Two Invasive Pests: European Pepper Moth and Bagrada Bug

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European pepper moth-Life stages
European pepper moth

• *Duponchelia fovealis* Zeller belongs to the grass moth or close-wing moth family Crambidae (Order: Lepidoptera)
• Native to the Mediterranean region and a greenhouse pest in the Netherlands
• Established in Europe, Middle East and Africa
• First discovered in San Diego County in 2004
• Widespread in California
• Present in Arizona, Colorado, Florida, Georgia, Oklahoma, and Texas
• Wide host range including corn, peppers, tomatoes, squash, strawberries, and ornamentals
European pepper moth - Eggs

- Eggs 0.5-0.7 mm and oval shaped
- Whitish green initially, turn pink, then red and eventually brown with mature
- Laid singly or in groups of 3-10 in roof-tile pattern
- Females lay up to 200 eggs
- Duration 4-9 days
- Found underside of leaves, on stems, plant base and in top layer of soil
European pepper moth-Larvae

- Creamy white to light brown with dark head capsule and brown or gray spots
- Grow from 1.5 mm at hatching to 20-30 mm at maturity
- Duration 3-4 weeks
- Feed on roots, stems, foliage, inflorescence and fruits
European pepper moth-Larvae
European pepper moth-Pupae

- Yellowish to light brown initially and turn dark with maturity
- About 9-12 mm long
- Cocoon 15-19 mm long and spun with silk, frass, and soil particles under the foliage, below the soil line or attached to the pots.
- Duration 1-2 weeks
European pepper moth-Adults

- Adults have brown to grey wings with a wing span of about 20 mm and are good fliers
- Males have a long, slender abdomen that is turned upwards
- Length of the life cycle depends on temperature, but varies from 6-8 weeks
European pepper moth - Detection

- Look for signs of damage (leaf wilting, stem collapse) and presence (webbing, frass, life stages)
- Check where leaves touch the soil
- Base of the pots in container plants
European pepper moth Control

- **Chemical and other options**: Acephate, azadirachtin, chlorpyrifos, emamectin, imidaclorpid, pyrethrins, and spinosad

- **Pheromone traps**

- **Cultural control**: Monitoring, sanitation, using drier potting medium

- **Biological control**: *Bt* products, predatory mites (*Stratiolaelaps miles, Hypoaspis miles* and *H. aculeifer*), predatory beetle (*Dalotia coriaria*), parasitoid wasps (*Trichogramma evanescens* and *T. cacoecia*), and entomopathogenic nematodes (*Heterorhabditis bacteriophora* and *Steinernema* sp.)
## European pepper moth-Control

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate (100gpa)</th>
<th>% Change (24 h)</th>
<th>% Change (72 h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>-</td>
<td>-33.0</td>
<td>33.3</td>
</tr>
<tr>
<td>Bifenthrin</td>
<td>20 oz</td>
<td>-75.0</td>
<td>-50.0</td>
</tr>
<tr>
<td>Bifenthrin+Orthene</td>
<td>20 oz + 8 oz</td>
<td>-50.0</td>
<td>-70.0</td>
</tr>
<tr>
<td>Emamectin</td>
<td>4.8 oz</td>
<td>0</td>
<td>-42.9</td>
</tr>
<tr>
<td>Lambda-cyhalothrin</td>
<td>5 oz</td>
<td>-12.5</td>
<td>-12.5</td>
</tr>
<tr>
<td>Chlorantraniliprole</td>
<td>16 oz</td>
<td>28.6</td>
<td>-28.6</td>
</tr>
<tr>
<td>Spinosad</td>
<td>22 oz</td>
<td>-28.6</td>
<td>-14.3</td>
</tr>
<tr>
<td>Orthene</td>
<td>8 oz</td>
<td>-37.5</td>
<td>-50.0</td>
</tr>
</tbody>
</table>

Bethke and Vander Mey, 2010
Bagrada bug
Bagrada bug

- *Bagrada hilaris* (Burmeister) belongs to the stink bug family Pentatomidae (Order: Hemiptera)
- Native to Africa and known to cause damage in Asia and Europe
- First discovered in Los Angeles in 2008
- Now present in Southern California, parts of Central Coast and parts of Arizona
- Prefers cruciferous hosts, but can feed on a variety of other hosts like potato, cotton, okra, legumes, cucurbits, cereals, and strawberries
Bagrada bug-Life stages
Bagrada bug-Mouthparts
Bagrada bug-Damage

- Stippling and necrotic spots on the foliage
- Stunted plant growth
- Loss of apical dominance
- Formation of multiple heads
- Plant death
- Younger seedlings are very susceptible
Bagrada bug-Eggs

- Barrel shaped eggs, whitish initially and turn orange as they mature
- Laid in clusters on foliage, stems, or in soil
- Females lay up to 95-150 eggs in 2-3 weeks
- Hatch in 3-6 days
Bagrada bug-Nymphs

- There are five nymphal instars
- Dark head and thorax and reddish or orange abdomen with white and black markings
- Newly hatched or molted nymphs are orange
Bagrada bugs-Adults

- Adults 5-7 mm long and 3-4 mm wide
- Males are smaller than females
- Life cycle varies from 3-8 weeks depending on temperature
Bagrada bug-Identity crisis

Convergent, sevenspotted, multicolored Asian lady beetles

Bagrada bug nymphs

Harlequin bug

Bagrada bug
Bagrada bug - Detection

- Look for eggs, nymphs, adults, and mating adults
- Active during warmer parts of the day
- Damage symptoms
- Look for them on alternate hosts such as alyssum and wild mustard
Bagrada bug-Diel activity

Natwick et al, 2010
### Bagrada Bug-Host Preference

<table>
<thead>
<tr>
<th>Host</th>
<th>Mean % Adults</th>
<th>% Nymphs*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alyssum</td>
<td>27.8</td>
<td>40.0</td>
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<tr>
<td>Wild mustard</td>
<td>27.8</td>
<td>0.0</td>
</tr>
<tr>
<td>Broccoli</td>
<td>25.0</td>
<td>0.0</td>
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<tr>
<td>Green bean</td>
<td>19.4</td>
<td>60.0</td>
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<tr>
<td>Tomato</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

*One assay
Bagrada bug

Potential risk for other hosts

Trap crops or source of infestation?

- Adults can live up to 4 months
- Survive cold winter nights by entering the cracks in the soil
- Extent of damage: males < females < males-females in copulation
- Several studies are under way to know more about this pest
Bagrada bug-Control

• **Chemical control:** Pyrethroids, organophosphates, and neonicotinoids
• **Cultural control:** Monitoring, mechanical removal, overhead irrigation, cultivation, and removal of alternate hosts
• **Other options:** Azadirachtin (against immature stages), pyrethrins, essential oils, insecticidal soaps, entomopathogenic fungi such as *Beauveria bassiana*, *Metarhizium brunneum* (M. anisopliae), and *Isaria fumosorosea* (*Paecilomyces fumosoroseus*)
Bagrada bug - Chemical control

Natwick et al, 2010

Treatments applied 28 Oct

Number/plant

Check
Beleaf 2.8 oz
Movento 4.0 oz
Movento 5.0 oz
Lorsban 32.0 oz
Hero 10.3 oz

Natwick et al, 2010
Bagrada bug-Microbial control

Natwick et al, 2010

Number infected

- Beauvaria bassiana
- Metarhizium anisoplae

1 million spores/ml 1000 spores/ml 100 spores/ml Untreated Control
Bagrada bug - Organic options

- Beauveria bassiana
- Metarhizium anisopliae
- Paecilomyces fumosoroseus
- Chromobacterium subtsugae
- Pyrethrins + Potassium salts of fatty acids
- Essential oils + Sodium lauryl sulfate

Dara, unpublished-average of two assays
How entomopathogenic fungi infect insects
Bagrada bug- *B. bassiana*
Thank you

• Keep an eye out for these pests

• Stay tuned for research updates

• This presentation can be downloaded from http://ucanr.edu/meetingpresentations