



UCCE Master Gardeners of El Dorado County

Contact us:

530-621-5512 (Tues-Fri 9:00AM-Noon)

mgeldorado@ucdavis.edu

Visit us at 311 Fair Lane, Placerville

The Good, the Bad, and the Bugly

Dealing with Garden Pests and Taking Care of Your Friends

El Dorado County Master Gardeners

Mary Tran

July 2018



Today's Topics

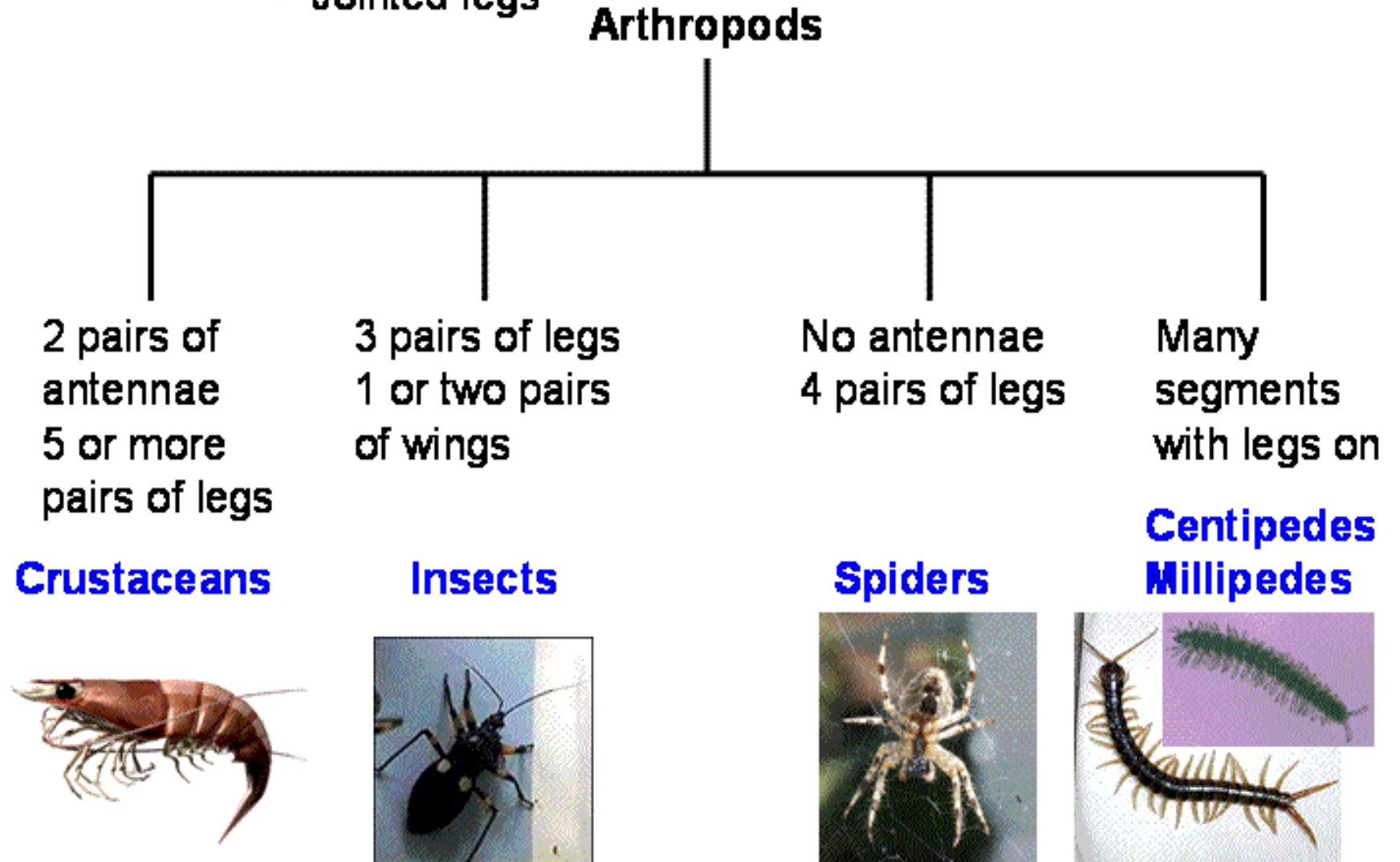
- Insects 101
- What is biological control? What do we mean by “Natural Enemies”?
- Gallery of common pests and their effects
- Gallery of insect Friends of the Garden
- Gallery of plants to support your F.O.G.

Insects 101

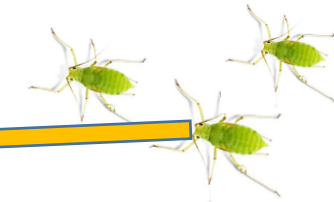
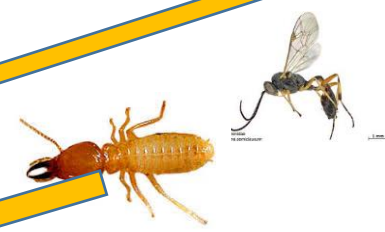
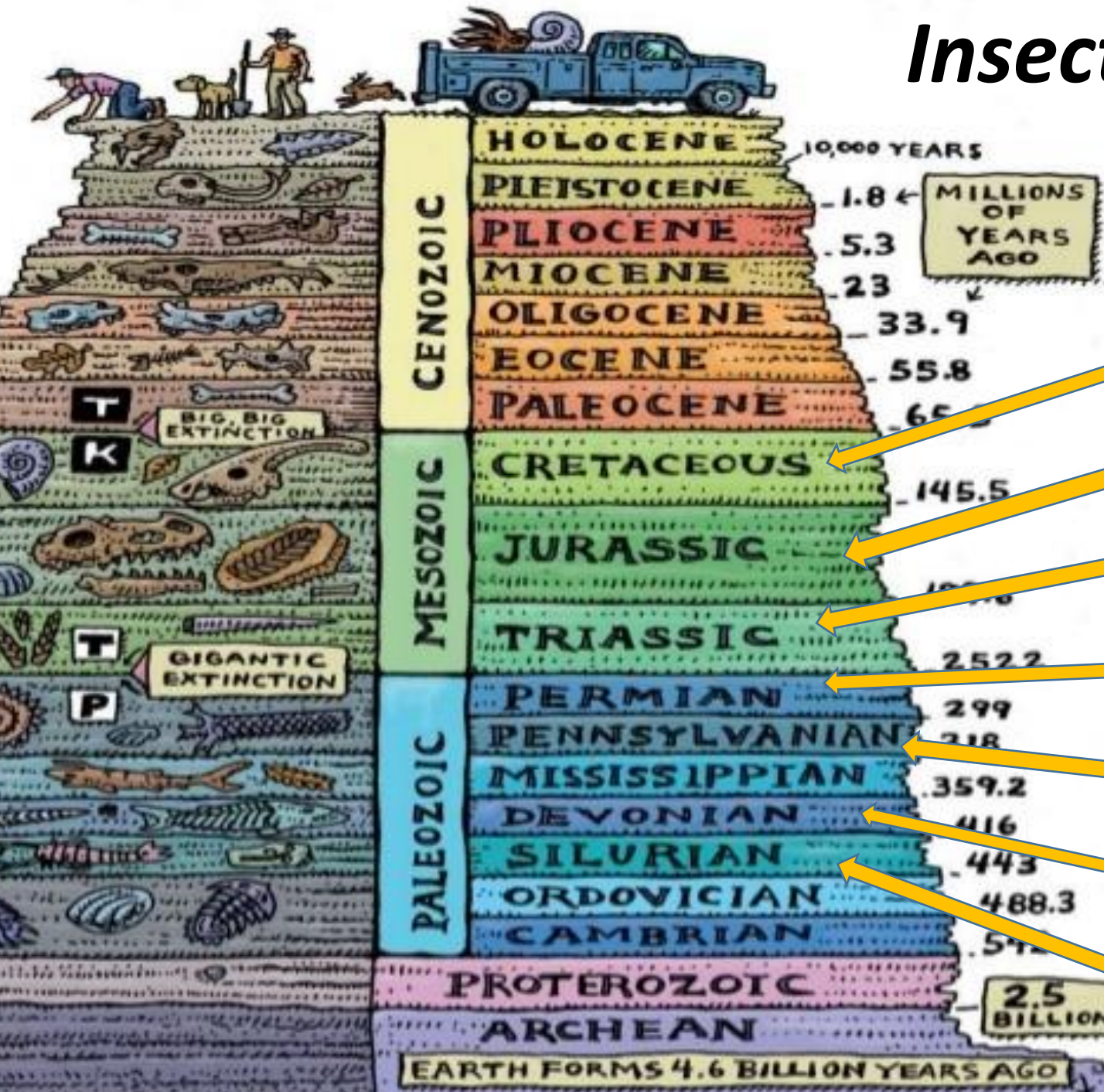
Insects are Arthropods

All arthropods have:

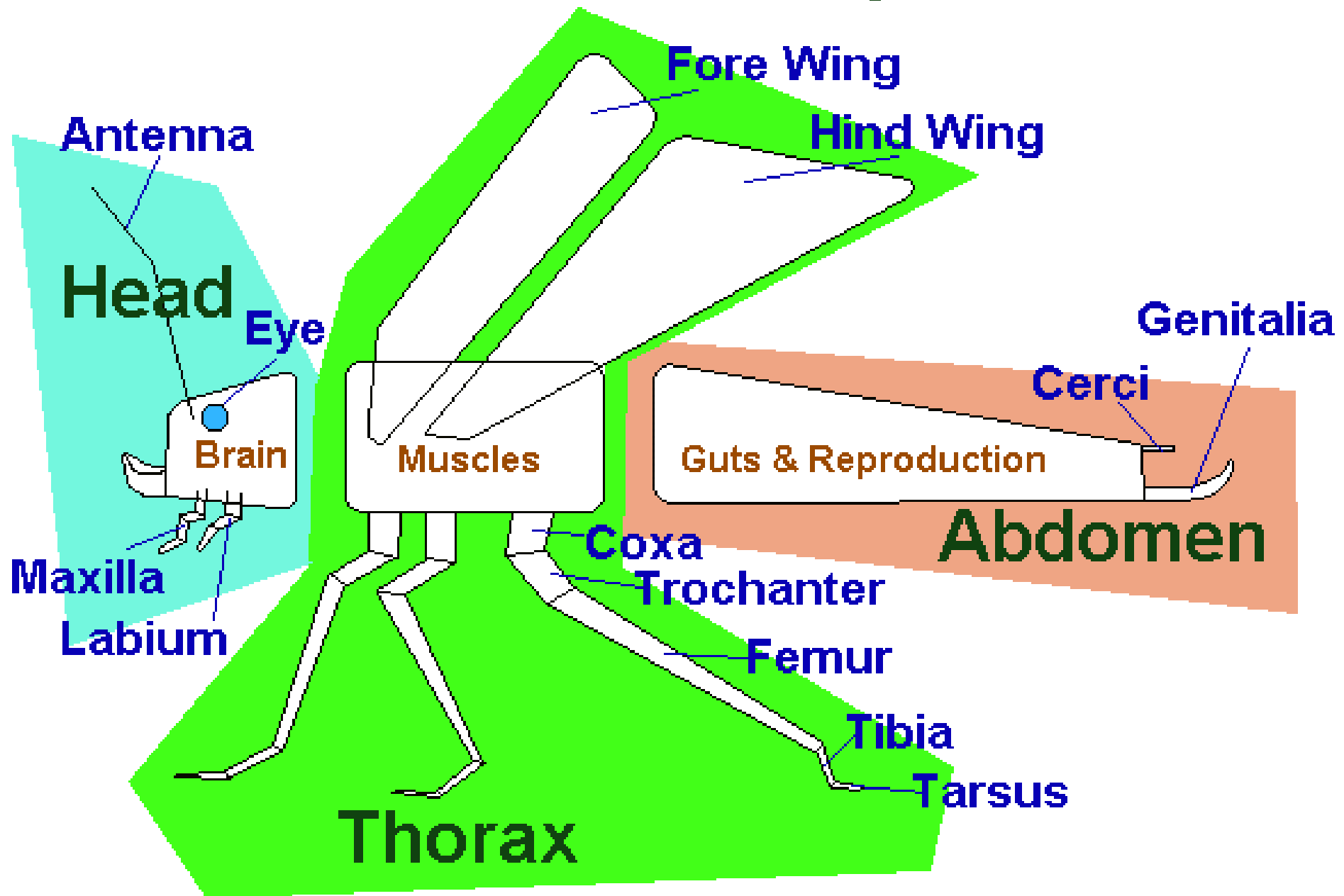
- A hard skeleton on the outside of their body
- Jointed legs



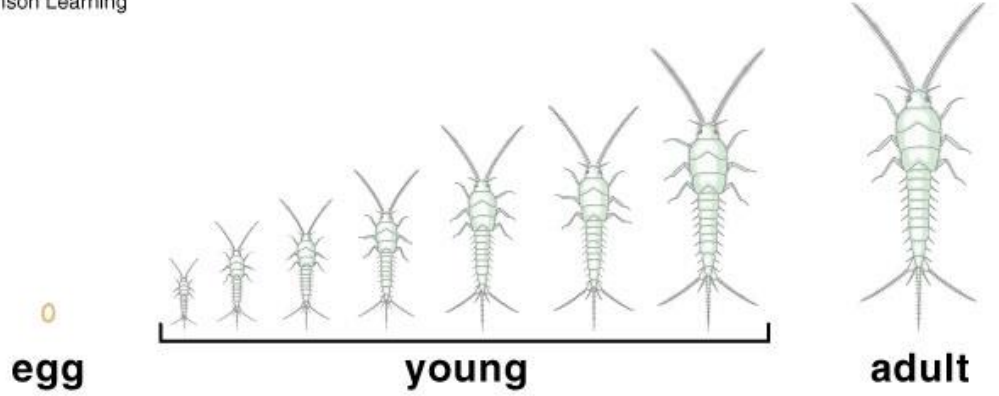
Insects are old



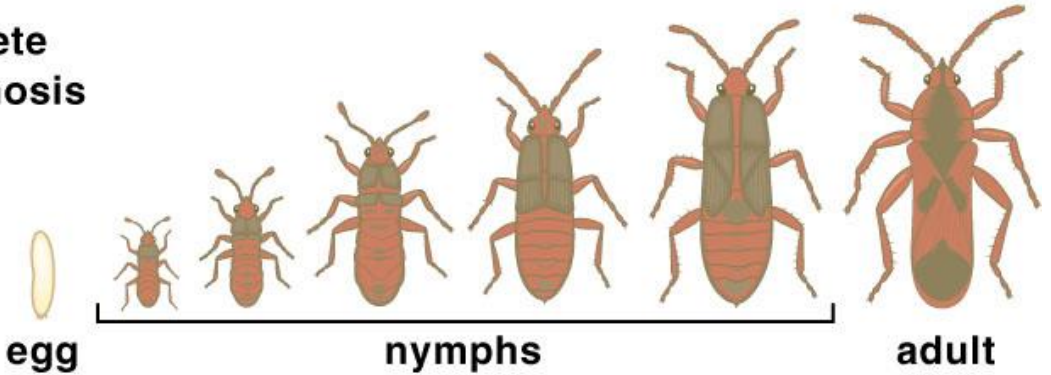
The Insect Body



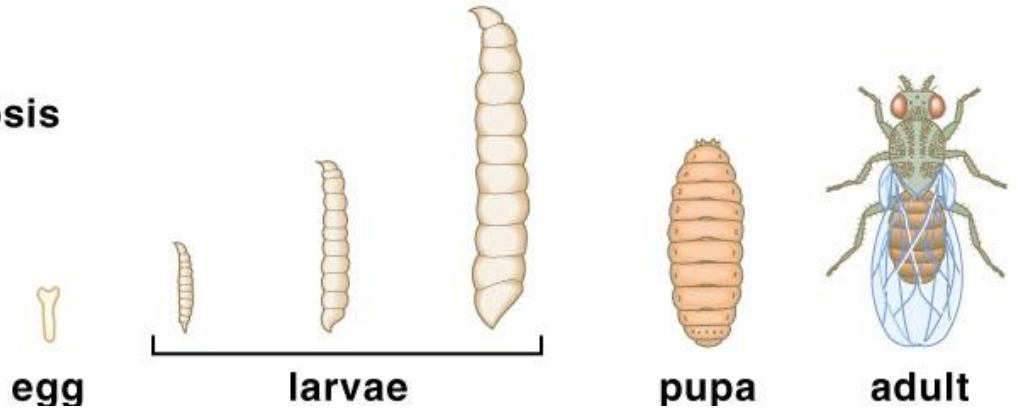
a Growth and molting



b Incomplete metamorphosis

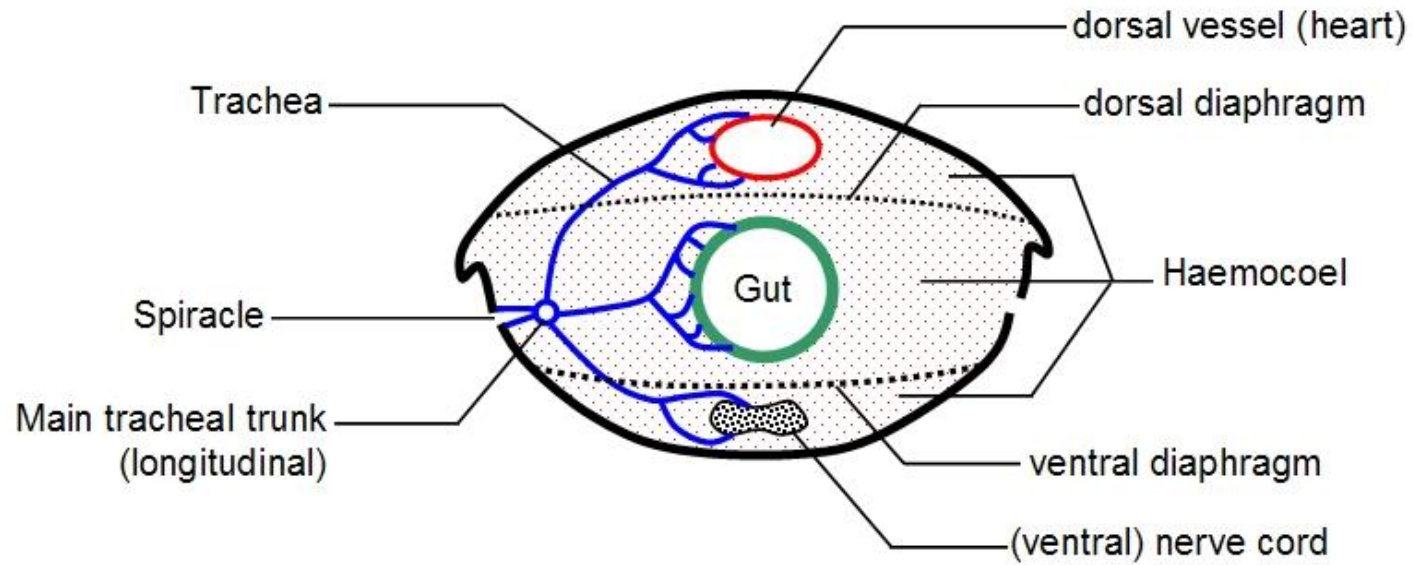


c Complete metamorphosis



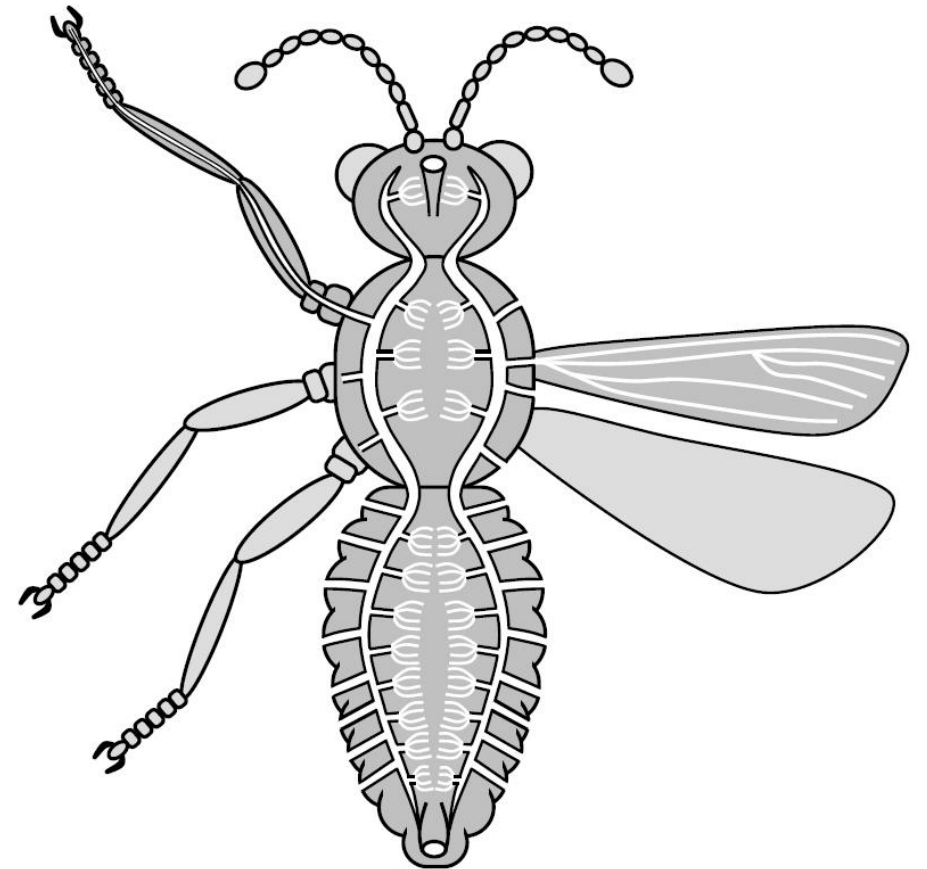
Three (four) types of insect life cycle





Transverse section of insect abdomen
(Showing tracheal system on left-side only)

Insect breathing



Insect Mouthparts

For cutting and
chewing



For piercing and
sucking



For sponging and
siphoning



Insect egg laying

In the ground and in water

On leaves and twigs

In other insects' eggs and bodies



Top: Dragon fly, grasshopper
Middle: Lady beetle, stink bug
Bottom: Parasitoid wasp laying on scale,
wasp laying on butterfly eggs, braconid
wasp eggs on hornworm.

What are natural enemies?
What is biological control?

What do we mean by “natural enemies”?

- Natural enemies are critters that reduce the numbers of other critters.
 - Critter: an organism, such as a fungus, an insect, a mammal, etc.
- How they do this:
 - By being a parasite
 - By being a predator
 - By “antibiosis” (secreting a substance that inhibits/kills the target)
 - By out-competing (for water, sunlight, food, shelter, etc.)

I call them “Friends of the Garden”

Parasitism

- Parasite: Lives on/feeds on a host (long term relationship)
- Parasitoid (an insect):
 - Eggs are laid in/on the host or host eggs.
 - Emerging adult kills the host.



Top: Parasitic wasp injecting eggs into butterfly larva.

Bottom: Aphid mummies and a parasitic wasp (*Lysiphlebus testaceipes*).

What kinds of insects are parasitic?

- Flies (Order Diptera)
- Wasps (Order Hymenoptera).
 - Over three dozen Hymenoptera families

For example:

- Tiny wasps (Aphelinidae, Encyrtidae, Eulophidae, and Ichneumonidae)
- Very tiny wasps (Trichogrammatidae)
- Parasitic flies (Tachinidae)



Top: Parasitoid wasp laying egg in tarnished plant bug nymph

Middle: Tomato Hornworm with Braconid Wasp cocoons

Bottom: Parasitic wasp larvae visible through the surface of their scale insect host.

Predation

- Predators kill and eat individual prey.
- Predators of insects include:
 - Many species of amphibians, birds, mammals, and reptiles
 - Predatory beetles, flies, lacewings, true bugs, and wasps
 - Most spiders
- Predators of mites include:
 - *Amblyseius* spp., *Neoseiulus* spp., and the western predatory mite, (*Galendromus occidentalis*)



Crab spider (*Misumena vatia*, Thomasiidae) eating yellow dung fly (*Scathophaga stercoraria*)



Adult assassin bug (*Zelus renardii*) paralyzes its prey.



Also:

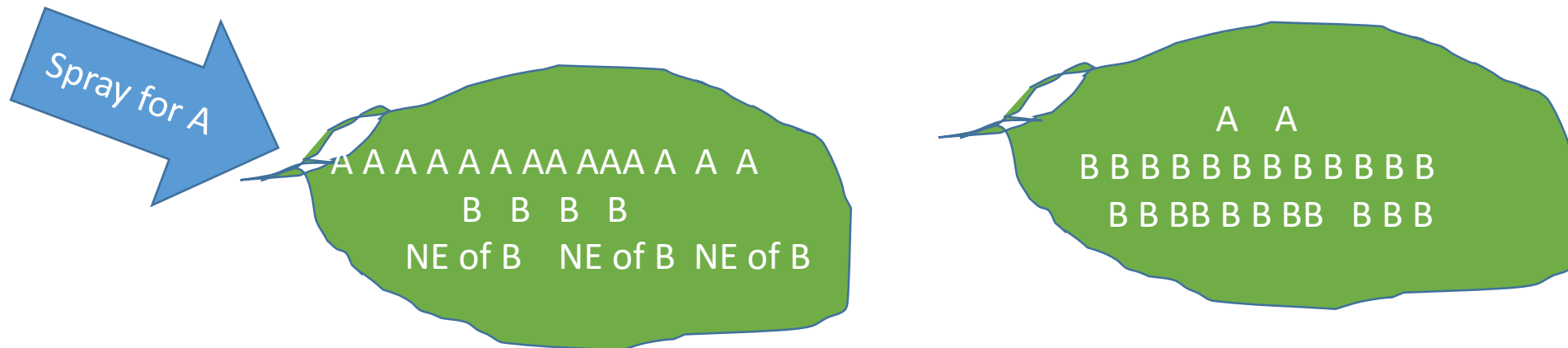
- “Antibiosis”
 - Secreting a substance that inhibits/kills the target
 - Penicillin is a case of antibiosis: a secretion of a mold to control bacteria
 - Can be used for controlling plant pathogens
- Out-competing another critter for water, sunlight, food, shelter, etc.
 - Has been used in control of weeds
 - Not yet used much for insect pest control

And what is biological control?

- Biological control is anything that is done by one species that reduces how much damage another species is causing (“human point of view”)
- Who does the work of biological control?
 - Living natural enemies.
- What is the effect of biological control?
 - Target population gets smaller
 - Amount of damage may be eliminated or reduced to (“human”) tolerable level.

Why biological control is useful and important

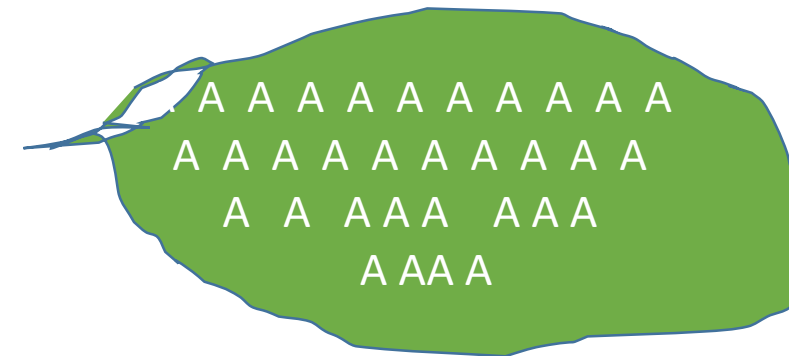
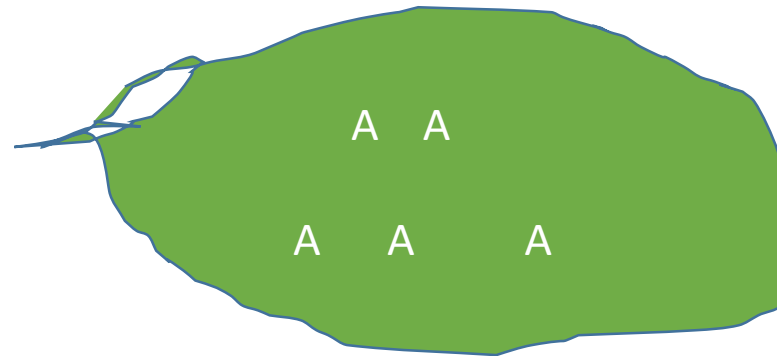
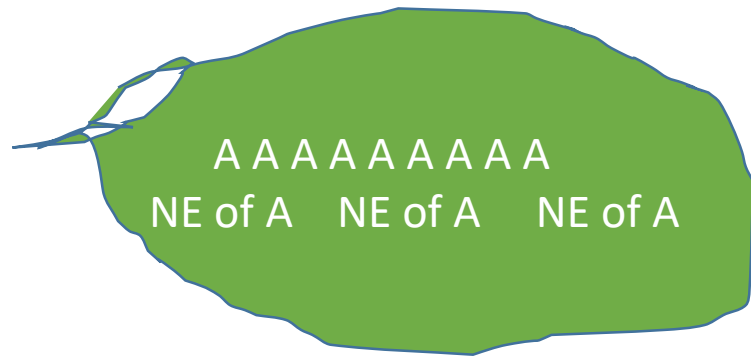
- Nearly every “pest” has natural enemies
- Normally the local community of natural enemies keeps the number of pests under control
- Balance can be upset by: pesticides, weather, introduction of new pest species
- For example: If you spray for Pest A, you can kill Natural Enemies of Pest B and get an over growth of B, or ...



Why biological control is useful and important

Another example:

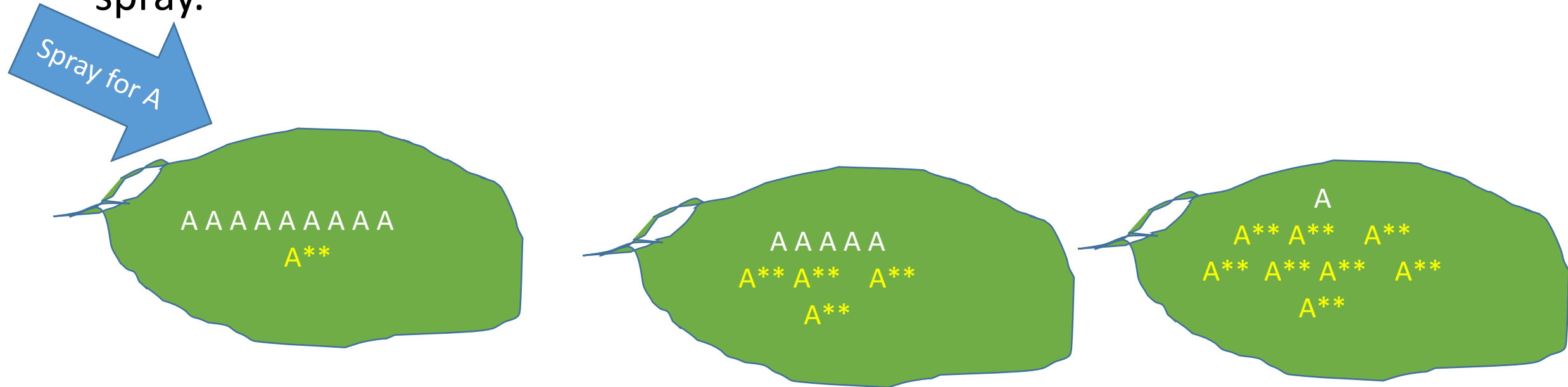
- If you spray for Pest A, you can get temporary decrease in Pest A BUT ALSO elimination of the natural enemies of A, so you end up with a resurgence of A, or ...



Why biological control is useful and important

Another example:

- Each time you spray for Pest A, you kill off the “susceptibles” in the A population, but not the ones with genetic resistance.
- With each new spray, more of the A population is resistant to that spray.



Basic strategies of biological control

- How you care for your garden:
 - Provide enough water so you don't stress the plants;
 - Take it easy with fertilizer;
 - Select resistant plants, adapted to your climate;
 - Keep down the dust;
 - Keep the garden tidy: Raking, pruning, toss the trash;
 - Control of ants (so you can control aphids and other honeydew sources).
- How you use pesticides:
 - Correct timing, plant, pest, application
 - Least toxic choice (to protect "natural enemies", the environment, your family)
- Adding "natural enemies" from outside
 - Lady beetles provide only temporary control of aphids, often are poor quality
 - For use against "imported" pests. By law, must be done by qualified scientists with government permits.
 - Can backfire: For example: frogs, mongooses, and certain fish
- How you manage your local habitat:
 - Growing perennials so there is something blooming all year



Gallery of Common Pests and Their Effects

Most photos in this section by Jack Kelly Clark

Caterpillars

- Are the larvae of butterflies and moths.
- Three pairs of legs directly behind the head PLUS leg-like appendages on some segments of the abdomen.
 - Unlike the larvae of beetles, sawflies and flies.
- Damage plants by chewing on leaves, flowers, shoots, fruits, or sometimes boring into wood.
 - Burrowing into ripening fruit and other plant parts makes management difficult/impossible.
 - May not be detected until the fruit is eaten or cut open.

Codling moth larvae bore to apple core and feed.
Corn earworm/ tomato fruitworm larva.
Mature tobacco hornworm larva.



Aphids

- Feed by sucking plant juices.
- Large populations can turn leaves yellow and stunt shoots.
- Excrete honeydew.
 - Ants farm them for the honeydew, which turns black with “sooty mold” fungus.
- Some inject a toxin which causes leaf curl, distorted growth.
- May transmit viruses from plant to plant.



As for releasing lady beetles (*Hippodamia convergens*):

- Control of aphids will be temporary.
- Lady beetle retailers lack sufficient numbers/quality.



- Potato aphid adults and nymphs.
- Aphids killed by parasitic wasps such as *Lysiphlebus testaceipes* (shown) become mummies, discolored and swollen with a crusty cuticle (skin).
- Rose buds heavily infested with rose aphids.

Leafhoppers



- Feed by sucking plant juices
- Many hosts (fruit, vegetable, flower, and woody ornamental hosts) Each species specializes.
- About 1/4-inch long. Can be green, yellow, or brown, mottled, brightly colored or in cammo.
- Crawl rapidly sideways or readily jump when disturbed.
- Look on underside of leaves for adults, nymphs, pale cast skins.
- Feeding causes leaf stippling (pale or brown). Shoots may curl and die. Some secrete honeydew.

Adult potato leafhopper.

Feeding damage due to rose leafhopper.

Scales

- Adult females / most immatures (nymphs) are immobile, wingless, and lack a separate head or other recognizable body parts.
- Excrete sticky honeydew. Look for black sooty mold.
- Damage includes: discolored, distorted, or dying leaves, twigs, or branches, especially with armored scales.
- Two common types:
 - Armored scales are tiny, flat. Covers can be removed. No honeydew.
 - Soft scales are larger, more rounded. Covers don't lift off. Do excrete honeydew.



Colony of greedy scale, *Hemiberlesia rapax*
Leaf spotting caused by sycamore scale.

Mealybugs

- Wingless, soft-bodied, whitish insects, related to scales.
 - Often have waxy filaments radiating from their body, tail.
- Move slowly, gather in groups covered with whitish mealy or cottony wax.
- Suck sap from plant phloem.
- Excrete sticky honeydew and wax.
- High populations can slow plant growth and cause leaf drop. Healthy plants can tolerate low populations.
- Plants growing indoors or in greenhouses are especially vulnerable because of year-round mild temperature on being protected from natural enemies that often keep mealybugs under control outdoors.



UC Statewide IPM Project
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**Obscure mealybug colony on grapes.
Mealybug infestation on succulents.**

Whiteflies

- Tiny, sap-sucking insects. Fly around plants when disturbed.
- Adults are white and may have darker markings on their wings.
 - Nymphs are oval, legless, and don't move.
- Look on underside of leaves for tiny nymphs, sooty mold.
- Damage includes yellowing, silvering, or drying leaves with whitefly nymphs on them.
 - Nymphs cause most of the damage.
- Natural enemies often keep them under control (lacewings, lady beetles).



Adult sweetpotato whitefly, *Bemisia tabaci*.

Thrips

- Really tiny. Infestation looks like pepper sprinkled on plants.
- Feed while hidden, often in buds/shoot tips or under sepals
- Look for:
 - Scabby, silvery to dark brown discoloration on fruit, leaves, or petals.
 - Dark specks of excrement on fruit or leaves.
 - Distorted, curled, galled, or dead shoot tips and leaves.
 - Often you will see the damage before seeing the thrips.
- Some are predators of some insects and mites.



Black adult and clear nymph greenhouse thrips; note liquid feces on tips of abdomens.
Leaves injured by bean thrips.
Galling of leaves and shoots caused by myoporum thrips, *Klambothrips myopori*, infesting myoporum, *Myoporum laetum*.

Mites

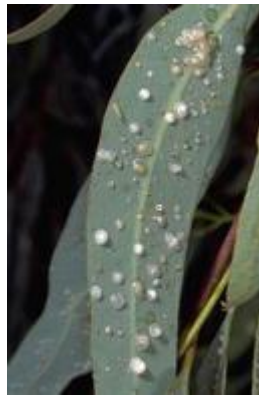
- Mites are arachnids (8 legs).
- They are tiny: Look like tiny, moving dots. Use a magnifying lens to see them.
- Cause damage by sucking cell contents from leaves.
- Damage first appears as a stippling of light dots on the leaves.
 - Most severe in hot, dusty conditions and on water-stressed plants.
 - A large population causes dense webbing that covers leaves, stems, fruit.
- Key predators include predatory mites, thrips, lacewings, and minute pirate bugs.



**Strawberry spider mite.
Potato leaf heavily infested
with spider mites, showing
webbing and yellow blotches.**

Psyllids

- Adults are 1/10 to 1/5 inch long and hold their wings rooflike over their bodies.
- Adults are quite active (jump away when disturbed).
- Nymphs of several species that feed on eucalyptus hide under hard covers (lerps).
- Damage includes:
 - Distorted or galled leaves or shoots,
 - Crystallized covers called “lerps”,
 - Abundant sticky honeydew, black sooty mold.
- FDA/CDFR monitoring spread of Asian citrus psyllid.



Adult, late-instar nymph, eggs, and the whitish cover of a nymph of eucalyptus redgum lerp psyllid.

Galled eucalyptus leaves. Psyllid lerps.

Brownish adult, yellow nymphs, and white wax of Asian citrus psyllids, *Diaphorina*. Photo by Michael E. Rogers, University of Florida.

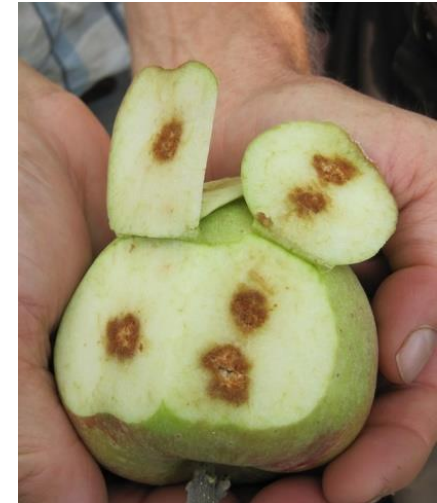
True Bugs

- Adult true bugs:

- At rest, folded wings form triangle or X-shape on back.
- Sucking mouthparts, pointing downward on plant-feeding species
- Some inject tissue-destroying enzymes into fruit, plant parts.

- We are monitoring for two in El Dorado County:

- Brown Marmorated Stink Bug BMSB (*Halyomorpha halys*)
 - Over 100 host plants. Serious agricultural pest on East Coast.
 - Overwinters under bark, in buildings. Emit an offensive odor.
- Bagrada Bug (*Bagrada hilaris*)
 - Makes “scorched” leaves, wilting and death of plant.
 - Especially damaging to small plants and may kill seedlings.



- Adult Bagrada bugs. Adult consperse stink bug and cluster of eggs. Adult and mature nymph of BMSB
- BMSB damage on apple. Feeding damage by Bagrada bug on mustard greens.



Time for a break

Coming up next ---

*A Portrait Gallery of
Best Loved Friends of the Garden*

*Planting for Year Round Flowering
and Pollen*

Gallery of Friends of the Garden



Compiled from: Natural Enemies, Listed by
Common Name, at:
[http://ipm.ucanr.edu/PMG/NE/natenemies
pest.html](http://ipm.ucanr.edu/PMG/NE/natenemiespest.html).

Spiders

- All spiders are predaceous
- They eat mainly insects, other spiders, and related arthropods.

Jumping spider eating a fruit fly.



Flower spider



Grass spider



Jumping spider



Funnel weaver spider



Cobweb weaver spider

Green & Brown Lacewings

- Generalist predators
- Fly at night, drawn to lights.
- Larvae look like tiny alligators with large mandibles.
- Larvae prey upon variety of small insects including mealybugs, psyllids, thrips, mites, whiteflies, aphids, small caterpillars, leafhoppers, and insect eggs.
- Green lacewings are commonly released predators.



Top: Brown lacewing adult and larva
Bottom: Green lacewing life stages

Dustywings

- When feeding on mites, dustywing larvae eat about 250 mites while developing through three larval stages.
- May have several generations per year.



Assassin bugs

Spined assassin bug



Adult leafhopper assassin bug



Egg cluster



Nymph



- All assassin bugs are predators.
- Some feed on insects, others on mammal blood.
- Insect-feeding species eat a wide variety of small to medium-sized insect prey including caterpillars, leafhoppers, other bugs, and aphids.
- They also feed on beneficial species such as lacewings.
- Often seen stalking or lying in wait for their prey.
- Inject prey with venom when caught.

Minute pirate bugs

- Adults and nymphs feed on insect eggs and small insects
- Prey include: psyllids, thrips, mites, aphids, whiteflies, caterpillars.
- Commercially available Orius spp. are sometimes released in greenhouses to control thrips.

Adult pirate bug, *Anthocoris nemoralis*, feeding on a nymph of eucalyptus redgum lerp psyllid, *Glycaspis brimblecombei*.



Damsel bugs

- Nymphs look similar to adults.
- Move rapidly if disturbed.
- Females insert their eggs into plant tissues where they are difficult to detect.
- Are generalist predators.
 - Appear later in the season than some other predators.
- Prey upon thrips, mites, aphids, other bugs, caterpillars, and leafhoppers.



Bigeyed bugs

- Common on low-growing plants, where they stalk their prey.
- Widely separated eyes give extensive field of vision for spotting prey.
- Eggs laid singly on leaf surfaces, develop reddish eyespots shortly after being laid.
- Prey includes insect eggs, other bugs, small caterpillars, flea beetles, and mites.



Multicolored Asian lady beetle



- Most lady beetles, including this species, are predaceous as both larvae and adults.
- Young lady beetle larvae usually pierce and suck the contents from their prey.
- Older larvae and adults chew and consume their entire prey.

Convergent lady beetle

- Adults and larvae feed on aphids (also whiteflies, other soft-bodied insects and insect eggs).
- In California, they overwinter in large aggregations in the Sierra Nevada.
- In spring, adults fly down from the mountains to coastal and valley areas.
- Commercially available *Hippodamia* are collected at overwintering sites and can be bought and released.
- But they disperse when released, even if food is abundant.
- Makes it difficult for them to be used in biological control programs.



Soldier beetles, leather-winged beetles

- Feed under bark or in soil or litter
- Primarily feed on eggs and larvae of beetles, butterflies, moths, and other insects.

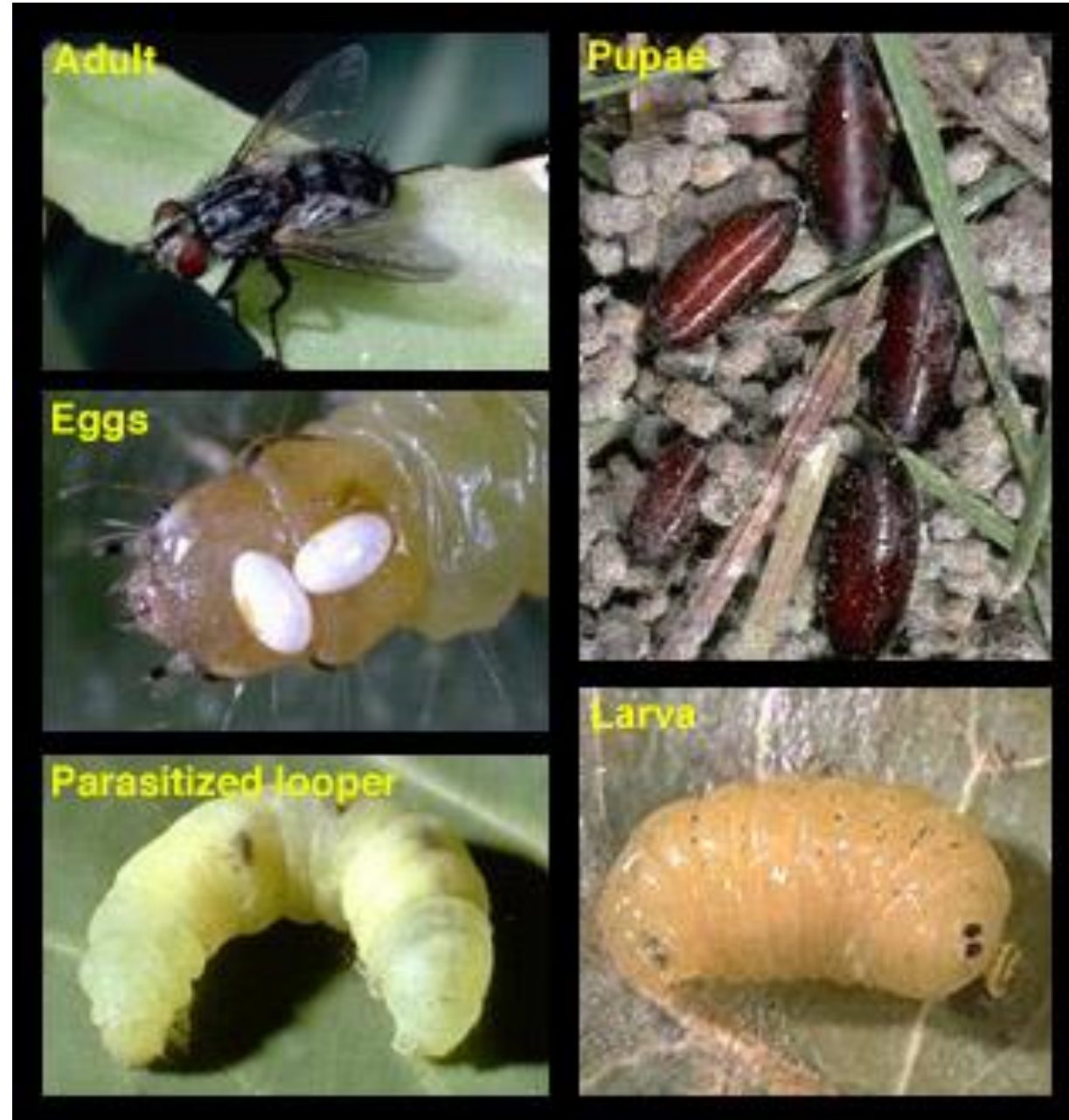


Tachinid flies

- Tachinid maggots feed internally in their hosts and exit the host body to pupate.
- Pupae are commonly oblong and dark reddish.
- Tachinid flies complete one to several generations per year.



Tachinid fly lays egg in caterpillar



Anaphes species

- Are small wasps.
- Internal parasites of insect eggs, including eggs of beetles and true bugs.
- Life cycle:
 - The female deposits her egg into the host egg.
 - The larva hatches and eats the host egg from inside.
 - Emerges as adult wasp. Egg is “dead”.
 - If female, the adult searches for suitable host eggs in which to deposit her eggs.



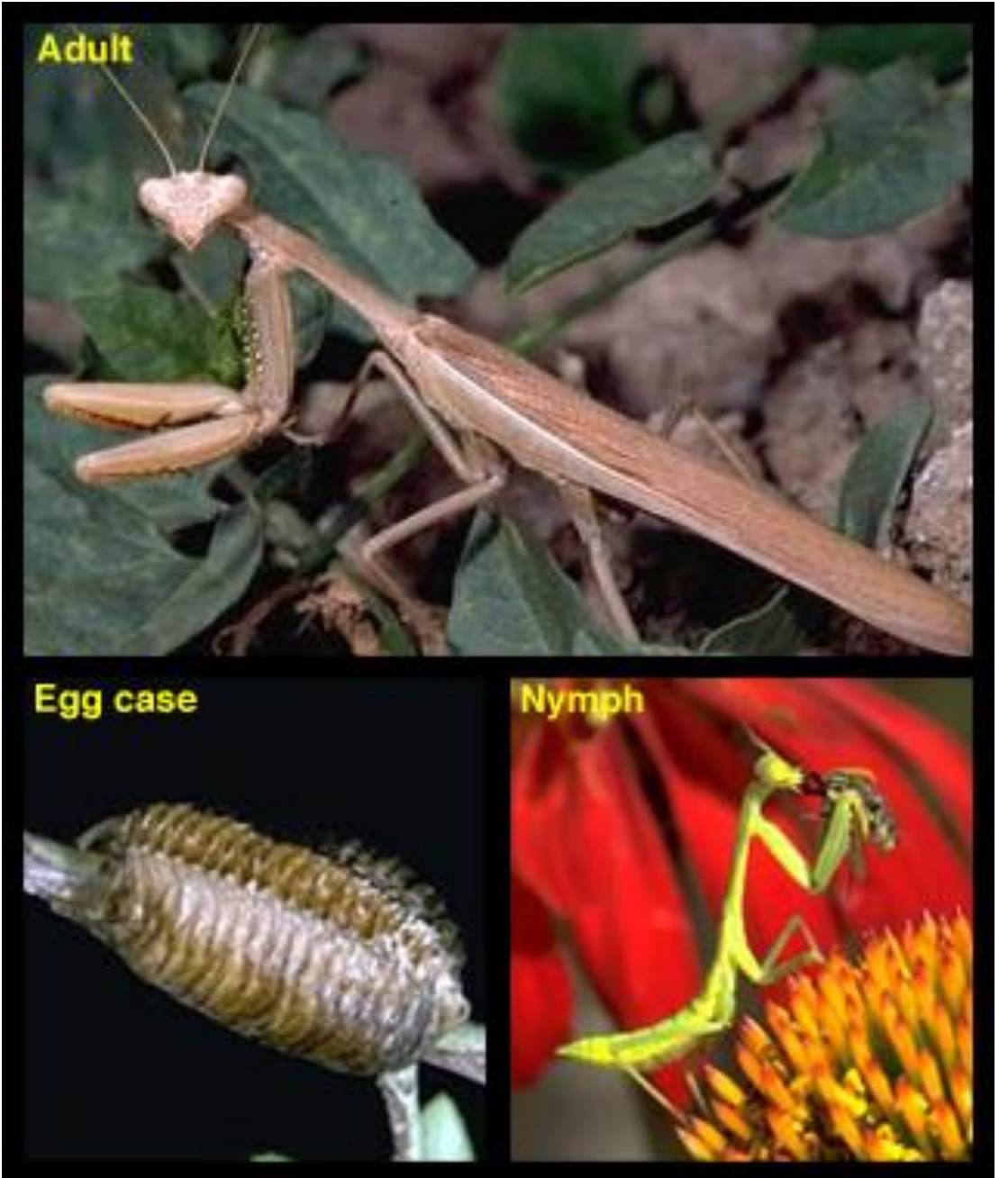
Trichogramma spp., egg parasite

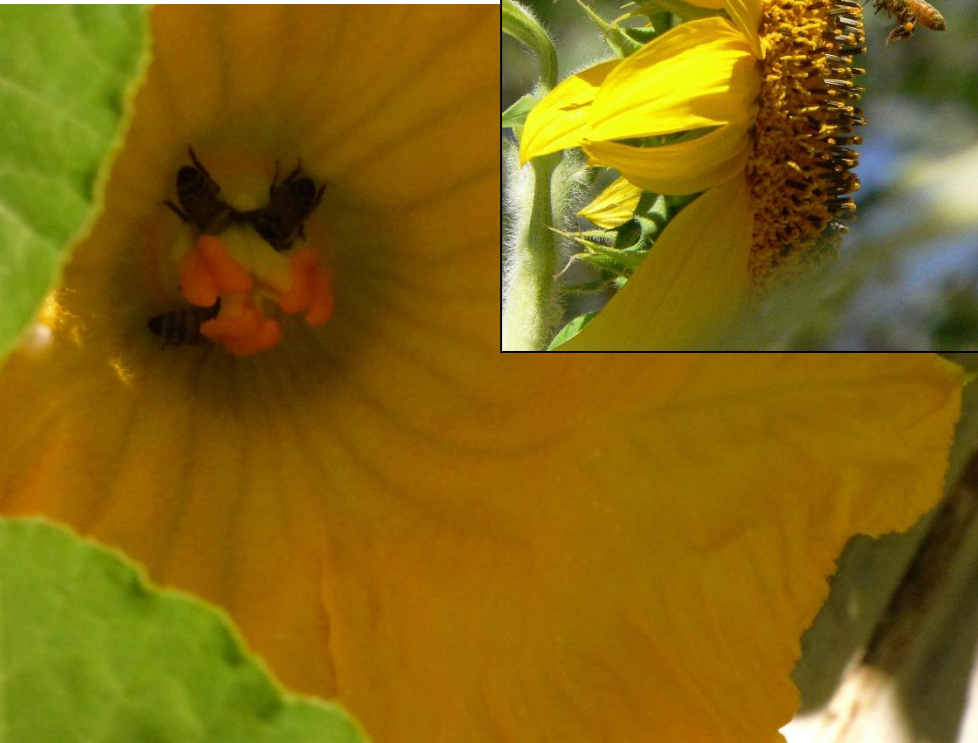
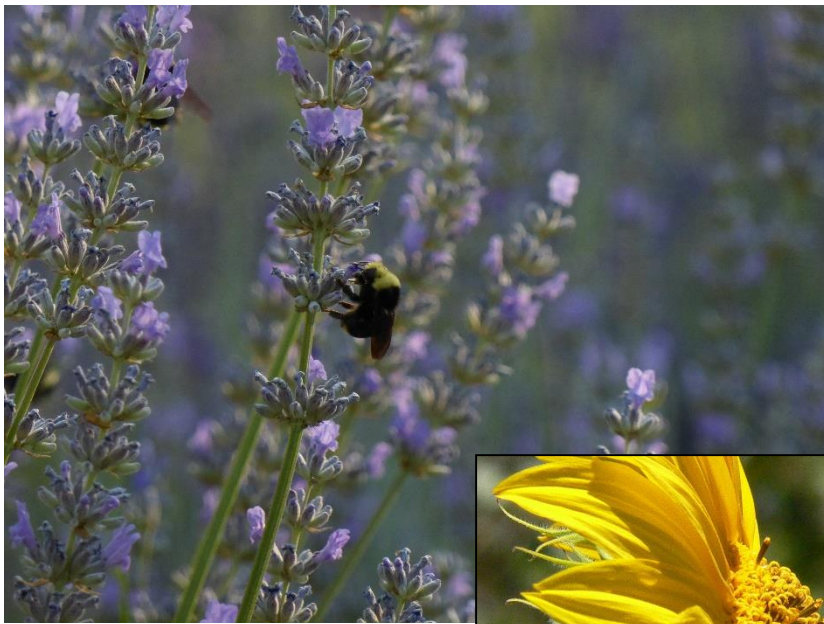
- The adult wasp lays an egg in a recently laid host egg.
- As the wasp larva develops, it eats the host embryo, causing the egg to turn black (useful for detection).
- Short life cycle (7 to 10 days) is shorter than hosts' so their populations can increase rapidly.



Mantids/ praying mantids

- Are wholly predaceous.
- Wait for prey at flowers where they capture nectar- and pollen-feeding insects.
- Consume both insect pests and beneficials so are not reliable for biological control.





Bees: The Pollinators

*Gallery of plants to support your
Friends of the Garden*

Plantings to retain predators and parasites

Many Friends of the Garden do poorly unless flowering / nectar-producing plants available to supplement diet.

- E.g. green lacewings, syrphid flies

What plants to include:

- A diverse range of plant species
- Adapted to the local conditions
- Can tolerate low populations of plant-feeding insects and mites
- Flower at different times in order to provide nectar, pollen, and shelter all season.



In this study, hedgerows enhanced the ratio of beneficial to pest insects compared with weedy areas. Plantings at Sierra Orchards in Solano County include deer grass, California lilac and elderberry. *Inset left to right, the beneficial insects identified included lady beetles, syrphid flies and their larvae (feeding on aphids).*

Coyote Bush

- Coyote bush (*Baccharis pilularis*). Also called chaparral broom.
- Grows as a ground cover or as a shrub, 3 to 9 feet high.
- After becoming established it only needs water once a month.
- Is deer resistant and possibly fire resistant.
- Especially valuable because is one of the few bushes to bloom in winter.



Ceanothus

- Ceanothus (*Rhamnaceae*). Also called California lilac.
- Grows as a bush or tree, depending on how it is pruned.
- Has beautiful white to blue flower spikes in spring, reliable green leaves in the rest of the year.
- Likes full sun, doesn't like to have its feet (roots) wet too much, and can handle winter frost.



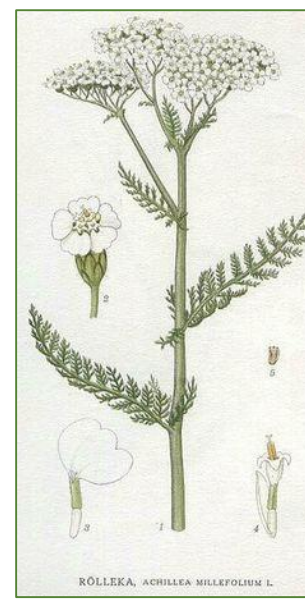
Redbud

- Redbud (*Cercis*).
- You have seen this tree with its brilliant pink bloom in the spring.
- Likes full sun but can handle some shade.
- Low water requirement.



Yarrow

- Yarrow (*Achillea*).
- Sunset Garden Book calls yarrow “Among the most carefree and generously blooming perennials for summer and early fall...”
- Grows as a low bush.
- Likes full sun.
- Needs little watering.
- This one is great for cut flowers, but leave some for our Friends of the Garden.



Coffeeberry

- Coffeeberry (*Frangula californica* or *Rhamnus californica* var. *occidentalis*). Also called California Buckthorn
- In our area it grows upright as a tree, reaching 8 feet tall.
- Not fussy about soil.
- Likes full sun.
- Can go without irrigation after it is established.
- After a fire or other disturbance such as cutting that removes the above ground stems, etc., coffeeberry sprouts vigorously from buds on the root crown and rapidly regains its original size and biomass.



Elderberry

- Elderberry tree (Sambucus)
- Not fussy about soil type or pH level.
- Needs some watering.
- Will virtually grow anywhere sufficient sunlight is available, but may need extra nitrogen.
- Often grown as a hedgerow plant since they take very fast, can be bent into shape easily and grow quite profusely.
- A protected California native.



Toyon

- Toyon (*Heteromeles arbutifolia*).
- Grows wild in our foothills at the elevations where we also find oaks and ceanothus.
- Can grow up to 25 ft. tall and about that big around.
- Puts out clusters of white flowers in early summer, then bunches of red berries in time for December table arrangements.
- Likes full sun but is ok with some shade.
- Is pretty drought tolerant, but looks better if it gets some water during the summer.



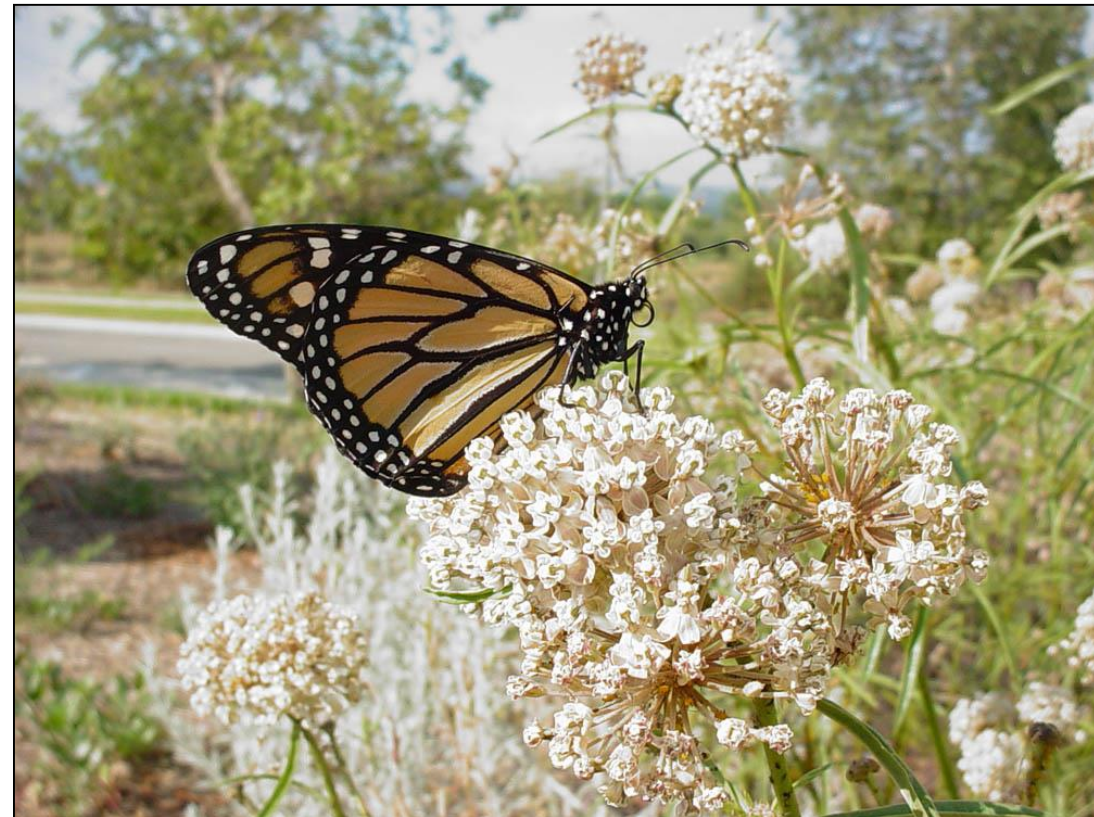
Bottlebrush

- Bottlebrush (*Callistemon*).
- Grown as large bush or tree about 15 ft. high by 25 ft. wide.
- Likes full sun.
- Low water requirement.
- Prefers well-drained, low-alkaline soil.

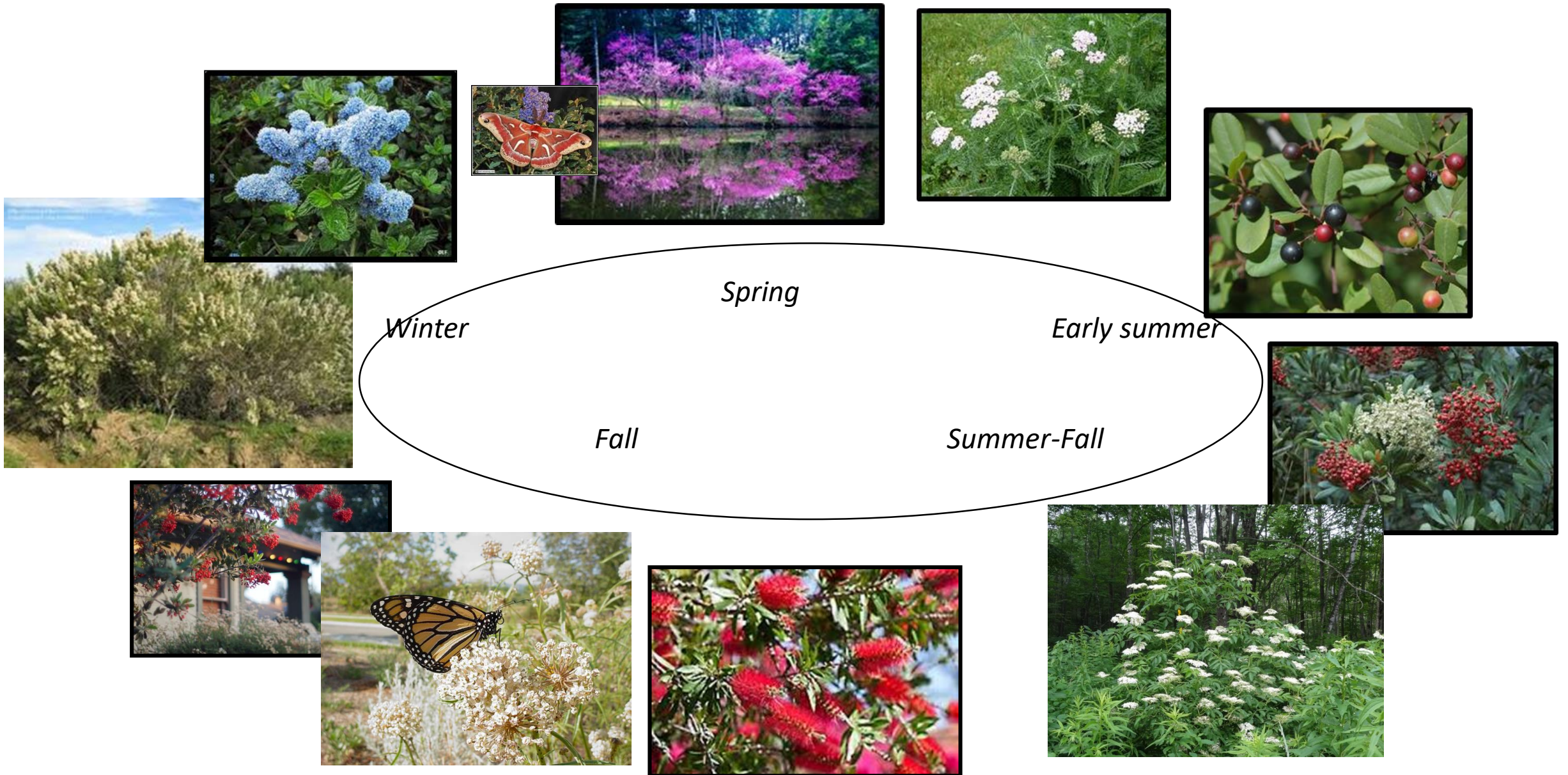


Narrowleaf milkweed

- *Narrowleaf milkweed (Asclepias fascicularis)*, also known Mexican whorled milkweed.
- *Flowering perennial, 1 ½ to 3 ft. high.*
- Blooms with white-lavender flowers in summer-fall.
- Is drought tolerant.
- Deer resistant.
- *Is a specific monarch butterfly food and habitat plant.*
- Plan on Monarch caterpillars munching on the leaves

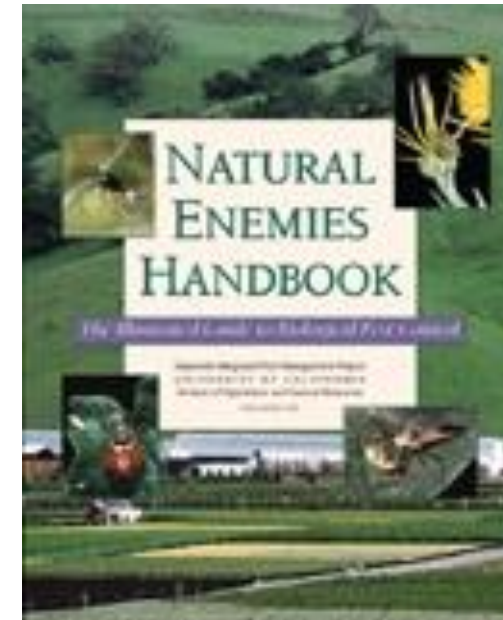


Year-Round Party Your Garden Friends Will Love



Resources

- Quick Tip cards available at <http://www.ipm.ucanr.edu/QT/>
 - Topic choices include: Beneficial Predators, Common Garden Spiders, Lady Beetles, Parasites of Insect Pests
- Pest Notes available at <http://ipm.ucanr.edu/PMG/PESTNOTES/>
 - Topic choices include: Biological Control and Natural Enemies of Invertebrates
- Plant problems diagnostic tool: <http://www2.ipm.ucanr.edu/diagnostics/>
- Natural Enemies Gallery at <http://ipm.ucanr.edu/PMG/NE/>
- Pesticide active ingredients database:
<http://ipm.ucanr.edu/PMG/menu.pesticides.php>
- Publications by the University of California, Division of Agriculture and Natural Resources
 - *Titles include: Natural Enemies Handbook, Pests of Landscape Trees and Shrubs, Pest of the Garden and Small Farm.*
- *Great textbook on entomology: The Insects: An Outline of Entomology, by Penny J. Gullan and Peter S. Cranston, Wiley-Blackwell, 2010.*
- Check web sites for seasonal plant sales at: UC Davis Arboretum, Calif. Native Plant Society, Master Gardeners.



Thanks for coming to this class



UCCE Master Gardeners of El Dorado County
311 Fair Lane, Placerville, Calif. 95667
530-621-5512
mgeldorado@ucdavis.edu

Any Questions?

