



# IPM for Common Fruit Tree Insect Problems

Diane Alston, Entomologist, Utah State University

Utah Green Industry Conference  
January 25, 2016

# Integrated Pest Management (IPM)

- Sustainable
  - Economics, Environment, and Society
- Integrate Strategies
  - Cultural (plant & site management)
  - Mechanical (barriers, disruption, traps)
  - Biological (natural enemies)
  - Chemical (conventional, organic & bio-pesticides)
- Monitor pest numbers/injury
  - Treat only when needed





# *Utah Pests* Online Resources

# Utah Pests Online Resources

[www.utahpests.usu.edu](http://www.utahpests.usu.edu)

The screenshot shows the Utah Pests website homepage. At the top, there is a navigation bar with the Utah State University logo and the text "EXTENSION Utah State University" on the left, and "UTAH PESTS" on the right. Below this is a secondary navigation bar with links: "UTAH PESTS Home", "Utah Plant Pest Diagnostic Lab", "Integrated Pest Management", "School IPM", and "Cooperative Agricultural Pest Survey".

The main content area features a search bar, a "Home" menu with links to "Fact Sheets", "Video Fact Sheets", "Image Galleries", "Slideshows", "Utah Pests News Quarterly", "Newsletter", "Bees and Other Pollinators", "In the News", and "Contact Us". Below the menu are social media icons for Facebook and Instagram.

The central part of the page has a large image of a pest (a wood-boring insect) and four main service tiles: "Utah Plant Pest Diagnostic Lab" (with a microscope icon), "Integrated Pest Management" (with a leaf icon), "School Integrated Pest Management" (with a book icon), and "Cooperative Agriculture Pest Survey" (with a clipboard icon). Each tile includes a brief description of the service.

On the right side, there is an "In the News" section with three news items, each with a title and a date. At the bottom right, there is a paragraph of text describing the Utah Pests group.

At the bottom of the page, there is a footer with the text: "Utah State University is an affirmative action/equal opportunity institution. © 2015 Utah State University Utah Pests".

Red circles are drawn around the "Fact Sheets" link in the Home menu, the "Utah Plant Pest Diagnostic Lab" tile, and the "Integrated Pest Management" tile.

# Fact Sheets: over 200 fact sheets on pests of ornamentals, turf, fruits, vegetables, field crops, health-related, nuisance, stored products, structural, etc.

UTAH PESTS fact sheet
Utah State University  
COOPERATIVE EXTENSION

Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory    ENT-054-11    December 2011

## Spruce Health in Utah Landscapes

Ryan S. Davis, Arthropod Diagnostician; Michael Kuhns, Extension Forester;  
Claudia Nischwitz, Extension Plant Pathologist

**DO YOU KNOW?**

- Spruces tend to prefer abundant moisture and may not do well on droughty sites.
- Water stress caused by too little soil moisture or too much heat can predispose spruces to insect attack.
- 80% of spruce trees submitted to the UPPDL are diagnosed with stress due to abiotic conditions such as drought stress and deep planting.
- Spruces are fairly shade tolerant.



Blue spruce (*Picea pungens* 'feil Fastigiata')<sup>1</sup>.

**BACKGROUND**

Spruces are common trees in cultivated landscapes in Utah. They have varied shapes, attractive foliage color, and can be fairly long-lived. They have pests, but not overly so, and are not very messy. Overall, the spruce genus (*Picea*) is commonly planted because it is a good tree for many landscape situations. There are also many native spruces in our mountains, and some of these come under cultivation when someone builds a cabin or other development occurs.

**SPRUCES IN UTAH**

Five species of spruce are commonly found in Utah, and are listed below in order of their commonality in the landscape. A few other species can be found but are very rare, examples include Brewer's spruce (*Picea breweriana*), black spruce (*Picea mariana*), and Oriental spruce (*Picea orientalis*)

**Blue Spruce (*Picea pungens*)**  
Our most common planted spruce: highly desirable because of its silver-blue color and dense conical form. Also grows in Utah's mountains on wetter sites, though it is not as common as Engelmann spruce. This is Utah's official state tree. Crown form can vary from fairly open, to dense and conical, to shrubby. Many cultivars exist that tend to focus on



Blue spruce (*Picea pungens* 'Glauca Procumbens')<sup>1</sup>.

UTAH PESTS fact sheet
Utah State University  
COOPERATIVE EXTENSION

Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory    ENT-19-07    May 2007

## Yellowjackets, hornets and paper wasps

Elin Hodgson, Extension Entomology Specialist      Alan Roe, Insect Diagnostician

**What You Should Know**

- Yellowjackets, hornets and wasps are closely-related social wasps commonly found in Utah.
- All social wasps are capable of repeatedly stinging without dying if they feel threatened.
- Bees are often blamed for most stings, but about 90% of all stings are likely caused by yellowjackets.
- Most social wasps are predatory of other insects and considered beneficial.
- Although providing natural insect control, social wasps can be considered nuisance pests when near humans.

**Social Wasp General Description**

- Have three well-separated body regions, a distinct waist and two pairs of clear wings.
- Care for their young and develop a caste system with different forms living together.
- Regenerate a new nest every year because only the queen overwinters; honey bee colonies overwinter together every year.
- Create their nests out of a wood and saliva paste.
- Capture prey with their legs and jaws and use stinging for defensive purposes only; this is different than solitary wasps that subdue prey with stinging (e.g., spider wasp).
- Go through complete metamorphosis (i.e., egg, larva, pupa, adult); adults and larvae have chewing mouthparts, and larvae are legless.
- Capable of multiple stings because they have "smooth" stingers; bees have barbed stingers (Fig. 2)




Fig. 1. Yellowjacket.<sup>1</sup>

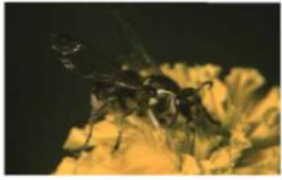


Fig. 2. Bald-faced hornet.<sup>2</sup>




Fig. 3. Honey bee (left) and wasp (right) stingers. page 1

UTAH PESTS fact sheet
Utah State University  
COOPERATIVE EXTENSION

Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory    ENT-169-13PR    September 2013

## Chinch Bugs


Kelly Kopp, Extension Water Conservation and Turfgrass Specialist, Ryan S. Davis, Arthropod Diagnostician, and Ricardo A. Ramirez, Extension Entomologist

**DO YOU KNOW**

- Chinch bugs are occasional pests of turfgrass in Utah.
- Chinch bugs feed on a variety of turfgrass species including Kentucky bluegrass, perennial ryegrass, the fescues, bentgrass and zoysiagrass.
- Damage is usually heaviest in sunny locations during hot, dry periods.
- Sound cultural (non-chemical) practices are the best defense against chinch bug damage.

**INTRODUCTION**

Chinch bugs (Fig. 1) are "true bugs". In Utah, the common chinch bug (*Blissus leucopterus leucopterus* [Say]), and western chinch bug (*Blissus occidentus*) may feed on turfgrass, especially under conditions of severe heat and drought. Coupled with under-irrigation, direct sunlight, and thick thatch, chinch bug numbers can soar from mid-summer to early fall.



Actual adult length

Figure 1. Adult chinch bug.

**BIOLOGY**

Adults overwinter in thatch, clumps of grass, next to buildings and along the edges of sidewalks. They emerge in early spring to mate (when temperatures reach 70°F). Females insert eggs on underground roots, behind leaf sheaths in the crowns of turf plants, in the folds of grass blades, or in the thatch. Eggs hatch in mid to late spring with development of immature stages requiring approximately 1 month. Adults of the first summer generation begin to appear in early to mid summer. Eggs of the second summer generation hatch approximately 1 month later and complete development in early to mid fall. Adults of

**IDENTIFICATION**

Chinch bugs go through numerous developmental stages (Fig. 2). First stage nymphs of the common chinch bug are tiny (1/64 in) and bright red with a white band across the abdomen (Fig. 2). As they mature through five nymphal stages, they turn orange-brown and then black. Adults are black (1/10 in long) and white with fully developed wings that fold over the back and extend to the end of the abdomen (Figs. 1 & 2). This creates a black triangle pattern behind the pronotum

# Guides

## Utah Vegetable Production and Pest Management Guide 2014



**EXTENSION**  
UtahStateUniversity

## INTERMOUNTAIN Commercial Tree Fruit Production Guide

# 2015

A publication by Utah State University, Colorado State University, and University of Idaho



**EXTENSION**  
UtahStateUniversity

University of Idaho  
Extension

Colorado State University  
Extension

## INVASIVE INSECT FIELD GUIDE for UTAH 2014



EXTENSION UtahStateUniversity  
Lori R. Spears & Ricardo A. Ramirez

## Common Pests of Schools & Structures in Utah



EXTENSION UtahStateUniversity  
Colorado State University Extension  
USDA NIFA

## A Guide to Common Organic GARDENING QUESTIONS

Step-by-Step Recommendations for Organic Vegetable and Fruit Gardening in Utah



garden.usu.edu

EXTENSION UtahStateUniversity  
SARE

# Video Fact Sheets

## Paper Wasp Traps

Entomologist Diane Alston discusses the difference between native paper wasps and European paper wasps, and how to make your own traps to combat them.



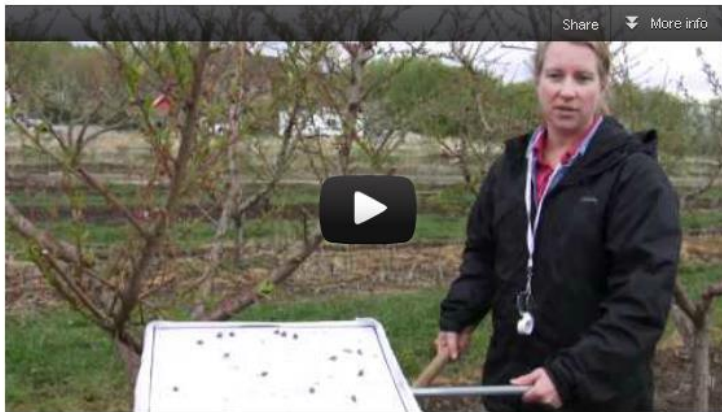
## Billbug Identification and Detection in Turf

Entomologist Ricardo Ramirez discusses the identifying characteristics of billbugs in turf, and demonstrates how to detect the damaging larval stage.



## Using a Beating Tray

A beating tray is a large cloth frame that is used to catch insects that fall from a shaken branch. It is helpful for monitoring a large area, such as an orchard, quickly.



## Tips for avoiding bed bugs while traveling.

Entomologist Ryan Davis discusses safe travel techniques to avoid falling prey to bed bugs, and how to minimize the chances of bringing bed bugs back to the home.



# IPM Advisories:

ornamentals, turf, fruits, vegetables

[www.utahpests.usu.edu/ipm](http://www.utahpests.usu.edu/ipm)

USU Links >> USU Home A-Z Index calendars MyUSU directory contact

**EXTENSION**  
Utah State University

**UTAH PESTS**  
Integrated Pest Management

UTAH PESTS Home | Utah Plant Pest Diagnostic Lab | **Integrated Pest Management** | School IPM | Cooperative Agriculture Pest Survey

Google™ Search

Plant Pests by Crop  
Fruit IPM  
Vegetable IPM  
Landscape IPM  
Field Crops IPM  
Pest Advisories  
Fact Sheets  
Image Galleries  
Slideshows  
Utah IPM & SA Mini-Grant Program  
Pesticide Information  
Weather Info  
Resources and Links  
Contact Us

**...not peachy** CHECK FOR LATE SEASON PEACH PROBLEMS

**Subscribe to IPM Pest advisories HERE**

**Integrated Pest Management (IPM):**  
"a comprehensive approach to pest control that uses a combined means to reduce the status of pests to tolerable levels while maintaining a quality environment."

*All you need to sign up for the advisories is an email address*

**In the News**  
Self-Medicating Parasitized Bees  
Sep 11, 2015  
Biodiversity belowground is just as important as aboveground  
Sep 11, 2015  
Improving wheat varieties in Kazakhstan  
Sep 08, 2015

Free subscription

Timely info on pest activity

-insects

-mites

-diseases

-nutrient deficiencies

-environmental stress

Lots of images!

IPM recommendations

Effective pesticides



# IPM Advisories (2015 Examples)

**EXTENSION**  
UtahStateUniversity

## Landscape IPM Advisory

Weekly Pest Update for Woody Ornamentals, Utah State University Extension, April 29, 2015





### What's In Bloom

(Salt Lake City area)

Blackhaw viburnum: first bloom Crabapple: end bloom Lilac: bloom - end bloom Redbud: end bloom Redtwig dogwood: first bloom	Japanese flowering cherry: bloom Kwanzan cherry: full to end bloom Quince: end bloom Serviceberry: full bloom
---	--

### Insect/Disease Information

#### DECIDUOUS TREES

##### Lilac-Ash Borer

Hosts: lilac and ash; occasionally privet and mountain-ash

- treat susceptible trunks now until mid-July



frass from larva feeding in tree (top)  
portion of lilac dying back (bottom)

Lilac-ash borer adults have just started to emerge and females are laying eggs on the bark of ash trees and lilac. Green and white ash (*Fraxinus*) are the most susceptible. Sometimes, mountain-ash (*Sorbus*) and privet are attacked.

Lilac-ash borer does not directly kill trees, but repeated infestations can cause branch dieback and can leave trees susceptible to breakage in storms. Infested trees will have round exit holes on the bark, sawdust-like frass near the holes or at the base of the tree, and rough, swollen, cracked bark, mostly near branch crotches.

This insect overwinters as a larva inside the host plant and pupates in spring, emerging as an adult moth, usually in early to mid May. Emergence and egg-laying continues for about 6 to 8 weeks.

**Treatment:**  
Healthy plants are able to withstand minor infestations, while stressed plants are more susceptible to attack and failure, so give trees optimal water and fertilizer, and prune properly.

Insecticides target the adults. Small trees can be treated by the home gardener, but in order to get thorough coverage on large trees, treatments should be made by a licensed pesticide applicator.

**Residential options:** Hi-Yield Permethrin, Spectracide Triazicide (lambda-cyhalothrin)

**Commercial options:** Acelepryn (chlorantraniliprole), permethrin (Astro, Covert, Waylay), or Onyx (bifenthrin)

**UtahState**  
**UNIVERSITY**  
**extension**

## Turfgrass IPM Advisory



### Seasonal Turfgrass Pest Update, Utah State University Extension, Winter 2014

#### Turfgrass Management

At this time of year, your thoughts may be turning to the potential effects of winter conditions on your turf. "Winterkill" is the general term describing turf loss that may occur as a result of winter conditions. This issue will discuss the actual causes of winterkill and how they may be prevented.

#### News/What to Watch For

During winter, most turfgrass diseases and insects are relatively inactive. However, one disease complex, the snow molds, may be at work despite recent low temperatures.

#### Focus on: Winterkill

When turfgrasses die over the winter months, it may generally be described as "winterkill" (Figs. 1 and 2). The term covers a multitude of actual causes of turfgrass death in the winter, which may include snow mold, low temperatures, ice sheets, desiccation and crown hydration.

#### Crown Hydration

Crown hydration is of most concern during the warmer days of late winter or early spring when there is the potential for a day or two of warm daytime temperatures followed by a hard freeze. Turfgrass plants may start to take up water as temperatures warm and then re-freeze rapidly. As a result, ice crystals may form in the crown of the plant, rupturing cells and causing death.

Of the commonly-used cool-season turfgrass species, annual bluegrass and creeping bentgrass are most susceptible to crown hydration problems, though annual bluegrass is the more susceptible of the two because it emerges from dormancy earlier.

#### Desiccation

During the winter when turfgrass plants are dormant or semi-dormant, drying of the leaves or plants (desiccation) may cause death. Desiccation is typically only a factor on elevated or extremely exposed or windy sites, and areas where surface runoff is rapid.




Figure 1. Winterkill symptoms in turfgrass.

**EXTENSION**  
UtahStateUniversity

## Tree Fruit IPM Advisory



Orchard Pest Update, Utah State University Extension, October 5, 2015

### JUST THE BASICS: Current Treatments

#### GENERAL

- Clean up fallen fruit to reduce pest pressure for next year.
- Mow tall weeds around trees/install barrier or wire to reduce rodent problems and deer rubbing.
- Make sure all new plantings get white tree paint or tree wrap (base of tree to scaffold limbs) from December through early April, to prevent sun scald.
- Give trees a good watering before the ground freezes.
- Do not do any pruning now; wait until winter (apples) or early spring (peaches).

#### APPLE & PEAR

- Apply lime-sulfur when the first leaves start turning color to control blister mites.
- To reduce codling moth for next year, remove bins and debris from the orchard after harvest and remove fruit on the ground or left on the tree.

#### PEACH/NECTARINE

- Prevent new coryneum blight (shot-hole) infections this fall by applying copper to trees when 50% of leaves have fallen.

### Insect and Disease Information

information for residential settings

information for commercial orchards

#### APPLE & PEAR

##### Blister Mites

Hosts: apple, pear



Blister mites cause early fall color change and leaf drop (shown here on apple).



Blister mite spots on pear turn black by mid to late season.

If treatment is desired, options include:


- 1.5-2% oil, thoroughly covering the bottoms of the leaves
- Sevin (carbaryl), alone or with 1% oil
- lime-sulfur (only at this time of year, you can mix with oil, but not on drought-stressed trees)

Blister mites belong to a group of mites called eriophyid mites (air-ee-oh-FYE-id). They are so small that they are invisible to the naked eye, but their feeding can cause visible symptoms.

continued on next page

# Utah Pests News


Quarterly newsletter on all things “insects and plant diseases” in Utah



## UTAH PESTS News

Utah Plant Pest Diagnostic Laboratory and USU Extension Vol. X, Winter 2016

### Utah Orchard Leafroller Survey



Leafrollers are a type of moth-caterpillar (Lepidoptera: Tortricidae) that may roll or tie leaves together to form a protective shelter, from which they feed on the leaves and fruits of plants. This group contains many economically important pests that attack fruits, vegetables, and ornamentals. The need for an orchard leafroller survey was prompted by an outbreak of leafroller caterpillars in Utah County tart cherry orchards just before harvest in July 2012.

What's Inside

USU Extension Demonstration Teaching Gardens at Wheeler Historic Farm

Advantages of Using Certified Seeds

Plant Disease Outbreaks in Utah

Biopesticides: From Nature to Nature

Vole Activity and Injury

An Alfalfa Weevil From the Underground

New Invasive Fruit Pest Detected in Utah

Two New Invasive Agricultural Pests in the United States

National IPM News

News Highlights

NEW PUBLICATIONS

Raspberry Crown Borer

Rose Stem Girdler


[utahpests.usu.edu](http://utahpests.usu.edu)

We surveyed for five species that commonly occur in western U.S. orchards. The survey included five counties of northern Utah from late spring through early fall in 2014 (21 orchards) and 2015 (20 orchards). We used pheromone traps for moths, and feeding injury inspections and beating tray sampling for larvae. In 2014, 11 of the orchards received minimal management, such as limited insecticides, pruning, and irrigation. The remaining orchards were commercially managed.

Our objectives were to determine the species of leafrollers present, types of orchards at greatest risk for infestation, leafroller phenology (timing of moth flight and caterpillar activity), and validate an existing temperature-based (degree-day) model that predicts timing of leafroller treatments.

Obliquebanded leafroller (OBLR) was the primary species caught in the pheromone traps, followed distantly by fruittree leafroller (FTLR), as shown in the graph above. We detected very few European leafroller (ELR) moths, and no omnivorous or pandemis leafrollers. In more limited surveys in 2012 and 2013, OBLR numbers were very high in 2012, the season of the larval outbreak in tart cherries. OBLR moth capture in 2015 increased over those in 2013 and 2014, and although several orchards had high trap captures, the overall catch in 20 orchards was not as high as the total catch in 2012 (6 orchards). Growers were notified when OBLR numbers were high, and populations will be monitored in 2016 to prevent another outbreak.

#### Total Leafroller (LR) Trap Catches



Species	2012	2013	2014	2015
Obliquebanded LR	~1400	~1000	~1000	~1400
Fruittree LR	~100	~100	~100	~100
European LR	~10	~10	~10	~10
Omnivorous, Pandemis LR	~10	~10	~10	~10

The survey showed that OBLR is the most common leafroller species in Utah, followed by FTLR.

continued on next page

# Pest Diagnostics

## Utah Plant Pest Diagnostic Lab

[www.utahpests.usu.edu/uppd/](http://www.utahpests.usu.edu/uppd/)

### Sample Submission

The screenshot shows the website's header with navigation links: "EXTENSION UtahStateUniversity", "UTAH PESTS Utah Plant Pest Diagnostic Lab", and "UTAH PESTS". Below the header is a navigation bar with "UTAH PESTS Home", "Utah Plant Pest Diagnostic Lab", "Integrated Pest Management", "School IPM", and "Cooperative Agricultural Pest Survey".

The main content area includes:

- A "Google™ Search" box.
- A sidebar with a "Home" link and a list of resources: "Fact Sheets", "Frequently Asked Questions", "Image Galleries", "\$7.00 Diagnosis", "Recent Pests", "Alfalfa Hay Testing", "Tick Survey", and "Contact Us".
- A "Current Pest Issues" section listing "Top 20 Insects", "Top 20 Arachnids", "Bed Bug Travel Tips", and "Hobo Spiders".
- A central banner for the "Utah Urban Pest Identification Handbook" with the text "IDENTIFY AND MANAGE PESTS WITH THE" and "Common Pests of Schools & Structures in Utah". It includes an image of the handbook cover and contact information: "To order a hard copy, email us at ryan.davis@usu.edu".
- An "Events" section listing "Dec 07, 2015 Explore the Garden Family Night: Homemade Wrapping Paper" and "Dec 08, 2015 2015 Forest Inventory and Analysis Science Symposium".
- A "Fact Sheets" section showing images of insects and a ruler, with a red circle around the text "Submit a Sample".

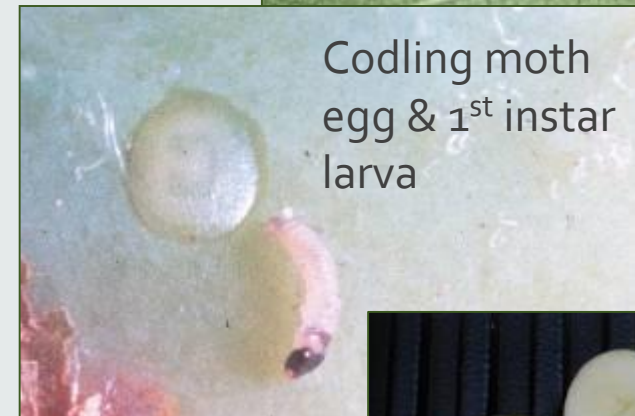
The footer contains a Facebook icon, the text "Utah State University is an affirmative action/equal opportunity institution. © 2015 Utah State University Utah Plant Pest Diagnostic Lab", and links for "ext home", "site map", and "ext directory".





# Codling Moth

- Primary internal fruit pest of apple & pear
- Spends the winter as an immature caterpillar under tree bark
- Adult stage is a moth; emerges beginning at apple bloom time
- Eggs laid on fruit & leaves
- 1<sup>st</sup> instar larva bores into fruit w/in 24 hr
- **Chemical control:** target newly hatched larva; timing based on moth trap catch info. & degree-days in your area
  - **Tree Fruit IPM Advisory – tells you the proper timing**
    - acetamiprid/Ortho, Assail (14 d)
    - carbaryl/Sevin (14 d)
    - gamma cyhalothrin/Spectracide (14 d)
    - spinosad (7 d)
    - malathion (7 d)
    - CM virus (CydX; 7 d)
    - Horticultural mineral oil (mix with above or use alone)
- **Sanitation:** pick up dropped fruit



# Tree Fruit IPM Advisory

Please check this table at each advisory as the information may change as the dates get closer. The forecasts use the average temperature for each site. Fruit should remain protected through each generation according to interval provided on your pesticide label. Many more locations can be viewed on the [Utah Climate Center TRAPs website](#) (select location; select codling moth).

## Codling Moth, First Generation

In the table, choose either Option A or B when starting your codling moth sprays.

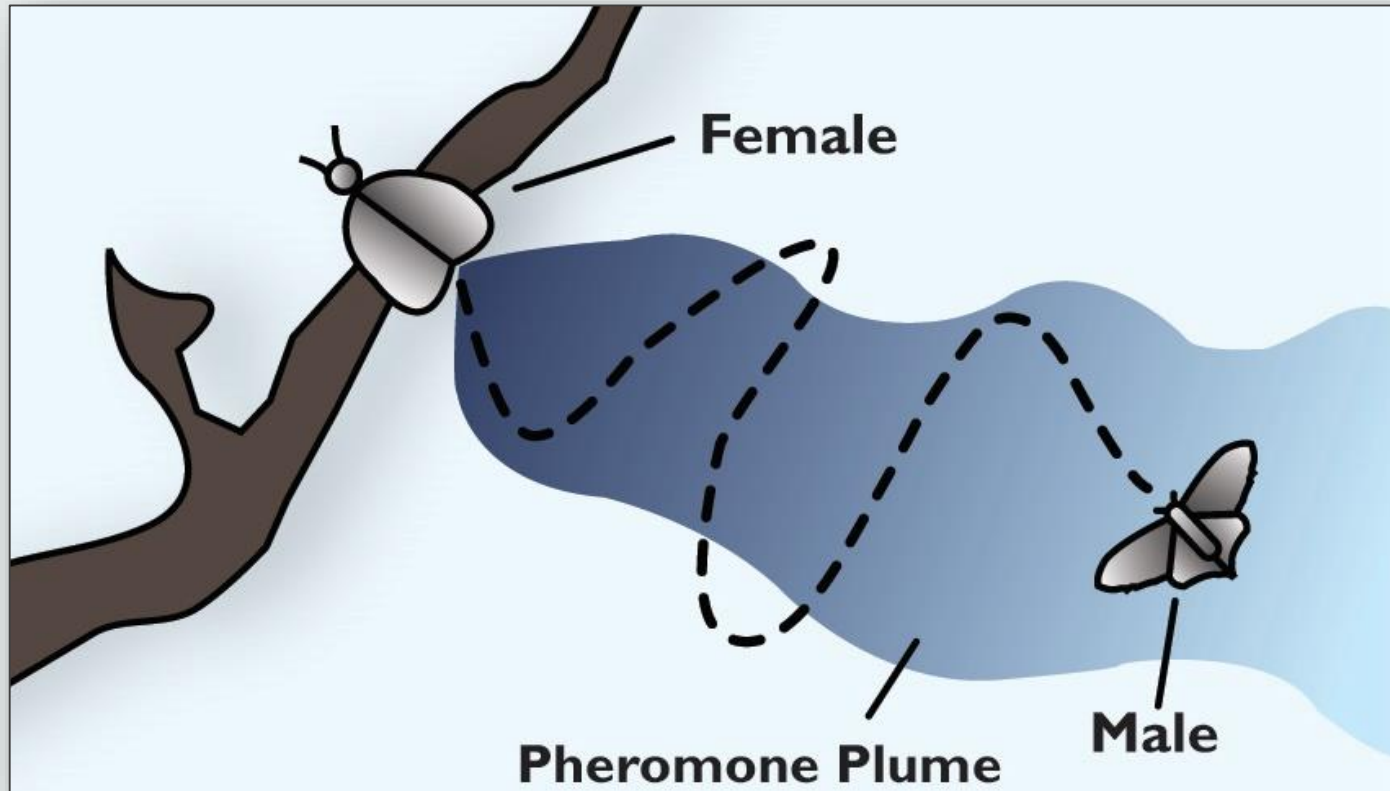
**Option A** is what most people will do. Apply insecticide at the recommended date, and repeat. **Option B** is an alternative that may help to reduce sprays. Liberally apply horticultural oil (1%) on the first date, and then apply your regular insecticide on the later date. The oil kills eggs that have been laid on fruit up to that point.

The "period of greatest egg hatch" is the time when 75% of all eggs for the first generation will hatch. Use this information to time your treatment applications.

County	Location	Option A Apply first spray	Option B		Period of Greatest Egg Hatch
			Apply oil	Apply first spray	
Box Elder	Perry	passed	passed	May 27	May 27 - June 17
	Tremonton	May 21	May 19	June 2	June 1 - 20
Cache	Logan Airport	May 31	May 29	June 11	June 10 - unknown
	River Heights	May 29	May 27	June 10	June 9 - unknown
Carbon	Price Airport	May 28	May 26	June 7	June 6 - unknown
Davis	Kaysville	passed	passed	May 27	May 26 - June 14
Grand	Moab	passed	passed	passed	through June 1
Iron	Cedar City Airport	May 27	May 25	June 6	June 5 - unknown
Salt Lake	Benches/Cooler sites	passed	passed	May 29	May 29 - June 13
	Most areas	passed	passed	May 24	May 23 - June 9
Sevier	Monroe	passed	passed	May 26	May 25 - June 16
Tooele	Erda Airport	passed	passed	May 27	May 26 - June 15
	Grantsville	passed	passed	May 25	May 24 - June 13
Uintah	Vernal Airport	May 31	May 29	June 10	June 9 - unknown
Utah	Alpine	May 20	passed	June 2	June 1 - 20
	American Fork	passed	passed	May 28	May 27 - June 15
	Genola (CHF)	passed	passed	May 21	May 23 - June 14
	Lincoln Point	passed	passed	May 30	June 1 - 19
	Orem (Lindon)	passed	passed	May 27	May 27 - June 12
	Payson	passed	passed	May 27	May 26 - June 14
	Provo Airport	passed	passed	May 27	May 27 - June 14
	Provo Canyon	May 25	May 27	June 4	June 5 - 20
	Santaquin (South Ridge)	passed	passed	May 31	May 31 - June 20

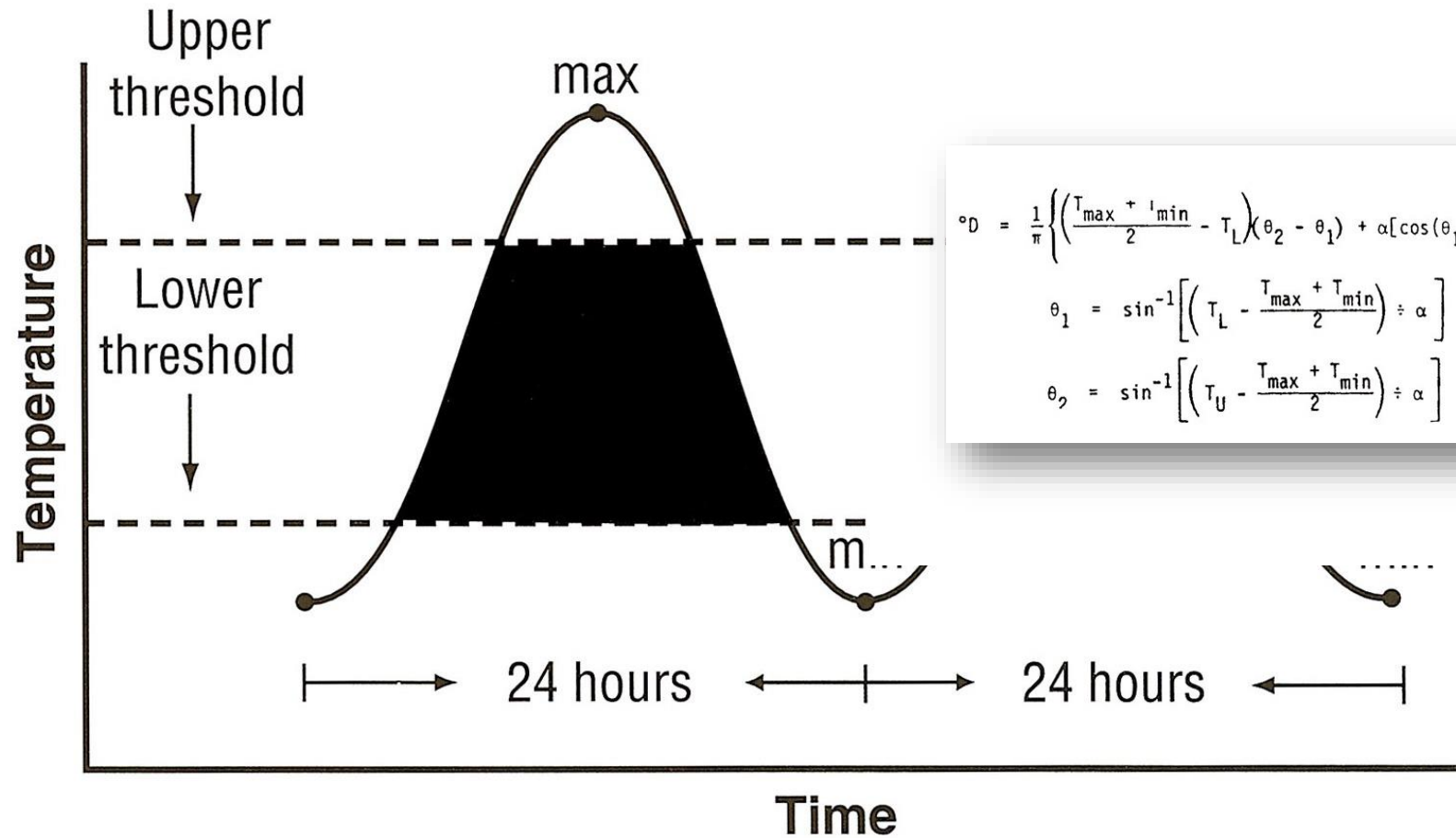
# Pheromones for Monitoring

Communication within a species



# Pest detection and evaluation – Degree Days

Degree days are a measurement of heat units over time





# Codling Moth Fact Sheet

## Codling Moth (*Cydia pomonella*)

Diane Alston, Entomologist • Marion Murray, IPM Project Leader • Michael Reding, Former IPM Project Leader

### Do You Know?

- Codling moth is the major pest of apple and pear in Utah.
- Damaging stage: larva tunnels into fruit
- Monitoring stage: adult moth
- Use of pheromone traps and the degree-day model (based on daily temperatures) are critical for determining optimal treatment timings.
- Insecticides and pheromone-based mating disruption are currently the main management tactics.
- Insecticides are targeted at newly hatched larvae and/or eggs.
- Mating disruption devices need to be applied immediately before or at biofix (first moth activity) to prevent or adequately delay moth mating.
- Biological control is minimally effective because larvae are protected inside fruit.
- Insect development and spray timing information are available on the USU Extension Integrated Pest Management (IPM) Tree Fruit Pest Advisories Web page ([www.utahpests.usu.edu/ipm/html/advisories/treefruit/](http://www.utahpests.usu.edu/ipm/html/advisories/treefruit/)) or from your county USU Extension office.



Fig. 1. Codling moth adult



Fig. 2. Codling moth larva

Codling moth (Order Lepidoptera, Family Tortricidae) is the most serious pest of apple and pear worldwide (Fig. 1). In most commercial fruit producing regions and home yards in Utah, fruit must be protected to harvest a crop. Insecticides are the main control tactic. There are new insecticides available, many of which are less toxic to humans and beneficial insects and mites than earlier insecticides. For commercial orchards with more than 10 acres of contiguous apple and pear plantings, pheromone-based mating disruption can greatly reduce codling moth populations to allow reduced insecticide use. Effective biological control has not been possible because fruit is attacked by newly hatched larvae, which are protected from natural enemies once inside the fruit (Fig. 2). Sanitation methods can help reduce codling moth densities within an orchard, but alone cannot provide satisfactory control.

In Utah, there are two to three generations of codling

moth each year (Fig. 3). In northern Utah, there are typically two full generations and a partial third generation. In southern Utah, most or all of a third generation will occur. First generation moths begin to emerge about bloom time and peak in June in northern Utah. Second generation moths begin emerging in late June to early July and peak in late July to early August. Third generation moths are active from about mid August to mid September before declining day length induces the end of activity for the year.

### HOSTS

apple, pear, crabapple, English walnut, quince, hawthorn, apricot, plum, peach, cherry

- Plan to use the same type of trap and lure from year to year so that you can compare results.

### Degree-day Model

#### The Degree-day Method

- The development of codling moth, like all insects, can be predicted based on accumulated heat over time, called degree days (DD). Use of the codling moth phenology model based on DD will help to more accurately time insecticide applications and reduce the number of applications to a minimum.
- Codling moth development occurs between the lower and upper temperature thresholds of 50° F and 88° F.
- Starting March 1 in northern Utah or January 1 in southern Utah, begin accumulating DD for an individual location by:
  - collecting representative daily maximum and minimum air temperatures and using the DD look-up table (Table 2), or
  - obtaining the information provided by the online degree-day calculator at Utah Climate center TRAPs website (<http://climate.usurf.usu.edu/pest.php>) or from your county Extension office.
- Place pheromone traps in orchards when 100 DD have accumulated (first pink of Red Delicious). The first moths are expected by 150 - 200 DD (full bloom of Red Delicious).
- Once biofix (first consistent moth catch) has occurred, accumulated DD are reset to zero (Table 1).

#### Timing Sprays

- If mating disruption (MD, see page 6) is used in an orchard, dispensers should be hung immediately before or at biofix to prevent mating and egg-laying (get a biofix at a nearby non-MD location). Supplemental insecticide treatments are usually necessary even when MD is used. The first cover spray is often the most important to apply as this timing should suppress the first generation, and thus, the following generations.
- Depending on the type of insecticide used, the first cover spray should be applied as follows:

DD after biofix	Timing/Target	Examples
50 - 75	pre-egg-laying	Rimon
100 - 200	early egg-laying	Horticultural oil, Esteem, Intrepid
220 - 250	first egg hatch (emergence of larvae)	Allacor, Assail, Asana, Calypso, Carbaryl, Codling Moth Granulosis Virus, Delegate, Diazanot, Guthion, Imidan, Proclaim

Table 1. Major events in a codling moth management program, based on accumulated degree days

Degree Days	% Adults Emerged	% Egg Hatch	Management Event
100*	0	0	• Place traps in orchards
150 - 200	First moths expected	0	• Check traps every 1-2 days until biofix is determined
<b>First Generation</b>			
0 (biofix)†	First consistent catch	0	• Reset degree days to 0
50 - 75	5 - 9	0	• First eggs are laid • Apply insecticides that need to be present before egg-laying
100 - 200	15 - 40	0	• Early egg-laying period • Apply insecticides that target early egg-laying period
220 - 250	45 - 50	1-3	• Beginning of egg hatch • Apply insecticides that target newly hatched larvae
340 - 640	67 - 98	12 - 80	• Critical period for control, high rate of egg hatch • Important to keep fruit protected during this period
920	100	99	• End of egg hatch for 1st generation
<b>Second Generation</b>			
1000 - 1050	5 - 8	0	• First eggs of 2nd generation are laid • Apply insecticides to target early egg-laying
1100	13	1	• Beginning of egg hatch • Apply insecticides that target newly hatched larvae
1320 - 1720	46 - 93	11 - 71	• Critical period for control, high rate of egg hatch
2100	100	99	• End of egg hatch for 2nd generation
<b>Third Generation</b>			
2160	1	15	• Beginning of egg hatch • Keep fruit protected through September 15 • Check pre-harvest interval of material used to ensure that final spray is not too near harvest.

\*Begin accumulating degree days after daily temperatures begin to exceed 50°F, typically on January 1 for southern Utah or March 1 for northern Utah.

† Biofix is when at least two moths are caught on consecutive nights.

# Mechanical Control: Codling Moth



Pupate inside silken cocoons on trunk  
Corrugated cardboard band -  
“mass-trap” to reduce population  
Late June to Mid-September



Fruit bags to exclude codling moth eggs  
Place bags over 3/4” diameter fruit

# Fruit Tree Leaf Burn Caused by Spider Mites

Induced by multiple applications of pyrethroid insecticides for control of codling moth & other insects



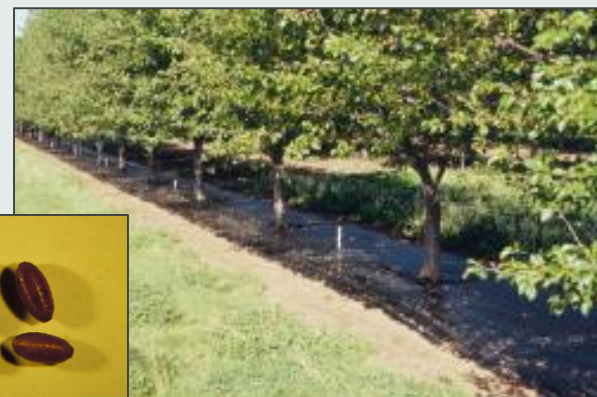
Pyrethroid insecticides stimulate spider mite feeding & reproduction

Pyrethroid insecticides can kill beneficial predatory mites


Pyrethroid active ingredients:  
beta-cyfluthrin, bifenthrin,  
deltamethrin, esfenvalerate,  
fenpropathrin, gamma-cyhalothrin,  
lambda-cyhalothrin, permethrin,  
zeta-cypermethrin

# Western Cherry Fruit Fly


- Larvae feed in sweet & tart cherries; female flies lay eggs in ripening fruit; fruit doesn't become soft enough for egg-laying until it turns salmon colored
- **Cultural controls:** Landscape fabric or barrier under tree canopy
- **Chemical control:** spinosad (7 d), malathion (5 d), carbaryl (7 d), pyrethrin (3 to 5 d)
- **Predation by fowl:** chickens, guinea hens



# Western Cherry Fruit Fly Fact Sheet



**UTAH**  
**PESTS fact sheet**




Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory    ENT-102-06    June 2010

## Western Cherry Fruit Fly (*Rhagoletis indifferens*)


Diane Alston, Entomologist • Marion Murray, IPM Project Leader

**Do You Know?**


- Western cherry fruit fly is the primary insect pest of sweet and tart cherries in Utah.
- Damage occurs from the larva developing inside fruit.
- Females lay eggs under the skin of fruit, so target adult flies for control.
- Insecticides are currently the most effective control method.
- Attract-and-kill (bait plus insecticide) can be effective for control in commercial and home cherry trees.
- Use of ground barriers (mulch, fabrics) can reduce pupation and fly emergence.
- Post-harvest sanitation can reduce populations.




**Figure 1.** Adult fly caught on trap.



**Figure 2.** Larvae feeding inside a cherry fruit.<sup>1</sup>



**Figure 3.** Damaged cherries with larval exit holes.



**Figure 4.** Cherry fruits are not susceptible to attack until they have a bluish salmon color.<sup>1</sup>

**HOSTS**

Sweet, tart, and wild species of cherries

**LIFE HISTORY**

**Pupa – Overwintering Stage**

- **Size:** about 3/16 inch (5 mm) long
- **Color:** light to dark brown and shaped like a large grain of wheat
- **Where:** overwinters in the soil of the orchard floor, 1 - 4 inches (2.5 - 10 cm) deep
- Rate of pupal development and adult emergence affected by soil temperature and moisture

**Adult – Monitoring Stage**

- **Size:** about 1/8 inch (5 mm) long
- **Color:** black body with white bands on abdomen [posterior body region]; wings are transparent with a distinctive pattern of dark bands (Figs. 1 and 7)

The western cherry fruit fly (Order Diptera, Family Tephritidae) is the most important pest of sweet and tart cherries in Utah. Once the skin of fruits becomes soft enough to penetrate, adult females (Fig. 1) insert eggs with their ovipositor, and larvae develop inside the fruits (Fig. 2). The result is “wormy” fruit that is unmarketable. It is difficult to determine whether a fruit is infested until the larva exits through a hole that it chews (Fig. 3) or the fruit is cut open to reveal the larva inside. For processed cherries, detection of one larva by the processor can result in rejection of the entire crop from that orchard and/or farm. Therefore, the best management strategy is to prevent fruit infestation.

Adult flies will migrate only short distances (< 40 m) if host fruit is available. This causes infestations to be spotty in a region; however, once established in an orchard, the western cherry fruit fly can spread rapidly and require annual control. Protective insecticide sprays are currently the major tactic for preventing infestation. An “attract-and-kill” technology where adult flies are enticed to feed on a sticky bait droplet containing an ultra low concentration of insecticide, has proven effective in Utah orchards.

There is one generation per year; however, adults can emerge from the soil over a period of 3 months or more. Cherry fruits are susceptible to infestation from when they first ripen to a salmon-blush color (Fig. 4) until they become too soft or fall from the tree.

control treatments begin based on timing information described above, maintain protection of fruit through harvest. Reapply insecticides based on the protection interval stated on the label. It is best to rotate the type of insecticide applied between applications to reduce development of resistance and negative effects on beneficial insects and mites. For example, insecticides such as carbaryl, malathion, and the synthetic pyrethroids are especially toxic to predatory mites.

**Recommended Insecticides\***

For home and commercial orchards:

- spinosad (GF-120, Success<sup>®</sup>, Entrust<sup>®</sup>) – reapply every 7 days
- carbaryl (Sevin<sup>®</sup>) – reapply every 7 days
- malathion (Malathion<sup>®</sup>) – best when used just before harvest as it lasts approximately 3 days
- esfenvalerate (Asana<sup>®</sup>, Ortho<sup>®</sup>)
- permethrin (Ambush<sup>®</sup>, Pounce<sup>®</sup>, Ortho<sup>®</sup>)

For commercial orchards only:


- imidacloprid (Provado<sup>®</sup>) – reapply every 14 days
- azinphosmethyl (Guthion<sup>®</sup>) – reapply every 14 days (scheduled for phase-out by 2012 by the U.S. Environmental Protection Agency)
- phosmet (Imidan<sup>®</sup>) – reapply every 14 days; do not use on sweet cherry
- diazinon (Diazinon<sup>®</sup>) – reapply every 10-14 days
- synthetic pyrethroids – reapply every 7-10 days
  - cyfluthrin (Baythroid<sup>®</sup>)
  - lambda-cyhalothrin (Warrior<sup>®</sup>)

\*All brand names are registered trademarks. Examples of brands may not be all-inclusive, but are meant to provide examples of insecticides registered on cherry trees in Utah. The availability of insecticides is changing rapidly. Always check the label for registered uses, application and safety information, and protection and pre-harvest intervals.

<sup>†</sup>Restricted use products that require an applicator license.

<sup>‡</sup>Insecticide products that may be available for use on home fruit trees.

It is critical to keep an adequate number of bait-insecticide droplets available to kill adults soon after they emerge and before they mate and/or females lay eggs. Currently it is only sold in larger volumes; larger than is practical for most home orchards.




**Figure 9.** Application of GF-120 attract-and-kill product with a 4-wheeler-mounted sprayer.<sup>1</sup>

**Cultural Controls**

**Ground Cover and Mulches**

Ground covers and mulches around the base of trees can prevent larvae from burrowing into the soil to complete development into the pupal stage. Successful vegetation covers include grasses and other plants with extensive, dense root systems (e.g., clover) that physically impede fruit fly larvae. Landscape fabric can prevent larval burrowing and emergence of adults from pupae in the soil (Fig. 10). Mulches of other dense materials may also interfere with their life cycle.



**Figure 10.** Landscape fabric under the trees can prevent larvae from burrowing into the soil to pupate.

**Sanitation**

Maintaining a “clean” orchard wherein the fruit fly population is kept at low levels from one year to the next is important because high populations are more difficult to control, even with insecticides. In years when the crop is not harvested or not all fruit is removed from trees, fruit fly populations can increase and cause greater pest pressure the following year. Therefore, it is important to remove dropped fruit from the orchard floor as it may contain larvae. In addition, remove any nearby abandoned or wild cherry trees to prevent them from serving as unmanaged hosts that contribute to the local fruit fly population.

**Biological Control**

There are some natural enemies that will attack fruit fly life stages, such as parasitic wasps that lay eggs on larvae within fruit, but control has not been shown to be significant. Birds and rodents take a larger toll on fruit fly larvae, but they generally also consume the fruit and so are not considered beneficial. Chicken and other fowl have been shown to eat fruit fly larvae and pupae in the soil and may provide some benefit.

# Peach Twig Borer

- Over winter as young larvae on limbs within cocoons
- From bloom to petal fall, brown caterpillars tunnel into new shoots
- 2<sup>nd</sup> & 3<sup>rd</sup> generation caterpillars enter fruit, usually at the stem end
- **Delayed Dormant Spray:** Dormant oil + permethrin or gamma-cyhalothrin (by first pink) – targets twig boring OR At-Bloom Sprays: 2 Bt sprays (early & full to late bloom)
- **Fruit Protection:** same insecticides as for CM
- See Tree Fruit IPM Advisory for timing



# Peachtree (Crown) Borer

- Female clear-winged moths lay eggs on lower trunk or in cracks in soil near the base; larvae bore into the cambium in lower trunk; trees may be girdled & die; adults begin activity in late June to early July in northern Utah
- **Control:** Trunk spray with carbaryl, permethrin, or gamma-cyhalothrin during first week of July; repeat every 2-3 weeks through August
- Kill larva in trunk with sharp point



# Fruit-Eating Wasps: Paper Wasps



**European paper wasp (fruit-eater):**  
Thin waist, more black than yellow,  
Upside down umbrella-shaped nests



**Yellow jacket:**  
“Chunky” body, more yellow  
than black  
Paper nests in ground &  
under dense vegetation  
Aggressively defend nest  
(painful sting!)



# Wasp Traps

- Place around perimeter of garden and yard and in spots slightly away from high human activity
- Yellow jacket – predator/scavenger
  - Commercial traps with heptyl butyrate bait
  - Homemade trap with raw meat
  - Locate ground nests in area - treat with insecticides & remove
- European paper wasp – fruit-eater
  - Homemade trap - liter plastic bottle with diluted fruit juice (1 part juice: 10 parts water) – ferment juice (1/4 tsp yeast) + 1/4 tsp liquid dish detergent (add piece of ripe fruit to excel fermentation) – see Video Fact Sheet!
  - Treat & remove nests



# Aphids

- Aphids have “tailpipes”
- Non-winged & winged adults
- Suck fluids from leaves & stems; curl leaves; produce sticky honeydew; black sooty mold growth
- Protect young trees, older trees can tolerate more aphid feeding
- **Controls:** Dormant oil at green tip stage
- **In-season:** Insecticidal soap, horticultural oil, azadirachtin, malathion
- **Biological control:** lady beetles, lacewings, syrphid flies, parasitic wasps



Rosy Apple Aphid

Green Apple  
Aphid



Woolly  
Apple  
Aphid

# Spider Mites

- Feed on leaves; produce webbing; injury appears as white speckles; severe feeding leads to bronzing
- Mites build up on broadleaf weeds (bindweed, knotweed, mallow, prickly lettuce); reproduce rapidly in hot weather
- **Cultural controls:** Avoid mowing, herbicides, drying of vegetation - prompts mites to move into trees
- Avoid multiple applications of pyrethroid insecticides
- **Biological control:** naturally occurring predatory mites & small black lady beetle
- **Chemicals:** horticultural oil, insecticidal soap



# Aphid & Mite Mechanical Control

Stiff spray of water every 2-3 days until aphid or mite numbers decline

Best if initiated before leaves are tightly curled (aphids) or extensive webbing & leaf injury occurs (mites)





# Beneficial Insects for Natural Biological Control



# Biological Control Insect Groups

Robber  
Fly



- Predator

- consumes (kills) two or more individuals to complete its development

Aphid  
Wasp



- Parasitoid

- consumes (kills) exactly one individual to complete its development

Varroa  
Mite



- Parasite

- consumes, but generally does not cause the death of one or more individuals; reduces growth rate & health of host

# Beneficial Insects & Mites

## *Cast of Common Characters in the Garden*



Parasitic wasps & flies



Big-eyed Bug

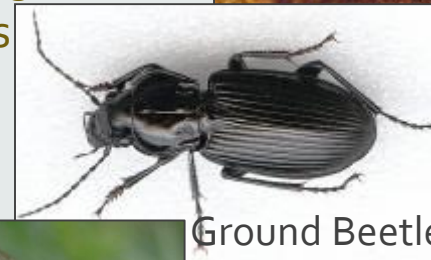


Damsel Bug

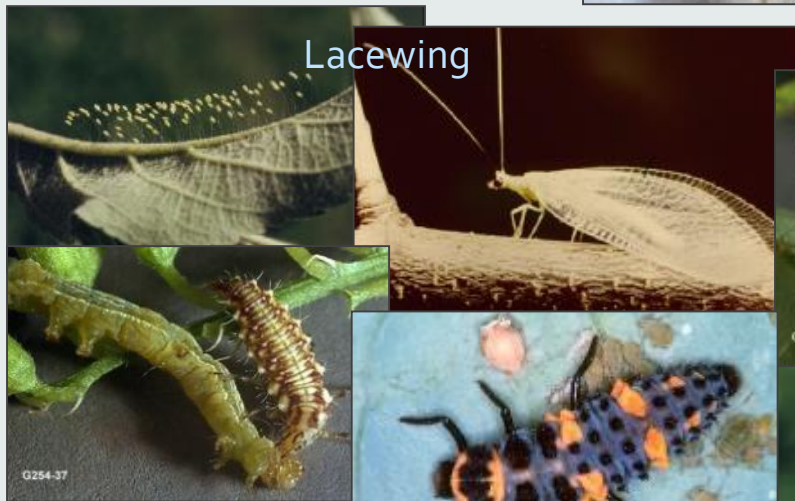


Minute Pirate Bug

Predaceous true bugs & beetles



Ground Beetle



Lacewing

Syrphid or Hover Fly

Lady Beetle

Common aphid predators



G128-1



Predaceous mites

# Misconceptions About Biological Control for Outdoor Situations

- Releasing insects is the best method - No
- Predatory insects will stay in your garden after release - No
- Other practices/activities don't matter - No





# Biological Control: Conserve Natural Enemies

- Enhance biodiversity
- Spatial diversity across the landscape
- Temporal diversity, throughout the season and from year to year
- Needs to be the right kind of diversity!!



# Beneficial Insects & Pollinators Need a Diverse Diet & Shelter

- Protein and carbohydrate (sugar) food sources
  - Protein
    - Insect prey, pollen, bird droppings
  - Carbohydrate
    - Nectar, plant nectaries, aphid honeydew
- Shelter & varied habitat

Flowering perennials & annuals  
Trees & shrubs  
Herbs  
Wildflowers



# Alyssum Attracts Hover Flies

## Hover Fly Larvae Prey on Aphids



Alyssum intercropped in lettuce fields



Alyssum planted in orchard alleyways

# Beneficial Insects



# Lady Beetles



# Lacewings



Green Lacewing



Brown Lacewing



Lacewing eggs  
are laid on stalks

Green  
Lacewing  
Egg Cluster

Green lacewings  
lay their eggs  
in clusters



Brown  
Lacewing  
Eggs

Laid singly





Lacewing  
larva  
preying on  
aphids

Siphoning  
mouthparts

# Syrphid Fly/Hover Fly







Syrphid or  
Hover Fly Adult

Mimic bees  
& wasps –  
black/yellow  
stripes on  
abdomen



Flies have  
large eyes

Feed on  
nectar  
at flowers

# Minute Pirate Bug



Adult



Nymph

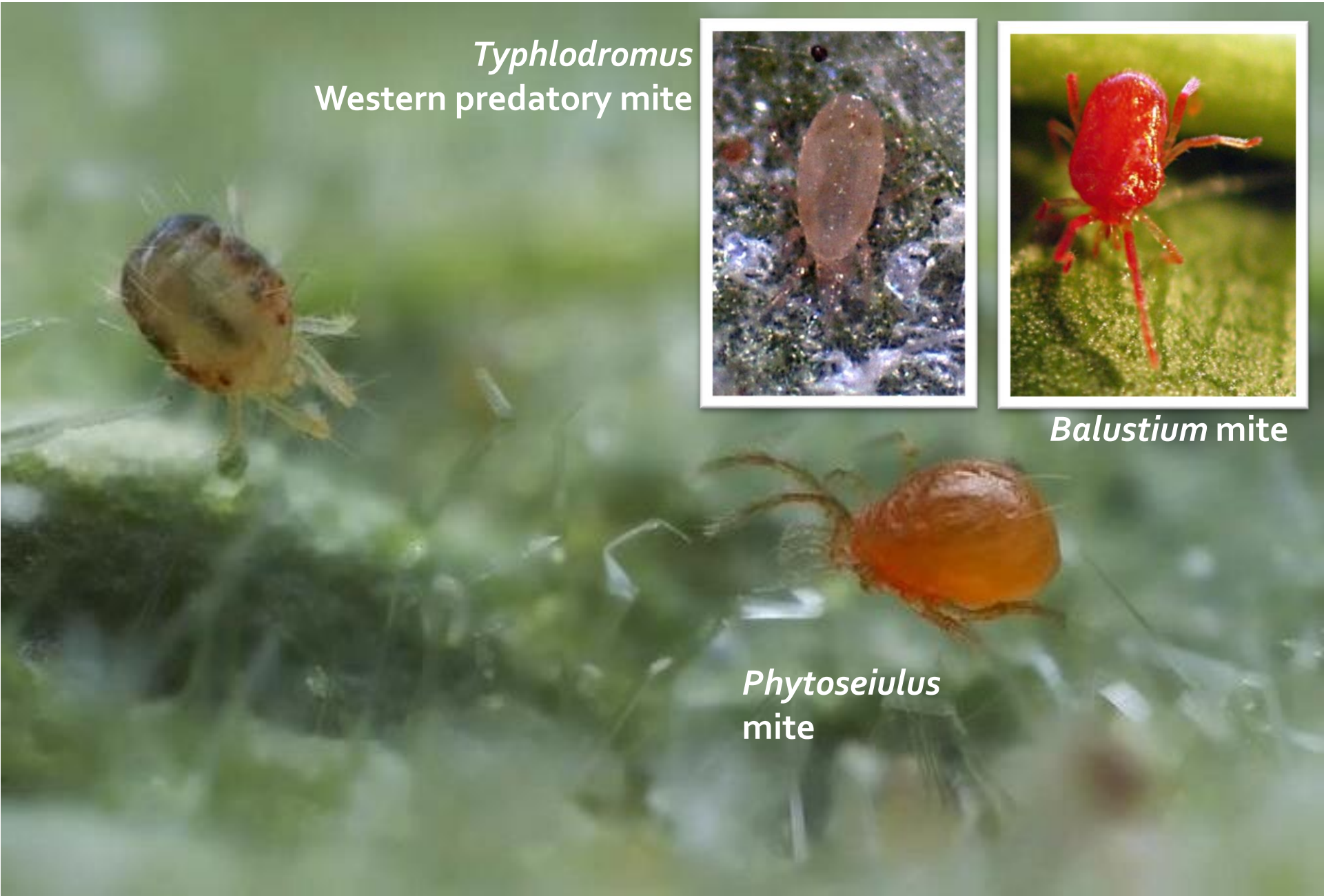
# Predatory Mites

*Typhlodromus*  
Western predatory mite



*Balustium* mite

*Phytoseiulus*  
mite



# Parasitoids (Wasps, flies)



Ichneumon Wasp

Long ovipositor



# Parasitoids (Wasps, flies)





# Parasitoids



Wasps  
parasitizing  
insect  
eggs  
& scale

# Aphid Parasitoids



Aphid Mummies

# Find this slideshow and others at [www.utahpests.usu.edu](http://www.utahpests.usu.edu)



for your attention...



Contact us

USU Links >> USU Home A-Z Index calendars MyUSU directory contact

EXTENSION Utah State University

UTAH PESTS

UTAH PESTS Home Utah Plant Pest Diagnostic Lab Integrated Pest Management School IPM Cooperative Agricultural Pest Survey

Google™ Search

Home  
Fact Sheets  
Video Fact Sheets  
Image Galleries  
Slideshows  
Utah Pests News  
Quarterly Newsletter  
Bees and Other  
Pollinators  
In the News  
Contact Us

f Instagram

Utah Plant Pest Diagnostic Lab  
Just \$7 gets your pest problem diagnosed or insect identified.

Integrated Pest Management  
Your source for fruit, vegetable, and landscape pest problems.

School Integrated Pest Management  
Teaching responsible pest management for a healthy learning environment.

Cooperative Agriculture Pest Survey  
CAPS protects Utah agriculture through statewide monitoring of invasive pests.

*Slideshows: Fruit Insects*

**In the News**  
Invasive Pests vs. Polar Vortex  
Nov 03, 2014  
Customs Agent in Buffalo Intercepts Invasive Tortricid Moth  
Oct 17, 2014  
New Leafhopper Species  
Oct 07, 2014

UTAH PESTS' is a group of Extension entomologists and plant pathologists that helps to solve the thousands of plant pest issues that concern Utah citizens every day. The UPPDL identifies, the IPM Program educates, and the CAPS Program investigates. Open one of the websites to get answers!