

INSECTS

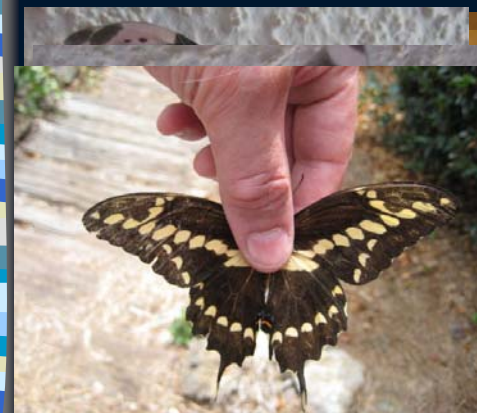


Managing Insects with Fewer Chemicals

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Homework Assignment

- Major insect pest
 - Life cycle (where, how long)
 - Each life stage
 - How do they arrive at crop?
- Available organic control for your pest
 - Cultural, biological, mechanical, chemical
 - Efficacy – do they work? How well?
 - Range of use – Do real people use them?





The World of Insects

- Superpower
 - scent: moth
 - strength: ant
 - sight: honeybee
- Murder
 - forensic entomology
 - Sarcophagid flies

FDA: Pesticides on Food

- 56% of samples had no detectable residues
- 73% of fruits
- 41% of vegetables
- 92% of dairy/eggs

You Gonna Eat That?

■ Sugar	■ Sugar 29,700 mg/kg
■ Aspirin	■ Roundup 4,320
■ Vinegar	*****
■ Nicotine	■ Vinegar 3310
■ Vitamin D	■ Malathion 2,800
■ Roundup	*****
■ Acetaminophen	■ Aspirin 1,000
■ Caffeine	■ Acetaminophen 300
■ Malathion	■ Caffeine 200
	■ Nicotine 50
	■ Vitamin D 10

The National Organics Program

- Why?
 - What does 'organic' mean?
 - Consumer protection
- What?
 - How about GMOs and using sludge?
 - NO!!!!

NOP: The Basic Rules

- 100% Organic
 - Only organically produced ingredients
 - The USDA seal may appear on product packages and in advertisements.
 - No excluded methods, sewage sludge, or ionizing radiation.

Basic Rules

- Organic
 - At least 95% organic ingredients
 - May use 'organic' and USDA seal
- Made with organic ingredients
 - At least 70% organic
 - No seal
- Less than 70% organic
 - May not use 'organic'
 - May identify organic ingredients

Who Can Certify?

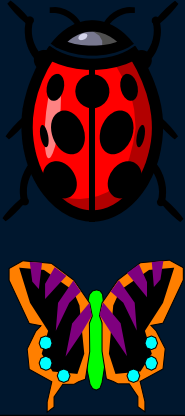
- USDA must approve certifying agencies
- May be state or private organization
- Still sorting this part out

Forbidden Natural Pesticides

- Arsenic
- Lead salts
- Sodium fluoaluminat (mined)
- Strychnine
- Tobacco dust (nicotine sulfate)


'Organic'

- More Natural
- Certain class of chemicals
- Better?
- NOT Without Pesticides



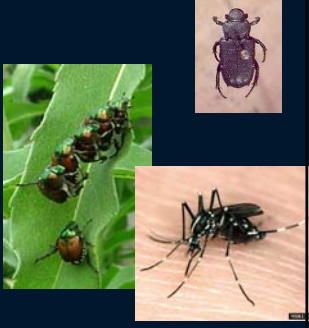
Why Do Farmers Use Pesticides?

- Labor substitute
- Knowledge substitute
- Less planning
- Rescue treatment
- Instant results
- Consistent, predictable results
- Consumer demands
- Economics



The World of Insects

- Master of Disguise
 - Cremastocheilus
- Sexual prowess
 - ants
- Sexual deviance
- Just plain gross
 - maggots
 - Scatology
- Deadly killers
 - which insect is the most dangerous?






What Are They Good For?

- Pollination
 - Coevolution
 - 1/3 of crop plants
 - 200,000 flowering species
 - \$\$\$ billions
- Controlling pests
- Recycling
 - the wheel of life
- Food and other products







How Do You Know It's An Insect?

- Three body parts
 - Head, thorax, abdomen
- Six legs (most of the time)
 - attached to thorax
 - Spiders, ticks, etc
- Wings (adults only) 0, 2, 4
 - attached to thorax
- Antennae (two)
 - immatures may not have
 - attached to head

More Insect Stuff

- Eyes
 - simple
 - compound
- Look Ma! No Bones!
 - Exoskeleton
 - chitin
 - molting
- Look Ma! No Circulatory System!
- Look Ma! No Lungs!
 - spiracles on abdomen
 - series of tubes

Still More Insect Stuff



- Mouth
 - chewing
 - piercing/sucking
 - siphon tubes
 - sponge
- Nervous System
 - Look Ma! No head!
- Tasting: Look Ma! No tongue!
 - Feet, mouth, palps
- Hearing
 - ears all over: legs, thorax, abdomen






Reproduction: the Bees and the Birds


- Parthenogenesis: making
 - aphids
- Sexual reproduction
 - most insects
 - many only mate once
- Combinations
 - haploid males, diploid females
 - switch hitters
- Eggs and live young
 - one or a bunch?

Growing Up Buggy

- Incomplete metamorphosis
 - egg, nymph, adult
 - egg, naiad (aquatic), adult
- Complete metamorphosis
 - egg, larva, pupa, adult
 - instars and molting
 - why bother?
- How long does it take?
 - Temperature
 - Light
 - Food
 - 48 hr to 17 years





Why Do They Have to Act That Way?

- I just can't help it: innate behavior
 - instincts
- Learning
 - food sources
 - time
- Finding food
 - distance cues
 - color
 - silhouette
 - smell
 - local cues
 - smell
 - taste
 - feel



Insect Classification or Who is who?

- Kingdom: Animal
- Phylum: Arthropoda
- Class: Insecta
- Order: Hymenoptera
- Family: Apidae
- Genus: Apis
- Species: mellifera
- Kings Play Chess On Fine Grained Sand



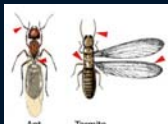
Odonata

- Dragonflies, damselflies
- Four similar wings
- Big Eyes
- Slender abdomen
- Incomplete metamorphosis
 - naiad (in water)
- Generalist predator
- Chewing mouthparts



Isoptera

- Termites
- Whitish, soft bodied
- Chewing mouthparts
- Incomplete metamorphosis
 - Alates have wings; workers do not
- Beaded antennae
 - Ants have elbowed antennae



Orthoptera

- Grasshopper, cricket, katydid
- Incomplete metamorphosis
- Chewing mouthparts
- Some are serious pests. Many are not.



Order: Blattaria (Blattodea)

- Body flattened oval
- Head concealed by pronotum
- Wings usually present
- Antennae long and slender
- Chewing mouthparts
- Two cerci
- About 30 spp live with man



Darryl Searcy ©



E. Tenezar, Loissleus, Arthropods

Order: Mantodea (mantid)

- Greek - soothsayer
- 5 spp common in U.S.
- Overwinter as eggs
- Grasping forelegs
- Large (usually over 1 in.)
- Chewing mouthparts
- Elongated prothorax
- Generalist predator



Order: Phasmatodea

- Herbivorous
- Eggs deposited singly
- Mimic vegetation
- Some have defensive compounds
- Leg autonomy common



mark 1967



Dermaptera

- Earwigs
- Chewing mouthparts
- Incomplete metamorphosis
- Characteristic "pincers" in back
- Most are general predators
- Positively thigmotactic



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Hemiptera - Heteroptera

- 'Bugs'
- Stink, damsel, ambush, leaf-footed, bed
- Wing base leathery; wing end membranous
- Piercing/sucking mouthparts
- Incomplete metamorphosis
- Pests and beneficials



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Reduviidae

Hemiptera - Homoptera

- Aphid, cicada, leafhopper, scales
- Incomplete metamorphosis
- Piercing/sucking mouthparts
- Wings usually held rooflike
- Pests
- Transmit plant diseases



Thysanoptera

- Thrips
- Tiny, quick
- Feathery wings
- Incomplete metamorphosis
- Rasping/sucking mouthparts
- Pests, particularly of seedlings
- Leaf deformation
- Transmit plant disease



Coleoptera

- Beetles
- Hard wing covers
- Chewing mouthparts
- Complete metamorphosis
- Both pests and beneficials
- More than 450,000 species



Lepidoptera

- | | |
|--|---|
| <ul style="list-style-type: none"> ■ Butterflies ■ Knob antennae ■ More colorful ■ Daytime fliers ■ Wings held flat ■ Complete metamorphosis ■ Larvae may be pests ■ Siphon mouthparts <ul style="list-style-type: none"> - larvae chewers | <ul style="list-style-type: none"> ■ Moths ■ Feathery antennae ■ Less colorful ■ Night fliers ■ Wings held over body ■ Complete metamorphosis ■ Larvae may be pests ■ Siphon mouthparts <ul style="list-style-type: none"> - larvae chewers |
|--|---|





Neuroptera

- Lacewings
- Complete metamorphosis
- Chewing mouthparts
- Predaceous

Diptera

- Flies, mosquitoes
- Two wings
- Piercing/sucking or sponging mouthparts
- Complete metamorphosis
- Often mimic wasps/bees
- Both pests and beneficials

Hymenoptera

- Bees, wasps, ants
- Four wings. Hind wings much smaller.
- Chewing mouthparts
- Complete metamorphosis
- Often brightly colored and thin 'waist'
 - often mimicked
- Stinger
 - only females
- Both pests and beneficials

Natural Controls of Insects

- Diseases
 - fungi, bacteria, virus, nematodes
- Weather
 - rain, cold, heat
- Vertebrates
 - birds, toads, mice, etc.

Natural Insect Controls: Predators vs Parasitoids

- PREDATORS**
 - Generalists
 - Kill and eat
 - size
 - Young & adults
 - Wasps, lady beetle, spiders, etc.
- PARASITOIDS**
 - Specialists
 - Lay eggs in host
 - Size less a factor
 - Host killed slowly
 - Wasps, flies

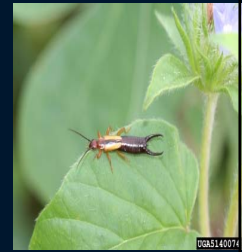
How can I help the good guys?

- What are they looking for?
 - Prey
 - tolerate some pests
 - shelter
 - water
 - other food items
 - pollen
 - nectar



IPM: The Basics

- Monitoring
 - looking
 - traps
- Thresholds
- Think about ecology
 - why, how
- Think compatibility
 - non selective insecticides
- Keep Records!
- Matters of scale



Compatible Controls

- MECHANICAL CONTROLS
- squash 'em
- exclusion: screen 'em out
- trapping: pheromones
 - Japanese beetle
 - slugs
- bug zappers



CULTURAL CONTROLS

- Plant health
- Resistance
- Tillage
- Timing: plant your corn early
- Pruning/Rouging
- Sanitation
- Rotation
 - broccoli, cauliflower, cabbage are the same
 - melons, squash, cucumber, pumpkin



The MAJORS: Managing aphids/whiteflies

- Control nitrogen
- Rouging
 - removing leaves
- Hose them down
 - can the plant take it?
- Look for natural control agents
 - lady beetles, parasitoids,
 - fungal disease
- Look for ants helping aphids



Aphid/whitefly pesticides

- Insecticidal soaps (watch temperature)
- Pyrethrins (non-selective)
- Horticultural oils (watch temperature)
- Control ants
 - baits
 - sticky barriers



How to Manage Caterpillars

- Type of damage
- Hand picking & foot stomping
- Bacillus thuringiensis
- Pyrethrins (non-selective)
- Horticultural oils (watch temperature)
- Hit them when they are small
- Corn earworm
 - mineral oil
 - cut off tips



Controlling Caterpillars

- Look for natural controls
 - wasps, ants, disease, spiders
- Squash vine borer
 - sudden death
 - spray twice/week from bloom
 - inject B.t.
 - surgery



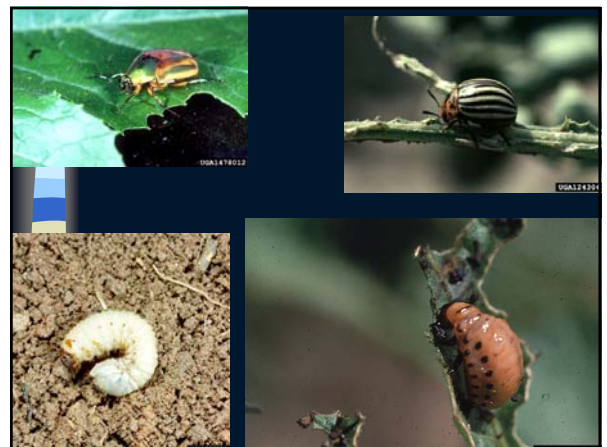
How to Manage 'Bugs'

- Type of damage
- Stink bugs, squash bugs
- Destroy eggs
- 'Bug' insecticides
 - pyrethrins (non-selective)
 - sabadilla (kills bees)
 - horticultural oils
- Hit them when they are small




How to Control Beetles

- What kind of damage?
- Hand picking
- Hit them when they are small
 - know immature stages
- Pyrethrins (non-selective)
- Horticultural oils (watch temperature)
 - larvae only



Some common 'organic' pesticides

- Spinosad - Bull's eye
 - beetles, caterpillars, thrips, and flies
- Sulfur (watch temperature)
 - mites, disease
- Neem
 - anti-feedant
 - insecticidal
- Diatomaceous earth
 - dangerous. Caution.
 - humidity affects efficacy



Know your friends

- Spiders
 - spider eggs sacs
- Ants (et tu Brutus)
- Wasps
- Mantids
- Ground beetles
 - like mulch (so do slugs)
- Lacewings
- Big-eyed bugs
- Minute pirate bugs
- Syrphid flies



How to Identify the Problem

- Correct ID is critical
- Think about current and future problems
- Common pests are common
- Search for "UGA *yourcrop*"
- Extension service
- Entomology books (Peterson)
- Internet (beware)

Reliable Sources of Information

ATTRA
[Cotton](#)
[Squash](#)

[Universities](#) (Calif., Fla., NC St.)

[Rodale Institute](#)

Beware of internet information