

Update on Insect Issues Affecting Trees and Shrubs (207)

2018 CSU Front Range Pest Management Conference



Whitney Cranshaw

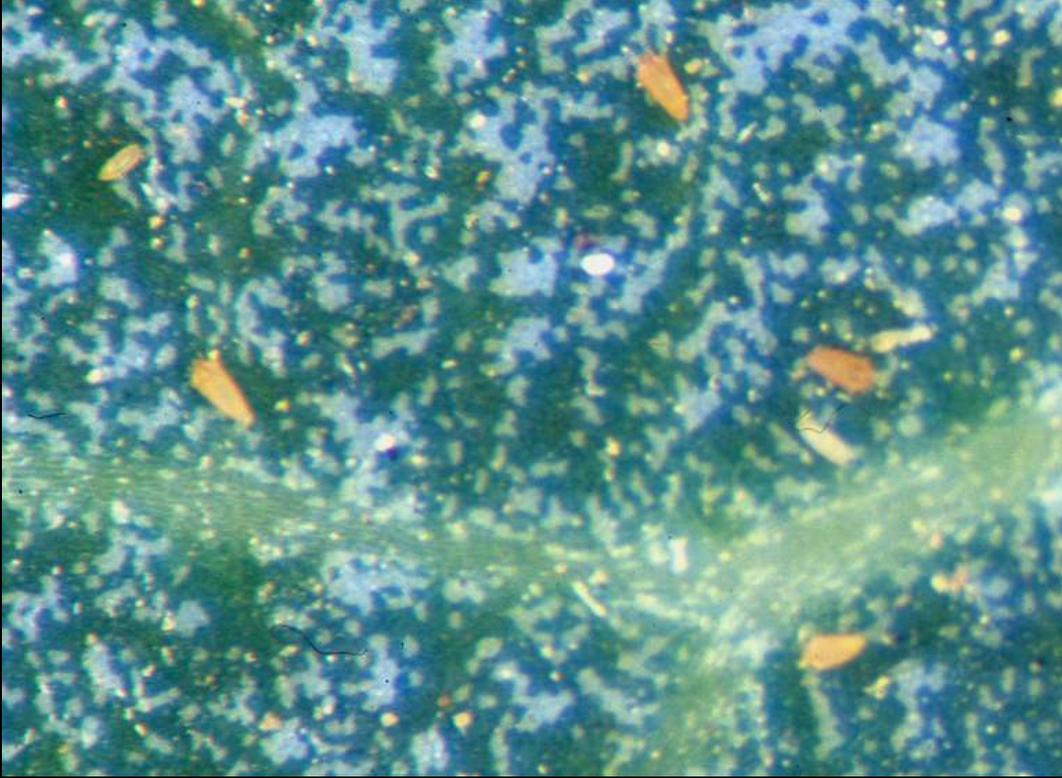
Colorado State University



Outbreaks of ash flowergall mite



**Ash flowergall mite is
an eriophyid mite**





Ash flower gall mite develops within the male flowers of ash trees, causing them to become grossly distorted and to persist on the trees



Typical ash flowergalls



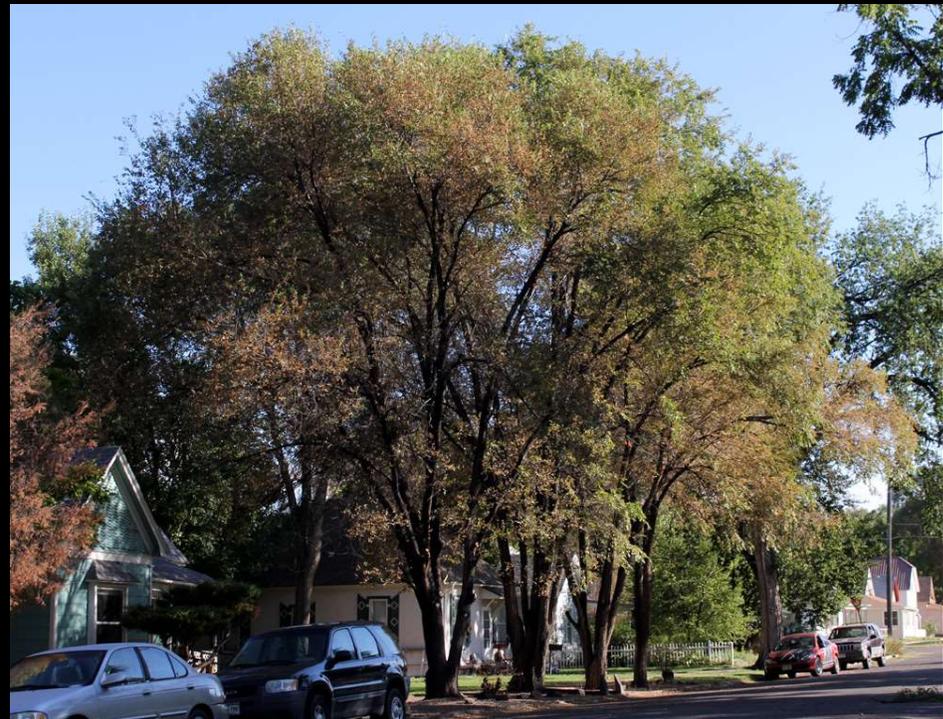
**Galls noted in 2018
were much more
extensive than normal
in many sites**



Elm Leaf Beetle

Xanthogaleruca luteola

Coleoptera: Chrysomelidae



Winter is spent in the adult stage. During this time they are in a dormant condition and dark olive green.

Elm leaf beetles often enter nearby buildings and can be common nuisance invaders in the cool seasons.





**Color changes
when they become
active during the
growing season.**

**Adults chew large,
irregularly circular
holes in the interior
of the leaves.**



Females lay a series of egg masses on the underside of elm leaves

Elm leaf beetle egg mass



Lady beetle egg mass



Elm leaf beetle egg mass





Early stage larvae chew small pits in leaves

As they get older they feed as **skeletonizers**







During outbreaks there can be extensive skeletonization of elm leaves from larval feeding





Full-grown larvae migrate down the trunk. Pupation usually occurs at the base of the tree.





Pre-pupae and pupae at the base of a Siberian elm

Pre-pupae Pupa





**Elm leaf beetle
pupae**





The cycle is repeated.

There are two generations produced annually.



**Cottonwood Leaf
Beetle**

Knab's Leaf Beetle

**Outbreaks of two beetles
on *Populus* and *Salix***





Cottonwood Leaf Beetle

Chrysomela scripta

Coleoptera: Chrysomelidae

Hosts are cottonwoods, some poplars,
occasionally some willows





Eggs are laid on their host plants – cottonwoods, certain poplars, occasionally some willows.



Young larvae initially feed as a group and produce skeletonizing injuries





As the larvae get older they feed as more generalist defoliators





**Adult with
prepupa**



**Pupa and
adult**

Knab's Leaf Beetle

Chrysomela knabi

Coleoptera: Chrysomelidae

Hosts: Certain **willows**, occasionally aspen



Outbreaks of two beetles on *Populus* and *Salix*



These insects may co-occur on certain willows





A concern?

Probably not much.
These are native
species, just having a
particularly good year.





Gambel oak borer

Agrilus quercicola

Another native insect,
acting badly



An emergent
pest of
English oak



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)

It is a native insect to Colorado, normally associated with Gambel oak



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 before 2003.

Populations exploded during the 2001-2003 drought years.

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



Large plantings of oaks killed by Gambel oak borer in 2003



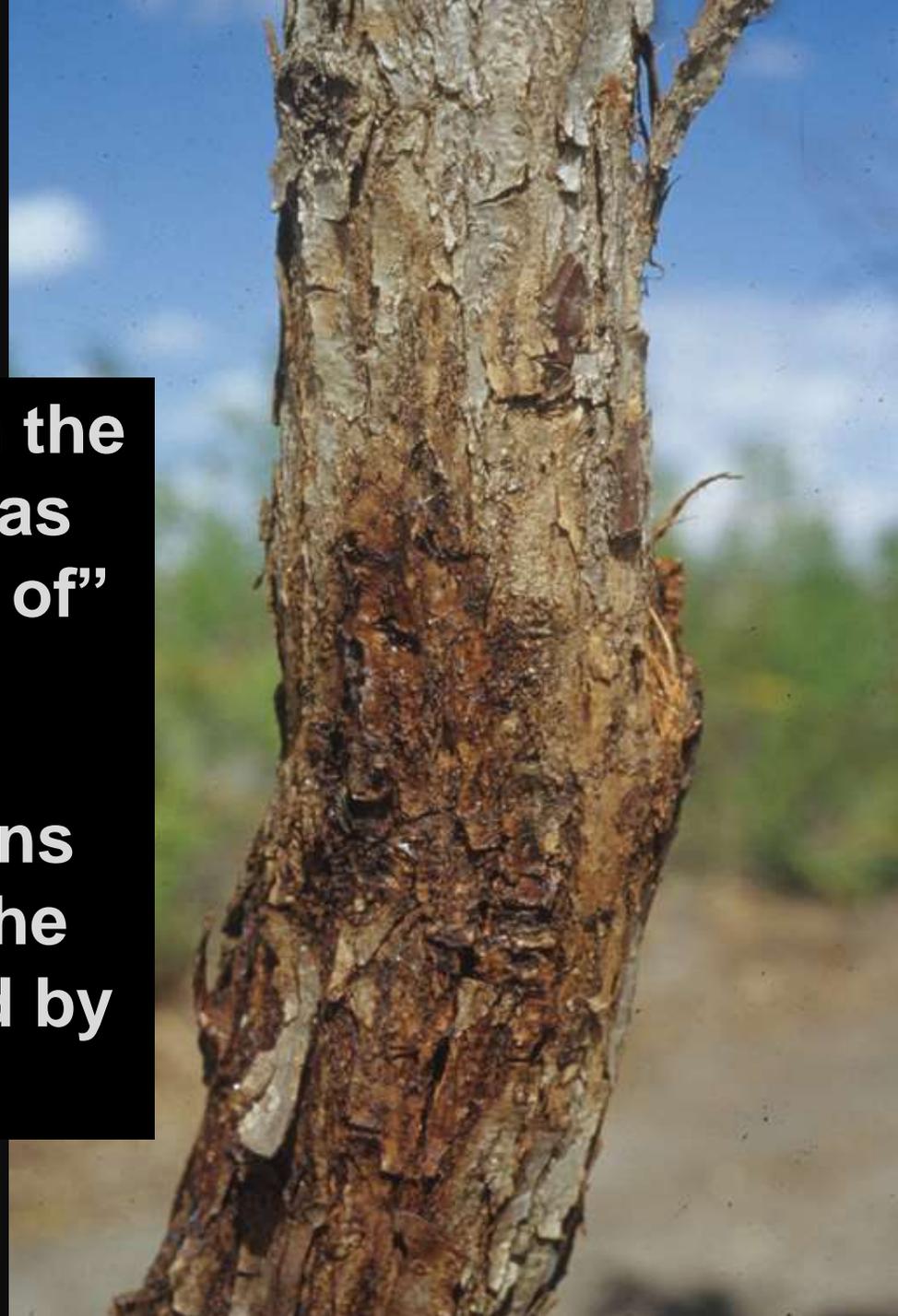
Native Gambel oak and source of Gambel oak borer





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



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



This proved to be the Gambel oak borer



This insect continues to be damaging to English oak in both the Denver area and in parts of Boulder



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

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)**

Fifth Anniversary!

Emerald Ash Borer in Colorado





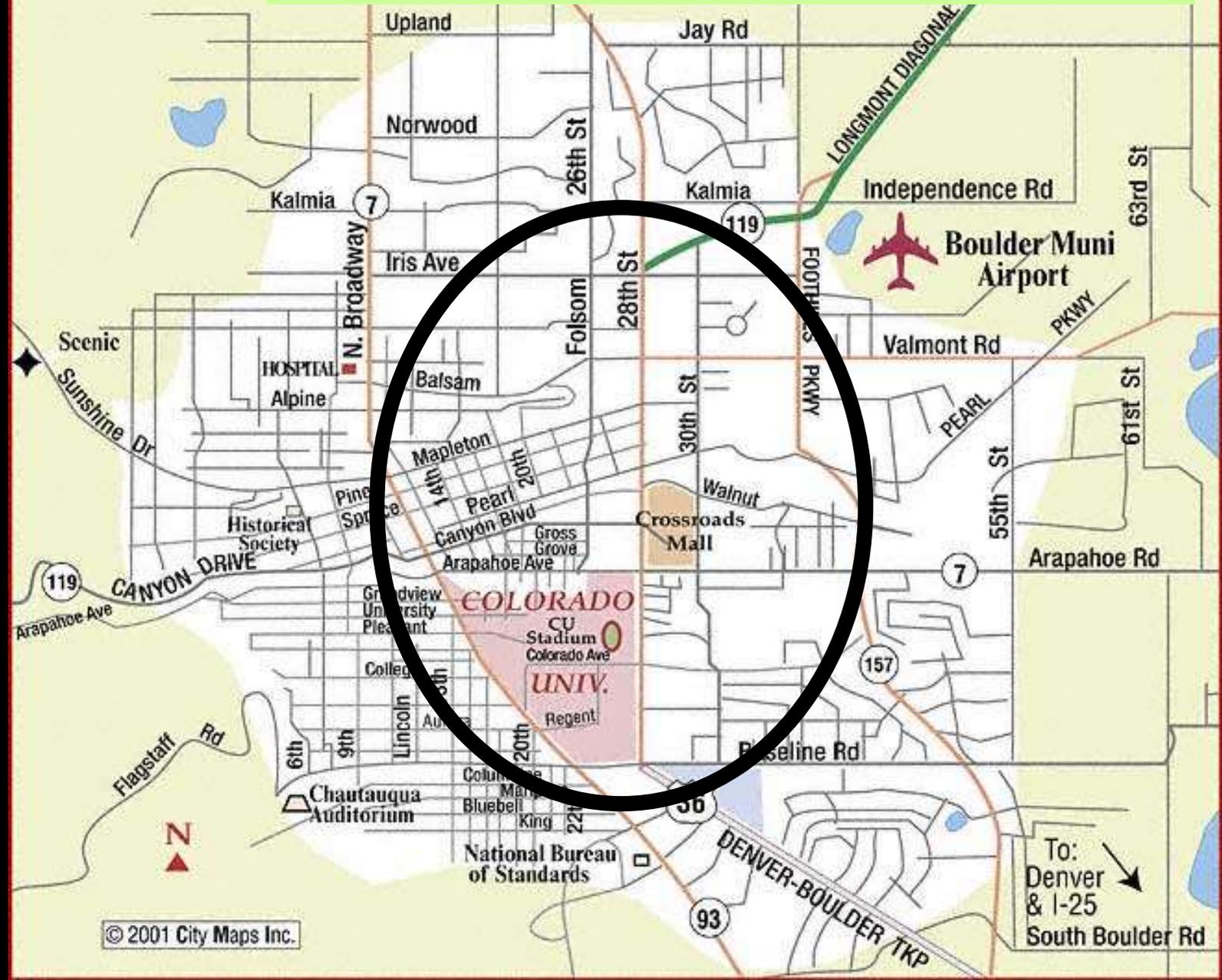
Colorado EAB Tree #1

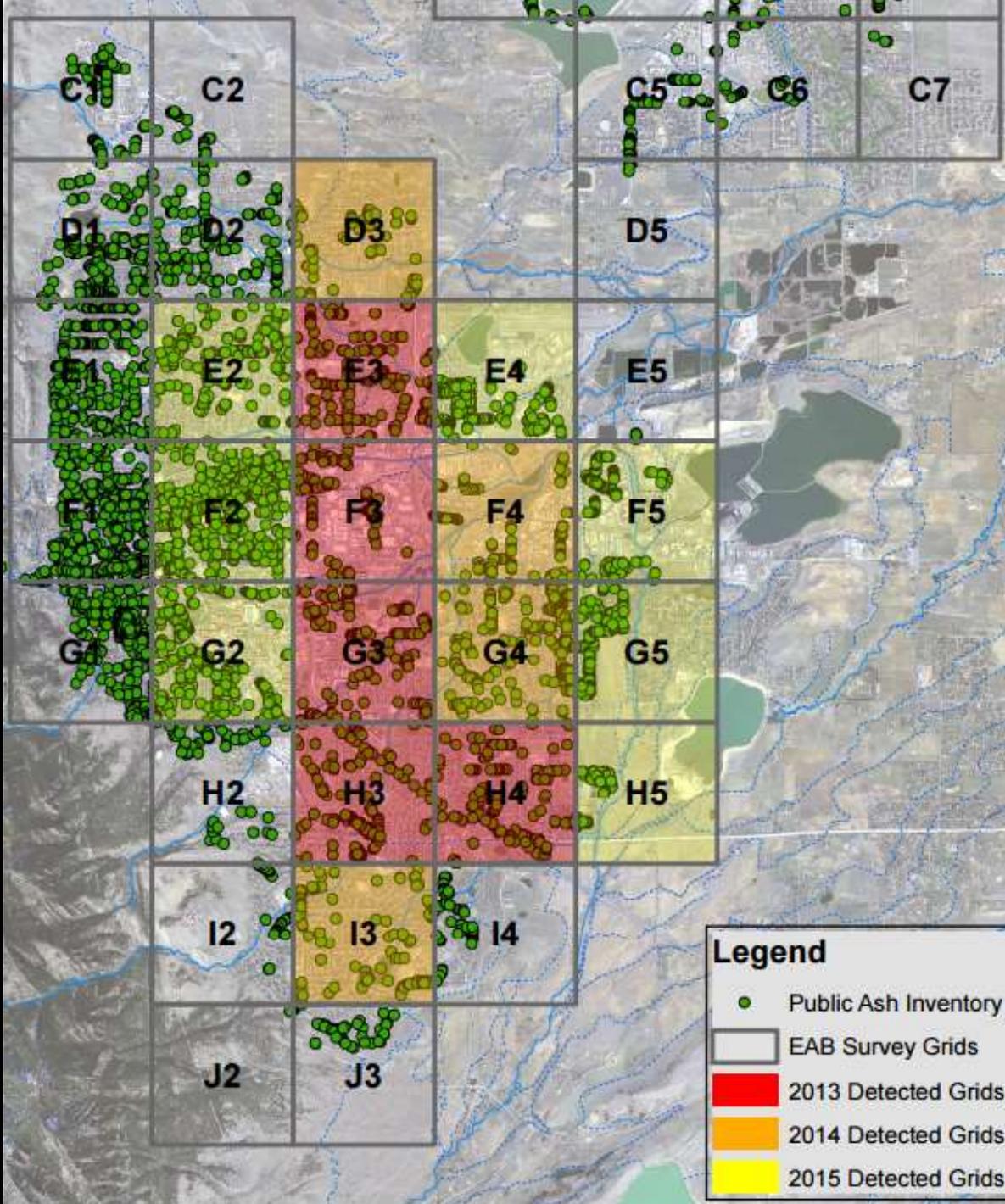
Located near the
intersection of 30th and
Valmont, Boulder

September 23, 2013

BOULDER

Area of original EAB infestation in Colorado



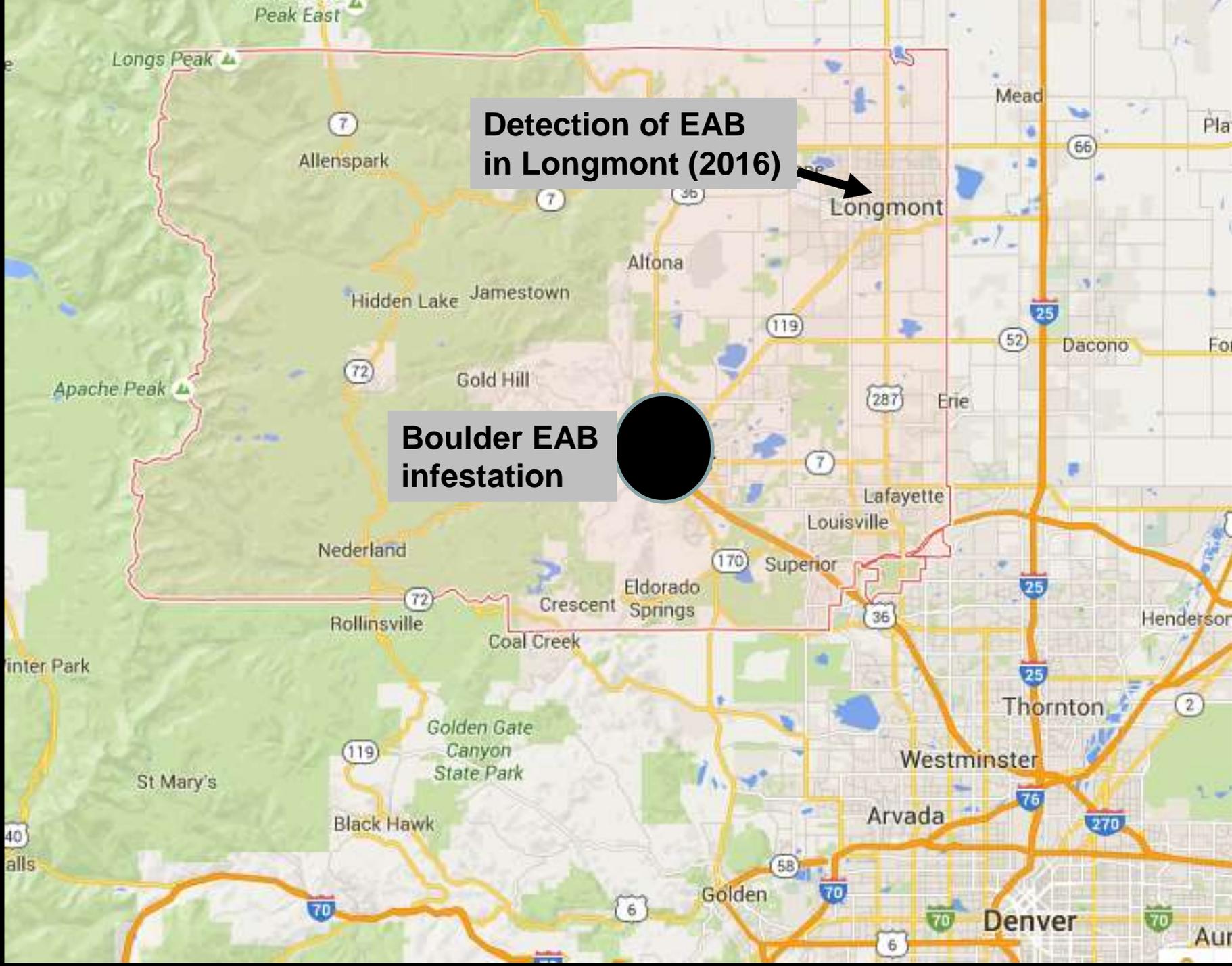


Areas known to be infested with emerald ash borer in Boulder end of 2015

How will EAB spread in Colorado?

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

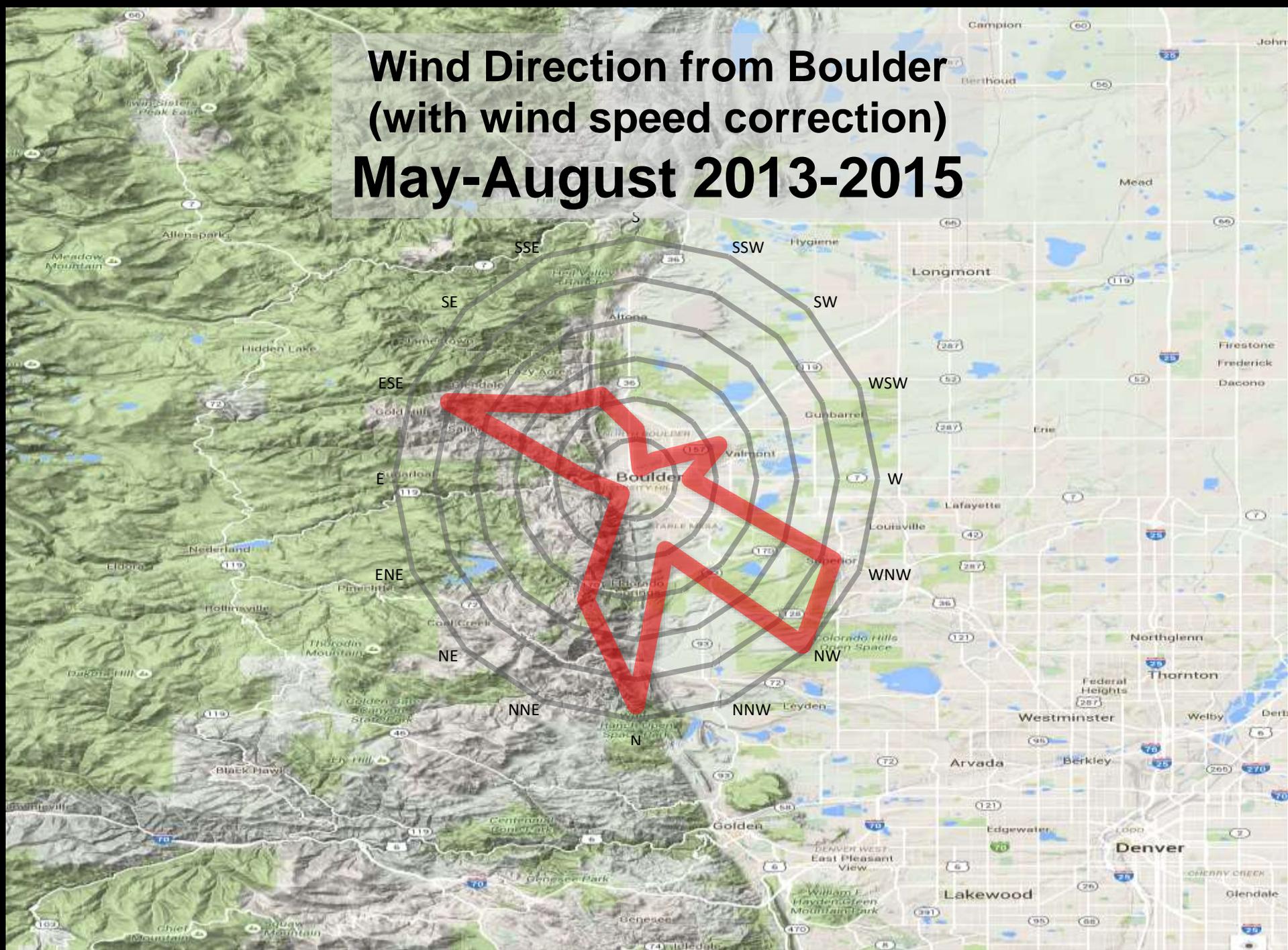




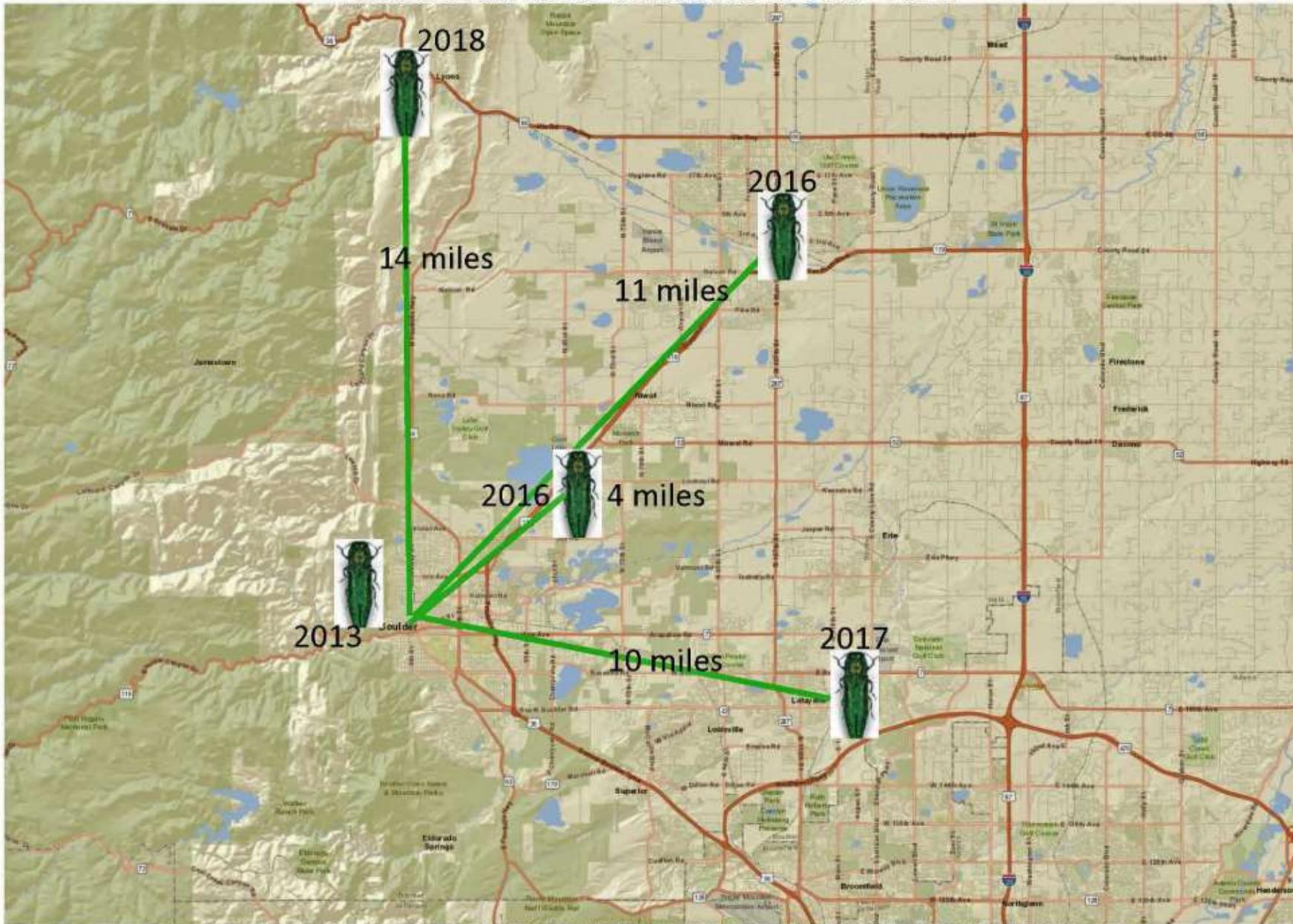
**Detection of EAB
in Longmont (2016)**

**Boulder EAB
infestation**

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



Emerald Ash Borer Detections in Colo - 2018



Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), Swire, © OpenStreetMap contributors, and the GIS User Community

0 2.25 4.5 9 Miles 1 in = 3 miles

Created by: D. West

Confirmed infestations of emerald ash borer presently occur in **Boulder, Longmont, Gunbarrel, Lyons and Lafayette**

Main Points About Emerald Ash Borer in Colorado Today

- **All known infestations remain confined within Boulder County**
 - In time it will spread throughout South Platte drainage
- **Treatments are available that can protect individual trees once they first become infested**
 - Each treatment option involves decisions balancing costs, environmental hazards, effectiveness, and ease of application

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, imidacloprid



Root Weevils

Otiorhynchus spp., primarily



Adults produce leaf notching wounds





Larvae of root weevils feed on roots, usually of the same plant on which the adults produce leaf notching



Black vine weevil



Common species of leaf notching root weevils

Strawberry root weevil



Decorated root weevil



Rough strawberry root weevil



Lilac root weevil



Lilac root weevil

Otiorhynchus meridionalis



A recent invasive species – *and a cause for concern?*



Adults feed at night. They notch leaves, making angular cuts along the leaf edge



Lilac, peony and privet
seem to be the
primary hosts for lilac
root weevil





Larva and root injury to peony by lilac root weevil

Root Weevil Control

- **Adult Control (foliage)**
 - A persistent pyrethroid (Tempo, Onyx, Scimitar, etc.)
- **Adult Control (soil injection/drench)**
 - Imidacloprid (*after flowering!*)
- **Larval Control (soil drench)**
 - *Heterorhabditis* spp. nematodes

Insect Parasitic Nematodes

- Also known as entomopathogenic nematodes
 - Associated with pathogenic fungi
- Commercially available genera
 - *Steinernema*
 - *Heterorhabditis*



Heterorhabditis spp.
nematodes **can**
penetrate directly
through the body wall



} = *Heterorhabditis* spp.

} = *Steinernema* spp.

Reddish color change from larvae killed by *Heterorhabditis* sp. nematodes



Only insect parasitic nematodes in the genus *Heterorhabditis* are recommended for control of white grubs and root weevil larvae

Entomopathogenic Nematodes

(“Predator Nematodes”, “Parasitic Nematodes”, “Beneficial Nematodes”)

Parasitic (Predatory) Nematodes- *Heterorhabditis* species. Insect-parasitic nematodes in the genus *Heterorhabditis* are applied to soil as a drench to control larvae of various insects. They are capable of penetrating the body of insect larvae and are the most effective form of control of soil-dwelling white grubs and root weevils, as well as caterpillars. Several *Heterorhabditis* species are available, which vary some in pathogenicity to insects and sensitivity to temperature. Among those available are *H. bacteriophora* (= *heliothidis*) (e.g., HeteroMask, Grub-Away, BioStrike Hb, GrubStake Hb), *H. indica* (e.g., Grub Stake Hi), *H. marelatus*, and *H. megidis*.

Sources (*Heterorhabditis bacteriophora*): 4, 6, 7, 8, 10, 13, 16, 18, 20, 22, 27, 33

Sources (*Heterorhabditis megidis*): 11

Sources (Unspecified *Heterorhabditis* spp.): 1

Source (Unknown predatory nematodes/Mixture of *Heterorhabditis* and *Steinernema*): 2, 5, 10, 12, 14, 18, 21, 25, 26, 32, 33

BIOLOGICAL CONTROL ORGANISMS FOR INSECTS AND MITES

Whitney Cranshaw, Austin Broberg, and Wendlin Burns
Colorado State University
May 31, 2017 Version

A wide variety of beneficial organisms are offered for sale by several suppliers to assist in management of insects and mites. The following is a listing of most of the US suppliers and it is organized into three sections. First is a brief description of organisms with potential applications followed by reference to sources where they may be purchased. This is followed by a brief summary listing of pest groups and the associated potential biological controls. At the end is a listing of addresses of many suppliers/producers.

Regulatory Note: Under current pesticide law, biological control organisms that involve microbes – such as bacteria, viruses, or fungi – are classified as pesticides and can only be used on crops for which they are labeled. These are in the section *Pathogens of Insects*. “Higher” organisms used for insect control – such as other insects, predatory mites and nematodes – are exempt and can be used on all crops.

Predators of Insects/Mites

Convergent Lady Beetle/Lady Beetles. When sold as “lady beetles” or “ladybugs” the species involved is the convergent lady beetle, *Hippodamia convergens*, a native lady beetle found throughout North America. Purchased lady beetles are all field collected insects, captured in high elevation areas of California where they periodically migrate to and mass aggregate, allowing easy collection. Ability of the collected lady beetles to reproduce is suspended (they are in “reproductive diapause”) so eggs are not produced for several weeks after release. (Pre-feeding lady beetles prior to release can allow some egg maturation to start and a few companies provide such “pre-conditioned” lady beetles). Lady beetles tend to readily disperse from the area of release. Since they store well, lady beetles are available most of the year, although supplies often are limited by midsummer.

Sources: 1, 2, 4, 5, 8, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 30, 32, 33, 34

Twospotted Lady Beetle. The twospotted lady beetle, *Adalia bipunctata*, is an aphid predator that most commonly forages on shade trees, shrubs, and fruit trees. It is widely established and common in most of

This source list is one of many things you can find at the **Insect Information Website**



**Leaf notching
by root weevils**



**Leafcutter bee
wounds**



**Leafcutter bee damage to rose,
lilac and Virginia creeper**





Leafcutter Bees
Hymenoptera: Megachilidae



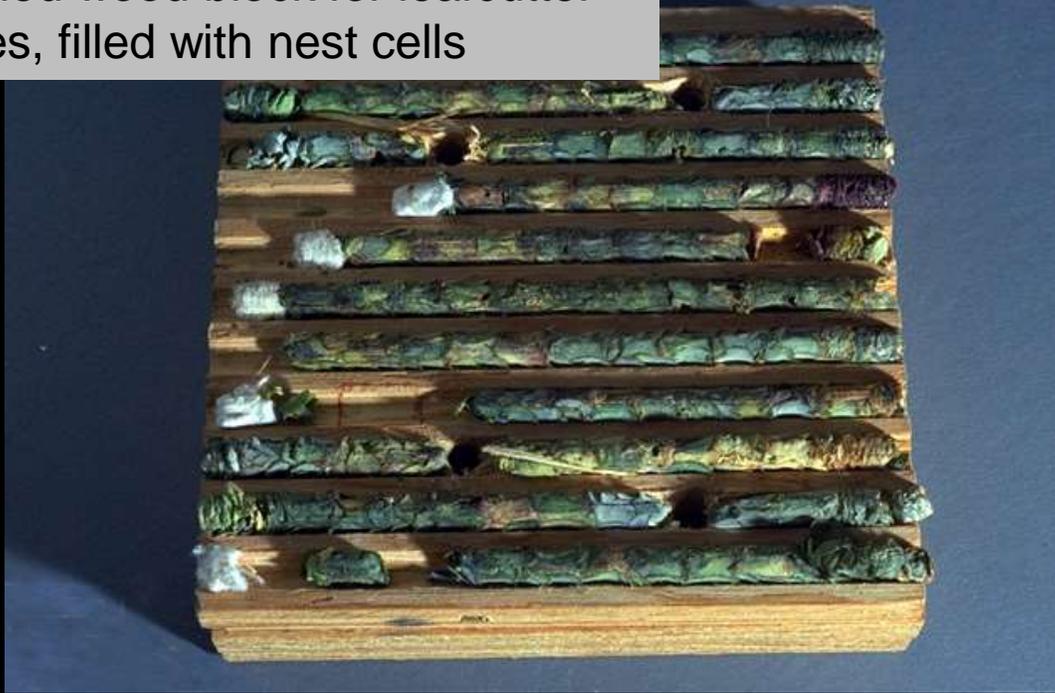


Leafcutter bee nest sites

Soft, rotting wood is
often excavated for
nest sites



Drilled wood block for leafcutter bees, filled with nest cells



Leafcutter bee nest cells and exposed larvae



Leafcutter bee nest cells



Leafcutter bee excavating nest cells in rotten wood of a porch deck



Leafcutter bee nest cells in a rotten log

Nest cells in pith of rose cane



Photograph courtesy of David Shetlar, Ohio State University

Pith nesting by leafcutter bees

Nest cells with pollen in stem of weed



Photograph courtesy of David Shetlar, Ohio State University

A common practice is to provide nest sites for cavity-nesting bees such as leafcutter bees and mason bees



Leafcutter bees cut fragments from the edges of leaves that are suitable for nest building



Line the nest with leaf/flower fragment



Note: Neither the bee or larva feed on the fragments



For nest construction:



3-4 rectangular pieces,
crimped for the base

Oval pieces along the sides of
the cell



Provision the nest with pollen



Note: Leafcutter bees carry pollen on their abdomen (ventral side)





**Plugs of pollen/nectar in cells
constructed within a plant stem**



For nest construction:



3-4 rectangular pieces,
crimped for the base

Oval pieces along the sides of
the cell

Nearly perfect circles used to
cap the cell





For nest construction:

**3-4 rectangular pieces,
crimped for the base**

**Oval pieces along the
sides of the cell**

**Near perfect circles used
to cap the cell**

**All leaf fragments are
oriented with the smooth
side inwards**



Japanese Beetle

Popillia japonica





Japanese beetle
damages plants in
two distinct ways

Japanese beetle adults
chew on leaves and flowers
of many plants



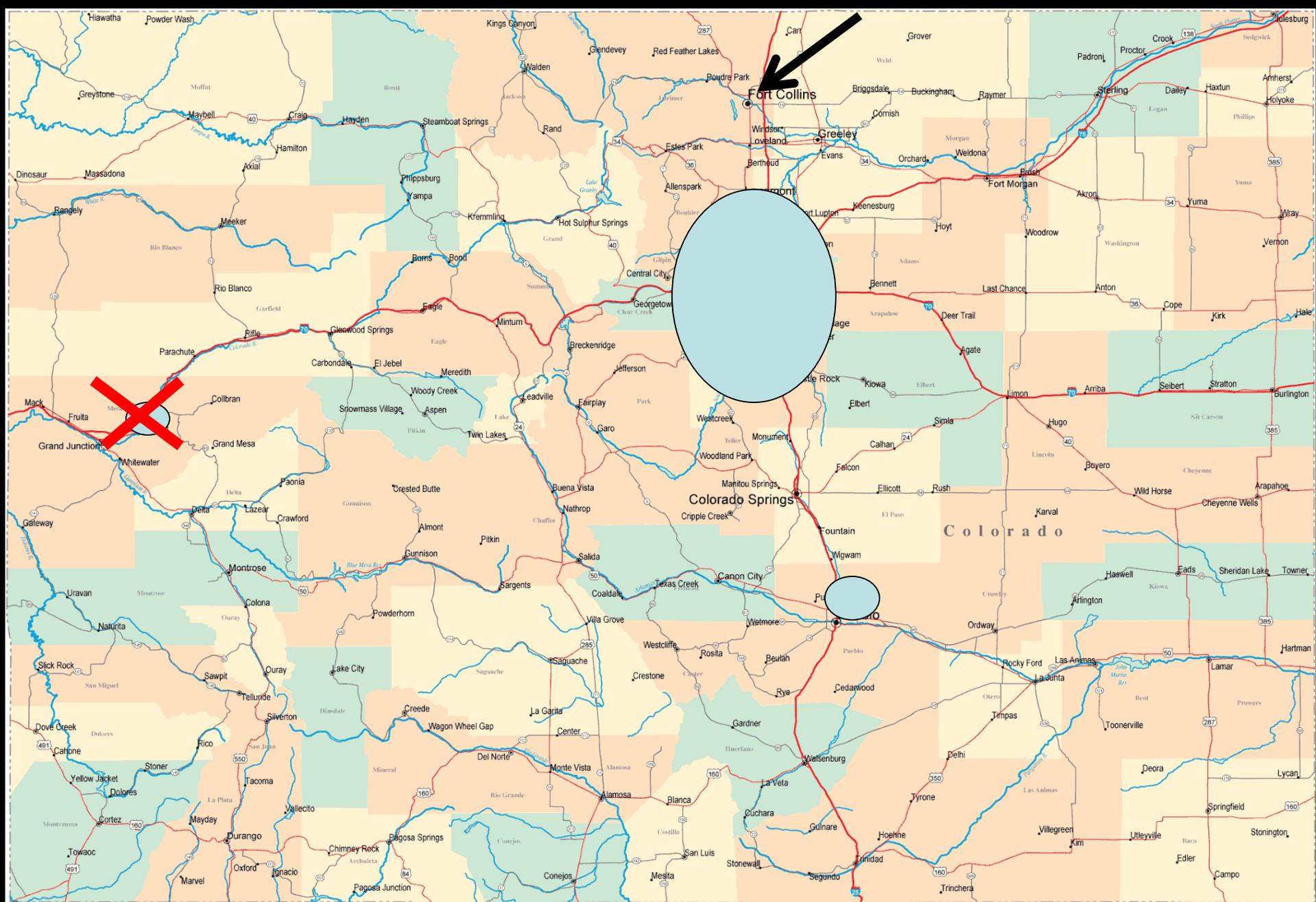
Flowers are often a favored plant part targeted by adult Japanese beetles



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

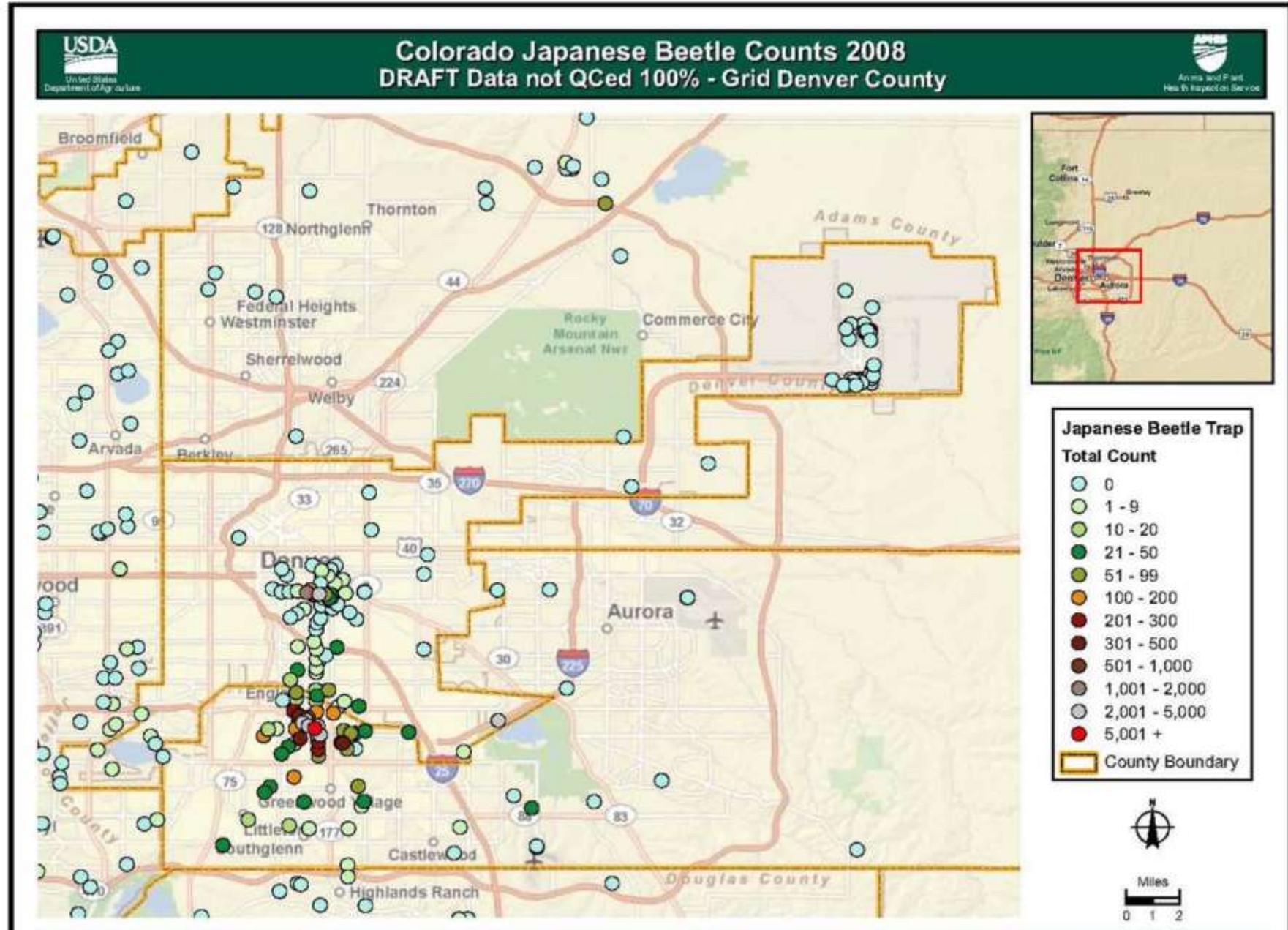


Japanese beetle affects
yard/garden plants **in two
distinct ways**



Japanese beetle is present in two main areas – and spreading fast

Results from extensive trapping of Japanese beetle in Denver area in 2008



USDA APHIS PRQ
 2950 N Lewiston Street, Suite 330
 Aurora CO 80011

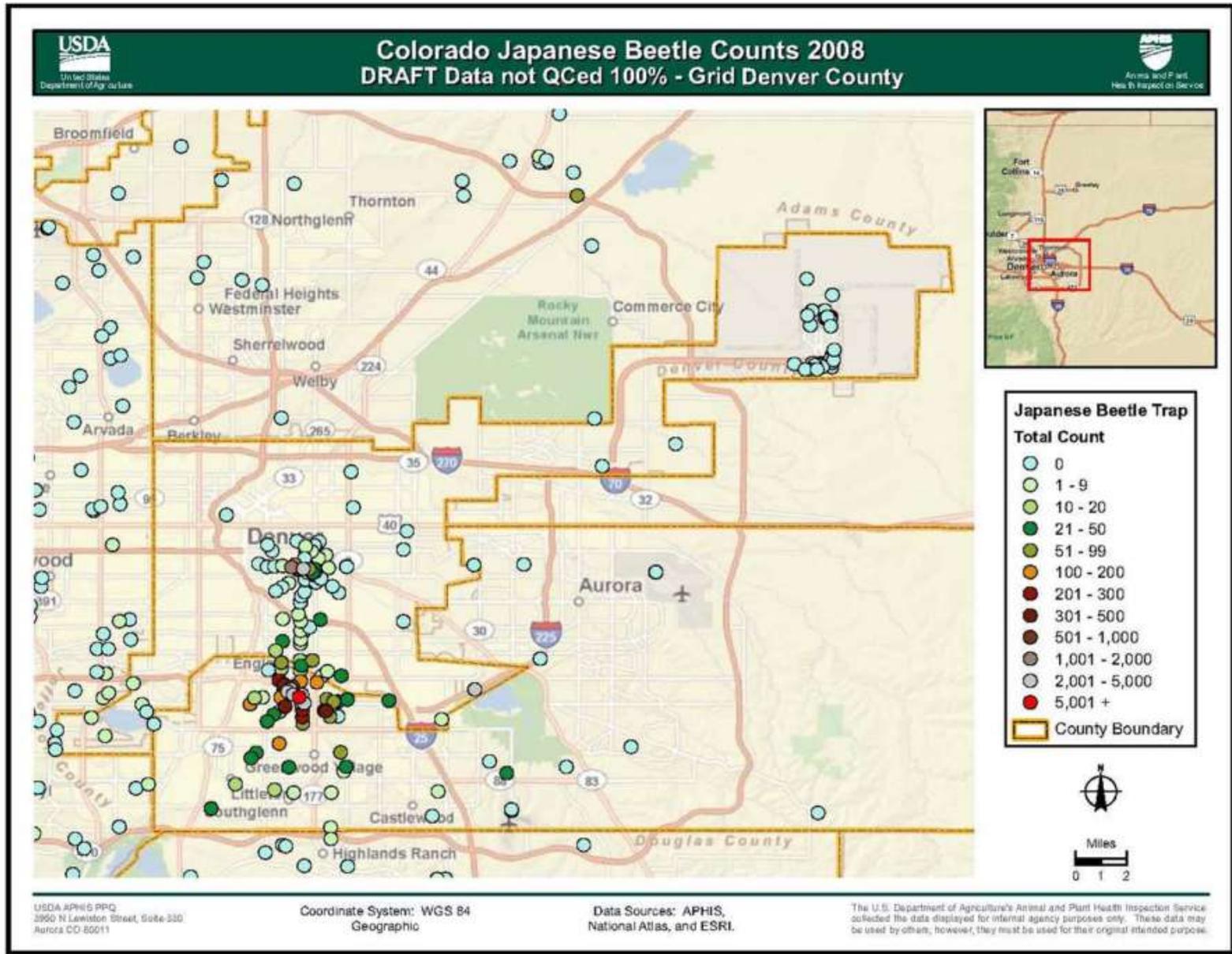
Coordinate System: WGS 84
 Geographic

Data Sources: APHIS,
 National Atlas, and ESRI.

The U.S. Department of Agriculture's Animal and Plant Health Inspection Service collected the data displayed for internal agency purposes only. These data may be used by others; however, they must be used for their original intended purpose.

Proposed Project for 2019

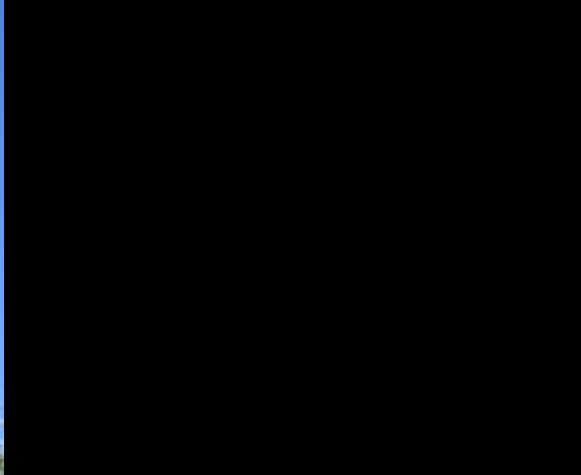
Repeat/Expand the 2008 Japanese beetle survey to establish the present situation in eastern Colorado





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 unusual 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****
- **Littleleaf Linden***
- **Virginia Creeper***
- **Silver lace****



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

Ornamentals

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

Food Crops

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

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

Evaluations of roses at the War Memorial Garden in Littleton, 2016-2017



Japanese Beetle Damage Evaluations on Roses – War Memorial Rose Garden

- Seven observations were made during season
- Damage by Japanese beetle ranked on a **0 to 3 scale**
(no damage to heavy damage)



Japanese Beetle Damage Evaluations on Roses – War Memorial Rose Garden

- Seven observations were made during season
- Damage by Japanese beetle ranked on a 0 to 3 scale (no damage to heavy damage)
- Observed flower visitation by bees ranked on a **0 to 3 scale (no visitation to high visitation)**



Roses that *Were Not* Observed Damaged by Japanese Beetle

- **Child's Play**
- **Cupcake**
- **Gemini**
- **Old Glory**
- **Rainbow Sorbet**
- **Angel Face**
- **Class Act**
- **Electron**
- **Jean Kenneally**
- **Perfecta**
- **Shining Hour**
- **Carrot Top**
- **Colossus**
- **French Lace**
- **Joseph's Coat**
- **Picotee**
- **Sun Sprinkles**
- **Merlot**

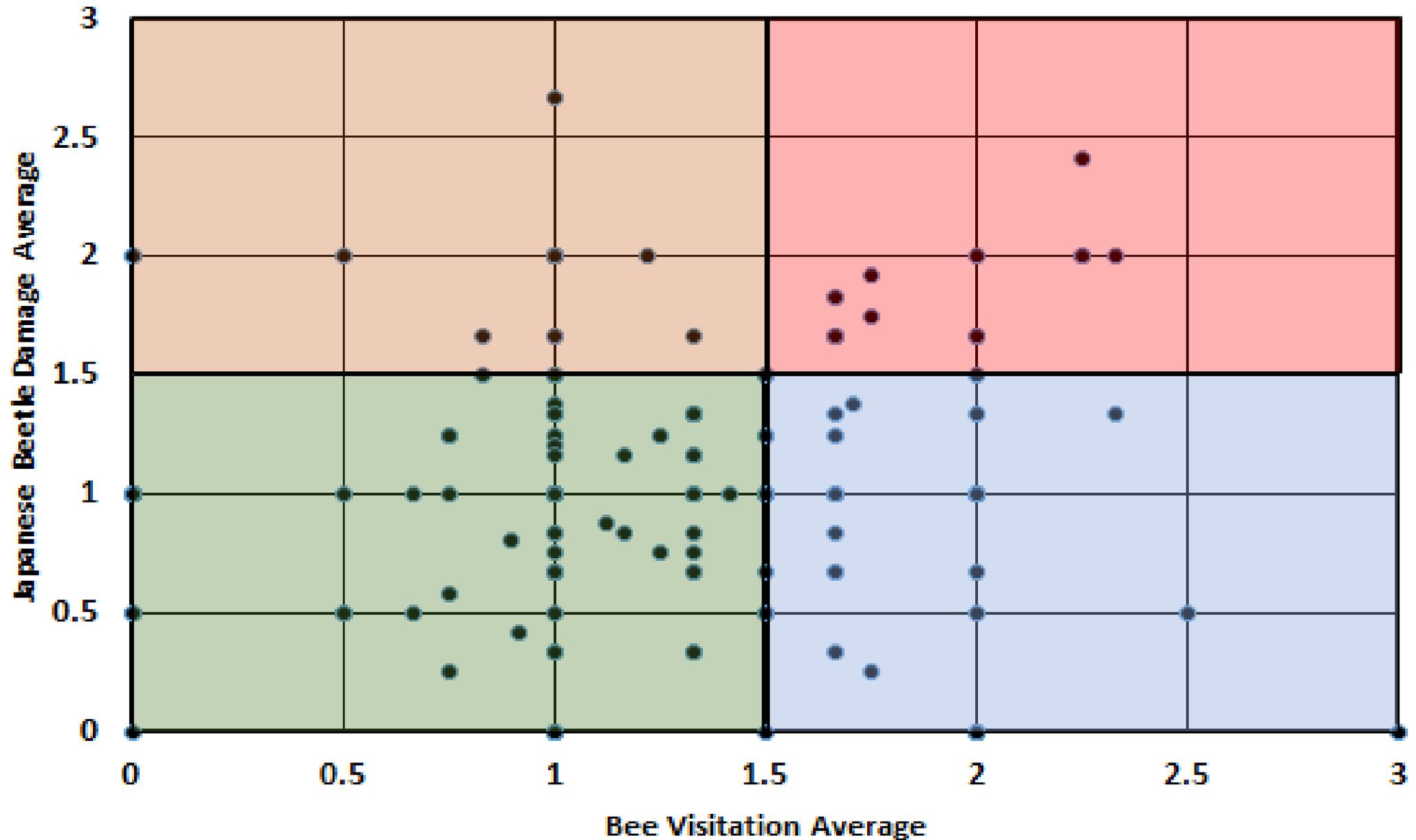
Table 1***Cultivars on which no bees were noted***

Child's Play (M)	Beauty (G)	John S. Armstrong (HT)
Midas Touch (M)	Ranada (M)	Trandescent (G)
Baby Boomer (M)	Cathedral (F)	Gala (M)
Graham Thomas (DAS)	Heritage (HT)	OreGold (HT)
Tuscan Sun (HT)	VooDoo (HT)	

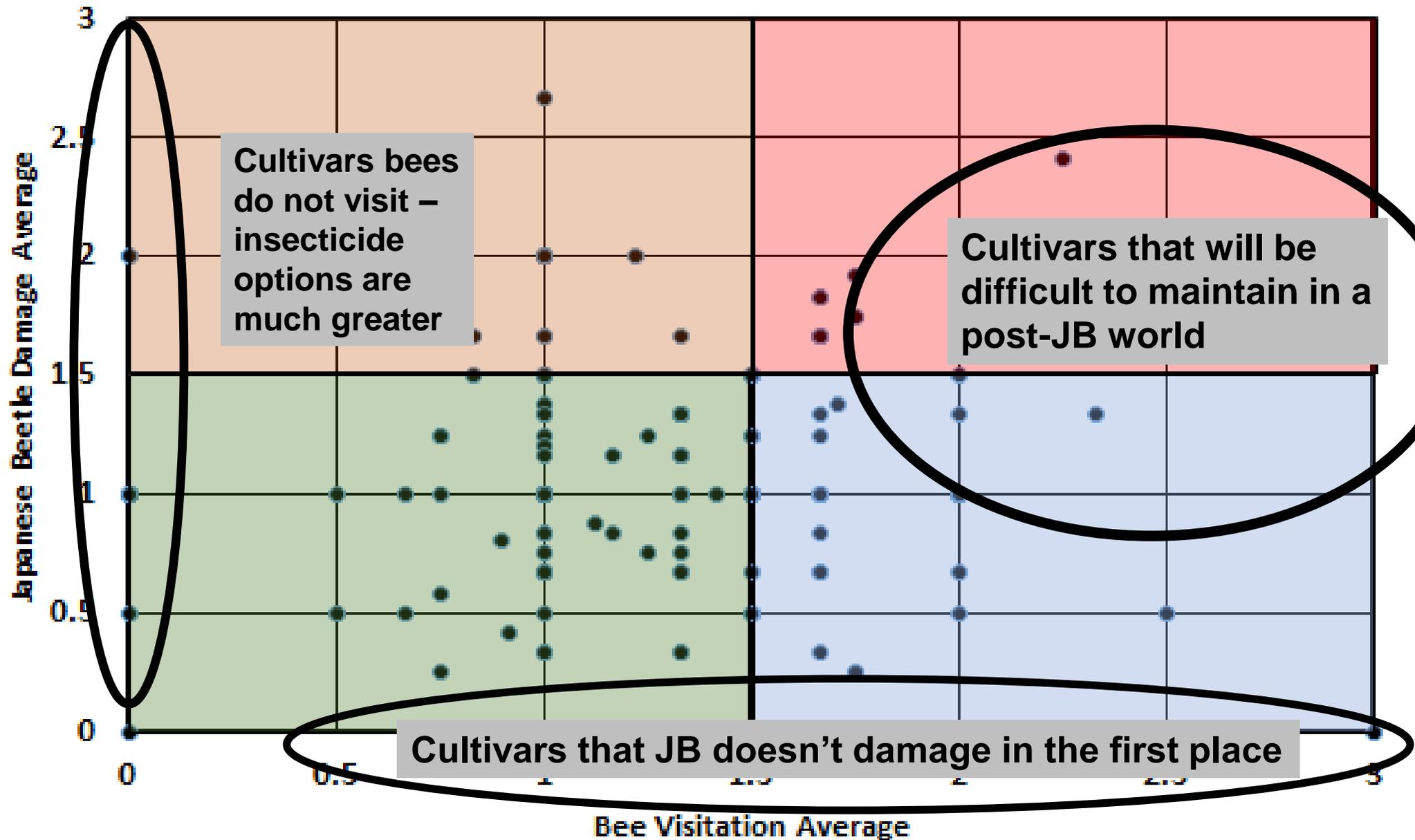
Cultivars on which very few bees were noted (0 - 0.5 rating)

Winsome (HT)	Carefree Wonder (S)	Cesar E. Chaves (HT)
Salmon Sunblaze (HT)	Crimson Bouquet (G)	Heidi (HT)
Eutin (F)	Rainbow End (G)	Rainbow Sorbet (S)
Shining Hour (HT)	Carrot Top (M)	Black Jade (M)
Garden Party (HT)	Camelot (G)	Peace Setter (HT)
Sun Flare (HT)	Mojave (HT)	Sutter's Gold (G)

Japanese Beetle Damage Average vs. Bee Visitation Average



Japanese Beetle Damage Average vs. Bee Visitation Average



Roses that are Heavily Damaged by JB and Visited *alot* by Pollinators

- **Prima Donna**
- **Carefree Delight**
- **Carefree Spirit**
- **Climbing New Dawn**
- **Day Dream**
- **Easy Does It**
- **Elle**
- **Eureka**
- **First Edition**
- **Fourth of July**
- **Glowing Peace**
- **Honey Perfume**
- **Hot Coco**
- **Lady Elsie May**
- **Moon Dance**
- **Morden Sunrise**
- **Pescali**
- **Rainbow Knock Out**
- **Starry Night**
- **Touch of Class**

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



Flowers can produce volatile attractants - without wounding - and may possess attractive colors



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!***

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
- Chlorantraniliprole
 - Acelepryn



Do not treat plants with flowers in bloom!

GROUP 28 INSECTICIDE

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



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^{TRR}

(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 on turfgrass and landscape ornamentals

TABLE 3: Foliar Ornamental Application Rates

Acelepryn Ornamental Foliar Application Rates					
Target Pests	Product (fl oz) per 100 Gallons	Lb AI per 100 Gallons	PPM	Percent AI (wt/vol)	Maximum Gallons per Acre per Year
Leaf-feeding caterpillars (such as bagworms and tussock moth caterpillars [including whitemarked tussock moth])	1	0.013	15.6	0.00156	3840
	2	0.026	31.3	0.00313	1920
	4	0.052	62.5	0.0625	960
	8	0.104	125	0.0125	480
For maximum residual control of the pests listed above	16	0.208	250	0.025	240

Soil Applications:

Acelepryn is a systemic product and will be translocated upward into the plant from root uptake. Soil treatment application rates are listed in Table 4. To assure optimum effectiveness, the product

Section 2(ee) recommendation indicates uses for control of many other insects – including Japanese beetle adults

The original federal label just includes certain caterpillars as target pests

Section 2(ee) Recommendation

Effective: 07/10/2015 **Expires:** 11/19/2018

AK1489002BC0715 Additional Pests of Ornamental Plants (Exterior Landscapes and Interior Plantscapes) in AK, AL, AR, AZ, CO, CT, DC, DE, FL, GA, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, OH, OK, PA, RI, SC, SD, TN, UT, VA, VT, WA, WI, WV and WY

For Use Banded ash clearwing, Fall webworm, Gypsy moth caterpillars, Hemlock Wooly Adelgid, Japanese beetle (adult), Lesser peachtree borer, Magnolia scale, Rhododendron borer, Rhododendron lace bug, Sawfly, Viburnum borer, Zimmerman pine moth

New biological control for Japanese beetle - *and other grubs?*

Bacillus thuringiensis var. *galleriae*

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

Sold as **beetleJUS** in gardener market

Adult control



Grub control

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

New biological control for Japanese beetle - *and other grubs?*

Bacillus thuringiensis var. *galleriae*

Sold as *beetleGONE!* in commercial/ag markets

Sold as *beetleJUS* in gardener market





beetJUS 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)





**A new leafmining insect in
Siberian elm to watch for**

Stigmella multispicata – the larva
of a tiny moth

Photograph courtesy of Daniel Gilrein

Leafminers and Needleminers



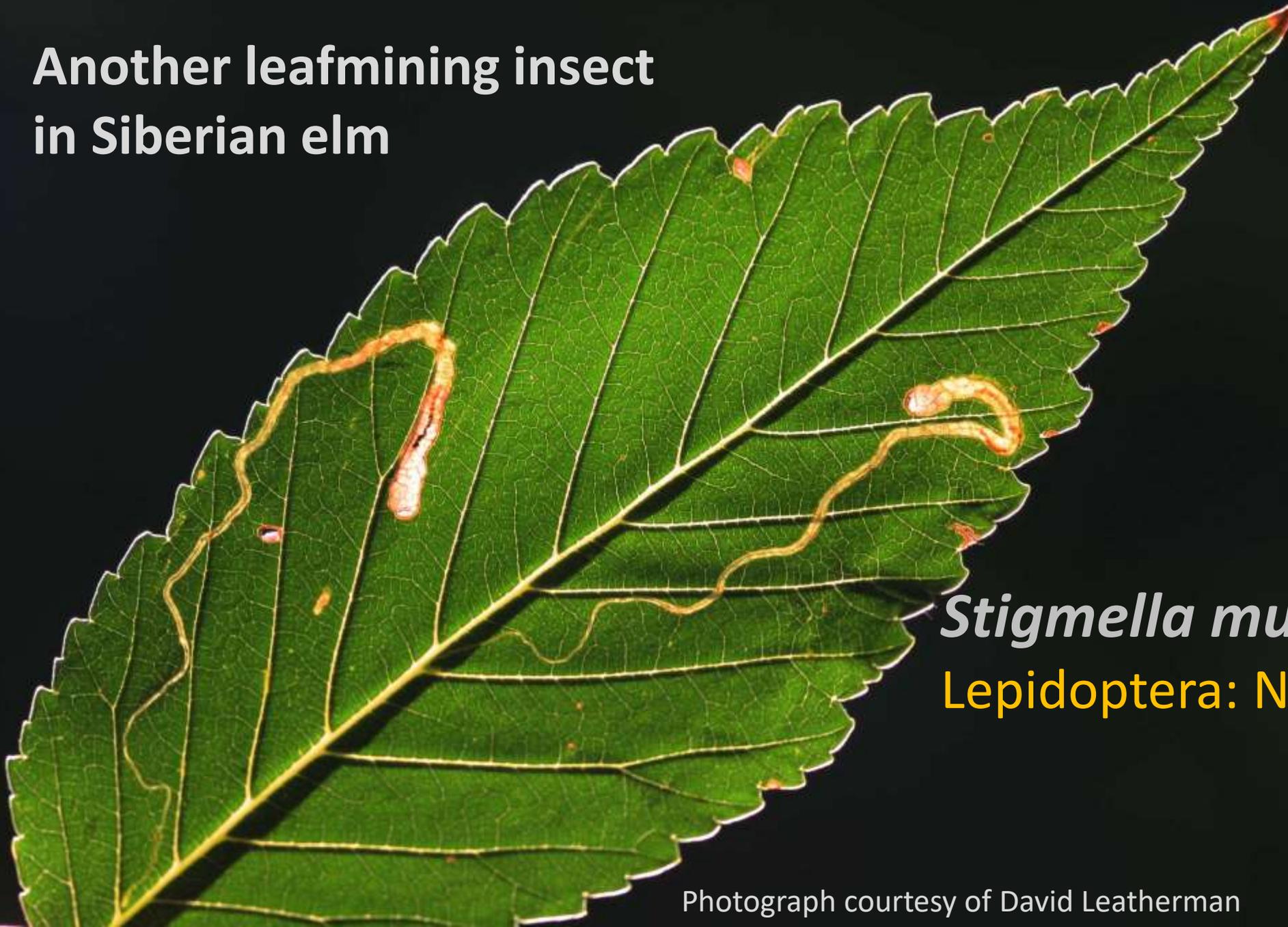
The leaf mine is produced by a developing insect that feeds between the upper and lower surfaces of the leaf



Tease the leaf apart and you should find the insect - and/or its frass!



Another leafmining insect
in Siberian elm



Stigmella multispicata
Lepidoptera: Nepticulidae

Photograph courtesy of David Leatherman

Photograph courtesy of Daniel Gilrein

This elm-infesting leafminer produces gradually widening serpentine mines in the center of the leaves



Photograph courtesy of Daniel Gilrein



Photograph by
Greg Raterman



**The adult is a tiny moth
that emerges in spring**

You may notice small green worms dropping or spinning down from trees in September.

European elm flea weevil injury – larvae produce a serpentine mine that terminates in a blotch-type mine



Larval mines initially are serpentine and meander. They then terminate as a blotch at the leaf edge.



**Larvae develop within the leaf mine
and later pupate in the leaf mine**





When the adults come out in June they chew small holes (shothole wounds) in leaves



Blotch mine of elm – Elm leafminer (a type of sawfly)



Elm leafminer adults are present shortly after new growth emerges in spring



Eggs are inserted into the leaf at the junction of the midrib and a large vein



**Larval tunnels expand
as the insect grows**



When full grown the larvae cut out of the mines, drop to the ground and produce a cocoon in which they will later pupate

There is one generation produced per year



Review of Elm Leafmining Patterns

- ***Stigmella multispictata*** (the new one)
 - Gradually enlarging serpentine form mine visible from the top. At least two generations/cycles of leafmining per year
- **European elm flea weevil**
 - Serpentine leafmine ending in a blotch at the leaf edge. Feeding usually completed by the end of May.
- **Elm leafminer**
 - Large blotch mine made in May/June



End of season curiosity

Mites massed on aspen –
with sheet-like webbing





Periodically there are reports of a sheet like material on aspen that cover large numbers of mites

This has also been reported to occur on willow in Montana





These mites were also observed in the mulch and lower trunk of spen



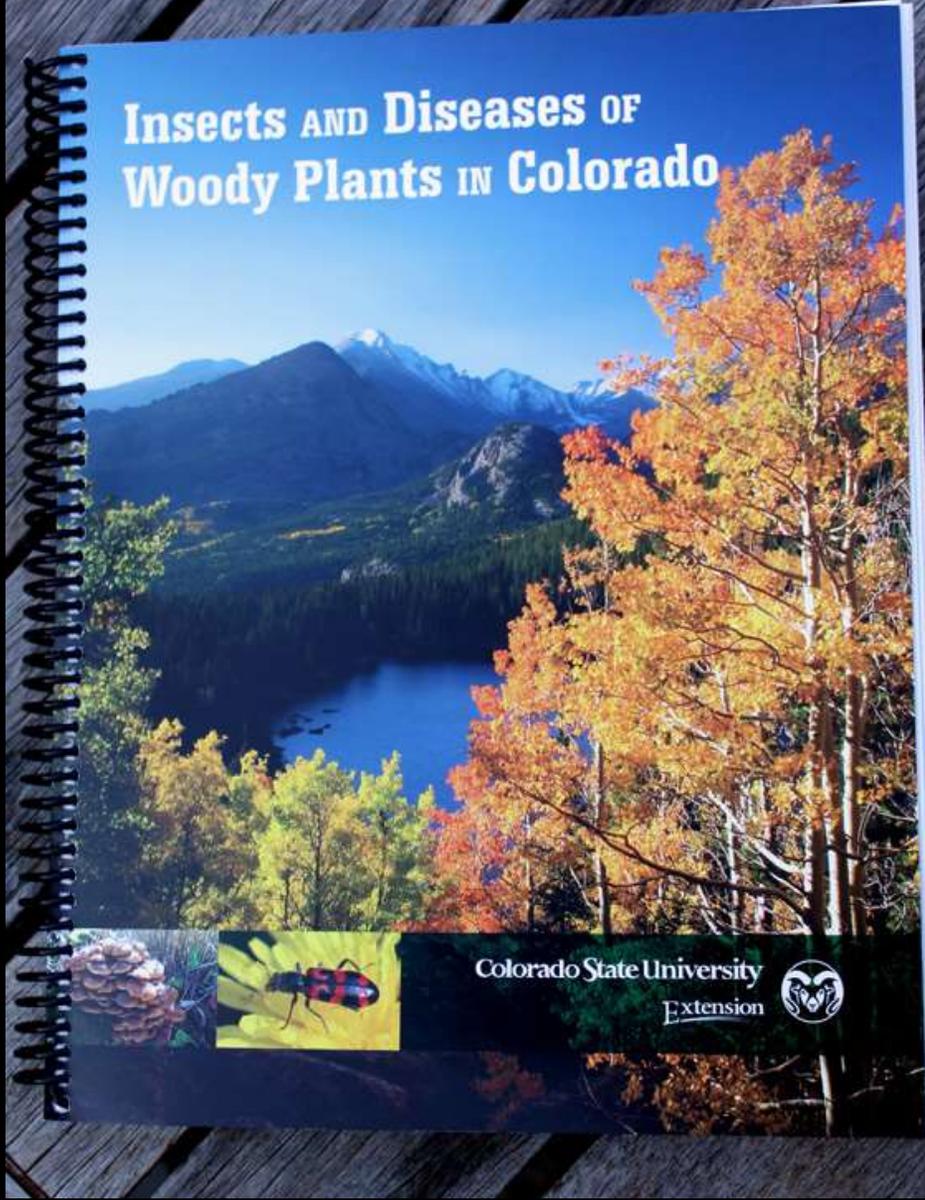
Eotetranychus populi



These are winter-form females of the spider mite *Eotetranychus populi*

Hosts include aspen, various *Populus* and willows

Insects AND Diseases OF Woody Plants IN Colorado

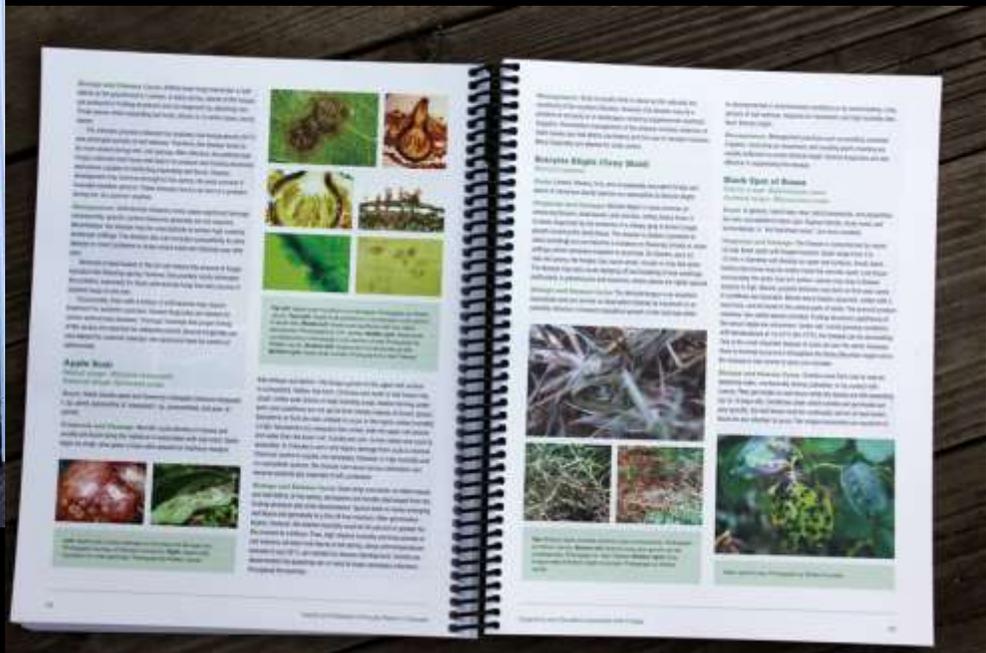


Colorado State University
Extension

Bulletin 506A

Available at CSU University
Resource Center

www.csuextstore.com



New Online Horticultural Entomology Course!

- **BSPM 356 – Horticultural Entomology**
 - Taught in both Spring and Fall Semesters
- **Comprised of three 1-credit modules**
 - 356A Basics of Entomology, Basics Identification, Basic Management
 - 356B Entomology of Horticultural Food Crops
 - 356C Entomology of Landscape Plants

This presentation will be posted at the Insect Information Web Site

- **Housed at Department of Bioagricultural Sciences and Pest Management**
 - **Search BSPM CSU**
- **Within Extension and Outreach**
- **Insect Information**
 - **Extension presentations for 2018 posted at bottom of page**

Insect Information

All materials needed in another accessible format can be made available upon request.

Arthropods of Colorado Fact Sheets

This is a listing of about 200 downloadable fact sheets related to insects and other "bugs" found in Colorado. It contains fact sheets that are written for the Colorado Arthropods of Interest series and the Extension fact sheets that are related to insects.

Fact Sheets

Click here for over 200 Fact Sheets

Some Entomology Hot Links:

- [Colorado Hemp Insect Website](#)
- [Western Colorado Entomology Website](#)
- [IPM Images/Bugwood \(Cranshaw\)](#)
- [IPM Images/Bugwood \(Peairs\)](#)
- [Entomology Resources List](#)
- [Honey Bee Swarm Hotlines](#)

Miscellaneous Insect Information

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, 2nd Edition](#)



Click here to bring
up links related to
**Emerald Ash
Borer**

Japanese Beetle Information

This is a listing of publications and other resources to assist with understanding and managing Japanese beetle in Colorado.

Resources

[Biology and Management of Japanese Beetle \(Potter and Held, 2002\)](#)

[Biology of Japanese Beetle \(Fleming, 1972\)](#)

[Insecticide and Biological Control Options for Control of Japanese Beetle Larvae \(White Grubs\) in Lawns](#)

[Insecticide Options for Control of Adult Japanese Beetle on Leaves and Flowers](#)

[Japanese Beetle Extension Fact Sheet 5.601](#)

[Questions and Answers about Japanese Beetle in Colorado](#)

[Relative Susceptibility of Landscape Plants to Japanese Beetle \(Held, 2004\)](#)

[CSU Insect Information Website](#)



Click here to
bring up links
related to
**Japanese
Beetle**

Master Gardener Information

This includes the handouts and PowerPoint presentations (as PDF) used in Master Gardener Entomology training. These will get updated annually at the end of the winter/spring training programs.

[Handouts](#)

[PowerPoint Presentations Used in 2018](#)

Recent Extension Presentations

This is a listing that provides the PowerPoint presentations (as PDF) of most Extension entomology programs conducted during the past 12 months.

[PowerPoint Presentations/Webinars](#)



**Click Here for the
powerpoint shown today**

This presentation will be posted at the Insect Information web site

- **Housed at** Department of Bioagricultural Sciences and Pest Management
 - **Search** “BSPM CSU”
- **Within** “Extension and Outreach”
- “Insect Information”
 - **Extension presentations for 2018** posted at bottom of page