

# Mid-Atlantic Region CCA Exam

**Authors: Joanne Whalen, Christie Hurt, Marty Spellman**

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## **Competency Area 3 – Management of Insects and Other Invertebrates**

- Major Insect Pests of Field Corn, Soybeans, Wheat and Alfalfa
- Key Characters of Major Pests: life cycle; when damage occurs in season; damage symptoms; and alternative controls

Know factors that affect insect growth and development – e.g. crop growth; crop production practices; weather factors; natural controls

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### **True Armyworm in Field Corn Life Cycle**

- **Moths** emerge in April
- Lay eggs on grasses
- **Larvae** feed on small grains and field corn then pupate in soil or under debris
- 3-4 generations/year
- overwinter as partially grown larvae

### **Damage**

- Larvae **feed** in late spring-early summer on early mid-whorl stage corn
- Attack small/seedling stage corn in no-till
- Do not damage growing point

### **Alternative Controls**

- Avoid planting near small grains
- Avoid planting into no-till small grain cover crop
- Bt Corn – for small larvae only present at planting time/ not-till covers

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## Slugs in Corn

### Life Cycle

- Overwinter as egg, immature or **adult**
- Feed on seedling corn leaves, young sprouts, and seeds

### Damage

- **Feeding** occurs in spring when cool and wet on young (spike-3 leaf stage) corn leaves, sprouts, seeds
- Favored by no-till; surface residue; wet conditions; poor seed furrow closer

### Alternative Controls

- Cultural practices
- conventional tillage one season
- min. tillage to reduce surface trash
- starter fertilizer
- trash cleaners

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## Stinkbugs in Field Corn

### Life Cycle

- Egg, nymph (immature), **adult**
- Overwinters as adult in leaf litter or debris
- Move to wheat in April, then to corn in late spring

### Damage

- Feeds on seedling plants
- Inserts mouthpart into stalk and growing point
- Causes **deformed, twisted plants**, wilting of new leaves and **elongated feeding holes**
- Most susceptible at spike to 4-leaf stage and corn no-tilled into wheat

### Alternative Controls

- Plant early
- Tillage to reduce harborage/overwinter sites
- Good seed slot closure – prevent feeding below ground

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## Northern & Western Corn Rootworm

### Life Cycle and Life History

- Overwinter as egg
- Larvae hatch mid-late May
- Feed on roots 3-4 weeks
- Pupate and males emerge first as early as late June
- Adults emerge late summer and lay eggs at base of corn plants

### Damage and Conditions Favoring Development

- Damage by larvae feeding on roots in late May-early June
- Favored by continuous corn
- Favored by heavy soils

### Alternative Controls

- Crop rotation still works
- No variants – beetles laying eggs in soybeans documented in our area
- No extended diapausing beetles – stay in soil 2 years documented in our area

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## European Corn Borer in Field Corn (First Generation)

### Life Cycle

- Overwinter as larvae
- Pupate in spring
- Moths lay eggs on corn in whorls
- Peak larval activity in mid-June
- Second Generation: late corn and vegetables

### Damage

- Feeding by 1st generation peaks in mid-June-affects translocation of nutrients

- Plants 18-24 inches in whorl stage most susceptible

### **Alternative Controls**

- Avoid early planting,
- Genetically resistant varieties/ BT corn
- Natural Controls: Nosema; fungal pathogens
- Deep Plowing – must be done in an area
- Released Parasites: *Lydella thompsoni*; *Trichogramma*

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### **Black Cutworm in Field Corn** **Life Cycle**

- Overwinter as full grown **larvae** or pupae
- **Moths** emerge in March
- Lay eggs on weeds
- Larvae hatch and feed on weeds then corn (1 generation/year)

### **Damage**

- Damage in late spring on spike to 5 leaf corn
- **Leaf feeding/ Shredding**
- **Cut plants**
- Feeds on growing point

### **Alternative Controls**

- Avoid by minimum or no-till plantings
- Avoid late planting and poorly drained soils
- Early heavy growth of broadleaf weeds favors moth egg laying – early burn down with herbicides
- Limited activity with Bt corn – small larvae only

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### **Seed Corn Maggot in Field Corn** **Life Cycle**

- Overwinters in soil as pupae

- Flies emerge as early as February
- Prefer to lay eggs in moist, freshly plowed soil with decaying organic matter or manure
- Eggs hatch in 1-9 days
- Larvae active- as low as 40 degrees F

### Damage

- Feed on seed content
- Death of seed or poor germination
- Occurs with cool, wet seasons and in highly organic soils

### Alternative Controls

- Shallow planting in well-prepared seedbed to encourage quick germination
- Fall plowing of manure
- Early plowing of cover crops
- Complete plowing of cover crops

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## Common Stalk Borer in Field Corn

### Life Cycle

- Overwinter as eggs on weedy plants (esp ditch banks)
- Larvae emerge in May, move to corn and move deep into whorls
- Moths emerge late summer

### Damage

- Feeds from spike to 4 leaf
- Larvae feed deep in whorl and then bore into stalks
- Feed on the growing point eventually boring into stalk

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## Wireworms in Field Corn

### Life Cycle

- Overwinter as larvae
- Five year larval life cycle

- **Adults** emerge in summer – click beetles
- Very responsive to moisture gradients in soil

### Damage

- **Feed on seeds** as well as the growing point of young plants
- Appears as missing plants in field/ wilting or death of terminal shoots
- Problem in cool, wet springs; fields that were grassy or weedy the previous year

### Alternative Controls

- Summer plowing of fallow fields
- Crop rotation away from small grains
- ??????

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### Fall Armyworm in Field Corn Life Cycle

- Migratory pest, moths found in our area in June
- Moths lay eggs on later planted corn
- **Larvae** feed in the whorl of pretassel stage corn in August
- Larvae most active early morning and late evening

### Damage

- Numerous **ragged holes**
- May prevent formation of normal ears
- General a problem in silage corn

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### Grasshoppers in Soybeans Life Cycle

- Egg, nymph, **adult**
- Overwinter as eggs/**nymphs**
- 3-4 generations per year
- Move out of ditch banks into fields

## Damage

- Defoliates plants as seedlings or later in season
- Can feed on pods
- Dry weather favors grasshoppers
- High populations: field edges; no-till plantings behind small grains

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## Green Cloverworm in Soybeans

### Life Cycle

- Egg, larvae, pupae, adult
- Moths lay eggs on underside of leaves starting in late June
- Larvae first detected in July and peak mid-Aug

## Damage

- Window Boxes – for small larvae
- Irregular Holes between main veins – larger larvae

## Alternative Controls

- Fungal pathogens play major role in control
- Natural Enemies

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## Spider Mites in Soybeans

### Life Cycle

- Egg, larvae, nymph, adult
- Adults overwinter in weedy and non-crop areas
- Move into crops as temperatures increase
- Development favored by hot, dry weather
- Populations generally explode during bloom

## Damage

- Yellow discoloration

- **Stunted Plants**
- Feed on cell contents
- First detected on field edges but can balloon into fields

### **Alternative Controls**

- Natural Predators
- Weather Conditions favoring pathogenic fungi

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### **Mexican Bean Beetle in Soybeans**

#### **Life Cycle**

- Overwinters as adult
- Adults lay eggs in early planted fields
- **Larvae feed**, then pupate on plants (3 generations/year)

#### **Damage**

- Larvae defoliate early planted full season and double crop beans
- Hot dry weather reduces populations

### **Alternative Controls**

- Trap crops
- **Parasitic wasps**
- Predaceous stink bugs
- Weather factors

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### **Corn Earworm in Soybeans**

#### **Life Cycle**

- Overwinters as pupae (in soil)
- Moths migrate from south, lay eggs on corn
- **Larvae feed**, pupate
- Moths emerge and move to soybeans in August



## Damage

- Young larvae feed on terminal leaves, flowers, pods
- Older larvae feed on pods and developing seeds
- Mainly a pod feeder

## Alternative Controls

- Mostly a problem in late-planted, open canopy fields
- Natural fungal pathogens – wet and humid conditions
- Natural Enemies- no released parasites

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## Stinkbugs in Soybeans

### Life Cycle

- Overwinter as adults and become active in spring on wild hosts
- Lay eggs in fields in late June but generally a problem late in the season

## Damage

- Mechanical injury to seed
- Can transmit a disease organism
- You seed damage = greater yield loss; late season infestations reduce oil content and germination of seeds

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## Bean Leaf Beetle in Soybeans

### Life Cycle

- Overwinters as an adult beetle
- Active in April-early May
- Larvae feed at base of stem or on roots
- Adults present again in late July-August

## Damage

- Prefer young plant tissue
- Pod damage – rarely on developing bean
- Generally problem on early planted beans; defoliation and reduced stands

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## Alfalfa Weevil in Alfalfa

### Life Cycle

- Overwinters as adult and egg
- Larvae feed on leaves 3-4 weeks
- Pupate on plant or on ground (1 generation/ year)

### Damage

- Larvae feed on leaves in late March-early April
- Pest of 1st cutting and sometimes regrowth for second cutting

### Alternative Controls

- Resistant varieties
- Early cutting
- Biocontrol: natural enemies/diseases
- Winter grazing
- Flaming

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## Potato Leafhopper in Alfalfa

### Life Cycle

- Egg, nymph, adult
- Adults migrate by wind arriving in late April
- Develop from egg to adult in 3 weeks when conditions favorable

### Damage

- Nymphs and adult feed on 2nd and 3rd cutting alfalfa
- Severe damage also done to spring seeded alfalfa
- Pest during hot, dry seasons

## Alternative Controls

- Early cutting
- Fungal Pathogens
- Resistant Varieties – Hoppergard

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## Blue Alfalfa Aphid Life Cycle

- Egg, nymph, **adult**
- Occur in March-April – same time as pea aphid

## Damage

- Damage to 1st cutting alfalfa
- **Plants stunted**
- Associated with spring black stem disease

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## Garden webworm in Alfalfa Life Cycle

- Egg, larva, adult
- Overwinter as pupae, moths emerge in spring feed and **larvae attack alfalfa** in August

## Damage

- defoliation and webbing

## Alternative Controls

- cutting to reduce food supply and expose webs to natural predation

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## Aphids in Wheat Life Cycle

- Egg, nymph, **adult**
- Overwinter as eggs or **adult females**
- More of a problem in early plantings
- Favored by mild winter and cool, dry spring

## Damage

- Damage in fall ( first 60 days after planting): vector BYDV, **greenbug aphid** injects toxin and get dead plants
- Damage in spring: Grain fill, dead plants, blasted heads

## Alternative Controls

- Natural parasites and predators
- Fungal Pathogens

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## True Armyworm in Wheat Life Cycle

- **Moths** emerge in April
- Lay eggs on grasses
- **Larvae** feed then pupate in soil or under debris
- 3-4 generations/year
- Overwinter as partially grown larvae

## Damage

- Larvae feed on leaves in early May
- Young larvae on upper leaf surface
- Older larvae- leaf blades
- Last instar does most of the feeding
- Heads clipped when all leaves consumed

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## Cereal Leaf Beetle in Wheat Life Cycle

- Overwinter as **adult**
- Emerge March, lay **eggs** for 2-3 weeks
- **Larvae** feed for 3 weeks, pupate
- Adults emerge and **feed** on corn

## Damage

- Larvae first feed on stem leaves
- Reduce Photosynthesis
- Move to flag leaf in late April-early May
- Most important defoliator

## Alternative Controls

- Early planting
- Introduced parasites
- Weather factors – late winter warm up followed by cool early spring

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## Grass Sawfly in Wheat Life Cycle

- Adults emerge in April
- Lay eggs on leaf margins until early May
- **Larvae** enter soil in mid-June for summer diapause (prepupal) stage

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## Factors Influencing Insect Population Growth, Decline and Management Decisions Cultural Practices

- No-Till Favours: slugs, stinkbugs, cutworms, seed corn maggot and cutworms in corn; grasshoppers in soybeans
- Planting Date: late planting favours stinkbugs, cutworms and fall armyworm in corn; late planted wheat more susceptible to cereal leaf beetle; late planted, open canopy soybeans more susceptible to corn earworm

## Environmental Factors

- Hot, Dry Weather: increases spider mites and grasshoppers in soybeans; decreases Mexican bean beetle in soybeans
- Cool wet weather: increase slug and seed corn maggot in corn
- High Humidity and Moisture: fungal pathogens of alfalfa weevil, green cloverworm and corn earworm

### **Crop Growth**

- Alfalfa less than 12 inches tall= more susceptible to weevil and leafhopper damage
- Blooming Soybeans: spider mites
- Open Canopy Soybeans: corn earworm

### **Importance of Beneficial Organisms**

- Alfalfa weevil: released parasites, fungal pathogens
- Aphids in Wheat and Alfalfa: predators, parasites and fungal pathogens
- Green Cloverworm and Corn Earworm: natural enemies and fungal pathogens
- Mexican Bean Beetle: parasitic wasps and predacious stinkbugs

### **Beneficial Organisms**

- Predators: Feed directly on pest, consume prey
- Parasites: lay eggs in pest, larvae develop in pest
- Pathogens: fungi, bacteria and viruses

### **Mode of Action of Insecticides**

- Contact – enters body wall by direct treatment of insect or treated surfaces
- Stomach – ingested and acts on digestive system
- Fumigant – absorbed through tracheal system as a gas
- Systemic – translocated through vascular system of plant, killing insect after feeding on host

### **Types of Pesticides**

- Organophosphates and Carbamates
- Pyrethroids
- Chloronicotinyls – imidachlorprid

- Naturallyytes: Spintor
  - Insect Growth Regulators
  - Biopesticides:
    - Bts
    - insecticidal soaps
    - Neem tree extracts
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Botanicals

### **Insecticide Resistance**

- Definition of Resistance: population no longer controlled with insecticides used at previously efficacious rates
- Resistance is inheritable, genetically linked trait
- Requires a lot of selection pressure
- It is not induced by low dosage habituation during life of an insect

### **Factors Favoring Development of Resistance**

- Over dependence on insecticide
- Continued use of a single insecticide
- Continued use of insecticides with the same mode of action