Applying your insect ID skills

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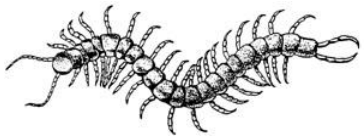
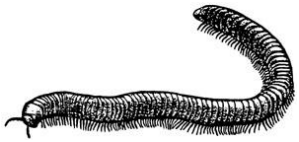
***Disclaimer: photos were taken from www for teaching purposes only**

Phylum arthropod

- **Class insecta (insects)**
- **Class crustacea (lobster, crabs, pill bugs)**
- **Class chilopoda (centipids)**
- **Class diplopoda (milipids)**
- **Class arachnida (spiders and mites)**





- **Class Insecta (Hexapod)-30 Orders?**
  - **Order Collembola (spingtails)**
  - **Order Thysanura (bristletails)**
  - **Order Ephemeroptera (mayflies)**
  - **Order Odonata (dragonfly)**
  - **Order Dermaptera (earwigs)**
  - **Order Isoptera (termites)**
  - **Order Hemiptera (true bugs)**
  - **Order Coleoptera (beetles and weevils)**
  - **Order Diptera (flies)**
  - **Order Lepidoptera (moths and butterflies)**
  - **Order Hymeoptera (wasps and sawflies)**

Outline

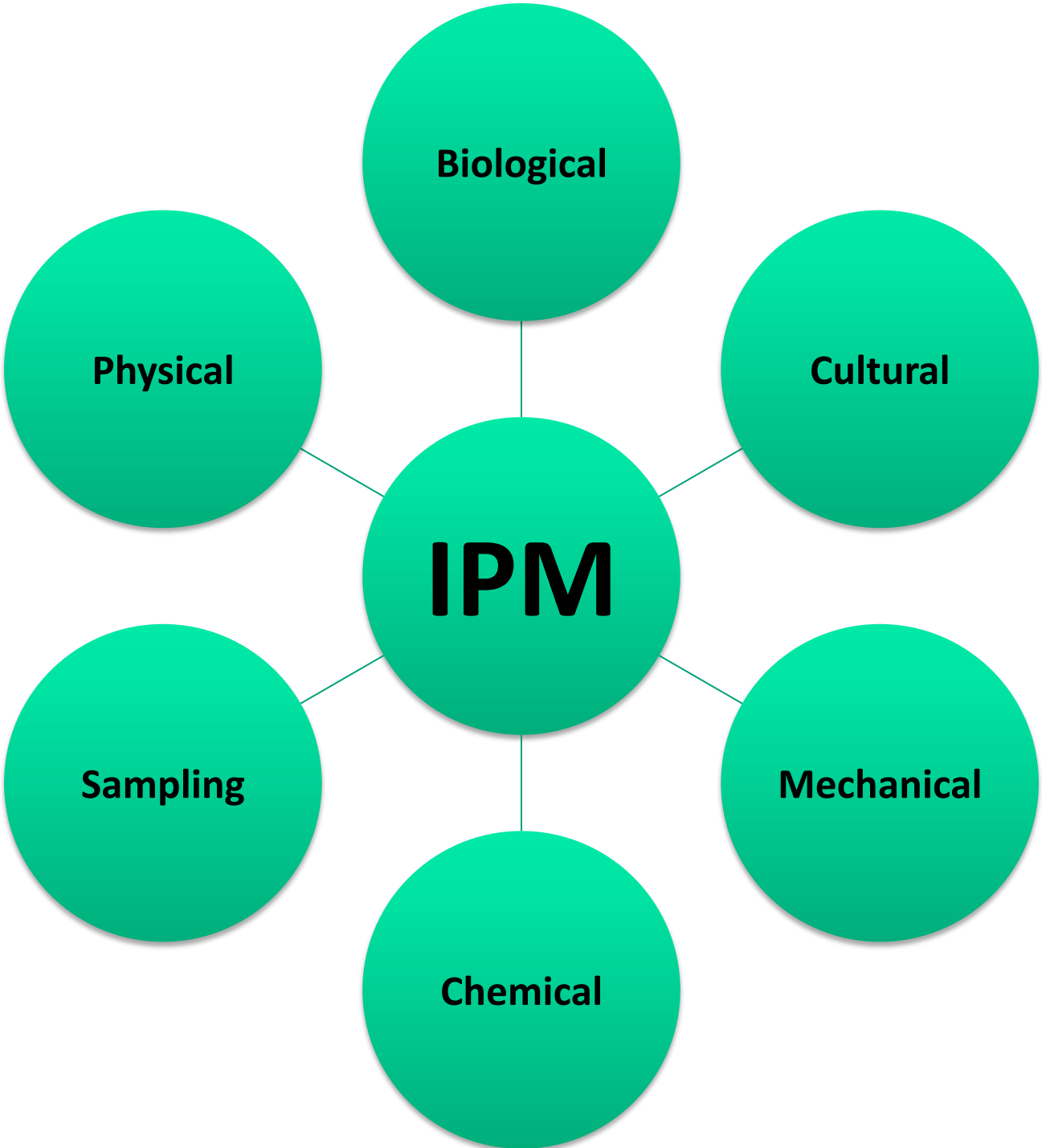
- Pest-IPM concept
- Scouting
- Insect ID: review

Insect
Weed
Disease

Integrated Pest Management (IPM)

- **A strategy to prevent and suppress pests with minimum impact on human health, the environment and non-target organisms**

- **Decision-making process that uses regular monitoring to decide if and when treatments are needed to control a pest, then uses a variety of tactics to keep pest numbers low**


Biological
Physical
Cultural
IPM
Sampling
Mechanical
Chemical

Principles of IPM

- Monitor the plants: sampling
- Identify the pest organism
- Establish an acceptable injury level
- Manage using all available strategies

Sampling

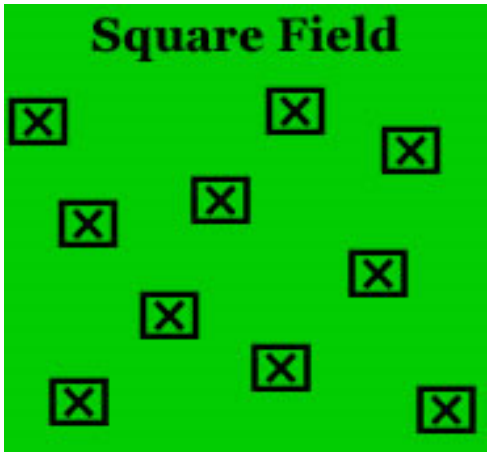
- One of the keys to a successful controlling pests
- Why ? Because:
  - Presence/absence
  - Whether the pests are parasitized or diseased
  - Whether pest infestation is decreasing or not

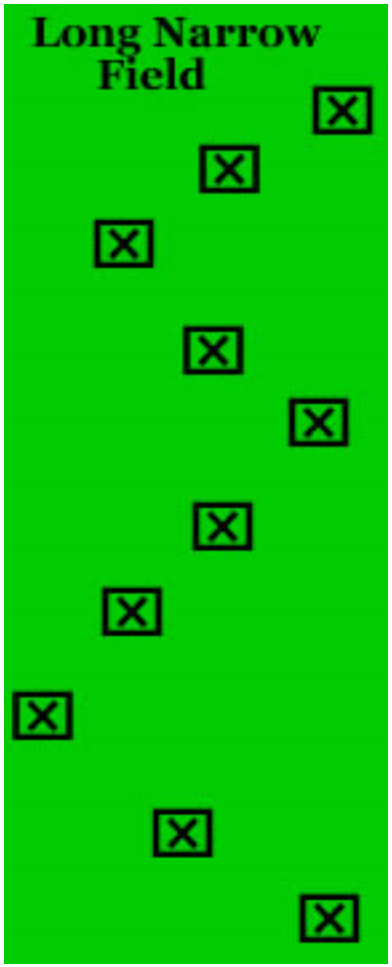

Kramite

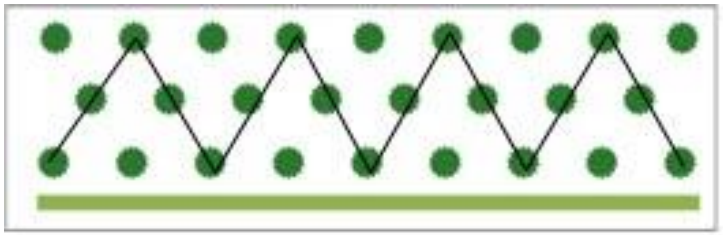
Advantages

- Prevention of the problem
- Determine the exact cause of the problem
- Identify and localize where the problem occurs
- Determine the best economic control
- Evaluates the efficiency of the control method

Sampling procedures



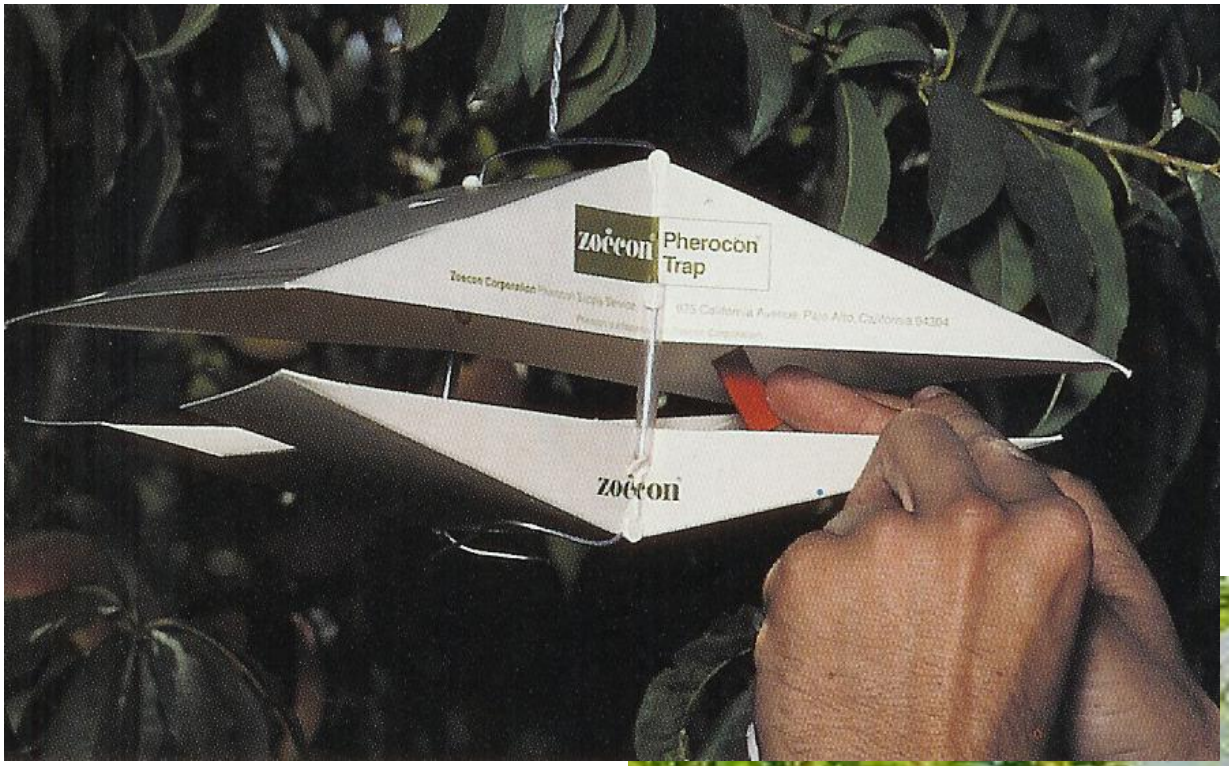




Sample Data Sheet											
Date	**Field #**	**Time**	**Crop**				**Growth Stage**				
Weather/field observations:											
Plant #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
Pest 1 *[Name]*											
Larvae											
Adults											
Parasite/Predator *[Beneficial Insect Name]*											
Parasite/Predator *[Beneficial Insect Name]*											
Parasite/Predator *[Beneficial Insect Name]*											
Notes:											
Plant #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
Pest 2 [Name]											
Larvae											
Adults											
Parasite/Predator *[Beneficial Insect Name]*											
Parasite/Predator *[Beneficial Insect Name]*											
Parasite/Predator *[Beneficial Insect Name]*											
Notes:											

Yellow sticky trap

Trapping for fungus gnats



Codling moth pheromone trap

Apple maggot trap

Trapping: slugs and snails

Trapping: insects Indoors

Know the pest

Once the pest is identified, learn about its life cycle and its natural enemies

Root weevil larva

Root weevil pupa

Root weevil adult

Manage using all available strategies

- Cultural
- Physical
- Biological
- Chemical
  - Use the easiest, least expensive, least disruptive and least toxic ones first

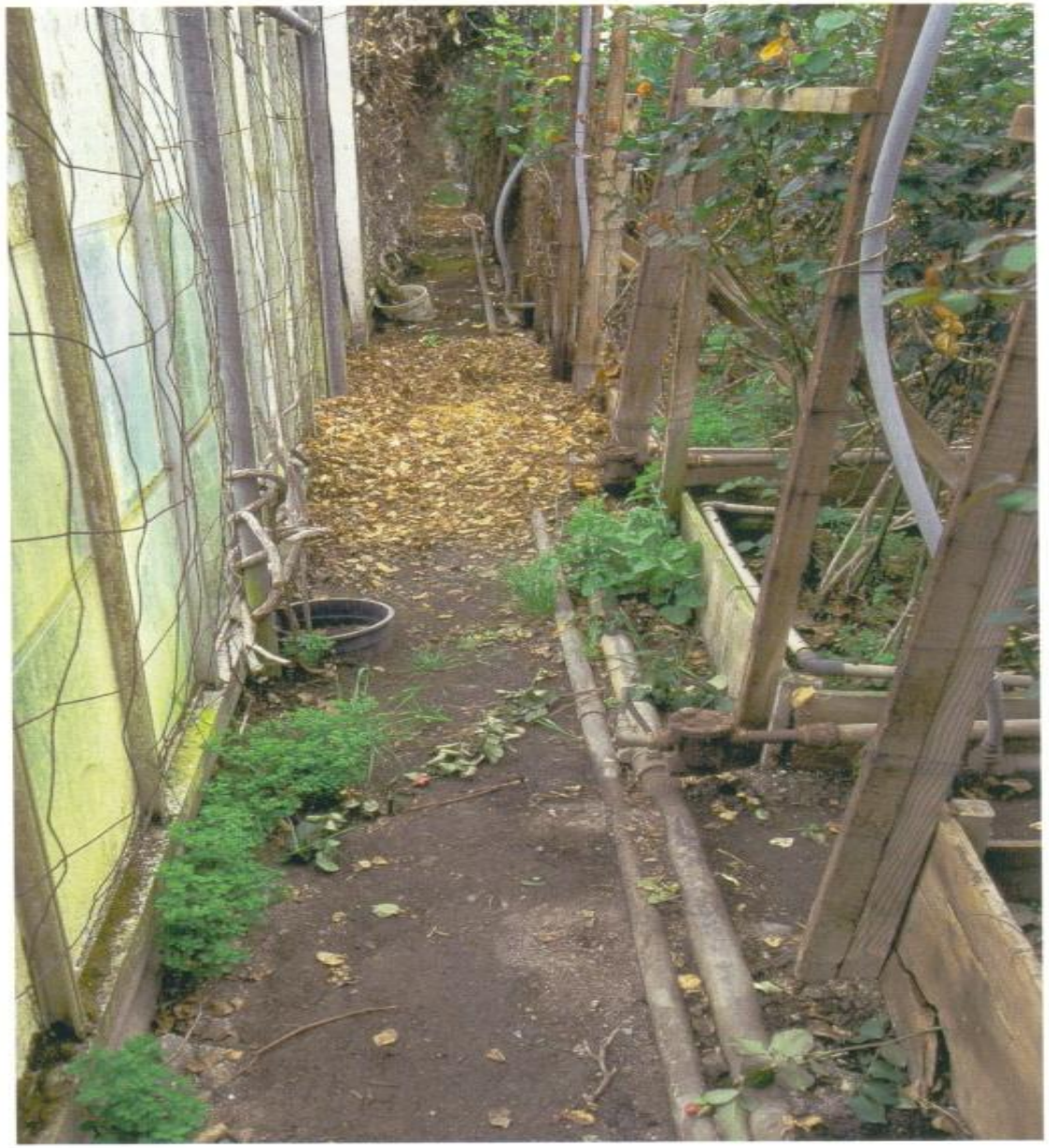
Cultural control

Prevents pest problems by keeping plant healthy

Adding compost

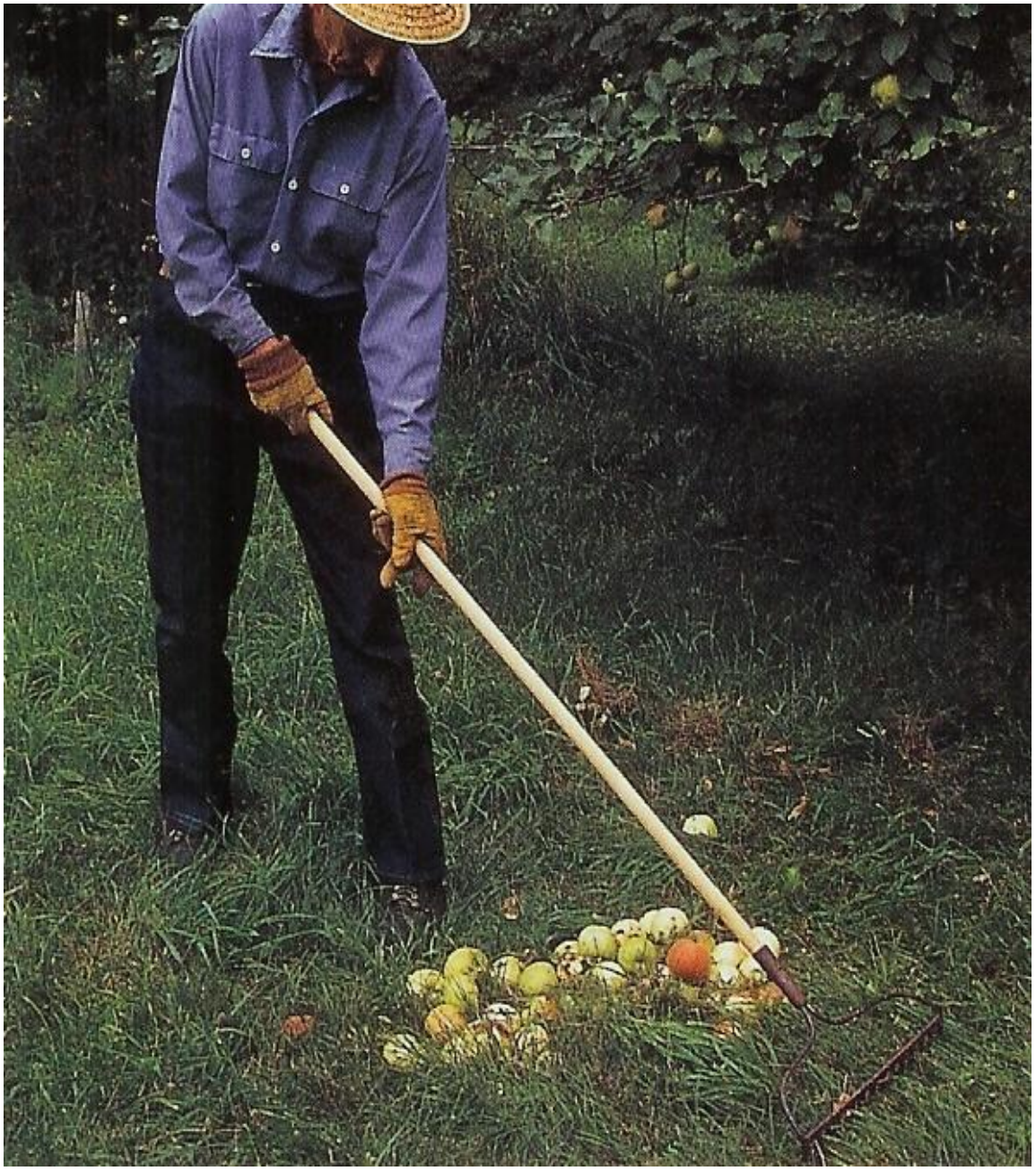
“Healthier plants often results in fewer pest problems”

Resistant varieties



Eliminating weeds

Weeding and mulching



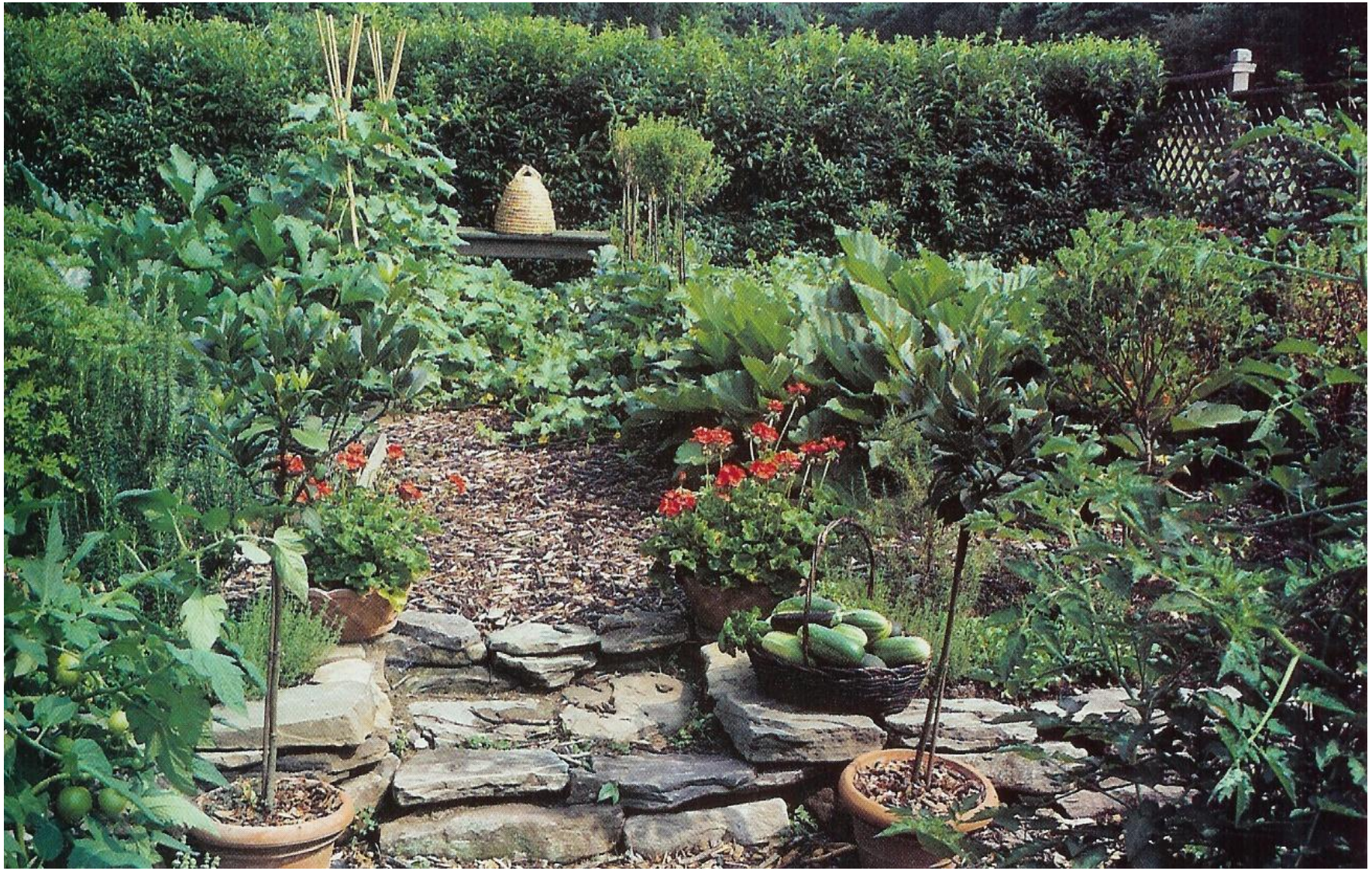
Sanitation

Eliminating cull piles

In this crop rotation scheme, each of the plant types moves on a four-year schedule, making it less likely for a plant to pick up a soilborne disease from a previous year. The climbing peas, members of the legume family, actually put nutrients back into the soil as they rotate.

Crop rotation

Trap cropping



Encourage ecological diversity in the garden

Physical control

Blocking, removing, or trapping pests

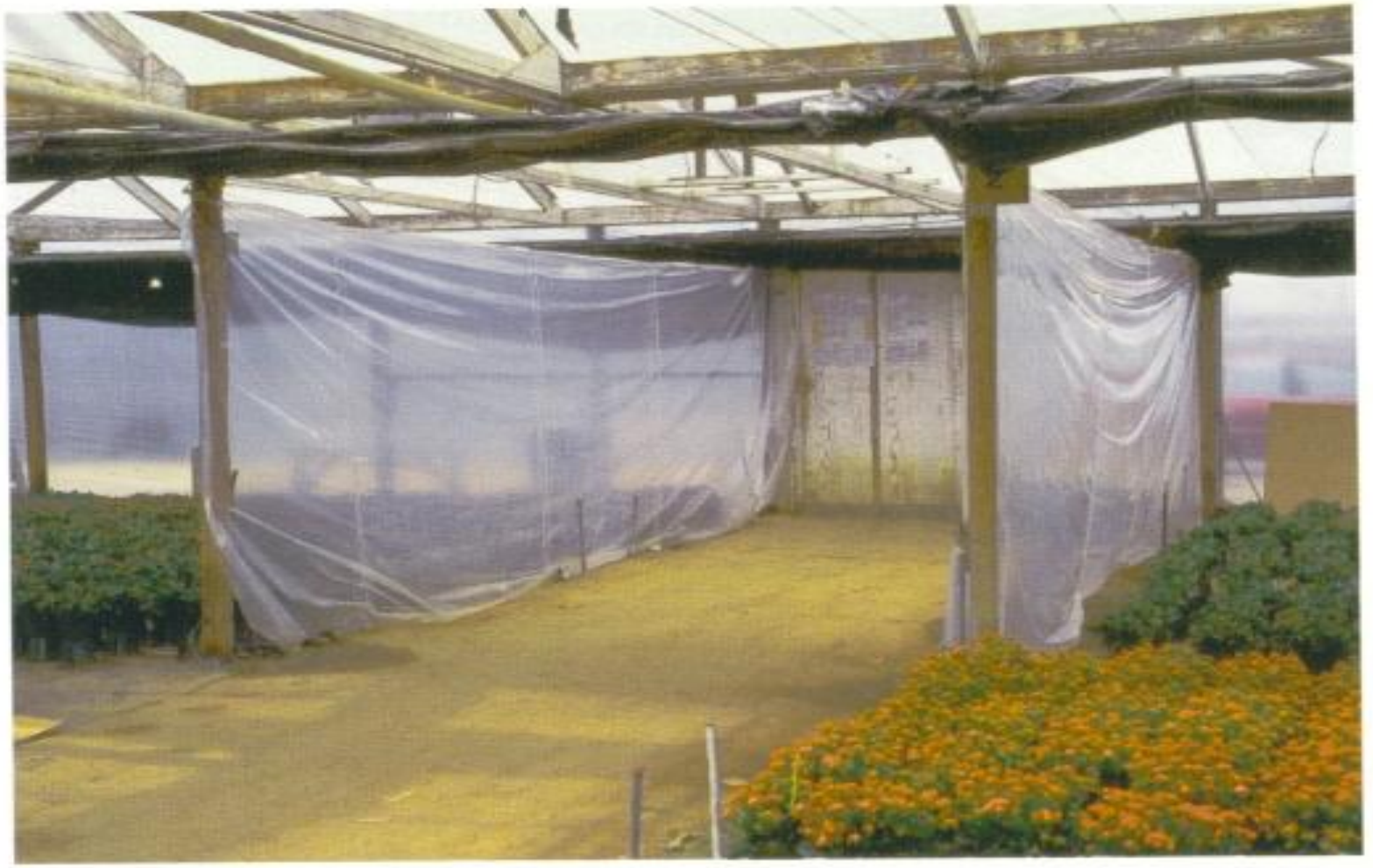
Barriers: row covers

Barriers: sticky barrier

Barriers: sticky barrier

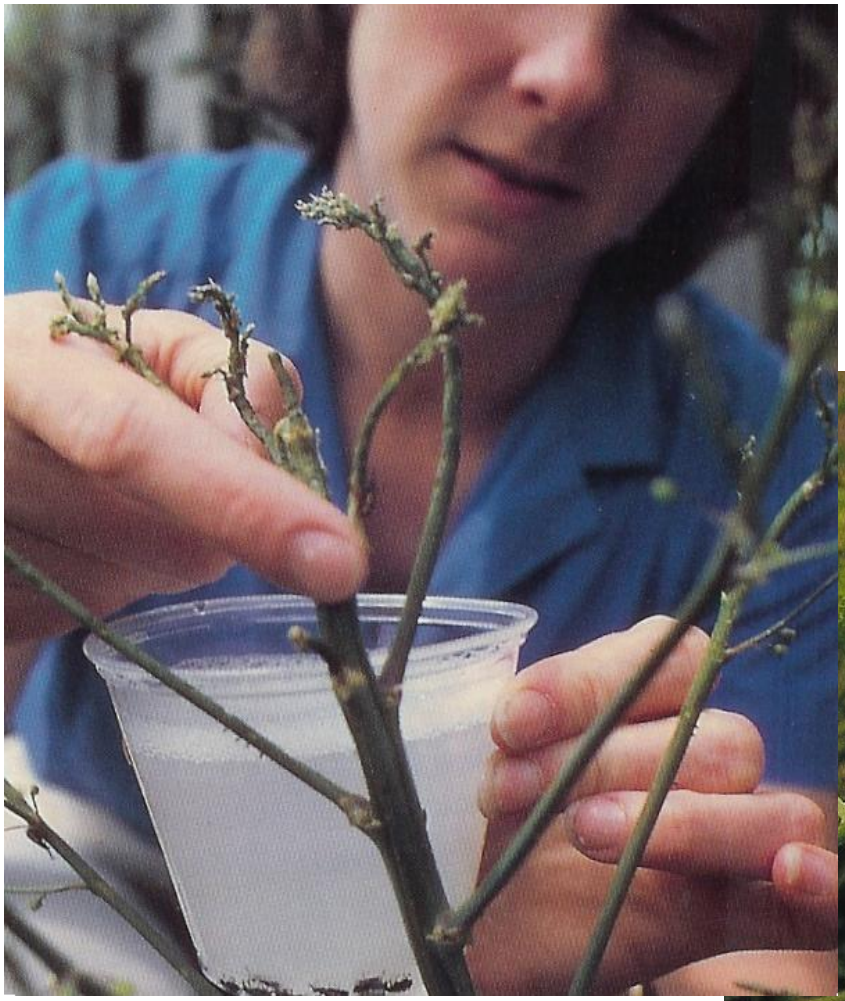
Root weevils

Ants tending aphids



Barrier: curtains

Barriers: plant cages and collars



Handpicking

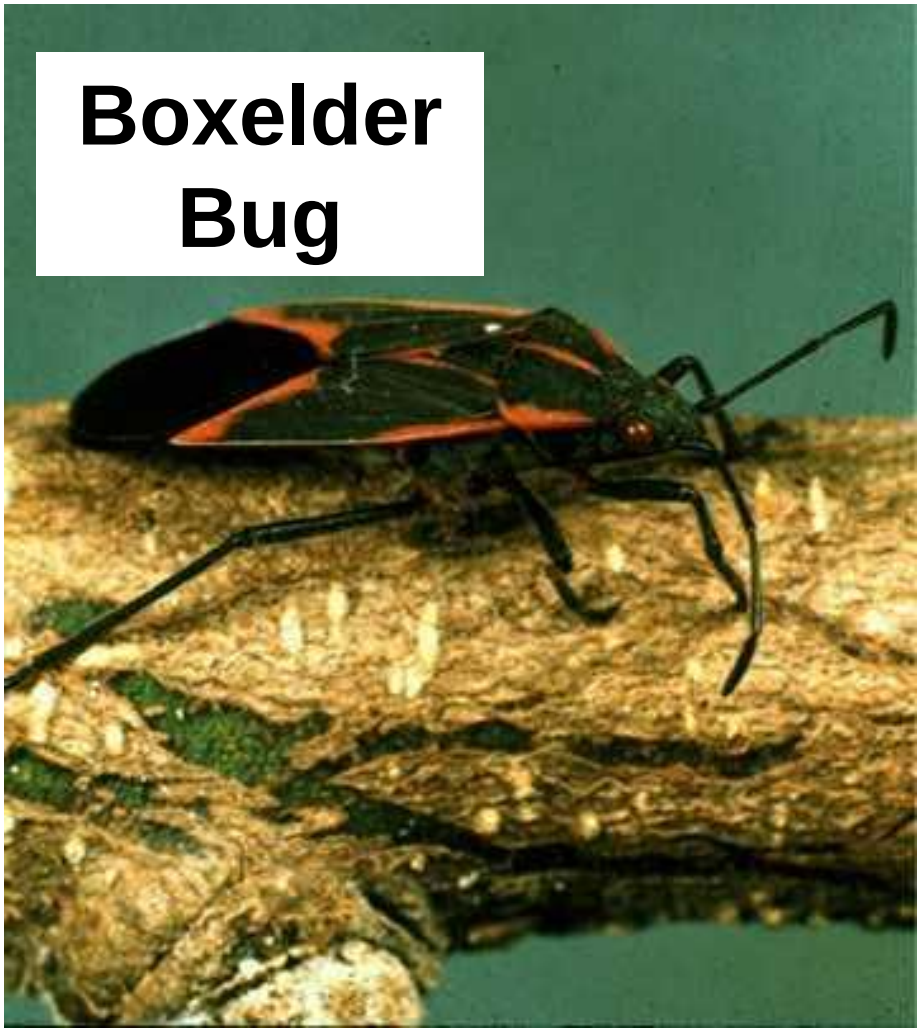
Spider mites

Aphids

Watering

Pruning

Tent caterpillars



Vacuuming

Tilling

Garden symphylan

Biological control

- Predators
- Parasitoids
- Microbials
  - Bt
  - Beneficial nematodes
- Pollinators

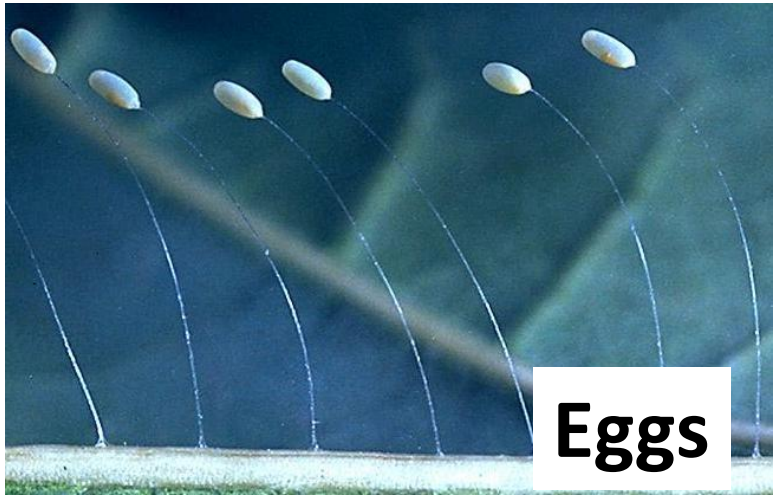
Predators

- Require many preys during their lifetime
- They are very active (seeking for food)

- **Superior in size and mobility as compared with the prey**
- **They can be extremely specialists (monophagous) or they can be generalistics (polyphagous)**

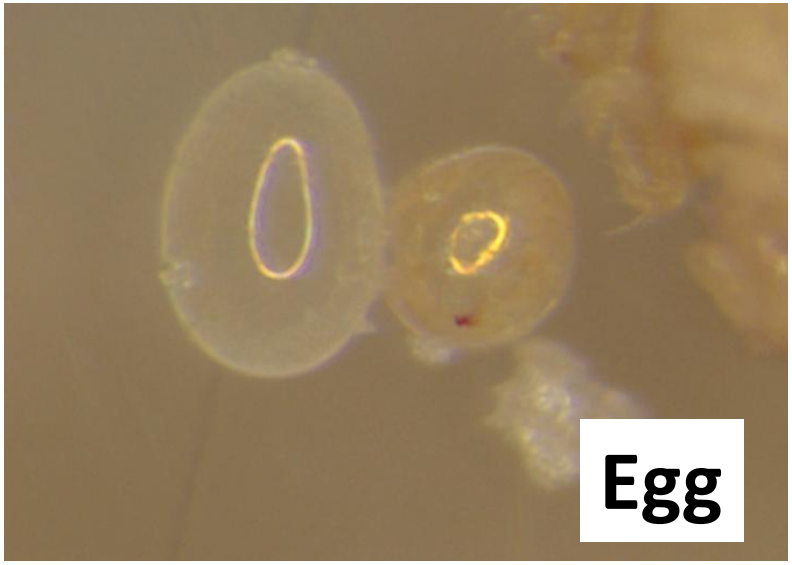
Lady beetles

Lace wings

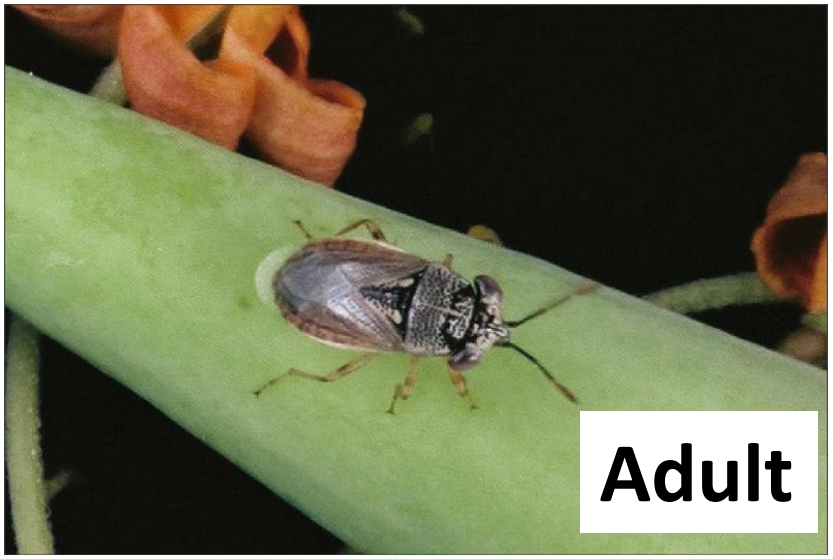


Syrphid flies

Predatory mites



Bigeyed bug



The minute pirate bug

Nymph

Eggs

Damsel bug

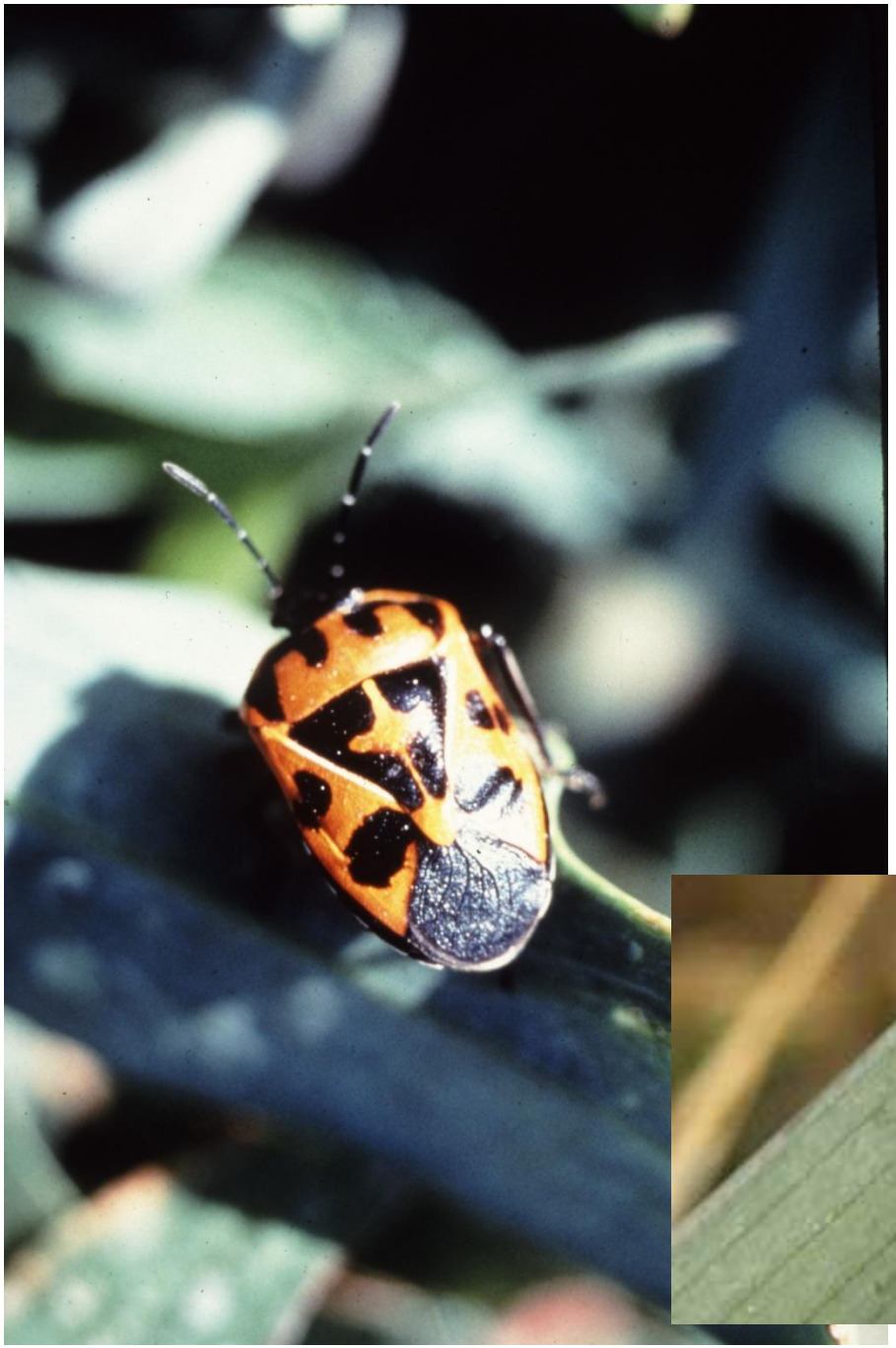
Adult

Nymph

Ground beetles

Praying mantis

Two-spotted stinkbug



Assassin bug

Soldier beetle

Parasitoids vs. parasite

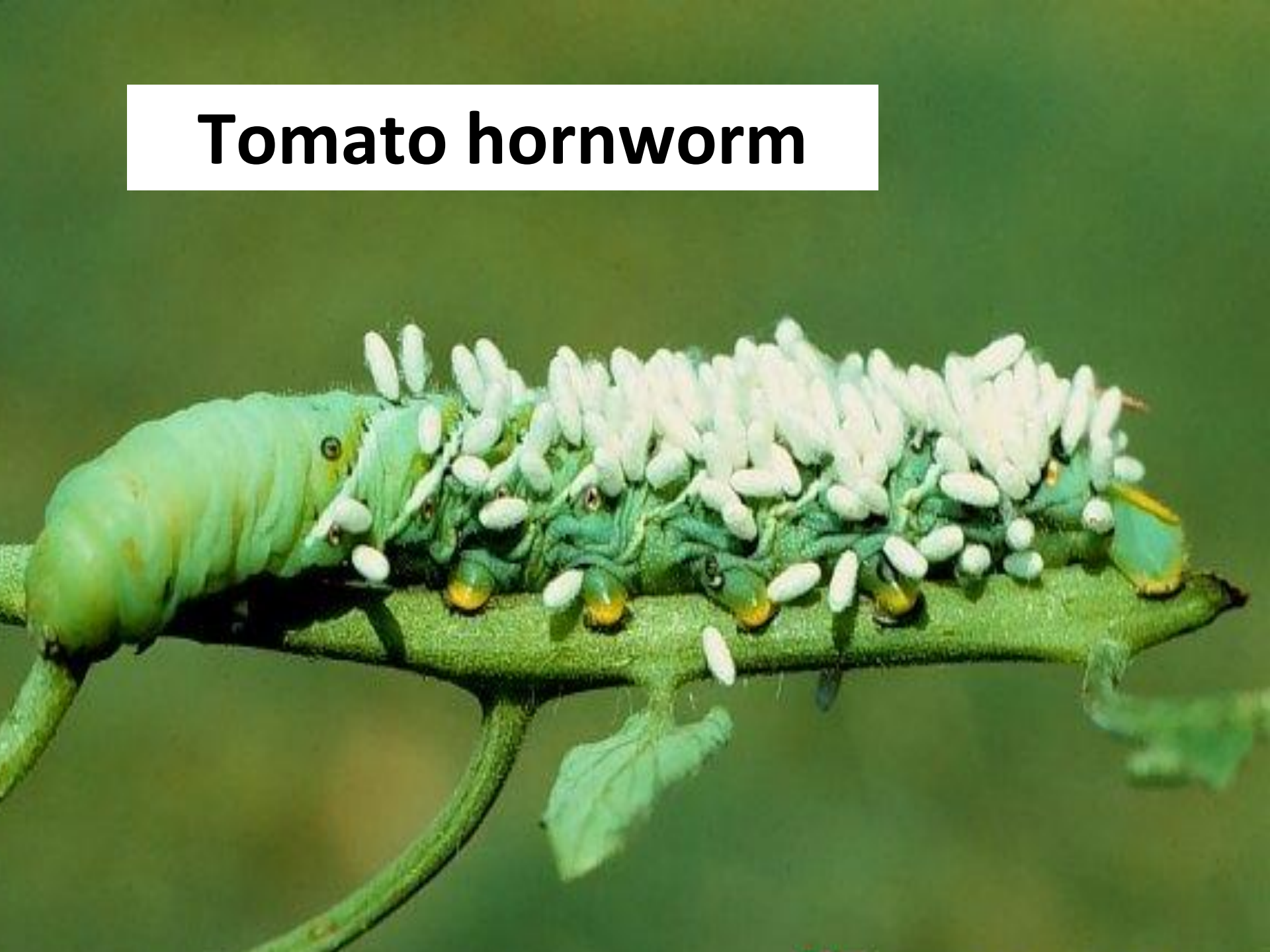
- **Parasitoids develop in or on a host and cause the host to die**
- **Parasites tend to weaken the prey rather than to kill the prey**
- **Most of them are monophagous**

Micro-wasps egg parasitoids

Tachinid fly

Encarsia formosa **parasitizing white fly**

Tomato hornworm



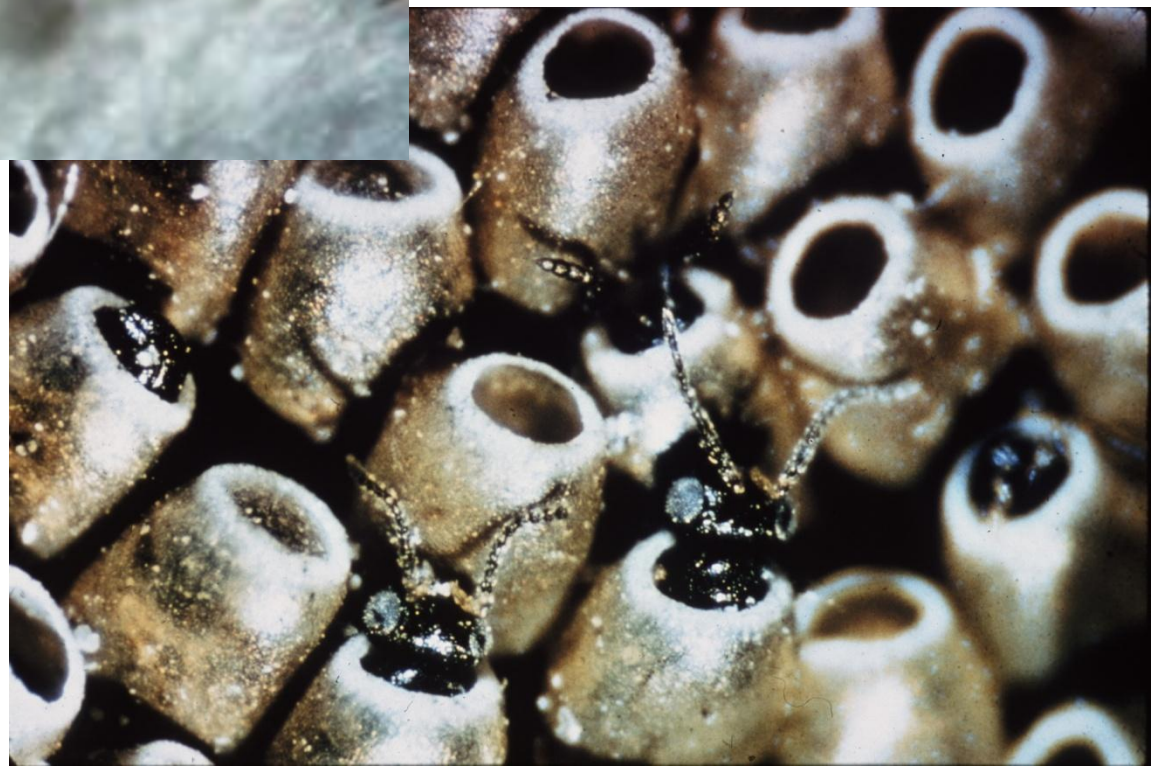
Potato tuberworm

Tachinid fly and elm leaf beetle larvae

Nymph stage parasitoids

Parasitoid wasp laying eggs in aphid

Aphid mummies



Trichogramma **adults emerging from caterpillar eggs**

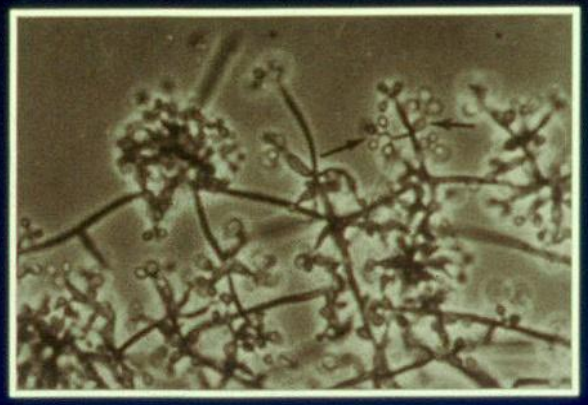
Pathogens

- In the form of bacteria, fungi, or viruses, they infect the hosts and lead to their weakening and eventual death of the pest attacked

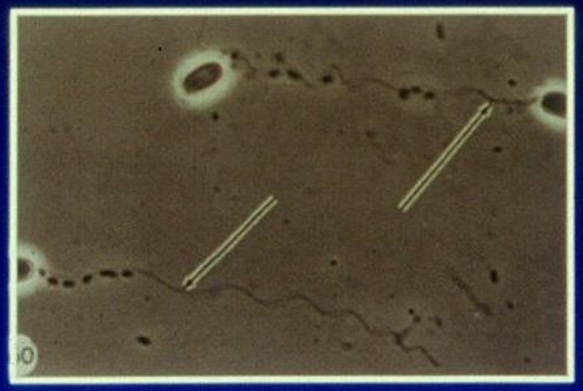
Insect Pathogens as Biological Control Agents

Bacteria

Viruses



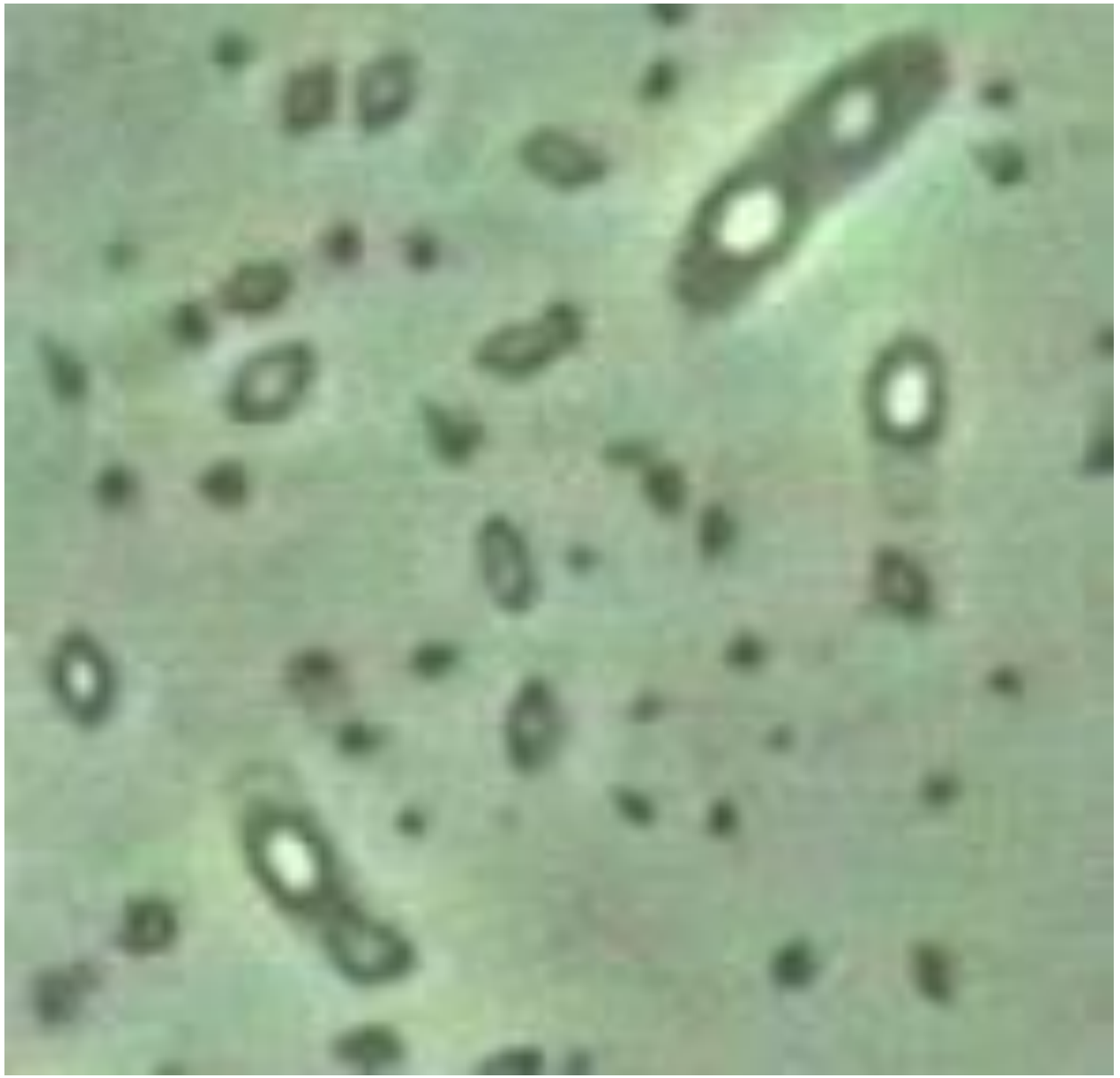
Fungi



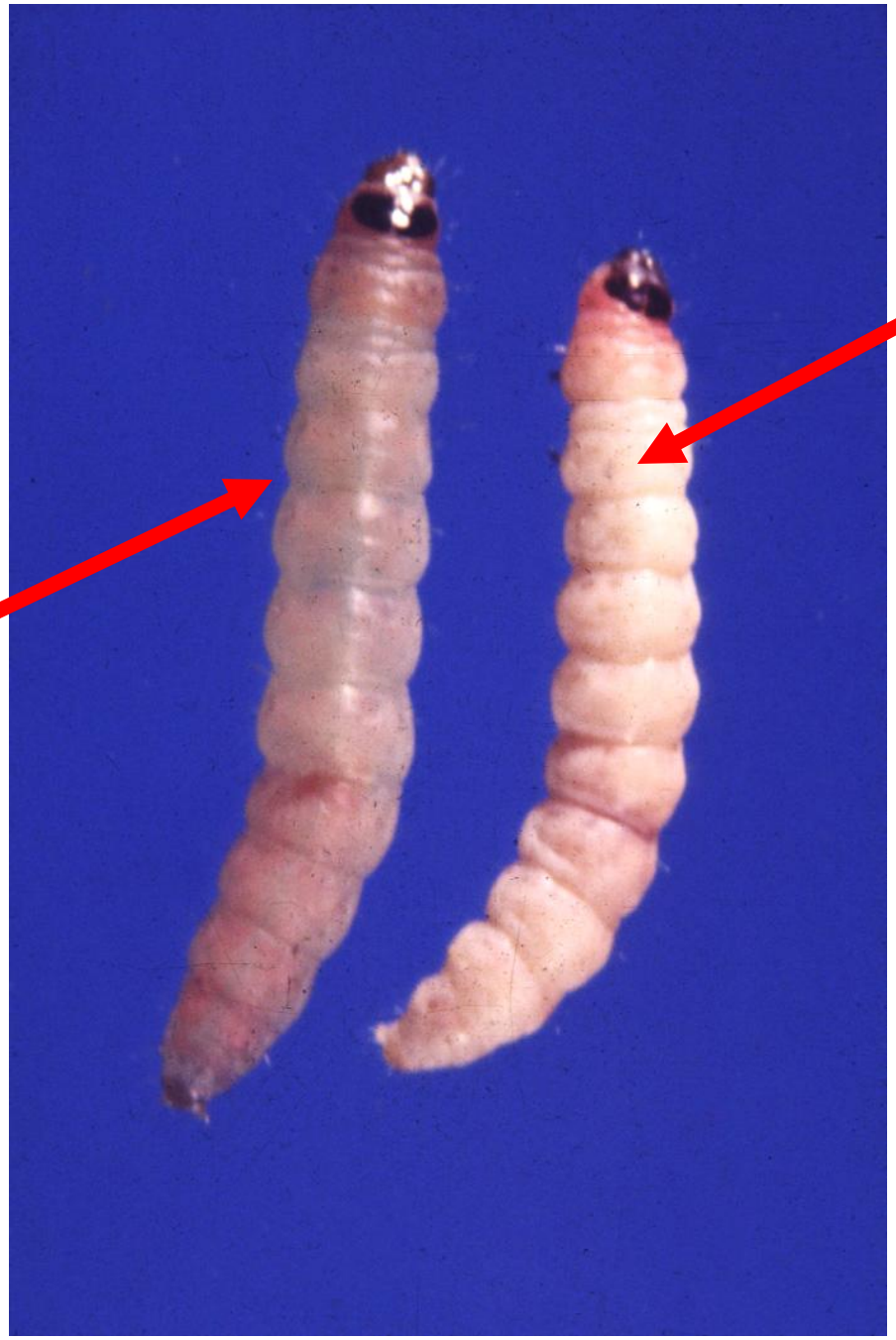
Protozoa

Nematodes

Bacillus thuringiensis or Bt



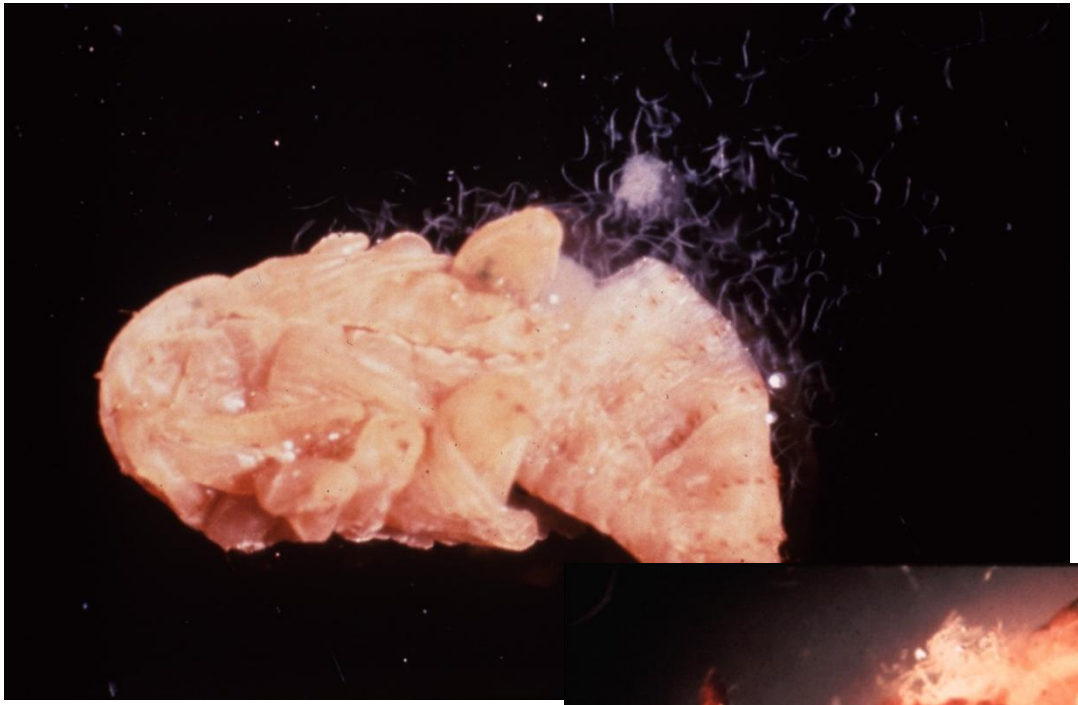
B.t. kurstaki **and caterpillars**


unhealthy
healthy

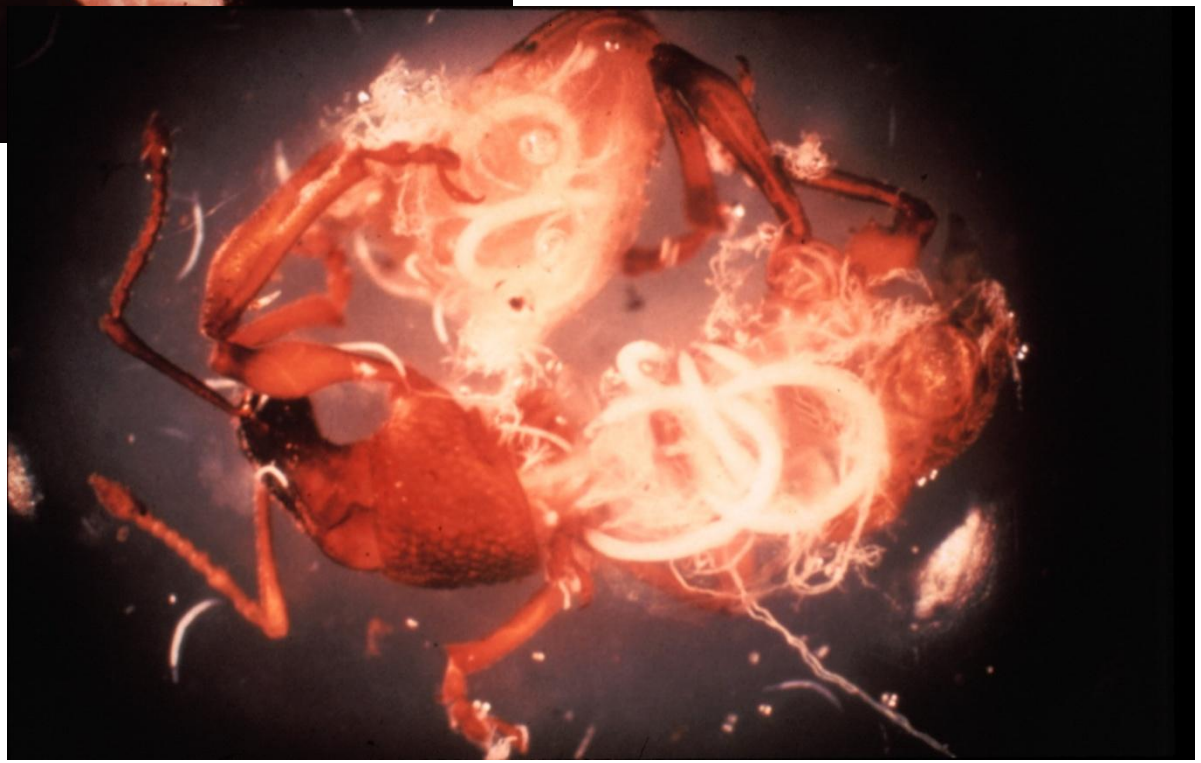
Pollinators

Bumblebee

Beneficial nematodes

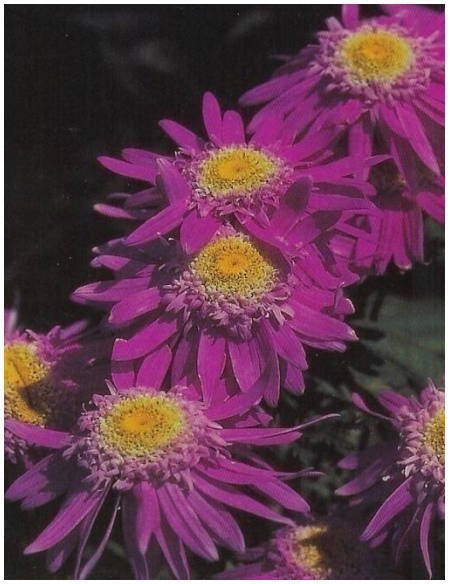


Infected root weevil pupa



Infected root weevil adult

Chemical control



- Derived from botanical sources
- Biodegrade rapidly
- Widely varying levels of toxicity

Security !!!

2006
PACIFIC NORTHWEST

Insect

MANAGEMENT HANDBOOK

This book is revised annually.
Poison emergency telephone number is on inside front and back covers.

Extension Services of Oregon State University,
Washington State University, and University of Idaho.

http://pnwpest.org/pnw/insects

KOPPERT BIOLOGICAL SYSTEMS

SUPPLIERS OF BENEFICIAL ORGANISMS IN NORTH AMERICA

http://www.cdpr.ca.gov/docs/ipminov/ben_supp/contents.htm

Commercial Availability of Predatory Mites

http://edis.ifas.ufl.edu/pdffiles/HS/HS24400.pdf

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http://oregonstate.edu/potatoes/ipm/index.htm