Area-Wide Program to Eradicate the European Grapevine Moth, *Lobesia botrana* in California, USA.

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Area-Wide Management of Insect Pest 22–26 May 2017, Vienna, Austria
An Old World Pest On The Move: *L. botrana* first detected in the Americas (Chile, April 2008; USA, California, September 2009; Argentina, April 2010).
Life cycle

Adult (Moth) → Egg

Larva (caterpillar) → Pupa

M. Cooper
Life cycle

3rd generation on fruit

3rd adult flight

2nd generation on fruit

2nd adult flight

1st generation on flowers

1st adult flight

Pupa (diapause)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

adapted from Maher, 2002 PhD thesis, Aquitaine, France
3rd generation

Eggs laid on ripening fruit
Larvae feed in ripening fruit
Botrytis bunch rot develops
Pupae overwinter under bark, in soil crevices
**Lobesia botrana** invasion in California

- Detected in September 2009
- Crop losses of 50% reported in some fields
- Area-wide control program initiated in 2010
- At peak in 2011, 10 counties quarantined, > 6,000 km² with >62,000 ha of grapes
- Pesticide and mating disruption and treatments 9,000 ha with >6,000 ha with mating disruption
- “Ground zero” in midst of iconic wine area by Napa River. Close to wild areas many alternate hosts nearby
Damage observed in September 2009 in Oakville, Napa County. Growers noticed unusual damage in 2008 but not identified until 2009.
No grapes collected in 2009 in this Chardonnay vineyard, which represents the “core of the infestation”
Program response

- Establishment of Technical Working Group of subject matter experts
- Establishment of Cooperative AW eradication program (see Cooper et al. California Agriculture, 2014: http://calag.ucanr.edu/Archive/?article=ca.v068n04p125)
- Begin outreach and communication programs
  - Industry, AG Commissioners, University, CDFA, USDA,
- Detection and delimitation program, traps and survey
- Regulation of movement of fruit, plants, green waste and winery wastes
- Mating disruption & coordinated pesticide applications
- Accelerated & targeted research effort
Structure of L. botrana AW Eradication Program
APHIS-PPQ formed a Technical Working Group in November 2009 to provide technical recommendations to the operational program. Members were Univ. California, industry, APHIS-PPQ, & international experts.
Napa Valley
December 2009

248 pheromone traps & visual surveys:

- 6 males
- 1 female
- 15 larvae
- 8 pupae

Legend

- **Lobesia botrana** pupae
- **Lobesia botrana** larvae
- **Lobesia botrana** males
- **Lobesia botrana** female collected
- 3 mile buffer **Lobesia botrana**
- LBAM State interior quarantine
2009: detected in the Napa Valley
2011: detected in 11 counties
(10 counties in quarantine)

~300 Km

Male catches 2010
Male catches 2011
- State-wide monitoring effort (map = example from 2015)
- 39 traps/km² in regulated areas
- 10 trap/km² for the rest of production areas
- Total > 33,000 traps for statewide survey, ~ 9,000 traps in Napa
Treatment & Response Program (1)

If *L. botrana* detected:

- 500 M radius treatment area & 4.8 km quarantine/regulated area

- AW applications of pesticides to target eggs & larvae on 1st & 2nd flights for two years post detection.
  - IGRS, Diamides, Indoxacarb, Spinosyns & *Bt* were on approved treatments list.

- Mating disruption (MD) used for two full flights after detection at 500 m radius.
  - Hollow tube dispensers at 500/ha.
  - Visual surveys for larvae in MD treated fields
Treatment & Response Program (2)

- Flower & fruit stripping/Bt in urban areas + some MD
- Trapping is increased within 500 m of previous finds to 39 traps/km$^2$ (from 10 traps/km$^2$)
- No mating disruption after first year
- Removed from quarantine after 6 full flights (3 years) with no detections
Program Detection Trapping

Traps were deployed:
Quarantine/regulated area:
• 2010/11: 8 km from a find
• 2012/16: 4.8 km from a find

Traps deployed in vineyards:
• Quarantine area: ~25 traps/mi²
• Outside quarantine: ~9 traps/mi²

Traps deployed in urban areas:
• ~5 traps/mi²
Two main treatments strategies used in tandem for commercial vineyard treatments

• Treatments:
  – To Vineyards within 500 meters of a find
    • In 2010-12: insecticide & MD treatments any find since 2009
    • In 2012-2016: Insecticide treatments finds previous 2 years, MD finds from previous year.

1. Application of Insecticides:
   1\textsuperscript{st} generation: 1 conventional or 2 (or 3) organic insecticides.
   2\textsuperscript{nd} generation: 1 conventional or 2 organic insecticides.

Insecticides used:
1. Conventional: methoxyfenoazide, chlorantraniliprole
2. Organic: Bt, spinosad

2. Mating disruption – \textit{L. botrana} pheromone (E,Z)-7,9-Dodecadien-1-yl Acetate) in hollow tube dispensers, 500/Ha, applied early spring before 1\textsuperscript{st} flight

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>OMRI</th>
<th>Ovicide/Larvicide</th>
<th>Toxicity Predator/Parasitoid</th>
</tr>
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<tbody>
<tr>
<td>Insect growth regulator (Ecdysone mimic)—IRAC grp. 18</td>
<td>N</td>
<td>Y / Y</td>
<td>low/low</td>
</tr>
<tr>
<td>Intrepid (methoxyfenozide)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Dipel (Bt Kurstaki)</td>
<td>Y</td>
<td>N / Y</td>
<td>low/low</td>
</tr>
<tr>
<td>Biobit (Bt Kurstaki)</td>
<td>Y</td>
<td>N / Y</td>
<td>low/low</td>
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<tr>
<td>Microbial (disrupts midgut membranes)—IRAC grp. 11</td>
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<td></td>
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<tr>
<td>Diamides (nerve and muscle targets)—IRAC grp. 28</td>
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<tr>
<td>Altacor (chlorantraniprole)</td>
<td>N</td>
<td>Y / Y</td>
<td>low/low</td>
</tr>
<tr>
<td>Belt (flubendiamide)</td>
<td>N</td>
<td>N / Y</td>
<td>low/low</td>
</tr>
<tr>
<td>Sodium channel blockers (paralysis)—IRAC grp. 22</td>
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<tr>
<td>Avaunt (indoxacarb)</td>
<td>N</td>
<td>N / Y</td>
<td>low/ med</td>
</tr>
<tr>
<td>Spinosyns (nicotinic AChR—nervous system block, paralysis)—IRAC grp. 5</td>
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<td></td>
<td></td>
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<tr>
<td>Success (spinosad)</td>
<td>N</td>
<td>N / Y</td>
<td>low/ med-high</td>
</tr>
<tr>
<td>Entrust (spinosad)</td>
<td>Y</td>
<td>N / Y</td>
<td>low/ med-high</td>
</tr>
<tr>
<td>Delegate (spinetoram)</td>
<td>N</td>
<td>N / Y</td>
<td>med/ high</td>
</tr>
</tbody>
</table>
For first flight (April-May 2010), traps captured 99,266 males in Napa & 78 in other 9 counties of CA.
• Outreach to non-commercial growers to ensure treatments are applied
• Outreach to residential properties
• California Department of Food and Agriculture
• Placed mating disruption in 2013 non-commercial and residential areas
• Survey of properties for EGVM hosts
• Removal of flower/fruit or Bt treatments
Mating Disruption in 2014
Napa County Agricultural Commissioner’s Office

- Ag Commissioner’s office distributed 8 km² worth of mating disruption to commercial growers.

- This represented 92 sites and 75 different growers within 500 meters of 2013 finds.

- Staff inspectors verified all 92 sites.

- All 92 sites have reported their pesticide use.
Total of 132 sites within 500 meters of a 2013 or 2012 find needed treatment

Approx. 3,300 acres including vineyards and olives

85 distinct Operators

All vineyards were treated

1st Flight Treatments Verified

Napa ag staff verified 111 applications (Olives and Grapes)

84%

2nd Flight Treatments Verified

Napa Ag staff verified 107 applications out of 128 (Grapes only)

84%
Quarantine Compliance
Napa County Agricultural Commissioner’s Office

Pre-harvest Meetings
• Treatments, Sanitation, Trapping or slack-filling
• Mechanical harvesting
• Harvest inspection
• USDA Systems Approach

Articles about sanitation & quarantine compliance
• Meetings
  • Countywide grower meetings
  • Pest Control Advisors
  • Vineyard Management Companies
  • Grower groups
  • Wineries-vineyard & grower relations
  • Individual growers

• Ads & Articles
  • Napa Valley Life
  • Napa Register
  • Industry & County newsletters
  • Craig’s List, Wine Business Mo.

• E-mail updates
Outreach: Hundreds of growers meetings and field day training

University field day training field monitoring (400 growers in one day)
With funding from USDA NRCS outreach materials were developed to help recognize all EGVM life stages in the vineyard.

- EGVM brochure.
- Guide to Moths & Worms in Grapevine Clusters.
- Bilingual poster.
- Online presentations in English & Spanish.
- Postcards
- Radio programs
Total EGVM moths on traps: Napa County 2010-2015 (A) & 2010 (B)
Eradication Declared in August 2016

- North America free of *Lobesia botrana*
- European Grapevine Moth Post-Eradication Response Guidelines developed.
  - Plan to trap and survey at high levels for at least three years
Research & Methods Development

- Detection methods in mating disrupted field & MD formulations & application methods
- Pesticide research
- Post harvest treatments of table grapes & regulatory treatments of green wastes & wine wastes
- Degree day models under California conditions
- Alternate hosts surveys
- Mass-rearing technology & SIT, Syria, Israel, Chile, USA, Argentina (others?) last CRP
- Economic analysis, ex-ante & post-ante
- Post program spatial analysis
Grape crush & sampling
Phenology Study in wild host riparian area
Phenology Traps Napa River
ALTERNATIVE HOST PLANT SURVEYS
FOCUS PLANT SPECIES
Spatial analysis of trap data to determine habitat suitability modeling for post program analysis
Example of creative outreach for communication about grapes pests by Napa County Agricultural Commissioner's office, “FaceBug” Campaign

DON’T “FRIEND” THE BUG!

DON’T BRING PLANTS INTO NAPA COUNTY

Don’t lower your guard and fall for the smooth talk. Sometimes you just can’t be friends. The best way to keep the Glassy-Winged Sharpshooter out of the county is by not bringing plants in. Buy all your plants from certified plant retailers inside Napa County, where shipments have been inspected before sale.

Thanks to our grapegrowers, landscapers, certified plant retailers and YOU, the sharpshooter has not yet established itself in the Napa Valley. But to keep it out, we must keep working together. For more information about how you can help, please call us at 1.866.BUG.SPOT or visit WWW.BUGSPOT.ORG.

A project of the Napa County Agricultural Commissioner’s Office.