UC Cooperative Extension
University of California
Agriculture & Natural Resources

CALIFORNIA CHERRIES

Methyl Benzoate as Oviposition Repellent against Spotted Wing Drosophila in Cherry Orchards

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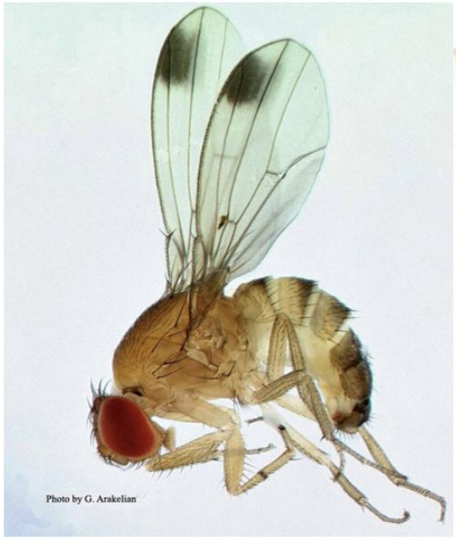
Cherry Research Review, February 2, 2026; Stockton, CA

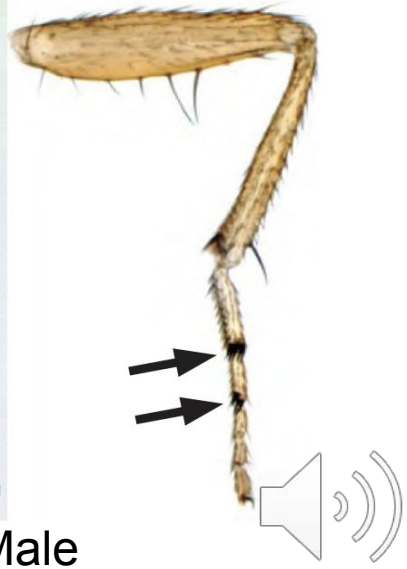
Spotted Wing Drosophila (SWD)

- Spotted wing drosophila (SWD), *Drosophila suzukii* (Matsumura), invasive pest
- First detected in California in 2008, now in 41 US states, Canada, Mexico, and many European countries
- Adult flies ~1/32 in (<6 mm), light brown with red eyes
- Females are uniquely devised with a ‘serrated’ ovipositor - capable of laying eggs on healthy fruits
- Male flies have a dark spot on the wing, and two “combs” on front legs

Female

Serrated ovipositor





Male

Photos: M. Hauser; https://extension.usu.edu/pests/research/spotted-wing-drosophila

SWD Damage in Caneberries and Cherries

- Fruits become susceptible to SWD damage as soon as fruit color begins to change,

  Blueberry: green to purple

  Cherry: green to pink/red

- Females lay eggs inside the fruit, and larvae feed on it internally.

- Infestation can lead to secondary pest/disease invasion

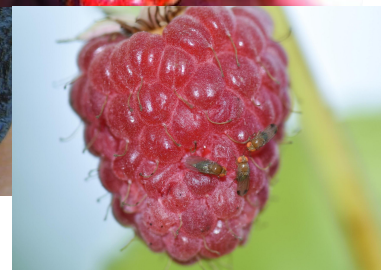


Photo: E. Burkness, D. Haviland; C. Teasdale, M. Hauser, UCIPM

Challenges related to invasive species - SWD

They can spread rapidly.

They can be difficult to detect and identify; mistaken for native species.

Very adaptable and resilient to new climates and habitats

No biocontrol present in the new environment

The First Line of Defense

SWD populations with reduced susceptibility

In Georgia, a significant decline in the susceptibility of *D. suzukii* adults to spinosad and malathion (Desi and Sial 2021)

In Michigan, reduction in SWD's susceptibility to malathion and spinetoram (Van Timmeren et al. 2019)

In California, Pesticide Resistant SWD in the Central Coast - Spinosad

Resistance Ratio (RR)

$$= \frac{\text{LC50 of resistant population}}{\text{LC50 of susceptible popultion}}$$

(RR >1 indicates that the pest population has built resistance to the particular insecticide)

2017-20 studies; spinosad:

- Extensive field studies showed widespread resistance of SWD populations with a Resistance Ratio (RR) from 10 to 17 folds.

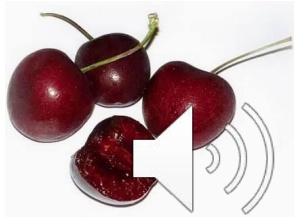
(Gress and Zalom 2018; Ganjisaffar et al. 2022b)

In California, Pesticide Resistant SWD in the Central Coast – Pyrethroids

Pyrethroid (bifenthrin, Type I; zeta-cypermethrin, Type II)

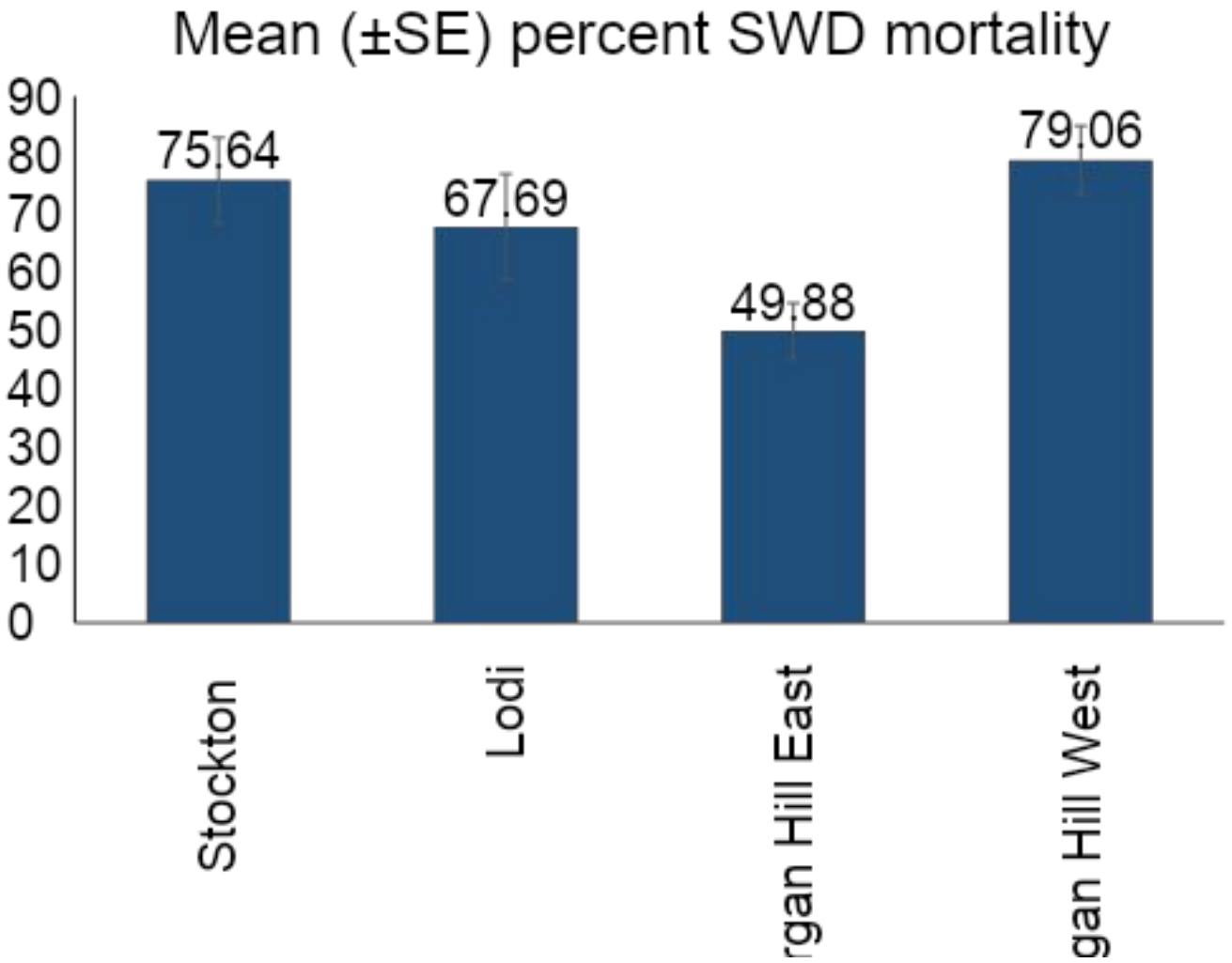
In 2020, The RR50 values were from **19.0- to 36.1 folds** for zeta-cypermethrin (Mustang Max) and from **-15.9- to 47.7** folds for bifenthrin (Brigade) (Ganjisaffar et al. 2022a)

What is the pesticide resistance status in California cherry orchards?



SWD Resistance Study -2023

Spinosad (LC99 x 2 dose): Average mortality of field-collected SWD

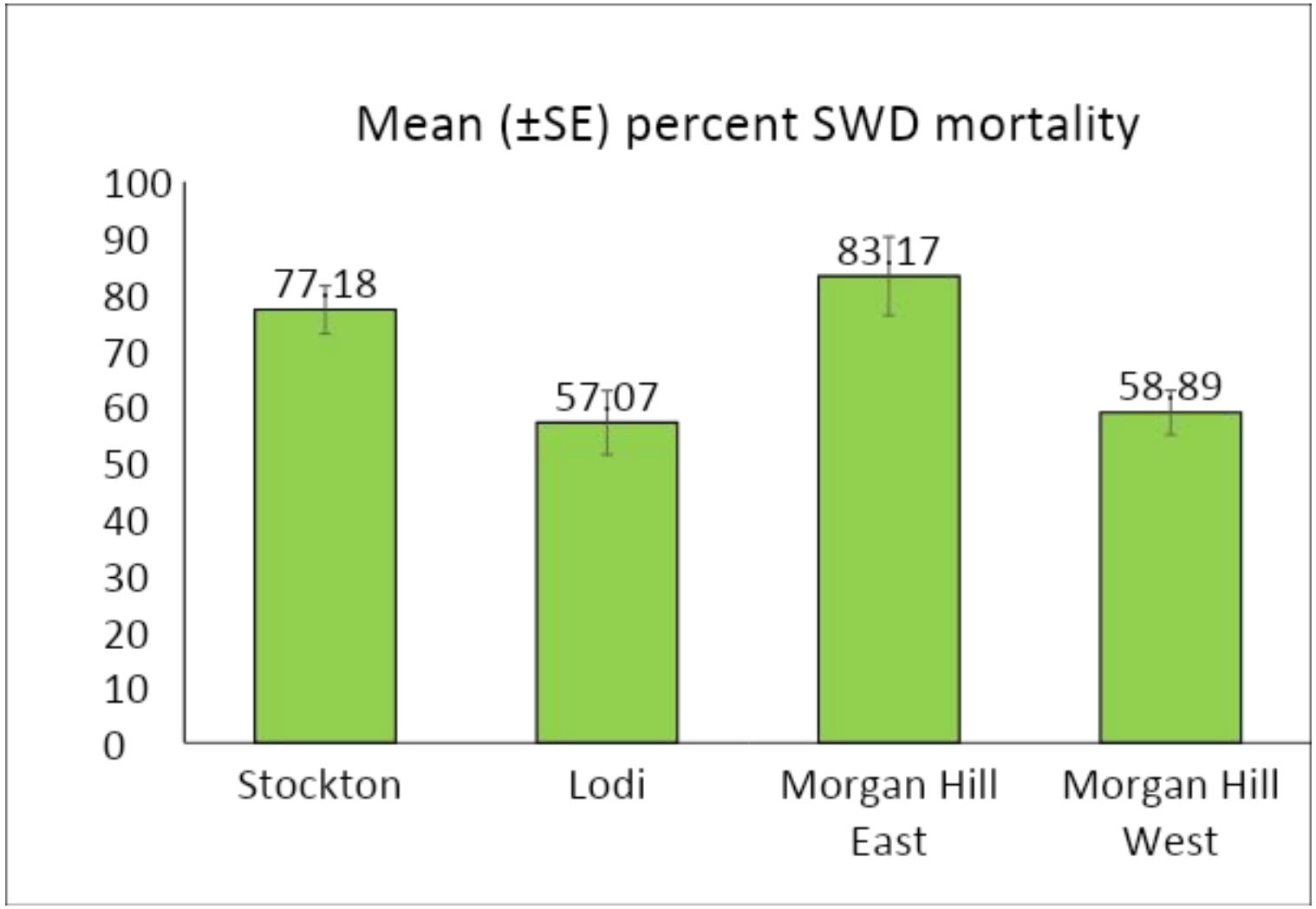


- ✔ **Treated mortality: 50-80%**
- ✔ **No mortality in Untreated Control**
- ✔ **100% mortality in the susceptible population**

Rijal and Sakaki, manuscript in prep.

SWD Resistance Study -2023

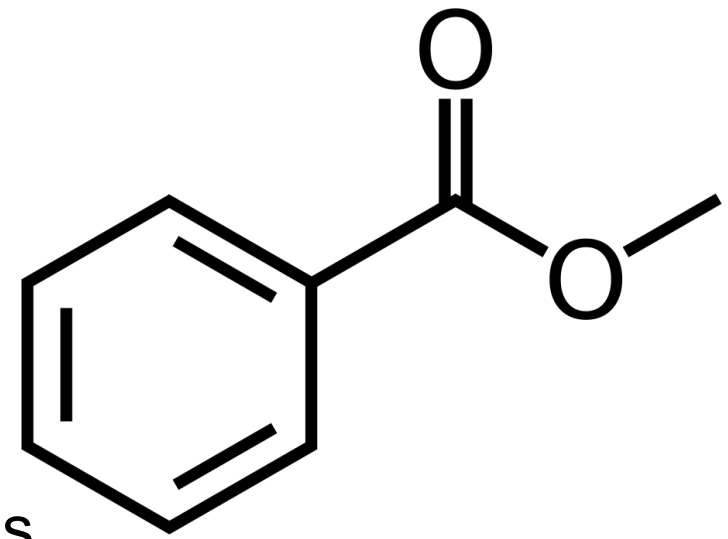
Pyrethroid/Cypermethrin (LC90 x 8 dose): Average mortality of field-collected SWD



- ✔ **Treated mortality: 57-83%**
- ✔ **No mortality in Untreated Control**
- ✔ **100% mortality in susceptible population**

Rijal and Sakaki, manuscript in prep.

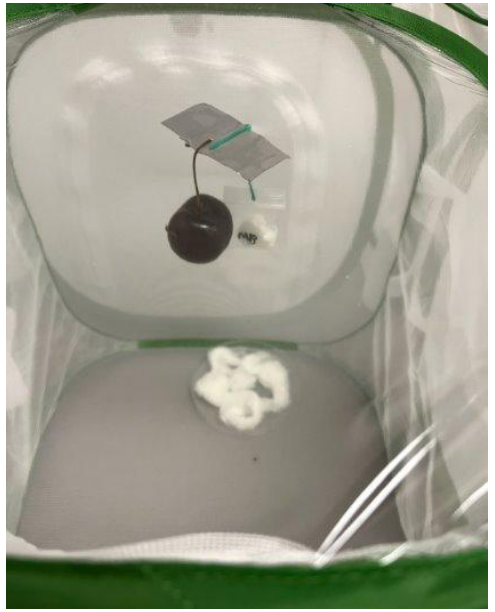
An Emerging IPM Tool: Methyl Benzoate (MB)



- Naturally occurring compound
- Safe for human consumption, FDA approved;
- Widely used as a flavoring agent in foods and beverages
- Toxicity and repellency towards pest insects, including sweet potato whitefly *Bemisia tabaci (*Mostafiz et. al, 2018) and SWD (Feng & Zhang, 2017)
- Significantly reduced SWD oviposition in blueberries (Gale et. al, 2024).
- Eco-friendly and non-toxic for non-target organisms (Zhao et. al, 2022)

2025- Lab Bioassay

- Dose Response (No Choice):
- 200µL, 500µL, 1000µL,1500µL, 2000µL Methyl Benzoate , and Control
- Oviposition stings per fruit counted after 24 hours

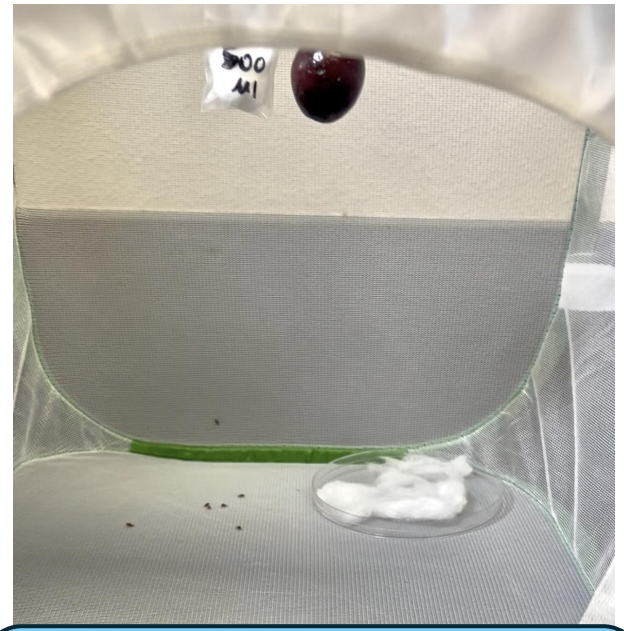


Lab Bioassay Methods

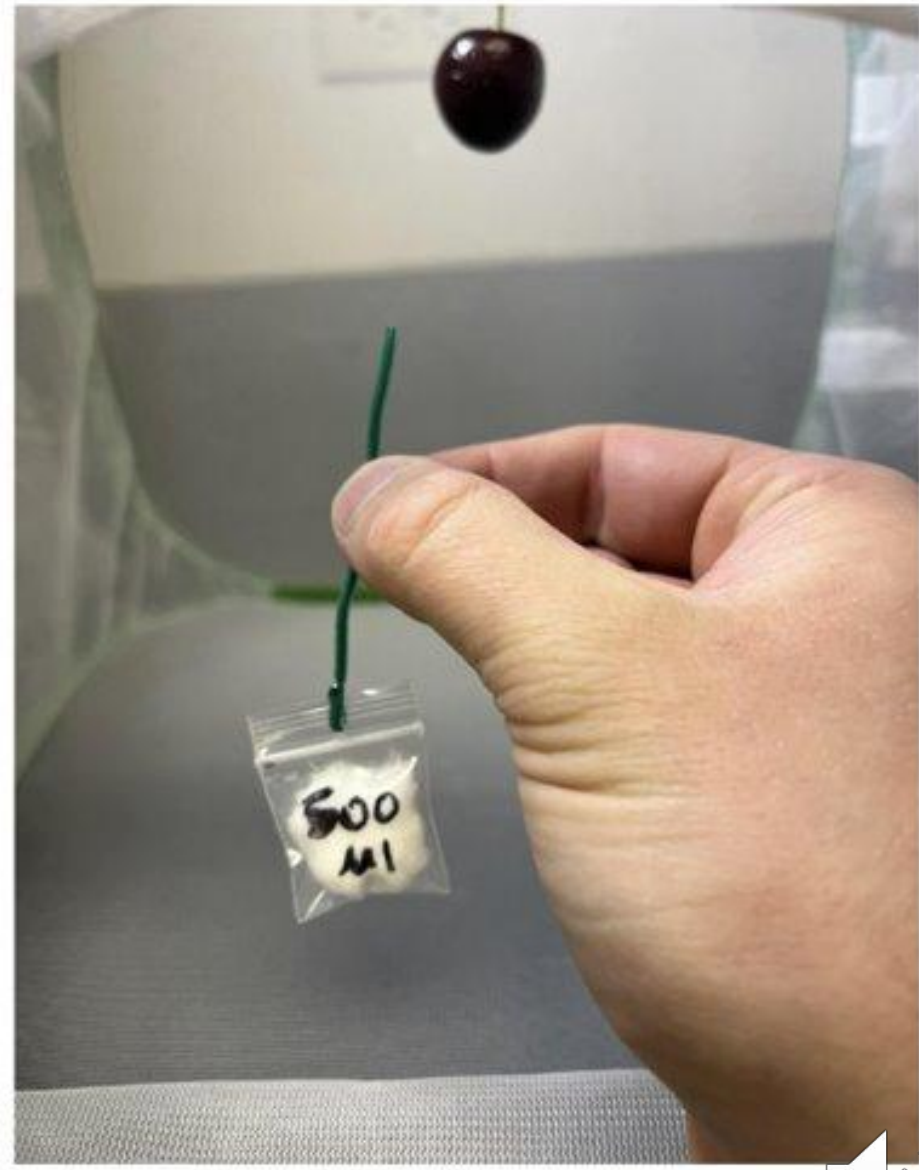
- Dose Response (No Choice):

200µL, 500µL, 1000µL,1500µL, 2000µL MB, and Control

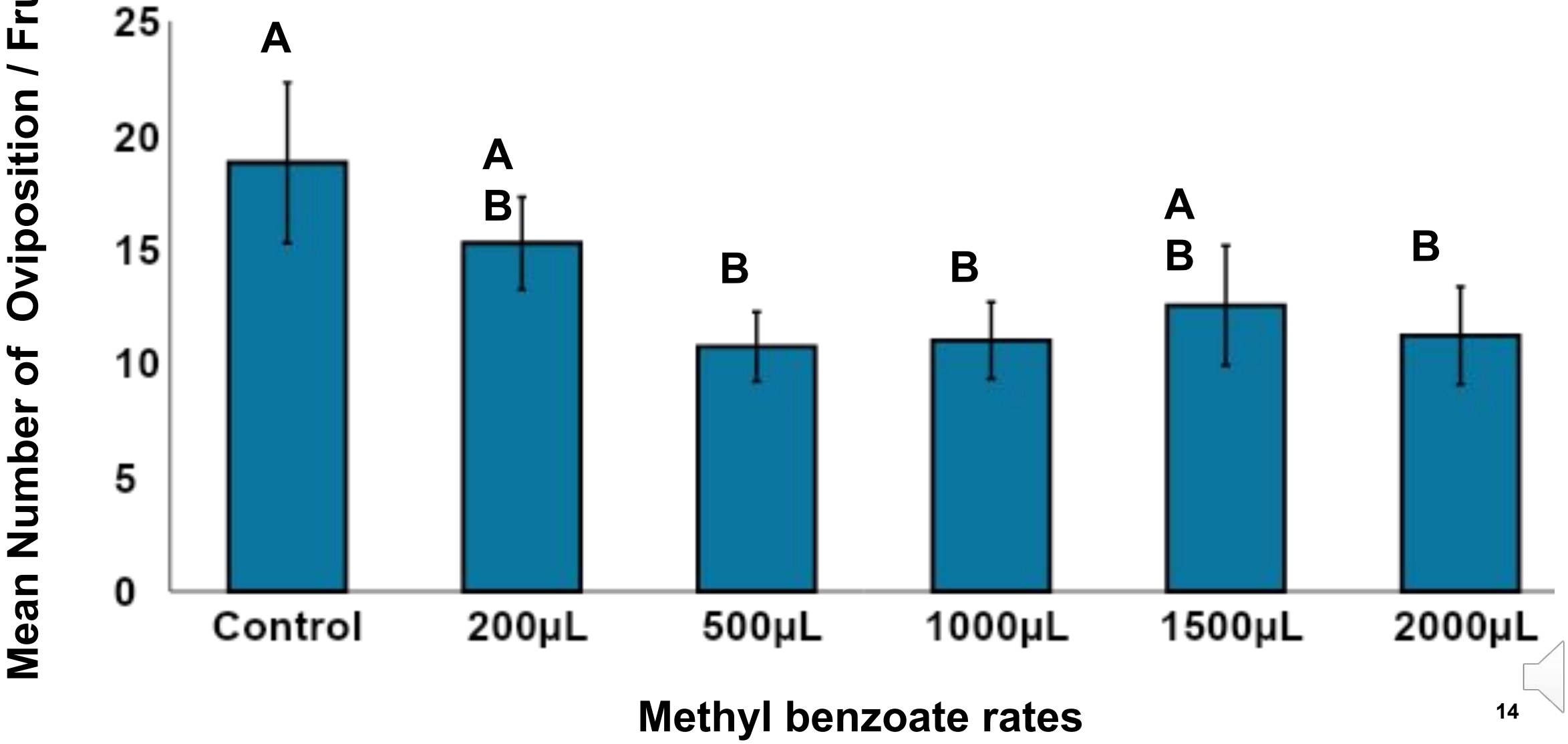
- 4 repetitions/trials, 4 replications each
- Oviposition stings per fruit counted after 24 hours
- Data analysis: Each Pair, Student's t-test



12x12x12 inch Cage
10 flies released:
5M, 5F – age 3-8 days

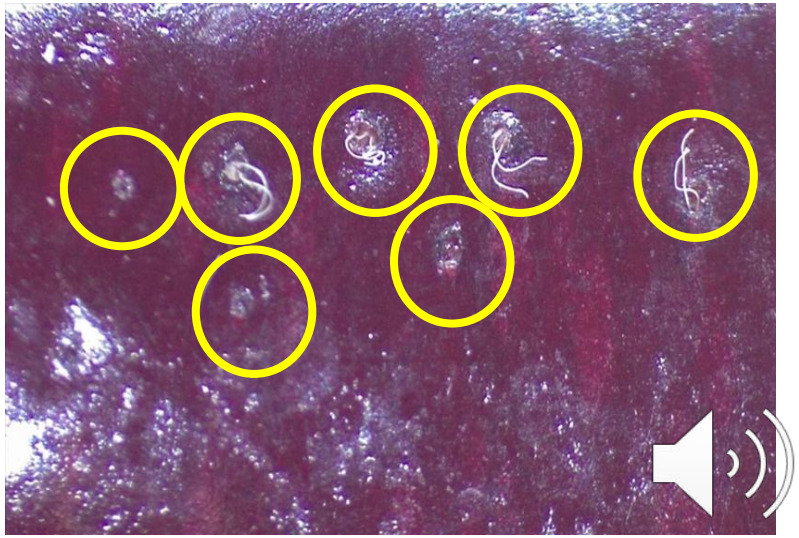


Lab Results: Dose Response Test



Field Study Methods

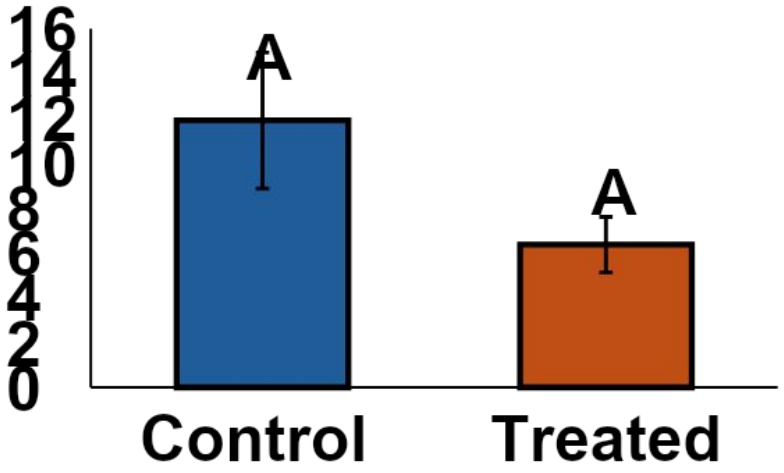
- An unsprayed section of a cherry orchard in Stockton, CA
- Four rows (replications)
- Each row contained an equal number of Treated (MB) & Control trees
- 5 MB dispensers per tree
- 4 weeks of data collection
- Oviposition stings per fruit recorded at the lab
- Data analysis: One-way ANOVA



Field Results- Weekly Oviposition Rate

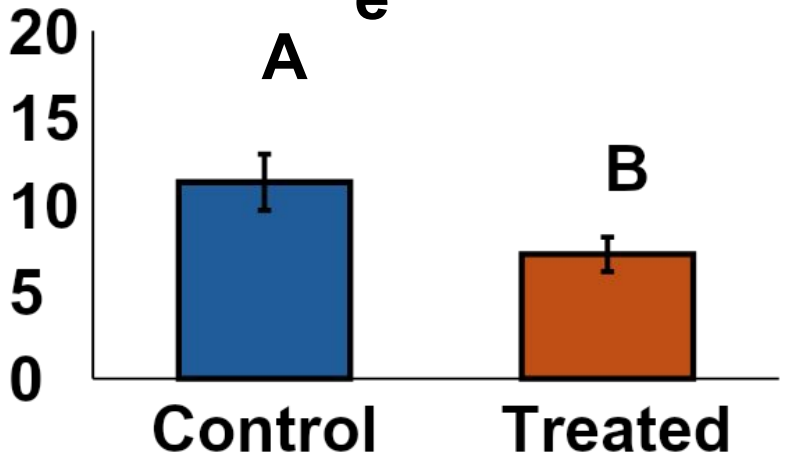
Mean Number of Oviposition / Fruit (±SE)

27-May



n= 22
F= 2.889
p= 0.097

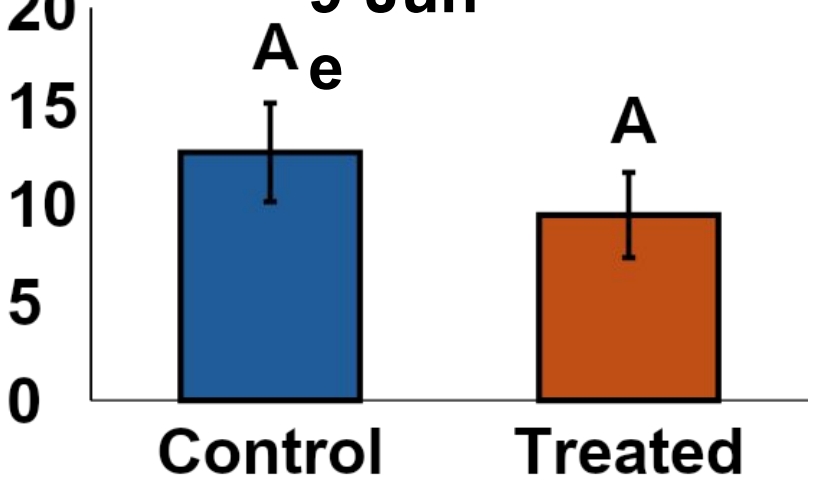
2-Jun



e

n= 20
F= 4.809
p= 0.034

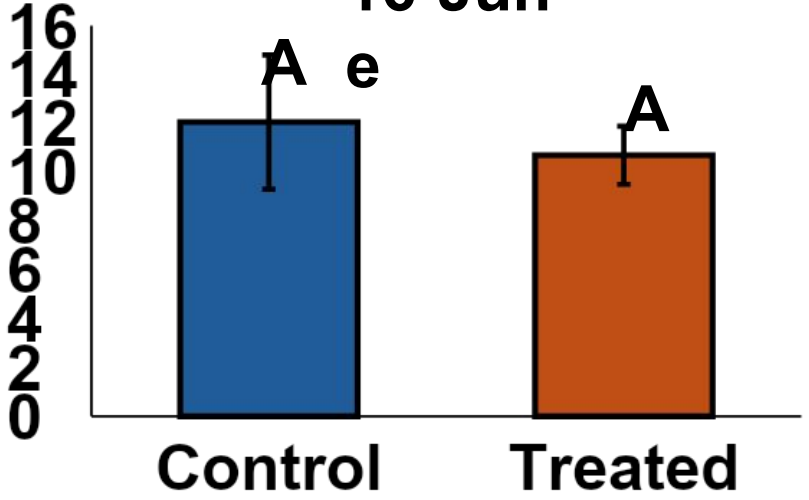
9-Jun



e

n= 19
F= 1.319
p= 0.258

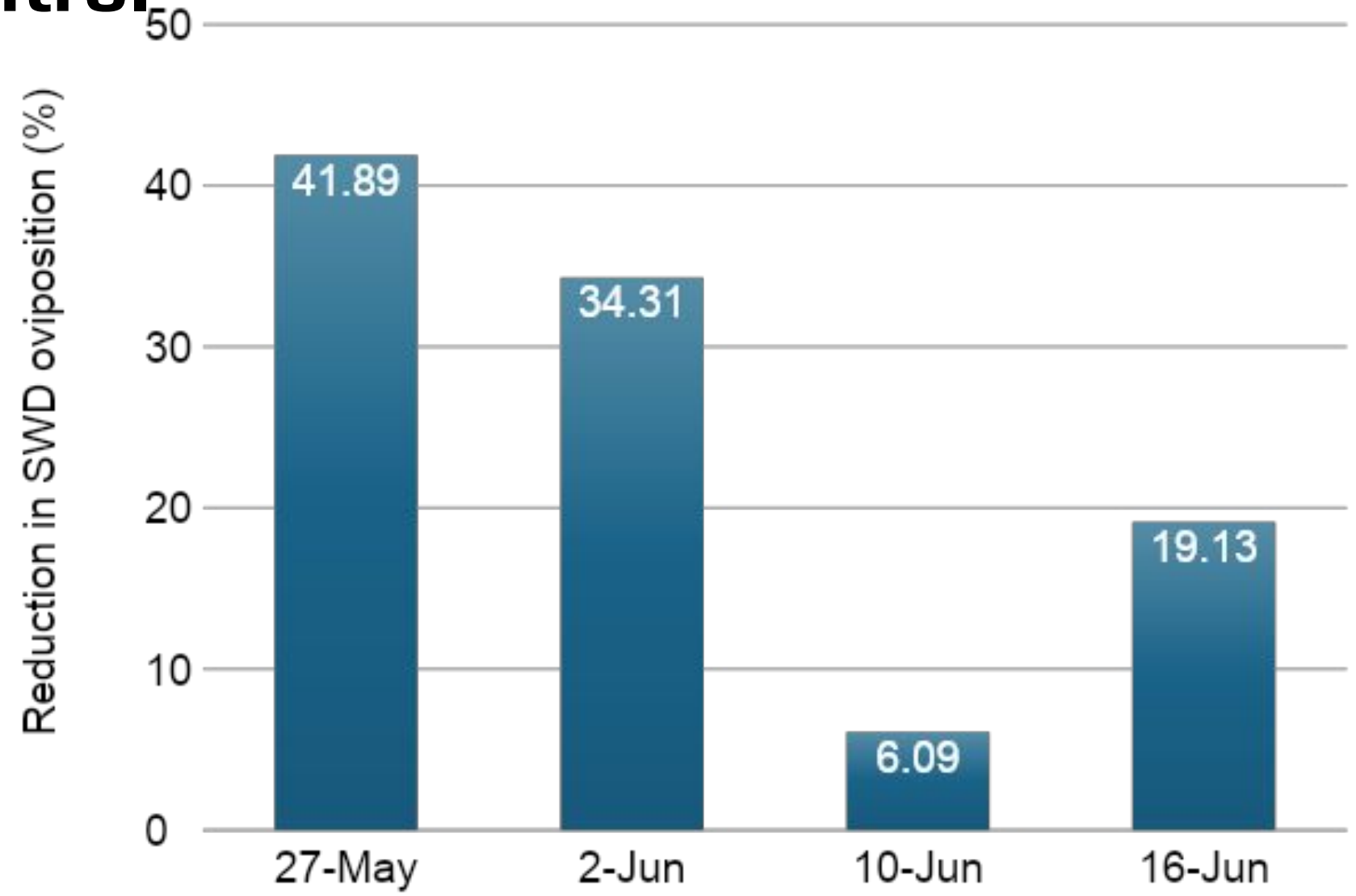
16-Jun



e

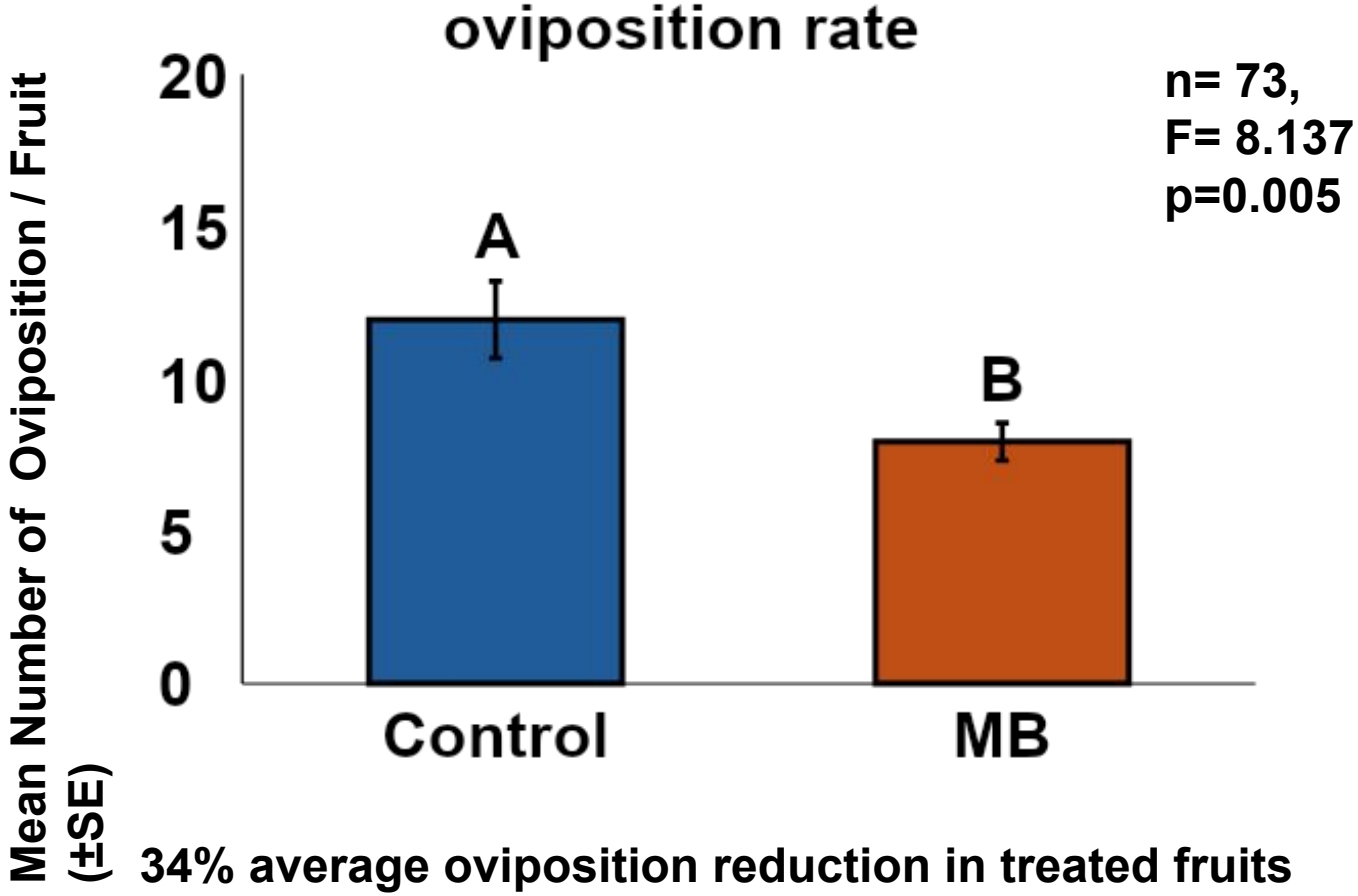
n= 12
F= 0.522
p= 0.477

Oviposition reduction in MB-treated fruits over Control



2025- Field Study (Seasonal Combined)

- 5 MB dispensers per tree
- 4 weeks of data collection
- Oviposition stings per fruit recorded at the lab



34% average oviposition reduction in treated fruits

Summary

- Dose Response test: significant oviposition reduction compared to control and with 500, 1000, and 2000 µL MB doses.
- Field test: significant oviposition reduction (34%) in fruits from treated trees (whole season average)
- Future research will focus on combining MB with insecticides and on testing a few new baits to reduce the amount of insecticide.
- Testing a few new active ingredients, and new formulations

Thank you!

- Cooperating growers

Dr. Samaneh Sakaki

Flint McGrath