Western Tarnished Plant Bug, *Lygus hesperus* Knight, Management in the San Joaquin Valley: Trends and Implications

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Cotton Arthropod Pests
California Seasonal
San Joaquin Valley – 95% of California cotton acreage

2012
345,000 acres
65-70% - Pima
30-35% - Acala and Uplands
Lygus Bugs in SJV

- Key pest in cotton IPM system
- Lygus management affects mites, aphids, worms
- Not an annual problem in every field
- Severity depends on:
  - Location, weather, hosts
  - Sustained migrations
- Fields need inspection twice a week
- Small squares most sensitive
Lygus Bugs
Long History in CA

Research Topics in 1961

Bacon
- Lygus species breakdown
- insecticide tolerance

Stern
- alfalfa intercropping
- biological control
- *Geocoris*

van den Bosch
- new carbamates

Reynolds
- control in beans

Carlson
- economic thresholds on vegetable seed crops, safflower

Shorey
- insecticide efficacy on central coast area

Allen
- Lygus in strawberries

Leigh
- Lygus in cotton
- host plant resistance
- Lygus biology
## Pest Status of Lygus

<table>
<thead>
<tr>
<th>Crops</th>
<th>Pest Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa</td>
<td>Non-pest, sink/source</td>
</tr>
<tr>
<td>Safflower</td>
<td>Non-pest, source</td>
</tr>
<tr>
<td>Cotton</td>
<td>Pest, 2-10/50 sweeps</td>
</tr>
<tr>
<td>Pistachios</td>
<td>Pest, No A.T.</td>
</tr>
<tr>
<td>Common beans</td>
<td>Pest, 1-2/sweep</td>
</tr>
<tr>
<td>Lima beans</td>
<td>Pest, 1-1.5/sweep</td>
</tr>
<tr>
<td>Lettuce</td>
<td>Pest, No A.T.</td>
</tr>
<tr>
<td>Strawberries</td>
<td>Pest, 1/10 plts</td>
</tr>
<tr>
<td>Apples/Pears</td>
<td>Pest; 1 dmg fruit/100</td>
</tr>
<tr>
<td>Blackeye beans</td>
<td>Pest, 0.5 -1/sweep</td>
</tr>
<tr>
<td>Seed alfalfa</td>
<td>Pest, 4-10/sweep</td>
</tr>
</tbody>
</table>
Weed Hosts for Lygus Bugs

Foothills/natural areas

Dock
Russian Thistle

Row middles in orchards

Shepherd’s Purse
Wild Radish
London Rocket

Tarweed
Management Options for Lygus Bugs

- **Biological Control:**
  - Highly migratory insect, control must be immediate following migration
  - Off-site biological control – being investigated

- **Environmentally soft approaches**
  - Mating disruption not available
  - Selective, biological materials not available (Bt, microbial)

- **Cultural control**
  - Host plant resistance not available (breeding or transgenic)
  - Vigorous well-managed cotton plant
  - Management of regional populations – some success

- **Chemical Control**
  - Important to prevent damage
Cotton - Damage
Chemical Options for Lygus

- **Organophosphates/carbamates**
  - Somewhat effective but limited residual
  - Orthene more effective but use limited due to mite flares
  - Vydate used

- **Pyrethroids**
  - Use ramped up in the mid-1990’s and has continued
  - Primary tool from ~1995-2005
  - Good control, better residual control – initially 10-14 days, now ~5 days
  - Associated with aphid outbreaks, also spider mites
  - Resistance an increasing issue, one application per season usable (probably)
Chemical Options for Lygus

- **Imidacloprid and other neonictinoids**
  - Suppressive at best®
  - Clothianidin – Belay® - more effective
  - Use limited now due to honey bee concerns

- **Other materials**
  - Indoxacarb - Steward® - suppressive
  - Novaluron - Rimon® - ineffective
  - Flonicamid - Carbine® - standard since 2007
Chemical Options for Lygus

- **Cotton Insecticides**
  - Carbine
  - Pyrethroids
    - Warrior, Capture, Baythroid, Leverage, other mixtures, etc.
  - Carbamates
    - Vydate
  - Steward
  - Organophosphates
    - dimethoate, others
  - Neonicotinoids
    - Provado, Centric, Assail

~ effectiveness
Management of Lygus Bugs in Cotton

**Sampling**
Begin sweep net samples for lygus at first square, sampling twice a week in each field.

**Thresholds**
Suggested thresholds:

- **Early Squaring** (before 1st flower): *2-4 lygus*/50 sweeps
- **Mid-Squaring** (1st flower - 1st boll): *7-10 lygus* (at least 1 nymph) per 50 sweeps and expected or better fruit retention. If retention is higher than expected you may be able to wait and monitor again that week before making a treatment decision. If retention is lower than expected and lygus bugs are present, consider treating.
- **Late Squaring** (after 1st boll): *10 lygus*/50 sweeps, including the presence of nymphs
# Management of Lygus Bugs in Cotton

<table>
<thead>
<tr>
<th>Total Fruiting Branches</th>
<th>Percent retention of the first position fruit on the BOTTOM 5 fructifying branches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Less than 5</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>73</td>
</tr>
<tr>
<td>6</td>
<td>73</td>
</tr>
<tr>
<td>7</td>
<td>73</td>
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<td>8</td>
<td>73</td>
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<td>9</td>
<td>73</td>
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<tr>
<td>10</td>
<td>71</td>
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<td>11</td>
<td>69</td>
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<td>12</td>
<td>66</td>
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<td>13</td>
<td>61</td>
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<td>14</td>
<td>55</td>
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<td>15</td>
<td>48</td>
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<td>16</td>
<td>40</td>
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<td>17</td>
<td>34</td>
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<td>18</td>
<td>28</td>
</tr>
<tr>
<td>19</td>
<td>23</td>
</tr>
</tbody>
</table>
Lygus Bug Management

- West Side Research and Extension Center or Shafter Cotton Station
- Applications as populations approach threshold – generally early to mid July; two to three applications
- Plots measuring 10 rows by 75’ with four replications
- Efficacy was assessed with sweep net samples (50 sweeps per plot) ~ twice per week
  - lygus bugs
  - natural enemies
- Sampled for secondary pests (cotton aphids, spider mites) twice per season with leaf samples
- In-season and end-of-season plant mapping
- Yield
Lygus Bug Management
2008

Lygus per 50 Sweeps

- Unt.
- Hero
- Leverage

0 DAT 1 DAT 4 DAT 7 DAT

Lygus per 50 Sweeps

0 5 10 15 20 25 30 35
Lygus Bug Management
2008

Number per 50 Sweeps

Avg. lygus nymphs
Avg. lygus adults
Avg. total lygus
Lygus Bug Management
2008

Lint Yield (lbs./A)
Lygus Bug Management
2008

Lygus bugs per 50 Sweeps
Lygus Bug Management
2010

% control following 1st appl.

- Adult Lygus
- Nymph Lygus
- Total Lygus

Products:
- Belay 2.13SC-4
- Belay+Danitol
- Transform-1.4
- Transform-2.1
- Orthene 90S-1.0
- Carbine 50WG-2.3
- Hero EW-11.2
- Leverage 2.7SE-5
- Warrior-3.84
- Vydame C-LV-32
Lygus Bug Management
2010

Lygus per 50 sweeps - untreated

12-Jul 19-Jul 26-Jul 2-Aug 9-Aug 16-Aug

8 7 6 5 4 3 2 1 0
Lygus Bug Management
2012

* applied 2 weeks earlier
Lygus Bug Management
2012

% Control

- Nymphs - 1st appl.
- Nymphs - 2nd appl.

Diamond
Diamond + Carbine
Transform-1.5
Transform-2.25
Assail + Lambda-cy
Assail
Carbine
Torac
Belay
Hero EW
Vydate
Lygus Bug Management
2012

Seed Cotton Yield (lbs./A)

Diamond | Diamond + Carbine | Transform-1.5 | Transform-2.25 | Assail + Lambda-cy | Assail | Carbine | Untreated | Torac | Belay | Hero EW | Vydate

0 | 4000 | 5000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000
Lygus Bug Susceptibility

- Used zip-loc bag bioassay
- Coat inside of bags with various concentrations of pesticides
  - Capture
  - Vydate
  - Monitor
  - Carbine
- Placed 5 adult lygus in each bag
- Held bags at room temperature
- Recorded mortality at 3, 8, and 24 hours after placing lygus into bag
- Compared results to values developed in late 1990’s
- Tested bugs from three locations in SJV collected each in June and August in 2008-12
- Insects collected from alfalfa adjacent to cotton fields
## Lygus Bug Susceptibility

<table>
<thead>
<tr>
<th></th>
<th>Dis. Dose (ppm)</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capture</td>
<td>200</td>
<td>600</td>
<td>370</td>
<td>500</td>
<td>225</td>
</tr>
<tr>
<td>Vydate</td>
<td>40</td>
<td>190</td>
<td>175</td>
<td>290</td>
<td>290</td>
</tr>
<tr>
<td>Monitor</td>
<td>100</td>
<td>900</td>
<td>275</td>
<td>950</td>
<td>450</td>
</tr>
<tr>
<td>Carbine</td>
<td>?</td>
<td>na</td>
<td>na</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lygus Bug Susceptibility

- Used floral foam bioassay method
- Floral foam plug (12 long and 17.5 mm diam.) saturated with formulation – honey water solution
- Five concentrations + control
- Placed in a 20 ml sample vial
- 2 adult lygus in each vial; 15 vials per dose
- Held at room temperature
- Recorded mortality at 24 and 48 hrs.
- Tested bugs from three locations in SJV collected each in June and August
  - 2010-12 – Carbine
  - 2011-12 – Belay and Transform
# Lygus Bug Susceptibility

<table>
<thead>
<tr>
<th>Product</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbine</td>
<td>4650</td>
<td>1650 (4 locations)</td>
</tr>
<tr>
<td>Belay</td>
<td>0.2</td>
<td>(0.04 to 0.7)</td>
</tr>
<tr>
<td>Transform</td>
<td>50.7</td>
<td>(25 to 90)</td>
</tr>
</tbody>
</table>
Impacts on Secondary Pests

Beneficals- 2010
Avg. of 10 sample dates over 2 applications

<table>
<thead>
<tr>
<th>Product</th>
<th>Beneficals per 50 Sweeps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belay - 4 oz.</td>
<td>4</td>
</tr>
<tr>
<td>Belay + Danitol - 4 + 10.6 oz.</td>
<td>2.7</td>
</tr>
<tr>
<td>Sulfoxaflor - 1.43 oz.</td>
<td>6</td>
</tr>
<tr>
<td>Sulfoxaflor - 2.14 oz.</td>
<td>7</td>
</tr>
<tr>
<td>Orthene - 1.0 lb.</td>
<td>6</td>
</tr>
<tr>
<td>Carbine - 2.3 oz.</td>
<td>8</td>
</tr>
<tr>
<td>Leverage - 5 oz.</td>
<td>7</td>
</tr>
<tr>
<td>Warrior - 3.84 oz.</td>
<td>5</td>
</tr>
<tr>
<td>Vydate - 32 oz.</td>
<td>3</td>
</tr>
<tr>
<td>Untreated</td>
<td>9</td>
</tr>
</tbody>
</table>
Mites and Aphids in Cotton

Strawberry spider mite: Tetranychus turkestani

Twospotted spider mite: Tetranychus urticae

Pacific spider mite: Tetranychus pacificus
Lygus Bugs – 2011
Secondary Pests

3 days after second application

Change in Population

Spider Mites
Cotton Aphids

~42 mites per leaf and ~30 aphids per leaf
Lygus Bugs – 2012
Secondary Pests

7 days after second application

Change in Population

- Spider Mites
- Cotton Aphids

~1.5 mites per leaf
and ~3.8 aphids per leaf
Impacts on Spider Mites and Other Secondary Pests

Late-season spider mite build-up in 2011 – worst since early to mid 1990’s -- Belay “blamed”
Thanks to:
- Cotton Incorporated
- staff of West Side REC
- summer field assistants