Bug basics and beyond

Erin W. Hodgson
Extension Entomologist
Utah State University

1st year MG course
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Outline

- Why insects are important
- Insects and their relatives
- Insect anatomy and biology
- Common insects
- Insect management
  - Vegetables, ornamentals

Why insects are important

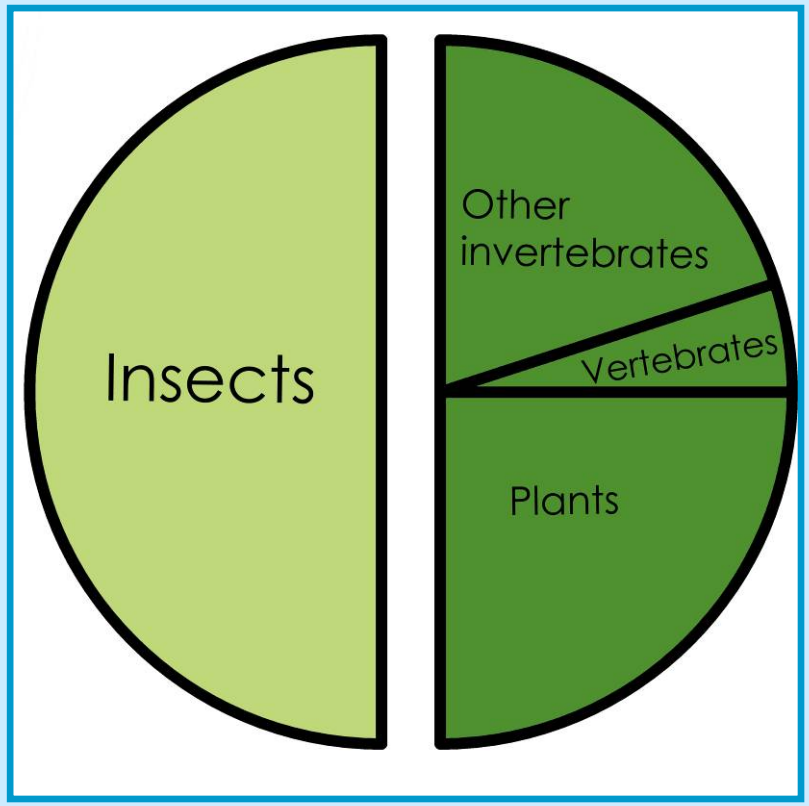
- Pollinators
  - Bees, beetles, flies, wasps, butterflies and moths
  - 65% of flowering plants need insects
  - Transfer pollen as they feed on nectar
- Produce food and other products
  - Honey, wax, royal jelly, pollen
  - Silk, dyes, shellac, inks, cosmetics

Why insects are important

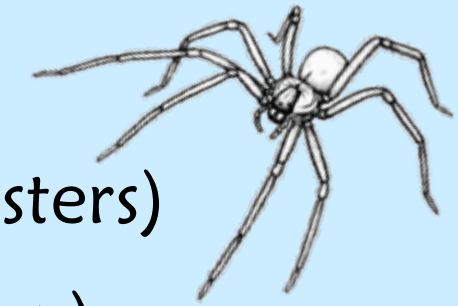
- Decomposers
  - Break down organic matter
- Biological control agents
  - Help reduce pest insects
- Part of the food chain
  - For larger insects and other animals (humans!)
- Forensic entomology
  - Predictable pattern of decomposition

Insects and their relatives

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

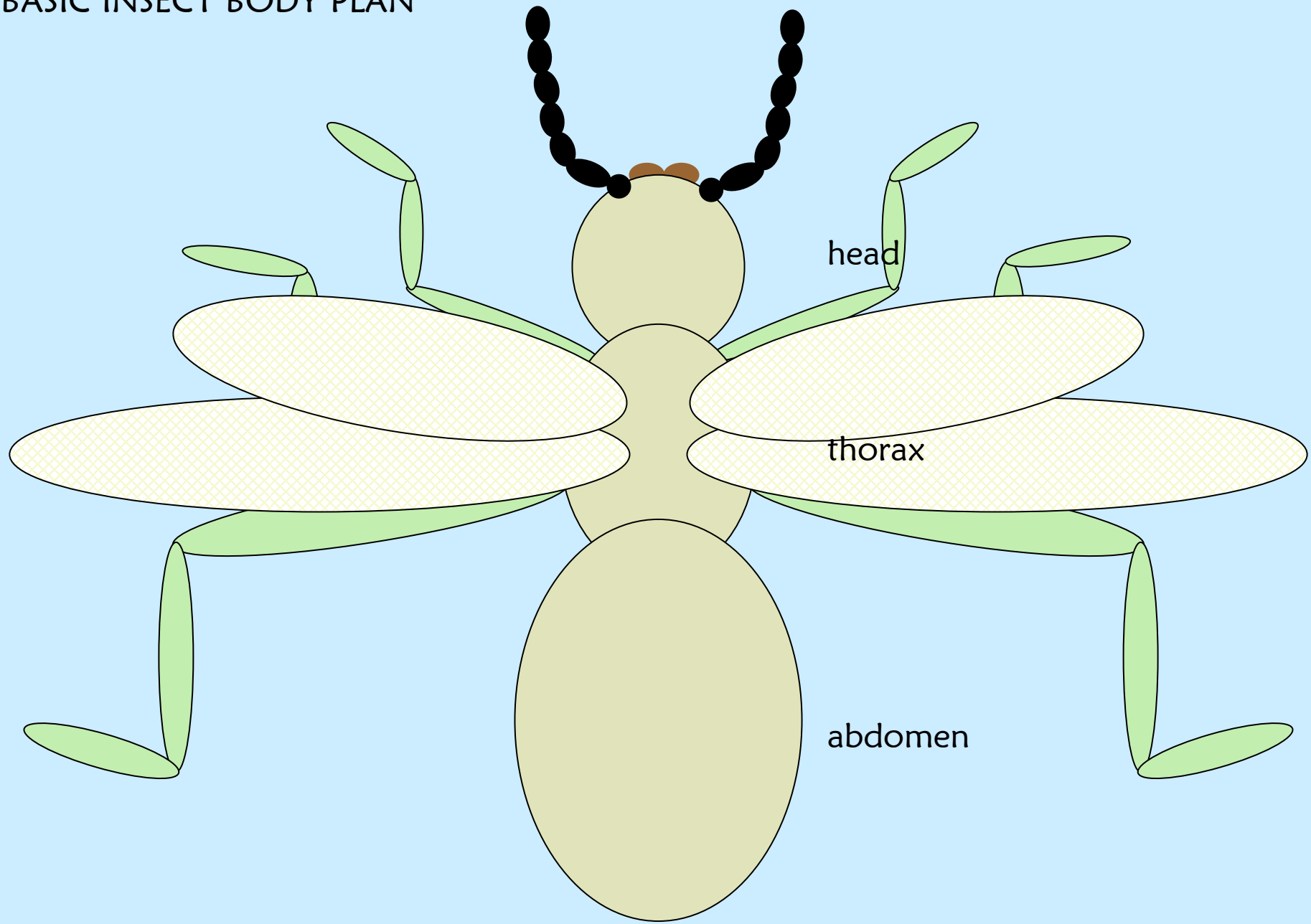


Insects and their relatives

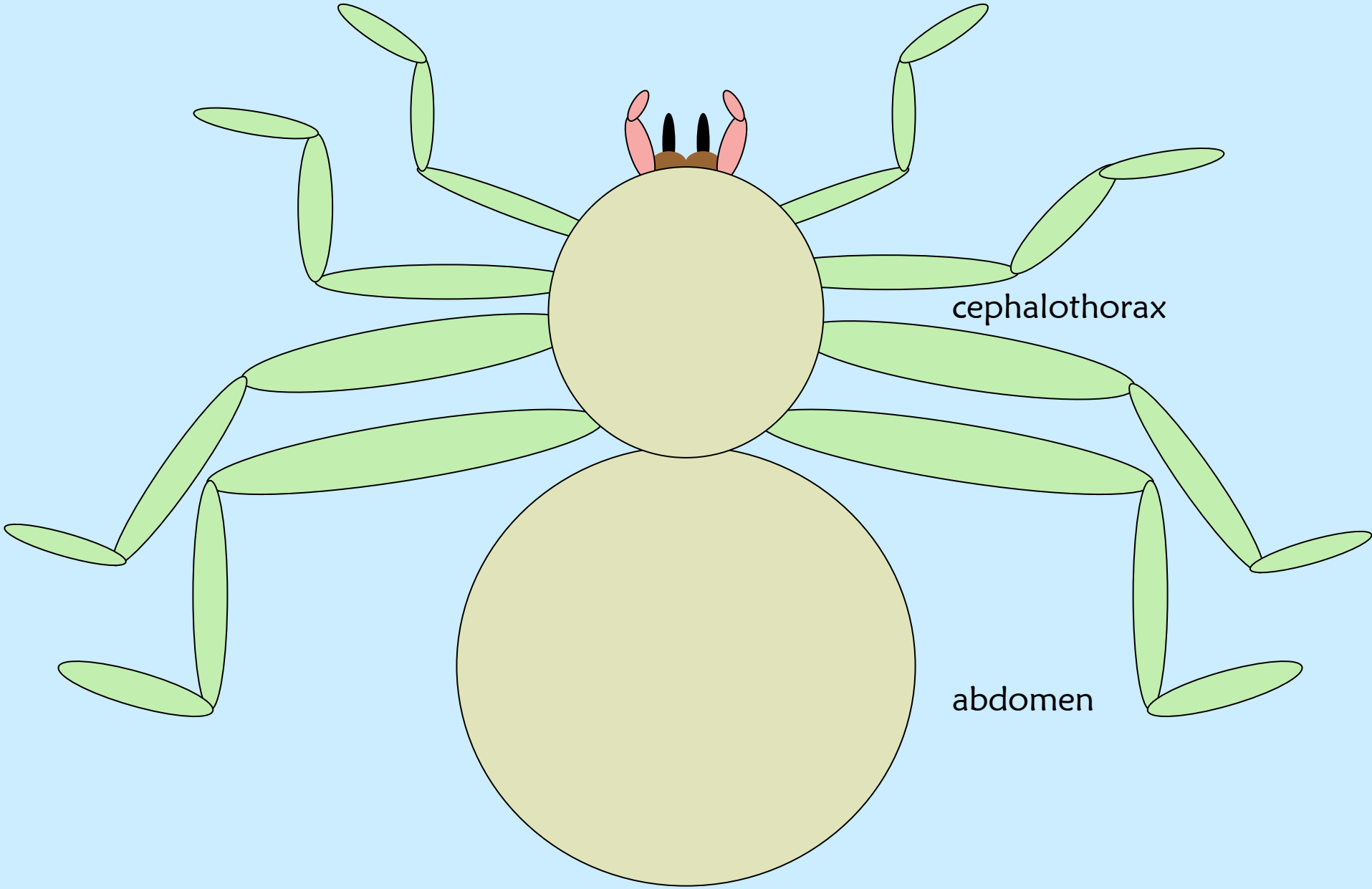


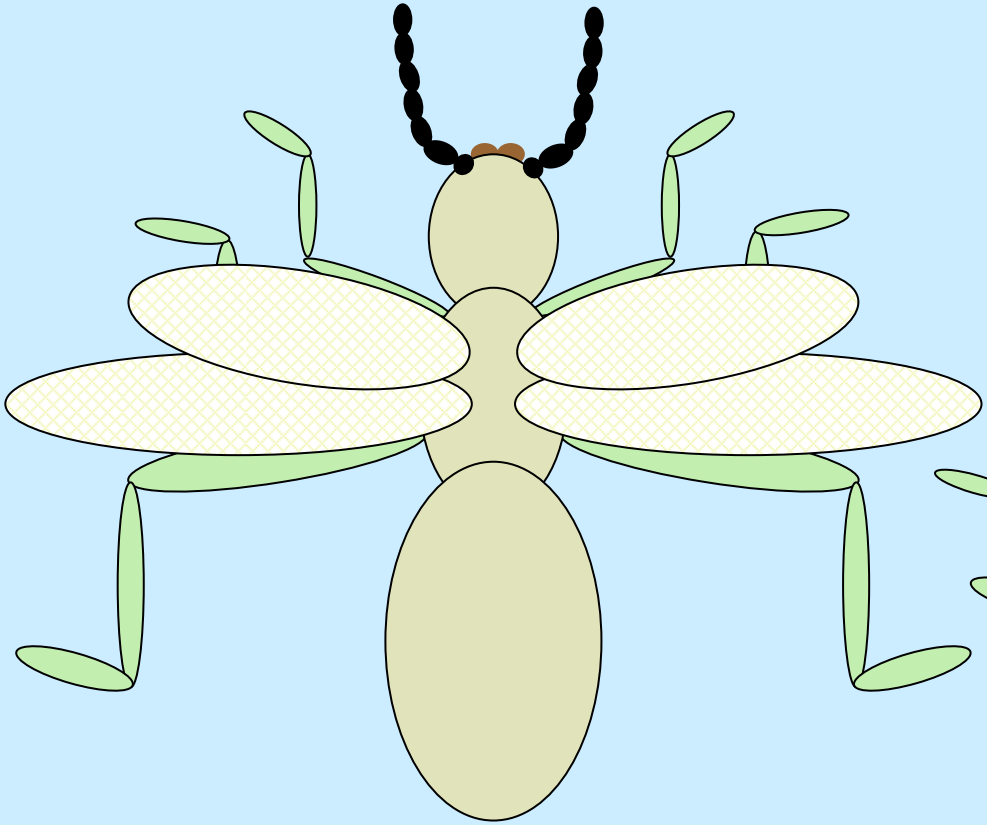
- Insects are arthropods
  - Arachnids (spiders, ticks, mites, lobsters)
  - Crustaceans (crayfish, crabs, sowbugs)
  - Centipedes, millipedes
- Exoskeleton is a hard outer shell
- Jointed appendages, segmented body
- *Not arthropods*: slugs, snails, earthworms

BASIC INSECT BODY PLAN



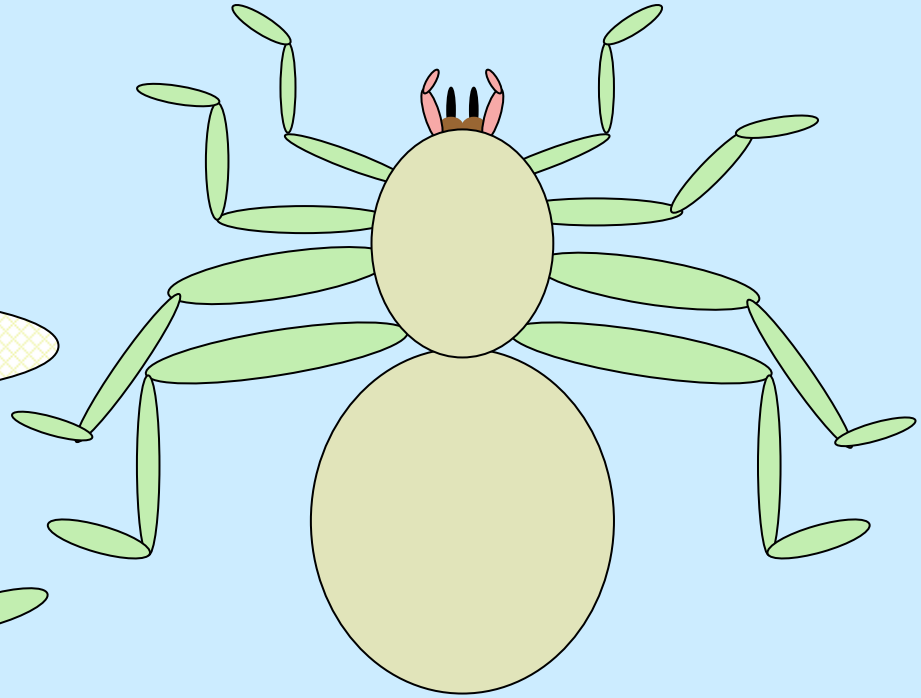
BASIC ARACHNID BODY PLAN





Insects

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



Arachnids

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

Are these insects?

yes, aphid

no, tick

yes, caterpillar

yes, wax scale

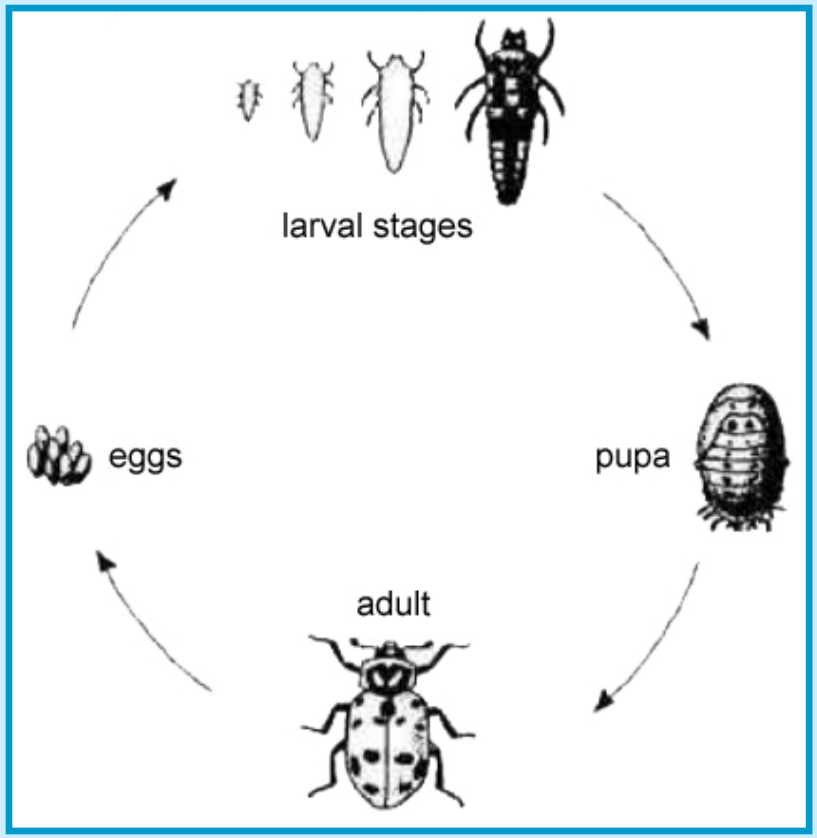
no, spider

yes, beetle

The insect body

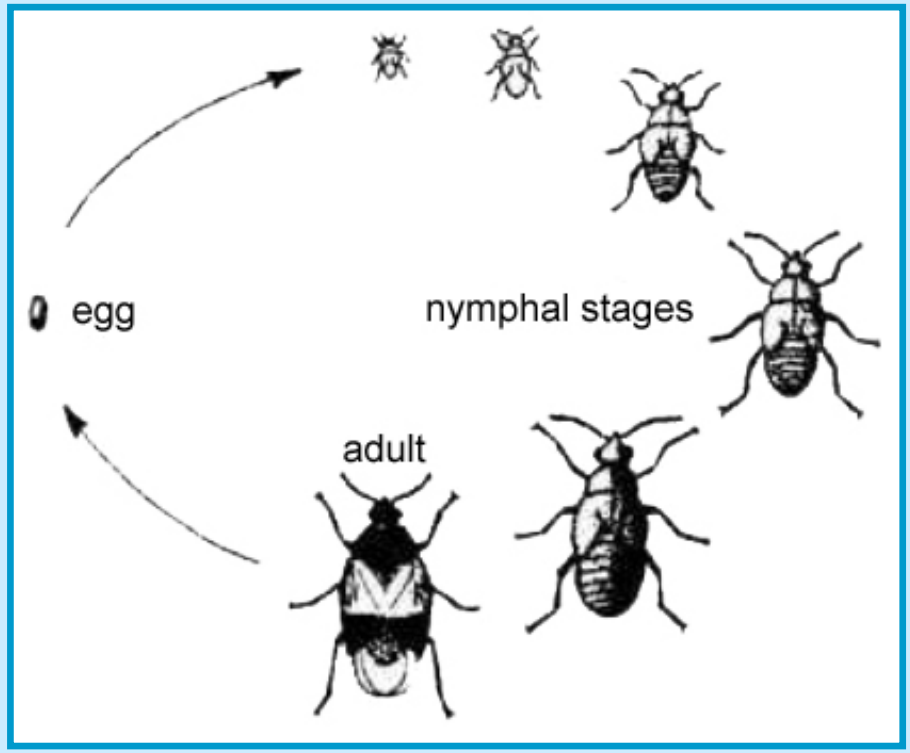
- Head
  - Thinking, sensory, eating
- Thorax
  - Locomotion (legs and wings)
- Abdomen
  - Digestion, reproduction, respiration

Insect metamorphosis



Complete: egg, larva, pupa adult

Examples: beetles, butterflies, flies

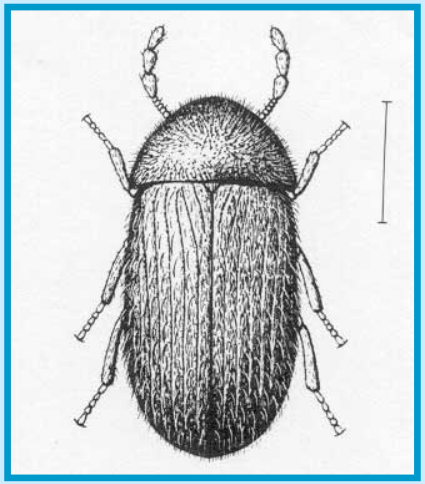


Simple: egg, nymph, adult

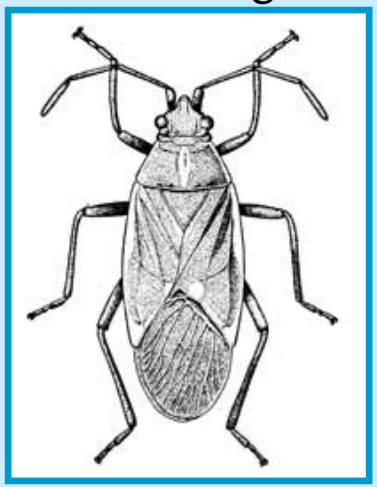
Examples: grasshoppers, true bugs, leafhoppers

How to ID insects: wings

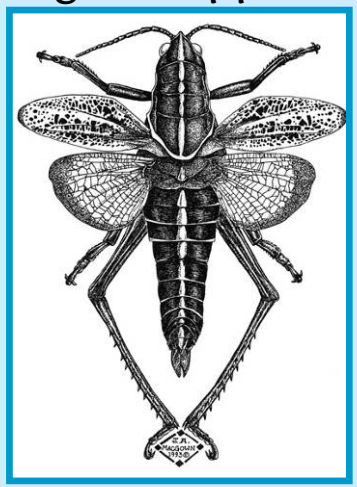
beetle



true bug



grasshopper



earwig

bee

butterfly

fly

How to ID insects: mouthparts

Chewing: grasshoppers, beetles

Piercing-sucking: mosquito

Chewing-lapping: honey bee

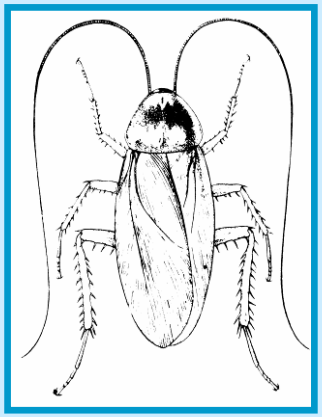
Siphoning: butterflies, moths

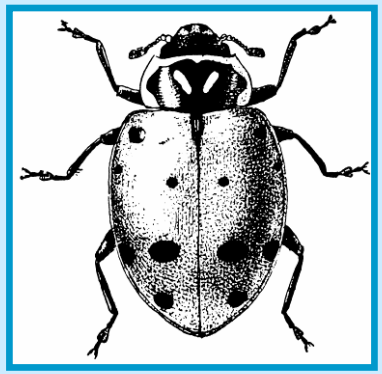
Sponging: house fly

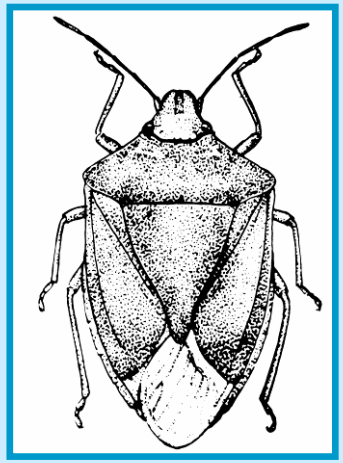
Different feeding groups

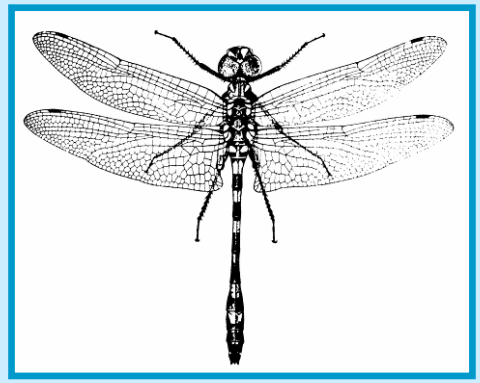
- Predator – animal matter
- Herbivore – plant matter
- Omnivore – plant and animal matter
- Detrivore – organic matter
- Saprophore – decaying matter

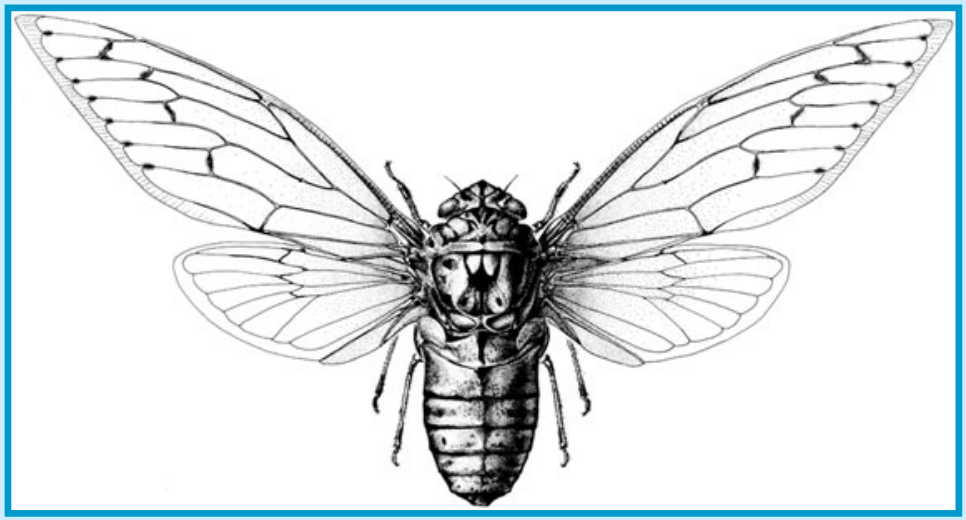
How to ID insects: antennae











How to ID insects: legs

Concept of IPM

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

Concept of IPM

- Integrated pest management
  - Use multiple tactics to reduce pests
  - Use thresholds (economic or aesthetic)
  - Plan ahead with regular scouting
  - Get a proper diagnoses

- Limit chemical applications
  - Follow rates/harvest intervals
  - Think about good timing
  - Mix up chemical classes

Get a proper diagnoses…

- 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.)

IPM tactics

- Regulatory
- Genetic
- Mechanical/physical
- Cultural
- Biological
- Chemical

Regulatory Control

- Quarantines (UDSA-APHIS-PPQ)
  - emerald ash borer, sudden oak death
- Exotic pest surveys (USU/UDAF)
  - Japanese beetle, imported fire ant
- Import/export restrictions
  - Certified "weed free" hay
  - Genetically modified foods

Mechanical/Physical Control

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

Cultural Control

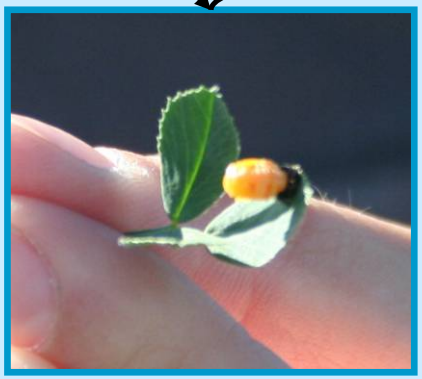
- Rotate crops, planting locations
- Seek resistant/tolerant plants
- Avoid susceptible plants (even favorites!)
- Start out with pest-free plants
- Diversify plant selection
- Keep plants healthy
- Set up zones for H_20, fertilization

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

Parasitoid wasp

Ladybug



Lacewing

Chemical control

- traditional pesticides

  - broad spectrum, long residual, toxic
  - pyrethroids, organophosphates, carbamates

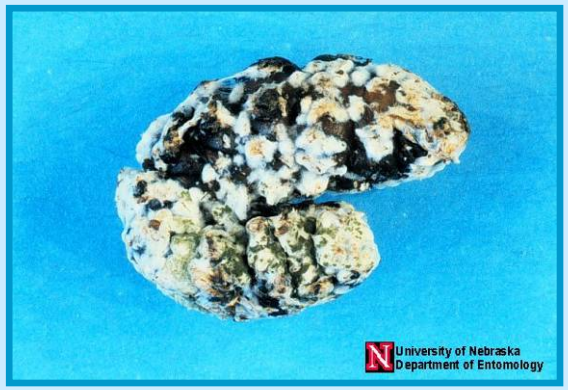
- reduced risk "softer" pesticides
  - selective, short residual, earth-friendly
  - microbial (bacteria, nematode, fungi)
  - soap, oil, dust, mineral (zinc, copper, sulfur)
  - botanical (pyrethrum, nicotine)

Microbials

- kill, reduce reproduction, or shorten the life
- usually specific to target species or to life stages
- depends on environment or host abundance
- control by pathogens may be unpredictable
- relatively slow acting; they may take several days or longer to provide adequate control

fungus

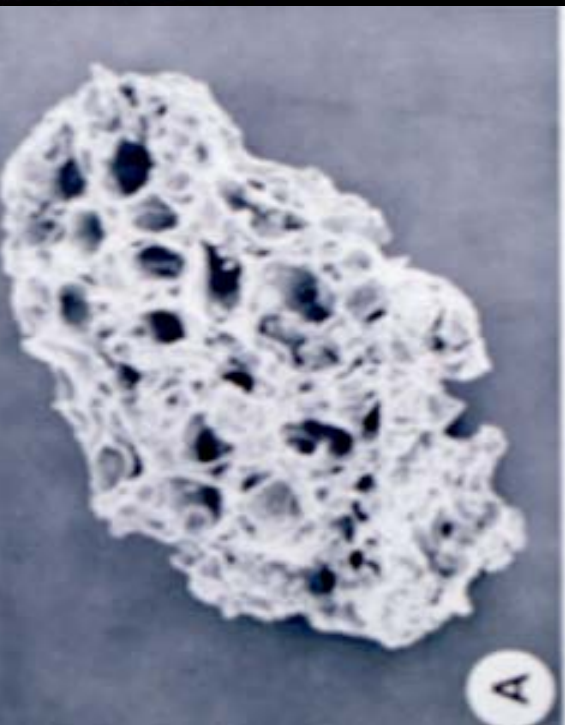

nematode



fungus

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®, Surround®, Sucrocide®, Dri-Die®, Bonide®, Entrust®, Success®
- Kaolin clay
  - Physical barrier, excessive grooming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Botanicals (aka plant derived)

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

Please take a break!

Look at the insects

Ask questions

Meet here in 20 minutes

Common vegetable insects

- Aphids
- Armyworms
- Asparagus beetle
- Cabbage looper
- Corn earworm
- Cucumber beetle
- Cutworms
- Earwigs
- Hornworm
- Grasshoppers
- Imported cabbageworm
- Leafhoppers
- Leafminers
- Onion maggot
- Pea weevil
- Potato beetle
- Spider mites
- Squash bug
- Whiteflies
- Wireworms

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

Asparagus beetle, *Crioceris asparagi*

- Spotted asparagus beetle, *C. duodecimpunctata*
- Found wherever asparagus is grown
- Overwinters as adults
- 2-3 generations/year

- Eggs laid on egg in rows, brown-colored
- Larvae feed on ferns, brown/dark gray

Asparagus beetle, cont.

- Adults attracted to young plants
- Damage to ferns and young spears
- Control options
  - Monitor early, harvest frequently
  - Sanitation, remove volunteer plants
  - Neem, Entrust, Surround, Success

Corn earworm, *Helicoverpa zea*

- Prefer corn, will eat many veggies
- Can not overwinter in cold climates
- Highly mobile, able to migrate
- 2 generations/year
- Eggs deposited on leaf hairs or silk
  - 500-3000 eggs/female
  - Look on leaves under flower clusters

Corn earworm, cont.

- Larvae feed on kernels, reproductive parts
  - Green/brown caterpillars
  - Numerous black spines
- Control options
  - Plant early
  - Fall tillage kills pupae
  - Mineral oil, Bt, Success®
  - Pyganic®, Ornazin®

Earwigs, *Furficula auricularia*

- Feed on a wide variety of plants
- Attracted to decaying animal matter
- 1 generation/year
- Overwinter as adults
  - Chewing mouthparts
  - Dark red/brown, small wing pads
  - Generally crawl
  - Nocturnal, hide under debris

Earwigs, cont.

- Nymphs and adults cause damage
- Look for holes in foliage
- Check garden at night
- Simple traps will work
  - Bran flakes, fish oil, toxicant
  - Rolled newspapers
  - Flat boards
  - Surround®

Grasshoppers, *Melanopus* spp.

- Several species found in UT
- Prefer tall broadleaf plants, weeds
  - Will feed on most veggies
- Chewing mouthparts
  - Plant defoliaters
- Overwinters as eggs in undisturbed soil




Grasshoppers, cont.

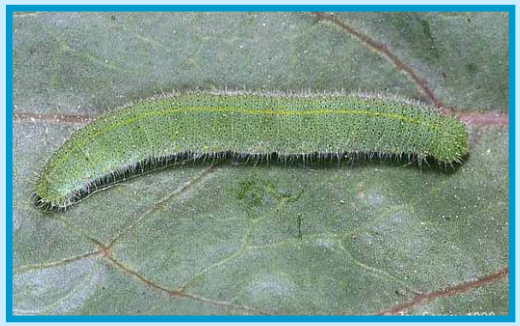
- Like hot/dry weather, susceptible to disease
- Control options (large scale)
  - Natural enemies: parasitoids of nymphs
  - Wheat bran + toxicant on borders
  - *Nosema locustae*, Bonide®, Botanigard®

Hornworms, cont.

- Adults are nocturnal, dull grey
  - wing span 8-13 cm
  - Siphoning mouthparts for nectar
- Overwinter as pupae
- Control options
  - Visual inspection
  - Hand removal before last instar
  - Fall tillage will kill pupae

Imported cabbageworm, *Pieris rapae*

- Easily confused with other white butterflies
- Found on crucifers, flowers, weeds
- ~3 generations/year
- Eggs laid singly on lower leaves



- Larvae are velvety green, white stripes
  - 5 prolegs, chewing mouthparts

Imported cabbageworm, cont.

- Adults are white with black wing spots
- Control options
  - Many natural enemies
  - Naturally occurring pathogens
  - Proclaim®, Ornazin®, Ecozin®

Pea weevil, *Bruchus pisorium*

- Only feed on peas
- 1 generation/year
- Adults lay eggs on pea pod
- Larvae feed on developing peas
- Overwinters as adults in pods
- Control options
  - Sanitation, careful harvesting
  - Early planting

Spider mites, *Tetranychus* spp.

- 4 pairs of legs, hairy body
- Overwinter in debris
- Wide host range
- Feed on lower leaf surface
  - Piercing mouthparts
  - Plants look dirty, webbed
  - Can look speckled, yellowed

Spider mites, cont.

- Very successful pests
  - Small size, many generations per year
  - Tolerance of pesticides
  - Like hot and dry weather

- Control options
  - Many natural enemies
  - Keep plants healthy, remove weeds
  - Strong stream of H_20, kaolin clay (Surround®)
  - Kanemite®, Tetrasul®, Floramite®, Hexygon®

Squash bug, *Anasa tritis*

- Feed on cucurbits, squash/pumpkin preferred
- 1-3 generations/year
- Eggs deposited on lower leaves
- Nymphs are gregarious
- Overwinters as adults in debris

Squash bugs, cont.

- Adults are dark brown
  - Piercing-sucking mouthparts
  - Transmit toxic saliva into the plant
  - Wilting, black foliage
- Control options
  - Plant early, early detection, sanitation
  - Difficult to kill large nymphs/adults
  - Apply chemicals to base of plant: Neem®, Bonide®, Surround®

Common landscape insect

- aphids
- bark beetles
- boxelder bugs
- earwigs
- grasshoppers
- mealybugs
- scales
- spider mites
- tree borers
- strawberry root weevil
- webworms
- white grubs (JB)

Landscape pests

- It is impossible to have a clean garden
- Quick ID and management is key
- Cultural disorders can flare pests
- Cultural control can minimize pests
  - Keep plants healthy
  - Diversify plant selection
  - Target weak links in life cycle

Bark beetles (*Ips* spp.)

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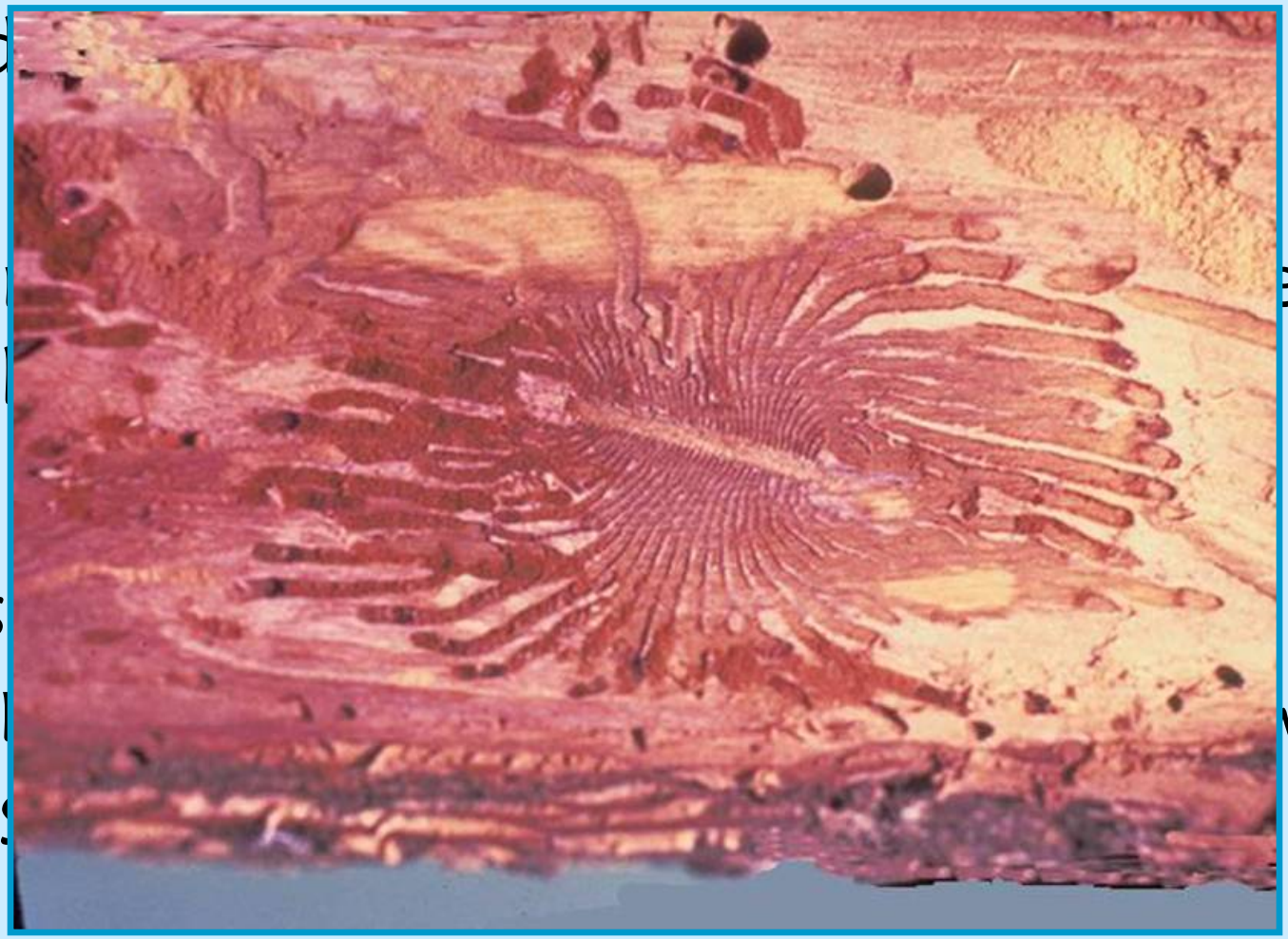

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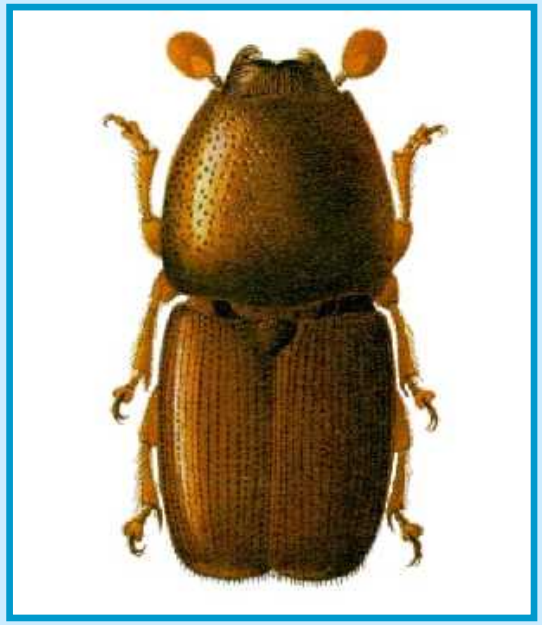
Bark beetles, cont.

- Maintain tree vigor, water every 2-6 weeks
- Remove infested material
- Preventative insecticide
  - Sevin®, permethrin Astro®
  - Treat before beetle flight (spring)
  - Treat in fall (Late Sept. – Oct)
  - Use high-pressure, >250 psi
  - Apply to entire bole and larger limbs



Strawberry root weevil

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  - fers
- U

Strawberry root weevil, cont.

- Larvae feed on roots
  - Legless larvae, brown head
  - Can kill plants abruptly
- Use soil drench in late spring/early fall
- Merit®, *Beauveria bassiana* (fungus)

Japanese beetle in UT

- Initially detected in Orem, July 2006
- UDAF set up trapping network
- Not detected outside original “hot spot”
- More than 600 adults have been trapped

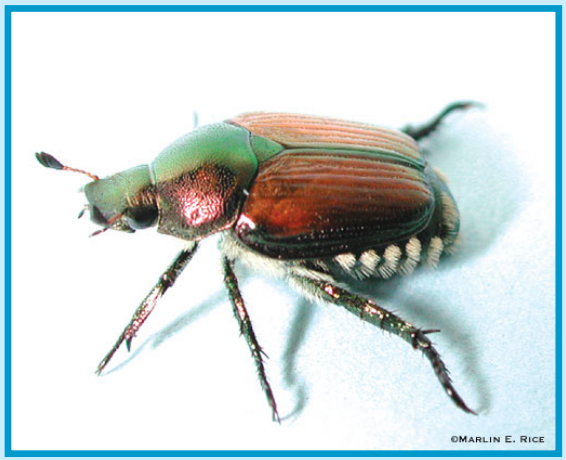
JB biology

- 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

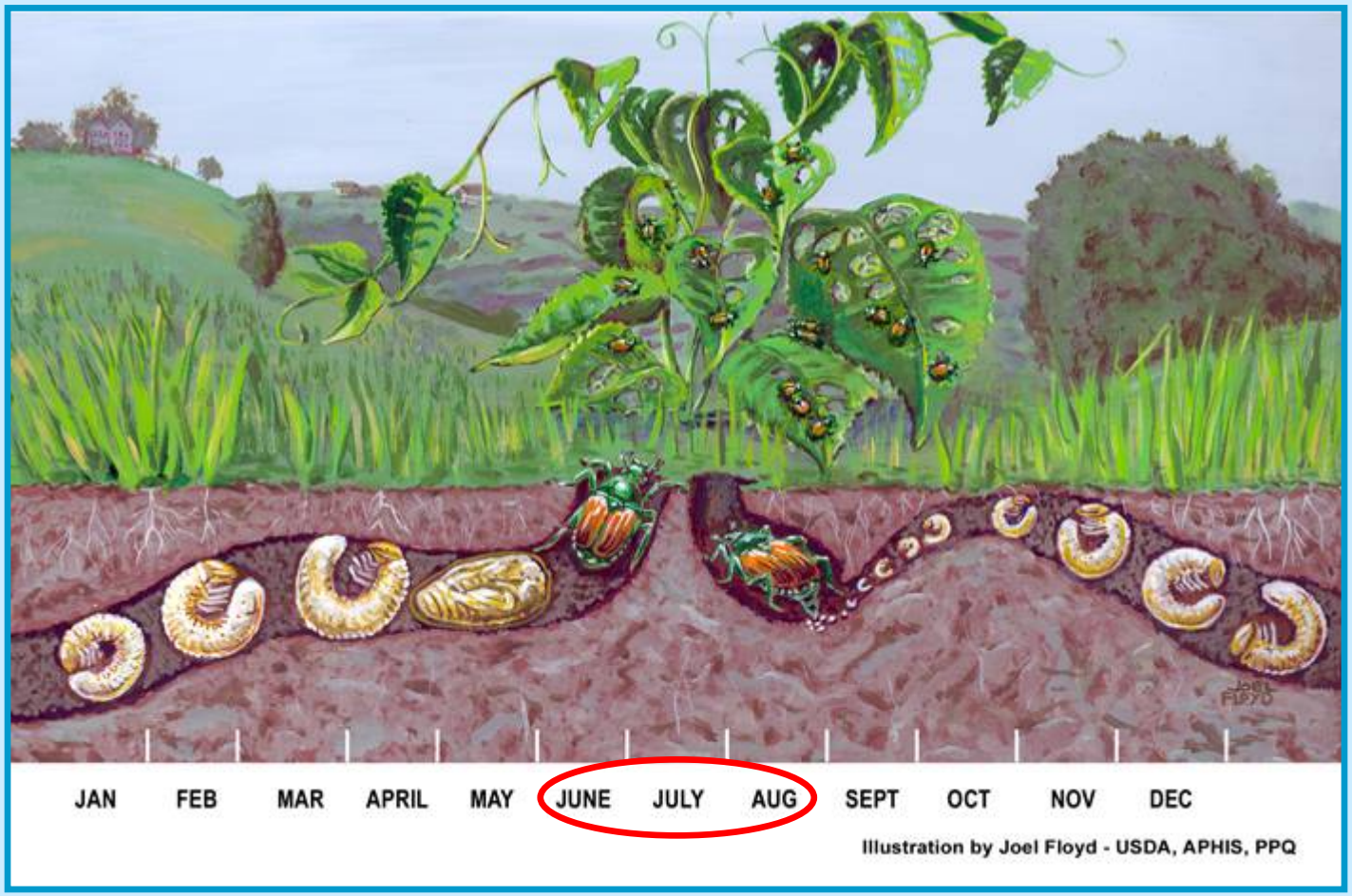
- Adults
  - oval, ~1/2” long scarab beetle
  - Metallic green with bronze wing covers
  - Six white tufts along each side
  - Clubbed antennae



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 IPM

- Keep plants healthy
  - Follow fertilization/irrigation schedules
- But not “too healthy”
  - Over fertilized turf becomes attractive
  - i.e., golf courses, parks
- Include non-attractive plants
  - Lilac, forsythia, dogwood, magnolia

JB sampling

- Start scouting for grubs in June
- Scout for adults weekly
- Start scouting for eggs, grubs in August

JB trapping

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

P.O. Box 129
Route 1, Box 1765
Adair, OK 74330

P: 866.785.1313
F: 918.785.3036
www.trece.com

JB control

- Adult control is difficult
  - Wide host range
  - Continuous feeding/mating movement
  - Insecticides are not recommended (at this time!)

- Many insecticides are available
  - Bayer Advanced®, Baythroid®, Concern®, malathion 5, Merit 2.5 G ®, Orthene®, Pounce®, Proaxis®, Sevin 4F®, Warrior®
  - Insecticidal soap, Conserve®

JB adult control options

- Flight is greatest on clear days, 84 - 95°F, winds <12 mph.
- A few beetles on plants will attract more; keeping numbers and damage low can mean fewer new arrivals.
- Adults begin feeding on plant tops and then move down - can pose coverage problems on large trees. Be aware of spray drift and applicator exposure.
- Some insecticides (carbaryl/permethrin) may flare non-targets. Use acephate or malathion if needed. Repeated applications may be necessary with short-residual products. Also, significant rainfall shortly after an application may reduce the effectiveness.

JB grub control

- Grub control is difficult
  - Threshold is 8-10/ft^2 with obvious damage
  - Treat if persistent grub damage is visible
  - Pushing product down in the soil
  - Insecticides are not recommended (at this time!)

- Insecticides are available
  - Merit 0.5G®, GrubEx® before egg hatch
  - Dylox 6.2G® for grub outbreaks

JB grub control

- Light aerification if thatch > ½”
- Pre-irrigate 48 hours
- Post-irrigate ½ - ¾”, then mow
- Repeat irrigation every 4 – 5 days

Summary

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

More Information

- http://extension.usu.edu/ipd/
- *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!

erin@biology.usu.edu

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