Integrated Pest Management

- System or strategy
- Utilizes all methods of pest suppression
- Compatible
- Maintain pests below economically damaging level
  - Environmentally sound
  - Economically sound

IPM Tactics

Texas Agricultural Extension Service

Biological Control in Vegetables

- Relatively fast growing annual crop
- Natural enemies may not develop
  - Especially early in crop development
- Natural enemies must come from adjacent areas or releases
- Maintain natural enemies with soaps, oils and *Bacillus thuringiensis*


Six spotted thrips
Western flower thrips
UC Statewide IPM Project
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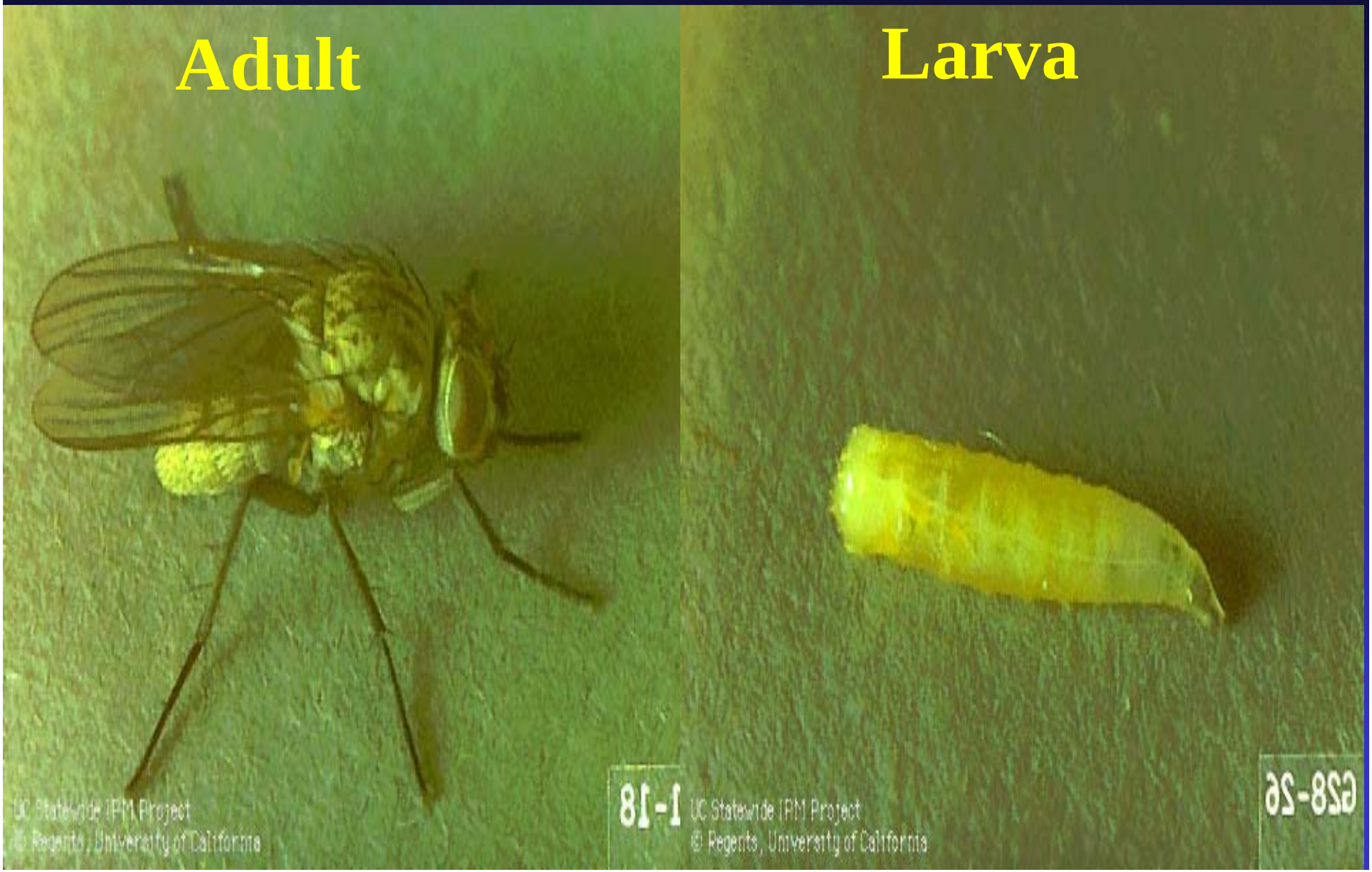
Predatory Mites

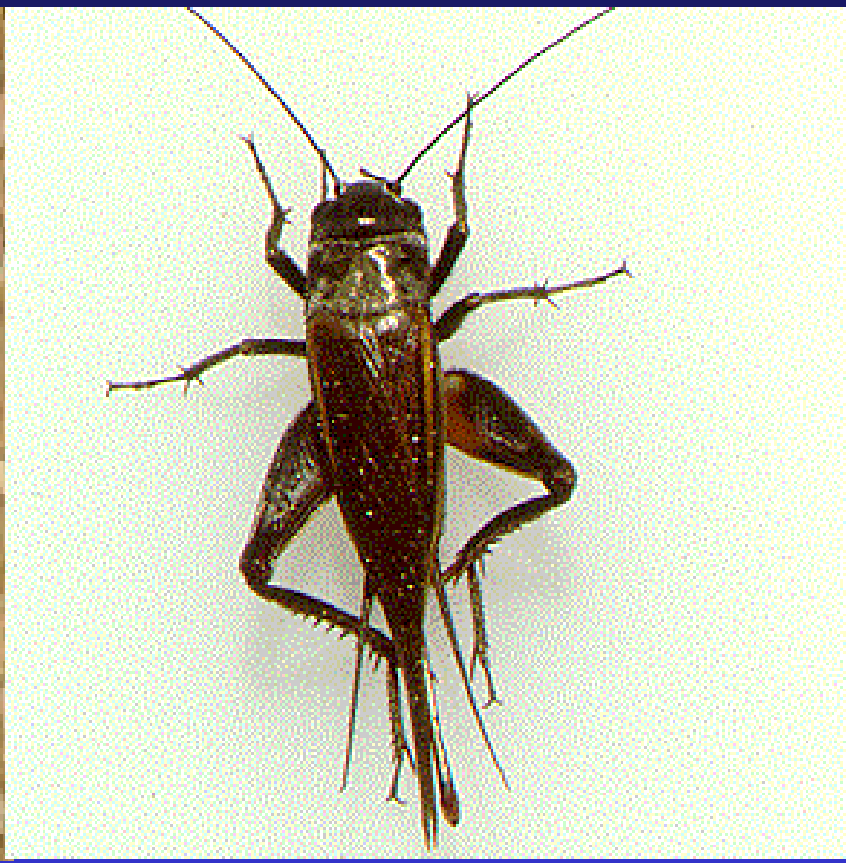
Seed corn Maggot



Control of Seed corn Maggot

- Small gray fly
- Maggot attacks germinating seeds or new transplants
- Problem only in cool conditions
- Destroy all residue and allow for residue decomposition
- Avoid cucurbits after root or cole crops
- Preventative seed treatments

Crickets



Crickets

- Generally not an economic problem
- Damage from eating flowers can result in poor pollination
- Some fruit feeding, especially at full slip on cucurbits
- Control can be achieved by discing field post harvest or use of Sevin

Cricket Control in the Home

- Reduce outdoor lighting
  - Low pressure sodium vapor
  - Yellow incandescent
- Entry points caulked and sealed
- Insecticides
  - Baits
  - Liquids

Flea Beetles

- Small
- Adults have well developed hind legs
- Will eat small holes in leaves
- May feed on fruit below calyx
- Larvae feed below ground

Flea beetle Damage

Control of Flea Beetles

- Eliminate plant stress from diseases and moisture
- Organic control includes pyrethrins and rotenone
- Treat only when present on the fruit
- Chemical methods include Sevin, Thiodan and Lannate

Aphids

- Many different species
- Most common
  - Melon aphid
  - Green peach
- Damage characterized
  - Leaf distortion
  - Sooty mold
  - Virus transmission
  - Loss of vigor
  - Stunting

Control of Aphids

- Cultural control
  - Row covers prior to bloom
  - Silver reflective plastic mulches
  - Control weeds
  - Do not over fertilize

Control of Aphids (continued)

- Biological control
  - Many natural enemies including lady beetles, lacewings, syrphids and parasites
  - Use of oils and soaps
  - None prevent virus transmission but may reduce spread of the virus
- Chemical control includes Admire, Monitor, Lannate, Metasystox-R, Capture and Thiodan

Spider mites

Spider mites

- Four stages: Egg, six-legged immature, eight-legged immature, adult
- Sucking insect
  - Destroys chlorophyll
  - Stippling
  - Reduced yield and quality
- Short generation time

Control of Spider mites

- Biological control is good
  - Lady beetles, lacewings, pirate bugs
  - Thrips
  - Predatory mites
- Cultural controls
  - Minimize dust
  - Control watering practices (humidity)
- Chemical control is difficult

Beet Armyworm Egg Mass

Beet Armyworms

- Multiple generations
  - Primarily a foliage feeder but can feed on fruit
- Feeding is usually superficial
  - Single or closely grouped holes
  - Decay organisms enter wounds

Control Tactics for Beet Armyworms

- Sanitation is important
  - Remove alternative host sites
- Biological control is critical
  - Predators important in reducing egg numbers
  - *Cotesia marginiventris* reduces larval numbers
- Chemical control includes *Bt*, Lannate, Monitor

Cabbage looper Adult

Cabbage looper Egg

Cabbage Loopers

- Multiple generations
- Egg laid singly on leaf
- Damage characterized by
  - Skeletonization of leaf
  - Fruit feeding on surface
- Control rarely needed on cucurbits

Control Tactics for Cabbage Loopers

- Many natural enemies
  - Egg predators
  - *Trichogramma* spp
  - Viruses
- Chemical control includes *Bt*, Asana and Lannate

Cucumber Beetles

- Overwinter as adults
- Eggs deposited at the base of the plant
- Larvae can feed on stems and on the base of the plant
- Adults congregate in flowers
  - Chew holes in leaf
  - Scar runners
  - Scar young fruit

Control of Cucumber Beetles

- No cultural control options
- Biological control is limited
  - Tachinid fly
  - Rarely provides economic control
- Organic control includes pyrethrins and rotenone
- Chemical control includes Sevin, Asana or Thiodan

Leafhoppers

- Adults are green
- Eggs laid below the leaf surface
- Nymphs pale green, move sideways
- Sucking mouthparts
  - White stippling
  - Leaf yellowing
  - Green spots on fruit
  - Leaf drop

Control of Leafhoppers

- Prevent moisture stress
- Maintain 6 to 8 healthy, non-infested terminal leaves
- Row covers prior to bloom
- Destroy crop residue
- Rarely treat however easily controlled by a number of compounds

Liriomyza sativa

Liriomyza trifolii-Leafminers

- Many species present
- Adults lay eggs along leaf edges
  - Will also host feed
- Damage is by larvae
  - Feed between leaf tissue layers
- Damage characterized
  - White tunnels
  - Leaf drying
  - Reduction in yield
  - Plant loss


Leafminer larva
Leafminer tunnel
UC Statewide IPM Project
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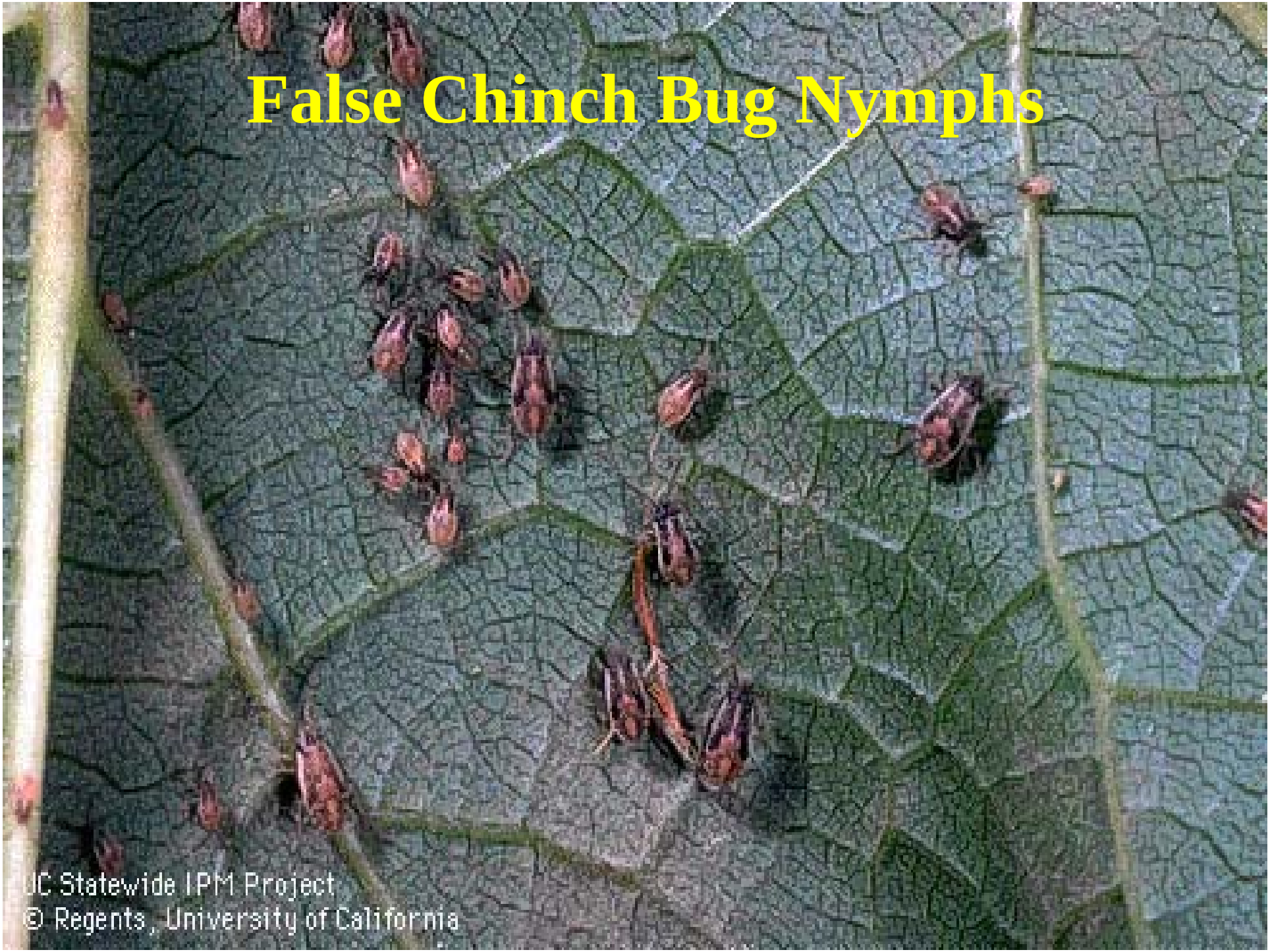
Control of Leafminers

- Many parasites are present
  - Spraying for other pests usually causes outbreak
- Prevent moisture and disease stress
- Row covers
- Monitor adults with sticky cards
- Chemical control includes Avid or Agrimek, Vydate, Monitor and Pounce or Ambush

False Chinch Bugs

- Small
- Various shades of gray
- Breeds in grassy areas
- Desiccates

False Chinch Bug Nymphs



Control of False Chinch Bugs

- Cultivate or burn adjoining grasslands
- Flooding can help, especially when nymphs are present
- Treat adjoining areas
- Chemical methods include Thiodan

Sap Beetles

- Adults are small
- Brown or black
- Eggs laid in fruit
- Damage occurs on fruit near maturity
- Also enter through other wounds

Sap Beetle Larvae

Control of Sap Beetles

- Become more of a problem late in the season
- Remove or disc nearby rotting fruit
- Minor pest so no insecticides registered

Stink Bugs

- Various color forms
- Sucking insects
- Multiple generations
- Damage includes
  - Growth distortion
  - Irregular surface
  - Internal spots

Control of Stink Bugs

- Monitor adjacent weedy fields and ditch banks
- No viable biological control
- Treat at egg hatch
- Chemical methods include Asana and Monitor

Squash Bugs

- Adults 0.5 inches
- Dark gray with orange abdomen
- Damage includes
  - Nymphs in clusters
  - Leaves droop
  - Leaves dry out

Squash bug Eggs

Squash bug Nymphs

Squash bug Damage

Squash Bug Control

- Cultural Control
  - Destroy crop residue
  - Reduce overwintering sites
  - Use of row covers
  - Tolerate high numbers
- Chemical control includes Asana and Thiodan

Squash Vine Borer

Control of Squash Vine Borer

- Cultural control
  - Rotation away from cucurbits
  - Destroy all crop residue
  - Natural control marginal with egg parasite
- Chemical control will work if applied early
  - Alternatives include Sevin and Thiodan