Biology & Biocontrol of Lewis spider mite (*Eotetranychus lewisi*), an emerging pest in strawberries

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Spider Mites

- Major recurring pest during both plantings in coastal California

- Problems associated with chemical control
  - *Resistance to miticides
  - Difficulty of applying miticides
  - Miticide residues on fruit
Twospotted spider mite
(*Tetranychus urticae*)

- Usually the most abundant & damaging mite pest on strawberry

- Present in summer & fall berries
Recently, PCAs & growers began to notice a new mite emerging...

**Lewis spider mite** (*Eotetranychus lewisi*)

- Populations are increasing in Ventura County
  - Cane berries
  - Strawberry
Lewis Spider Mite
vs.
Twospotted (TSSM)
Twospotted spider mite (TSSM)

- Usually the most abundant & damaging mite pest on strawberry

- Multiple hosts (crops & ornamentals)

- Present in summer & fall berries

- ♀ Hibernates (Diapause) in the winter

© ADAS UK
Lewis spider mite (LSM)

- Multiple hosts (crops & ornamentals)
- MAJOR pest of Poinsettias
- Minor pest of citrus

- Becoming a major pest of raspberry & strawberry in Ventura Co.

- Present in fall or summer plantings (?)

- No hibernation (Diapause) period known
Damage

- Feed on the underside of leaves
- Yellow mottling on topside
- Necrosis on underside
- Webbing
  - Spreads mites
  - Attracts dust on the underside
  - Can change transpiration
- Reduction in fruit size & yield
- Heavy infestations cause stunting & leaf drop
- Can kill a stressed plant
<table>
<thead>
<tr>
<th></th>
<th>Lewis</th>
<th>TSSM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spots</td>
<td>Multiple</td>
<td>One large spot on each side</td>
</tr>
<tr>
<td>Size</td>
<td>0.36mm</td>
<td>0.5mm</td>
</tr>
</tbody>
</table>

Lewis ♀ adult

Twospotted ♀ adult
Zalom et al.

Lewis mite vs. twospotted spider mite development - different hosts

<table>
<thead>
<tr>
<th></th>
<th>Mean number of mites at temperatures (°C)</th>
<th>15 °C</th>
<th>20 °C</th>
<th>25 °C</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Females</td>
<td>Males</td>
<td>Total</td>
<td>Females</td>
</tr>
<tr>
<td>Castor bean</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T.urticae</td>
<td>0.33±0.57</td>
<td>0.0±0.0</td>
<td>0.33±0.57</td>
<td>7.33±4.61</td>
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<tr>
<td>E.lewisi</td>
<td>13.33±4.93</td>
<td>2.33±2.30</td>
<td>15.66±4.50</td>
<td>30.66±14.64</td>
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<tr>
<td>P =</td>
<td>0.0043</td>
<td></td>
<td></td>
<td>0.0768</td>
</tr>
<tr>
<td>Strawberry</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T.urticae</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E.lewisi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P =</td>
<td>Not analyzed</td>
<td></td>
<td></td>
<td>0.0003</td>
</tr>
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</table>

TSSM survives longer and produces more eggs on strawberry in cooler temps.
Lewis mobiles (strawberry host only)
TSSM mobiles (strawberry host only)
Previous lab bioassay results by Frank Zalom

Lewis Mite Mortality, Bioassays, 2011

Percent mortality

Agri-Mek 0.70SC  Agri-Mek 0.15EC  Fujimite  Zeal  Acramite  Kanemite  Oberon  JMS Stylet Oil
What about biocontrol?

- *Phytoseiulus persimilis* is the commonly released predator for TSSM…
But it may not work for Lewis mite management

- Mites shifting from twospotted to Lewis

- How do you control this?

**Goal:**

- To figure out which predatory mite works best in management of Lewis mites
Methods

- Collected Lewis mites from the field

- Raised Lewis mite colony on clean strawberry leaves

- Ordered predatory mites
  - *Neoseiulus californicus*
  - *Neoseiulus fallacis*
  - *Amblyseius andersoni*
  - *Phytoseiulus Persimilis*
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- Ordered predatory mites
  - *Neoseiulus californicus*
  - *Neoseiulus fallacis*
  - *Amblyseius andersoni*
  - *Phytoseiulus Persimilis*
- Transferred 40 Lewis mites onto a new leaf
- Settle for one day
- Added 10 predators of a particular species per plate
- 4 plates per predator species
- 4 plates for control (no predators)
- Lab conditions: 18:6 (day:night), ~75 ºF, ~52% RH

- Counted number of Lewis mite mobiles & eggs every 4\textsuperscript{th} day for 2 weeks
*P. persimilis* would not feed on Lewis spider mites & starved to death. Excluded from the analysis.
Overall all 3 predatory mites can control Lewis mites...

*N. fallacis* attacking Lewis mite
But what happens when you have both twospotted & Lewis mites?

What are the interactions between Lewis & twospotted spider mite?

Do the predatory mites prefer one over the other?
- Transferred
  - 20 Lewis + 20 twospotted

- Settle for 1 day
- Added 10 predators of a particular species per plate
- Lab conditions: 18:6 (day:night), ~75 °F, ~52% RH

- Counted number of Lewis & TSSM mobiles every 4th day for 2 weeks
Lewis + TSSM + *N. californicus*

**Mean number of Lewis & TSSM**

**Days**

- U-Lewis
- NC-Lewis
- U-TSSM
- NC-I TSSM
How will they behave in the field?
- Environmental variability
- Spatial variability
Methods

- Sampled fields with both mite species present
  - Organic field (fall berries)

- 4 replications per treatment (1 bed per rep)
  - *A. andersoni*
  - *N. californicus*
  - *N. fallacis*
  - Grower Standard (*P. persimilis + N. californicus*)
1 bed per treatment (AVG size: ~300ft x 4ft wide)

Each treatment separated by 4 beds

3 subplots

All beds were sprayed with Grandevo (MBI)
- Collected 6 mid-tier trifoliates from each subplot per rep
- 72 trifoliates per treatment = 288 total

- Counted number of Lewis & TSSM mobiles & eggs every week for 10 weeks (Feb – April 2013)

- Counted the number of predators

- Baseline Count of Lewis & TSSM mobiles

- Released at a rate of 25,000 per acre (equivalent to what the grower was releasing)
No sig. difference between treatments
Repeated measures ANOVA: $p = 0.715$
No sig. difference between treatments
Repeated measures ANOVA: $p = 0.926$
N. californicus + Lewis mite + TSSM

AVG mite mobiles per leaf

Week

1 2 3

Nc+lewis
Nc+TSSM
No sig. difference between treatments
Repeated measures ANOVA: $p = 0.972$
Recommended predatory mites for...

**TSSM ONLY**

- *P. persimilis*
- *N. fallacis*
- *A. andersoni*
- *N. californicus*

© Photo courtesy Holt Studios, UK

University of Florida, Eléna M. Rhodes
- To implement the best IPM program
  - Scout your fields
  - Properly ID your mites
  - Apply the best control for your situation
Acknowledgements

Frank Zalom & his lab (UC Davis)
Dan Cahn & Sally Gray (Syngenta Bioline)
Brett Chandler (Associates Insectary)
California Strawberry Commission
Success Valley Farms
Paul Penza
Jaime Lopez
Total spider mites counted: 99,261

Total eggs counted: 250,843