Insect Pests of Vegetables & Fruit in Home Gardens

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The Ohio State University

Common pests: i.d. & management

- Veg specialist pests
- Generalist pests on veg & fruit
- Fruit specialist pests
- One new pest alert!

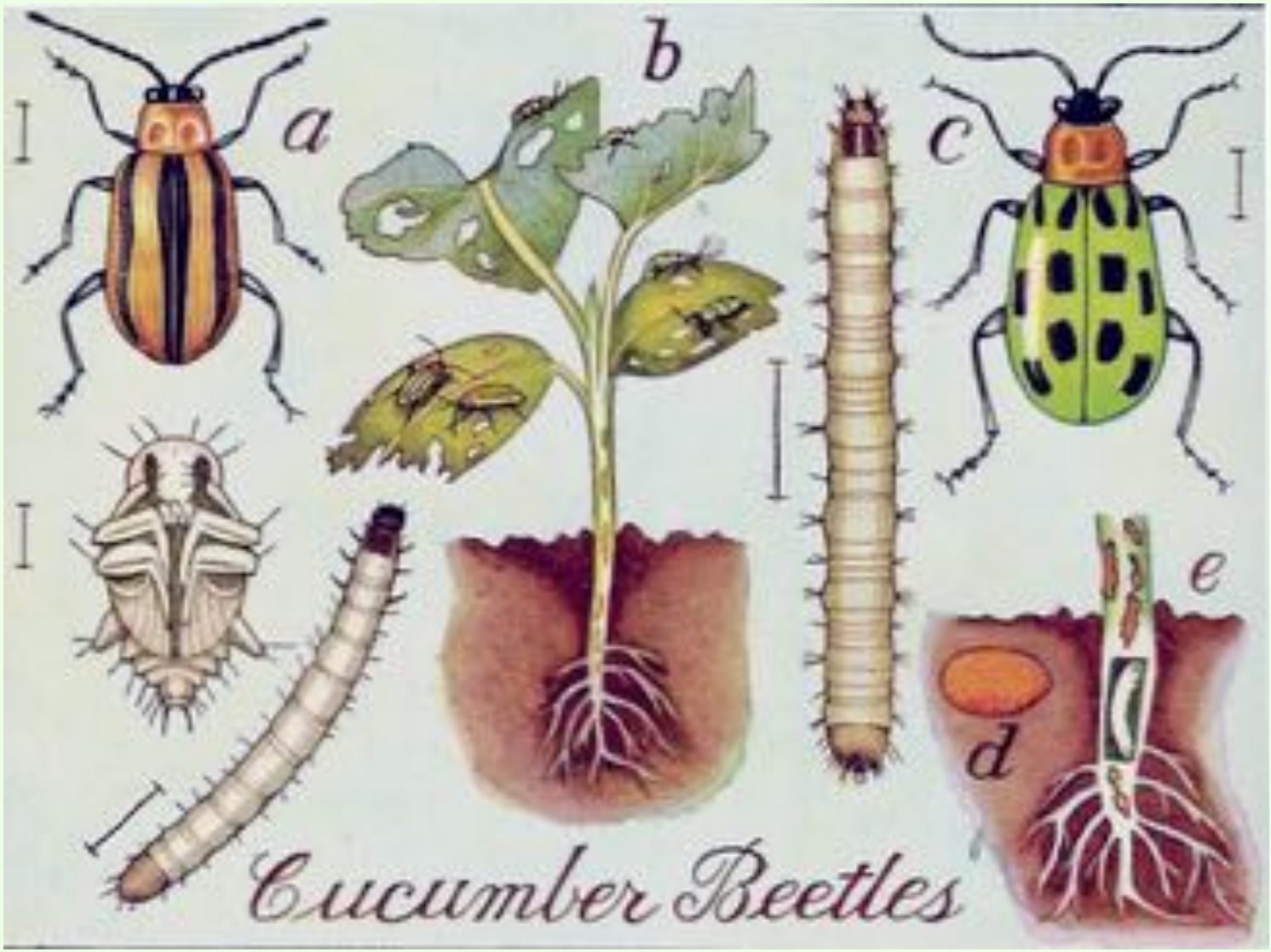
Vegetable specialist pests

- Cucurbits (4 pests)
- Cole crops (4 pests)
- Tomato etc. (2 pests)
- Beans (2 pests)
- Spinach (1 pest)
- Asparagus (2 pests)
- Corn (2 pests)

Cucumber beetles

Striped cucumber beetle

Spotted cucumber beetle



Cucumber beetles: key pests

Feeding damage

Vectors of bacterial wilt disease

Bacterial wilt of cucurbits: Vectored by cucumber beetles

- Transmitted in feces
- Enter via plant wound
- Moisture needed
- Cotyledon stage most susceptible

Russ Ottens, University of Georgia, Bugwood.org

Natural enemy of cucumber beetles

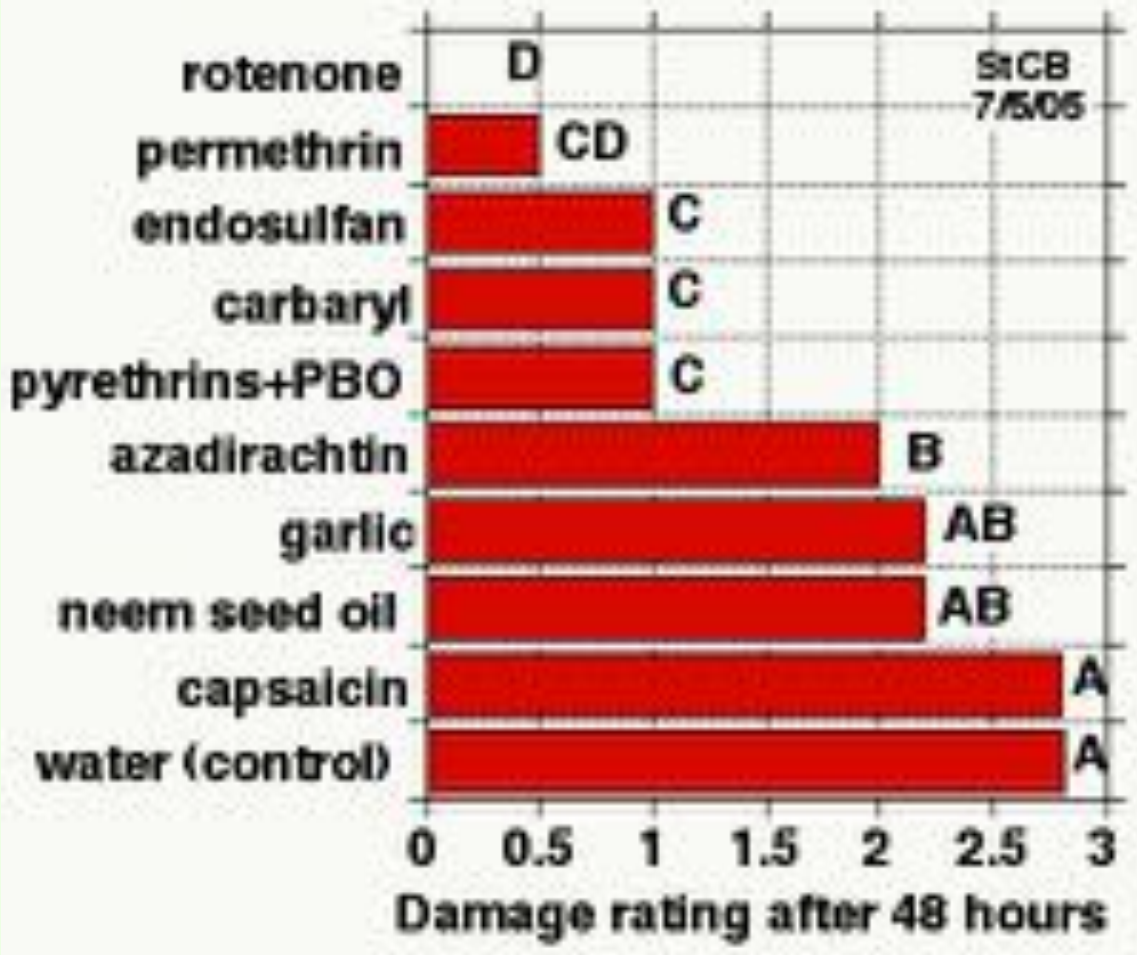
- **Parasitoid fly, *Celatoria setosa***
- **Looks like a small house fly**
- **Kills adult cucumber beetles**
- **Common in Ohio**
- **We need to encourage its survival!**

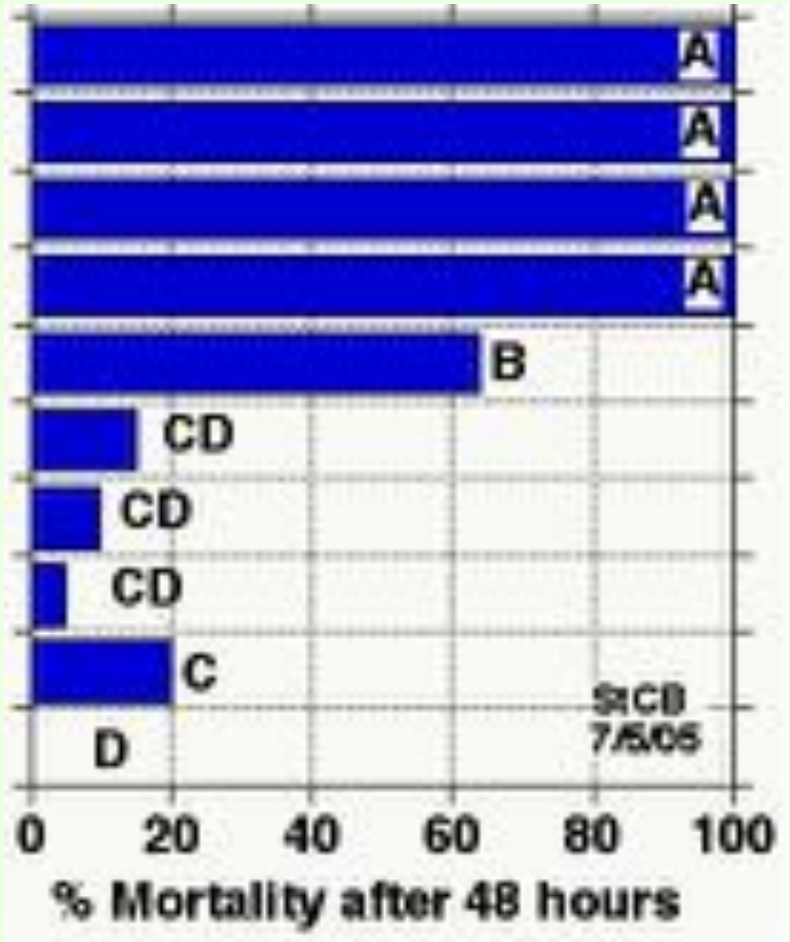
Cucumber beetle management

- For beginners
  - Mechanical control
    - Screen or row cover (seedlings)
  - Chemical control
    - Spray with carbaryl, permethrin, or pyrethrins+PBO
- For advanced gardeners
  - Cultural control
    - Early trap crop (squash: buttercup or Blue Hubbard or Turks Turban)
  - Biological control
    - Conserve parasitoids (by no spray)
  - Behavioral control
    - Pheromone/Kairomone trap

Striped cucumber beetle

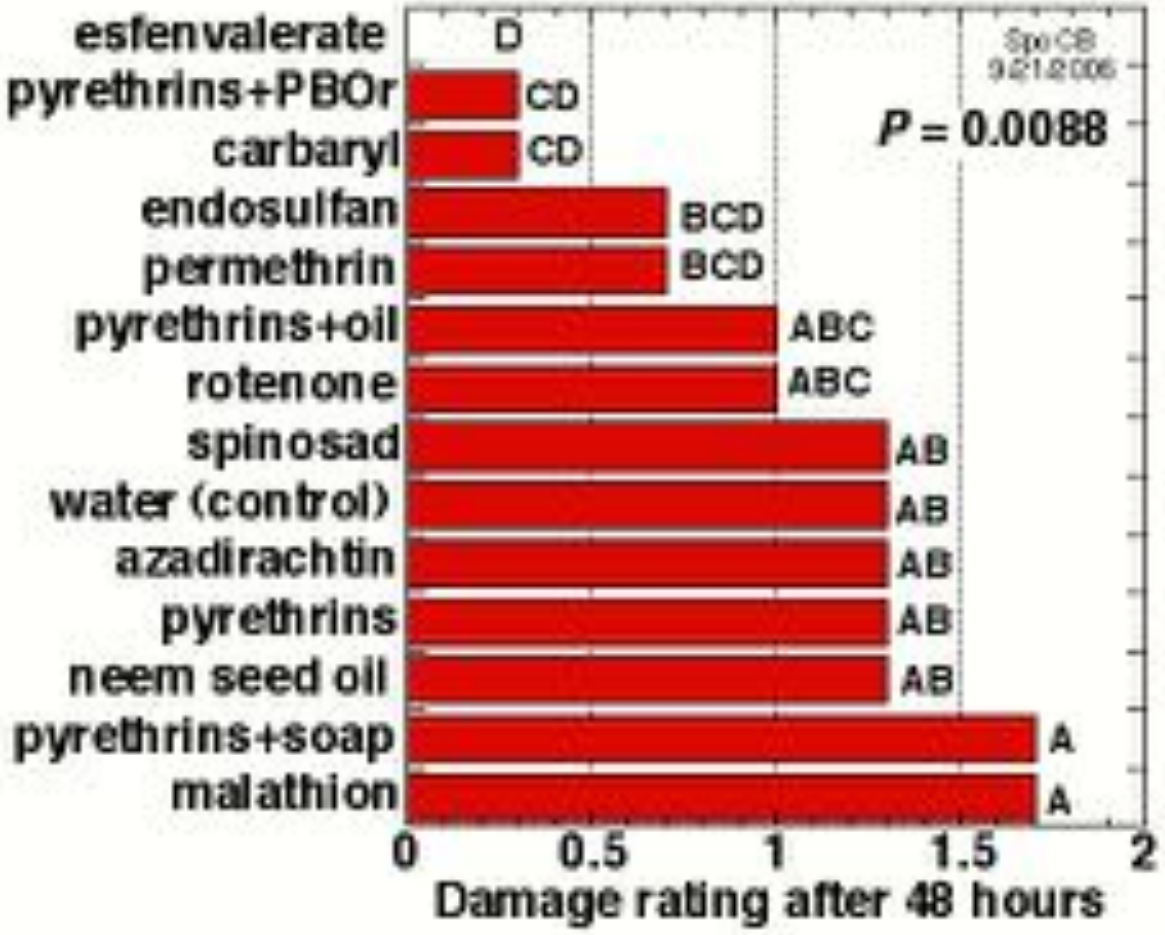
tested on pumpkin leaves, 7/5/05;
4 replicates/treatment, 5 beetles/replicate

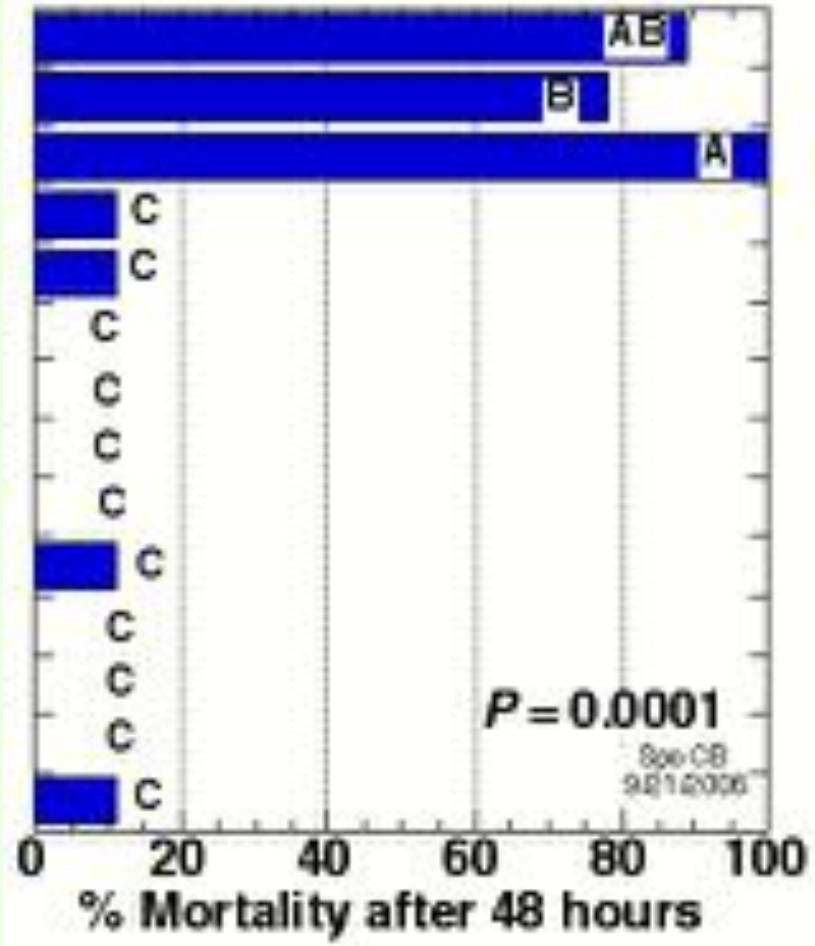




Spotted cucumber beetle

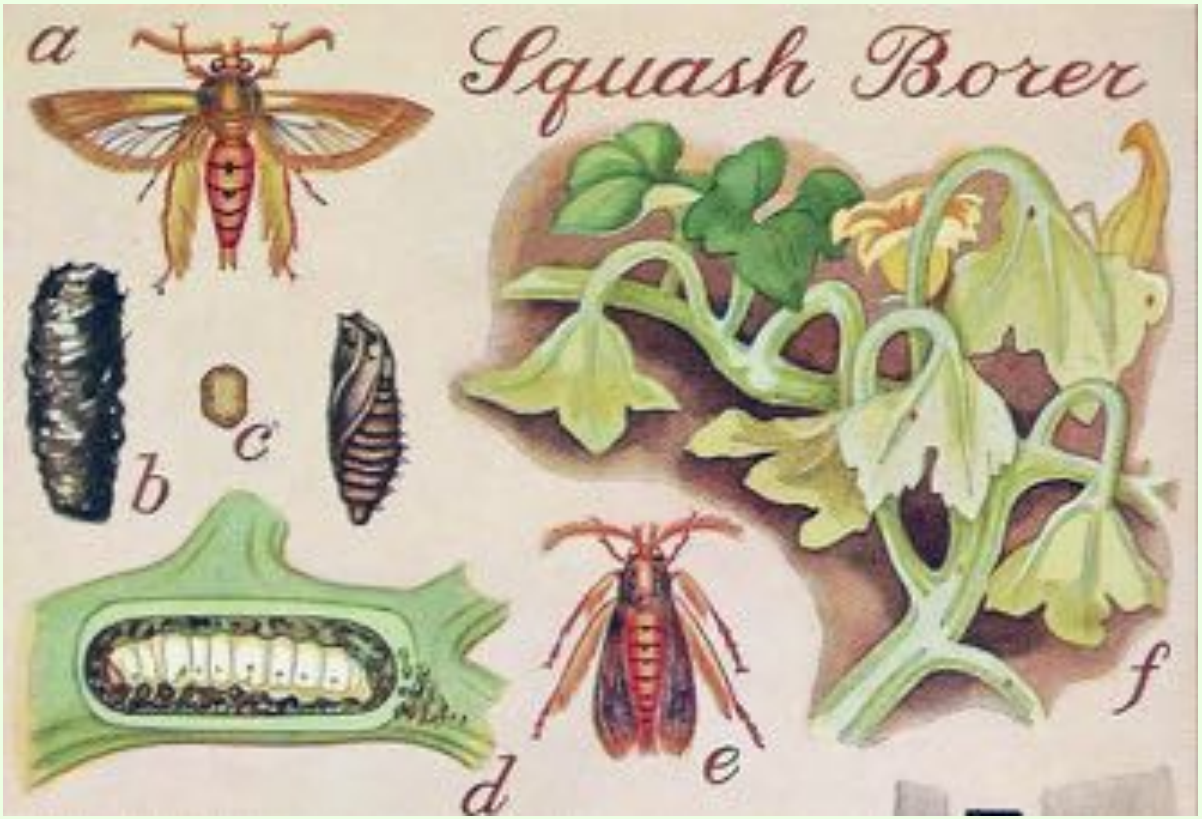
tested on pumpkin leaves, 9/21/2006
3 replicates/treatment, 3 beetles/replicate





Squash vine borer

- **Infests squash, gourd, pumpkins**
- **Plants often die by July**



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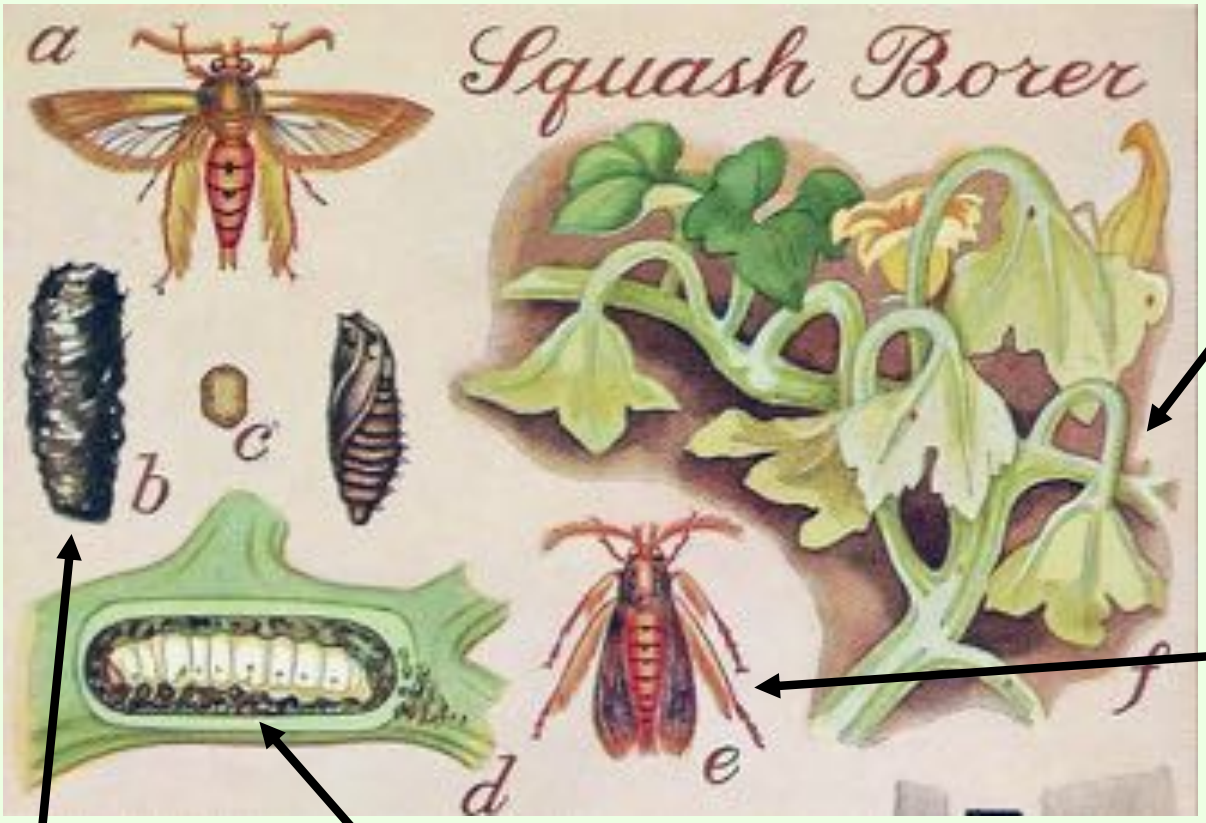


wilting leaves are symptom of infestation

adult is a day-flying moth, lays eggs in late June to mid-July

larva is a caterpillar that bores into stem

cocoon in soil overwinter

Squash vine borer: Management

- **Cultural**
  - **Till soil to destroy pupae**
  - **Plant late for main crop**
  - **Small planting early as trap crop**
- **Mechanical**
  - **Row covers (until flowering)**
- **Chemical spray on plant base**
  - **Minimum 2 sprays 1 week apart early July**
  - **Maximum 4 sprays 1 week apart, late June to late July**

Squash bug

eggs

adult

eggs hatching

young nymphs

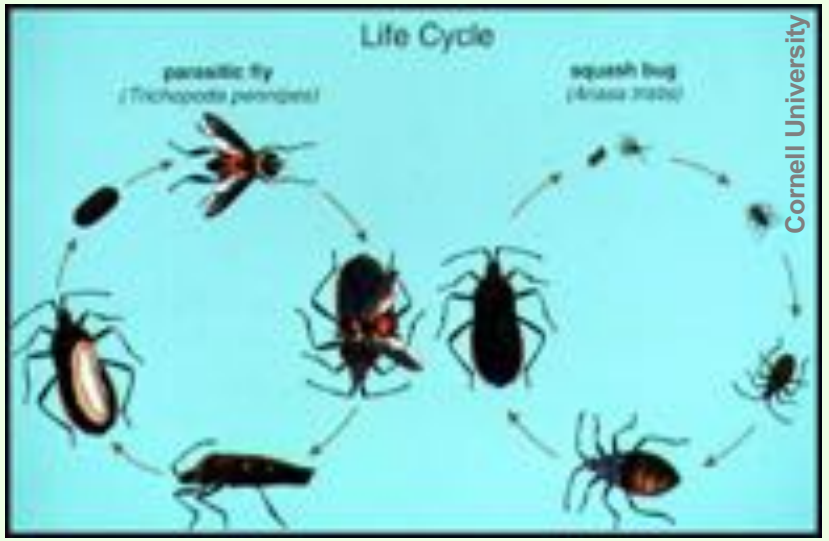
older nymphs

Squash bug: Damage

- **Suck sap: leaves, stems**
  - **Patches turn black, die**
- **Plants wilt**
  - **Can die**
  - **Can live but not develop fruit**
- **Bugs feed on fruit before harvest**

Squash bug: natural enemies

- **Feather-legged fly**
  - ***Trichopoda pennipes***
  - **lays eggs on adult or large nymph**
- **Egg parasitoid wasps**
  - ***Gryon pennsylvanicum***
  - ***Ooencyrtus anasae***

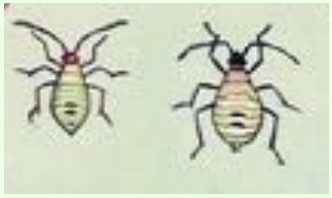


Squash bug: Management

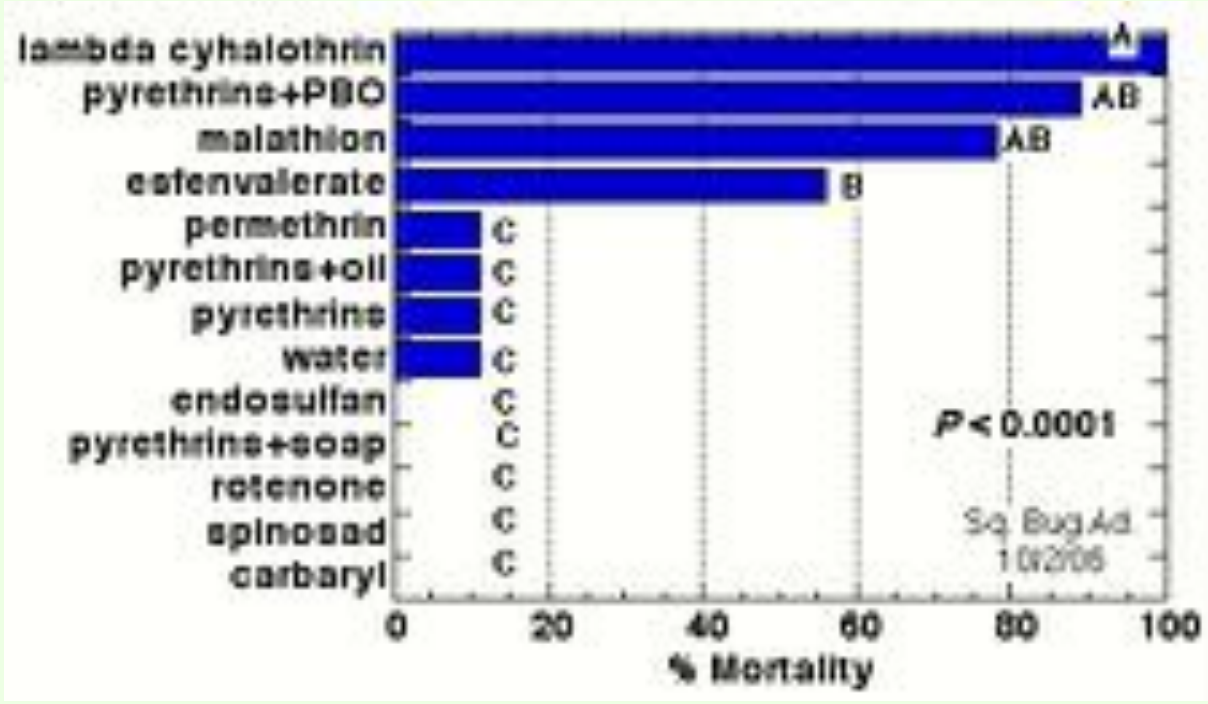
- **Mechanical control**
  - Row covers (until flowering)
  - Hand picking, especially eggs
  - Shelter traps: board or shingle
- **Cultural control**
  - Promote early growth of crop
  - Destroy crop remains
  - Rotate with non-cucurbits

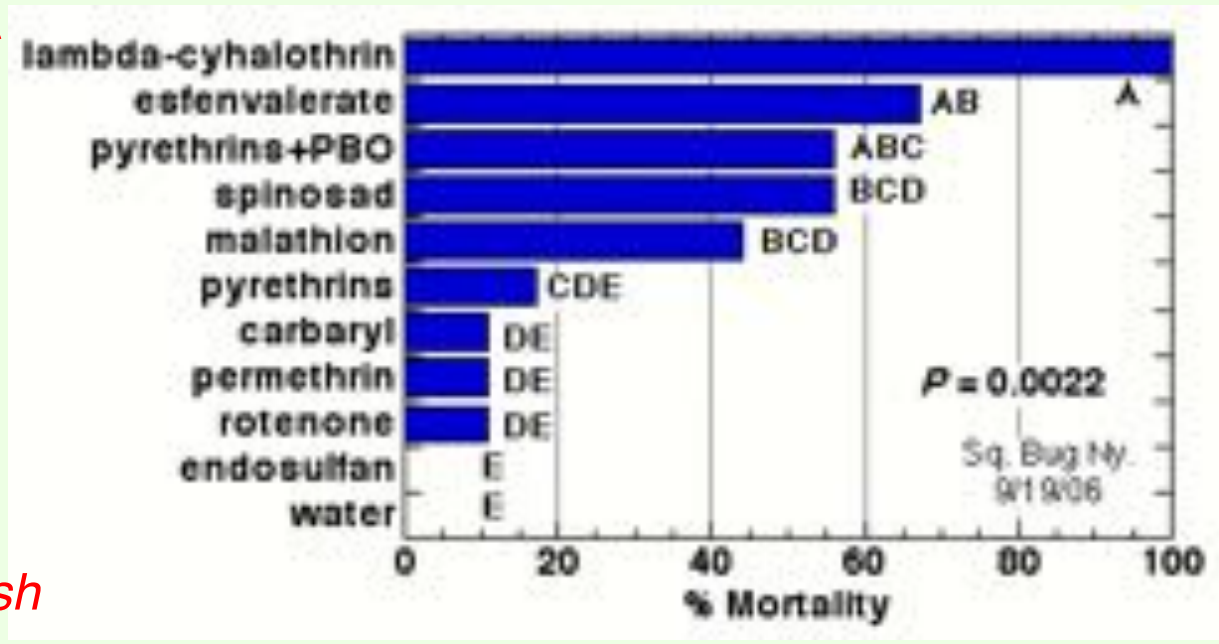
Squash bug

adult



nymph



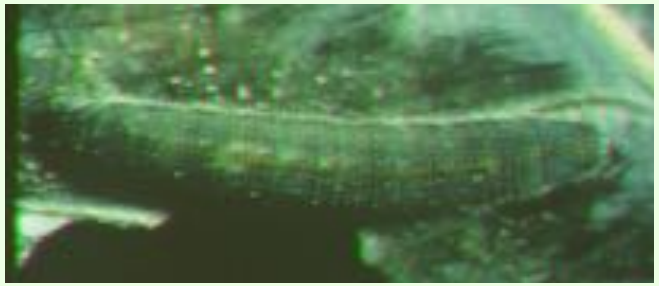


**Not registered for use on squash*

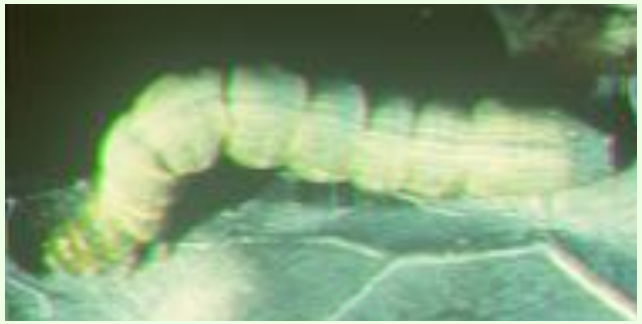
Test question!

- It's late July and my cucumber plant is dying
  - What is likely cause?
  - What can I do about it?
  - When will I do that?
- It's late July and my squash plant is dying
  - What is likely cause?
  - What can I do about it?
  - When will I do that?

3 Caterpillars on cole crops



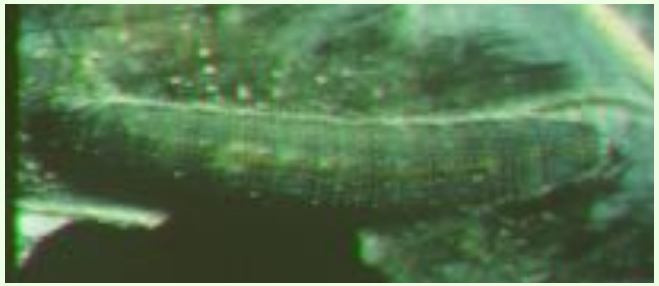
Imported cabbageworm



Cabbage looper

Diamondback moth

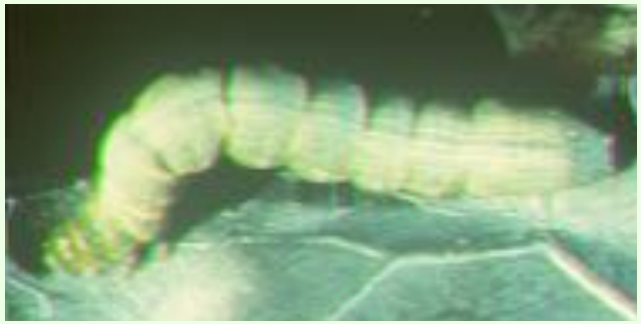
3 Caterpillars on cole crops & their parasitoids



Imported cabbageworm

Cotesia larvae spinning cocoons

Cotesia adult wasp



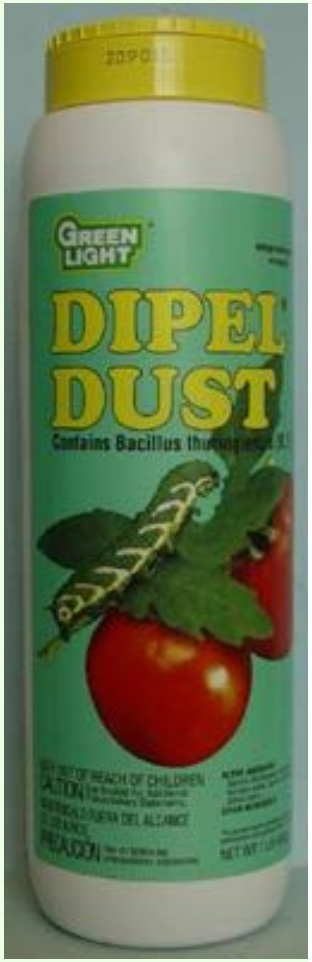
Cabbage looper

Copidosoma floridanum wasps emerging from one cocoon

Diamondback moth

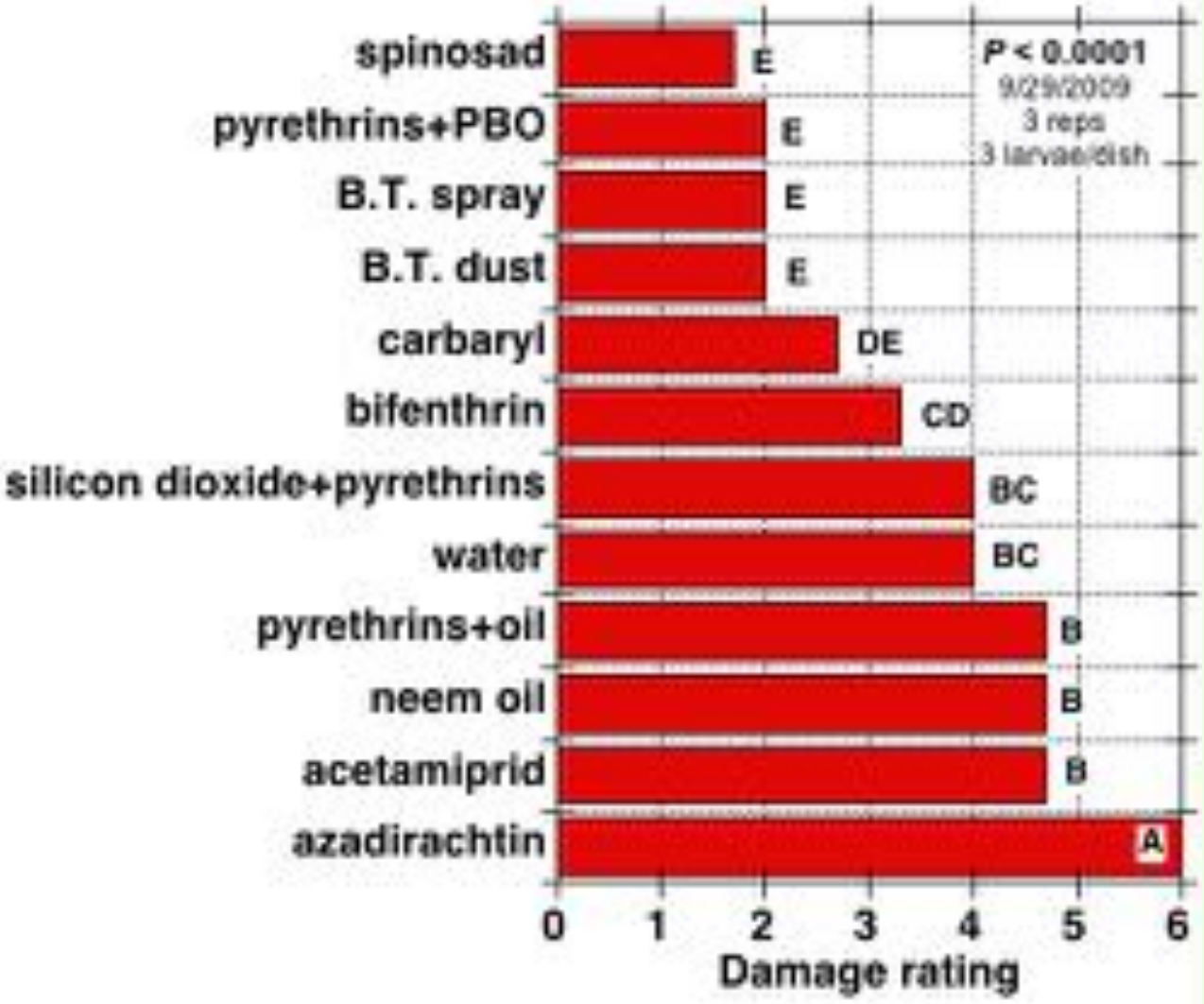
Diadegma insulare oviposits on larvae

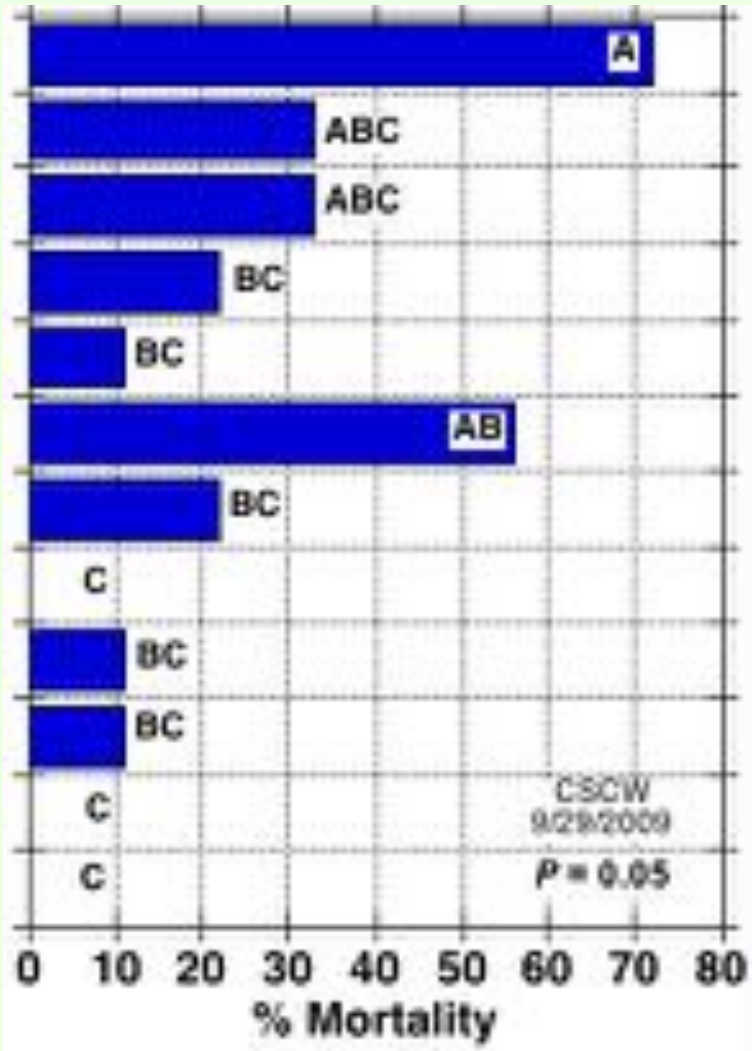
Integration of Chemical Control & Biological Control



- **Depends on choosing a <u>selective</u> insecticide**
  - **Kills caterpillars**
  - **Does not kill parasitoids**
  - **Use B.T. microbial insecticide**
    - **'DiPel' etc.**
  - **Spinosad also easy on parasitoids**
- **Plant border of sweet alyssum to attract parasitoids**

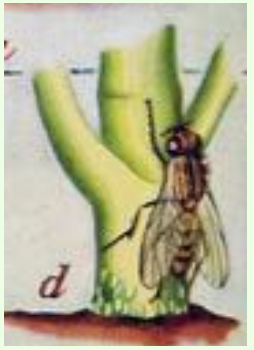
Cross-striped cabbageworm

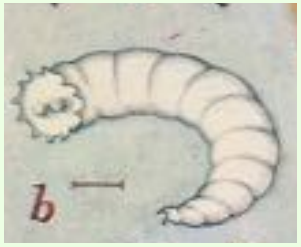




Cabbage maggot

- Turnip, radish, other cole crops
- **Symptoms**:
  - Seedlings wilted, stunted
  - Holes or tunnels in roots
- **Life cycle**:
  - Adult fly lays egg at stem base
  - Larvae feed for 3 weeks
  - 3-4 generations per year
- **Control**:
  - Choose planting date to avoid egg peak
  - Cardboard collars on stem





Row covers

from seeding
until harvest,
protects from
- worms
- maggots

Colorado potato beetle

- **Damage:** chewed leaves
  - By adults & larvae
  - Potato, eggplant, tomato
- 2 generations/year
- **Control:**
  - Hand pick (knock in bucket)
  - Plant potato early or late but not both
  - Spray larvae with spinosad

Eggplant flea beetle

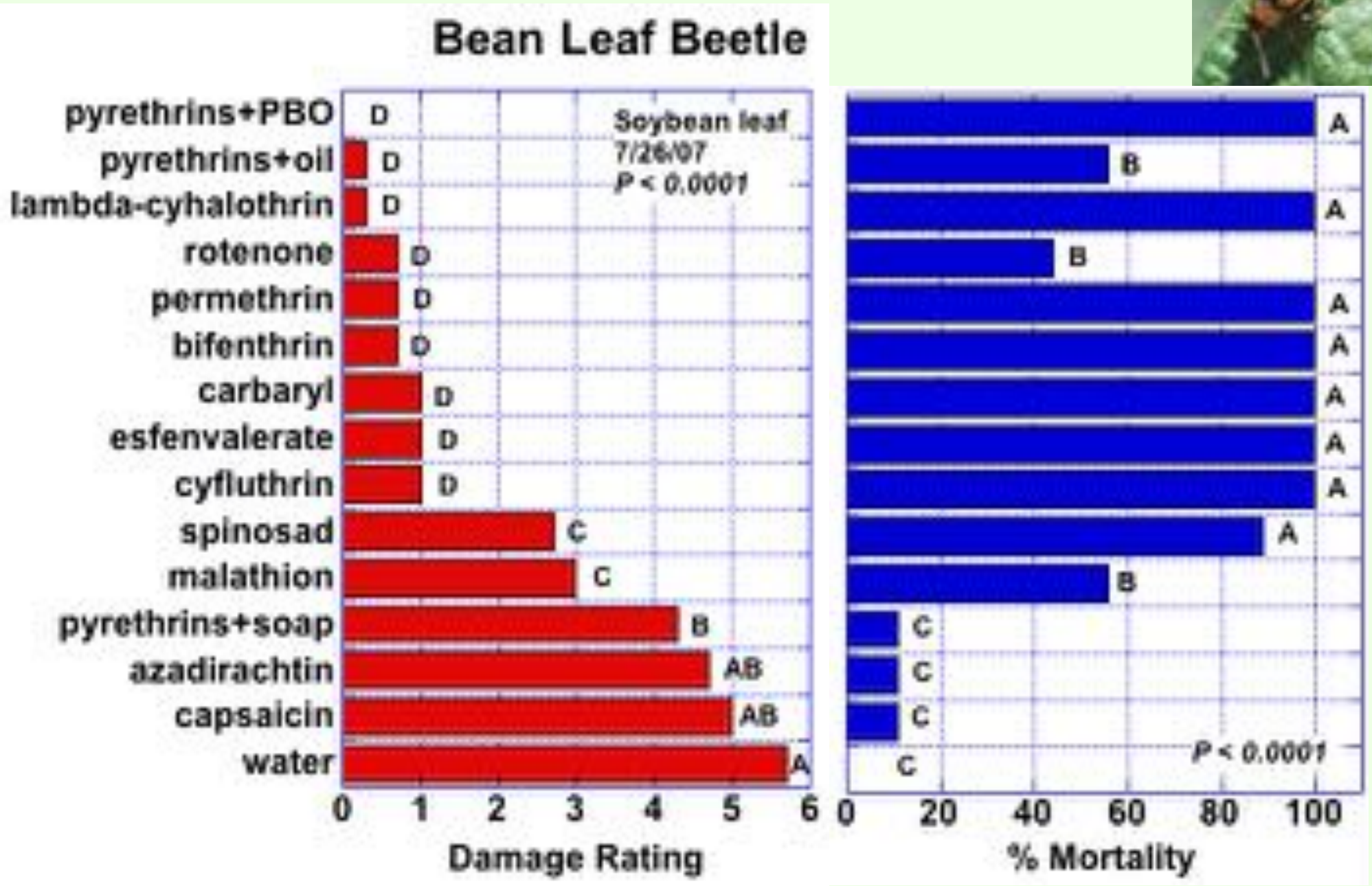
- Chew many holes in leaves
- Damage critical to seedlings
- Management:
  - Remove (aspirate) daily
  - Insecticides or repellents
- Similar species on:
  - Cabbage, arugula (2 species)
  - Potato

Beetles on beans

- **Bean leaf beetle:**
  - Adults chew holes through leaves, pods
- **Mexican bean beetle:**
  - A true lady beetle
  - Larvae skeletonize leaves
- **Cultural control:**
  - Exclusion (row covers)
  - Plow after harvest
- **Chemical control:**
  - Sevin or pyrethrins+PBO

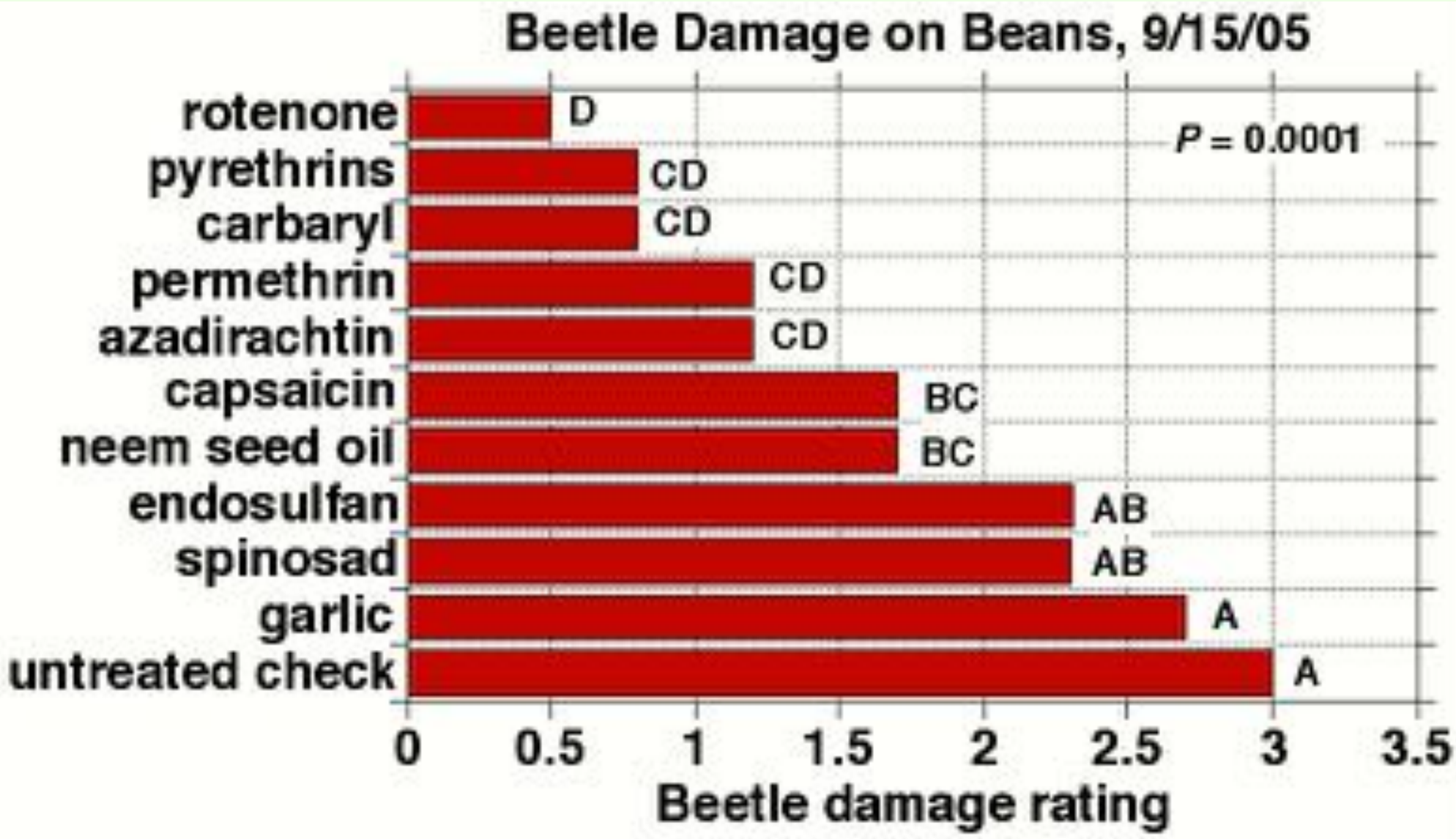
Bean leaf beetle

Bean Leaf Beetle



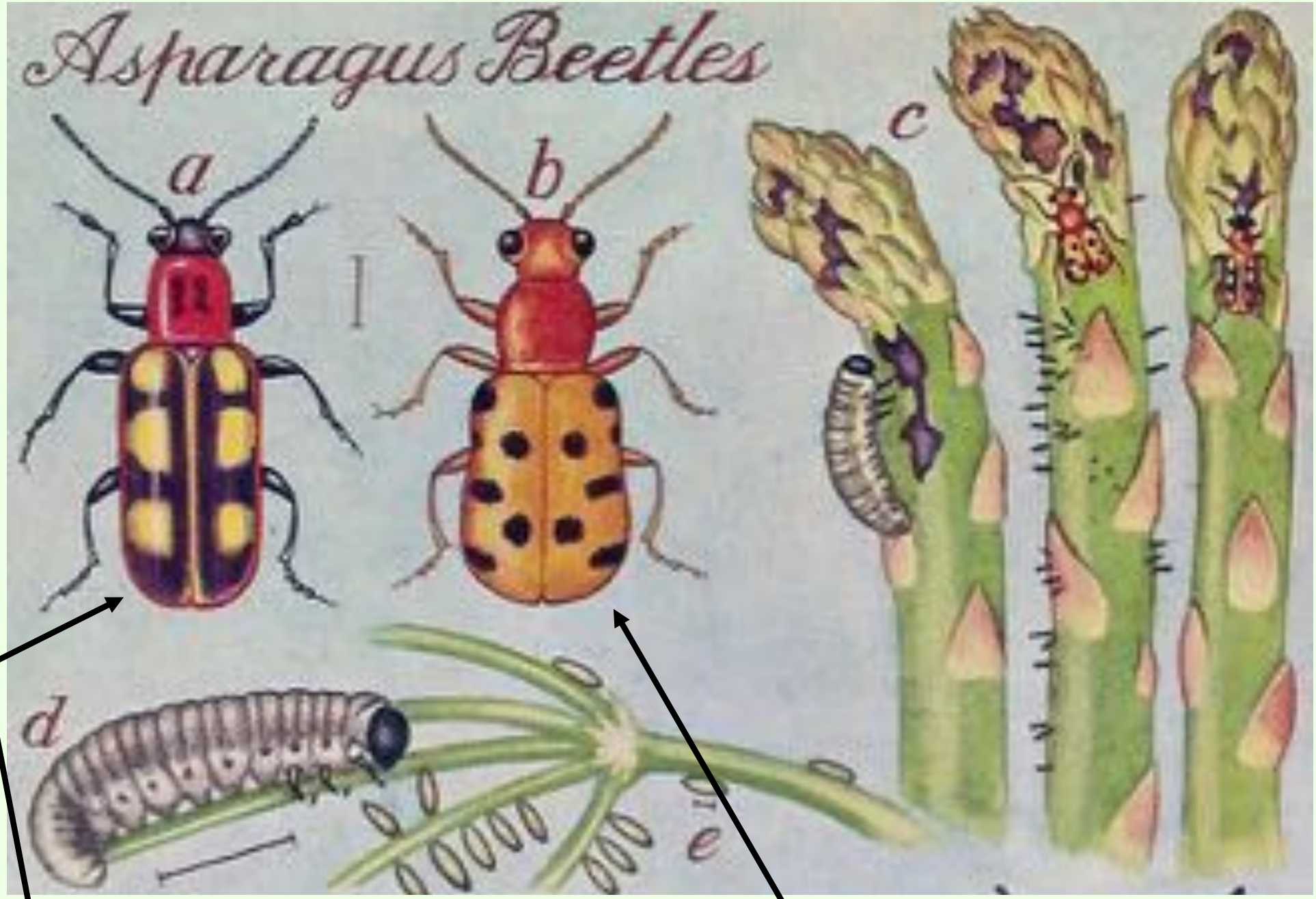
Field trial on snap beans

(bean leaf beetle + spotted cucumber beetle)



Spinach leafminer & beet leafminer

- Adult fly lays eggs
  - On leaf underside
  - in early spring
- Maggots feed inside leaf, 1-2 weeks
  - Narrow mine when young
  - Large blister-like mines when older
- Pupate in soil
- Several generations per year
- Hand pick infested leaves, 3x/week

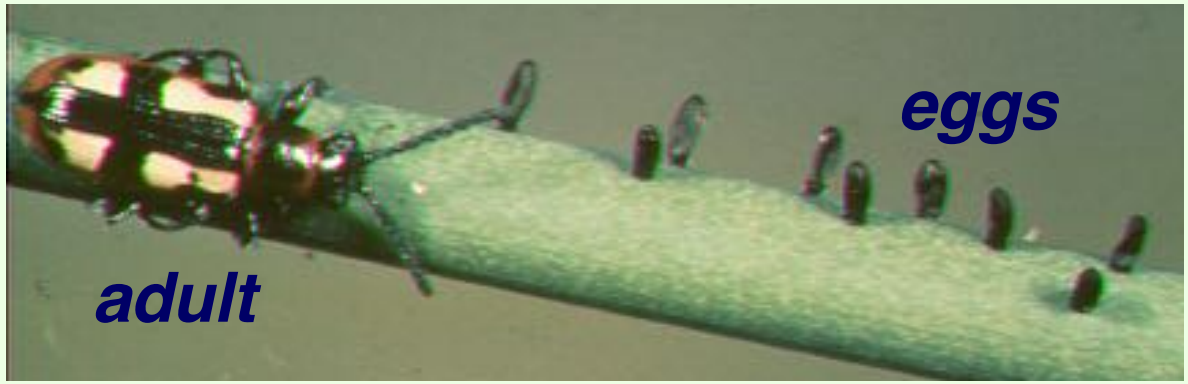


Common asparagus beetle

Spotted asparagus beetle

Asparagus beetles: Damage

- **Common asparagus beetle**
  - Adults feed on spears
  - Adults lay eggs on spears
  - Larvae feed on leaves
- **Spotted asparagus beetle**
  - Adults feed on spears
  - Larvae feed in berries



Asparagus beetles: Management

- Hand picking
- Insecticides or repellents

Corn worms

1. European corn borer

- Damage at tip or shank or side
- Two generations per year
- Damage in June & August
- Worm appearance:
  - dark brown head
  - body with rows of flat spots
  - body without microspines

Corn worms

2. Corn earworm

- Damage at ear tip only
- Damage usually mid-August & later
- Worm appearance:
  - light brown head
  - body with long stripes
  - body covered with short microspines

Corn Worm Management

- **Planting date:**
  - Early & late plantings difficult
  - Middle plantings easiest
- **Traps for monitoring**
  - Excellent for corn earworm
  - Good for European corn borer
- **Chemical control:**
  - BT for 1st generation borer
  - Oil + BT in ear tip for earworm
  - Spinosad for both pests
- **Biocontrol:**
  - Encourage generalists: *Orius*, ladybugs
  - *Trichogramma* egg parasitoid

Veg & fruit generalist pests

- Japanese beetle
- Slugs
- Whiteflies
- Mites
- Aphids
- Brown marmorated stink bug

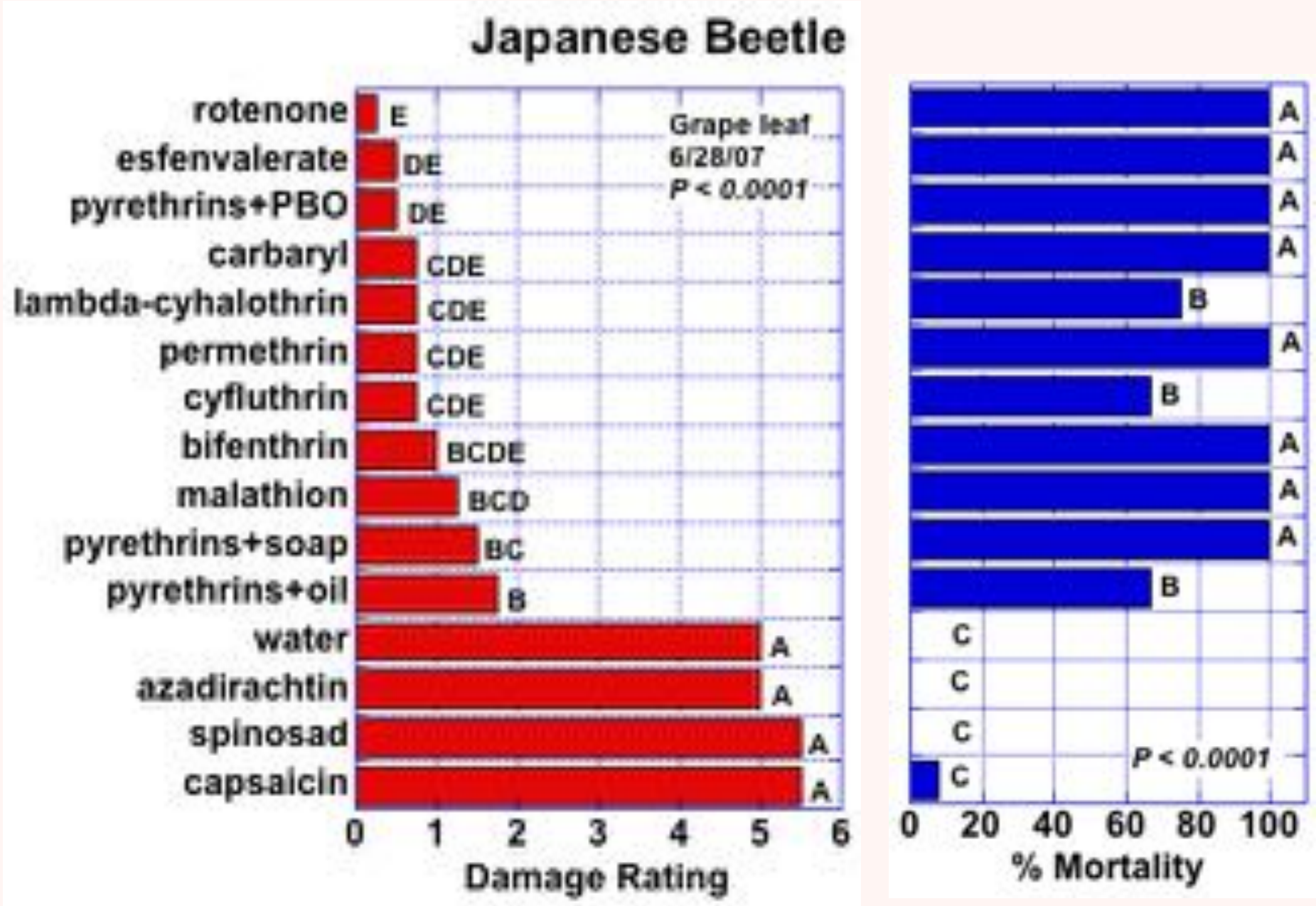
Japanese beetle

- Adults attack many crops:
  - Grape
  - Raspberry
  - Blueberry
  - Plum
  - Peach
  - Sweet corn
  - Beans
- Emerge in early July
- Larvae: pests of grass roots

Japanese beetle

- **Insecticides**
  - **Sevin (carbaryl)**
  - **pyrethrins + PBO**
- **Traps**
  - **can bring in MORE beetles**
  - **Do not place close to crop**

Results of insecticide tests in laboratory bioassays



Slugs

- Not insects!
- No wings or legs
- Move around plants by sliding
- Feed mostly at night
- Hide during daytime
- Favored by moisture, thick mulch
- Can not swim

Slug damage

- Strawberries, lettuce, tomato
- Mouth with tooth-like radula
- Injury:
  - Scraped surface
  - Chewed leaves & stems
  - Ragged holes & tunnels
  - Defoliation
- Evidence:
  - Slime trails
- Often in protected sites, like under strawberry cap

Slug appearance

Common species: grey garden slug

- Slimy
- 1-2 inches (25-50 mm) when fully extended
- Grey to pale yellow with light mottled markings
- Eyes are rounded knobs on stalks, can be retracted

Slug eggs

- Clear, round
- In clusters of about 5 eggs
- Laid in the fall
- Laid under mulch or plant debris
- Easily seen under straw in spring

Slug management

- **Cultural tactics**
  - Reduce plant density
  - Delay fall mulching
  - Remove debris around field
  - Border mulch of sweetgum balls
- **Mechanical removal tactics**
  - Board traps
  - Beer traps

- **Chemical tactics**
  - Border of diatomaceous earth
  - Baits on soil around plants

Slug control by baits

- Spread around base of plants, not on the plants themselves
- Best if applied to moist soil
- If dry, irrigate just before spreading bait, to stimulate slug activity
- Avoid watering for 3-4 days after application
- Ideal to apply in late afternoon or evening

Slug control by bait

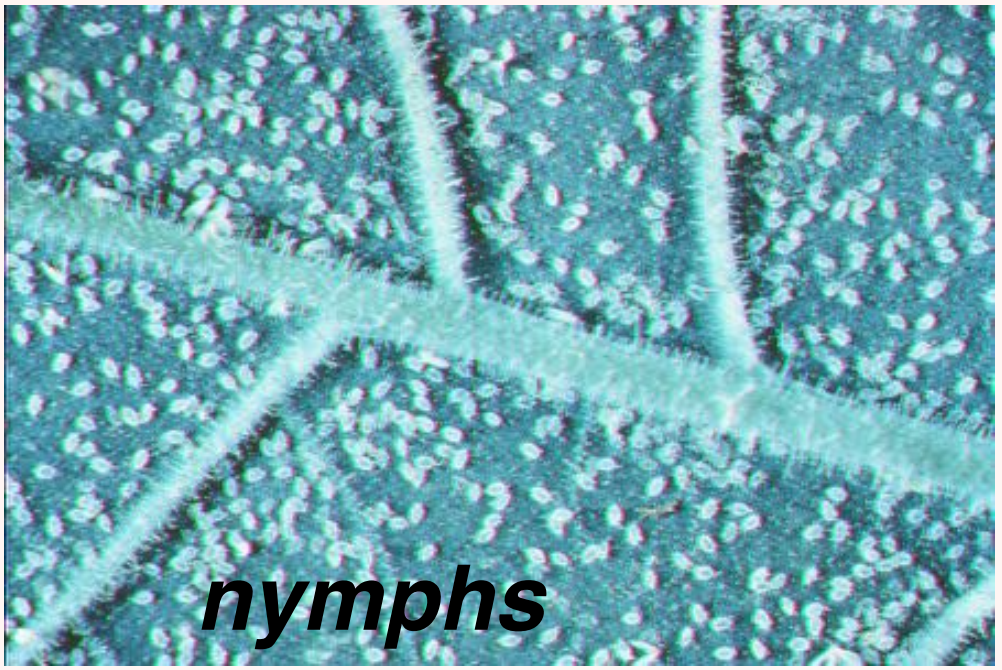
- **Option 1: metaldehyde (Bug-Geta)**
  - Kill slugs by over-stimulating mucous
  - Prevents damage
  - Toxic to dogs
  - Works best at warm temperature

Slug control by bait

- **Option 2: iron phosphate (Sluggo, etc.)**
  - Safe to humans, dogs, natural enemies
  - Less rapid toxic effect than metaldehyde
  - Stop the slugs from feeding
  - Eventually leads to their death

Whiteflies

adult



nymphs

- Suck sap
- Damage done by nymphs from leaf undersides
- **Need magnifier** to see nymphs

Whiteflies: damage

- Cause scorch
- Sooty mold can follow

Whiteflies: hosts

tomato

squash

beans

lettuce

Whiteflies: insecticides

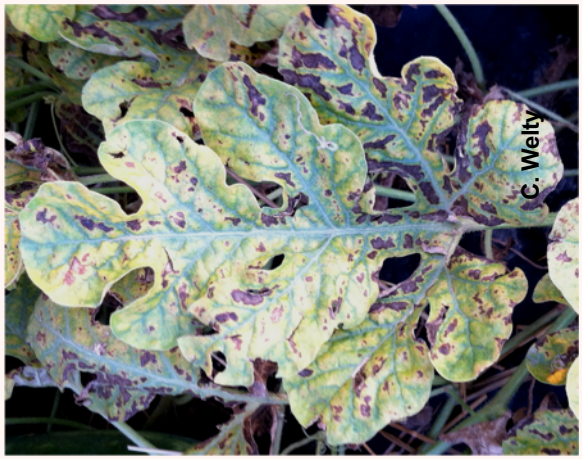
- **Best controlled by neonicotinoids**
  - **acetamiprid**
  - **imidacloprid**
  - **be sure to know pre-harvest interval**
- **Insecticidal soap: soft option**

Two-spotted spider mite

- Often overlooked
- Often mistaken for disease
- hot dry weather
- Tiny (1/60 inch)
- White with 2 black spots
- 8 legs

Two-spotted spider mite: hosts

- Tomato
  - Yellow blotches
- Bean
  - White stippling
- Watermelon
  - Yellow blotches
  - Brown lesions



Two-spotted spider mite: diagnosis

- Fine webbing on leaf underside
- Scout by tapping leaf over paper, look for moving specks
- Early diagnosis for good control

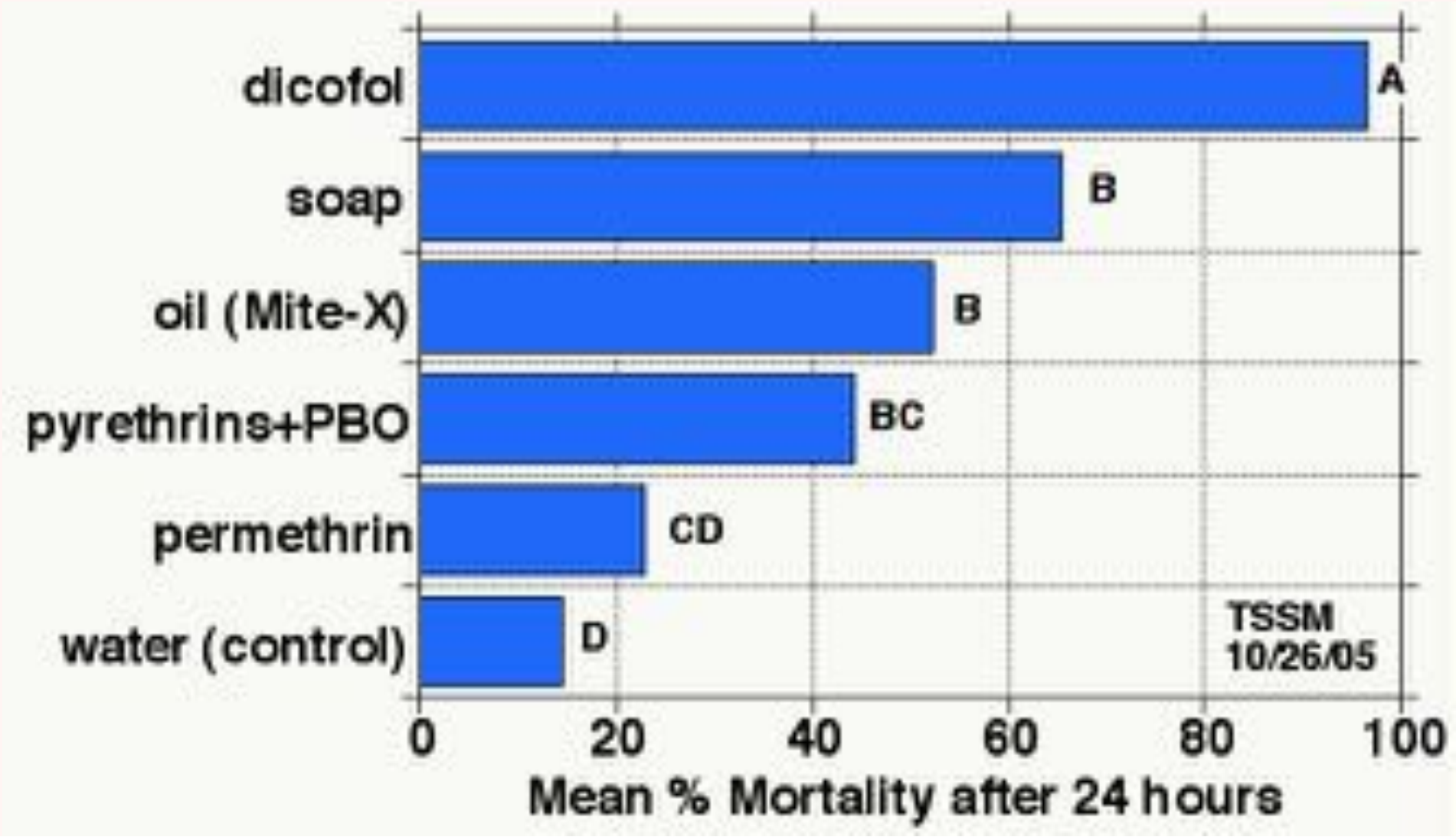
webbing

Spider mite management

- Tolerable at low density
- Conserve natural predators
- Overhead irrigation can help
- Soft control:
  - Insecticidal soap
  - Hort. Oil

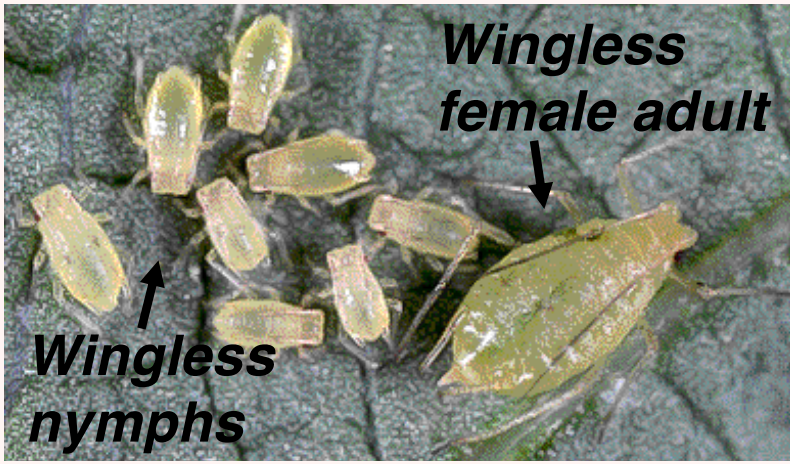
Two-spotted spider mite

tested on snap bean leaves, 10/26/05;
3 replicates/treatment, 30 mites/replicate



Aphids

- **Appearance:**
  - Small, soft, 2 ‘tailpipes’
  - Every species with winged & wingless forms
- **Damage:**
  - Suck sap
  - Cause leaf puckers
  - Deposit honeydew
  - Transmit viruses



Winged female adult

Aphids: common species

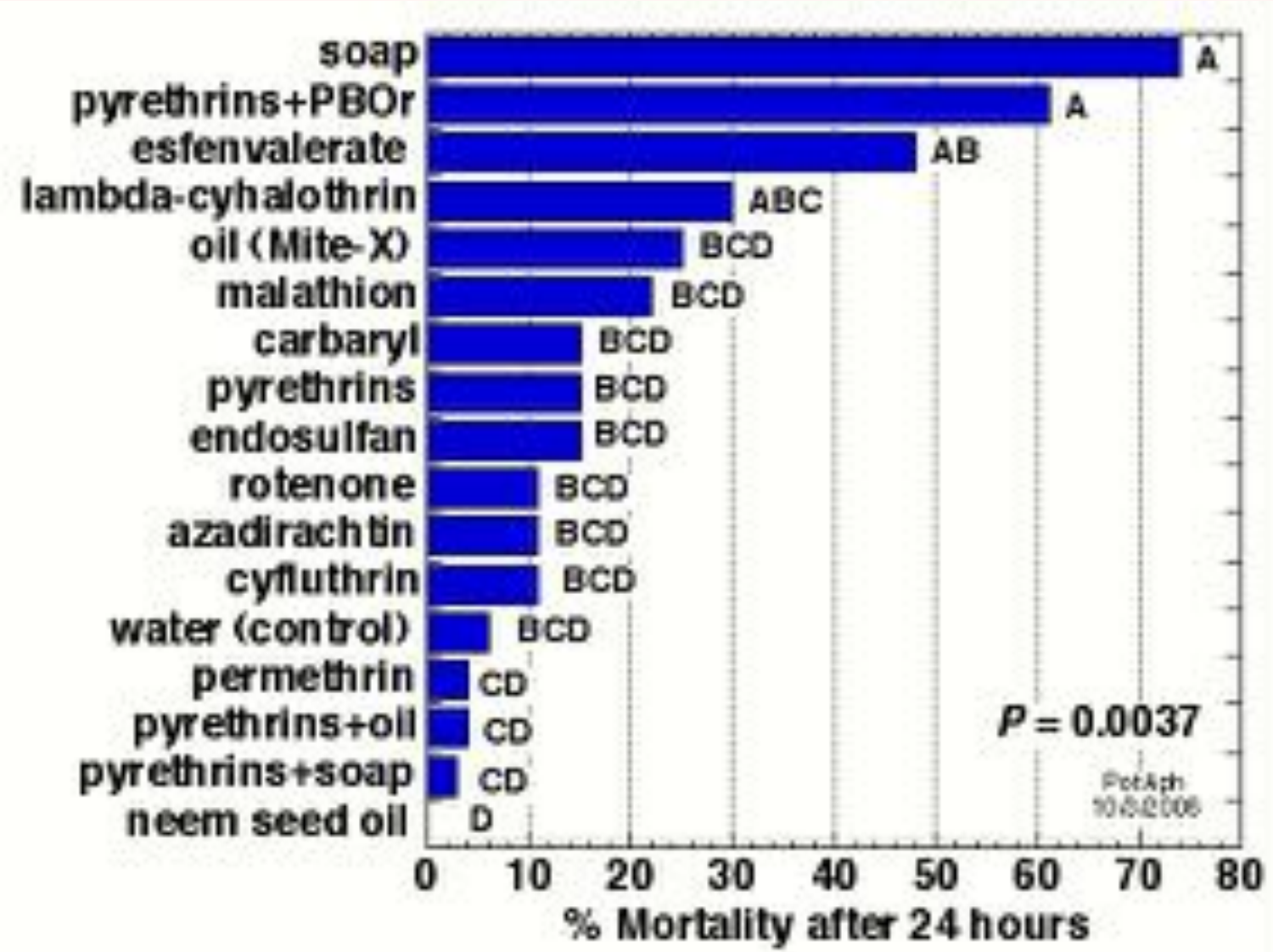
- Potato aphid (tomato, lettuce)
- Green peach aphid (lettuce, pepper)
- Melon aphid (cucurbits)
- Rosy apple aphid (apple)
- Green apple aphid (apple)

Aphid management

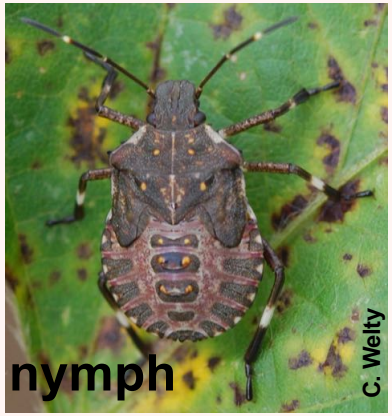
- **Encourage natural enemies by avoiding use of broad-spectrum insecticides**
- **Suffocate with spray of insecticidal soap**
- **Reflective mulch to prevent colonization by winged aphids**

Potato Aphid

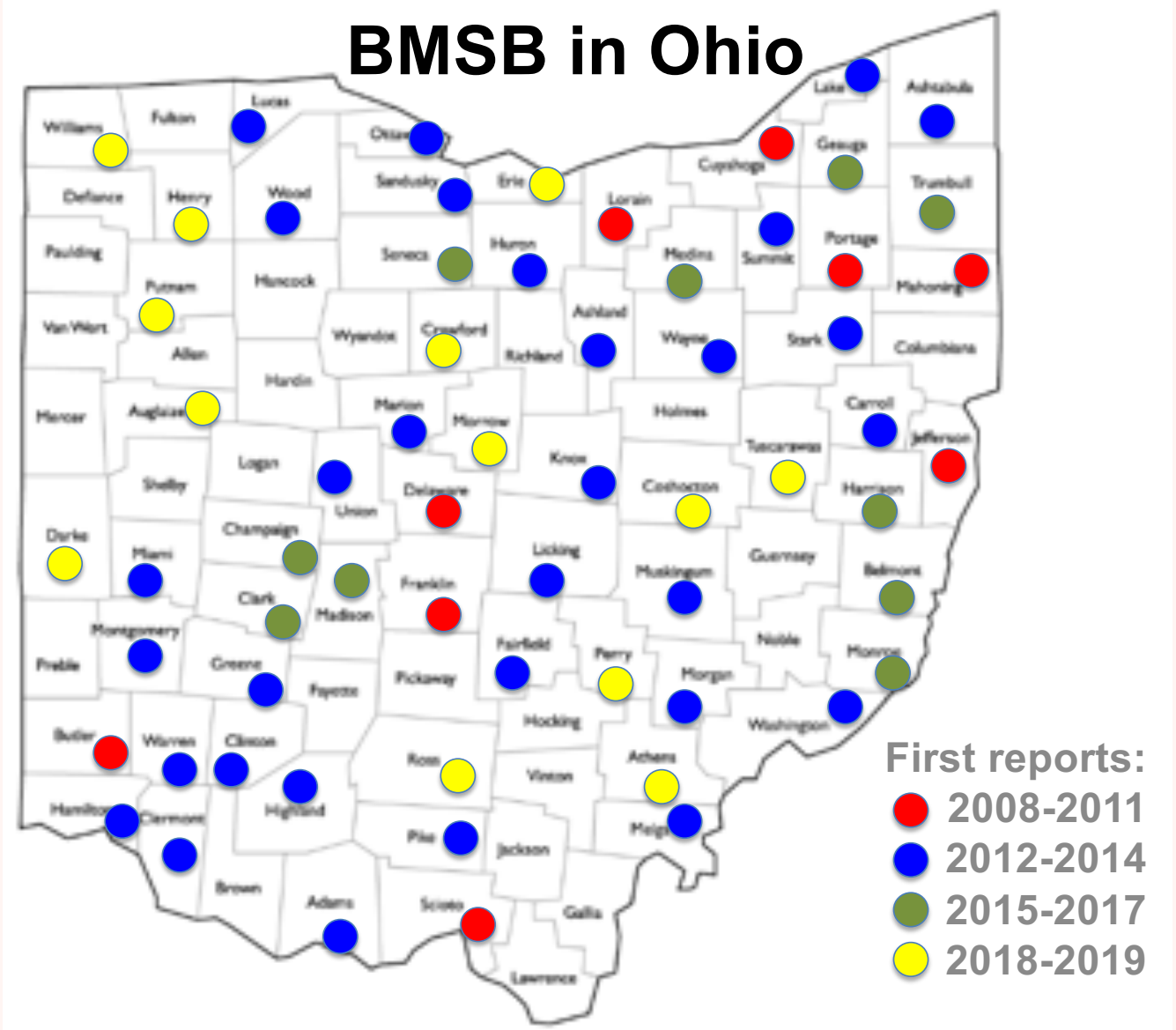
tested on tomato leaves, 10/3/2006
3 replicates/treatment, 10 aphids/replicate



Brown marmorated stink bug



- Invading Ohio since 2007
- Attacks fruits & seed pods
- Also nuisance pest: invades homes in autumn



BMSB detected in at least 63 of Ohio's 88 counties as of 2019

Injury by stink bug

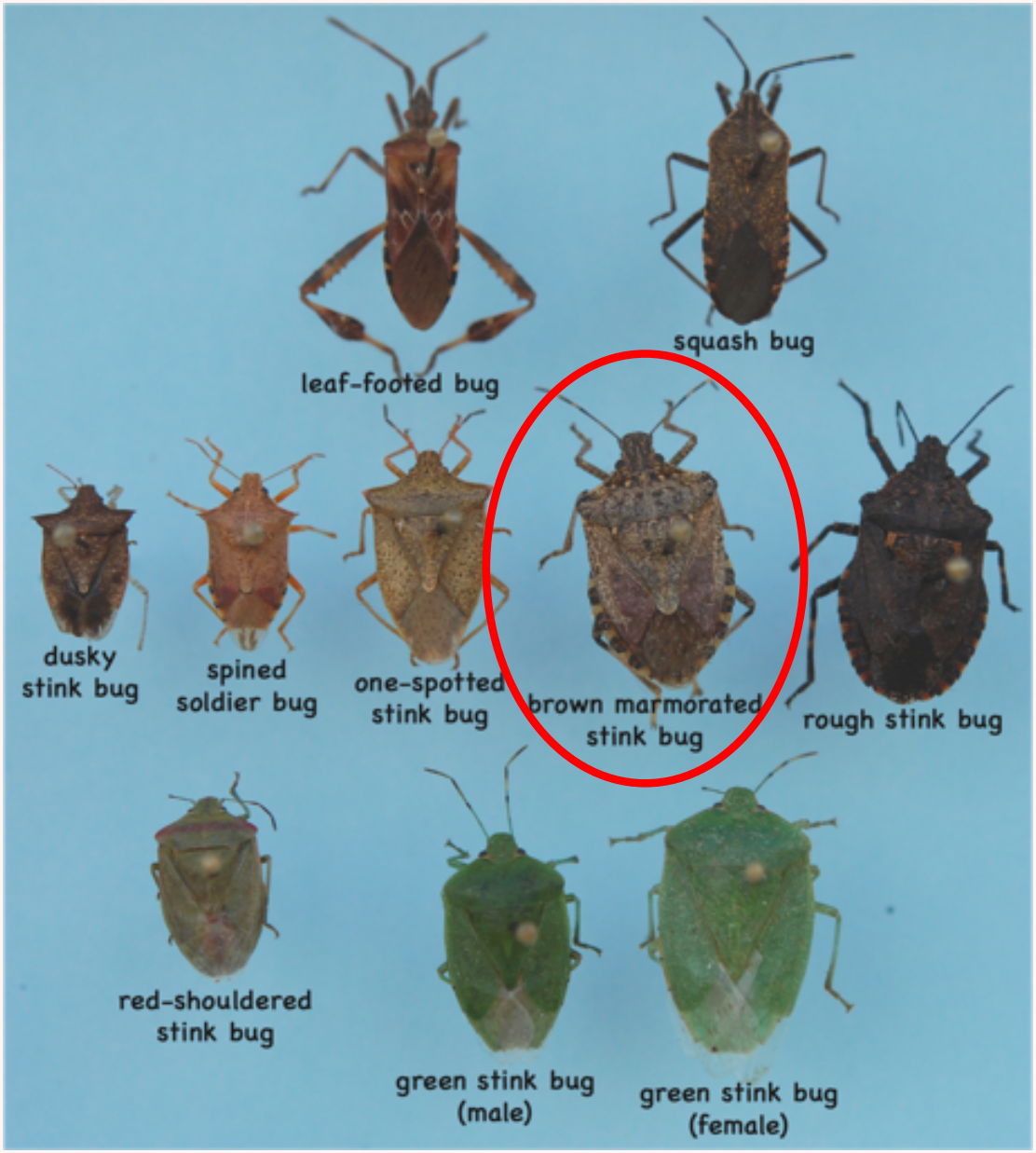
Brown marmorated stink bug: injury

corn

pepper

tomato

beans



Note differences in size & shape in pinned specimens side-by-side

Mechanical control of stink bugs

- Lightweight row covers
- The preferred tactic in small plantings

Stink bug control in gardens

Category	*Ingredient*	*Representative brand name*
pyrethroids	bifenthrin + zeta-cypermethrin	Ortho Bug B Gon Insect Killer for Lawns & Gardens
	gamma-cyhalothrin	Spectricide Triazicide Insect Killer for Lawns & Landscapes
	lambda-cyhalothrin	Bonide Eight Insect Control Garden & Home
		Spectricide Triazicide Insect Killer for Lawns & Landscapes Long Lasting Formula
	cyfluthrin	Bio Advanced Vegetable & Garden Insect Spray
	esfenvalerate	Monterey Bug Buster II
neonicotinoid	acetamiprid	Ortho Flower Fruit & Vegetable Insect Killer
deterrent	kaolin	Surround At Home
for nymphs, not adults	spinosad	Bonide Captain Jack's Deadbug Brew

Fruit specialist pests

- Raspberry (1 pest)
- Strawberry (1 pest)
- Apple (2 pests)
- Peach (2 pests)
- Apple + peach (2 pests)
- Cherry (1 pest)

Photo by G. Arakelian

Spotted-wing Drosophila

- Looks like common vinegar flies on overripe, fallen, decaying fruit
- But the new species attacks <u>healthy</u> ripening fruit
- Invading mainland USA since 2008

Fruit injury by Spotted-wing Drosophila

Management of spotted-wing Drosophila

- **Sanitation**
  - Strongly recommended!
  - Destroy leftover fruit
  - Easier said than done
  - Do every 2 days
  - Culls in clear plastic bags in sun, 1 week
  - Or bury culls 2 ft deep

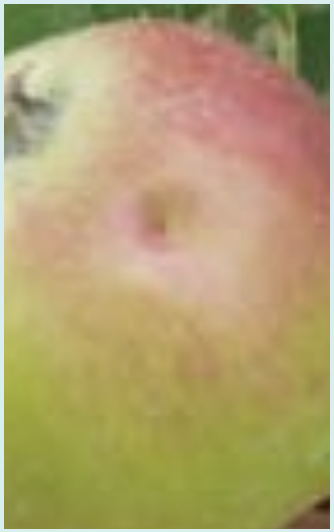
Insecticides for SWD in garden raspberries & blackberries

Rating	Active ingredient	PHI	Representative brand name
Very effective	spinosad	3-day	Captain Jack's Deadbug Brew (Bonide)
	bifenthrin + zeta-cypermethrin	3-day	Ortho Bug B Gon Insect Killer for Lawns & Gardens
Effective	malathion	1-day	Bonide Malathion
Moderately effective	acetamiprid	1-day	Ortho Flower Fruit & Veg Insect Killer Concentrate
Uncertain, likely good	pyrethrins + PBO	0-day	FoxFarm Don't Bug Me

REQUEST!

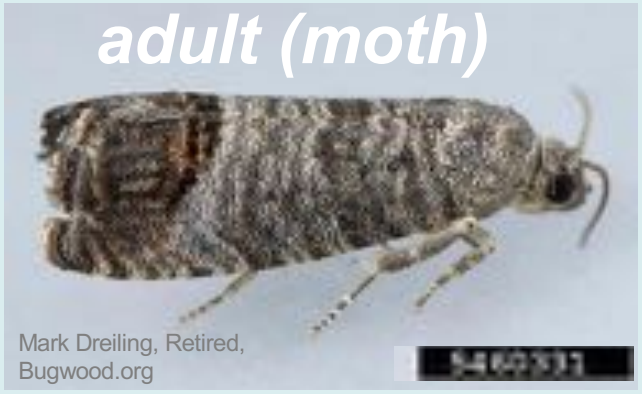
- **Anyone with a planting of raspberries or blackberries nearby in Columbus?**
- **Need a site to put a trap for SWD, to be checked by my crew once per week**
- **Please let me know of any potential sites**

Tarnished plant bug



- **Causes fruit deformities:**
  - Strawberry: apical seediness
  - Peaches: ‘catfacing’
  - Apples: ‘dimples’
- **Cultural control by weed management**
- Chemical control before & after bloom
  - permethrin
  - pyrethrins + PBO

Codling moth

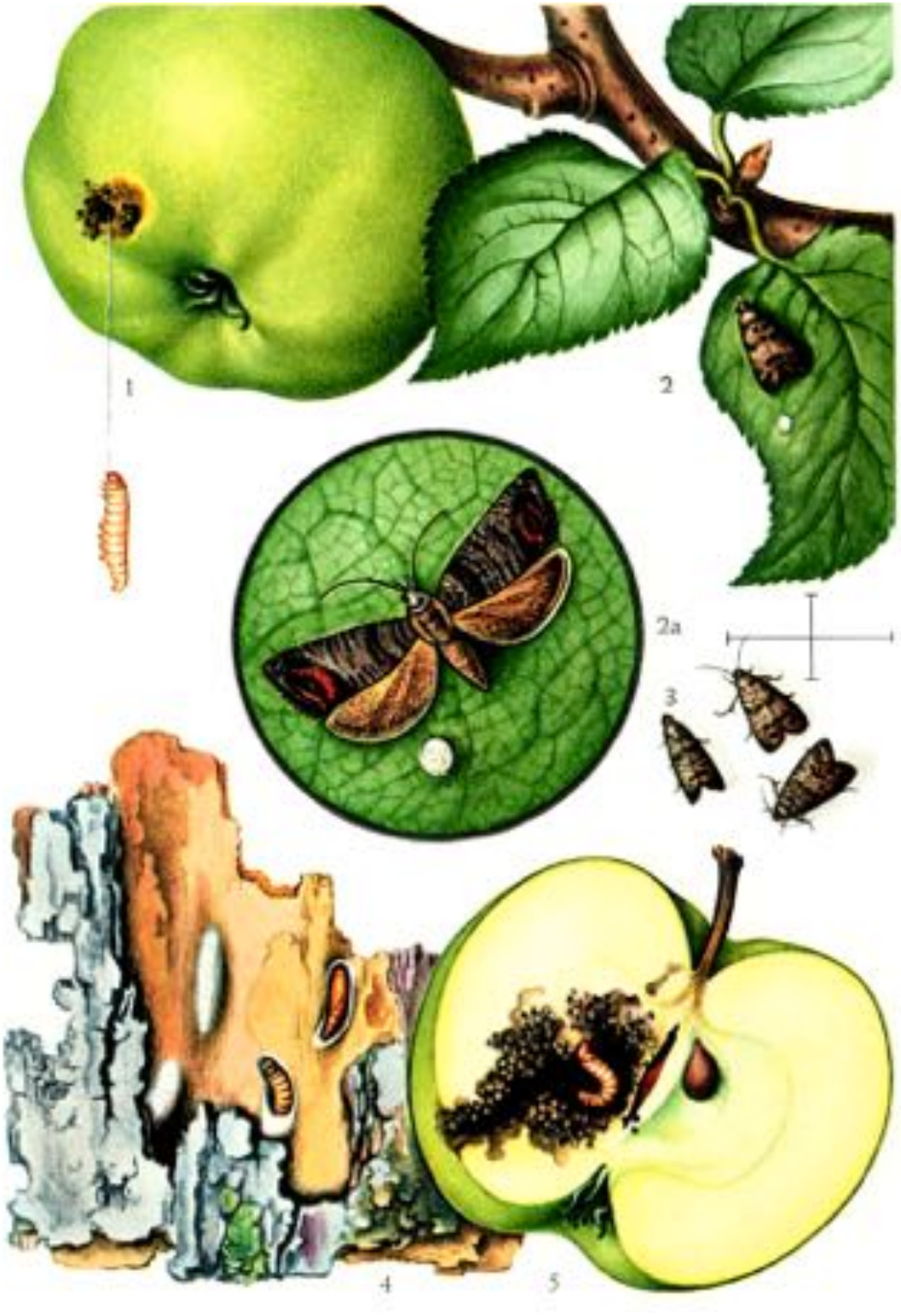


- **The key pest in apple & pear fruit**
- **Young larva enters fruit, tunnels to seeds at core**

Codling Moth Life cycle

1st generation in May/June

2nd generation in July/August

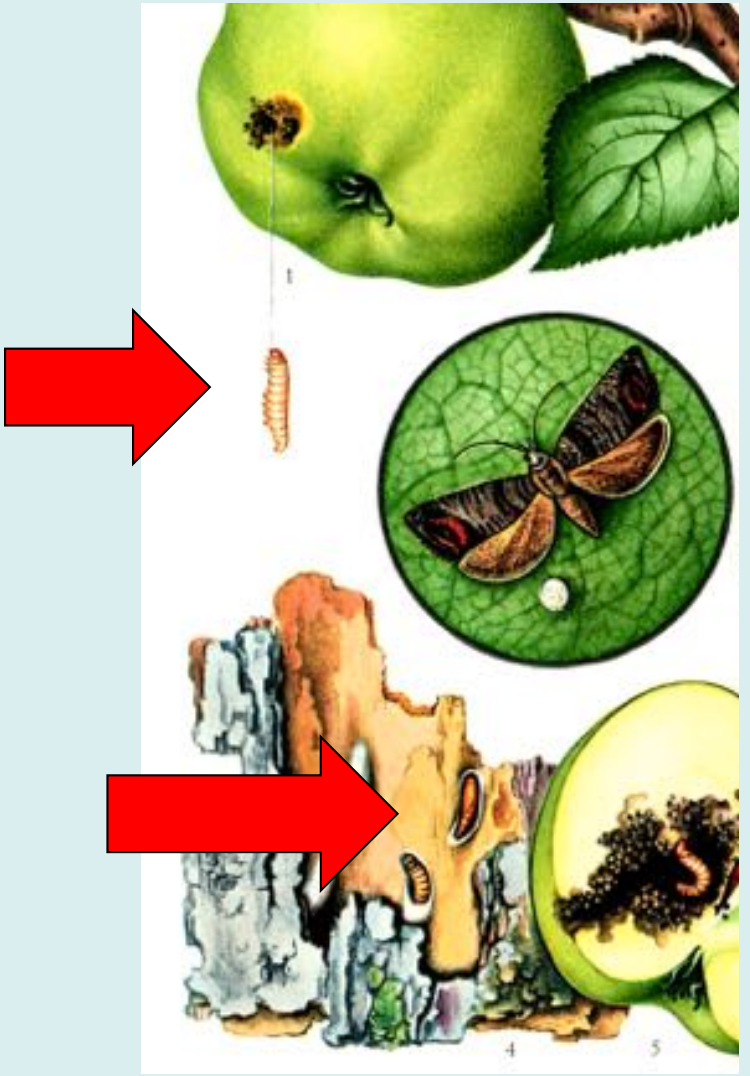


Mechanical controls of codling moth

- Trunk bands
- Fruit bagging

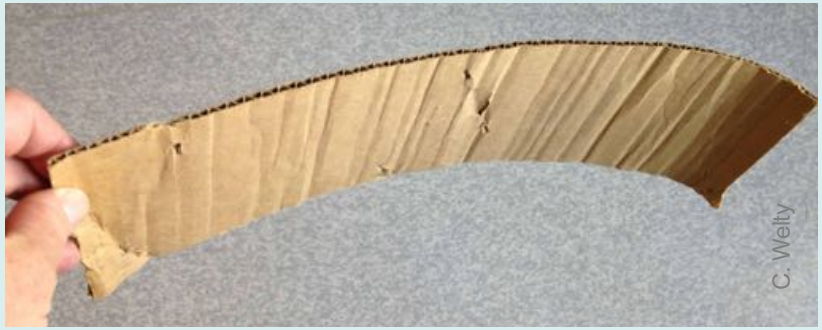
Trunk bands: the idea

- Larva exits fruit
- Crawls under bark scale to pupate
- Bands offer shelter
- Destroy the shelter!



Trunk bands:

4 - 6” corrugated cardboard on trunk & main branches



Target	*Install*	*Remove & destroy*
1st generation	mid-May	Late June
2nd generation	mid-July	November

Fruit bagging

- **Supplies:**
  - **2-layer Japanese bags**
  - **Or brown paper bags + twist ties**

Fruit bagging

- Install on fruit ½ - ¾” diameter (~2 – 3 weeks after petal-fall)
- Remove 2 weeks before harvest
- Labor intensive!

Cultural controls of codling moth

- **Sanitation:**
  - **Scrape cocoons from picking crates, fences**
- **Host reservoir elimination:**
  - **Cut down abandoned trees**

Insecticide for codling moth?

- Calendar approach:
  - Spray every 2 weeks from petal-fall until harvest (= 9 sprays)
- IPM approach:
  - Use 2 sprays @ 2 generations
  - 1st spray at 1st egg hatch
    - Memorial Day +/- 1 to 2 weeks
    - 250 degree-days (base 50°F) after moths begin sustained flight
    - Use pheromone trap for moth flight
  - 2nd spray 14 days later

kaolin: ‘Surround At Home’

Apple maggot

- **A key pest in northern USA**
- **Not a pest in southern USA**
- **Variable in latitude of Ohio**

Apple maggot: mechanical control

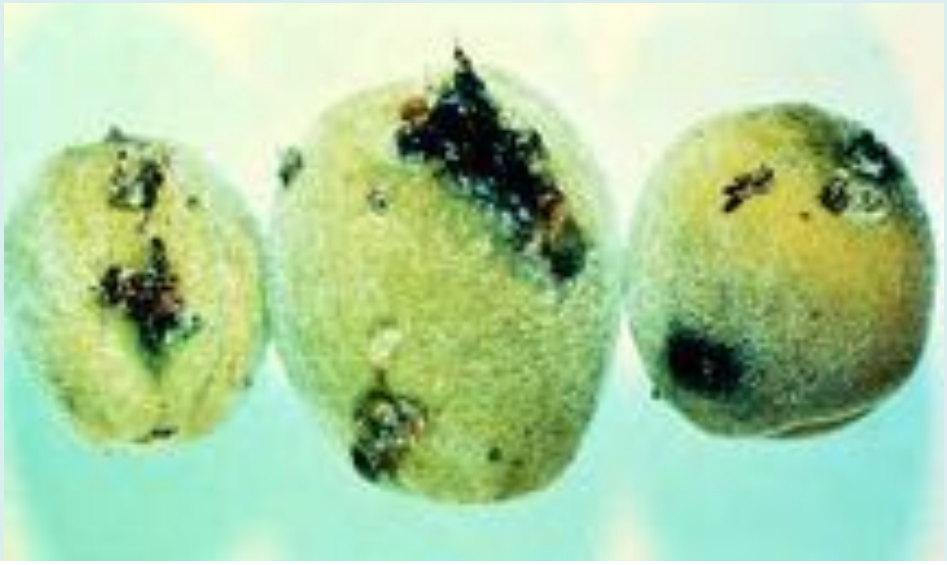
- Adult female fly attracted to round red object
- **Sticky ball trap**: 1 trap per 100 real fruit
- '**Tanglefoot**'
- Clean with **mineral spirits**
- Optional: fruit volatile lure

Apple maggot: chemical control

- Spray **every 2 weeks** in July & August
- Products:
  - acetamiprid
  - carbaryl
  - esfenvalerate
  - spinosad

Oriental Fruit Moth

- 1st & 2nd broods: tunnel in terminal shoots
- 2nd & 3rd broods: tunnel in fruit



Oriental Fruit Moth in Peaches

Control Options:

- **Prune flagged terminal shoots in spring**
- **Insecticide**
  - **permethrin, malathion, or Sevin**
  - **Most important to apply at petal-fall**
  - **Additional applications in all remaining cover sprays**

Borers in peach trees

- **Peachtree borer**
  - Attack healthy tree at soil line
  - One generation per year
- **Lesser peachtree borer**
  - Attack injured scaffold branches
  - Two generations per year

Control of peach borers

- **Cultural**
  - Train trees to form wide angles
  - Avoid practices that injure bark
- **Mechanical** 
  - ‘Worming’ Insert knife into entry hole
- **Chemical**
  - Dip bare roots before planting new trees
  - Bark drench with permethrin (start year 2)

Plum curculio

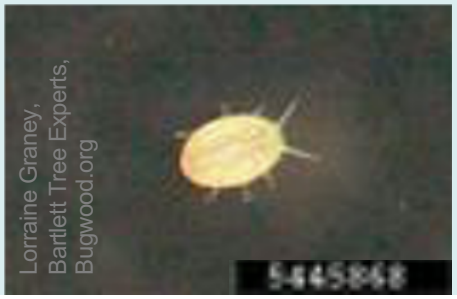
- External damage from egg-laying
  - Apples
  - Plum, peach, cherry, blueberry
- Internal damage from larvae
  - Plum, peach, cherry, blueberry
  - Not in apple
- Adults hide by day, feed at night

Plum curculio: control

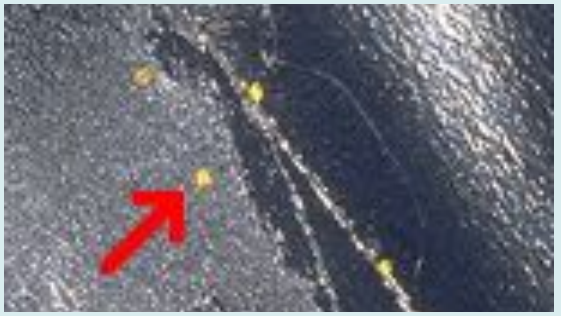
- Not many effective tactics
- Mechanical :
  - Limb jarring ('beating') on first warm humid nights near petal-fall
- Chemical :
  - permethrin at petal-fall
  - kaolin ('Surround') at petal-fall & weekly for 2 more weeks

San Jose scale

- Apple & peach
- Sucking pest
- Injures fruit & bark
- Overwinters on **bark**
- Disperses to **fruit** in crawler stage

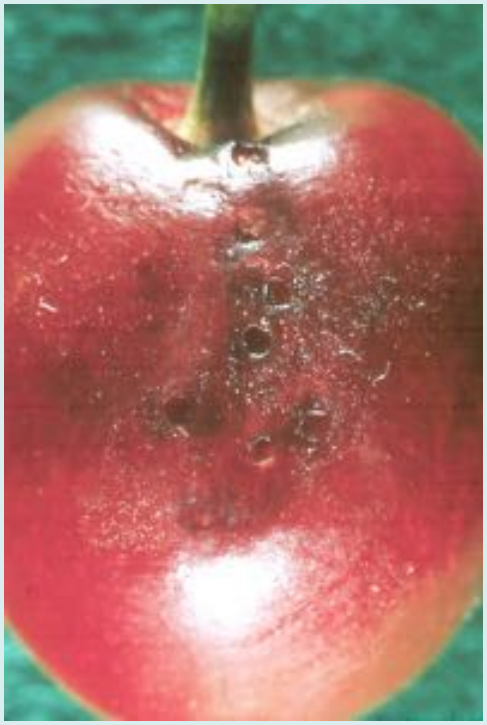


San Jose scale: control



- At dormant stage in early spring
  - Use oil to smother scales on bark
  - Or use lime sulfur
- Post-bloom insecticide
  - Target crawler stage (~mid-June)
  - Detect with black sticky tape
  - insecticidal soap, malathion, carbaryl

Cherry Fruit Fly



- Similar to apple maggot
- Female fly lays eggs on fruit for 3-4 weeks in June and July

Cherry Fruit Fly

- Mechanical control by traps
  - Yellow sticky traps baited with ammonium
- Chemical control
  - Insecticide targets adult flies
  - carbaryl or spinosad or permethrin
  - Apply within 1 week of first fly emergence
  - Every 10 days from June to harvest

Potential new pest of fruit crops in Ohio:

Spotted lanternfly

- Native to China
- First find in USA:
  - Sept. 2014
  - S.E. Pennsylvania

Spotted lanternfly: what is it?

- *Lycorma delicatula*
- A planthopper
- Sucks sap
- 1” long
- Poor flier
- Strong jumper (1 - 3 m!)

Damage

- Suck sap
- Weeping wounds of sap on bark
- Excrete large amounts of sweet fluid (honeydew)
- Sooty mold grows on sweet fluid

Host plants

- **Major hosts:**
  - **Tree of Heaven**
  - **Grape**
- **Other crops:**
  - **Apple**
  - **Cherry**
  - **Peach**
  - **Blueberry**
  - **Hops**
- **Forest & ornamental trees:**
  - **Oaks**
  - **Walnuts**
  - **Poplars**
  - **Maples**
  - **Willows**

Life stages

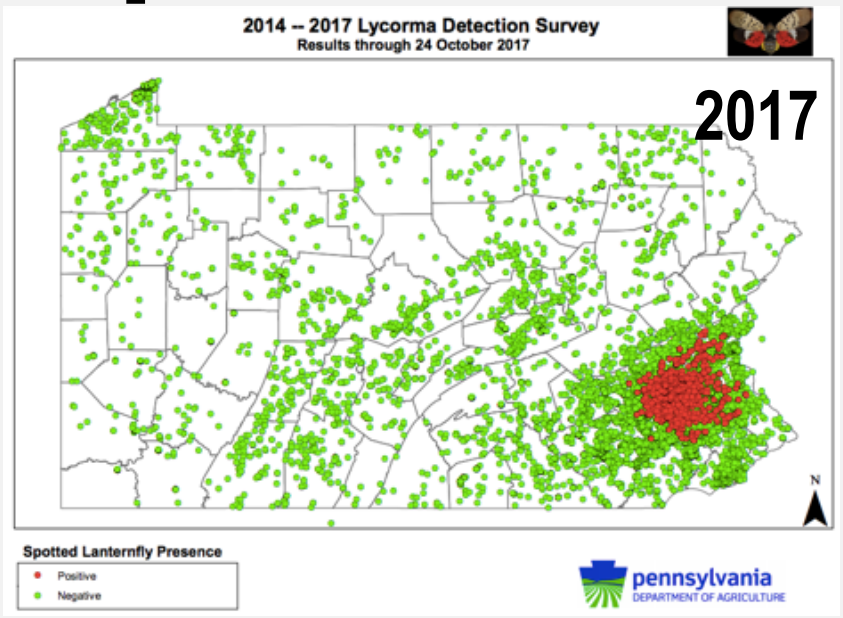
- **Adult**
- **Eggs**
- **Young nymphs:** black with white spots
- **Older nymphs:** red with white spots

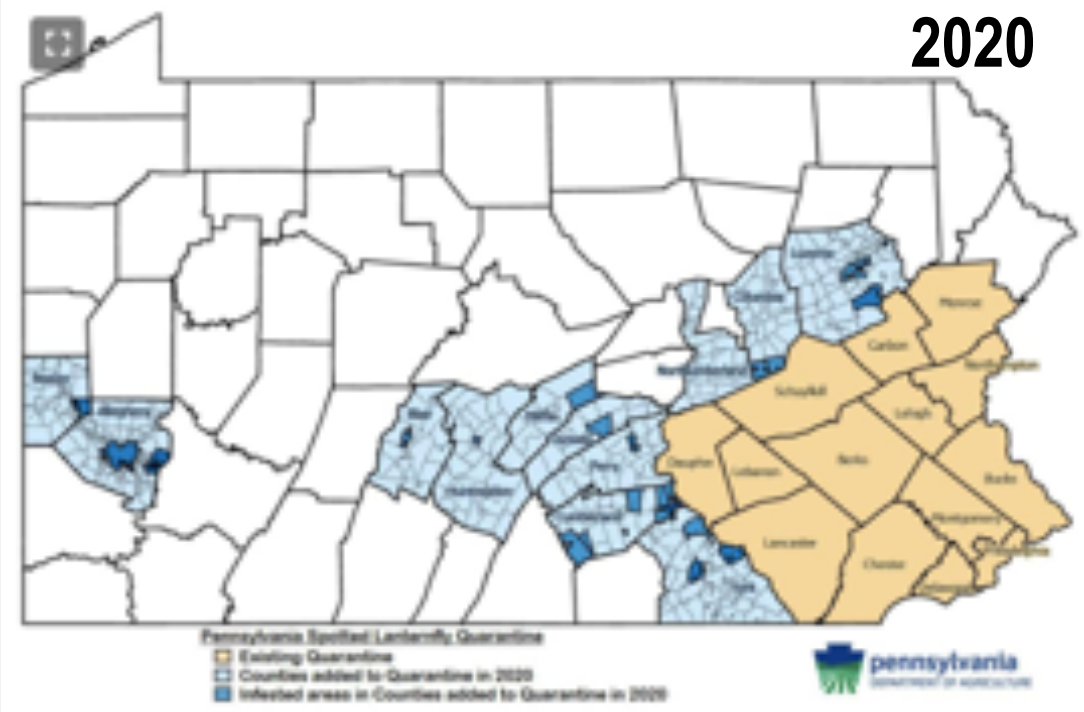
Behavior

- Nymphs on leaves, stems
- Adults on branches, trunks
- Aggregate on trunk at base
- Lift forewings to flash red hindwings

Origin & spread

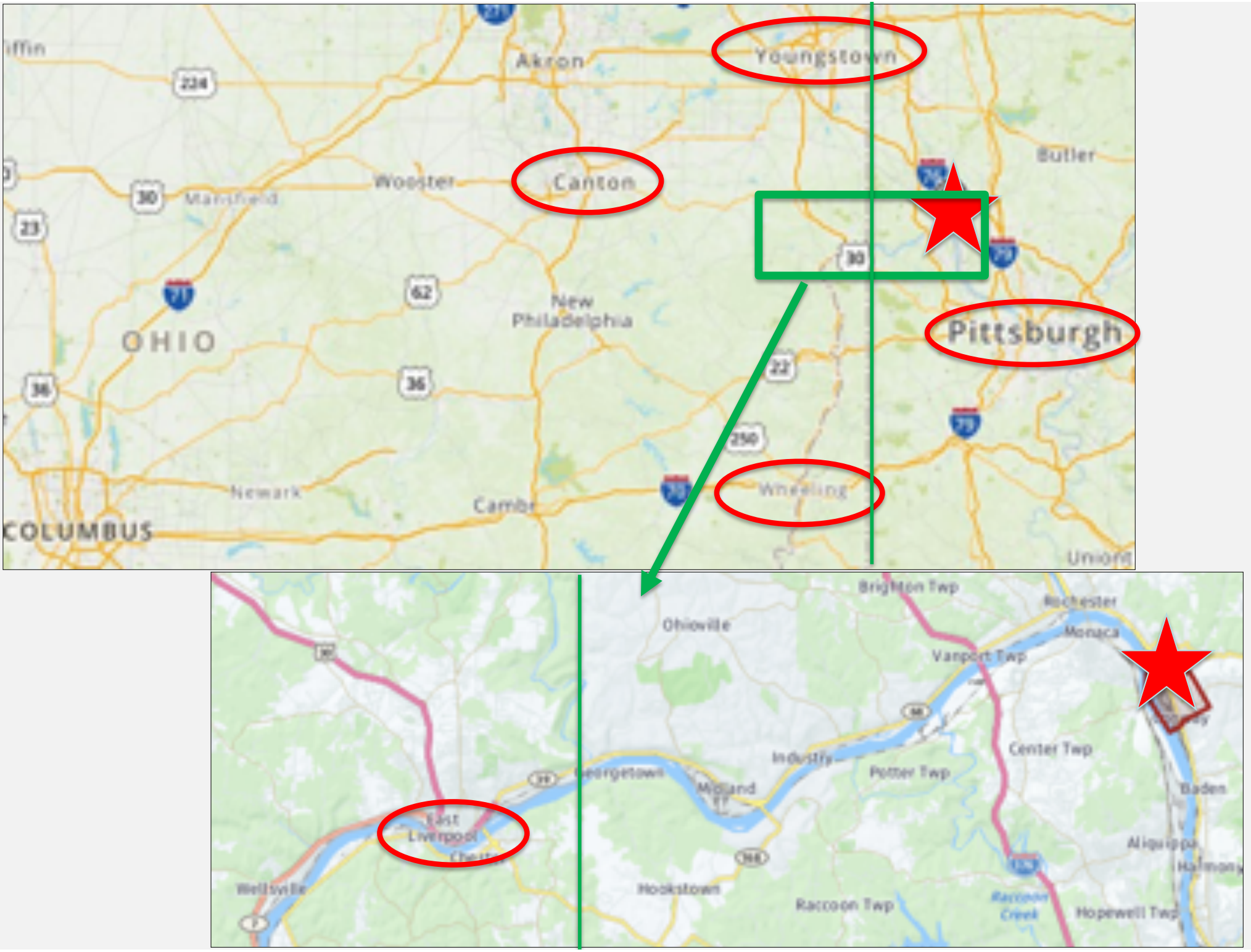
Year	Number of counties in PA
2014	1
2015	4
2016	5
2017	6
2018	14
2020	26





Recent find near Ohio

- Egg masses at rail yard
- Conway in Beaver County, PA
  - 23 miles NW of Pittsburgh PA
  - 15 mi from Ohio state line
  - Near East Liverpool in Columbiana County, OH


Youngstown
Akron
Canton
Wooster
Mansfield
Butler
OHIO
New Philadelphia
Pittsburgh
Wheeling
Newark
Cambr
COLUMBUS
Unionf
Brighton Twp
Rochester
Monaca
Ohioville
Vanport Twp
Industry
Georgetown
Midland PT
Potter Twp
Center Twp
Baden
East Liverpool
Aliquippa
Harmony
Wellsville
Hookstown
Raccoon Twp
Raccoon Creek
Hopewell Twp

Where to look, Sept. - May?

- **Egg masses, on smooth vertical surfaces:**
  - **tree trunks, stones, fence posts, vehicles, buildings, furniture**

Characteristic 'tire tread' pattern left after eggs scraped off →

← **Brown corky appearance of old egg mass after eggs hatched**

the end

Info on fruit & veg. pests

u.osu.edu/pestmanagement

Questions?

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