

OUTLINE-INSECTS

2010 Northern Front Range Counties

Note to Master Gardeners: This outline is provided to assist you in taking notes on the insect training section. The talk (*ideally*) will follow this outline. Where there are relevant Colorado State publications, these are indicated. Space has been left where additional information will be presented, so that you may make notes. email: Whitney.Cranshaw@ColoState.edu

INTRODUCTION

A. Characteristics of Arthropods

- Jointed body
- External skeleton (exoskeleton)
- Jointed appendages
- Dorsal heart/Ventral nerve cord
- Bilateral symmetry

Classes of Arthropods

1. Crustacea (pillbugs, sowbugs) (**Fact Sheet 5.552**)*
2. Millipedes (**Fact Sheet 5.552**)*
3. Centipedes (**Fact Sheet 5.552**)*
4. Arachnids (spiders, mites, ticks, sun spiders, scorpions)*
5. Insect characteristics
 - 3 body regions (head, thorax, abdomen)
 - 3 pairs of legs in the adult stage
 - 1 pair of antennae
 - Adult stage often winged
6. Abundance of Arthropods (total life forms):
 - Number of species of insects: About a million

B. *Metamorphosis* (change in form)

1. Gradual/Simple metamorphosis
 - Egg-Nymph/Larva-Adult
 - Examples of insects with gradual/simple metamorphosis: Grasshoppers, earwigs, true bugs, aphids, mantids

* Information on spiders and other arthropods in homes is presented in **Extension Bulletin 557A, Household Insects of the Rocky Mountain States**. Spiders are covered on **Fact Sheets 5.512, 5.605, and 5.607**; Ticks and Tick-borne Disease in **Fact Sheet 5.593**; Sunspiders/Windscorpions in **Fact Sheet 5.589**

2. Complete metamorphosis
Egg-Larva-Pupa-Adult

Examples of insects with complete metamorphosis: Beetles, butterflies/moths, flies/mosquitoes, wasps/ants

THE INSECT ORDERS

Currently, most experts recognize approximately 30 different orders of insects. Several are infrequently encountered in the yard and garden either because of small size, scarcity or habits that restrict them to different environments, such as the aquatic insects. The orders and metamorphosis of the insects most likely to be seen included the following:

Order (common name)	Type of metamorphosis
Collembola (springtails)*	Primitive type with little change in features other than size and sexual maturity (FS 5.602)
Thysanura (silverfish, firebrats)	Primitive type with little change in features other than size and sexual maturity
Orthoptera (grasshoppers and crickets)	Simple
Mantodea (mantids)	Simple
Blattodea (cockroaches)	Simple
Isoptera (termites)	Simple
Dermaptera (earwigs)	Simple
Hemiptera (true bugs, hoppers, aphids, psyllids whiteflies, scale insects)*	Simple, but some species show features intermediate with complete metamorphosis
Odonata (dragonflies and damselflies)	A variation on simple metamorphosis with immature, aquatic forms
Thysanoptera (thrips)	A variation on simple metamorphosis including nonfeeding stages prior to adult emergence
Neuroptera (alderflies, dobsonflies, snakeflies, fishflies, lacewings, antlions, and owlflies)	Complete
Coleoptera (beetles)	Complete
Diptera (flies, gnats, mosquitoes, etc.)	Complete
Lepidoptera (butterflies, moths, skippers)	Complete
Hymenoptera (sawflies, ichneumons, chalcids, ants, wasps, and bees)	Complete

* Recent taxonomic revisions: 1) consider Collembola to be “entognathous hexapods”), a separate sister group to the insects; and 2) combine the Homoptera (aphids, scales, psyllids, etc.) within the Hemiptera (formerly restricted to the “true bugs”).

NATURAL AND BIOLOGICAL CONTROLS OF INSECTS-INTRODUCTION

Natural control ("Balance of Nature")

A. Topographic controls

B. Abiotic controls

Rainfall

Wind

Temperature

C. Natural enemies (biotic or biological controls) **Fact Sheet 5.550**

a. Predators (characteristics)

Immature stage a freelifving hunter

Kills several *prey* in course of development

1) Lady beetles (lady bugs, lady bird beetles) **Fact Sheet 5.594**

2) Green lacewings

3) Syrphid flies

b. Parasites/Parasitoids (characteristics)

Immature stage lives in/on a *host*

Kills (usually) a single host

1) Parasitic wasps

Pigeon tremex and giant ichneumon wasp (**Fact Sheet 5.604**)

2) Tachinid flies

c. Hunting wasps (solitary wasps)

Hunt, paralyze live insects

Nest in cavities (soil, plants, etc.)

d. Social wasps (**Fact Sheet 5.525**, Nuisance Bees and Wasps)

Yellowjackets

Nest underground

Scavenging habit – attracted to wasp traps

Hornets

Nest aboveground

Paper wasps

Open-celled nest

Predatory habit

Not attracted to wasp traps

New species of interest – European paper wasp (**Fact Sheet 5.611**)

Related Fact Sheet: 5.510 *Mantids of Colorado*

CHEWING INSECTS

A. Groups of 'bugs' that chew (crush food with mandibles, maxillae)

Lepidoptera (moths and butterflies)

Coleoptera (beetles)

Hymenoptera (sawflies, gall wasps)

Diptera (root maggots, fungus gnats, gall midges)

Orthoptera (grasshoppers, crickets)

Dermaptera (earwigs)

Gastropoda (slugs) (odd, rasping type of mouthpart function)

B. Types of injuries

Leaf/needle chewing

Leaf/needle mining

Trunk and branch tunneling

Infestation of fruit

Tip moths

Transmission of fungal diseases, bacterial diseases

C. Leaf chewers

1. Lepidoptera (moths and butterflies)

a. Cabbage "worm" complex

1) Imported cabbageworm/cabbage butterfly

2) Cabbage looper

3) Control

Bacillus thuringiensis (**Fact Sheet 5.556**)

Advantages

Limitations

Other strains of Bt

Spinosad – New insecticide of biological origin

b. Tomato/tobacco hornworm (**Fact Sheet 5.517**)

Adult stage – sphinx moth

“Hummingbird moth” – sphinx moth that flies during the day

c. Cutworms

General term applied to many caterpillars

Surface feeders (cutters)

Climbing cutworms

Subterranean cutworms

#1 species – Army cutworm (**Fact Sheet 5.547**)

Winters as larva

Wide host range – prefers broadleaf plants

Transformation to adult – Colorado “miller moth”

Miller moth-generic term for any moth that is locally abundant

Migrates to high country in late spring

Reverse migration to plains in early fall

Landscaping and miller moth nuisance problems

2. Hymenoptera - Sawflies

Differences between sawflies (Hymenoptera) and caterpillars (Lepidoptera)

Conifer sawflies

Imported currantworm

Brownheaded ash sawfly (**Fact Sheet 5.586**)

Hymenoptera – Leafcutter bees (**Fact Sheet 5.576**)

Semicircular cut of leaf edge

Leaf fragments used in nest construction

3. Coleoptera

Leaf beetle example – elm leaf beetle

New species on the move - European elm flea weevil

Larval damage – leafmining

Adult damage – shothole wounds of leaves

Flea beetles (**Fact Sheet 5.592**)

Shothole feeding by adults

Several species – each with different host range

Highly dispersive – migrate long distances

Larval habits

Most species feed on roots

Some species feed on foliage (e.g., apple flea beetle on evening primrose)

Management

Promotion of rapid seedling establishment/growth

Row covers

Trap crops

Japanese beetle – insect to watch for in area (**Fact Sheet 5.601**)

Root weevils (**Fact Sheet 5.551**)

Adult feeding – leaf notching

Adults as nuisance invaders

Larval feeding

4. Slugs (**Fact Sheet 5.515**)

Slugs vs. pear slugs

Biology

Control

Natural enemies

Moisture and moisture manipulations

Metaldehyde baits

Iron phosphate baits

Ammonia

Repellents

Traps/Attractants

5. Earwigs (**Fact Sheet 5.533**)

Feeding habits-true omnivore

Thigmotaxis – “a predilection for pressure”

Traps

Baits

6. Orthoptera (Grasshoppers, Crickets, etc.) (**Fact Sheet 5.536**) Life History in Colorado (particularly of *Melanoplus* spp.)

Natural Controls

Biological

Nematodes (*Mermis nigrescens*)

Fungal diseases

Birds

Blister beetles

Abiotic

Timely rainfall

Control

Treatment of breeding sites

Nosema locustae (NoLo Bait, Semaspore)

The "Mystery of the Rocky Mountain Locust"

D. Wood boring insects (**Fact sheet 5.530**)

1. Roundheaded borers/Longhorned beetles (Cerambycidae)

Species in news – Asian longhorned beetle

2. Metallic wood borers/Flatheaded borers (Buprestidae)

Species in news – emerald ash borer

3. Clearwinged borers (Sesiidae)

Peach tree borer (**Fact Sheet 5.566**)

Lilac/Ash borer

4. Pyralid/*Dioryctria* borers (Zimmerman pine moth, pinyon pitch mass borer)
(**Fact Sheet 5.591**)

4. Control of wood borers

Host plant vigor

Sanitation

Insecticidal sprays timed at exposed stages

Pheromones and pheromone traps

Soil-applied systemic insecticides

Only effective against cambium feeding beetles (e.g., flatheaded borers)

E. Bark beetle transmission of fungal diseases

1. Mountain pine beetle (**Fact Sheet 5.528**)

Adults tunnel and produce egg gallery

“pitch out” is host plant response

Aggregation pheromones

Blue stain fungi

August 2008 “blow-out” that colonized parts of NE Colorado

Spruce bark beetle

Douglas fir beetle

2. *Ips*/Engraver beetles (**Fact Sheet 5.558**)

Spruce ips

Pinyon ips

Ips and forest thinning

3. Walnut twig beetle and 1000 cankers disease of black walnut – a serious new problem of the western US (Check out Wikipedia entry on “thousand cankers disease”)

Combined activity of an insect (walnut twig beetle) and a fungus (*Geosmithia*)

Black walnut (*Juglans nigra*) most susceptible

Current eastern edge Adams/Denver counties and Otero/Crowley counties

INSECTS/MITES WITH SUCKING MOUTHPARTS

- A. Structure of basic type of sucking mouthparts
 Two pairs of stylets (mandibles, maxillae)
 Interlocking
 Food canal to remove fluids
 Salivary canal to inject saliva
- B. Groups of Insects/mites with sucking mouthparts
Hemiptera-True bugs, aphids, whiteflies, scales, psyllids, leafhoppers
Thysanoptera-Thrips
Acari-Spider mites, eriophyid mites
- C. Types of injury
 Honeydew production Loss of vigor
 Gallings Toxic response to insect saliva
 Transmission of viruses and phytoplasmas
- D. **Aphids**-an important groups of insects with sucking mouthparts **Fact Sheet 5.511**
1. Feeding habits
 - Stylets penetrate to phloem
 - Honeydew*-sticky material excreted by many sucking insects (soft scales, aphids, whiteflies, leafhoppers)
 - 1) Sooty mold grows on honeydew
 - 2) Ants collect honeydew and protect honeydew producers
 - 3) Ants and peonies
 2. Life cycle
 - All females in summer (asexual reproduction)
 - Eggs hatch in female
 - May produce winged or wingless adult forms
 - Overwintering stage often an egg on a woody plant
 - Multiple overlapping generations following egg hatch
 - Males may occur in late summer
 - Continuous generations in greenhouses
 3. Damage
 - a. Nuisance honeydew production
 - b. Most species of little importance/infestations transitory
 - c. Leafcurling species can deform new growth
 3. Aphid control
 - a. Exposed aphids
 - 1) Contact insecticides (e.g., esfenvalerate, imidacloprid)

2) Soaps and detergents (**Fact Sheet 5.547**)

Advantages

Limitations

Optimizing Use

- b. Leafcurling species-leafcurl has been produced
 - 1) Systemic insecticides (e.g., Orthene, Disyston in past)

Newest product - imidacloprid

- c. Species that overwinter as egg stage on a woody plant (e.g., fruit trees)
 - Oils applied during dormant season (discussed more later)
- d. Species that overwinter as egg stage on an herbaceous perennial plant (e.g., columbine, asparagus)
 - Sanitation (removal of old debris)

E. Scale insects

- 1. "Hard Scales"/Armored Scale (Diaspididae)
 - a. Oystershell scale (**Fact Sheet 5.513**)
 - b. Pine needle scale (**Fact Sheet 5.514**)
- 2. "Soft Scales" (Coccidae, Eriococcidae)
 - a. European elm scale
 - b. Cottony maple scale
 - c. Striped pine scale (**Fact Sheet 5.514**)

3. Scale control

Pruning, scraping

Crawler sprays

Oil sprays (**Fact Sheet 5.569**)-dormant/foliar treatments

Advantages

Limitations

Systemic insecticides

Primarily move to feeding sites of phloem feeders (soft scales)

F. Spider mites (**Fact Sheet 5.507**)

Method of feeding

Life cycle

Twospotted spider mite

Honeylocust spider mite

Spruce spider mite and other conifer mites

Control of spider mites-general

Water and mite outbreaks

Drought stress on the plant

Dry air

Avoid pesticides that may aggravate (flare) problems

Some pesticides that can help

Horticultural oils

Clover Mites (**Fact Sheet 5.505**)

Primary turfgrass spider mite

Timing – “cool season”

Location

Controls

G. Gall insects and mites (**Fact Sheet 5.557**)

1. Gall-abnormal plant growth induced by insects or other organisms

2. Gall formation

Feeding, oviposition wounds

Chemicals

3. Cooley spruce gall (**Fact Sheet 5.534**)

4. Psyllid galls

Leaf, bud, bark swellings on hackberry

5. Eriophyid mite galls

Felty patches (erineum) on leaves

Raised bumps

Distortion of buds

Fingergalls

Distortion of flowers

Witches' broom of hackberry

7. Gall midges, flies

Simple swellings, stunting

Examples:

Pinyon spindlegall midge

Honeylocust podgall midge

Willow conegall midge

Poplar twiggall fly (**Fact Sheet 5.579**)

8. Gall wasps

Most elaborate (determinate) of gall makers

Occur on oaks or rose family plants

9. Control of gall insects and mites

Realistic assessment of injury

Timing of sprays – production of susceptible new growth

H. Insect Produced Plant Toxemias

Toxemia-Plant disease produced by an insect toxin

1. Plant bugs

Honeylocust plant bug (**Fact Sheet 5.571**)

Lygus plant bugs

"True Bugs" that are common nuisance invaders of homes

Boxelder bugs (**Fact Sheet 5.522**)

Conifer seed bugs (**Fact Sheet 5.588**)

2. Potato/tomato psyllid (**Fact Sheet 5.540**)

Life history

Symptoms of psyllid yellows

Control

Survey

Sulfur, permethrin

Parsleyworm/Butterfly Gardening

Life History and Habits

Butterfly gardening (**Fact Sheet 5.504**)

State Insect - Colorado Hairstreak