Recognizing and Working with Natural Enemies of Insect Pests

Natural Controls

Temperature Extremes

Heavy Rainfall

Abiotic (Weather-related) Controls of Insects

Natural Enemies

- Predators
  - Hunting wasps
- 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

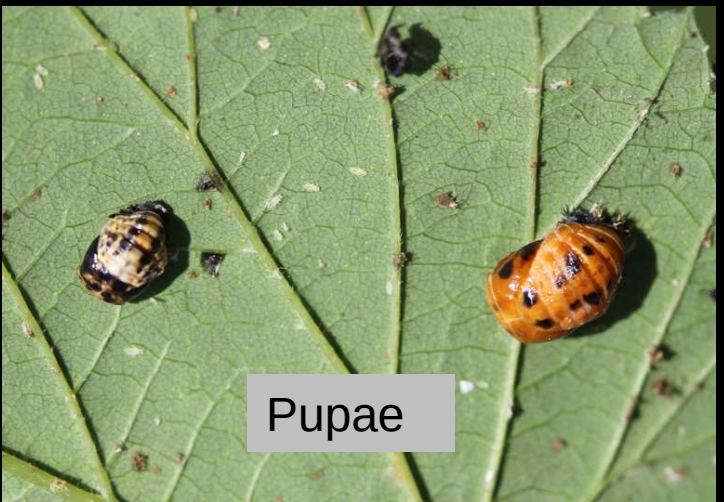
Mexican bean beetle

- a plant feeding lady beetle

Larva

Pupa

Lady Beetle Life Stages



Lady beetles with egg masses

Lady beetle 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?

A handout available through the UW website

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.

Regulatory Note: Under current pesticide law, biological control organisms that involve microbes – such as bacteria, viruses, or fungi – are classified as pesticides and can only be used on crops for which they are labeled. These are in the section *Pathogens of Insects*. "Higher" organisms used for insect control – such as other insects, predatory mites and nematodes – are exempt and can be used on all crops.

Predators of Insects/Mites

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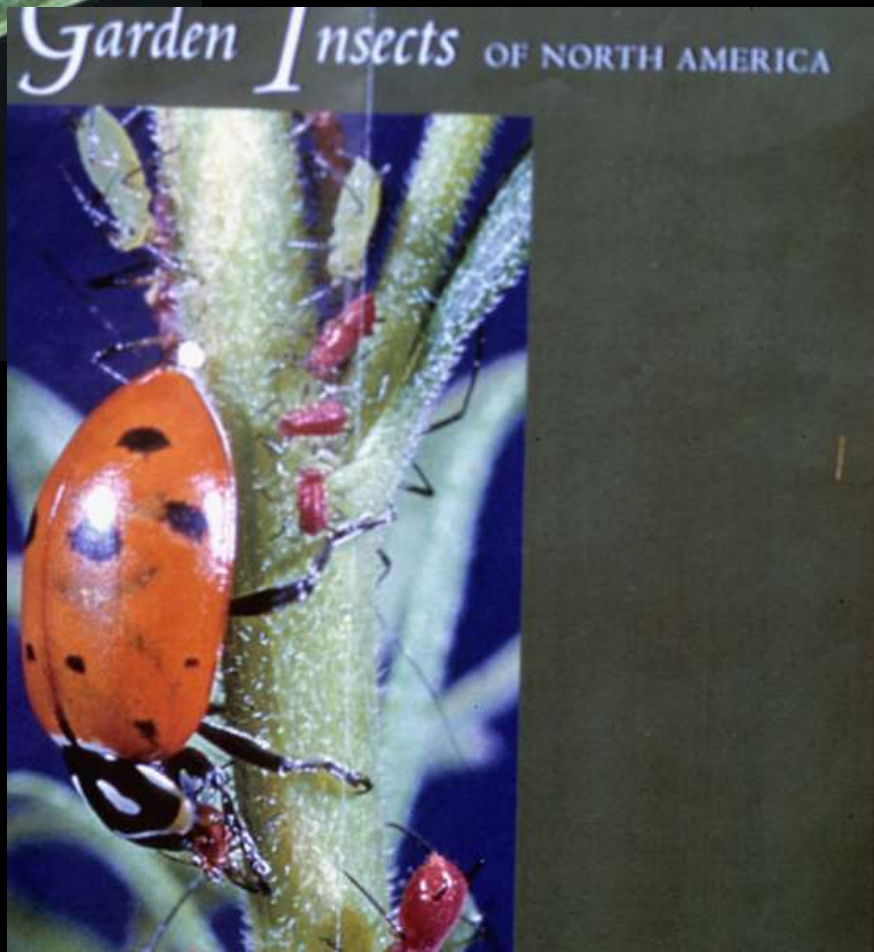

Convergent lady beetle (*Hippodamia convergens*) – the lady beetle of commerce

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

My favorite plant for insect action

Mooncarrot

Seseli gummiferum

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??

Perennial plants that consistently provide predator food sources in my garden

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THE XERCES SOCIETY GUIDE

Farming with Native BENEFICIAL INSECTS

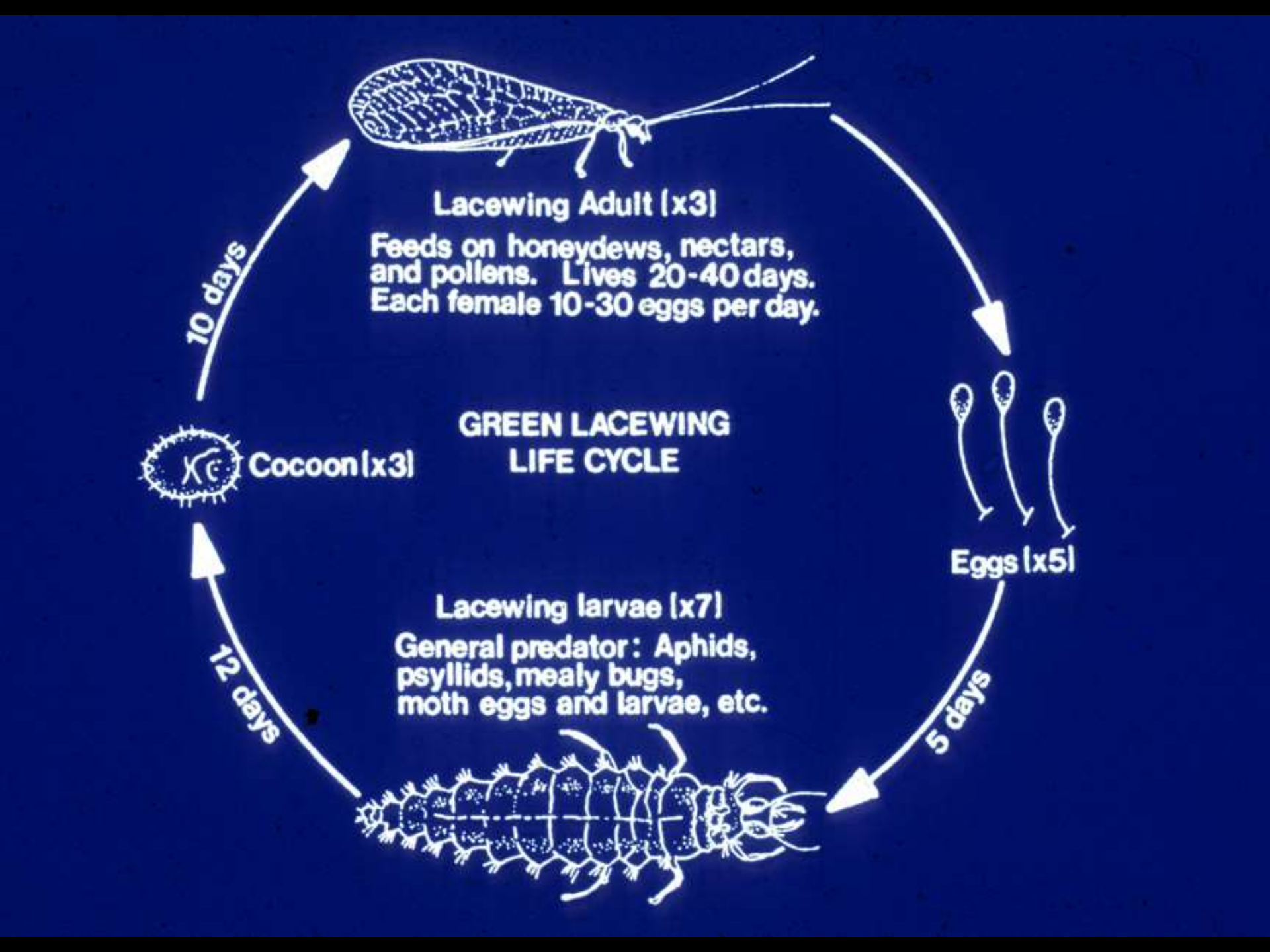
Ecological Pest Control Solutions

An excellent new publication by the Xerces Society

Green Lacewings

Neuroptera: Chrysopidae

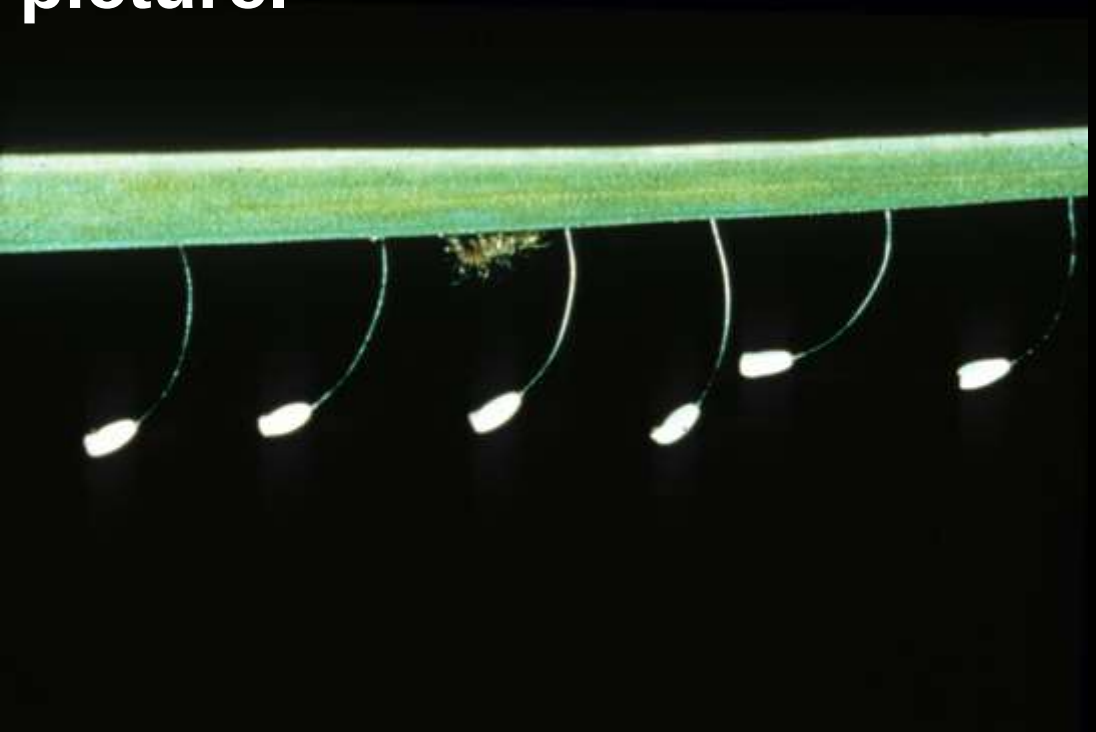
Adult green lacewings maintain themselves on nectar and pollen


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 elm scales

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?

Fly or Bee?

Syrphid egg in aphid colony

Photograph courtesy Brian Valentine

Flower fly larvae

Syrphid “smear’

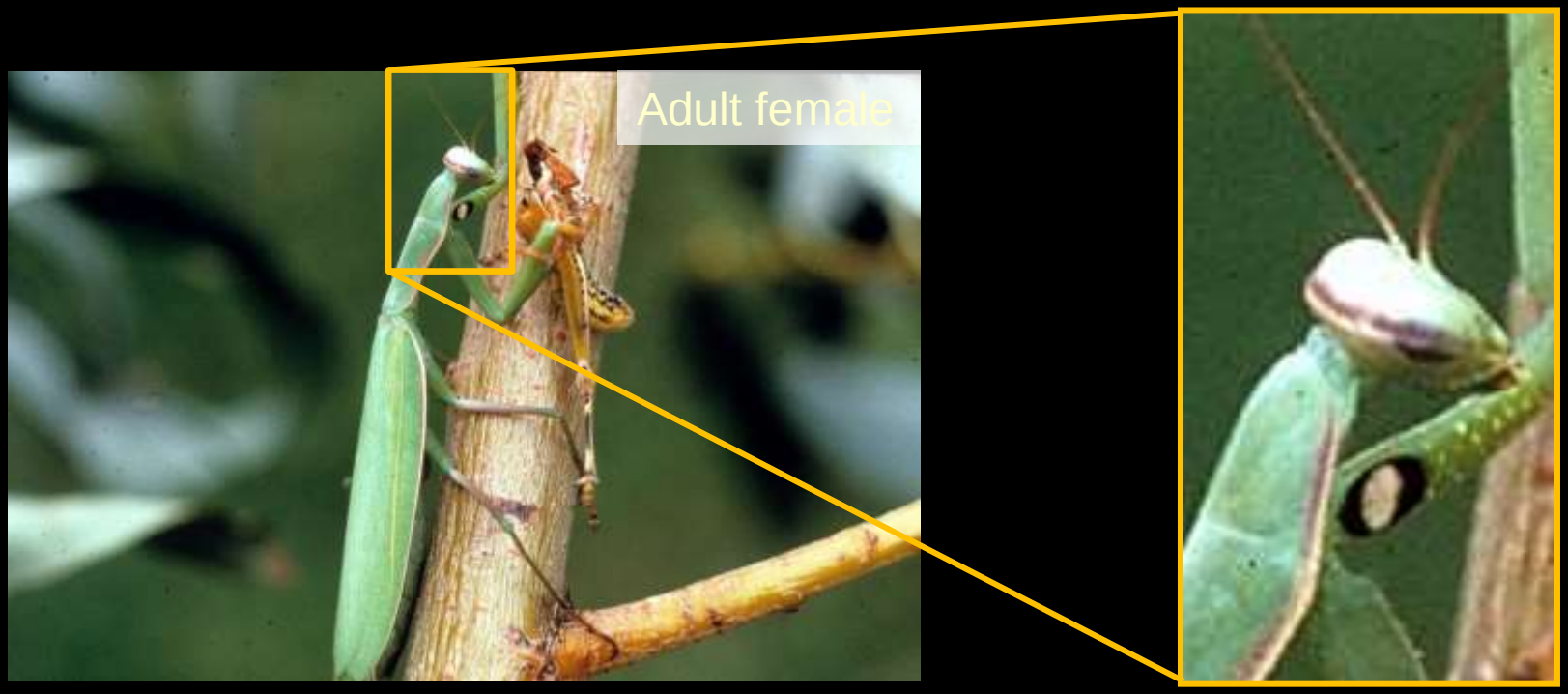
Order Mantodea

Mantids

European Mantid

Mantis religiosa

European mantid – Armpit “bullseye”



European mantid life stages

Adult female, green morph

Adult male, brown morph

Nymph

Egg case (ootheca)

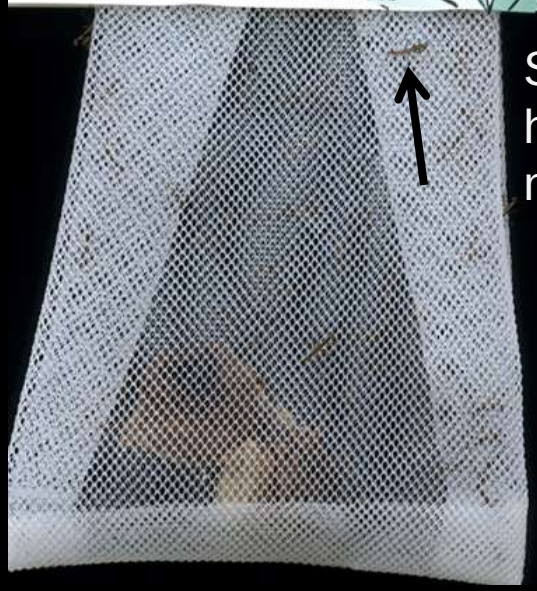
Mantis Egg Laying

European mantid egg cases

Chinese Mantid

Tenodera sinensis

Chinese mantid



Some newly hatched nymphs

Adult

Chinese Mantid

This mantid is “the mantid of commerce” because its ootheca is commonly sold at garden centers for biological control of pest organisms.

Egg cases of the Chinese mantid are sold by some nurseries and in some garden catalogs

I hope not!!

THE GENTLE GIANT

KIND to humans . . . DEADLY to garden pests!

No need for dangerous chemical sprays when you make a valuable ally of the helpful Praying Mantis! Maintain the balance of nature by "planting" its fertile eggs in your own garden—they hatch at the proper time and remain until all harmful aphids, lice and many other pests that plague your precious foliage, fruit and flowers are devoured. Each hardy egg cluster contains hundreds of eggs which hatch and thrive on insects, then lay their own eggs for next season's life cycle. Comes with full instructions for storage and use.

A006148Y . . . Praying Mantis Egg Cluster
$1.95 each; 3 for $4.99; 6 for $8.49; 12 for $14.79

Carolina Mantid

Ground Mantid

North American Native

Carolina Mantid

Stagmomantis carolina

All Spiders are Predators

Hunting Wasps (Solitary)

Families Crabronidae, 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

Hunting Wasps (Social)

Hymenoptera: Vespidae

Paper Wasps

Polistes species, primarily

Paper wasp gnawing on weathered board for wood fibers

Photograph courtesy of Joseph Berger

1983 division of Univar

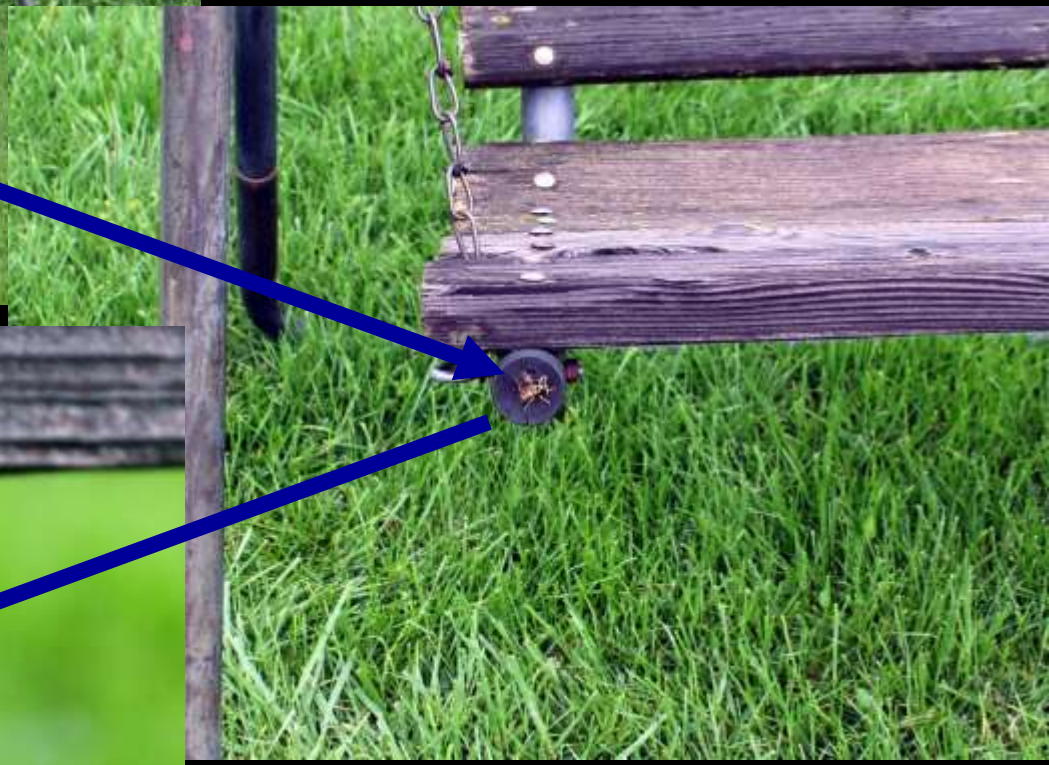
Paper wasps feed their young freshly killed insects (mostly caterpillars) that they capture and chew

Paper wasps native to Colorado

European Paper Wasp

A new species in Colorado (post 2001)

European Paper Wasp Nesting in Metal Building Support



Yellowjackets

Vespula species

Western Yellowjacket (*Vespula pensylvanica*) – Key nuisance wasp of the western United States

Western yellowjacket feeding on fresh chicken parts

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

Yellowjackets almost always nest below ground

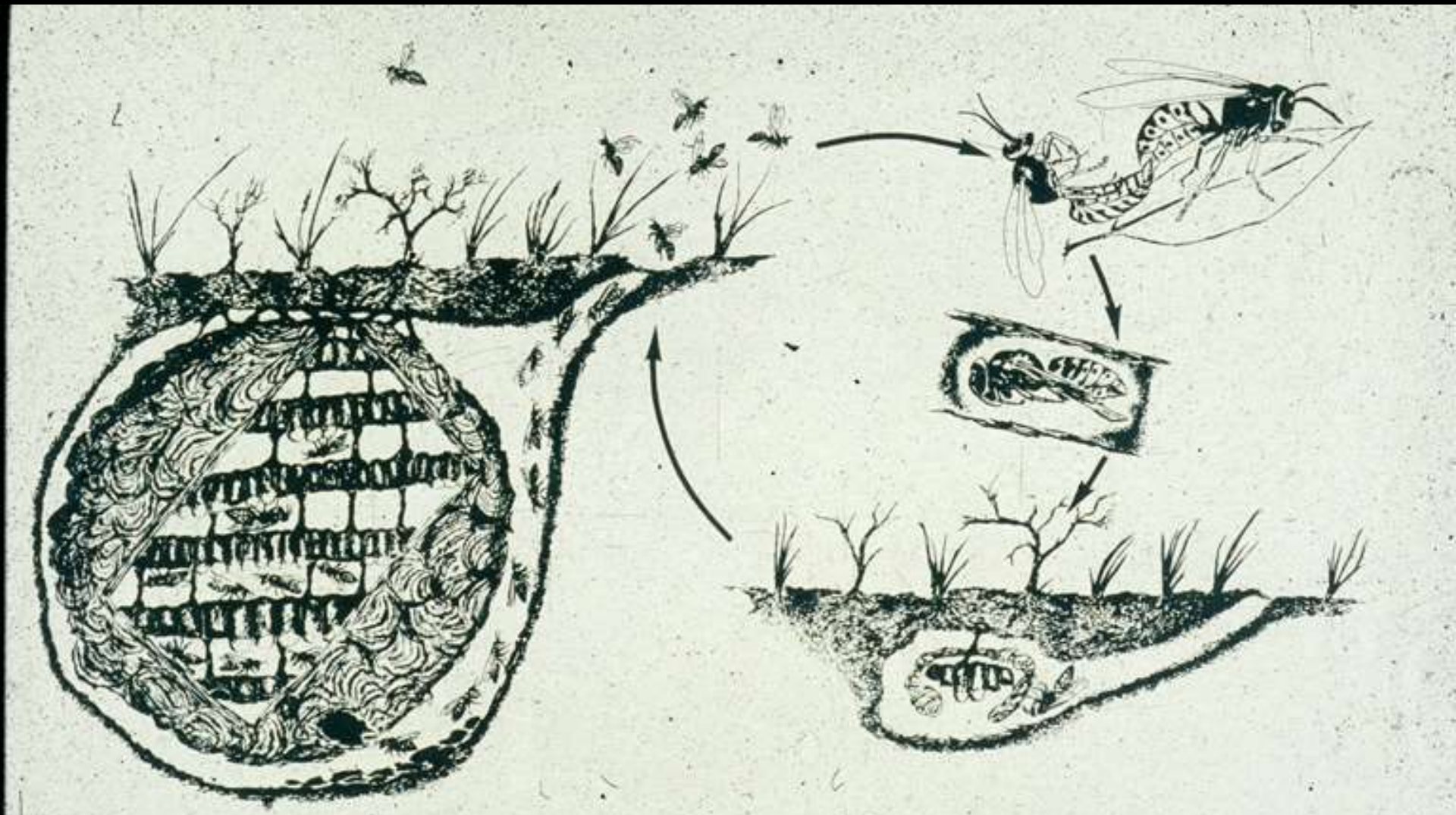
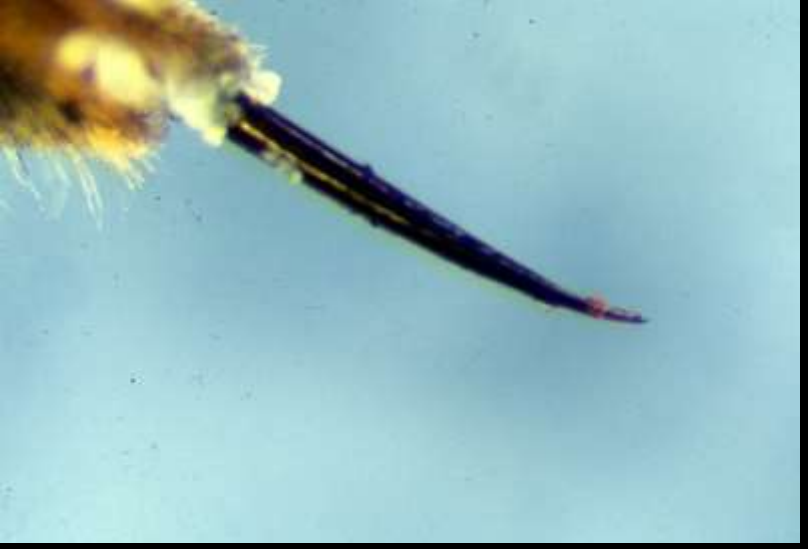


FIGURE 29 — Yellowjacket life cycle (*Vespula pensylvanica*): *a*, Mating; *b*, fertilized queen in diapause during winter months; *c*, queen nest beneath soil surface; *d*, nest at peak of colony development (J. Krispyn).

1
2
3
STANLEY
4
5
6
7
8



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

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

Yellowjackets as pollinators?

***Marginal*, at most.**

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

Parasitic Wasps

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

Some parasitic 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 – a wood boring wasp of deciduous trees in decline

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

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)

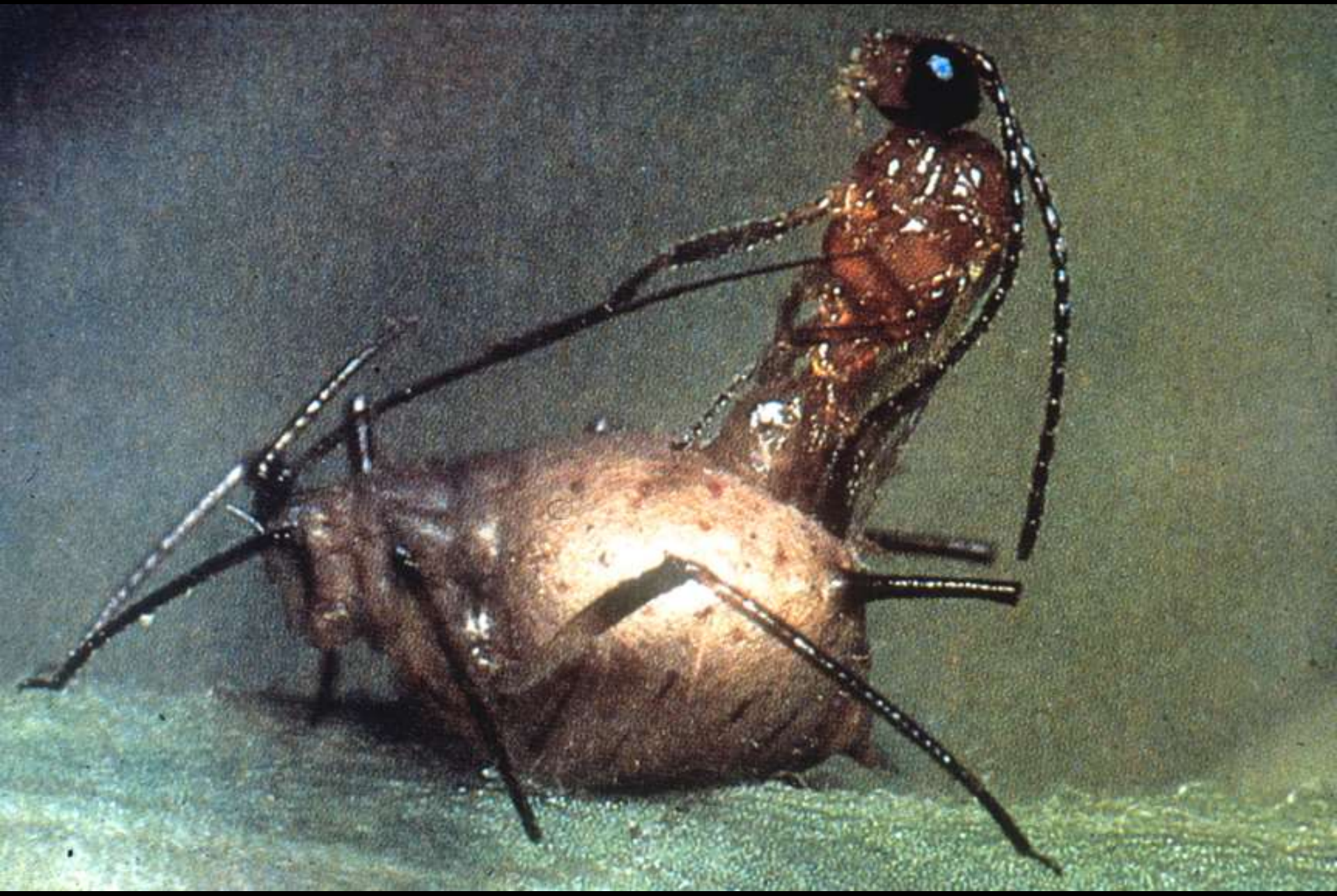
Aphid parasitoids

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)

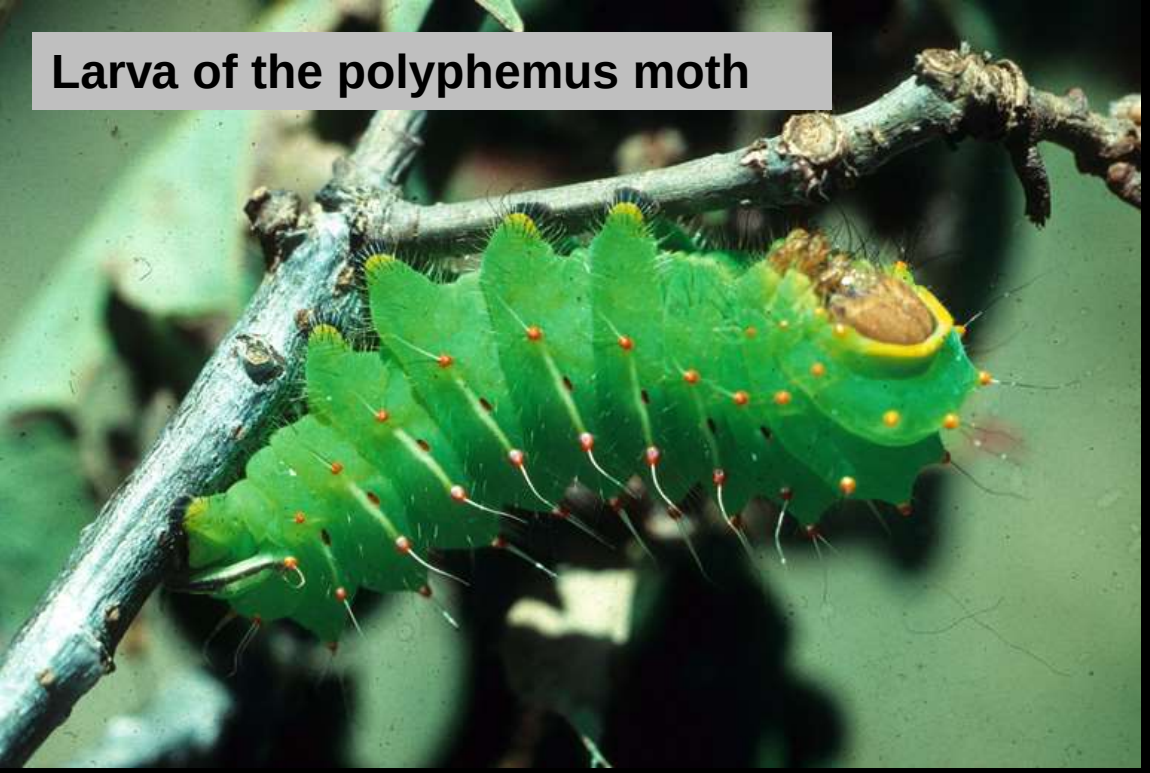
Cabbage looper supporting six developing tachinid fly larvae

Tachinid fly pupae within killed cabbage looper larva

Caterpillars killed by tachinid flies

Photograph courtesy of Ken Gray/Oregon State University

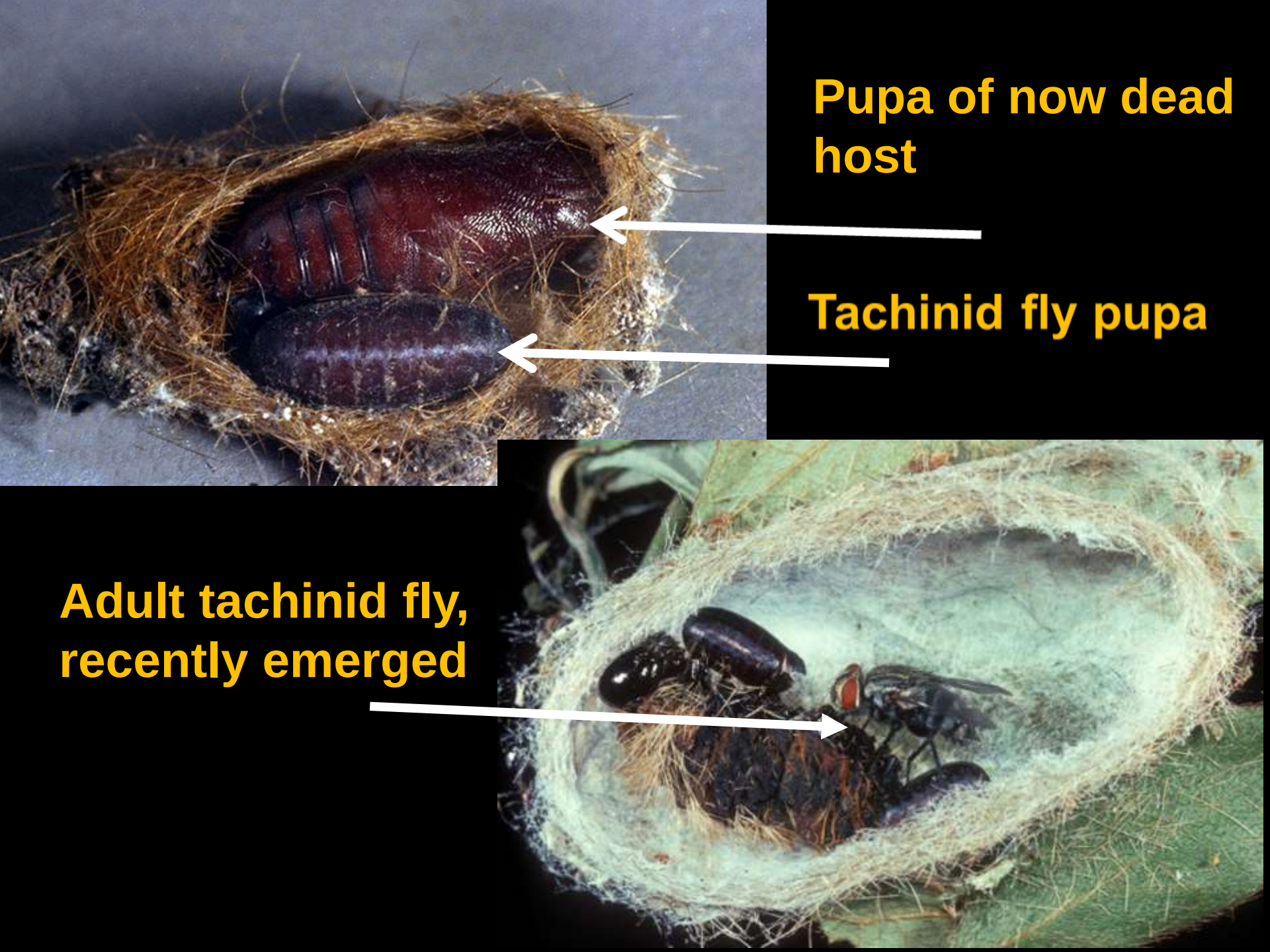
Larva of the polyphemus moth

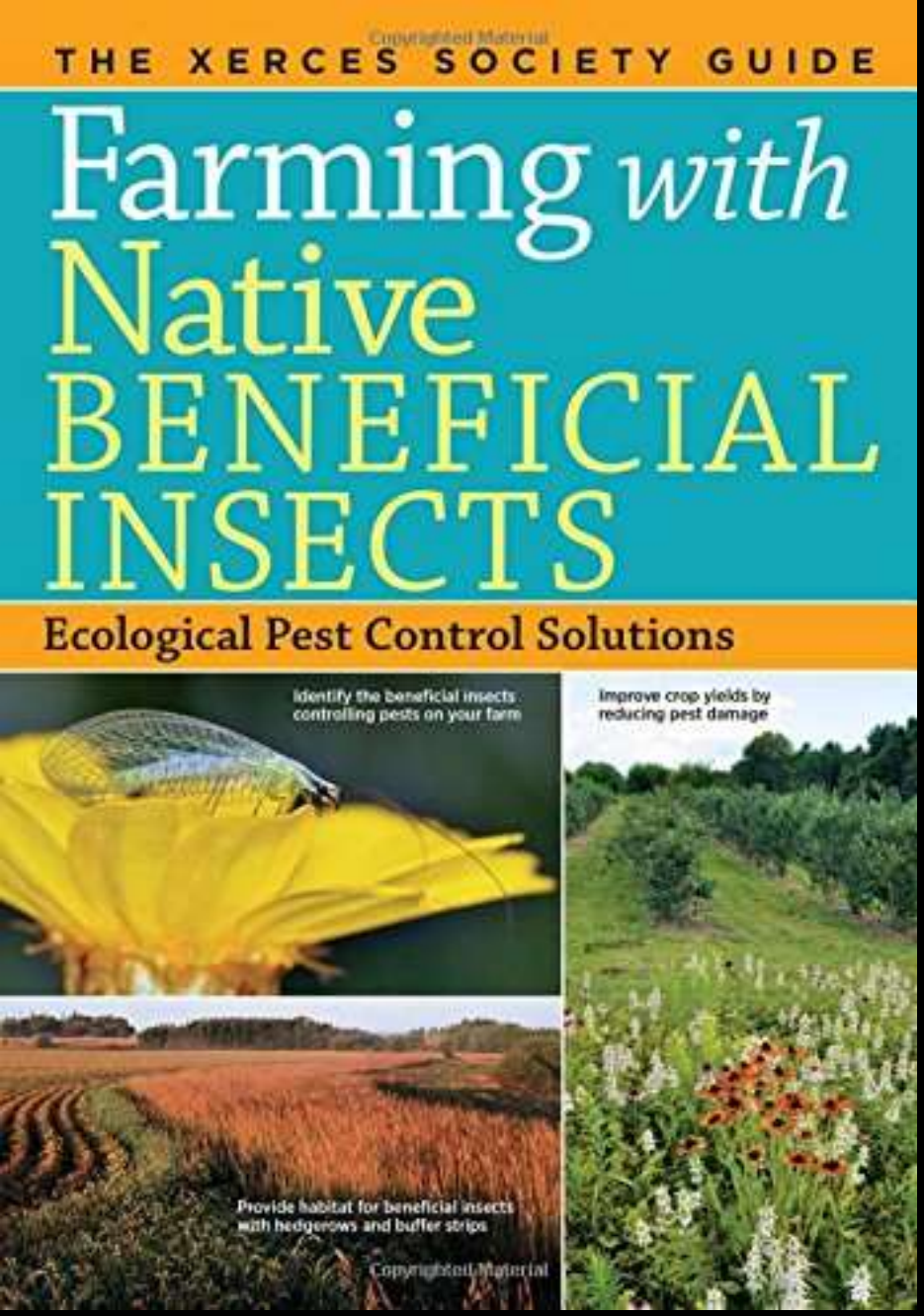


Larva of the cecropia moth

Polyphemus moth

Cecropia moth


Pupa of now dead host
Tachinid fly pupa
Adult tachinid fly, recently emerged



An excellent new publication by the Xerces Society