Garden insect pest management using non-chemical tactics:

advanced training for Master Gardeners




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2009

Topics

- Overview of IPM
- Under-utilized non-chemical tactics for garden pests
  - Cultural
  - Mechanical
  - Biological

Integrated Pest Management (IPM)

- a comprehensive approach to dealing with pests
  - strives to reduce pest status to tolerable levels
  - using multiple methods
    - effective
    - economically sound
    - ecologically compatible

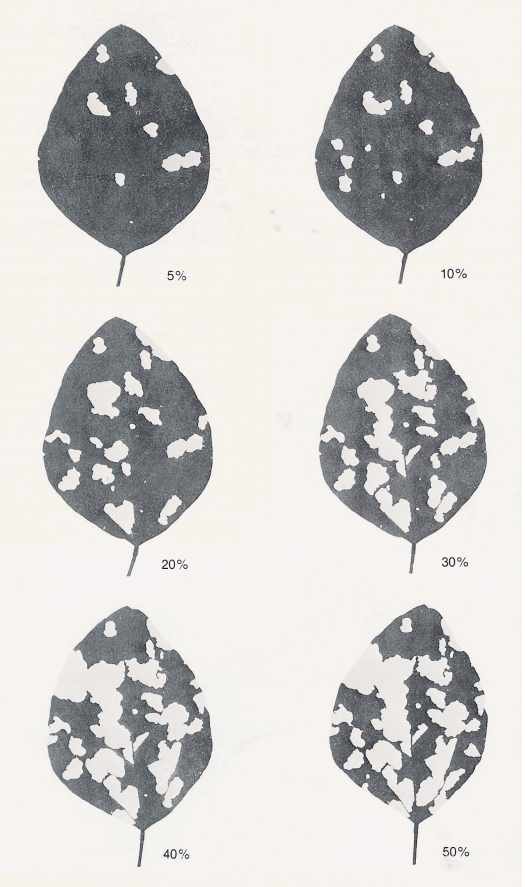
IPM uses a combination of tactics

- Cultural
- Host Plant Resistance
- Mechanical
- Biological
- Behavioral
- Microbial
- Chemical
- Genetic
- Regulatory

Insect Life Cycles:
the search for a weak link

Components of IPM

- **Multiple tactics**
  - —Preventive options
  - —Remedial options
- **Monitoring**
  - —Scouting
  - —Trapping
- **Action thresholds** →



Cultural Controls

- **Minimize infestations by choosing appropriate crop management practices**
- **Categories:**
  - **Crop selection**
  - **Crop location**
  - **Timing of operations**
  - **Field preparation**
  - **Crop maintenance**

Cultural Controls

- **Under-utilized tactics:**
  - —Delayed planting
  - —Trap cropping
  - —Combined delayed planting + trap cropping
- **Best as part of multi-tactic plan**

Delayed planting

- Cucumber beetle
  - —Problem if plant in late May
  - —Less problem if plant in mid-June
- Squash vine borer
  - —Same
- Bean leaf beetle
  - —Peak populations in May, July
  - —Fewer in June

Trap cropping

- Lure pest away from main crop to a more attractive crop
- Once the pest infests trap crop:
  - —Leave it (sacrifice)

  or

  - —Hand-pick pests from trap crop

  or

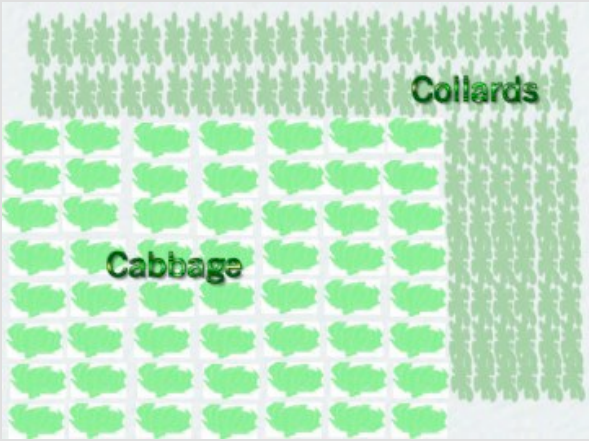
  - —Spray trap crop with insecticide

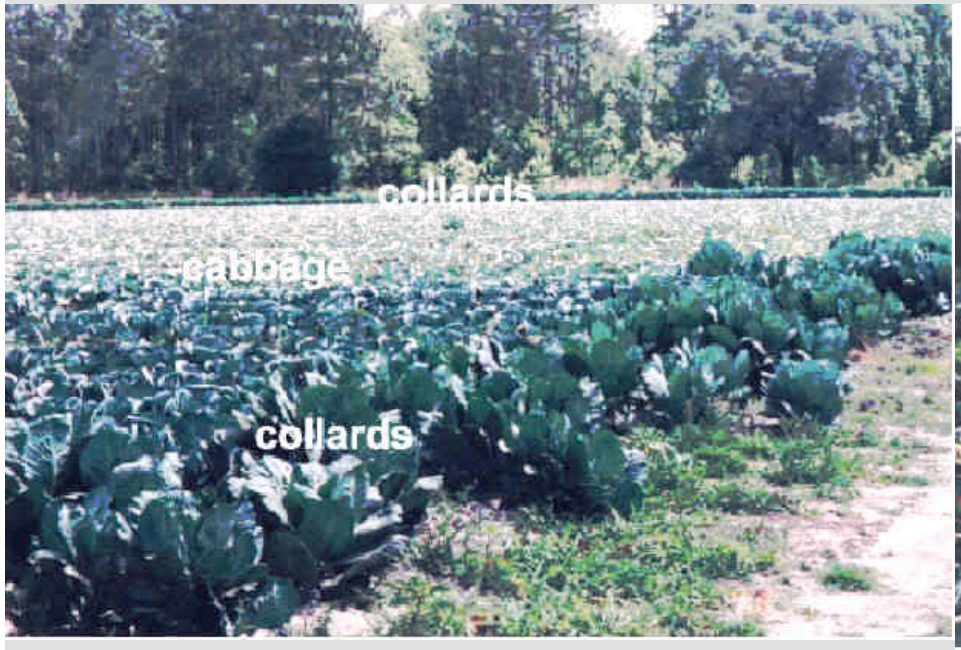
Trap cropping examples

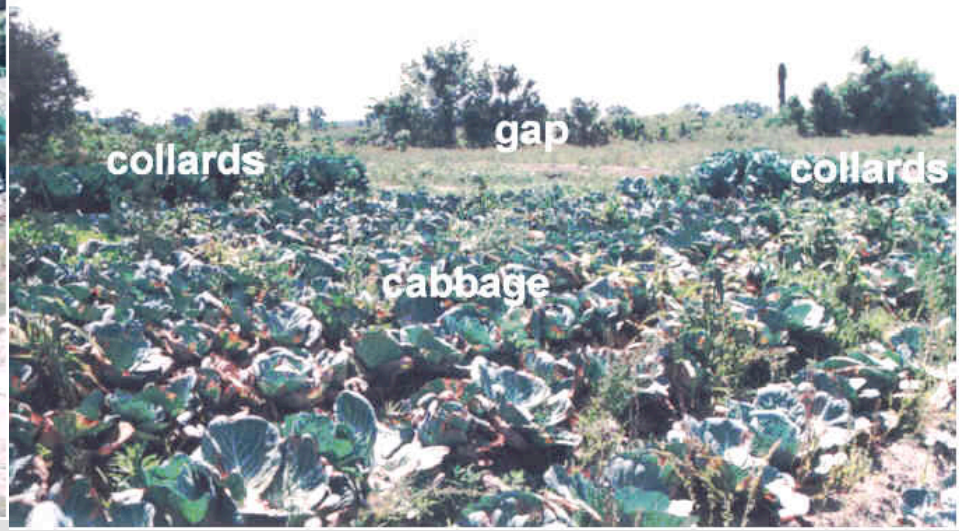
Main crop	*Trap crop*	*Target pest*
cabbage	collards	diamondback moth
cabbage	kale	harlequin bug
cucumber	hubbard squash	cucumber beetles
peppers	sweet corn (late)	Europ. corn borer
potato	eggplant	Colo. potato beetle

Trap Crop Example

- Collards around cabbage
- Diamondback moth







Trap Cropping Variations

- **Plant 2 crops (trap crop & main crop) at same time**
- **Plant only 1 crop (main crop) but at 2 times: small amount early, & larger amount later**
- **Trap crop can be a potted plant**

To weed or not to weed?

- Some weeds act as trap crop
  - —Smartweed in sweet corn for Japanese beetle

- Weeds are alternate hosts of some pests
  - —Remove horsenettle to control pepper maggot

  - —Remove curly dock to control rhubarb curculio

Mechanical Controls

- Tactics to prevent or delay pests from infesting a site
- Tactics not needed for purposes other than pest management
- Exclusion: by row covers
- Removal: by hand or traps

Removal by hand

- Recommended for gardeners who do not want to use insecticides
- Target pests:
  - Conspicuous pests
  - Pests not too active
  - In relatively restricted area

Hand Removal Methods

- Hand picking
  - Spinach leafminer (infested leaves)
  - Hornworms
  - Cabbageworms
  - Asparagus beetle (eggs)
  - Japanese beetle (adults)
- Beating (shaking) into bucket
  - Colorado potato beetle (adults, larvae) **
- Shelter traps
  - Squash bugs
  - Slugs
- Aspirator
  - Flea beetles **

Removal by aspirator: Eggplant flea beetle

Removal by Mass Trapping

Kairomone trap for cucumber beetle

- **Mimic of host plant odor**
  - **—Flower volatile lure**
  - **—Cucurbitacin bait**
  - **—Made by Trécé**
- **Use for early season trap-out tactic**

Biological Control

- Control of pest by other organisms that act as natural enemies
- Overview of common natural enemies
  - —Predators
  - —Parasitoids
- Tactics of biocontrol

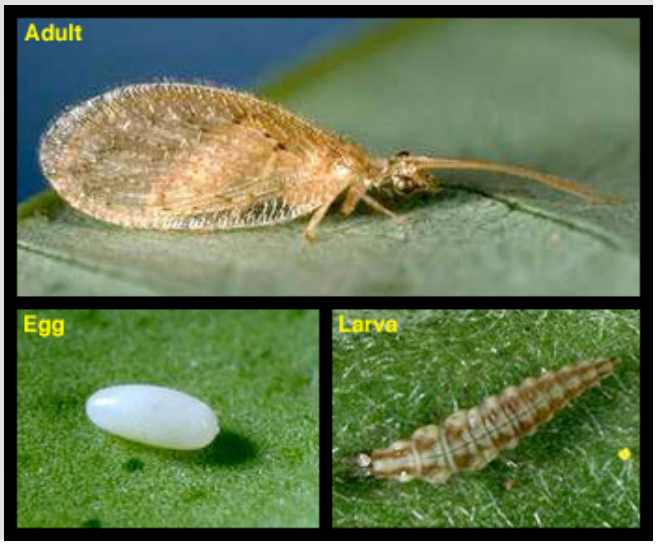






Predators: Lacewings

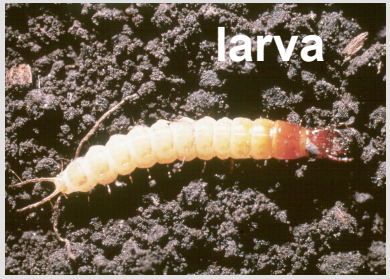
- Green lacewings
- Brown lacewings

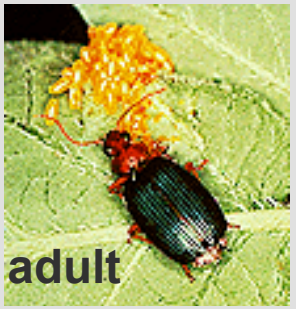


Predatory Beetles

- **Lady beetles**

- **Ground beetles**





Predatory Bugs

- **Stink bugs**
  - Spined soldier bug
  - Twospotted stink bug
- **Flower bugs**
  - Minute pirate bug
  - Insideous flower bug
- **Damsel bugs**
- **Assassin bugs**

Predatory Flies

- **Hover flies (flower flies)**

- **Aphid midges**

- **Robber flies**

Other Predators

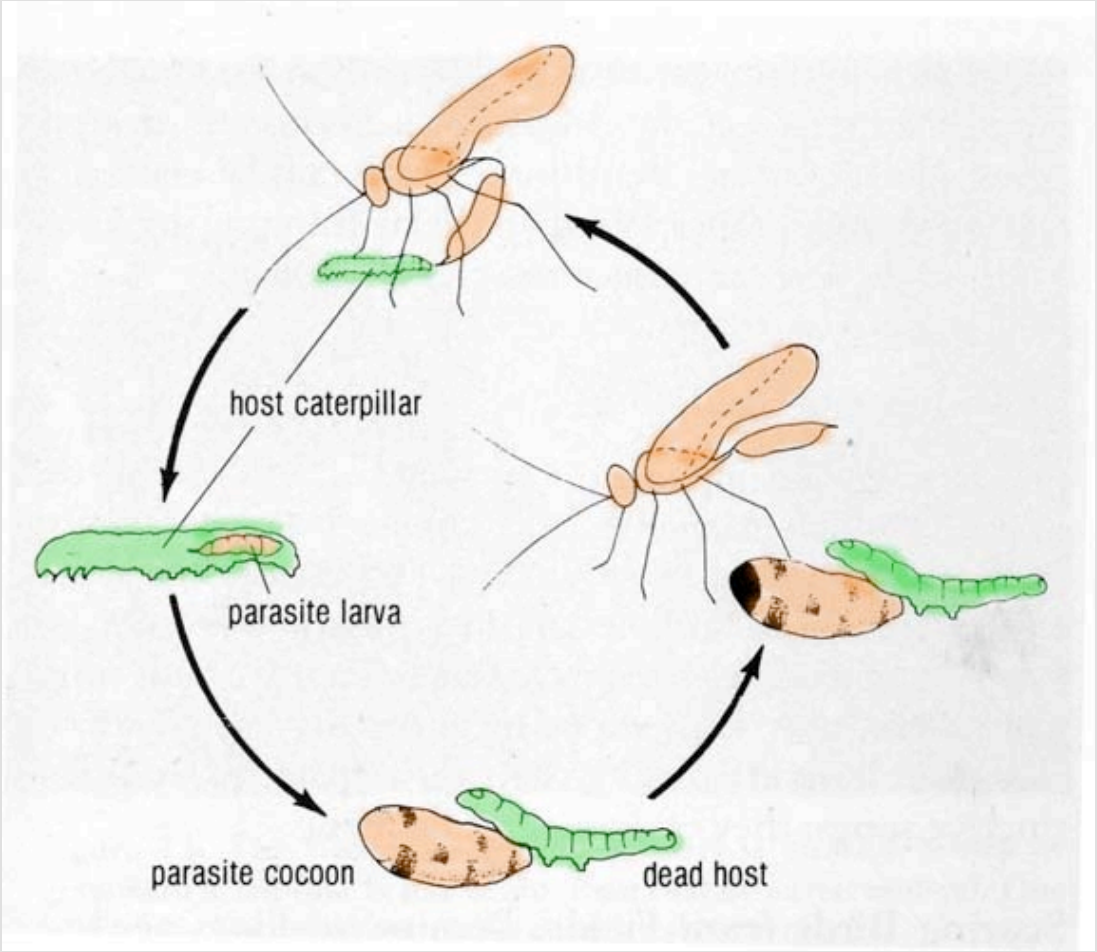
- **Wasps:**
  - **—Yellowjackets**
- **Thrips:**
  - **—Black hunter thrips**
- **Mites:**
  - **—Phytoseiid mites**

Natural enemies of pests

- **Parasitoids**
  - **—Some wasps**
  - **—Some flies**

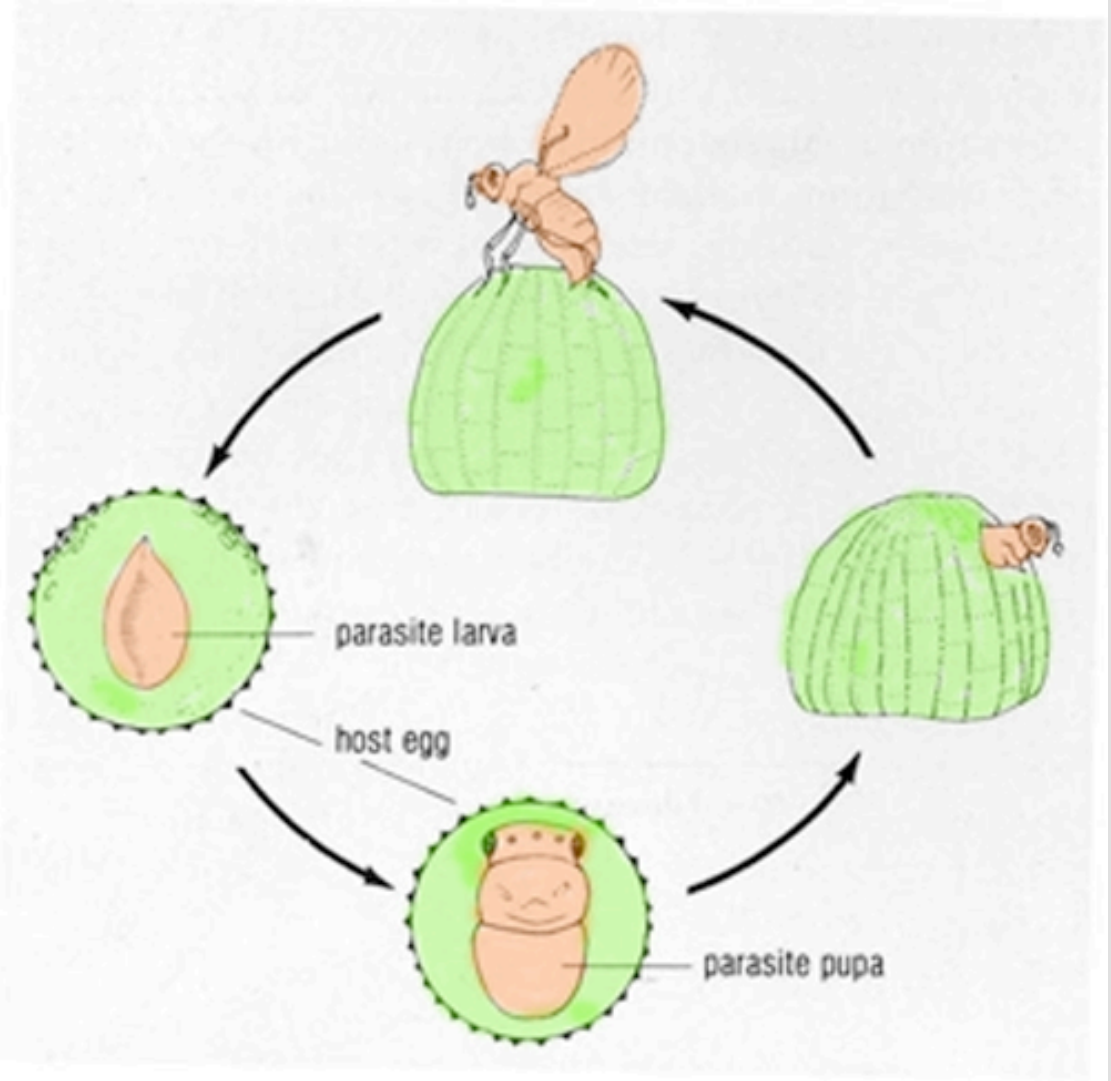
Life Cycle of Parasitoid

Hyposoter **wasp attacking caterpillar**



Life Cycle of Parasitoid

Trichogramma **wasp attacking caterpillar egg**

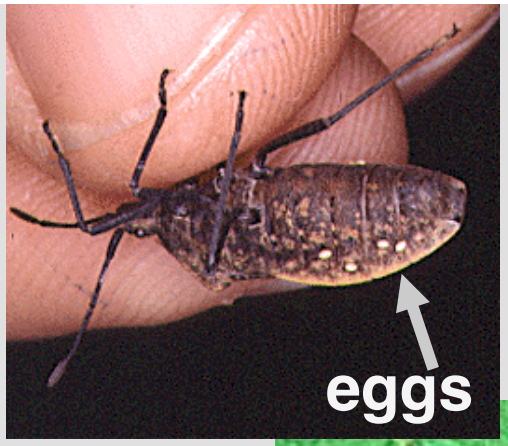


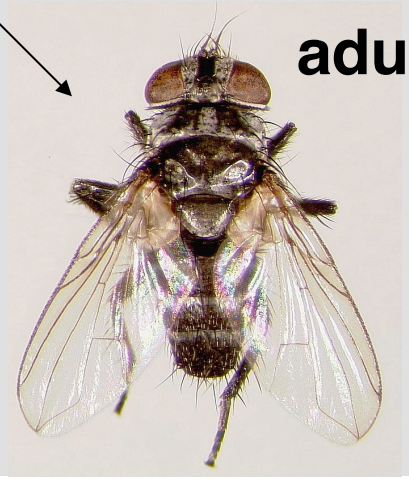
Parasitoids

- Some wasps
  - Braconid wasps
    - On hornworm: *Cotesia congregata*
    - On imported cabbageworm: *Cotesia glomeratus*
    - On aphids: *Diaeretiella rapae*
  - Ichneumonid wasps
    - On diamondback: *Diadegma insulare*
  - Other wasps
    - On whiteflies: *Encarsia*
    - On caterpillar eggs: *Trichogramma*

Parasitoids

- Tachinid flies
  - —On squash bug: *Trichopoda pennipes*
  - —On striped cucumber beetle: *Celatoria setosa*





Biological Control

- **Categories**
  - –'Natural' (local species)
  - –Importation (exotic species)
  - –Conservation (local species) **
  - –Augmentation (local species)

- **Under-utilized tactics:**
  - –Avoid broad-spectrum insecticides
  - –Refuge planting for natural enemies
  - –Collect-&-transfer generalists

Collect-&-transfer generalists

- What to do?
  - —Hunt for predators in spring
  - —Collect them
  - —Transfer them to garden
- Who, where, when?
  - —Ladybug larvae on Spirea in early May
  - —Lacewings, aphid midges on apple leaves in early June
  - —Damsel bugs on alfalfa in April-June

Refuge planting for natural enemies

- Adult parasitoids need nectar
- Adult predators need pollen
- Plant flowering border at garden edge to enhance biocontrol

Refuge planting for natural enemies

Phacelia

sweet alyssum *

nasturtium

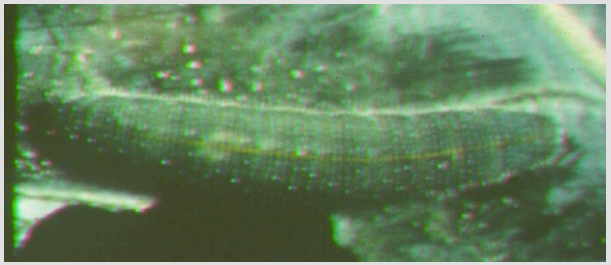
cilantro

dill

Integrated Chemical & Biological Control

- **Use selective chemical (kills pest but *not* the natural enemies)**
- **Allows natural enemies to help kill pest**
- **Good strategy where insecticide resistance is problem**
- **Example: Cabbage Worms & B.t.**

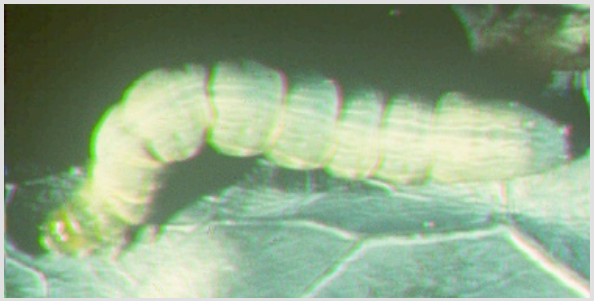
Caterpillars on Cole Crops



Imported cabbageworm

Cotesia larvae spinning cocoons

Cotesia adult wasp



Cabbage looper

Copidosoma floridanum wasps emerging from one cocoon

Diamondback moth

Diadegma insulare oviposits on larvae

Healthy pupa

Parasitized pupae

Summary of Caterpillar Management on Cole Crops

Insecticide	*Imported cabbage-worm*	*Diamond-back moth*	*Cabbage looper*	*Natural enemies*
Conventional	Excellent control	Fair control	Good control	Poor survival
B.t.	Good control	Good control	Fair control	Excellent survival

Thus B.t. works best when diamondback moth or imported cabbageworm is dominant pest

Info on vegetable pest management

http://bugs.osu.edu/welty/