

Insect Basics for Yard & Garden



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Utah Pests is a great resource!

- see this talk again (and many more!)
- fact sheets
- how to submit a sample to the UPPDL
- photo gallery, FAQ's, etc.

go to www.utahpests.usu.edu





UtahState UNIVERSITY extension



UTAH PESTS

Utah's diverse landscape supports thousands of insects and plant pathogens. **UTAH PESTS** is your portal for learning more about pests and their beneficial counterparts around the state, and how Utah Extension personnel are working to provide a greater understanding of these organisms in our world.

Click on one of the web site links below to get started!



[integrated pest management](#)

Choose this site for the [plant pest advisories](#), the [IPM Mini-Grant program](#), [weather data](#), and much more.



[plant diseases](#)

Choose this site for a multitude of fact sheets on diseases and disorders of [field crops](#), [fruits](#), [ornamentals](#), [turf](#), and [vegetables](#).



[insects and their relatives](#)

This site will help to shed some light on the insect world, with [fact sheets](#), [images](#), [slide shows](#), and more.



[utah plant pest diagnostic lab](#)

The UPPDL, the only lab of its kind in Utah, is here to identify and provide management recommendations for your pest problems.

UTAH PESTS

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Overview

- Why insects are important
- Insects and their relatives
- Insect anatomy and biology
- Beneficial insects
- Hot topics
- Common pests



Why insects are important

- Pollinators
 - Bees, beetles, flies, wasps, butterflies and moths
 - 75% of flowering plants need insect pollination
 - Transfer pollen as they feed on nectar
- Produce food and other products
 - Honey, wax, royal jelly, pollen
 - Silk, dyes, shellac, inks, cosmetics



Why insects are important

- Decomposers
 - Break down organic matter
- Biological control agents
 - Help reduce pest insects
- Part of the food chain
 - For larger insects and other animals (humans)
- Forensic entomology
 - Predictable pattern of decomposition



Insects and their relatives



A diagram showing the taxonomic classification of a honey bee. It consists of seven horizontal bars of decreasing width from top to bottom, each representing a taxonomic rank. The bars are colored in a gradient from light green at the top to dark purple at the bottom. To the right of each bar is a corresponding arrow-shaped box containing the taxonomic name. A decorative horizontal bar at the top of the diagram is composed of alternating purple and light green segments.

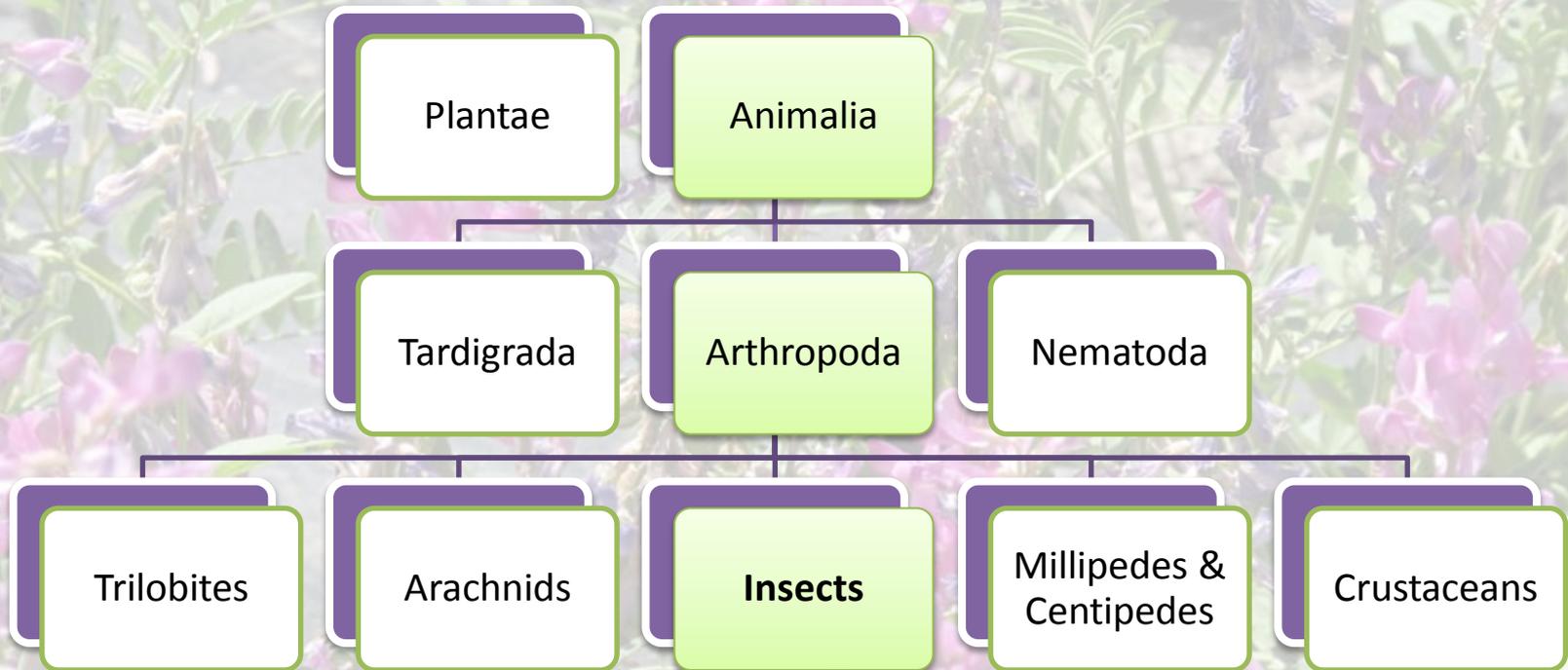
Kingdom	• Animalia
Phylum	• Arthropoda
Class	• Insecta
Order	• Hymenoptera
Family	• Apidae
Genus	• Apis
Species	• mellifera

Scientific name: *Apis mellifera*

Common name: honey bee

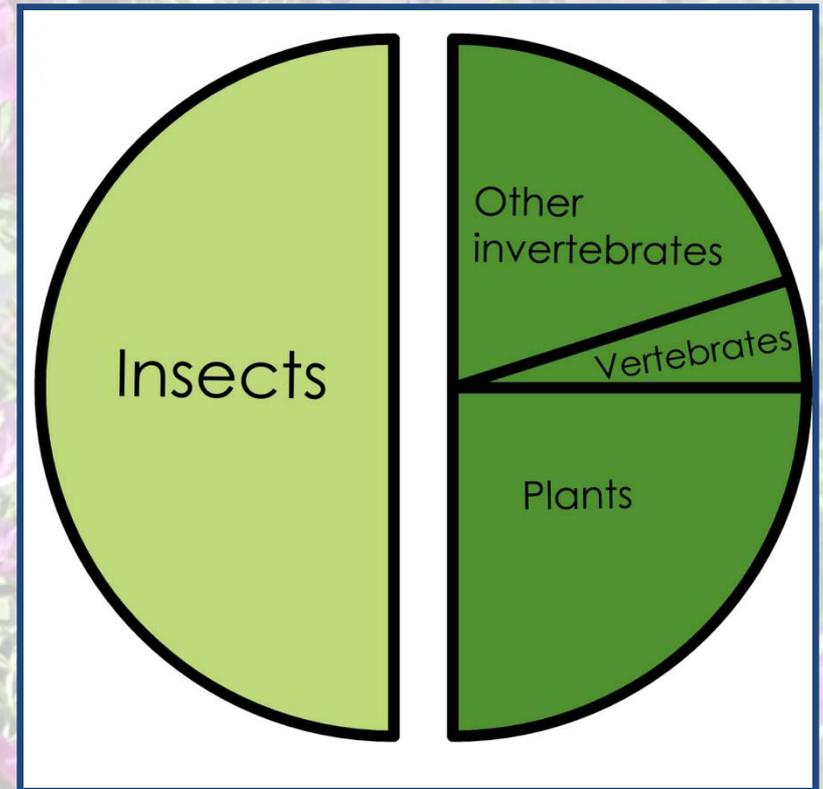
Insects and their relatives

Arthropods: insects, spiders and more



Insects and their relatives

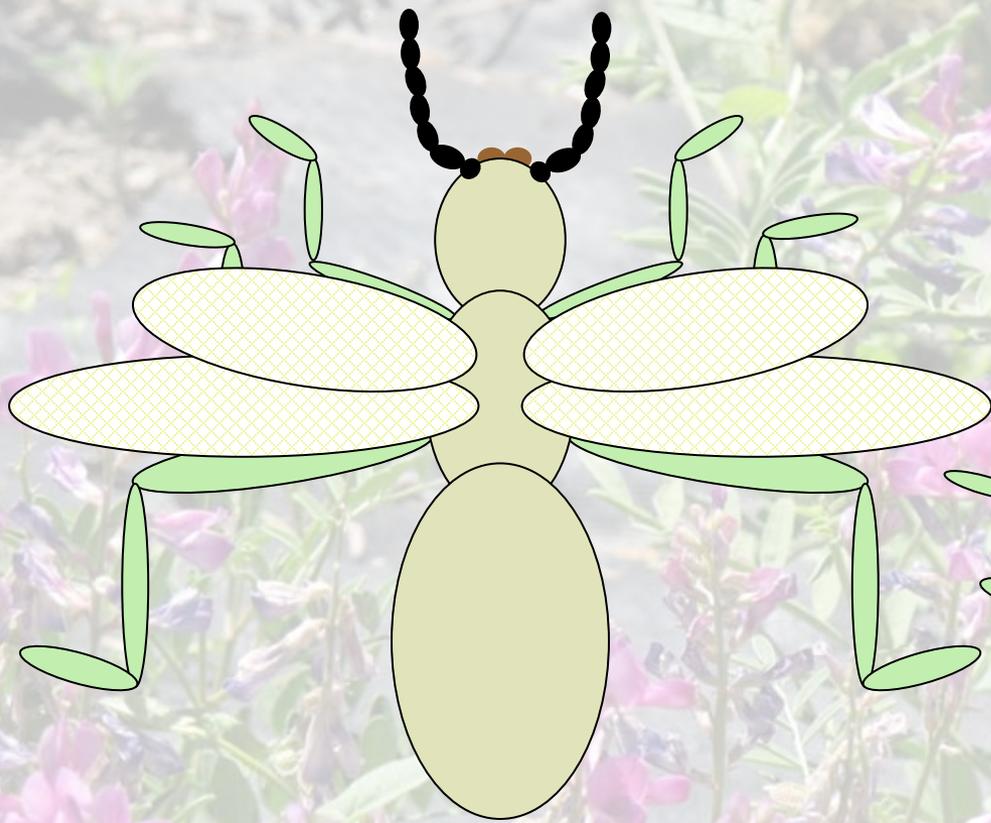
- More insects than all other plants and animals combined
- More than 1 million different species
- 1 out of every 5 animals is a beetle!



Insects and their relatives

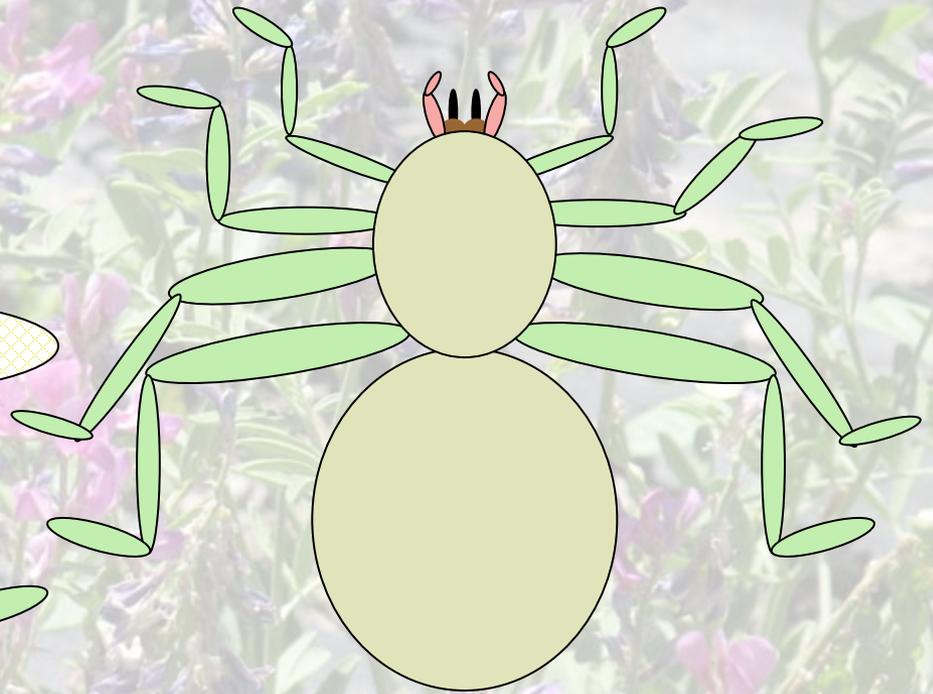
- Arthropods are numerous and diverse
 - Insects (beetles, flies, moths, earwigs, aphids)
 - Arachnids (spiders, ticks, mites, scorpions)
 - Crustaceans (crayfish, crabs, lobsters, sowbugs)
 - Centipedes, millipedes
- Exoskeleton is a hard outer shell
- Jointed appendages, segmented body
- *Not arthropods*: slugs, snails, earthworms





Insects

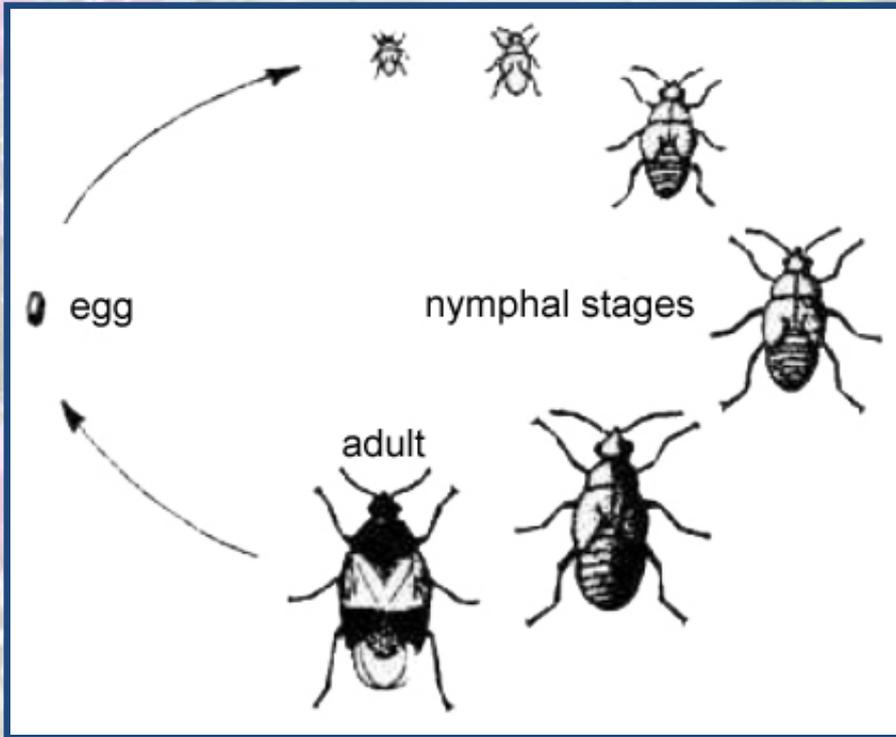
- 3 body regions
- 1 pair of antennae
- 3 pairs of legs
- 2 pairs of wings



Arachnids

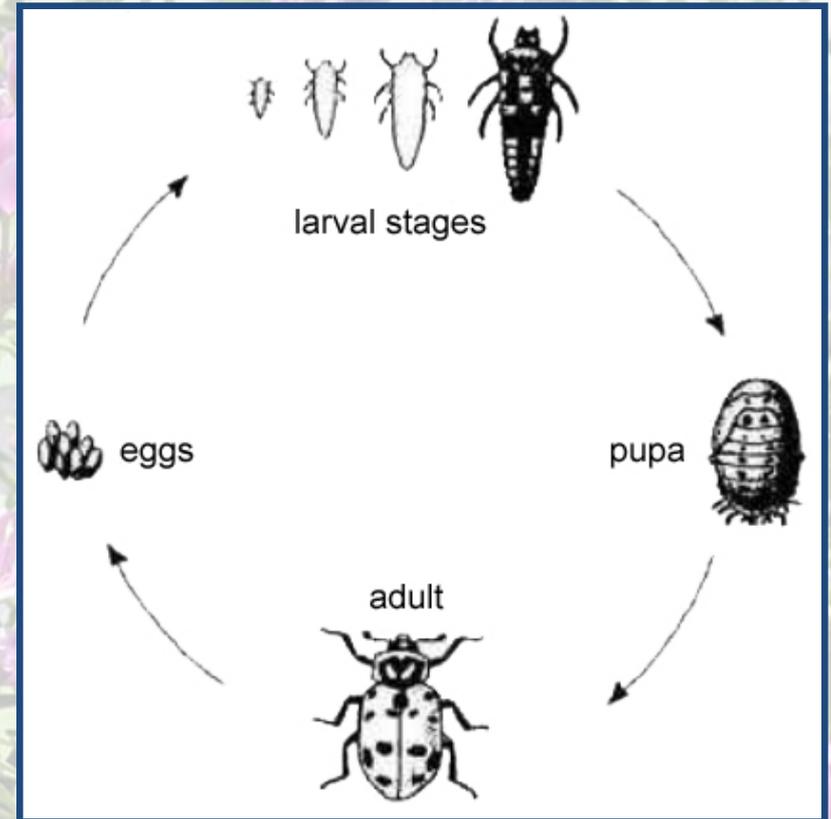
- 2 body regions
- No antennae
- 4 pairs of legs
- No wings

Insect metamorphosis



Simple: egg, nymph, adult

Examples: grasshoppers, true bugs



Complete: egg, larva, pupa, adult

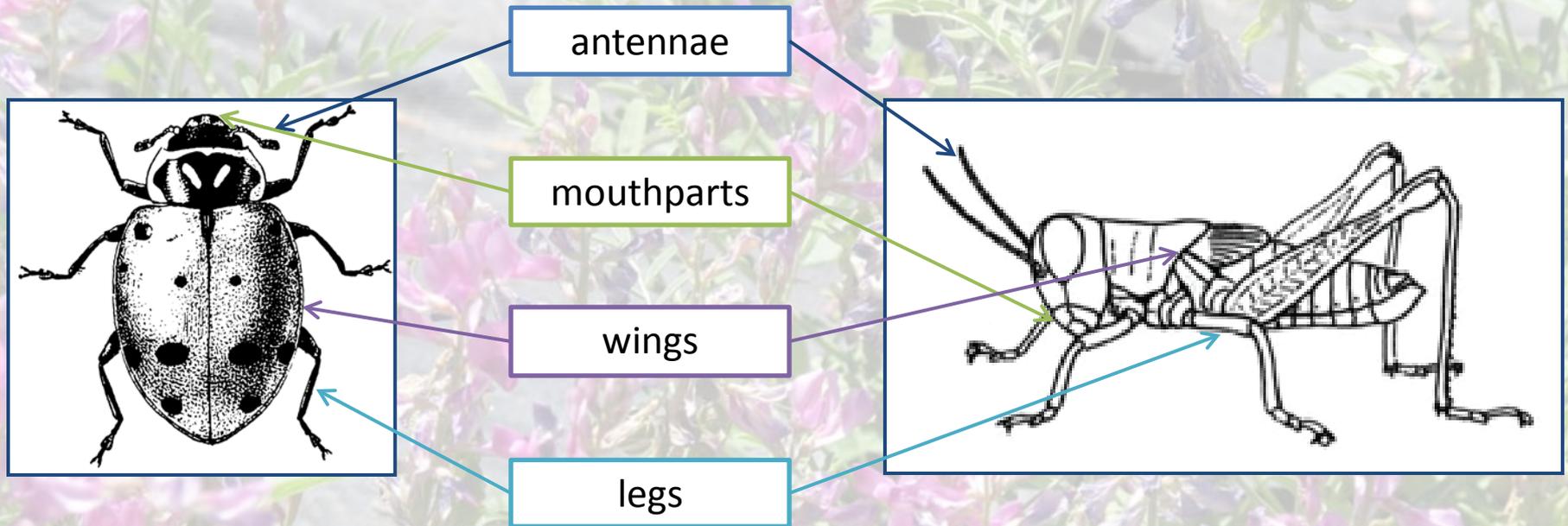
Examples: beetles, butterflies, flies

Different feeding groups

- Carnivore – animal matter
- Herbivore – plant matter
- Omnivore – plant and animal matter
- Detritivore/Saprophage – decaying organic matter
- Coprophage – feed on feces!



How to identify insects



Insect Diversity (Not all insects are pests!)

- 
- Beneficials
 - Pollinators
 - Pests
 - “Neutral” Insects

Concept of IPM

- Integrated pest management
 - Use multiple tactics to reduce pests to tolerable level
 - Promote plant health
 - Plan ahead with regular scouting
 - Use thresholds (economic or aesthetic)
- Limit chemical applications
 - Follow rates/harvest intervals
 - Think about good timing
 - Mix up chemical classes

Know your system...

- 
- What is the plant, what is normal?
 - Most plant health problems are not caused by biotic factors (insects, disease)
 - Most plant health problems are a result of abiotic factors (environment, cultural methods, irrigation, fertilization, etc.)
 - Proper identification of insect or disease

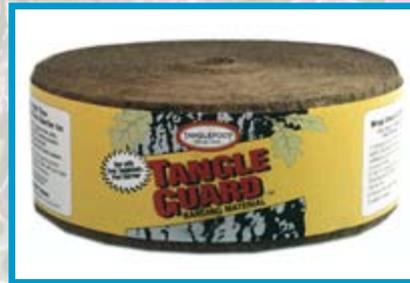
IPM tactics

- Mechanical/physical
- Cultural
- Biological
- Chemical



Mechanical/Physical Control

- Barriers, screens
- Traps, bands
- Mulch
- Hand removal



Cultural Control

- 
- Rotate crops, planting locations
 - Sanitation, crop destruction
 - Seek resistant/tolerant plants
 - Avoid susceptible plants (even favorites!)
 - Diversify plant selection
 - Keep plants healthy
 - Row spacing
 - Set up zones for H₂O, fertilization

Biological Control

- Insects controlling pests
- Predators, parasitoids, pathogens
 - Most pests have enemies
 - Will respond to low/moderate density
- Encourage natural enemies
 - Use native nectar-producing plants
 - Avoid monocultures

Plants with Quality Nectar and Pollen



USDA *ars* United States Department Of Agriculture
Agricultural Research Service

Northern Plains Logan, UT Pollinating Insects-- Biology, Management and Systematics Research

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Research

Plants Attractive to Native Bees

Sorted By Genus
Blue plant names are widely cultivated & broadly attractive to bees.

<u>FAMILY</u>	<u>GENUS</u>	<u>COMMON NAME</u>	<i>Notes</i>
Caprifoliaceae	<i>Abelia</i>	abelia	
Fabaceae	<i>Acacia</i>	acacia	
Aceraceae	<i>Acer</i>	maple	
Asteraceae	<i>Achillea</i>	yarrow	<i>A. millefolium</i> weedy
Ranunculaceae	<i>Aconitum</i>	monkshood	
Lamiaceae	<i>Agastache</i>	hyssop	
Lamiaceae	<i>Ajuga</i>	carpet bugle	
Malvaceae	<i>Althea</i>	hollyhock	not doubled
Liliaceae	<i>Allium</i>	allium	
Rosaceae	<i>Amelanchier</i>	serviceberry	
Boraginaceae	<i>Anchusa</i>	wild forget-me-not	
Apiaceae	<i>Anethum</i>	dill	
Ranunculaceae	<i>Aquilegia</i>	columbine	not doubled
Ericaceae	<i>Arctostaphylos</i>	manzanita	
Papaveraceae	<i>Argemone</i>	prickly poppy	
Plumbaginaceae	<i>Armeria</i>	sea thrift	
Asteraceae	<i>Aster</i>	aster	not doubled
Fabaceae	<i>Astragalus</i>	locoweed	
Asteraceae	<i>Baileya</i>	desert marigold	

ARS Research Links

- ARS National Programs
- Search for a research project

Insect Pathogens = Entomopathogens



Nematodes
Fungi
Protozoa
Viruses



Beneficial Insects 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 plants
Herbs
Wildflowers



Chemical Control

- Advantages:
 - May be quick
 - Often most effective way to deal with a large pest population
- Disadvantages:
 - Pest resistance or resurgence
 - May kill non-target organisms
- **Timing and chemical choice are important!**
 - Economic or aesthetic threshold
 - Mode of action
 - Time of application
 - “Softer” vs. “traditional” insecticides
- Product label is your best source of information.
 - Application rates
 - Preharvest intervals
 - Warnings
 - Protective equipment

Insecticide Mode of Action (MoA)

- Insecticide Resistance Action Committee (IRAC) (www.IRAC-online.org)
- Resistance: *'a heritable change in the sensitivity of a pest population that is reflected in the repeated failure of a product to achieve the expected level of control when used according to the label recommendation for that pest species' (IRAC).*
 - Translation: if you repeatedly use the same type of chemicals, you will no longer get insect control.

Insecticide Mode of Action (MoA)

6.2. Classification Table

IRAC MoA Classification v 7.0, August 2010 ¹		
Main Group and Primary Site of Action	Chemical Sub-group or exemplifying Active Ingredient	Active Ingredients
1* Acetylcholinesterase (AChE) inhibitors Nerve action (Strong evidence that action at this protein is responsible for insecticidal effects) * Please see footnotes for further information on the use of compounds between sub-groups	1A Carbamates Window Snip	Alanycarb, Aldicarb, Bendiocarb, Benfuracarb, Butocarboxim, Butoxycarboxim, Carbaryl, Carbofuran, Carbosulfan, Ethiofencarb, Fenobucarb, Formetanate, Furathiocarb, Isoprocarb, Methiocarb, Methomyl, Metolcarb, Oxamyl, Pirimicarb, Propoxur, Thiodicarb, Thiofanox, Triazamate, Trimethacarb, XMC, Xylylcarb
	1B Organophosphates	Acephate, Azamethiphos, Azinphos-ethyl, Azinphos-methyl, Cadusafos, Chlorethoxyfos, Chlorfenvinphos, Chlormephos, Chlorpyrifos, Chlorpyrifos-methyl, Coumaphos, Cyanophos, Demeton-S-methyl, Diazinon, Dichlorvos/ DDVP, Dicrotophos, Dimethoate, Dimethylvinphos, Disulfoton, EPN, Ethion, Ethoprophos, Famphur, Fenamiphos, Fenitrothion, Fenthion, Fosthiazate, Heptenophos, Imicyafos, Isofenphos, Isopropyl O-(methoxyminothio-phosphoryl) salicylate, Isoxathion, Malathion, Mecarbam, Methamidophos, Methidathion, Mevinphos, Monocrotophos, Naled, Omethoate, Oxydemeton-methyl, Parathion, Parathion-methyl, Phenthoate, Phorate, Phosalone, Phosmet, Phosphamidon, Phoxim, Pirimiphos-methyl, Profenofos, Propetamphos, Prothiofos, Pyraclofos, Pyridaphenthion, Quinalphos, Sulfotep, Tebupirimfos, Temephos, Terbufos, Tetrachlorvinphos, Thiometon, Triazophos, Trichlorfon, Vamidothion
2 GABA-gated chloride channel antagonists Nerve action (Strong evidence that action at this protein is responsible for insecticidal effects)	2A Cyclodiene organochlorines	Chlordane, Endosulfan
	2B Phenylpyrazoles (Fiproles)	Ethiprole, Fipronil
3* Sodium channel modulators Nerve action (Strong evidence that action at this protein is responsible for insecticidal effects) * Please see footnotes for further information on the use of compounds between sub-groups	3A Pyrethroids Pyrethrins	Acrinathrin, Allethrin, d-cis-trans Allethrin, d-trans Allethrin, Bifenthrin, Bioallethrin, Bioallethrin S-cyclopentenyl isomer, Bioresmethrin, Cycloprothrin, Cyfluthrin, beta-Cyfluthrin, Cyhalothrin, lambda-Cyhalothrin, gamma-Cyhalothrin, Cypermethrin, alpha-Cypermethrin, beta-Cypermethrin, theta-cypermethrin, zeta-Cypermethrin, Cyphenothrin, (1R)-trans-isomers], Deltamethrin, Empenthrin, (EZ)-(1R)-isomers], Esfenvalerate, Etofenprox, Fenpropathrin, Fenvalerate, Flucythrinate, Flumethrin, tau-Fluvalinate, Halfenprox, Imiprothrin, Kadethrin, Permethrin, Phenothrin [(1R)-trans-isomer], Prallethrin, Pyrethrins (pyrethrum), Resmethrin, Silafluofen, Tefluthrin, Tetramethrin, Tetramethrin

“Softer” Insecticides: Suffocants, Desiccants

- Soaps, oils, sucrose esters, dusts, DE
 - Smothers to prevent breathing
 - OR
 - Disrupts the waxy outer layer (cuticle) of soft-bodied insects, causing the insect or mite to dry out and die
 - Concern[®], Safer[®], Sucroicide[®], Dri-Die[®], Bonide[®], Entrust[®], Success[®]
-
- Kaolin clay (Surround[®])
 - Physical barrier, excessive grooming

Dust/ash will smother insects and cause them to dry out and die!



“Softer” Insecticides: Botanicals (aka plant derived)

- Neem (neem trees)
 - Trilogy[®]
- Pyrethrum (pyrethrum daisy)
 - Pyganic[®], Evergreen[®]
- Rotenone (subtropical leguminous shrubs)
 - Pyrellin[®]
- Spinosad (bacterial fermentation)
 - Conserve[®], Success[®], Entrust[®]

“Softer” Insecticides: Microbials

- Targeted host selection
- Kill, reduce reproduction
- Environment controls effectiveness
- Relatively slow acting; may take several days and repeated applications



fungus



nematode



fungus

Please take a break!



Look at the insects and books

Ask questions

Meet back here

Beneficial Insects & Mites



Parasitic wasps & flies



Predaceous true bugs & beetles



Lacewing

Common Aphid Predators



Syrphid Fly

Lady Beetle

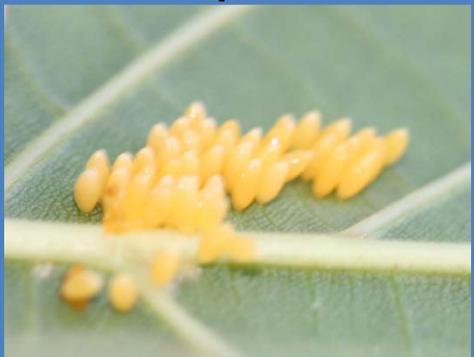


Predaceous Mites

Parasitoid wasp



Ladybug



Lacewing



Lady Beetles (Lady Bugs)

Native

Introduced



**Synchrony of predator
& prey**
Continuous food source
Shelter
Alternative food



Prey:
Aphids
Scales
Spider mites
Mealybugs
Insect eggs

Lacewings



**Green lacewing
most common**



Wide variety of prey:
small insects
aphids
mealybugs
thrips
caterpillars
leafhoppers
insect eggs



Brown lacewing



Syrphid or Hover Flies



Adults mimic
bees



Eat a variety of small insects
& insect eggs



Ground Beetles & Tiger Beetles



Eat mid-sized prey
caterpillars
cutworms
slugs
Live on the ground
Nocturnal

Minute Pirate Bug



Adult

Nymph



Prey

small insects & mites
caterpillars, leafhoppers, psylla, aphids, etc.
insect eggs

Big-eyed Bug



Adult



Nymph

Eat small insects, insect eggs, & mites

Damsel Bug



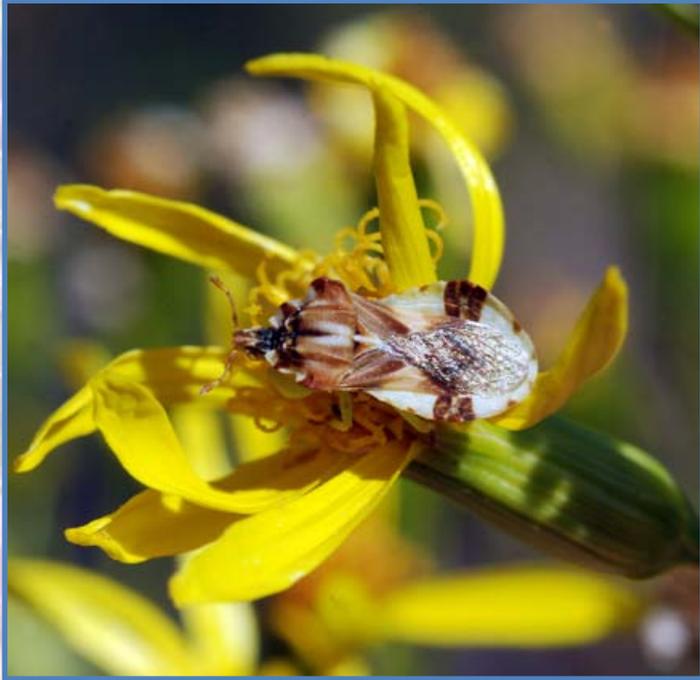
Adult



Nymph

Eat small insects & eggs

Ambush Bug



**Use camouflage
and ambush to
attack prey**



Their bite can hurt – ouch!

Eat small to mid-sized insects



Predatory Mites



Western predatory mite

Native species
Need plant-feeding
spider mites for food
Cannibalistic
Some also eat pollen
& nectar

Zetzellia



Parasitic Wasps



Kathy Kirk

Parasitic Flies



Tachinid Fly

Lay eggs on caterpillars

Fly larvae parasitize host

Hot Topics

- Colony Collapse Disorder
- Spotted Wing Drosophila
- Japanese Beetles
- Grasshoppers

Honey Bee Losses

- Parasitic mites
 - Varroa
 - Tracheal
- Queen failure
- Diseases
 - *Nosema apis* and *N. ceranae* (microsporidia)
 - Viruses
 - Deformed Wing Virus (DWV)
 - Israeli Acute Paralysis Virus (IAPV)
 - American foulbrood
- Nutrition problems
- Pesticide exposure
- Poor hive management
- **Colony Collapse Disorder**



Varroa mite on honey bee



tracheal mites



Feces streaks on the outside of the hive are a sign of *Nosema*.

Honey Bee Losses

- 
- Since 1869, 18 discrete episodes of unusually high colony mortality documented internationally
 - Colonies in decline since 1940's
 - Losses have increased since introduction of tracheal and Varroa mites in 1980's
 - Colony Collapse Disorder first recognized in 2006-2007
 - 1/3 losses attributed to Colony Collapse Disorder
 - Managed and feral colonies affected

CCD: What We've Learned

- CCD is either contagious or results from exposure to a common risk factor.
 - Combination of stress factors weakens colony
- Higher number of viruses/pathogens, pesticides, & parasites in CCD colonies
 - Secondary co-infections, high virus loads
 - Either exposed to more pathogens or immunodeficient
 - *N. ceranaea* not a major contributor.
 - IAPV not highly correlated with CCD.

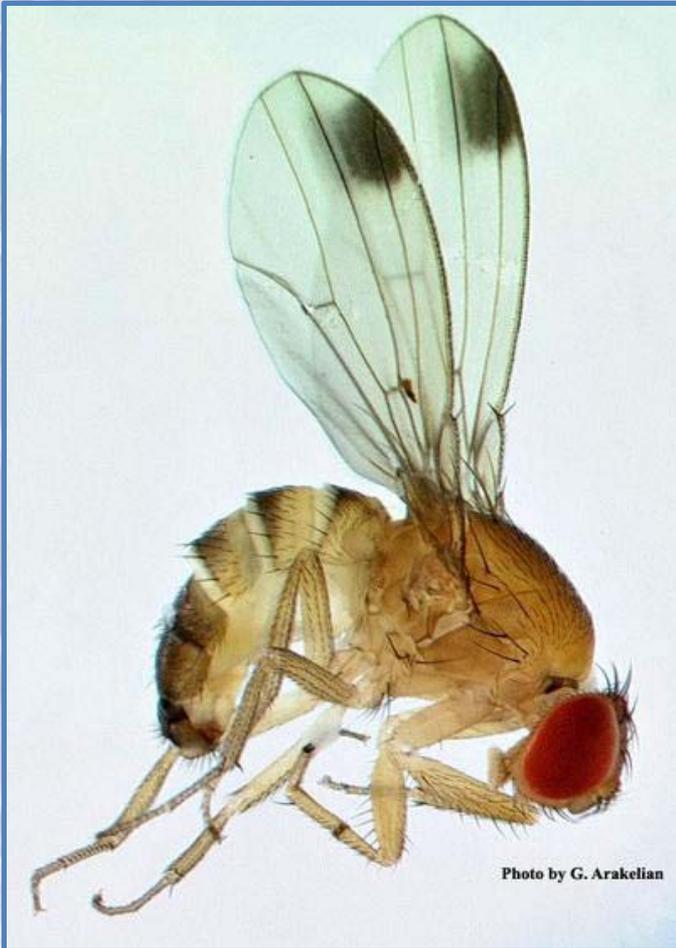
CCD: What We've Learned

- 
- Sublethal effects of two common miticides (fluvinate, coumaphos)
 - Synergistic effect of pesticides (neonicotinoids, fungicides, surfactants, miticides)
 - Confirmed links between poor colony health and inadequate diet and long distance transportation

CCD: What's Being Done

- ARS Area-wide Project on Honey Bee Health
- CSREES-funded Cooperative Agricultural Project (CAP)
- Key accomplishments to date:
 - Varroa mite resistant bee stocks
 - Comb irradiation to reduce pathogen levels
 - Alternative pollinators
- Progress being made toward:
 - New pest and pathogen detection capabilities
 - IPM strategies for controlling Varroa mites
 - Comprehensive Best Management Practices for beekeepers

Spotted Wing Drosophila



Males have a single spot on each wing.

Females have a serrated ovipositor.

This enables infestation of unripe fruit.

Spotted Wing Drosophila

- Originally from Asia.
- First found in U.S. in October 2009.
- U.S. range: California, Oregon, Washington, Florida, Louisiana, North Carolina, South Carolina, and...
 - Found in Davis County, UT in September 2010.
- Hosts include:
 - tree fruits (apple, apricot, cherry, mullberry, nectarine, peach, persimmons, plum, pluot)
 - small fruits (blackberry, blueberry, grapes, raspberry, strawberry)
 - vegetable fruits (melons, tomato)
 - Any soft-skinned fruit may be susceptible to SWD.

Spotted Wing Drosophila

Utah Pests fact sheet: <http://extension.usu.edu/files/publications/publication/ENT-140-10d.pdf>

- Recommendations:

1. Monitoring

- Homemade or commercial traps

2. Non-chemical control

- Trapping, sanitation, exclusion, timely harvest, freezing

3. Chemical control

- Only if detected
- Mostly applies to commercial growers



Japanese beetle in Utah

Utah Pests fact sheet:

[http://extension.usu.edu/files/publications/factsheet/Japanese Bettle 2010.pdf](http://extension.usu.edu/files/publications/factsheet/Japanese_Bettle_2010.pdf)

- Initially detected in Orem, July 2006
- UDAF set up trapping network
- JB trapped in Orem
 - 675 in 2006
 - 2157 in 2007
 - 101 in 2008
 - 7 in 2009
- In 2009, 1 male trapped in SLC & 1 male trapped in Hyde Park (Cache Co.)

JB biology

- Adults have a broad host range
 - Rose, apple, stonefruits, Virginia creeper, willow, elm, birch, maples, pin oak, sycamore
 - Strongly attracted to ripening fruit
 - Release a mating/feeding pheromone
- Grubs feed on turfgrass roots
 - Overwintering stage
 - Can weaken turf system



JB description

- Adults
 - oval, ~1/2" long scarab beetle
 - Metallic green with bronze wing covers
 - Six white tufts along each side
 - Clubbed antennae

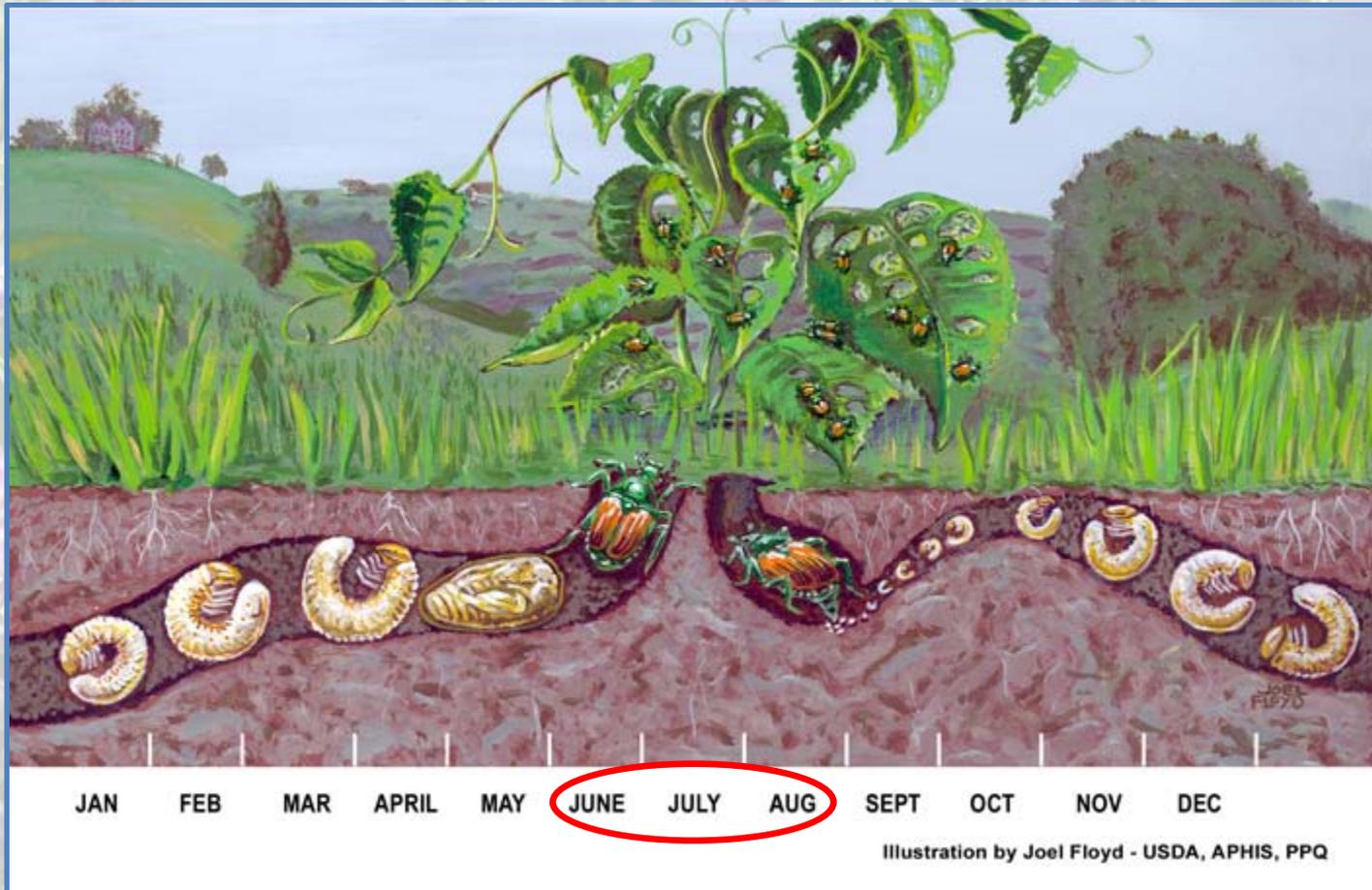


JB description, cont.

- Eggs – white, laid in small clusters
- Larvae (grubs)
 - C-shaped, ~1” long fully developed
 - Creamy white, brown head, dark “butt”
 - 3 pair of thoracic legs, no prolegs
- Pupae – white, fragile



JB life cycle



JB damage - adults

rose



blueberry



Virginia creeper



linden



JB damage - grubs

- Small patches of turf destroyed
- Patches coalesce, quickly
- Spongy turf, easily pulled back



JB trapping

- Use a pheromone trap (catch ~75%)
- Start monitoring early, look for damage

Contech Enterprises Inc.
Unit 115-19 Dallas Road
Victoria, BC V8V 5A6
Canada

Phone: 800-767-8658

Fax: 800-876-1666

www.contech-inc.com



JB adult control

- Adult control is difficult
 - Wide host range
 - Continuous feeding/mating movement
- Many insecticides are available
 - Merit, Acelpryn, Concern, Pyganic, Surround (all “reduced risk”)
 - Insecticidal soap, Conserve

JB grub control

- Grub control is difficult
 - Threshold is 8-10/ft² with obvious damage
 - Treat if persistent grub damage is visible
 - Pushing product down in the soil
- Insecticides are available
 - Merit 0.5G, GrubEx before egg hatch
 - Dylox 6.2G for summer outbreaks

JB grub control

- Light aerification if thatch > ½"
- Pre-irrigate ½" 48 hours before
- Post-irrigate ½ - ¾"
- Repeat irrigation every 4 – 5 days



Grasshoppers

- Currently at high levels in Utah
- Four species do most damage in Utah:
 - Red-legged grasshopper, Differential grasshopper, Two-striped grasshopper, & Migratory grasshopper
- Prefer tall broadleaf plants, weeds
 - Will feed on most veggies
- Chewing mouthparts
 - Plant defoliators
- Overwinters as eggs in undisturbed soil

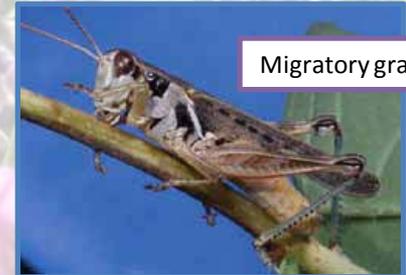
Differential grasshopper



Two-striped grasshopper



Migratory grasshopper

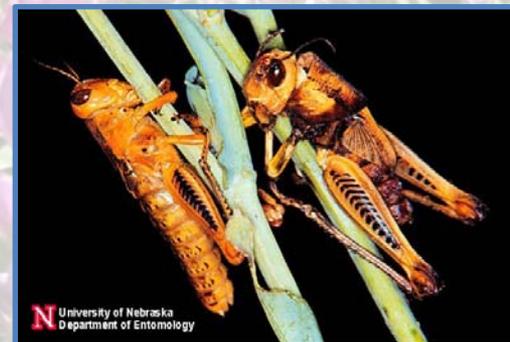


Grasshoppers

Utah Pests fact sheet:

<http://extension.usu.edu/files/publications/factsheet/grasshopper-control09-2.pdf>

- Treatment options
 - Bait + insecticide (wheat bran + carbaryl or *Nosema locustae*)
 - Dust (carbaryl)
 - Sprays (malathion, carbaryl, permethrin, bifenthrin)
 - Over 500 products registered in Utah



Other Nuisance Pests

- Squash bugs
 - <http://extension.usu.edu/files/publications/factsheet/ENT-120-08.pdf>
- Aphids
- Yellowjackets, hornets, and wasps
 - <http://extension.usu.edu/files/publications/factsheet/yellowjackets-hornets-wasps09.pdf>
- Boxelder bugs
 - <http://extension.usu.edu/files/publications/factsheet/boxelder-bugs06.pdf>

Squash bug, *Anasa trititis*

- Feed on cucurbits, squash/pumpkin preferred
- 1-2 generations/year
- Egg clusters deposited on underside of leaves
- Nymphs are gregarious and very damaging
- Overwinters as adults in debris



Squash bugs

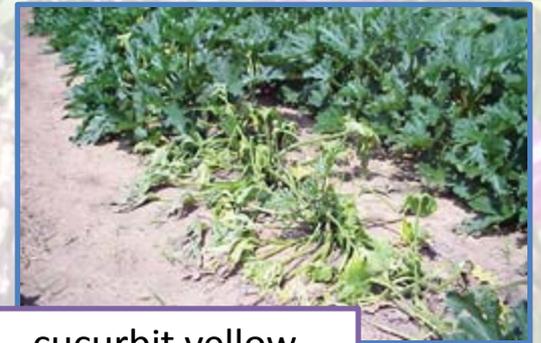
- Feed on vines, leaves, and fruit with piercing-sucking mouthparts
- Transmit (toxic?) saliva into the plant
 - Disease vector
- Wilting, black foliage, scarred fruit, or sudden wilt



damaged foliage



damaged fruit



cucurbit yellow
vine disease (CYVD)

Control of Squash Bugs

- Monitor early
- Cultural and mechanical methods effective, esp. against eggs and nymphs
- Natural enemies are parasitoids (flies, wasps)
- Use insecticides prudently



Tachinid fly,
parasitoid of
squash bugs

Common aphids in Utah

- 
- American walnut aphid
 - Birch aphid
 - Elm leaf aphid
 - Giant conifer aphids
 - Giant willow aphid
 - Green peach aphid
 - Honeysuckle witches' broom aphid
 - Leafcurl ash aphid
 - Leafcurl plum aphid
 - Rose aphid
 - Oak aphid
 - Snowball aphid
 - Woolly apple aphid

Aphids

- Many species on ornamentals
- Overwinter as eggs on woody plants
 - Parthenogenic during the summer
 - Give live birth, only females produced
- 10+ generations/year
- Piercing-sucking mouthparts
 - Fluid feeders, remove phloem/plant sap
 - Can vector disease, form galls

Aphid feeding damage

- Cluster on flower buds, under leaves, stems
- Produce mottling or leafcurl
- Yellowing or speckling
- Reduce plant vigor and dehydrate
- Honeydew and tending ants
- Black sooty mold will reduce photosynthesis



Aphid control options – Level 1

- 
- Tolerance, do nothing
 - Natural enemies can regulate populations
 - Keep plants healthy
 - Stress attracts aphids and other insects!
 - Follow irrigation and fertilization regimes
 - Remember over-fertilization also favors insects

Aphid control options – Level 2

- 
- Monitor for eggs and crawlers
 - High pressure from water hose
 - Prune infested branches and leaves
 - Rake, bag and discard infested debris
 - Scrub limbs with mesh dish sponge

Aphid control options – Level 3

- 
- Dormant oils
 - Suffocants applied before bud burst
 - Horticultural oils
 - Suffocants geared for aphids/crawlers
 - Can burn plants
 - Insecticidal soaps
 - Remove the waxy cuticle and cause dehydration
 - Repeated applications may be needed

Aphid control options – Level 4

- 
- Reduced risk insecticides
 - Conserve natural enemies
 - Relatively short residual
 - E.g., Concern, Esteem (IGR), Pyganic
 - Systemic insecticidal drenches
 - Geared for all feeding life stages
 - Extended residual for fluid feeders
 - E.g., Imidacloprid

Aphid control options – Level 5

- Foliar insecticidal sprays
 - Longer residual, broad spectrum
 - Must make contact!
 - E.g., carbaryl, chlorpyrifos, dimethoate, malathion, permethrin

Summary



- Use non-chemical methods first
 - Monitor your garden (early!)
 - Encourage natural enemies
 - Promote diversity and plant health
 - Sanitation
- Apply reduced risk pesticides second
 - Slower acting, may need multiple applications
- Use traditional pesticides sparingly

Yellowjackets, Hornets, & Wasps



Paper Wasp

Boxelder Bugs



More Information



- <http://utahpests.usu.edu>
- *Handbook of Vegetable Pests*. 2001.
J.L. Capinera. ISBN 0121588610.
- *Garden Insects of North America*. 2004.
W. Cranshaw. ISBN 0691095612.
- *Insects that feed on trees and shrubs*. 1991.
W.T. Johnson and H.H. Lyon. ISBN 0801426022.



Thank you!

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