
THE CONNECTICUT POMOLOGICAL SOCIETY
Annual Meeting
Tuesday, December 1, 2015

Peter Jentsch
Senior Extension Associate – Entomology

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[Image of insects and plants related to the topic]
Pear Psylla Biology

Pear Psylla, *Cacopsylla pyricola* (foerster)

- **Invasive pest:** accidentally *introduced* into Connecticut in about 1832 from Europe
- Feeds on European host varieties such as Bosc, Bartlett, Seckle
- Pear psylla has three life stages, egg, nymph & adult, **3-4 gen./yr.**
- Overwinters in the adult stage within and outside orchards
- Spring migration and egg laying begins prior to bud break
- Nymphs undergo 5 instars, last instar ‘Hardshell’ less susceptible
- Nymphs pierce leaf & stem to feed on sap, inject toxic saliva
- Excess sap shunted as concentrated ‘honeydew’, used for protection
- Sap phytotoxic to foliage & fruit; defoliation, russet, tree decline
Pear Psylla Biology

- 3 – 4 Generations Per Season; Varietal, Site and Weather Dependent
- Nymphs emerge in mid-late April
- Shunt excess sugar from sap feeding causing sooty mold, russetting and Bosc decline
Pear Psylla Biology

- Near season long presence of nymphs in some orchards
Pear Psylla Adult Vacuum Sweeps & Egg Counts in Untreated Bartlett Pear
Hudson Valley Lab. Highland, NY - 2006

First egg observed.

"Spring-Winter-form" Overwintering adult

"1st Generation Adult" Summer-form

"2nd & 3rd Generation Adults" Fall Winter-form

Seasonal Psylla Adult Management

GC  WB PF

Bartlett  Harvest  Bosc

A  E  N  A  E  N  A  E  N
Pear Psylla Adult Vacuum Sweeps & Egg Counts in Untreated Bartlett Pear
Hudson Valley Lab. Highland, NY - 2006

First egg observer:
"Spring-Winter-form"
Overwintering adult

"1st Generation Adult"
Summer-form

"2nd & 3rd Generation Adults"
Fall Winter-form

Bartlett

GC    WB    PF

Bosc

A    E    N

A    E    N

A    E    N
Seasonal Pear Psylla Nymph Management

First egg observation:
- "Spring-Winter-form" Overwintering adult
- "1st Generation Adult" Summer-form
- "2nd & 3rd Generation Adults" Fall Winter-form

Graph showing seasonal trends of adults and eggs from 3/31/06 to 9/8/06.
Management Options for Pear Psylla

Cultural Control Option:

• 2nd generation pear psylla: critical population to control.
• Egg laying from Mid-May through mid-June
• Pear psylla adults lay eggs on new succulent foliage during the onset of the 2nd generation (interior shoots; water sprouts).

• Removal of new shoots acts as an Attract and Kill strategy for psylla management.
• Begin shoot removal shortly after 2nd generation nymphs hatch in early-mid June
  • Hand pull shoots while succulent during dry periods to avoid fireblight
  • Mark and maintain specific shoots for limb renewal
Management Options for Pear Psylla

**Biological Control:** Anthocorid bugs, predaceous plant bugs, lacewings reduces pear psylla yet ineffective in maintaining psylla in commercial pear production.

**Mating Disruption:** 13-methylheptacosane is a sex attractant pheromone for *C. pyricola* winterform males (first identification of a sex pheromone in the Psylloidea).
Management Options for Pear Psylla

Chemical Control Options:

I. Adulticides
   Toxicants: AgriMek, Pyrethroids, Neonicotinoids

II. Adult Repellents / Ovipositional Deterrents
   Barrier films: Kaolin Clay & Horticultural oil

II. Insect Growth Regulators
   Esteem, Rimon, Portal

II. Ovicides
   Liquid lime sulfur (literature – burns succulent foliage)

II. Nymphicides
   Neonicotinoids
Alternative Materials and Strategies to Manage Pear Psylla Life Stages in Each Generation

Eggs

Overwintering Adults (Susceptible)

Summer Adults (Less Susceptible)

Nymphs - 1st Instar (Susceptible)

Nymphs (4-5th Instar Less Susceptible)
Pear Psylla Resistance Management

Insecticide resistance likely to occur in psylla populations:

* reside in the orchard (PP OW in the orchard)
* have multiple generations (2-4 gen)
* are exposed to insecticides with the same mode of action (pyrethroids / seasonal AgriMek)

Practical Management for Insecticide Resistance

- Target Population Developmental Stages with Single AI’s
- Rotate AI’s for Each Generation
- Use Barrier Film and Oil to Reduce Resistance Potential as these materials do not induce insecticide resistance
Pear Psylla Insecticide Management

I. Adulticides

- Pyrethroids
  - Ambush 25WP (Permethrin)
  - Asana XL 0.66EC (Esfenvalerate)
  - Danitol 2.4EC (Fenpropathrin)
  - Pounce 25 WP (Permethrin)
  - Warrior II ZT (Lambda-cyhalothrin)

- Neonicotinoids
  - Actara 25WDG (Thiamethoxam)
  - Assail 30SG (Acetamiprid)

- Nicotinic (nAChR) allosteric modulators
  - Delegate (Spinetoram)

- Abamectin
  - AgriMek
II. Adult Deterrents

Barrier Film & Repellent

Begin at the onset of adult presence

- Surround WP (Kaolin Clay) IRAC Un-MoA
  25-50#/A Dilute; Premix
- Bio-Cover (Horticultural Oil) IRAC Un-MoA
  1% volume to volume (1 gal. oil /100 gal. water)
- Aza-Direct 1.2L (Azadirachtin) IRAC Un-MoA
III. Insect Growth Regulators

- Application at the onset of 1st oviposition
- Pre-bloom – low toxicity to beneficials
- Esteem (Pyriproxyfen) (IRAC 7C) J. hormone analog, causing sterility; ovicidal
- Centaur (Buprofezin) (IRAC 16) chitin biosynthesis, suppresses oviposition
- Rimon (Novaluron) disrupts chitin synthesis in immature insects and eggs
  - Impacts eggs deposited on residue
IV. Ovicides

- Early oviposition prior to hatch
- IGR’s
- **Liquid lime sulfur** (contact – caustic), will burn foliage after bud break
  - 21d between LLS and oil applications
  - Not to be used on sensitive var. (*d’Anjou, Comice or Seckle*)
IV. Nymphicides

Applied at first or early hatch

- Portal (**Fenpyroximate**) + penitrant (NIS, oil at 0.25%)  
  IRAC 21A
- AgriMek (**Abamectin**) + penitrant (NIS, oil at 0.25%)  
  IRAC 6
- Delegate (**Spinetoram**)  
  IRAC 5
- Movento (**Spirotetramat**) + penitrant (NIS, 0.25%) – Systemic  
  IRAC 23
- Neonicotinoid
  - Actara (**Thiamethoxam**), Assail (Acetamiprid)  
    IRAC 4
IV. Nymphicides

• Pre-mix group

  • Agri-Flex SC (Thiamethoxam/Abamectin) IRAC 4A/6
  • Gladiator (Zeta-Cypermethrin/Avermectin B1) IRAC 3A/6
  • Voliam Flexi WDG (Chlorantraniliprole/Thiamethoxam) IRAC 4A/28
Pear Psylla Management

- Adults / 1st Egg
- 1st G. Nymph
- Swollen Bud
- Green Cluster
- Full Bloom
- 10d Post PF
- 70% PF
- 1st generation
- Hort. Oil Pyrethroid + PBO
- 2nd G. Nymph
- 2nd generation
- 3rd & 4th generation
- Hort. Oil Pyrethroid + PBO
- 3rd & 4th Gen. Nymph
- Actara (PC)

Cornell University
College of Agriculture and Life Sciences

Hudson Valley Research Laboratory
Pear Psylla Adult Vacuum Sweeps & Egg Counts in Untreated Bartlett Pear
Hudson Valley Lab, Highland, NY - 2006

"First egg obser.
"Spring-Winter-form" Overwintering adult

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"2nd & 3rd Generation Adults" Fall Winter-form

Seasonal Psylla Adult Management

GC WB PF Bartlett Harvest Bosc

A E N A E N A E N
Pear Psylla Management

- Adults / 1st Egg
  - Hort. Oil Pyrethroid + PBO

- 1st G. Nymph
  - Hort. Oil Pyrethroid + PBO

- 2nd G. Nymph
  - AgriMek + oil

- 3rd & 4th Gen. Nymph
  - Delegate (OBLR)

- Movento + Assail +

- Actara + oil (PC)

- 70% PF
- Full Bloom
- 10d Post PF
- Swollen Bud
- Green Cluster

Graph showing peaks and troughs of Psylla Eggs and Nymphs with application points for various pesticides.
Pear Psylla Management

Surround WP

1st Egg

1st G. Nymph

Green Cluster

Swollen Bud

Full Bloom

10d Post PF

Psychia Eggs

Psychia Nymphs

1st generation

2nd generation

3rd & 4th generation

Surround WB

Horticultural oil 1% dilute

Horticultural oil 1% dilute

Horticultural oil 1% dilute

Horticultural oil 1% dilute

Surround WP

Horticultural oil 1% dilute

Horticultural oil 1% dilute

Horticultural oil 1% dilute

Horticultural oil 1% dilute
# Evaluations of insecticide schedules against summerform pear psylla adults on Bartlett pear

**Hudson Valley Lab., Highland, N.Y.-2005.**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Formulation</th>
<th>Appl. Dates</th>
<th>7/5 SF Adults(^1) # / 3 min.</th>
<th>7/15 SF Adults(^1) # / 3 min.</th>
<th>% Reduct. SF Adults</th>
</tr>
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<tbody>
<tr>
<td>Actara 25WP</td>
<td>1.4 oz.</td>
<td>14 July</td>
<td>32.2 a</td>
<td>9.5 a</td>
<td>70.5</td>
</tr>
<tr>
<td>AgriMek</td>
<td>2.5 oz.</td>
<td>14 July</td>
<td>37.7 a</td>
<td>11.9 a</td>
<td>68.4</td>
</tr>
<tr>
<td>Damoil</td>
<td>32.0 oz.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asana XL</td>
<td>5.8 oz.</td>
<td>14 July</td>
<td>34.5 a</td>
<td>11.9 a</td>
<td>65.5</td>
</tr>
<tr>
<td>Incite</td>
<td>2.0 oz.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assail 70WP</td>
<td>0.85 oz.</td>
<td>14 July</td>
<td>54.2 a</td>
<td>17.8 a</td>
<td>67.2</td>
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<td>Damoil</td>
<td>32.0 oz.</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warrior</td>
<td>1.71 oz.</td>
<td>14 July</td>
<td>30.4 a</td>
<td>58.8 b</td>
<td>-93.4</td>
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<tr>
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<td>5.8 oz.</td>
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<td>-162.3</td>
</tr>
<tr>
<td>Damoil</td>
<td>1.0 gal.</td>
<td>14 July</td>
<td>13.3</td>
<td>33.3</td>
<td>-150.4</td>
</tr>
<tr>
<td>Untreated</td>
<td>-</td>
<td>-</td>
<td>62.8</td>
<td>140.3 c</td>
<td>-123.4</td>
</tr>
</tbody>
</table>

- **Incite - Piperonyl butoxide** (a P450-dependent monooxygenase inhibitor)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Formulation amt. /100 gal.</th>
<th>Appl. Dates</th>
<th>7/5 SF Adults(^1) # / 3 min.</th>
<th>7/15 SF Adults(^1) # / 3 min.</th>
<th>% Reduct. SF Adults</th>
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<td>Damo    oil</td>
<td>32.0 oz.</td>
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<td><strong>- 162.3</strong></td>
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<tr>
<td>Damo    oil</td>
<td>1.0 gal.</td>
<td>14 July</td>
<td>13.3</td>
<td>33.3</td>
<td><strong>- 150.4</strong></td>
</tr>
<tr>
<td>Untreated</td>
<td>-</td>
<td>-</td>
<td>62.8</td>
<td>140.3 c</td>
<td><strong>- 123.4</strong></td>
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Incite - Piperonyl butoxide (a P450-dependent monooxygenase inhibitor)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Formulation</th>
<th>Application Dates</th>
<th>7/8 nymphs$^1$</th>
<th>7/18 nymphs$^1$</th>
<th>% Reduct. nymphs$^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actara 25WP</td>
<td>1.4 oz.</td>
<td>14 July</td>
<td>2.1 abc</td>
<td>1.0 cd</td>
<td>52.3</td>
</tr>
<tr>
<td>AgriMek</td>
<td>2.5 oz.</td>
<td>14 July</td>
<td>6.3 d</td>
<td>1.3 d</td>
<td>79.5</td>
</tr>
<tr>
<td>Damoil 32 oz.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asana XL</td>
<td>5.8 oz.</td>
<td>14 July</td>
<td>1.2 a</td>
<td>0.1 a</td>
<td>94.4</td>
</tr>
<tr>
<td>Incite</td>
<td>2.0 oz.</td>
<td>14 July</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>Assail 70WP</td>
<td>0.85 oz.</td>
<td>14 July</td>
<td>1.8 ab</td>
<td>0.4 b</td>
<td>79.2</td>
</tr>
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<td>Warrior</td>
<td>1.71 oz.</td>
<td>14 July</td>
<td>5.0 bcd</td>
<td>1.8 de</td>
<td>64.1</td>
</tr>
<tr>
<td>Asana XL</td>
<td>5.8 oz.</td>
<td>14 July</td>
<td>5.5 cd</td>
<td>2.8 ef</td>
<td>50.0</td>
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<tr>
<td>M-Pede 49L</td>
<td>1 gal.</td>
<td>14 July</td>
<td>1.1 a</td>
<td>0.9 ab</td>
<td>20.0</td>
</tr>
<tr>
<td>Damoil 32 oz.</td>
<td></td>
<td></td>
<td>0.9 a</td>
<td>2.3 b</td>
<td>-172.0</td>
</tr>
<tr>
<td>Damoil 0.5 gal.</td>
<td></td>
<td></td>
<td>1.8 a</td>
<td>0.8 ab</td>
<td>57.2</td>
</tr>
<tr>
<td>Damoil 1.0 gal.</td>
<td></td>
<td></td>
<td>0.8 a</td>
<td>0.2 a</td>
<td>80.4</td>
</tr>
<tr>
<td>Untreated</td>
<td>-</td>
<td></td>
<td>6.6 d</td>
<td>4.1 f</td>
<td>36.8</td>
</tr>
</tbody>
</table>
Evaluations of insecticide schedules against 1s generation pear psylla adults and nymphs on Bartlett pear. Hudson Valley Lab., Highland, N.Y.-2005.

<table>
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<tr>
<th>Treatment</th>
<th>Formulation</th>
<th>Application</th>
<th>Dates</th>
<th>Adults&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Nymph</th>
<th>Egg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damoil</td>
<td>2.0 gal. / 100</td>
<td>BB</td>
<td></td>
<td>1.0 a</td>
<td>0.9 a</td>
<td>6.1 a</td>
</tr>
<tr>
<td>Asana</td>
<td>5.8 oz. / 100</td>
<td>WB</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AgriMek 0.15EC</td>
<td>2.5 oz. / 100</td>
<td>10dp PF</td>
<td></td>
<td>0.9 a</td>
<td>6.1 a</td>
<td></td>
</tr>
<tr>
<td>+ Damoil</td>
<td>0.25% V/V</td>
<td>10dp PF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AgriMek 0.15EC</td>
<td>2.5 oz. / 100</td>
<td>10dp PF</td>
<td></td>
<td>1.2 ab</td>
<td>7.7 ab</td>
<td></td>
</tr>
<tr>
<td>+ Damoil</td>
<td>0.25% V/V</td>
<td>10dp PF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Esteem 35WP</td>
<td>1.25 oz. / 100</td>
<td>DD, 10dp PF</td>
<td></td>
<td>0.7 a</td>
<td>14.6 bc</td>
<td></td>
</tr>
<tr>
<td>+ Damoil</td>
<td>0.25% V/V</td>
<td>DD, 10dp PF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warrior</td>
<td>1.71 oz./100</td>
<td>WB, PF – 1C</td>
<td></td>
<td>2.8 bc</td>
<td>11.0 ab</td>
<td></td>
</tr>
<tr>
<td>Aza-Direct</td>
<td>4.0 oz. / 100</td>
<td>SB, 1C</td>
<td></td>
<td>3.5 c</td>
<td>29.0 cd</td>
<td></td>
</tr>
<tr>
<td>Untreated control</td>
<td></td>
<td></td>
<td></td>
<td>2.5 bc</td>
<td>4.0 c</td>
<td>32.7 d</td>
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</table>

Data taken from Bartlett on 6 June
<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate * 6/14</th>
<th>% Redn.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actara 25WG</td>
<td>1.4</td>
<td>92.5</td>
</tr>
<tr>
<td>Agri-Mek 0.15 EC</td>
<td>5.0</td>
<td>72.5</td>
</tr>
<tr>
<td>Assail 70WP</td>
<td>0.8</td>
<td>52.0</td>
</tr>
<tr>
<td>UNTREATED</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
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Rate * oz. / 100 (10d) 6/14

Applied using handgun at 400 GPA
All applications included 0.25% horticultural oil
### Evaluations of insecticide schedules against summerform pear psylla adults on Bartlett pear[^1]. Hudson Valley Lab., Highland, N.Y.-2005.

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<td>-</td>
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<td>140.3 c</td>
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</tbody>
</table>

[^1]: SF Adults

Incite - Piperonyl butoxide (a P450-dependent monooxygenase inhibitor)
Management Options for Pear Psylla

**Barrier / Particle Films:** Surround WP acts as an ovipositional deterrent. Kaolin clay formulation produces a reflective white film and texture to disorient and repel adults from trees.

![Graph showing Psylla Eggs/leaf before and after treatment with Surround, Oil, and Untreated.](image)

<table>
<thead>
<tr>
<th></th>
<th>Pre-appl.</th>
<th>3-Apr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surround</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Oil</td>
<td>0.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Untreated</td>
<td>0.5</td>
<td>1</td>
</tr>
</tbody>
</table>

2011: F=20.7, P=.0001
Management Options for Pear Psylla

**Surround WP** as an ovipositional deterrent at DD, GC, WB for 1\textsuperscript{st} generation

Actara at PF

Horticultural oil at 10-14d intervals to end of season.
Barrier Film: Surround WP impact on nymph populations.
Thank You

Technical staff and assistants
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