

OUTLINE-INSECTS

Spring 2018 Master Gardener Program, High Country 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.

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)
2. [Millipedes](#) ([Millipedes Fact Sheet](#), [Duff Millipede Fact Sheet](#))
3. Centipedes ([Fact Sheet 5.552](#), [House Centipede](#), [Giant Desert Centipede](#))*
4. Arachnids (spiders, mites, ticks, windscorpions/sunspiders, 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

* Spiders are covered on [Fact Sheets 5.512](#), [5.605](#) and [5.607](#); Ticks and Tick-borne Disease in [Fact Sheet 5.593](#); Windscorpions/Sunspiders in [Fact Sheet 5.589](#). [Scorpions](#), [tarantulas](#), [funnel weaver spiders](#), [whitebacked/banded garden spider](#), [jumping spiders](#), [catfaced spider](#) and some other spiders are found in various fact sheets in the [Colorado Arthropods of Interest](#) series.

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
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 and termites)*	Simple
Dermoptera (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 non-feeding 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; 2) combine the Homoptera (aphids, scales, psyllids, etc.) within the Hemiptera (formerly restricted to the “true bugs”). More recently the termites (formerly order Isoptera) are now classified as a specialized type of social cockroach and are in the order Blattodea.

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 free-living hunter

Kills several *prey* in course of development

1) Lady beetles (ladybugs, ladybird beetles) [Fact Sheet 5.594](#)

2) Green lacewings

3) Syrphid/flower flies

b. Parasites/Parasitoids (characteristics)

Immature stage lives in/on a *host*

Kills (usually) a single host

1) Parasitic wasps

[Fact Sheet 5.604](#), Pigeon tremex and the giant ichneumon wasp

2) Tachinid flies

c. Social wasps

Yellowjackets

Nest underground

Scavenging habit – attracted to wasp traps

Hornets

Nest aboveground

Paper wasps

Open-celled nest

Predatory habit (chewed insect larvae)

Newly dominant species – European paper wasp ([Fact Sheet 5.611](#))

Traps and paper wasps – none presently available

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. Coleoptera

Flea beetles ([Fact Sheet 5.592](#))

Shothole feeding

Several species – each with different host range

Management -

2. Lepidoptera (moths and butterflies)

a. Tomato/tobacco hornworms ([Fact Sheet 5.517](#))

Hornworms > Sphinx moths

Day-flying sphinx moths – “hummingbird moths”

[Whiteline sphinx \(*Hyles lineata*\)](#) most common species

b. Tent-making caterpillars ([Fact Sheet 5.583](#))

Tent caterpillars (*Malacosoma* spp.)

Spring hatching

Create dense mats of silk in crotches

Western tent caterpillar

Southwestern tent caterpillar

Forest tent caterpillar (non-tent making)

Fall webworm (*Hyphantria cunea*)

Summer hatching

Create loose, enclosing silk tents

3. 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"
 High Plains grasshopper outbreaks of the 30's

4. Earwigs ([Fact Sheet 5.533](#))

One species (introduced) in CO – European earwig

Feeding habits-true omnivore

Thigmotaxis – “a predilection for pressure”

Traps

Baits

5. Slugs ([Fact Sheet 5.515](#))

Slugs vs. pear slugs

Biology

Control

Natural enemies

Moisture and moisture manipulations

Metaldehyde baits

Iron phosphate baits

Repellents

Traps/Attractants

D. Fruit pests

1. Codling moth ([Fact Sheet 5.613](#))

Key insect pest of apples, pear/Caterpillar is the “worm” in a wormy apple
Life History

Controls

Trapping (trunk bands)

Thinning

Insecticides applied during times of egg hatch

Pheromone traps can improve timing

Pheromones and mating disruption?

2. Spotted-wing drosophila ([Fact Sheet 5.596](#))

New insect to region – most damaging to small fruits (raspberry, strawberry, etc.)
Related to common “fruit flies” that attack overripe fruit

Controls

Traps

Regular harvesting of all ripe fruit

Eliminate other breeding sources (other fruits)

Shift to earlier bearing cultivars

Insecticides (spinosad, acetamiprid)

Can be applied *only during times when bees are not visiting plants*

3. Western cherry fruit fly ([Tri-Rivers Area Fact Sheet](#))

Adult - a "picture winged fly"

Larvae (maggots) develop in fruit

Monitoring - yellow sticky traps

E. Fungus gnats ([Fact Sheet 5.584](#))

Very common insect found indoors and outdoors

Larvae develop primarily on fungi – may damage roots

Potato piece to sample for larvae

Management

Minimize watering – allow soil drying

Natural enemies (control of larvae in soil)

Bacillus thuringiensis var. *israelensis*

Soil predator mite

Insect parasitic nematodes

Adult control – persistent pyrethroids (short life of adults limits target stage)

F. Wood boring insects (**Fact sheet 5.530 – presently in revision**)

1. Metallic wood borers/Flatheaded borers (Buprestidae)

Appearance/habits

Damage

Species in the news – **emerald ash borer**

Current status/future spread

(Check out emerald ash borer section in [Insect Information Web Site](#))

2. Roundheaded borers/Longhorned beetles (Cerambycidae)

Appearance habits

Damage

3. Clearwinged borers (Sesiidae)

Peach tree borer ([Fact Sheet 5.566](#))

Lilac/Ash borer ([Fact Sheet 5.514](#))

4. Control of wood borers

Host plant vigor

Sanitation

Insecticidal sprays timed at exposed stages

Pheromones and pheromone traps

G. Bark beetles

1. Mountain pine beetle/Spruce bark beetle/Douglas fir beetle (all *Dendroctonus* species) ([Fact Sheet 5.528](#))

Aggregation pheromones

Blue stain fungi

2. *Ips* beetles ([Fact Sheet 5.558](#))

Spruce ips

Pinyon ips

Ips and forest thinning

INSECTS/MITES WITH SUCKING MOUTHPARTS

- A. Structure of basic type of sucking mouthparts
 Two pairs of stylets (mandibles, maxillae), interlocking (stylet bundle)
 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. Wilting, premature leaf drop *when infestations high and sustained* (rare)
 - b. Nuisance honeydew production
 - c. Leafcurling species can deform new growth

4. Aphid control

a. Exposed aphids

- 1) Contact insecticides (e.g., bifenthrin, acetamiprid)
- 2) Soaps and detergents ([Fact Sheet 5.547](#))

Advantages

Limitations

Optimizing Use

b. Leafcurling species-leafcurl has been produced

- 1) Systemic insecticides (e.g., acetamiprid, imidacloprid, acephate)

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. Whiteflies ([Fact Sheet 5.587](#))

Primary species – greenhouse whitefly (*Trialeurodes vaporariorum*)

Subtropical species that cannot survive outdoors in Colorado winter

Life cycle

Eggs

Nymphs (last stage non-feeding – sometimes called a “pupa”)

Adult (winged)

Management

Exclusion/host free periods

Trapping

Use primarily for monitoring population changes

Biological controls

Parasitic wasps (*Encarsia formosa*, *Eretmocerus californicus*)

Insecticides

Horticultural oils (mostly nymphs)

Pyrethroids (mostly adults)

Neem (*with azadirachtin!*)

Imidacloprid (systemic insecticide)

F. 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. Cottony maple scale

b. European elm scale

c. Soft brown scale – common species on indoor plants

3. Scale control

Pruning, scraping

Crawler sprays

Oil sprays ([Fact Sheet 5.569](#))-dormant/foliar treatments

Advantages

Limitations

Systemic insecticides?

Phloem feeders (soft scales) more susceptible

G. Spider mites ([Fact Sheet 5.507](#))

Method of feeding

Life cycle

Twospotted spider mite

Honeylocust spider mite

Spruce spider mite and other conifer mites

Turfgrass mites

Clover Mites ([Fact Sheet 5.505](#))

Early spring nuisance invader

Banks grass mite

Turf – Water = Spider Mites in Turfgrass

Management of Spider Mites

Monitoring

Drought stress on the plant and spider mites

Dry air and spider mites

Proper selection of pesticides

Horticultural oils presently often best available option

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

"Finger galls"

Distortion of flowers

"Witches' broom" of hackberry

7. Gall midges, flies

Simple swellings, stunting

Examples:

Pinyon spindlegall midge

Willow conegall midge

Honeylocust podgall midge

Chokecherry fruitgall 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. Nuisance Household Invaders

Spring invaders – clover mites, cluster flies, field ants, millipedes, miller moths....

Summer invaders – root weevils, windscorpions, duff millipedes, earwigs, springtails.....

Fall invaders – crickets, funnel weaver spiders.....

Species that winter in homes

Cluster fly – parasite of earthworms (Fact sheet in press)

Boxelder bugs ([Fact Sheet 5.522](#))

Western conifer-seed bug ([Fact Sheet 5.588](#))

[Elm seed bug](#) – new nuisance invader of western Colorado

Management

Sealing openings

Understanding nature of problem (transitory, originating outdoors...)

Parsleyworm/Butterfly Gardening

Life History and Habits

Butterfly gardening ([Fact Sheet 5.504](#))

State Insect - [Colorado Hairstreak](#)

Pest Talk email Discussion Group

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