Recognizing and Working with Natural Enemies of Insect Pests

Natural Controls

Temperature Extremes

Heavy Rainfall

Abiotic (Weather-related) Controls of Insects

Natural Enemies

- Predators
- Parasitoids
- Pathogens

Parasitoids

Predators

Pathogens

Recognize so you can work with existing natural controls

Life Styles of the Swift and Vicious

Characteristics of Insect Predators

- Immature stages actively hunt prey
- Several prey are consumed in the course of development
- Adults may or may not have similar food needs as immature form

Some Common Arthropod Predators

- Lady beetles
- Ground beetles
- Lacewings
- Flower flies
- Robber flies
- Mantids
- Assassin bugs
- Predatory stink bugs
- Minute pirate bugs
- Predatory thrips
- Predatory mites
- All spiders

LADY BEETLE

Most lady beetle adults are brightly colored

Photograph courtesy Jim Kalisch, University of Nebraska

Upper left: ***Coccidophilus*****, a scale predator**

Lower left: ***Olla*** **sp., a grey colored lady beetle of forests**

Below: ***Chilochorus*** **sp., a predator of various scales**

The “bad apple” of the lady beetle clan

Adult

Eggs

Mexican bean beetle

- a plant feeding lady beetle

Larva

Pupa

Lady Beetle Life Stages

Lady beetles with egg masses

Lady beetle larvae at egg hatch

Lady beetle larvae

Predators of small soft-bodied arthropods (aphids etc…)

Lady beetle prepupae (stage just before they molt to a pupa)

Lady beetle pupae

Stages of a newly molted convergent lady beetle

LADYBIRDS DO THE WORK...

No More Poison Sprays

Use the safe biological method used by government and large growers to destroy aphids, inchworms, Japanese beetles, fruit scales, leafhoppers, boll worms, corn ear worms, mites, etc. Ladybugs (ladybird beetles) live on larvae, eggs and insect pests. About 9000 Ladybugs to the pint. Instructions.

A000455E . . . Ladybugs (½ pint) $9.95
A000463E . . . Ladybugs (1 pint) $15.95

Purchasing lady beetles?

BIOLOGICAL CONTROL ORGANISMS FOR INSECTS AND MITES

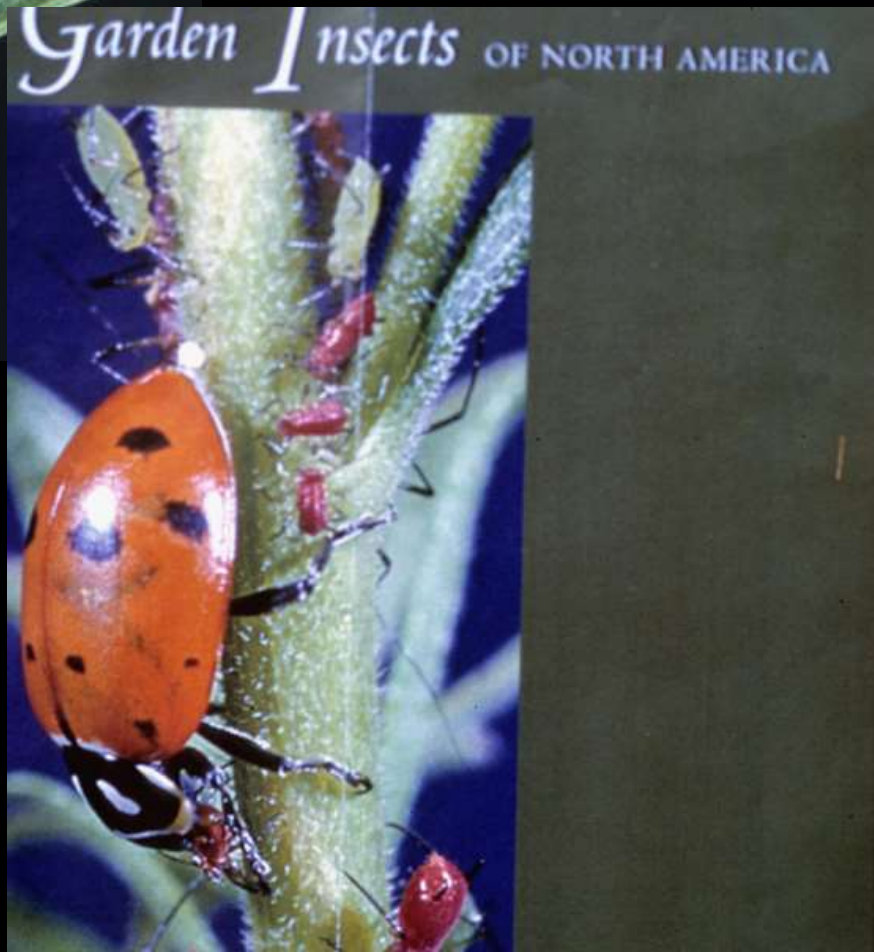
Whitney Cranshaw, Austin Broberg, and Wendlin Burns
Colorado State University
May 31, 2017 Version

A wide variety of beneficial organisms are offered for sale by several suppliers to assist in management of insects and mites. The following is a listing of most of the US suppliers and it is organized into three sections. First is a brief description of organisms with potential applications followed by reference to sources where they may be purchased. This is followed by a brief summary listing of pest groups and the associated potential biological controls. At the end is a listing of addresses of many suppliers/producers.

Predators of Insects/Mites

Convergent Lady Beetle/Lady Beetles. When sold as "lady beetles" or "ladybugs" the species involved is the convergent lady beetle, *Hippodamia convergens*, a native lady beetle found throughout North America. Purchased lady beetles are all field collected insects, captured in high elevation areas of California where they periodically migrate to and mass aggregate, allowing easy collection. Ability of the collected lady beetles to reproduce is suspended (they are in "reproductive diapause") so eggs are not produced for several weeks after release. (Pre-feeding lady beetles prior to release can allow some egg maturation to start and a few companies provide such "pre-conditioned" lady beetles). Lady beetles tend to readily disperse from the area of release. Since they store well, lady beetles are available most of the year, although supplies often are limited by midsummer.

Sources: 1, 2, 4, 5, 8, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 30, 32, 33, 34



Convergent lady beetle (*Hippodamia convergens*) – the lady beetle of commerce

Unlike most lady beetles, the convergent lady beetle often masses during the dormant period

Photograph courtesy of Jim Kalisch, University of Nebraska

Massed lady beetles in the Sierra Nevada Mountains

Photograph courtesy of James Solomon USDA-FS

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Purchasing lady beetles?

Lady beetle releases *are* fun

Conserve and enhance existing lady beetles

Conserving and Enhancing Natural Enemies

- **Don’t kill them**
  - **Limit use of broad spectrum insecticides**
- **Provide foods that the adults need**
  - **Often need nectar, pollen**
- **Provide foods that the immature stages need**
  - **Allow there to be some hosts, prey available**

Adults of many predators use flowers (nectar, pollen) for sustenance

Small, accessible flowers are most commonly used by natural enemies of garden pest insects

Some plants useful for providing food for adult stages of insect predators and parasites

- Most Apiaceae - (dill, fennel, mooncarrot, etc.)
- Yarrow
- Many sedums
- Spurges
- Alyssum
- Basket-of-gold
- Thyme, several herbs

Promote habitat diversity to optimize natural enemies

Principles of Gardening for Insect Natural Enemies

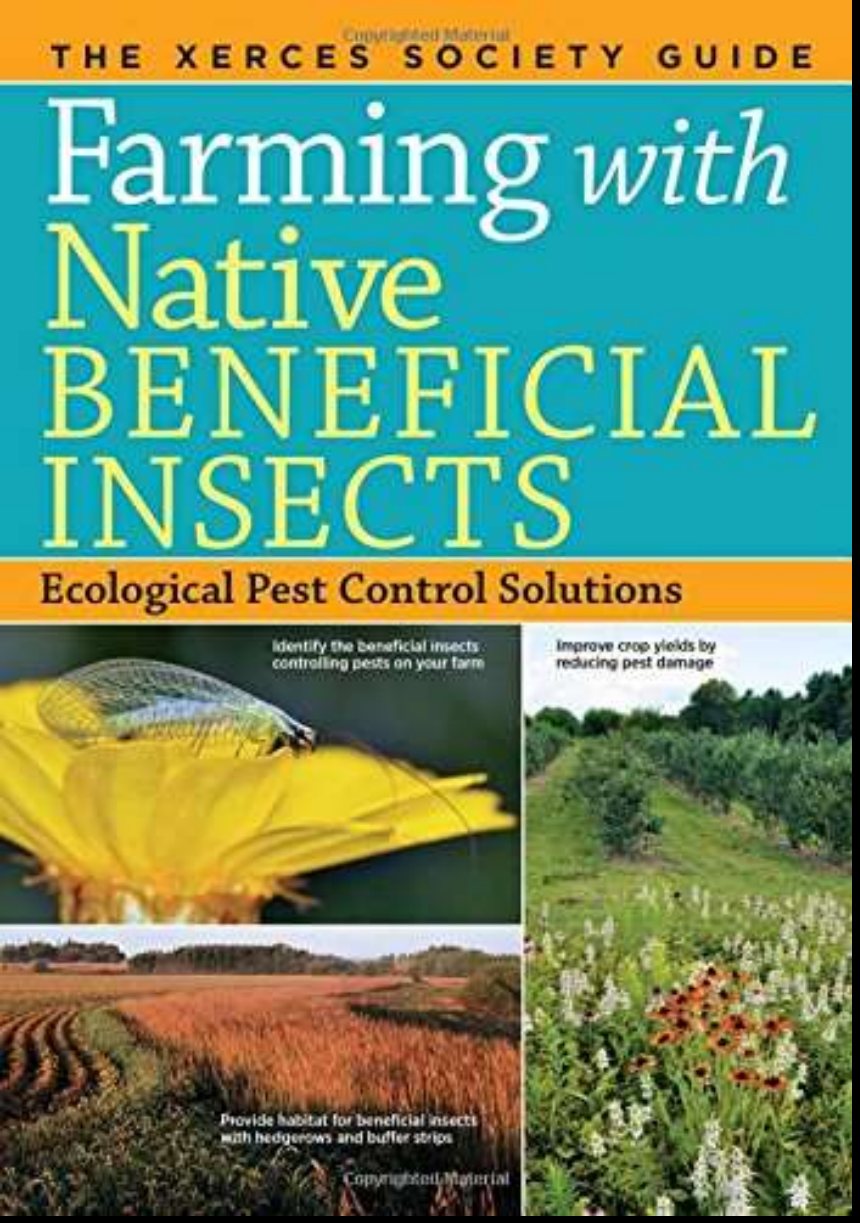
- Learn to recognize them – and don't kill them
- Provide for food needs of adults
- **Provide for food needs of immature stages**
- Provide nest sites, if required

Spirea aphids on my bridal wreath spirea shrub – A pest??

Bridal wreath spirea

Rubber rabbitbrush

Perennial plants that consistently provide predator food sources in my garden

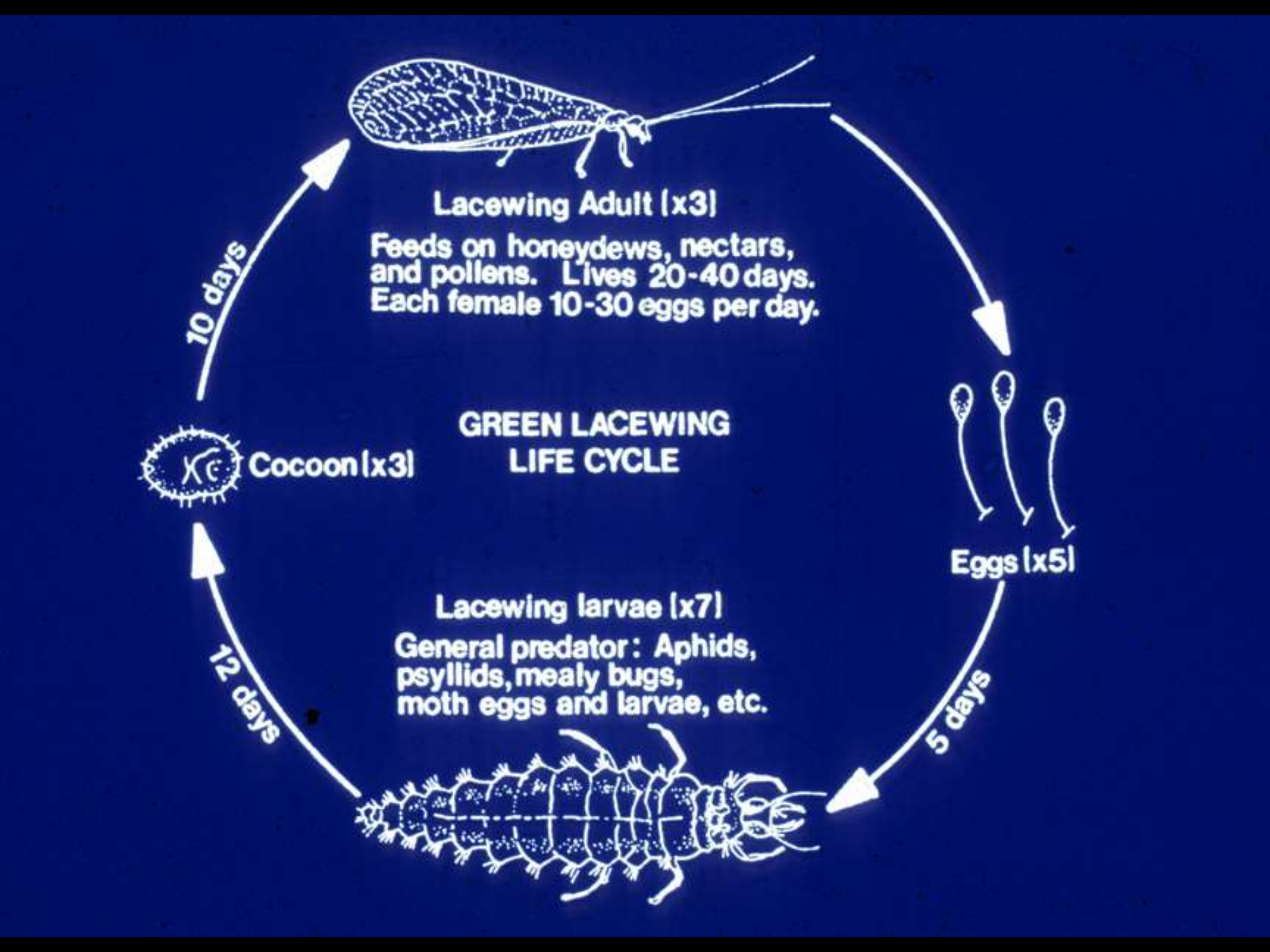


An excellent new publication by the Xerces Society

Green Lacewings

Neuroptera: Chrysopidae

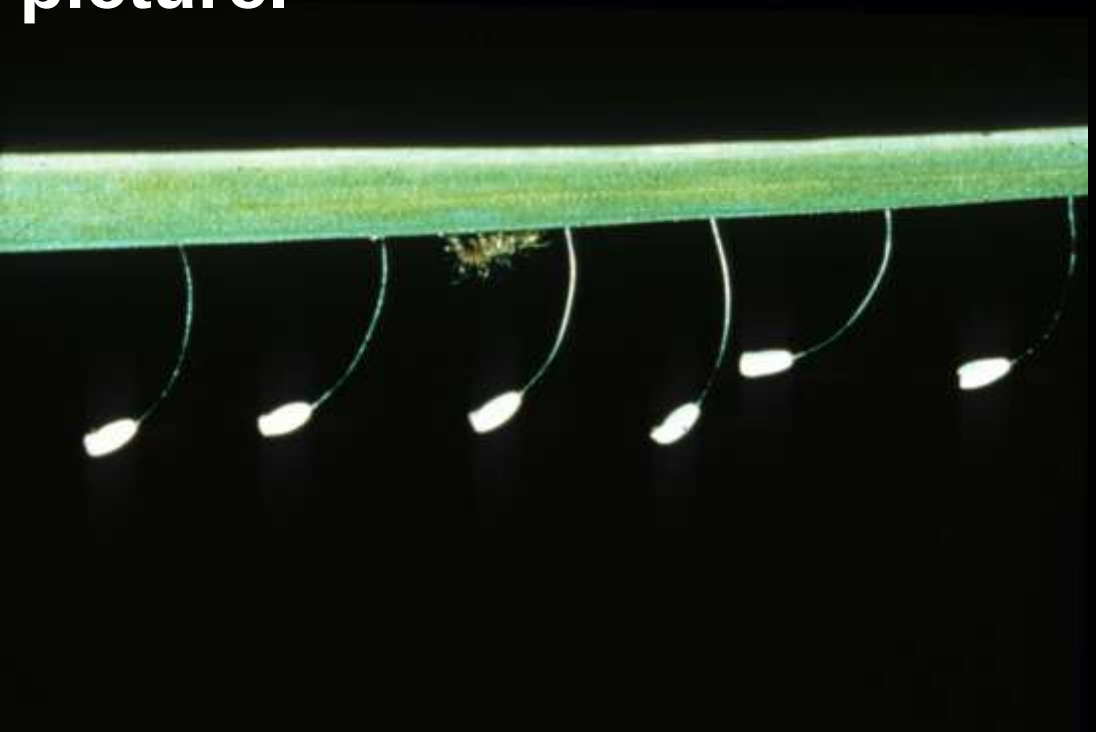
Adult green lacewings maintain themselves on nectar and pollen


Lacewing Adult (x3)
Feeds on honeydews, nectars, and pollens. Lives 20-40 days. Each female 10-30 eggs per day.
10 days
GREEN LACEWING LIFE CYCLE
Eggs (x5)
5 days
Lacewing larvae (x7)
General predator: Aphids, psyllids, mealy bugs, moth eggs and larvae, etc.
12 days
Cocoon (x3)

Green lacewing eggs are uniquely stalked

Green lacewing eggs often are laid in groups.

Egg hatch has occurred in the lower picture.



Photographs courtesy of Brian Valentine

Left: Green lacewing larva eating aphid

Right: Green lacewing larva eating leaf beetle larva

Green lacewing eggs are available from many suppliers that rear/distribute insects

Flower (Syrphid) Flies

Photograph courtesy Brian Valentine

Flower (Syrphid) Flies

Syrphid flies are excellent mimics of bees and wasps

Honey Bees

Honey Bee …or Flower Fly?

UGA2116051

Syrphid egg in aphid colony

Photograph courtesy Brian Valentine

Flower fly larvae

Syrphid “smear’

Characteristics of Insect Parasitoids

- Larvae develop in, rarely on, their hosts
  - One or more larvae develop in a single host
- They are invariably lethal to the host
  - "parasitoids"
- Adults often have different food needs
  - Nectar, honeydew
  - Pollen
  - Insect blood feeding may occur

Common Insect Parasitoids

- Parasitic Hymenoptera
  - Braconid wasps
  - Ichneumonid wasps
  - Chalcid wasps
  - Eulophid wasp
  - Trichogrammatid wasps
- Parasitic Diptera
  - Tachinid flies

Parasitoid Wasps

Ichneumonidae, Braconidae, Eulophidae, Trichogrammatidae, Encrytidae, Chalcidae and other families

Some parasitoid wasps

Females possess an ovipositor (“stinger’)

Photograph courtesy Brian Valentine

Parasitic Wasps – Male (left) and Female (right)

Ectoparasitic wasp larvae on fall webworm caterpillar host

Parasitoid larvae emerging from caterpillar host

Parasitoid larvae (*Cotesia glomeratus*) emerging from cabbageworm host and spinning pupal cocoons

Cocoons of cabbageworm parasitoid

Some parasitoids pupate on the insect host

Left: Buck moth caterpillar

Below: Tobacco hornworm

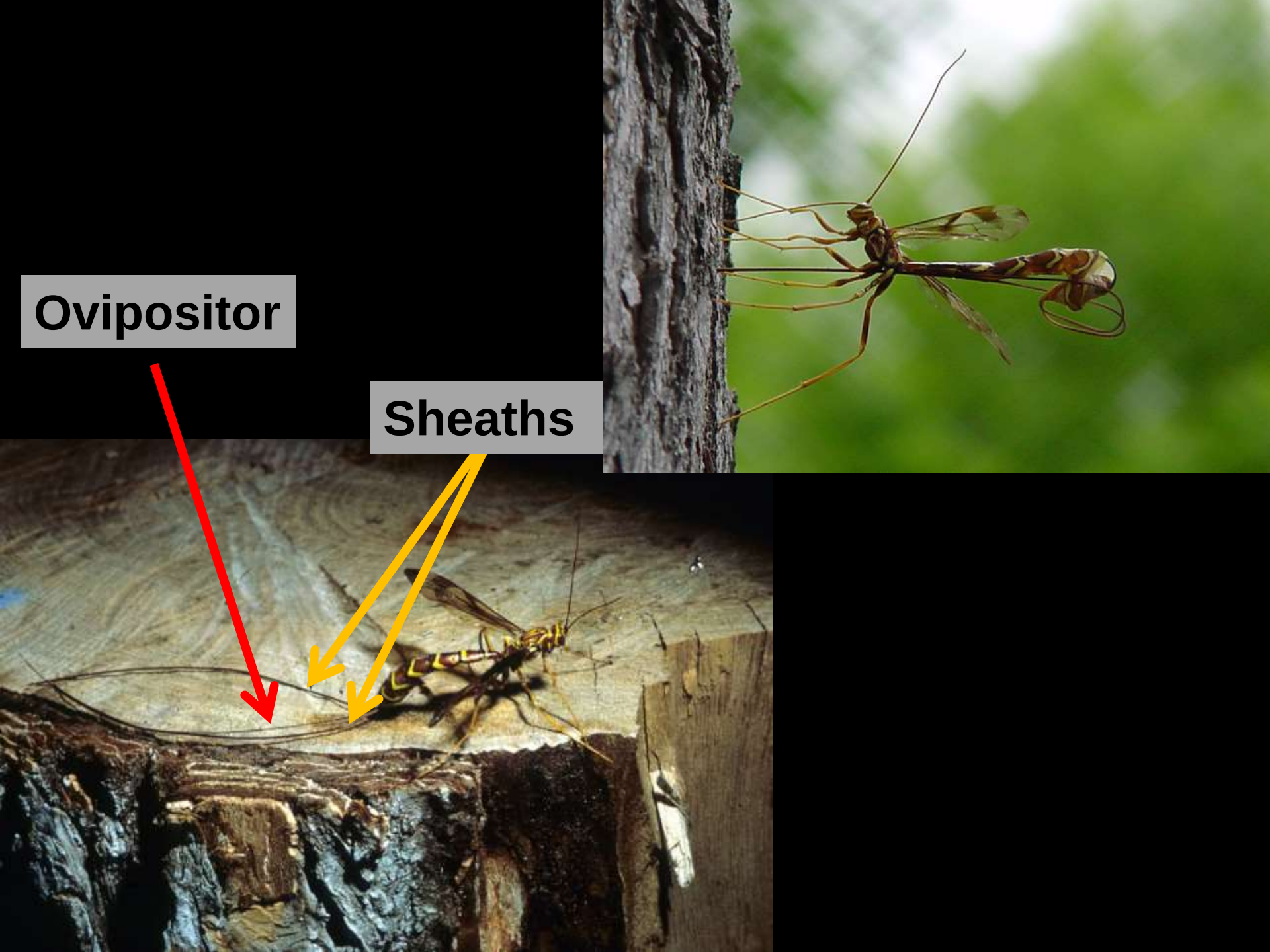
Giant Ichneumon Wasp, Parasitoid of the Pigeon Tremex Horntail

Pigeon Tremex and Giant Ichneumon Wasp

Fact Sheet 5.604

Pigeon tremex – a wood boring wasp of deciduous trees in decline

Giant ichneumon wasp – the most spectacular natural enemy of the pigeon tremex


Ovipositor
Sheaths

Egg parasitoids

Trichogramma wasps

A type of egg parasitoid

What's wrong with this picture?

"WONDER WASPS"

(Trichogramma)

The Wonder Wasp seeks and destroys the eggs of over 200 pest insects—bollworms, gypsy moths, tomato hornworms, to name a few. She drills into and lays her eggs within the eggs of destructive pest insects, then the newly hatched wasp larvae feed on and destory the host eggs. These wasps *will not sting* people or pets or harm plants, and they coexist with praying mantis and other beneficial insects. Each container provides enough wasps to protect one-half acre of garden or field crop.

A009795E . . . WONDER WASPS—1 vial	**$ 3.95**
A009803E . . . WONDER WASPS—3 vials	**$ 9.95**
A009811E . . . WONDER WASPS—6 vials	**$17.95**
A009829E . . . WONDER WASPS—9 vials	**$24.00**
A009837E . . . WONDER WASPS—12 vials	**$27.95**

(Delivery March thru June)

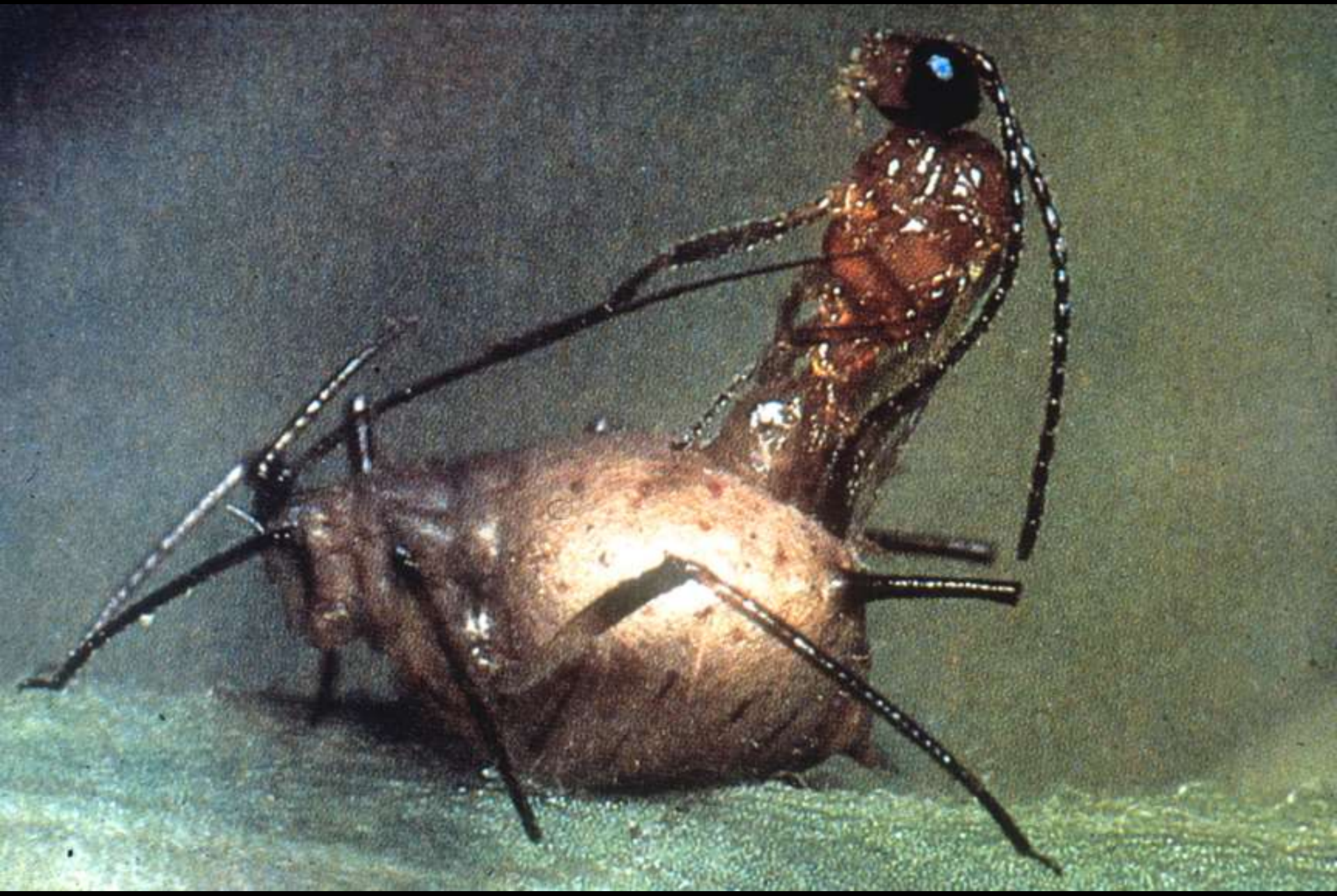
Aphid parasitoids

Host evaluation

Oviposition

Photographs courtesy of
Brian Valentine

Aphid Mummies



Parasitized psyllids (above) and oystershell scales (below)

Parasitized aphids (above) and whiteflies (black forms, below)

TACHINID FLIES

Tachinid Flies

Tachinid fly eggs on caterpillar (above) and squash bugs (upper right) and Japanese beetle (lower right)

Egg
(hatched)
Breathing hole
for larva

UGA1335009

Cluster Flies

Pollenia species

Cluster flies are parasitoids of certain earthworms

Note: They ***do not*** affect the “red wrigglers” or other worms used in vermicomposting!

Cluster flies are characterized by having golden, curled hairs on the thorax

Scenario for Cluster Fly Invasion of a Building

- Flies move to sunlit vertical surfaces when seeking winter shelter
- Flies move upward as sun sets
- Flies enter upper areas of building
- Flies often cluster together behind walls during cool season

Hunting Wasps

Families Sphecidae,
Pompilidae

Ammophila **wasp digging nest (left), carrying caterpillar prey (lower left), at nest entrance with prey (below)**

Bembix wasp digging while holding horse fly prey

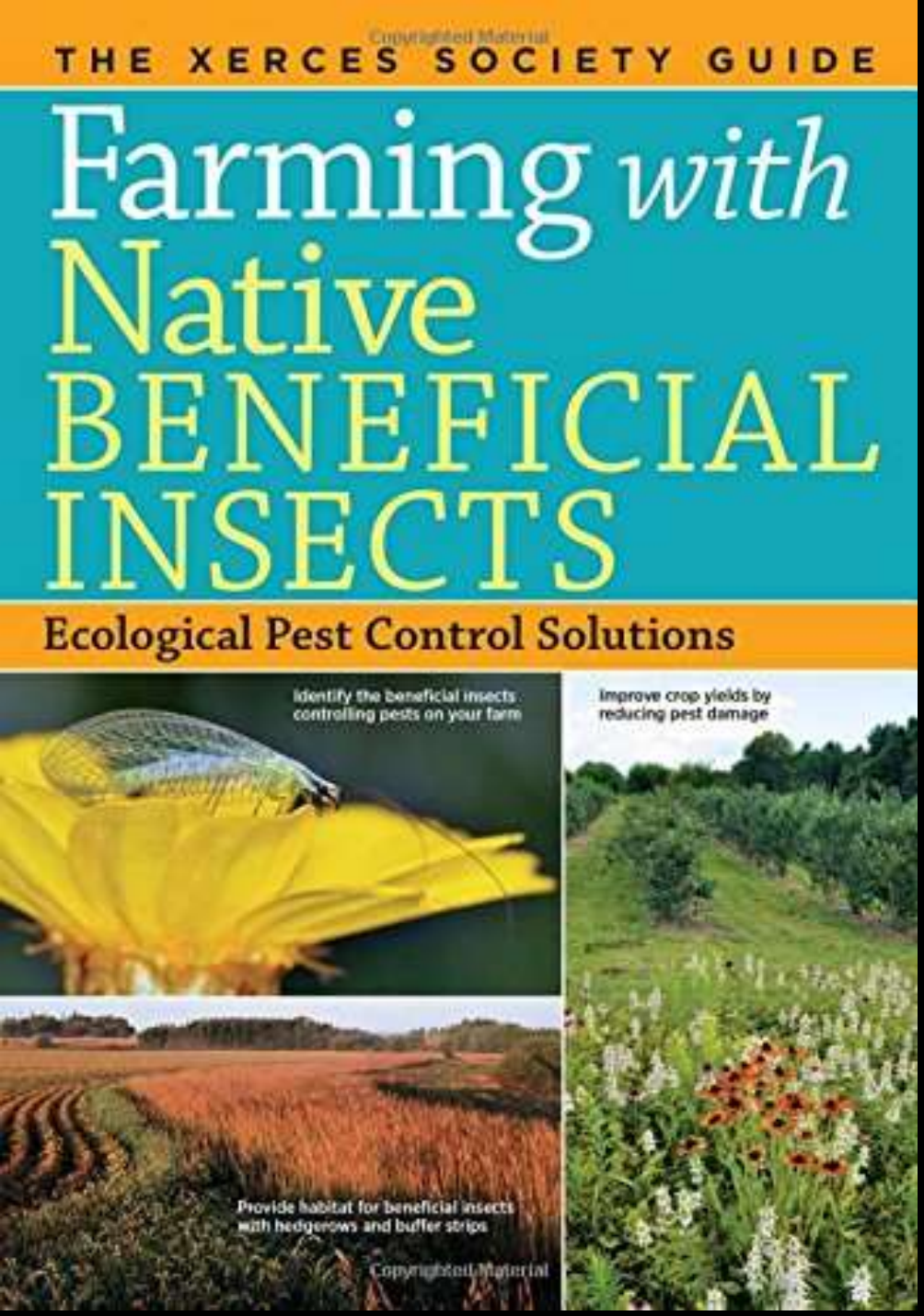
Golden Digger Wasp –
Predator of longhorned grasshoppers/katydids

Cicada Killers –
Largest hunting wasps

***Pemphredon* wasps nest in plant stems and hunt small insects**

Pemphredon **wasps nest in plant stems and hunt small insects**

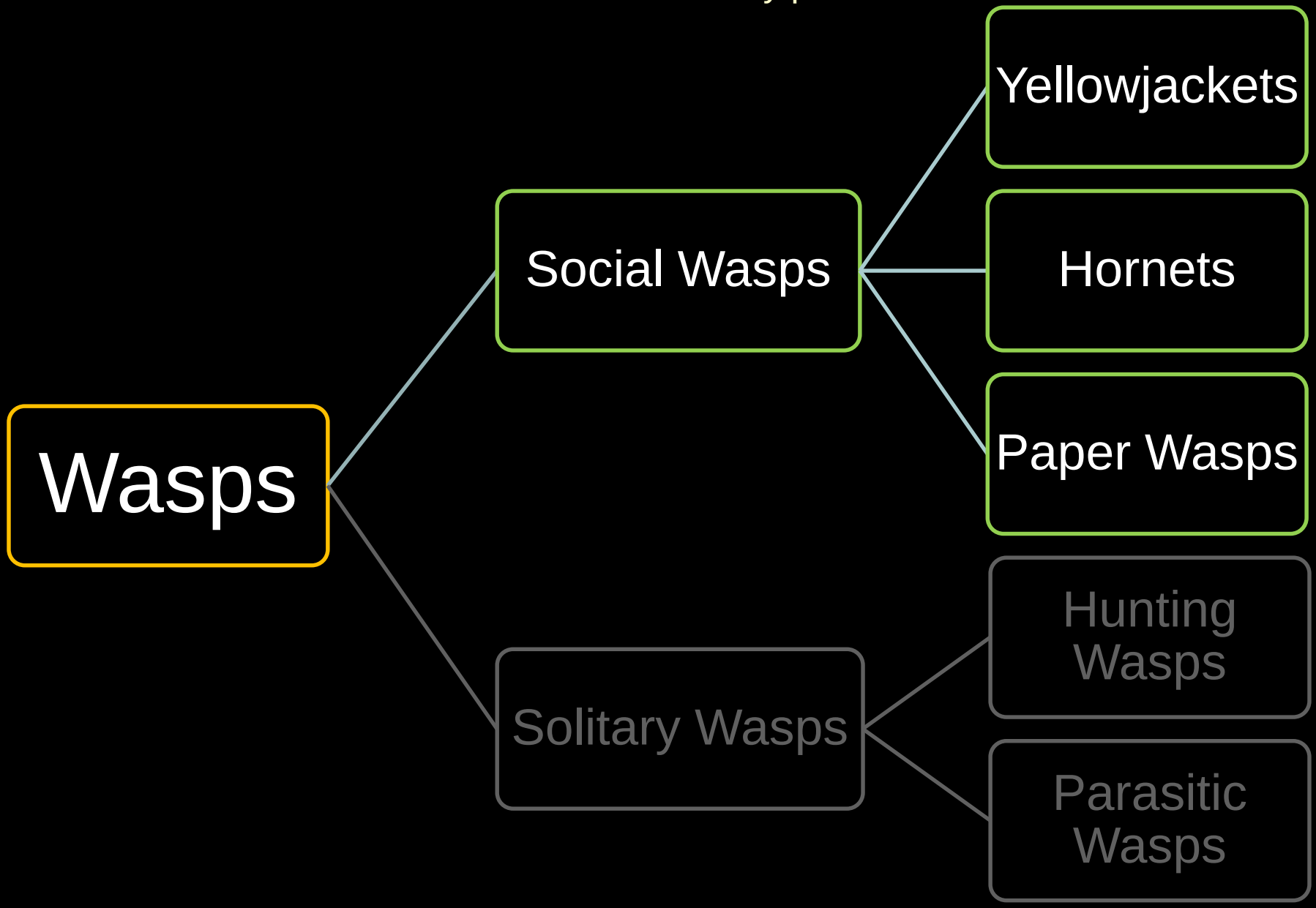
Condominium Project for Pith Nesting Pempredon Wasps



An excellent publication by the Xerces Society

Common Social Wasps

Note: All are annual colony producers



Yellowjackets

Vespula species

Western Yellowjacket (*Vespula pensylvanica*)

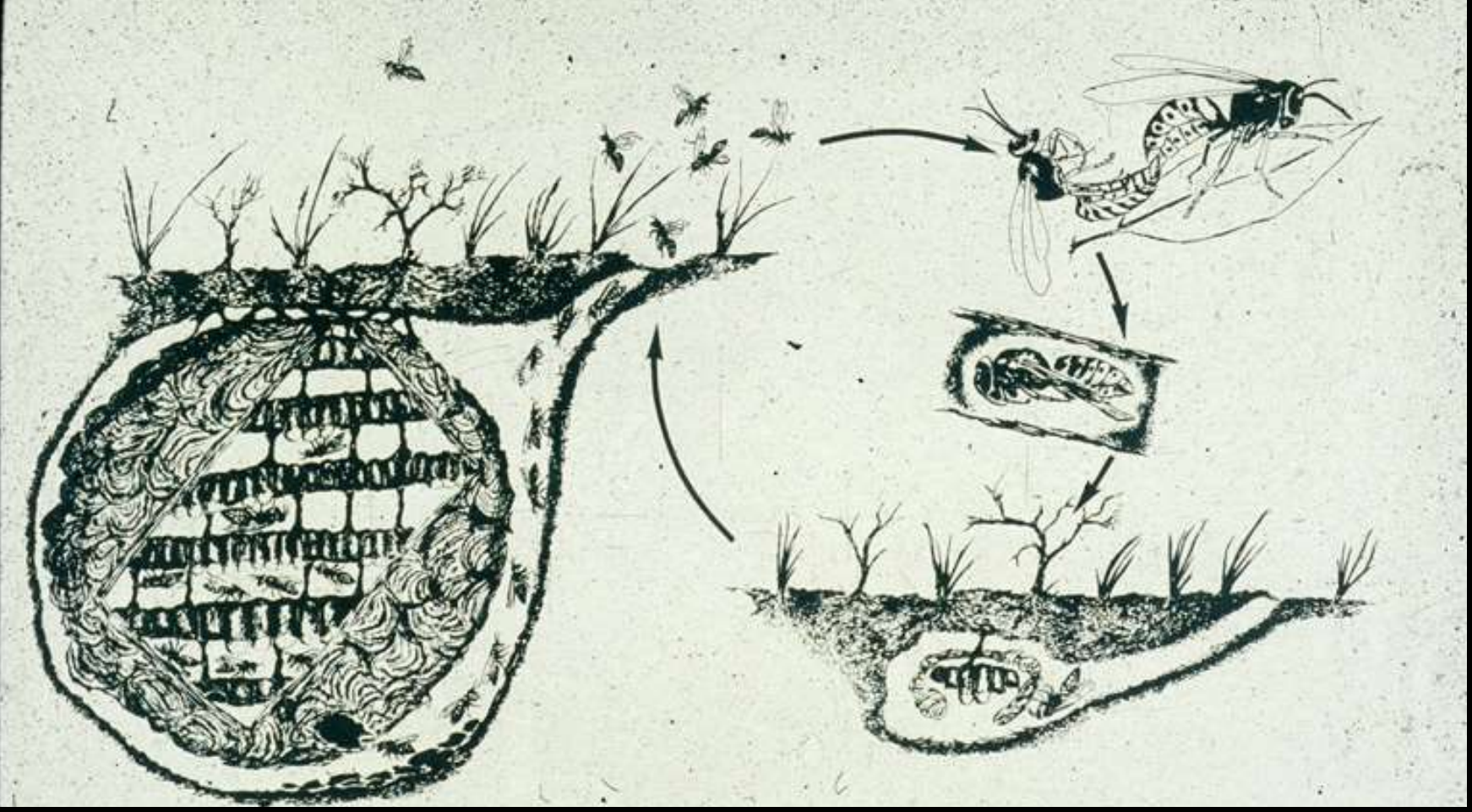
The most important stinging insect in western North America

The western yellowjacket feeds its young animal matter – usually carrion or dead insects

Western yellowjacket scavenging on meat (left), dead earthworm (below, left) and splattered insects on automobile

They will commonly feed on meaty materials in outdoor dining areas

…and also take sweets

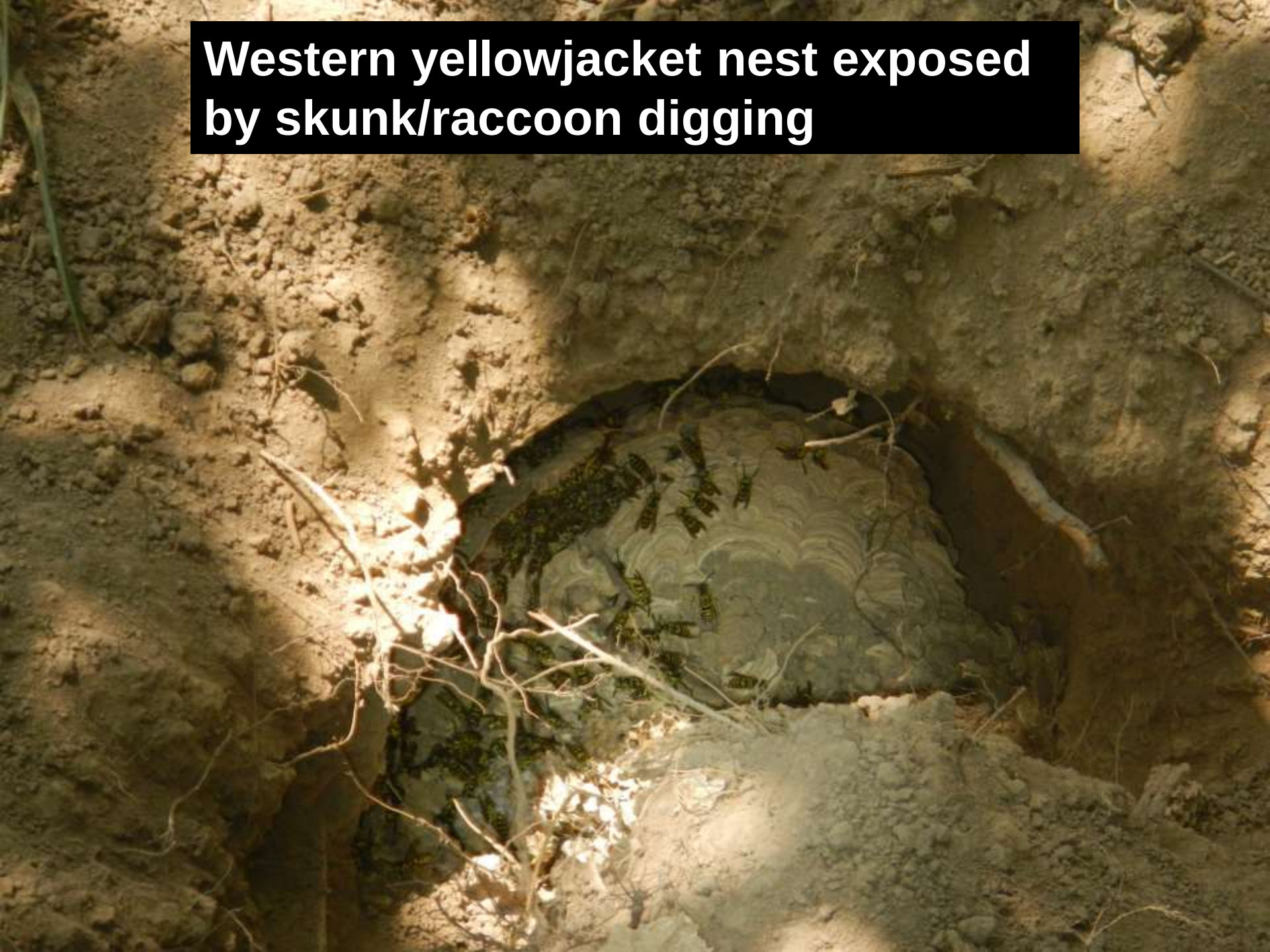


Yellowjackets produce new nest every year.

Nests are established in spring by a single queen.

Nest are abandoned at the end of the season. **Fertilized females – queens – produced near the end of the year are the only stage that survives between seasons.**

Yellowjacket nests are always hidden, usually underground


Western yellowjacket nest exposed
by skunk/raccoon digging

Western yellowjacket nest at base of wall and spruce tree in my yard

Note mud at entrance from excavations during colony expansion

Western yellowjacket nest located in an abandoned compost pile. This was dissected on September 28, 2018

About a foot below the surface
the top of the nest was reached

More complete excavation of
the nest showed it to be about
a foot in diameter

The entrance of the nest was about 18 inches from the opening to the outside of the compost pile

Nests consisted of multiple layers of paper comb

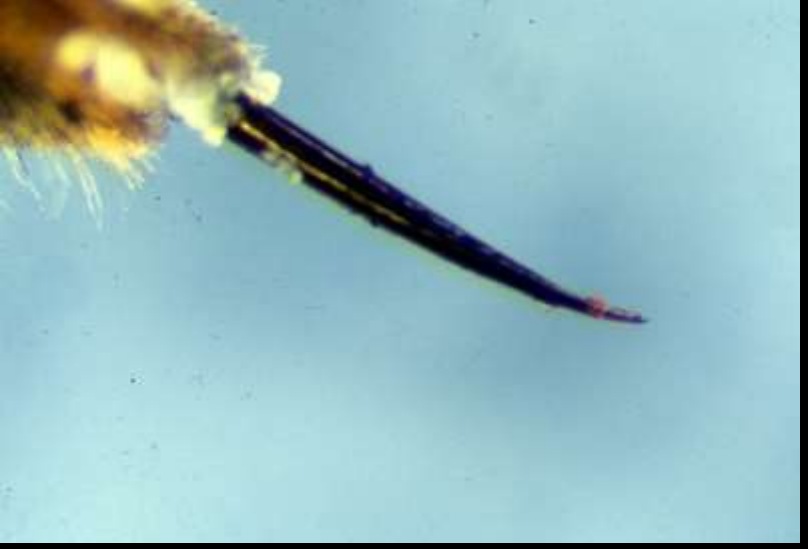
Cells that are capped and appear white have pupae in them

Yellowjacket adult wasp
tending larvae
Van Waters & Rogers Inc.
1987
subsidiary of Univar

Nest entrances are often inconspicuous

Nest entrances are usually guarded

Wasp stingers *are not* barbed



Most “Bee Stings” *Are Not* Produced By Bees!!!!

Yellowjackets are involved in 90%+ of all “bee stings”

Yellowjackets as pollinators?
***Marginal*, at best.**

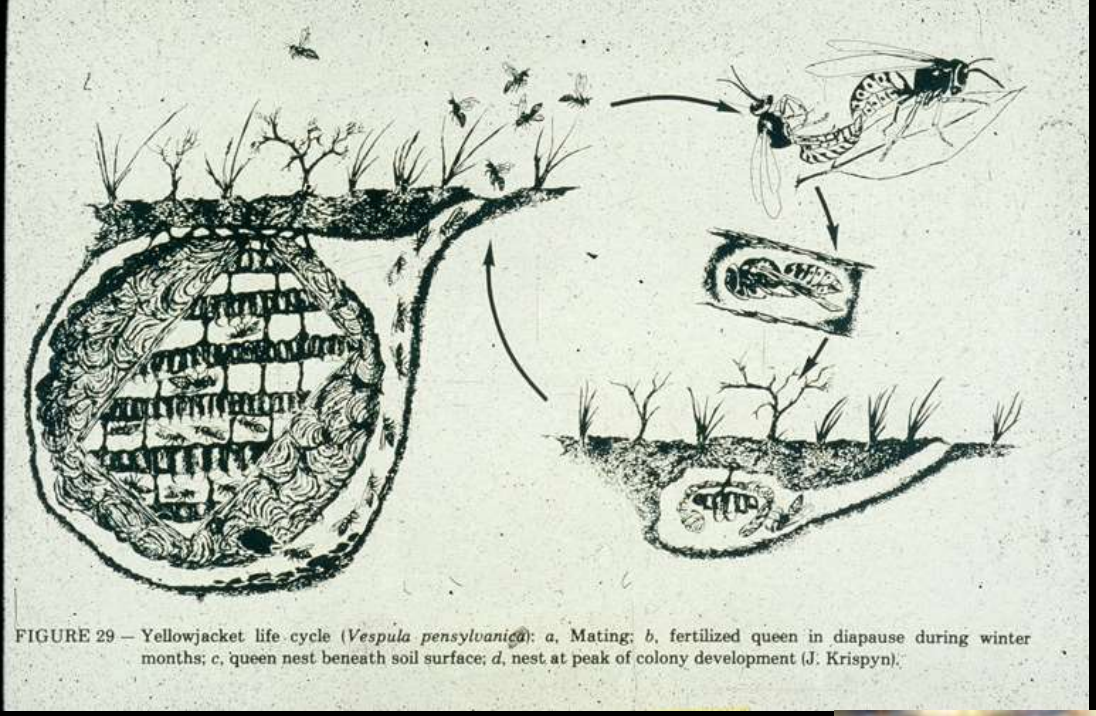


FIGURE 29 — Yellowjacket life cycle (*Vespula pensylvanica*): *a*, Mating; *b*, fertilized queen in diapause during winter months; *c*, queen nest beneath soil surface; *d*, nest at peak of colony development (J. Krispyn).

Nests are **annual**, constructed anew each year

The only stage surviving between seasons are **fertilized queens**, produced in late summer and early fall.

Ultimate colony size can be many hundreds by the end of summer

Only *a few* females, fertilized potential future queens will survive between seasons.

Many traps are sold to capture yellowjacket wasps

Traps that are *very poor* in capturing yellowjackets

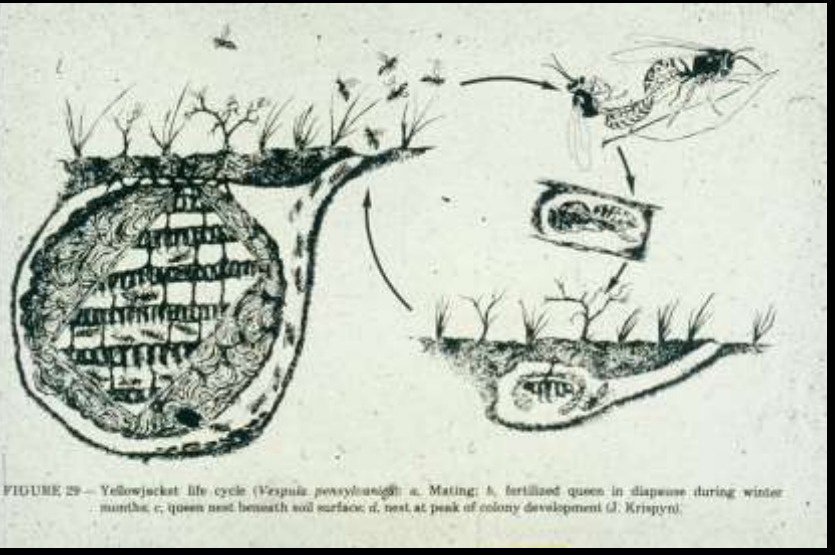


FIGURE 29.—Yellowjacket life cycle (*Vespula pensylvanica*): *a*, Mating; *b*, fertilized queen in diapause during winter months; *c*, queen nest beneath soil surface; *d*, nest at peak of colony development (J. Krispyn).

Most effective use of yellowjacket traps?

Probably early in the year targeting overwintered queens

Hornets

Dolichovespula species

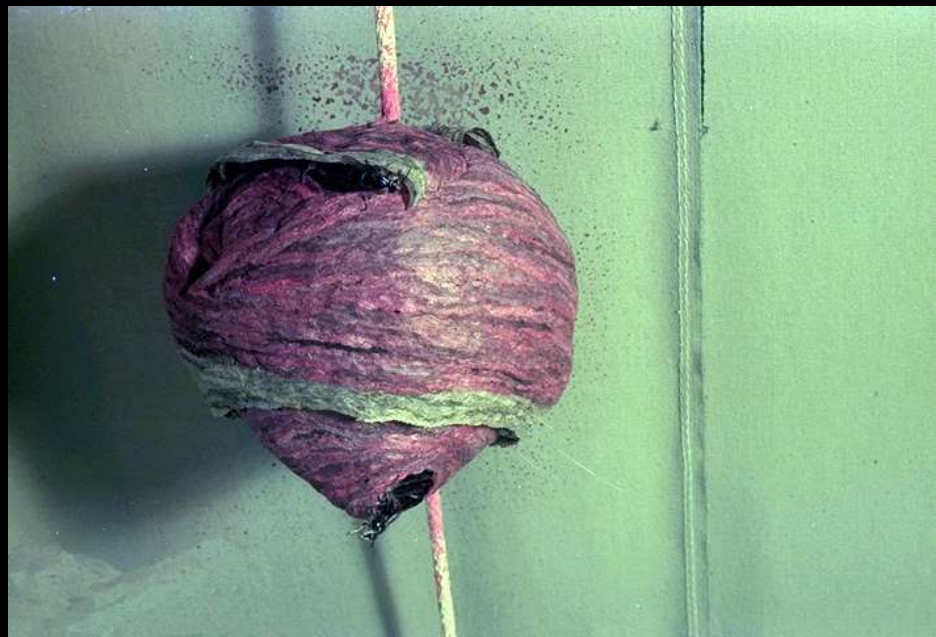
Baldfaced Hornet

Dolichovespula maculata

Baldfaced Hornet Nests in Trees and Shrubs

Baldfaced hornet chewing on weathered wood

Surface of a baldfaced hornet nest



Aerial Yellowjacket, *Dolichovespula arenaria*

Aerial Yellowjacket nests under eaves and on sides of buildings

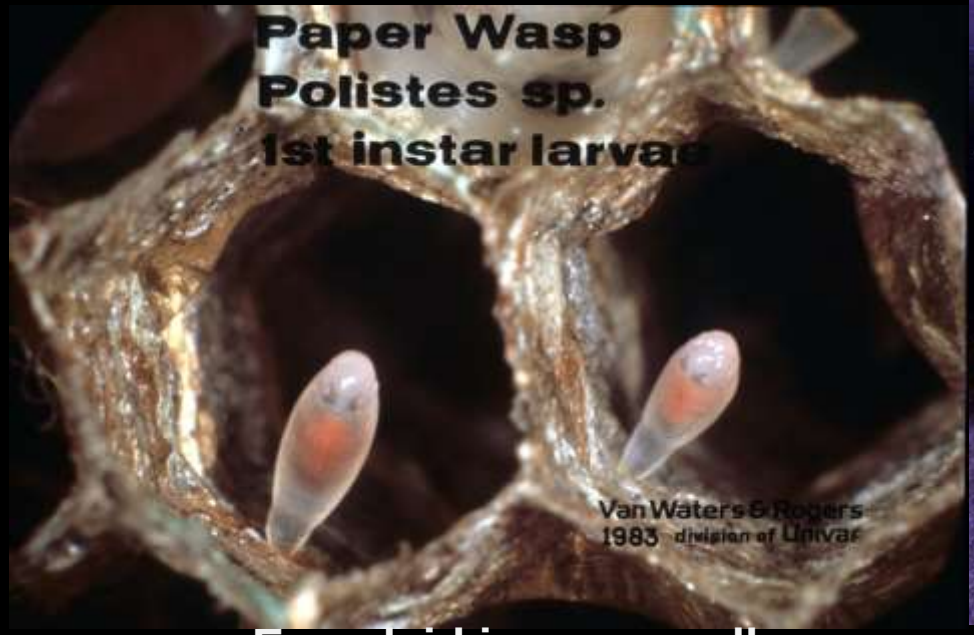
The Stinger of Hornets is Not Barbed

Paper Wasps

Polistes species, primarily

Paper wasp gnawing on weathered board for wood fibers

Photograph courtesy of Joseph Berger



Eggs laid in paper cells

Full grown larvae in paper cells

Pupa exposed in paper cell

The food fed to paper wasp larvae

Live insects chewed into “bug burger”

1983 division of Univar

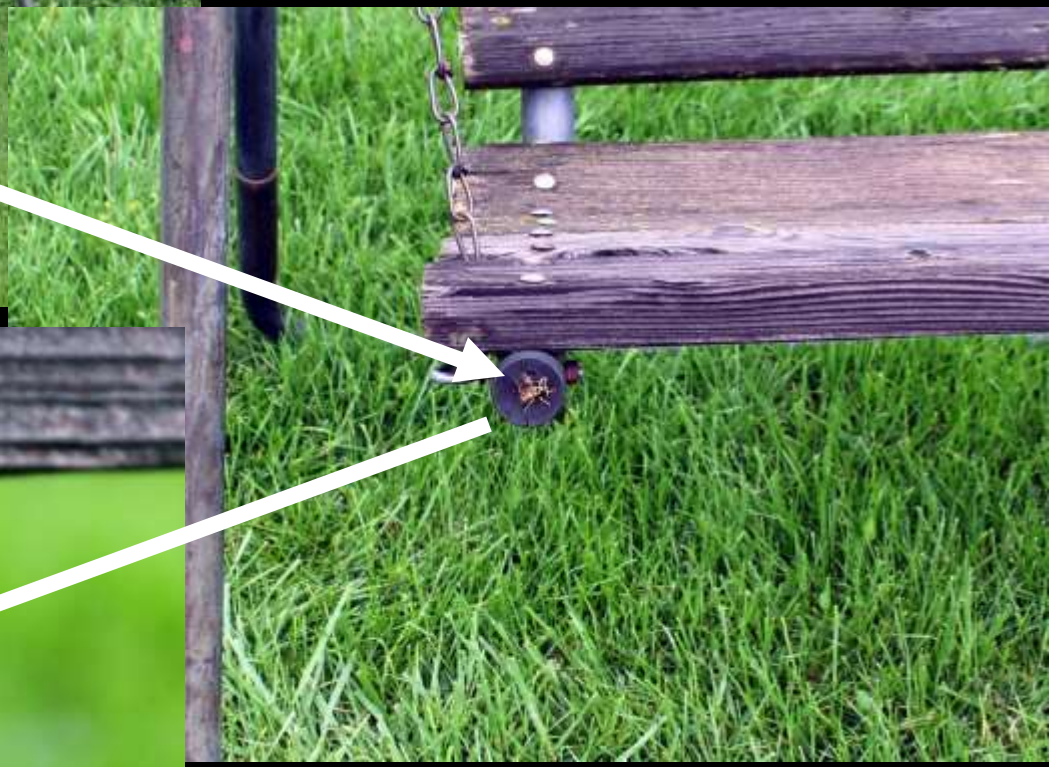
Paper wasps native to Colorado

European Paper Wasp

Polistes dominula

A new species in eastern Colorado (post 2001)

European Paper Wasp Nesting in Metal Building Support



European paper wasps in our clothes line

European paper wasp nest established on growing sweet corn!

Photograph courtesy of Joseph Berger/BugWood.org

Large Nest of European Paper Wasp

European Paper Wasp vs.Western Yellowjacket

- Predator of insects, primarily
- Produces open nests above ground
- Less likely to sting than most social wasps/bees
- Not attracted to wasp traps

- Scavenger. Commonly visits food and garbage.
- Produces below-ground or hidden nest
- Readily stings when nest disturbed
- Attracted to wasp traps

Some Impacts of the European paper wasp on the Rocky Mountain West

- **Added a significant new stinging pest to region**
  - **Highly visible**
- **Impacts on yard/garden Lepidoptera**
- **Stimulates ineffective purchases of wasp traps**

Nests are ubiquitous and very frequently observed. Stings are common, although not as common as by western yellowjacket.

Impacts on yard/garden Lepidoptera

Impacts on Butterfly Gardening

European Paper Wasp

Western Yellowjacket

Western yellowjacket
Note trailing legs of European paper wasp

Traps do not capture the European paper wasp or any other paper wasps

WHY Trap

Wasp

Hornet

Yellowjacket

European Paper Wasp vs.Western Yellowjacket

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