Olive Fly – Biology, Control and Research Update

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Olive Fly

*Bactrocera oleae* (Gmelin)
Adult female

Photo: R. Copeland

Egg laying punctures
Olive fly biology

- Olive fly egg
- 1st instar
- 3rd instar
- Adult fly emerging from fruit
- Feeding tunnels
- Puparia
- Emergence hole
Presentation Topics

- Approaches to monitoring olive fly
- Optimum placement of traps within trees
- Timing and application of GF-120
- Current management alternatives
- Olive fly numbers in untreated olives
- Impact of summer heat on fly numbers
- Controlling black scale
- Biological control efforts underway
Ways to Monitor Olive Fly

- Visual inspection of foliage / fruit for adult flies
- Check for infested fruit within trees and on the ground
- Monitor for adults with traps hung in trees***
Adult olive flies are difficult to see on olive foliage.
Checking fruit is too time consuming
Aerial traps attract adult flies with the help of food & sex lures
ChamP Trap
Simple Yellow Panel Trap

- Easy to assemble
- Commercially available

Ammonium bicarbonate packets are recommended.

Suppliers:
- Trece
- Suterra
Olive fly on trap

Walnut Husk Fly

Male

Female

Olive fly on trap
Trap Maintenance

• Check yellow panel traps weekly
• Change the ammonium bicarbonate packets every 2 to 4 weeks depending on amount of active ingredient left
• Change the spiroketal pheromone plugs every four months
• Change traps when they become too cluttered with other insects or dust
McPhail Trap

Torula Yeast & Borax
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Placement in Trees

- Place on north side of tree in spring / summer
- Place on south side of tree in fall / winter
- Place in upper one third of tree
- Allow clear space around trap
- At least one trap per 5 - 10 acres of olives
- At least 2 traps per olive block; use more if possible

Remember:
No fruit; no flies on trap!!
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Application of Bait Spray

GF-120 NF Naturalyte Fruit Fly Bait
Approved for organic use
Section 18 presently
Application of Bait Spray

- Aerial applications not recommended
- Use alternate row coverage
- Treat north or east sides of trees

- Direct spray into upper half of tree
- Use dilutions from 1:1.5 to 1:4 parts GF-120 to water
- 4 - 5 mm droplets are best
Timing and Use of Bait Sprays
As recommended by the Olive Advisory Group / 2005

• Control of olive fly is essential because of the near-zero tolerance level established by table olive processors

• Timing of bait sprays should be based on a sharp increase in numbers of male flies coming to monitoring traps as well as crop phenology. A safe guideline is to initiate treatments near June 1 or two weeks before olive pit hardening

• GF-120 is the only sprayable bait legally available for use

• It cannot be applied more than once every 7 days

• Use rates vary from 10 oz. to 20 oz. active ingredient per acre

• 14 oz. a.i. per acre is currently being recommended
GF-120 Residue Longevity Studies

Tags indicating field exposure periods

Flies were exposed to aged residues for 4 hours & then held 72 hours to record mortality

Bait droplets on leaf

Lab test units
Mean daily maximum temp = 94.4 ± 5.9 °F
Mean maximum RH = 84.1 ± 3.7 %
Days when dew formed = 0.0 %
Days Exposure of GF-120 Residue

Percent Mortality 72 hrs After Treatment

9 Sept – 29 Sept 2004

4 Water : 1 GF-120

1.5 Water : 1 GF-120

0 4 7 14 21

0 10 20 30 40 50 60 70 80 90 100 110
Mean daily maximum temp = 87.9 ± 8.8 °F
Mean maximum RH = 84.9 ± 5.4 %
Days when dew formed = 33.3 %
Percent Mortality 72 hrs After Treatment

Days Exposure of GF-120 Residue

4 Water : 1 GF-120
1.5 Water : 1 GF-120

12 Oct – 1 Nov 2004

12 Oct – 3 Nov 2003

12 Oct – 1 Nov 2004
12 Oct – 1 Nov 2004

Mean daily maximum temp = 82.0 ± 9.3°F
Mean maximum RH = 90.6 ± 1.9%
Days when dew formed = 95.2 %
Black scale, *Saissetia oleae*

- Black scale is common throughout the Central Valley and produces honeydew that flies may potentially use as a carbohydrate source.
- Does honeydew attract OLF away from “weathered” GF-120 residues?
Choice vs. No Choice Tests of GF120 vs. Honeydew

\[ F = 13.17; \; df = 2, 11; \; P = 0.002 \]

Olive fly adults feed on honeydew, when present, thereby reducing the amount of GF-120 ingested.
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Other Ways to Suppress Olive Fly

- **Post-harvest sanitation** — Knock down fruit remaining in trees as soon after harvest as possible. Destroy the fruit on the ground by mulching or disk ing. Bury fruit at least 4 inches deep. If fly densities are high in area, this method may have minimal effect.

- **Mass trapping** — This method may lower fly numbers in an orchard, but economically significant fruit damage may still occur. Only use where fly numbers are very low.

- **Kaolin clay protectant** — Fine film of clay covers plant and changes olive fly attraction or behavior towards plant host. Farm Advisor Paul Vossen reports good results with the product Surround WP. Research is still ongoing to determine its best use.

- **Attract and kill traps** — One device (Magnet OL®) is available from AgriSense. It utilizes food and sex lures to attract olive fly adults and a pesticide to kill attracted adults.
Attract & Kill Trap

- Made by AgriSense
- Device is: Magnet OL®
- Registered in CA
- Adult olive flies are attracted by food and sex lures, and die after contacting insecticide impregnated material
- Active ingredient is lambda cyhalothrin
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Untreated olives:

- Abandoned orchards
- Residential / business landscapes
- Roadside plantings
- Organic orchards

Roadside Ornamental Olive Trees
Average Adult Olive Fly Trap Counts in Tulare & Fresno Counties

Survey Date 2003

Mean No. Total Flies / Trap / Week

- Treated Commercial Orchards
- Untreated Urban Sites

No olive fruit

Olive fruit present
Average Adult Olive Fly Trap Counts in Tulare & Fresno Counties

Must protect crop from this increase in olive fly

No olive fruit

Survey Date 2003
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Why do we see a drop in trap catches?

- The flies appear to alter their behavior patterns so that they are only active during cooler periods (i.e., early morning), thus less chance to be trapped.

- Extreme heat (greater than 95°F) can kill: 1) adult flies that cannot obtain enough water and sugar sources; and 2) eggs and 1st instars within the fruit. However, death may require 3 to 5 consecutive days of high temperatures.

- Flies with plenty of water and food can survive the entire summer (at least under field test conditions).

- The flies may leave the olive grove to seek out cooler, more humid places to sit out the extreme heat (e.g., citrus trees). *More data is needed on this.*
Tree Cage
San Joaquin Valley: Parlier, CA

Days Exposure in Field in 9-14 Sept 2005

Days Exposure in Field in 20-25 Sept 2005

Days Exposure in Field in 15-20 Aug 2005

Days Exposure in Field in 28 Sept - 3 Oct 2005

Percentage Survival of OLF Females

Temperature: 83, 82, 82, 84, 84 °F

Temperature: 95, 95, 93, 82, 76 °F
Survival of Caged Adult Female Olive Flies in Parlier, San Joaquin Valley, California

When water and honey were provided, olive fly adults survived over 8 months (Feb to Oct) in field cages.
What is the impact of high temperatures on olive fly eggs and first instars?
Mortality of OLF stages after 0 to 5 Days Exposure to 100°F

Duration of Exposure within Olive

Proportion Dead

- Egg
- 1st Instar
Other Factors to Consider

• Based on historical temperature data from the Central Valley, the frequency at which 3 to 5-day periods of 100 to 105°F occur vary dramatically between the olive production areas of the San Joaquin Valley versus the Sacramento Valley.

• The San Joaquin Valley has longer and more frequent periods of high temperatures than the Sacramento Valley.

• Irrigation methods vary between the regions with the San Joaquin Valley having dryer orchards with little ground cover within orchards to provide moisture, shade, and high humidity for OLF adults.

• Black scale, *Saissetia oleae*, is common throughout the Central Valley and produces honeydew that flies may potentially use as a carbohydrate source.
Number of Years with Maximum Temperatures Greater Than or Equal to 100 deg F For Three Consecutive Days

**Ending on July 15**

*The olive orchard locations were obtained from county land use data obtained from the State of California Department of Water Resources for the period 1993 to 2003 inclusive. Temperature data were from 1992 to 2001, inclusive.*

Number of Years with Maximum Temperatures Greater Than or Equal to 100 deg F For Three Consecutive Days

**Ending on August 15**

*The olive orchard locations were obtained from county land use data obtained from the State of California Department of Water Resources for the period 1993 to 2003 inclusive. Temperature data were from 1992 to 2001, inclusive.*
Number of Years with Maximum Temperatures Greater Than or Equal to 100 deg F For Three Consecutive Days Ending on August 15

* The olive orchard locations were obtained from county landuse data obtained from the State of California Department of Water Resources for the period 1993 to 2003 inclusive.

Temperature data were from 1982 to 2001, inclusive.

Number of Years with Maximum Temperatures Greater Than or Equal to 100 deg F For Three Consecutive Days Ending on September 15

* The olive orchard locations were obtained from county landuse data obtained from the State of California Department of Water Resources for the period 1993 to 2003 inclusive.

Temperature data were from 1982 to 2001, inclusive.
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• Biological control efforts underway
Black scale, *Saissetia oleae*

- Black scale is common throughout the Central Valley and produces honeydew that flies may potentially use as a carbohydrate source.
- Does honeydew consumption enable flies to survive periods of extreme heat?
Provision of water with honey or honeydew enables olive fly adults to survive short periods of high temperatures.
Some factors that potentially influence the impact of summer temperatures on olive fly

- Intensity of daily maximum temperature*
- Duration of daily highs (e.g., > 100°F for 4 days)*
- Relative humidity*
- Olive fly’s access to water (availability of irrigation sources, morning dew, ponds, creeks, etc.)
- Olive fly’s access to a carbohydrate source (e.g., honeydew)
- Olive fly’s ability to seek refuge from the heat by dispersal

* Highly dependent on location in state
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Potential for control using biocontrol agents

Non-target effects?

Beneficial on Star Thistle
Biocontrol Agents Under Consideration for Release

**Utetes africanus**  
Africa

**Bracon celer**  
Africa

**Diachasmimorpha kraussii**  
KM Daane

**Psyttalia lounsburyi**  
Southern Africa

**Fopius arisanus**  
SE Asia

KM Daane

MW Johnson
Summary

- The easiest and most efficient way to monitor for olive fly is via yellow panel traps that attract adult flies with food and sex lures.

- Various options for suppression of olive fly are available with GF-120 bait sprays probably being the optimum control currently available to commercial olive producers.

- Control of black scale may reduce survival of olive fly adults due to removal of a potential food source.

- Efforts are underway to reduce numbers of required baits sprays using alternative methods while maintaining high levels of fruit quality.
OLIPE
Olive Fruit Fly Trap from Spain

1.5 to 2.0 liter plastic bottle. Fill 2/3 full with a 3-5% (30-50 grams per liter) solution of di-ammonium phosphate or ammonium bicarbonate and water. Sometimes vinegar and protein hydrolysate bait is also added.

If stings exceed 3% - one mg of microencapsulated liquid spiroketal pheromone is added.

Hang in the inside of the south side of the tree in the shade.

Three to six 4-5mm (3/16 – ¼ inch) holes drilled or melted into neck.

June – Sept.
8-10 traps/acre

Sept. – Dec.
16-20 traps/acre

From Varela & Vossen 2002