Management of Arthropod Pests in Organic Strawberry

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Vegetables and Strawberries

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Principle of organic agriculture:
Diversity increases stability

• Is crop diversity important for pest suppression in organic strawberry?
• Can we use crop combinations to put strawberry pests at a disadvantage?
• Can we use insectary plants to enhance biological control of pests in organic strawberry?
Strawberry pests

- twospotted spider mite, strawberry cyclamen mite
- Lygus
- corn earworm, beet armyworm
- whiteflies
- thrips
- light brown apple moth
Twospotted spider mite, *Tetranychus urticae*

- **Host range**: many vegetable, field and tree crops
Factors favoring spider mites

- Dust
- Hot/Dry
- Wind

Importance of wind breaks, dust barriers.

Vigorous strawberry plants are better able to withstand mite damage.
Damage – spider mites puncture plant cells to drink sap.
Monitoring spider mites

Examine leaves in the middle of the plant, underside.

10 plants/acre in small fields; 5 plants/acre large fields.
Thresholds according to UC:

4-5 months after transplanting: average of 5 mites/leaf
Summer transplants: average 10 mites/leaf

60% Persimilis?
Carmine spider mite – rarely causes damage
Predatory mite *Persimilis* (right)
Predatory mite *Galendromus*
Suppliers of mite predators:

• Biotactics
• Rincon Vitova
• Syngenta
• Kuida Ag (distributors)

Others…
Rates? Thousands per acre…

Frequency?

There are many approaches to managing spider mites with predatory mites.

Different predatory mites have different characteristics:

best for strawberry?
Other predators
Good Bug Blend for mite management?
Organic acaricides:
Rosemary oil (no residual)
Organic stylet oils

Efficacy?
Lygus

(Lygus hesperus)
Lygus Sources
Infested second year plantings
Weedy hosts around fields
Alternate host crops

Courtesy Frank Zalom
Monitoring guidelines

Sweep net - for weeds, trap crops, and other crops

Beating hoop or tray - strawberries

A-vac (or other suction devices) - strawberries

Courtesy Frank Zalom
Alfalfa Interplants in Cotton - Studied since the late 1960s

Grow 20' strip for every 300'
Mow 1/2 every 14 days
Leave unmowed strip

Courtesy Frank Zalom
Bug Vacs

Courtesy Frank Zalom
Swezey et al. 2007. Environmental Entomology

- 3 year Lygus study
- Twice-weekly vacuuming of alfalfa trap crop in strawberry
  - Adults reduced by 72%
  - Nymphs reduced by 90%
- Less damage
- Cheaper than vacuuming entire field
Sampling Lygus in Strawberry, UC Management Guidelines

UC threshold: 1 nymph/10 plants (beating)
Degree Days: combining scouting and temperature information to predict Lygus development

Lower temperature threshold for Lygus: 54°F

Figure 1. Thresholds and accumulated degree-days
Degree-day Accumulations (> 54°F) Required for Each Stage of Lygus Development

<table>
<thead>
<tr>
<th>Developmental stage</th>
<th>DD (°F)</th>
<th>DD (°C)</th>
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</thead>
<tbody>
<tr>
<td>Eggs:</td>
<td>252.0</td>
<td>140.0</td>
</tr>
<tr>
<td>Nymphs:</td>
<td>371.0</td>
<td>206.1</td>
</tr>
<tr>
<td>Egg to Adult:</td>
<td>623.0</td>
<td>346.1</td>
</tr>
<tr>
<td>Pre-Oviposition:</td>
<td>176.0</td>
<td>97.8</td>
</tr>
<tr>
<td>(Egg to Egg):</td>
<td>799.0</td>
<td>443.9</td>
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Lygus Phenology Model after Sevacherian et al.

Using the Lygus DD model

Biofix 1

Late Winter

Biofix 2

Spring

Fall planted berries

first nymphs seen on weeds

first adults seen in strawberries

first generation of nymphs seen in strawberries

second generation of nymphs seen in strawberries

third generation of nymphs seen in strawberries
Vacuuming:

- Destroys beneficials
- Spreads powdery mildew

Alfalfa:

Can be a source of thrips
Egg parasitoid is commercially available – efficacy?

*Anaphes iole*, laying egg in *Lygus* egg.
Organic insecticides for Lygus:
M-Pede, insecticidal soap.

May kill up to 50% nymphs.
Will not impact adults.

Lygus builds up in second year berries.
Good Bug Blend for Lygus management?
Beet armyworm (*Spodoptera frugiperda*),

Corn earworm (*Helicoverpa zea*)

Each has a broad host range.
Beet armyworm egg mass

Corn earworm: eggs laid singly
Beet army worm
Smooth; black spot above second leg

Corn earworm
Dark tubercles and bristles, color variable
Beet armyworm and corn earworm

Eggs, larvae: attacked by several parasitoids and predators.

Attacked by pathogens.

Bt and Entrust (spinosad) can be used in organic production. Young larvae must be targeted.
Greenhouse whitefly (*Trialeurodes vaporariorum*)

- **Adults and eggs**
- **Nymphs**
- **Parasitized nymphs**
- **Red-eyed nymphs or pupae**
Whitefly damage:

crop debilitation

Whiteflies build up on second year berries.

Sooty mold

pallidosis related decline
Whitefly control in organic strawberry:

“Preserving naturally occurring biological control agents, cultural controls, sprays of narrow range oil, azadirachtin (Neemix), and insecticidal soaps, and releases of Encarsia formosa into hot spots against low-to-moderate populations of greenhouse whitefly are acceptable for use on organically certified strawberries.”
Western flower thrips
(*Frankliniella occidentalis*)

Control:
Spinosad, predators

Type 1 bronzing
Thrips can build up in alfalfa.
Light brown apple moth (*Epiphyas vittata*)

Female

Male

Egg cluster
Hortnet, New Zealand

Fotos: David Williams, Principal Scientist, Perennial Horticulture, Department of Primary Industries, Victoria, Australia

Pupa
Hortnet, New Zealand

Larva
Macleay Museum, University of Sydney
Insectaries with strawberry?

- Lygus
- Spider mites
- Beet armyworm
- Whiteflies