals

# *Btg - Bacillus thuringiensis* var. *galleriae*

Sold as ***beetleGONE!*** in commercial/ ag markets

Sold as ***beetleJUS*** in gardener market

Adult control



Btg-susceptible Insects

**Weevils**

**Scarab Beetles**

# *Bacillus thuringiensis* (Bt)

- Derived from a widely distributed soil bacterium
- Active ingredient a toxic protein crystal that destroys cells of the midgut
- Used as a stomach poison
- Several different strains – each effective against different insects

# Several Bt strains are present, each with specific activity

Caterpillars – kurstaki, *aizawi* strains

Leaf beetles – *tenebrionis* strain

Gnat, mosquito larvae – *israelensis* strain

# Treated Foliage Consumed

# Feeding Inhibition（1 Hour）

- Toxin Crystals Dissolve in Gut.
- Larvae Stop Feeding.
- Growth Stops.

# Death（2-5 Days）

- Starvation
- Gut Disruption

# *Bacillus thuringiensis* var. *galleriae*

Sold as ***beetleGONE!*** in commercial/ag markets

Sold as ***beetleJUS*** in gardener market


beetleJUS treated

Water check

## beetleJUS for adult Japanese beetle?

Provides **good reduction in feeding** injury by Japanese beetle

Provides **fair mortality** of Japanese beetles and mortality is slow

Persistence of effects probably a few days

**Bee hazard warnings and use restrictions?**

**None.** **You can apply this product to plants in bloom when bees are visiting.**

## After application:

Are they dead? (probably not)

Are they still feeding? (probably not)

# Japanese Beetle Biological Control Program

# Natural Enemies of Japanese Beetle Exist Elsewhere in the US

- ***Paenibacillus popilliae*** **(Milky spore)**
  - **Bacterium**
- ***Istocheta aldrichi****
  - **Tachinid fly**
- ***Tiphia* species***
  - **Parasitic wasps**
- ***Ovavesicula popilliae****
  - **Microsporidium (fungus)**

* Species involved in Colorado Japanese Beetle Biological Control Program

## Natural Enemies of Japanese Beetle for Potential Introduction into Colorado?

*Tiphia vernalis* (Spring Tiphia) – parasitoid was of late stage Japanese beetle grubs

Photograph by David Shetlar, The Ohio State University

David Shetlar photo

**Adults of the Spring Tiphia emerge in May. The adults feed on nectar and honeydew.**

**The availability of nearby sources of nectar and honeydew is important in the success of this insect as a biological control of Japanese beetle**

**Dan Potter**, University of Kentucky, spraying sugar water on foliage to attract spring tiphia for collection.

A source of spring tiphia was developed in 2019, near Lexington, Kentucky

The 2019 wasps were released at a golf course site in Boulder

This site was chosen since it had **high numbers of grubs** *and nearby sources of nectar and honeydew*

Female wasps dig into the soil to locate Japanese beetle grubs that are nearly full-grown.

They then lay an egg on the grub.

The **developing larva** of the wasp **feeds on and kills the grub**.

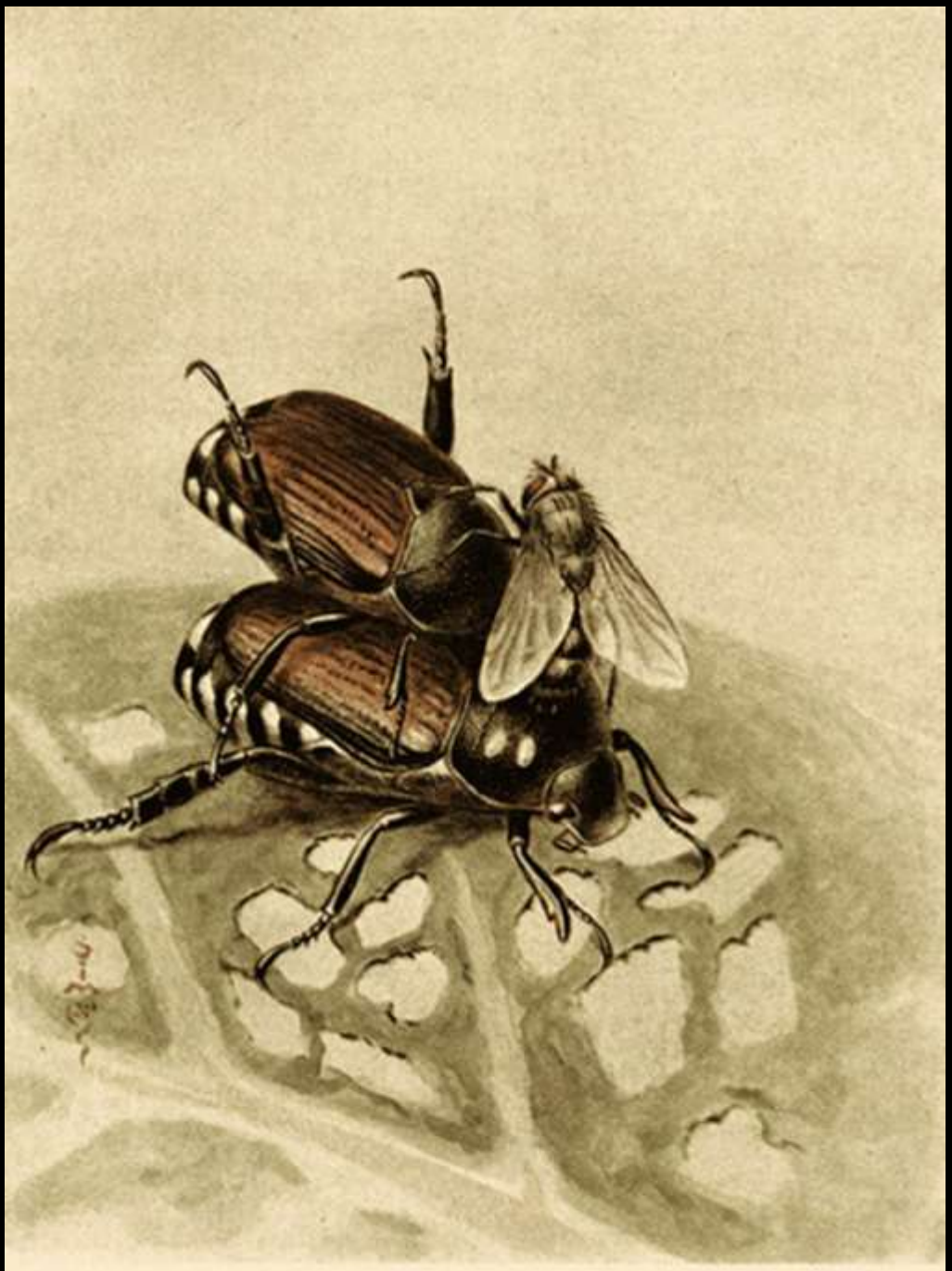
It then pupates. The adult emerges next spring.

# Status of *Tiphia vernalis* Releases

- **Boulder**
  - 1 Release Site (2019)
- **Littleton (CDA)**
  - 1 Release Site (2018, 2019)

## Natural Enemies of Japanese Beetle for Potential Introduction into Colorado?

*Istocheta aldrichi* – tachinid fly parasitoid of Japanese beetle adults



A female *Centeter cinerea* in the act of ovipositing upon *Popillia japonica* female

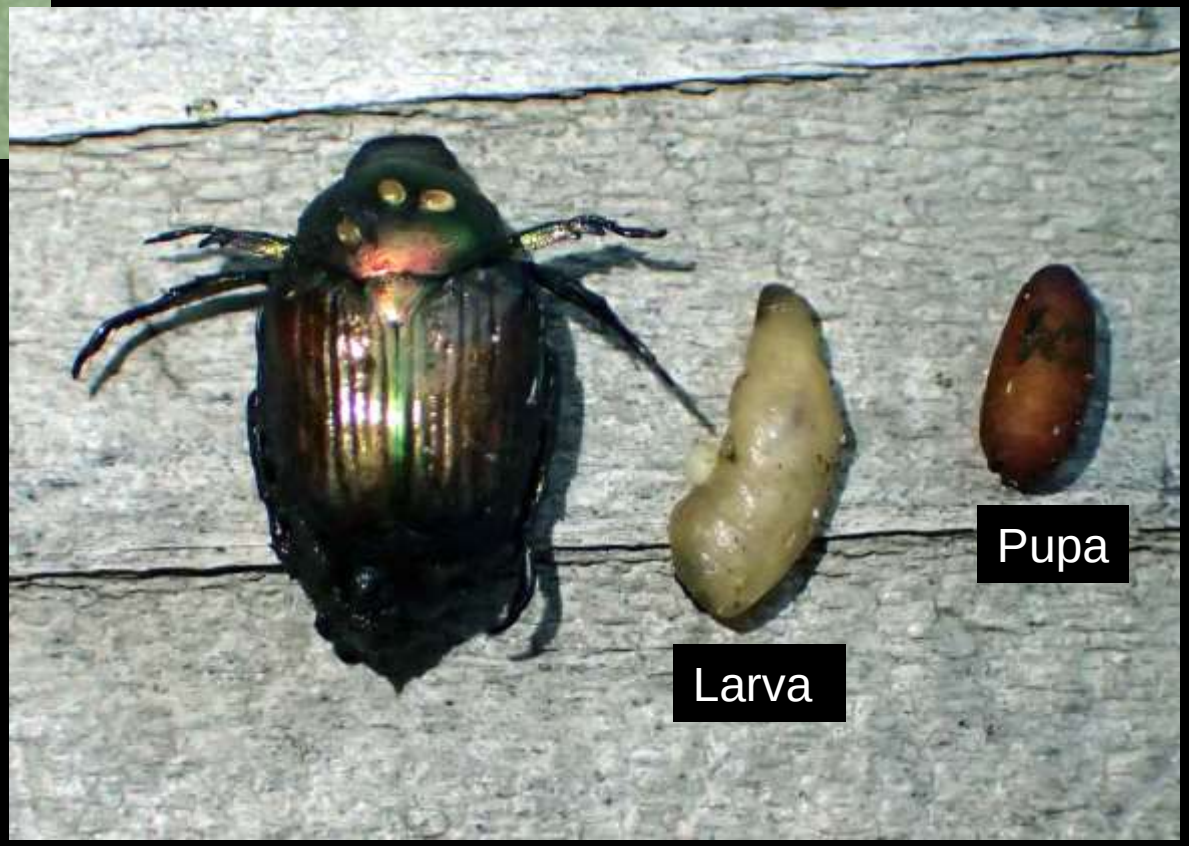
*Istocheta aldrichii* requires accessible nectar/pollen resources when the adults are active

– late June-July

A female *Centeter cinerea* in the act of ovipositing upon *Popillia japonica* female

*Istocheta aldrichii* (“winsome fly”) lays eggs on adult Japanese beetles in July


The egg(s) hatches and the larva of the fly enters the beetle.




Ultimately the beetle is killed.

The larva then migrates out of the beetle and moves into the soil where it pupates.

The adult emerges the following year.

# Status of *Istocheta aldrichii* Releases

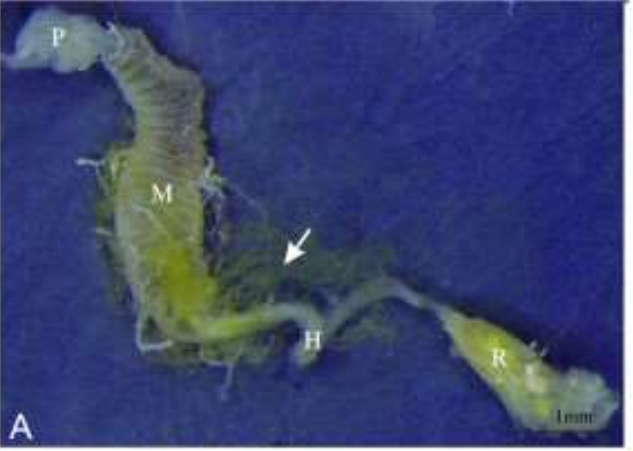
- **Boulder**
  - 1 Release Site (2019)
- **Pueblo**
  - 1 Release Site (2018)
- **Denver/Littleton**
  - 2 Release Sites (2018)

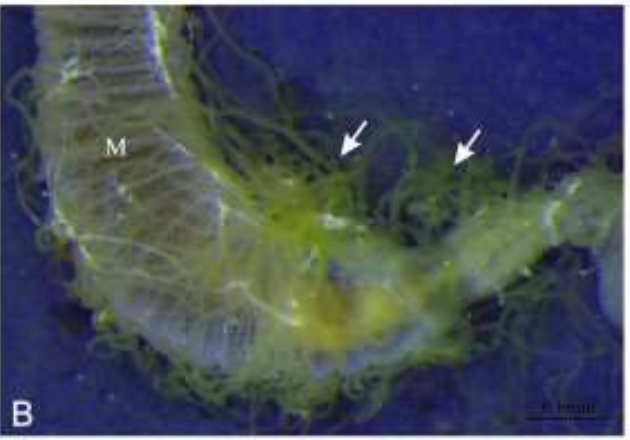
## Natural Enemies of Japanese Beetle for Potential Introduction into Colorado?

*Ovavesicula popilliae* – a microsporidian (fungal) disease of Japanese beetle larvae

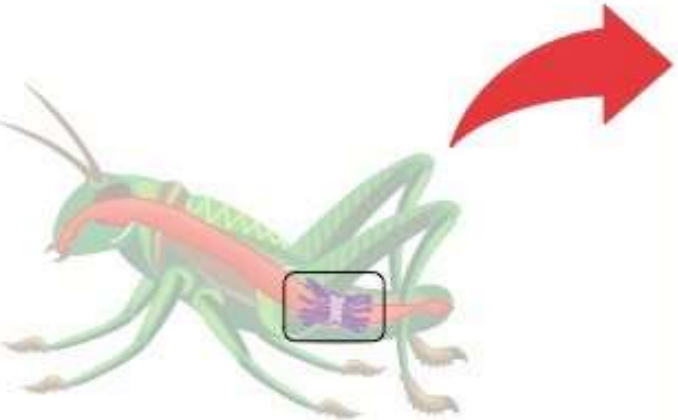
*Ovavesicula* infection of Malpighian tubules of Japanese beetle larva

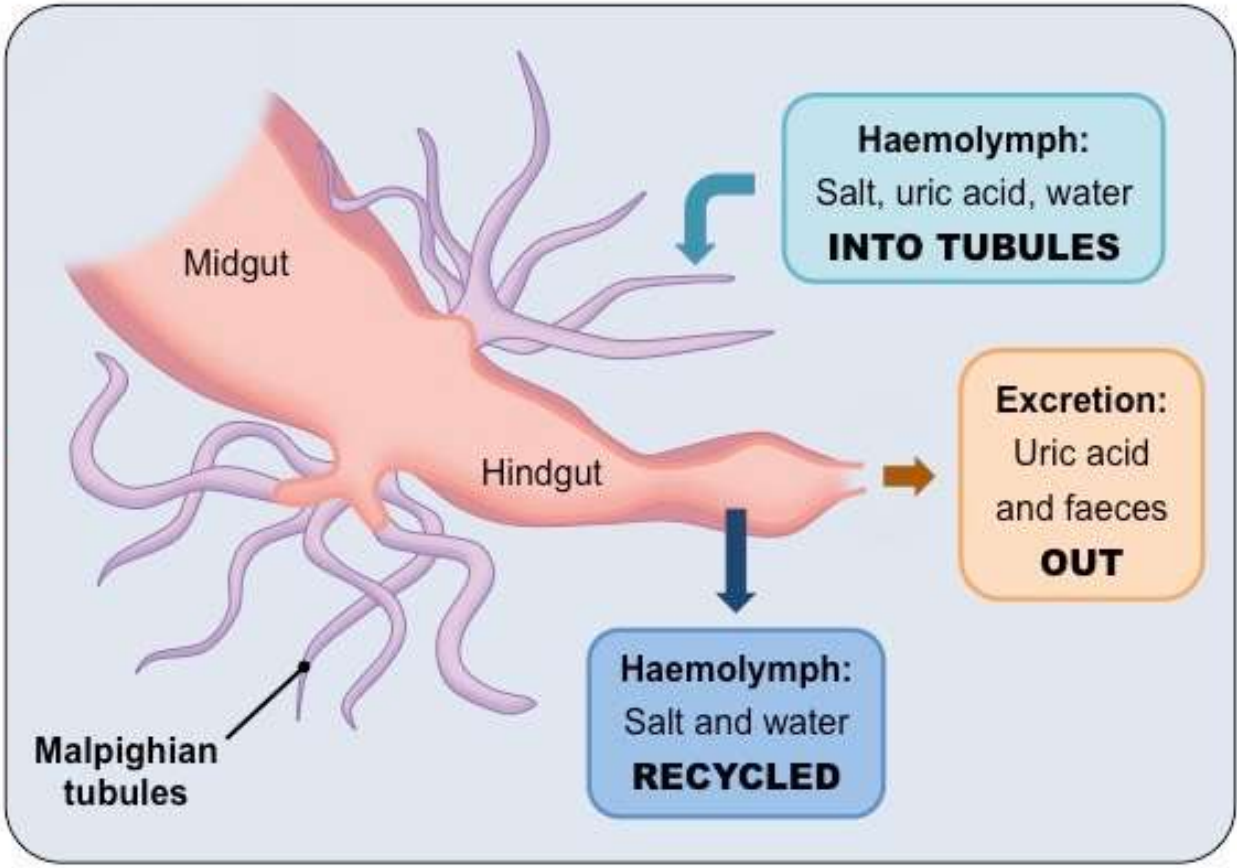
**Main observed effects from infection – reduced fecundity, reduced winter survival**



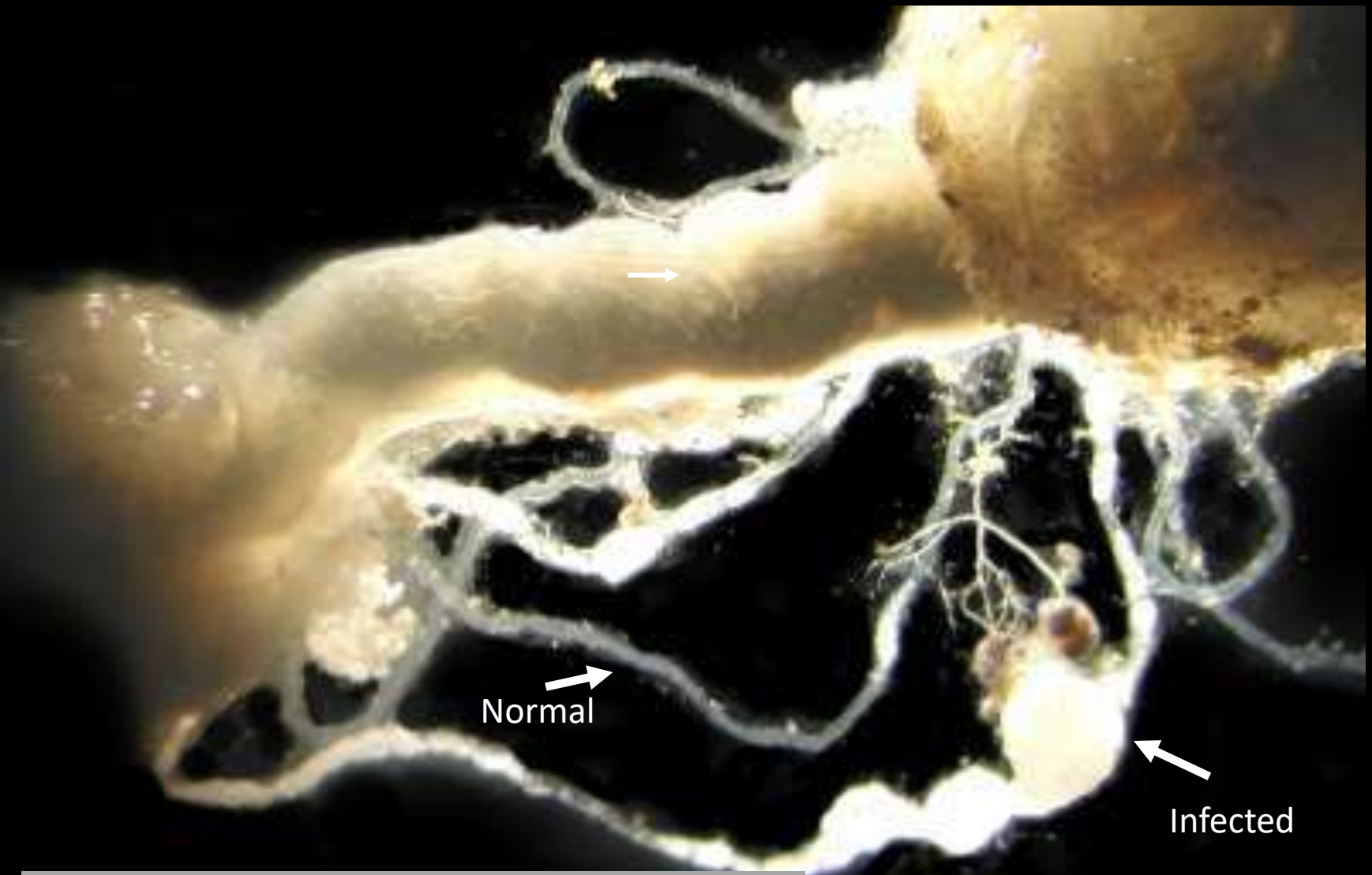




The **Malpighian tubules** of insects filter wastes from the blood, functioning somewhat like what the kidney does in humans





# Heavy *O. popilliae* infection of Malpighian tubules of Japanese beetle




Source: David Smitley, Michigan State University

# Status of *Ovavesicula popillae* Releases

- **Boulder**
  - 1 Release Site, 2015)
  - **Confirmed established**
- **Pueblo**
  - 3 Release Sites (2015, 2018)
- **Denver/West Arapahoe Counties**
  - 6 Release Sites (2018)

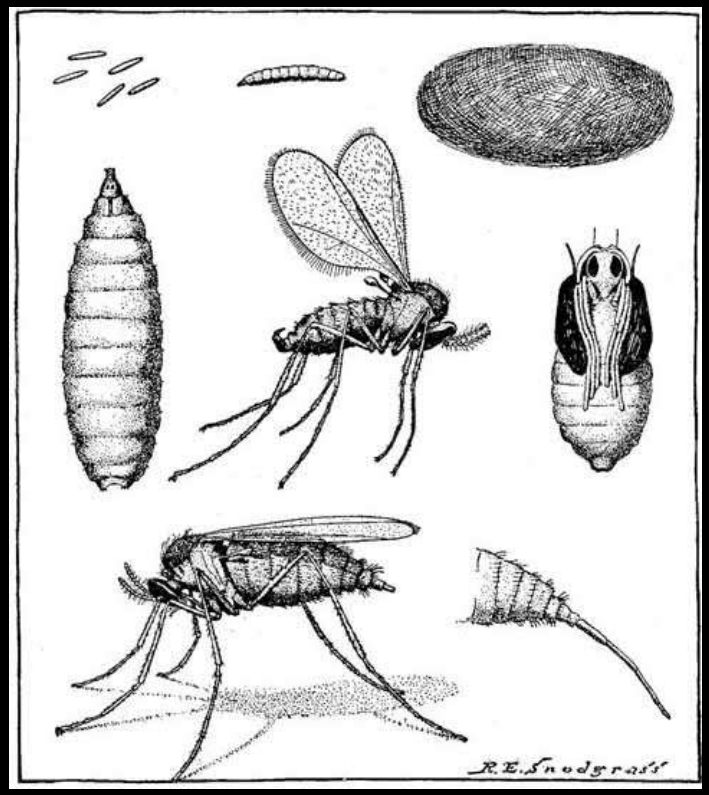
# If the Japanese Beetle Biological Control Project works, what would be considered success?

In 10-15 years there would only be three Japanese beetles on your rose, instead of ten

# Miscellaneous topics until I run out of time

- Rose midge
- Hawthorn mealybug
- Two gall wasps on bur oak

# A trial to find a rose midge control product

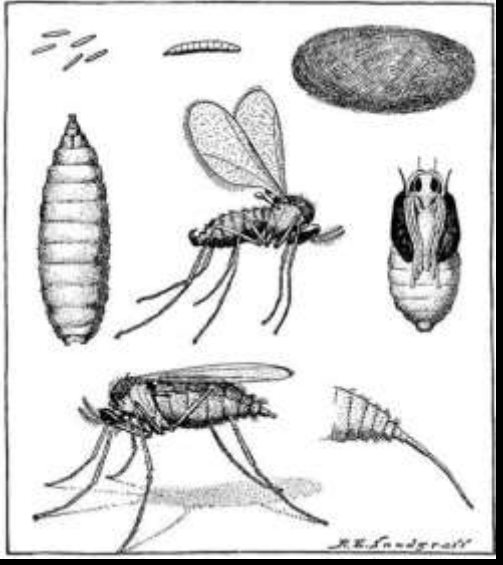



# Rose Midge

*Dasineura rhodophaga*

Diptera: Cecidomyiidae

A tiny fly that damages the developing flower buds of rose



Jim Baker, North Carolina State University

The adult midge lays eggs on developing shoots, flower buds

© Robin Rosetta, Oregon State University

Rose midge larvae are tiny cream colored maggots that slash the buds as they feed

David Shetlar photo

This results in a variety of symptoms that produce destruction or distortion of developing flower buds

A site was identified in 2019 for a trial to determine if any of the newer insecticides available to a rose grower might be effective for control of rose midge.

Dave Ingram of the Denver Rose Society was partnered on this project


Spinosad

Acetamiprid


The products chosen had to be available for retail sale, have high safety to bees, and were known to be effective against some kinds of other fly/midge pests.

# Results

| Treatment | No. Damaged Terminals/Plants |
| --- | --- |
| • Spinosad | • 0.85 |
| • Acetamiprid | • 0.85 |
| • Untreated Check | • 2.85 |

Bottom Line: Both treatments tested provided about 70 percent control

# Hawthorn Mealybug

***Phenococcus dearnessi***

- **Highly Susceptible**
  - English hawthorn
  - Arnold hawthorn
  - Thornless cockspur
- **Less Susceptible**
  - Snowbird hawthorn
  - Russian hawthorn
  - Macracantha hawthorn
- **Apparently Resistant**
  - Cordata Washington

A range of resistance appears to exist among hawthorn species

Today, hawthorn mealybug is spending the winter on cracks of the bark.

It is very small, an immature stage. Whitish wax indicates where the insects have aggregated.

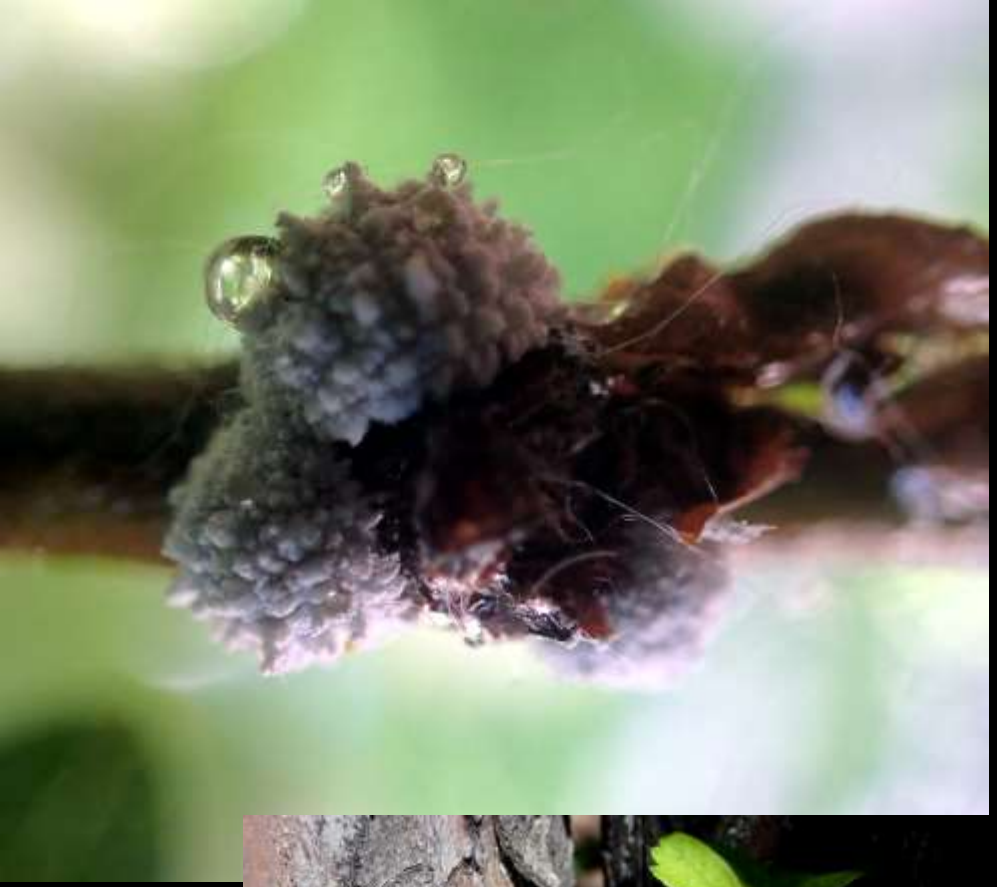
**Soon they will resume activity. Looking closely you may sometimes see a male (they are winged).**

**By early May the overwintered females migrate to the twigs.**

**Many settle near the base of the emergent buds.**

These ones settled, and developed, underneath some flagging tape on the branch.

**During May the females swell with eggs**



# Hawthorn mealybug secretes a lot of honeydew

Honeydew on leaves

Sooty mold on bark

**Crawlers migrate to the leaves and feed there for a couple of months**

**In midsummer the mealybugs move from the leaves and settle in crevices on older wood and the trunk.**

They remain in these sites, dormant, until the following spring.

# Control – **Systemic neonicotinoids?**

**No.** Hawthorn is an early season flowering plant that is ***heavily used by honey bees for nectar and pollen.***

# Pyriproxifen as a mealybug treatment

- Trade names Distance, Fulcrum, Endeavor
- Acts on hormones insects use in development (IGR)
- Mostly works on scales, aphids and related sucking insects (like mealybugs)
- Very little effect on natural enemies of insect pests
- Compatible with pollinators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# Dormant Oils?

Target the overwintering stages on the trunk/ larger branches.

Pyriproxifen applications with/without oils should also be very effective at this time.

# Gall Wasps

## Hymenoptera: Cynipidae



**Most gall wasps on oak have two generations that produce two different types of galls**

# Oak rough bulletgall wasp

This is an all-female generation

**Adults emerge from galls in mid-October to mid-November and lay eggs in buds…….**

**The eggs from this hatch in spring to produce a generation within a budgall**

Spring stage adults are much smaller than those observed in fall

Spring stages consist of both males and females

**Spring stage adults lay eggs in the emergent twig growth**

**New galls begin to erupt in late spring/early summer. They become full-sized by late summer.**


These galls exude **honeydew**
Photograph by Crystal Cooke

**The honeydew on the galls attracts many kinds of insects**

# Oak rough bulletgalls produce a sweet exudate that is are attractive wasps

Stunting produced by oak rough bulletgall wasp

There is a wide range in susceptibility to this insect. Some trees are highly susceptible, some highly resistant, many somewhat in between.

# A Collage Made of Galls from Oak Twigs

Artist: Crystal Cooke

**Oak rough bulletgall wasps eaten by woodpeckers**

Photograph by David Cappaert

# An interesting **gall wasp-woodpecker interaction** on bur oak

Photograph by David Leatherman

The gall wasp *Callirhytis flavipes* develops under the bark of twigs branches, and the trunks of oak

Photographs by David Leatherman

They are small and develop within small chambers.  There are dozens of these chambers in the above photo.


Downy woodpeckers work the bark and extract the developing gall wasp larvae in winter and early spring

This can result in extensive debarking of trunks, branches

This can lead to dieback of limbs and the upper trunk

After this gall wasp emerges from the trunks//branches, it moves to new leaves.  The summer generation develops within an irregularly shaped gall of the midrib.

One group of gall makers that is never well controlled with insecticides

Gall wasps on woody parts of the plant

Ready….

Set….

# *Go to Sign-out for your Credits!*