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 flower gall mite is an eriophyid mite.
Ash flowergall mite develops within the male flowers of ash trees, causing them to become grossly distorted and to persist on the trees.
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.
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
Elm leaf beetle pupae
The cycle is repeated. There are two generations produced annually.
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.
Gambel Oak Borer

A native insect acting badly

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.
Native Gambel oak and source of Gambel oak borer

Large plantings of oaks killed by Gambel oak borer in 2003
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
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
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.
Common species of leaf notching root weevils

- Black vine weevil
- Rough strawberry root weevil
- Strawberry root weevil
- Decorated root weevil
- Lilac 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.

\[= Heterorhabditis \text{spp.}\]

\[= Steinernema \text{spp.}\]
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.
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 the United States and several other parts of the world. The eggs are laid in clusters inside the bark, or they may be placed on the undersides of leaves.
Leaf notching by root weevils

Leafcutter bee wounds
Leafcutter bee damage to rose, lilac and Virginia creeper
Leafcutter Bees
Hymenoptera: Megachilidae
Soft, rotting wood is often excavated for nest sites.
Leafcutter bee nest cells

Drilled wood block for leafcutter bees, filled with nest cells

Leafcutter bee nest cells and exposed larvae

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

Leafcutter bee nest cells in a rotten log
Pith nesting by leafcutter bees

Nest cells in pith of rose cane

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 adults chew on leaves and flowers of many plants. Japanese beetle damages plants in two distinct ways.
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
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.
Overlap of adult feeding on flowers – and use of those flowers by pollinators

Issue of unusual concern with Japanese beetle
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**

<table>
<thead>
<tr>
<th>Child's Play (M)</th>
<th>Beauty (G)</th>
<th>John S. Armstrong (HT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midas Touch (M)</td>
<td>Ranada (M)</td>
<td>Trandescent (G)</td>
</tr>
<tr>
<td>Baby Boomer (M)</td>
<td>Cathedral (F)</td>
<td>Gala (M)</td>
</tr>
<tr>
<td>Graham Thomas (DAS)</td>
<td>Heritage (HT)</td>
<td>OreGold (HT)</td>
</tr>
<tr>
<td>Tuscan Sun (HT)</td>
<td>VooDoo (HT)</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Winsome (HT)</th>
<th>Carefree Wonder (S)</th>
<th>Cesar E. Chaves (HT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salmon Sunblaze (HT)</td>
<td>Crimson Bouquet (G)</td>
<td>Heidi (HT)</td>
</tr>
<tr>
<td>Eutin (F)</td>
<td>Rainbow End (G)</td>
<td>Rainbow Sorbet (S)</td>
</tr>
<tr>
<td>Shining Hour (HT)</td>
<td>Carrot Top (M)</td>
<td>Black Jade (M)</td>
</tr>
<tr>
<td>Garden Party (HT)</td>
<td>Camelot (G)</td>
<td>Peace Setter (HT)</td>
</tr>
<tr>
<td>Sun Flare (HT)</td>
<td>Mojave (HT)</td>
<td>Sutter's Gold (G)</td>
</tr>
</tbody>
</table>
Cultivars that will be difficult to maintain in a post-JB world

Cultivars bees do not visit – insecticide options are much greater

Cultivars that JB doesn’t damage in the first place
Roses that are Heavily Damaged by JB *and* Visited *alot* by Pollinators

<table>
<thead>
<tr>
<th>Roses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prima Donna</td>
</tr>
<tr>
<td>Carefree Delight</td>
</tr>
<tr>
<td>Carefree Spirit</td>
</tr>
<tr>
<td>Climbing New Dawn</td>
</tr>
<tr>
<td>Day Dream</td>
</tr>
<tr>
<td>Easy Does It</td>
</tr>
<tr>
<td>Elle</td>
</tr>
<tr>
<td>Eureka</td>
</tr>
<tr>
<td>First Edition</td>
</tr>
<tr>
<td>Fourth of July</td>
</tr>
<tr>
<td>Glowing Peace</td>
</tr>
<tr>
<td>Honey Perfume</td>
</tr>
<tr>
<td>Hot Coco</td>
</tr>
<tr>
<td>Lady Elsie May</td>
</tr>
<tr>
<td>Moon Dance</td>
</tr>
<tr>
<td>Morden Sunrise</td>
</tr>
<tr>
<td>Pescali</td>
</tr>
<tr>
<td>Rainbow Knock Out</td>
</tr>
<tr>
<td>Starry Night</td>
</tr>
<tr>
<td>Touch of Class</td>
</tr>
</tbody>
</table>
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
- Imidaclorpid
- 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!
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, include plantscapes and soil types.

EPA Est. No. 4607-TN-003™
EPA Est. No. 072564-MO-004™
(Superscript is first three letters of batch code on container)
EPA Reg. No. 100-1489

Active Ingredient:
Chlorantraniliprole
3-bromo-4-[3-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 antranic chloride chemical class.

Product of USA

KEEP OUT OF REACH OF CHILDREN

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

Photograph courtesy of Daniel Gilrein
You may notice small green worms dropping or spinning down from trees in September. The adult is a tiny moth that emerges in spring.
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
There is one generation produced per year

When full grown the larvae cut out of the mines, drop to the ground and produce a cocoon in which they will later pupate.
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
These are winter-form females of the spider mite *Eotetetranychus populi*

Hosts include aspen, various *Populus* and willows
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.

Miscellaneous Insect Information

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
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
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)
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”
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