Sustainable SWD Management

Project # 2020-51181-32140

Improvements in SWD Monitoring and Management

Dr. Hannah Levenson

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Moving from Crisis Response to Long-Term Integrated Management of SWD: A Keystone Pest of Fruit Crops in the United States

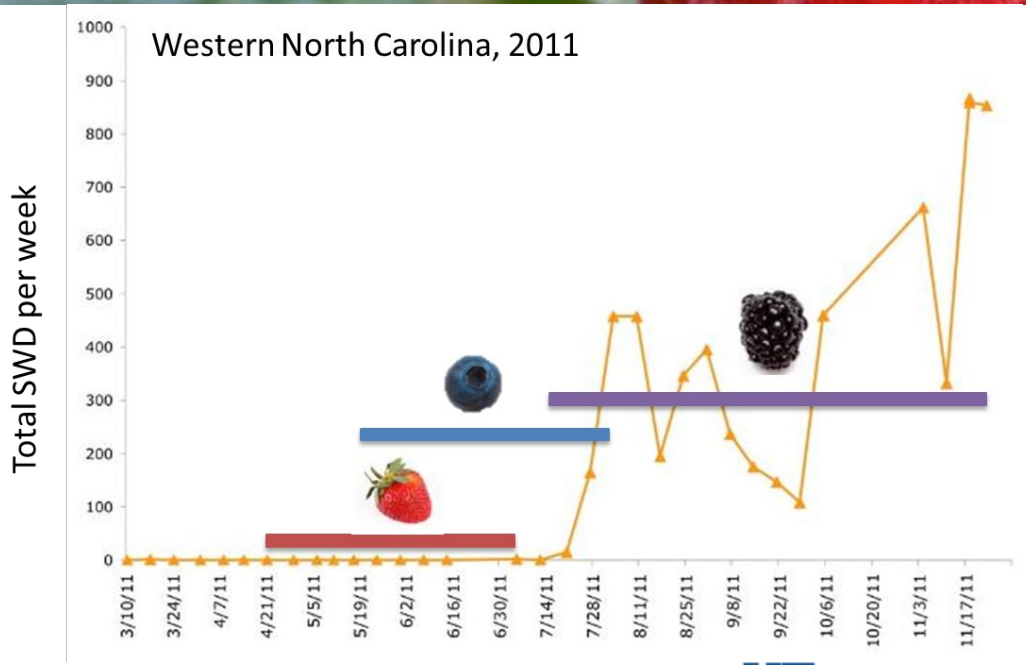
Project Director: Ash Sial[1]

Co Project Directors: Elizabeth Beers[2], Hannah Burrack[3], Joanna Chiu[4], Kent Daane[5], Rufus Isaacs[3], Miguel Gómez[6], Cesar Rodriguez-Saona[7], Vaughn Walton[8]

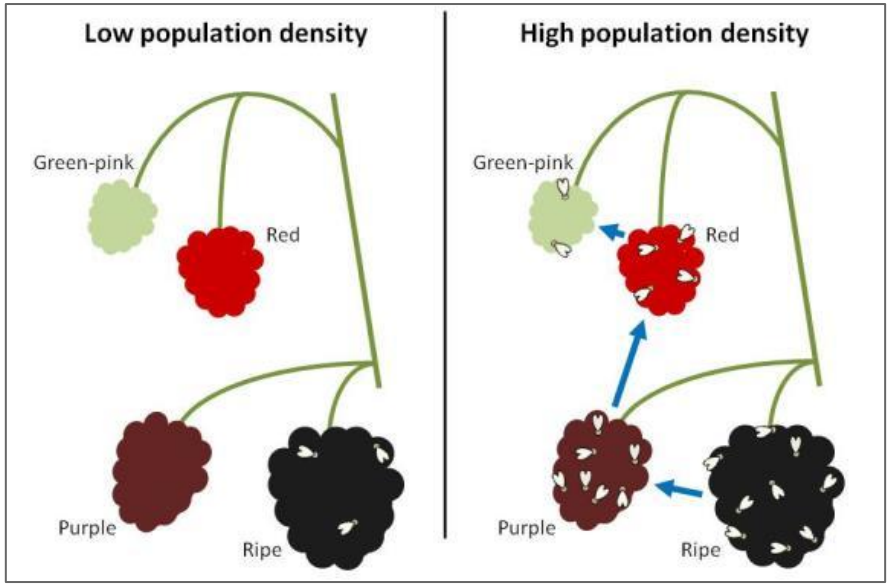
Co Principal Investigators: Philip Fanning[9], Karina Gallardo[2], Greg Loeb[6], Kim Hoelmer[10], Kay Kelsey[11], Tobin Northfield[2], Frank Zalom[4], Jim Walgenbach[12], Hannah Levenson[12]

[1]University of Georgia; [2]Washington State University; [3]Michican State University; [4]University of Califorina, Davis; [5]University of California, Berkeley; [6]Cornell University; [7]Rutgers University; [8]Oregon State University; [9]University of Maine; [10]USDA ARS; [11]University of Florida; [12]North Carolina State University;

Seasonality & geography influences crop risk



Fruit become susceptible to infestation when they first ripen, but risk can be reduced by decreasing populations



Swoboda-Bhattarai and Burrack. 2016. Acta Horticulturae.

2020 summary rankings of insecticide efficacy against SWD

Sustainable SWD Management
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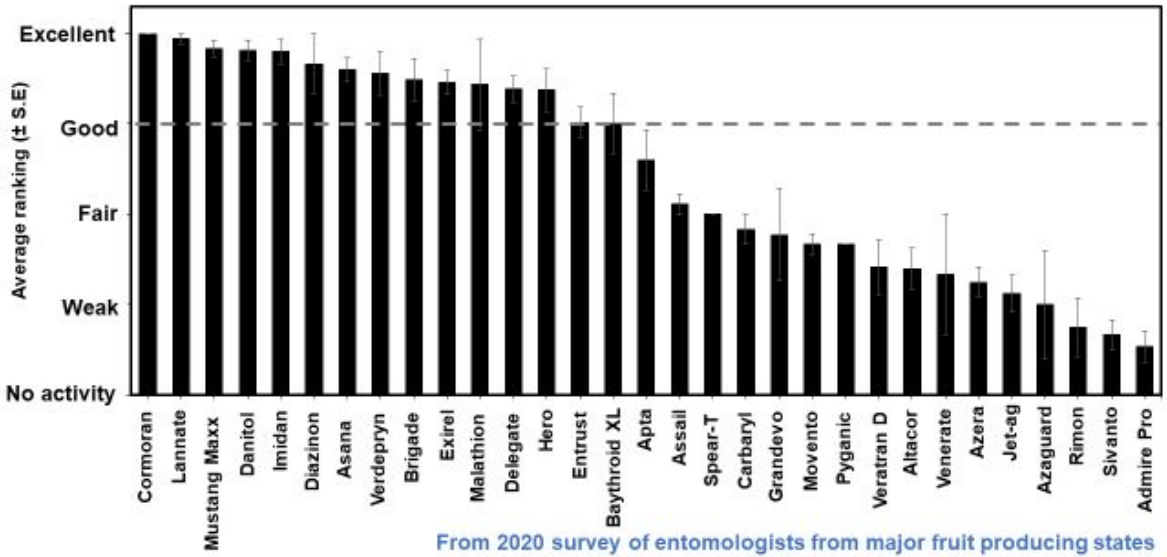
Insecticide efficacy rankings for SWD control



From 2020 survey of entomologists from major fruit producing states

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2020 summary rankings of insecticide efficacy against SWD

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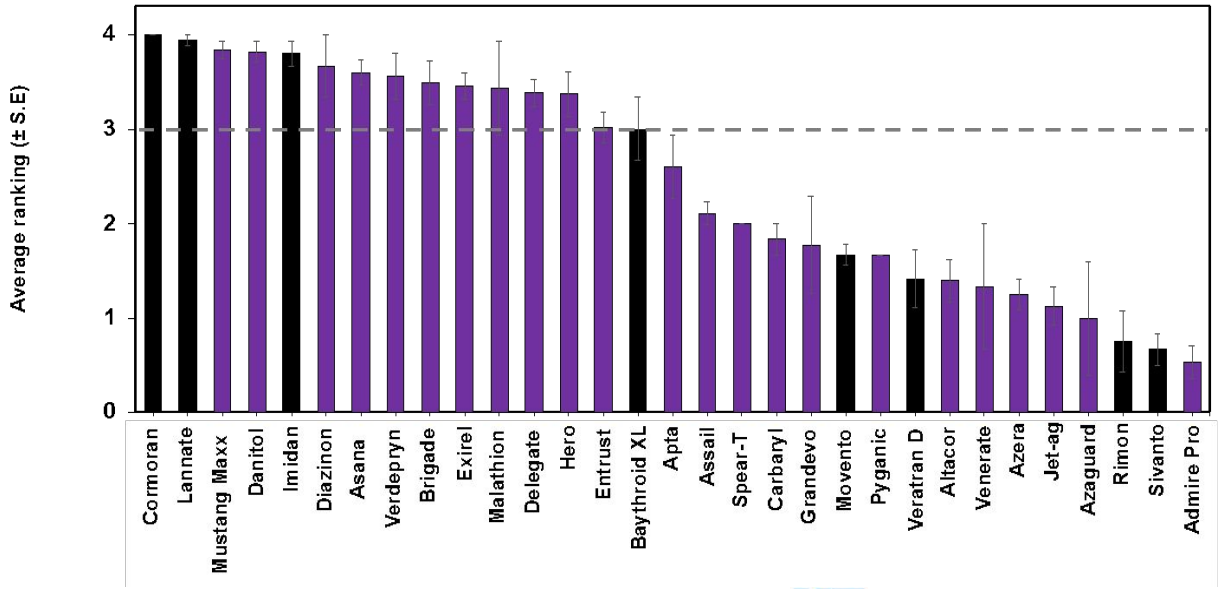
Insecticide efficacy rankings for SWD control in caneberries



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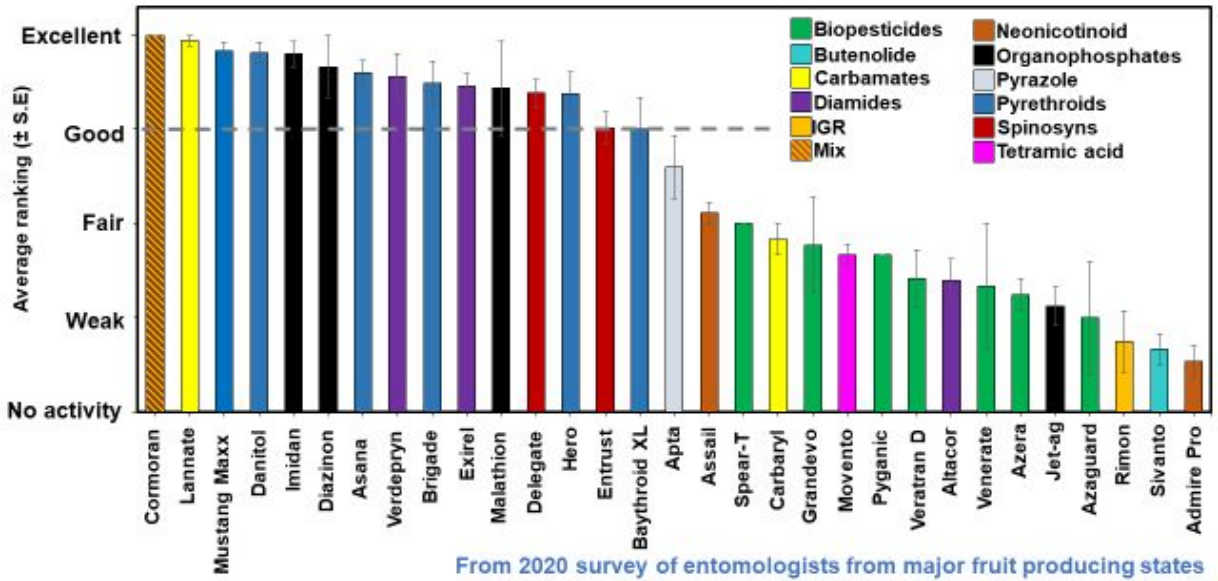

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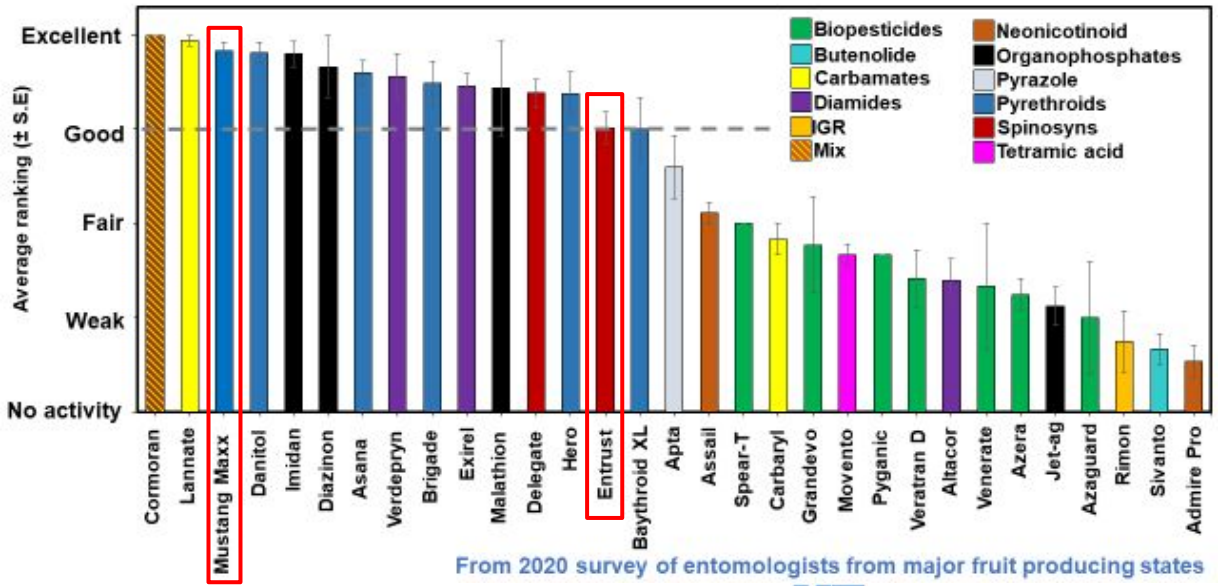

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Resistance monitoring and detection

California strawberries 2020

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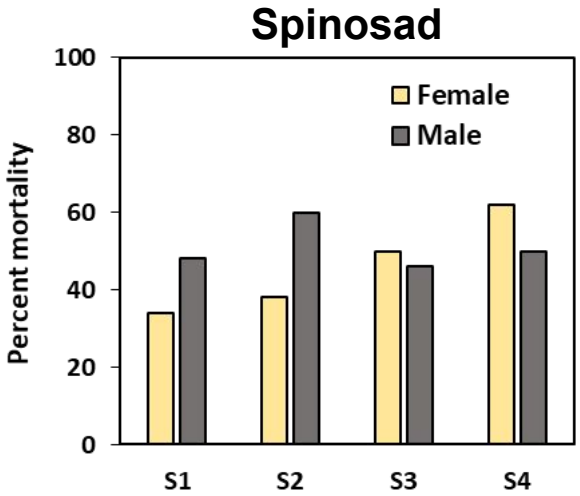
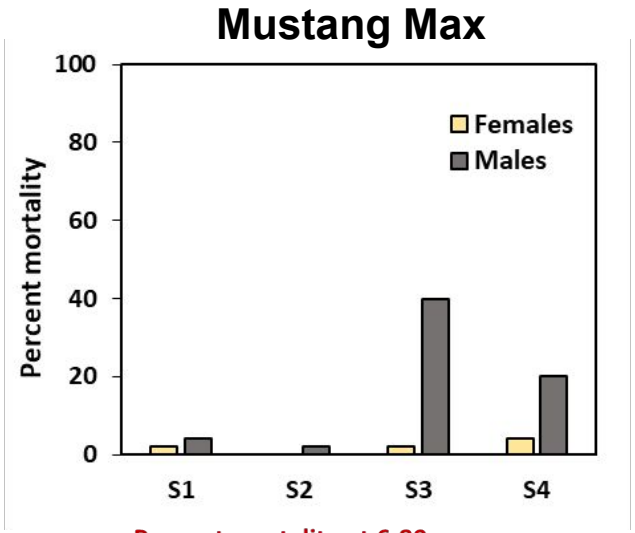


Percent mortality at:
847.77 ppm = LC90x8 for a susceptible population
927.94 ppm = LC99x2 for a susceptible population



Percent mortality at 6.89 ppm =
LC99x2 for a susceptible population

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Current management recommendations

1. Deploy traps before berries start to change color
2. Initiate weekly applications of insecticides after first SWD detection
3. Fruit sampling to check for infested fruit
4. Rotation of insecticides with different modes of action
    - Include more reduced risk insecticides: Delegate or Exirel
5. Store harvested fruit under cold temperatures
    - At least 3 days at 32 C

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Cultural & Postharvest Control

FACTORS AFFECTING SWD ENVIRONMENT SUITABILITY

1 - Netting
2 - Irrigation type
3 - Presence of weed mat
4 - Pruning intensity
5 - Harvest frequency
6 - Refrigeration

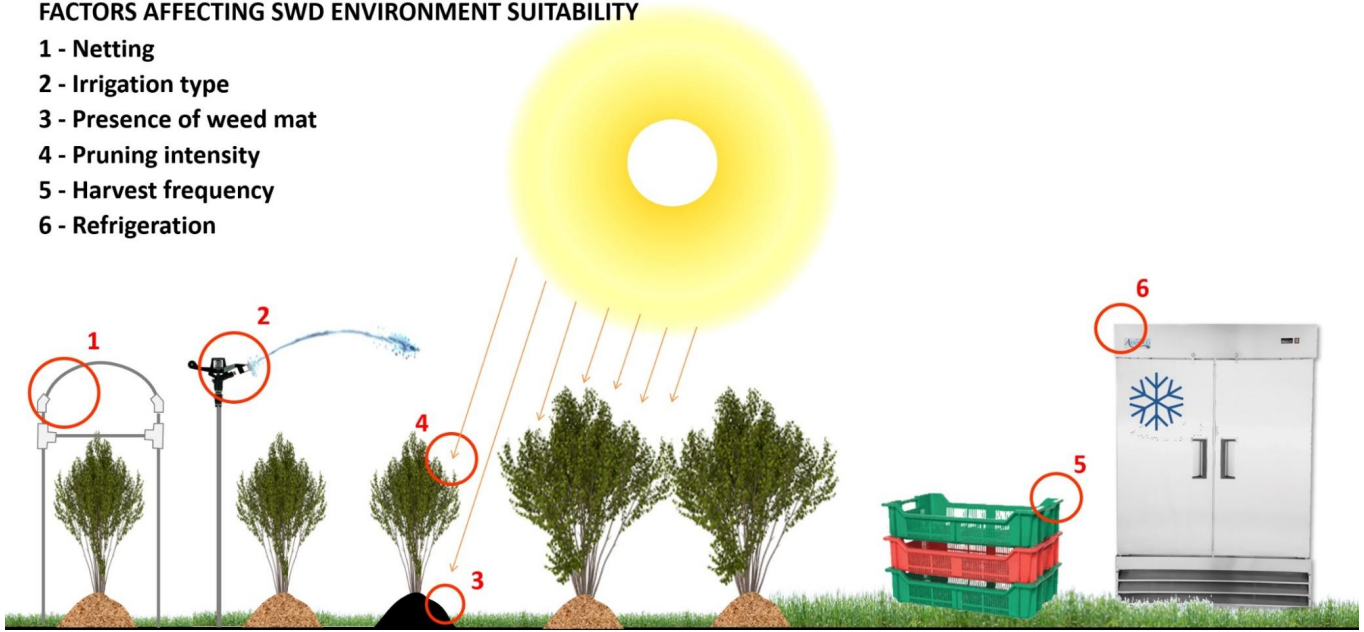

Illustration: Marco Rossi-Stacconi, © OSU

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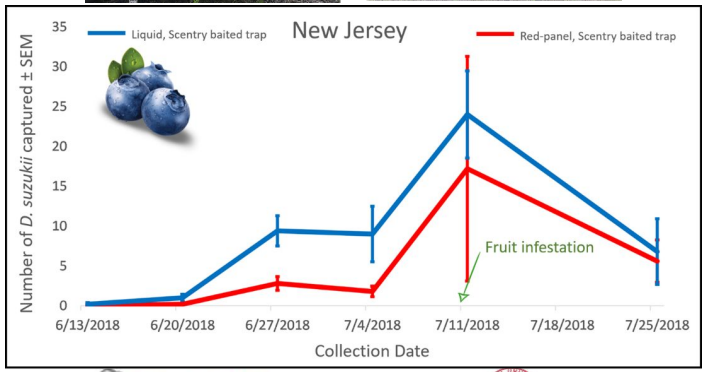
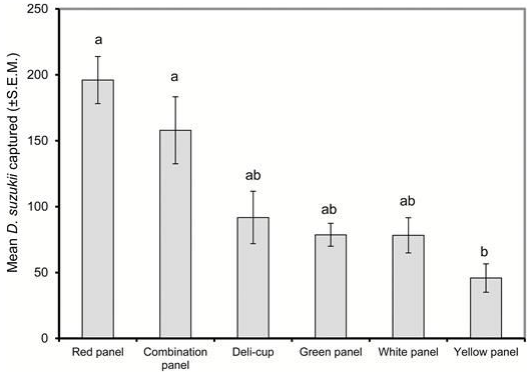
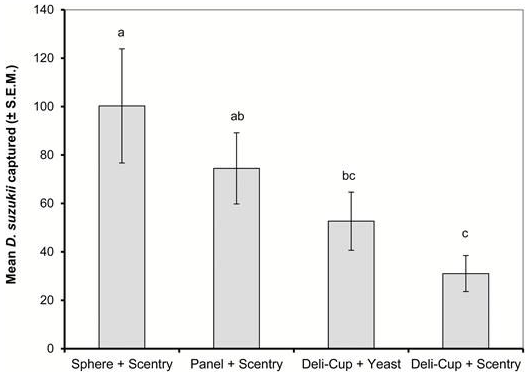
Dry, sticky red panels are an easier to use alternative to liquid traps

Cesar Rodriguez-Saona
Rutgers University







Kirkpatrick et al. *J. Econ. Entomol*. 2018

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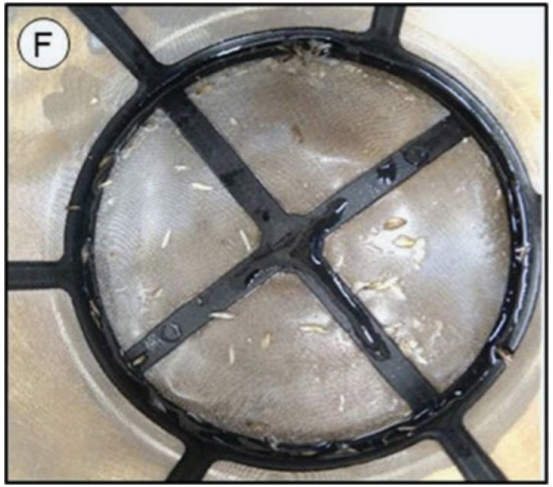
Do sticky red panel captures relate to fruit infestation?

Nick Aflitto
Cornell University



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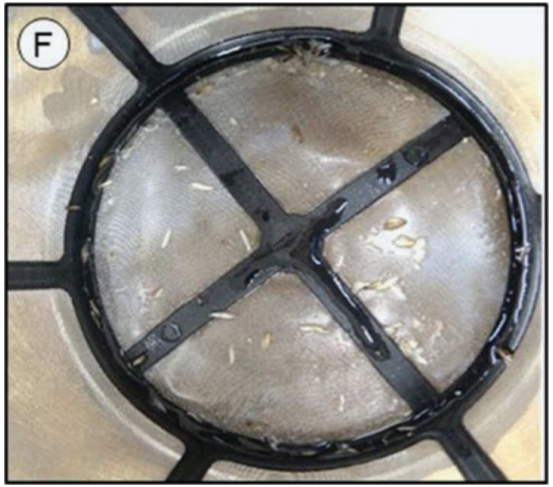

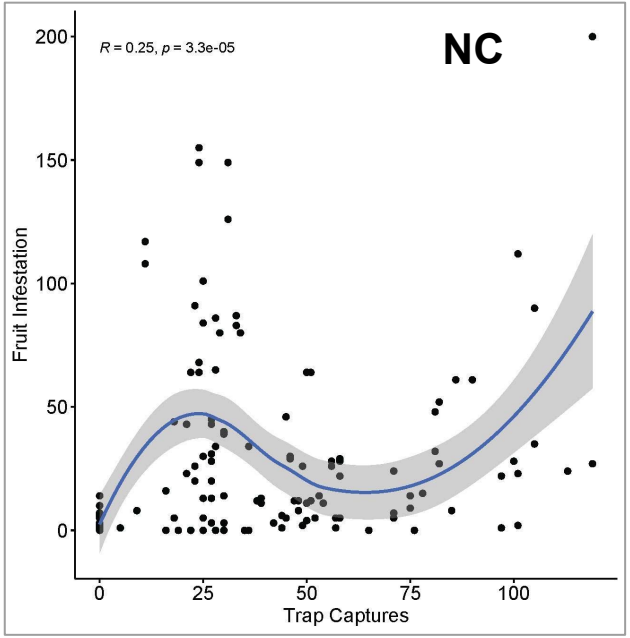

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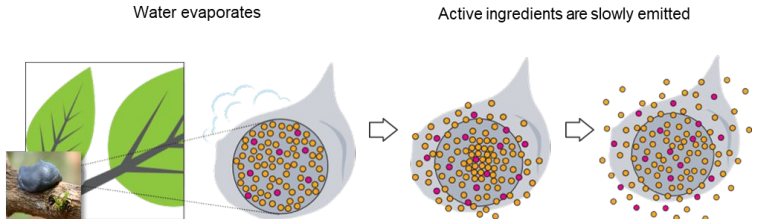
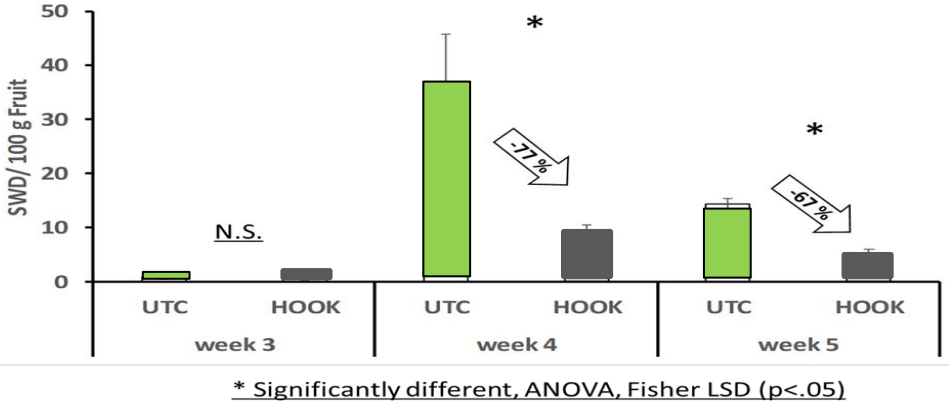
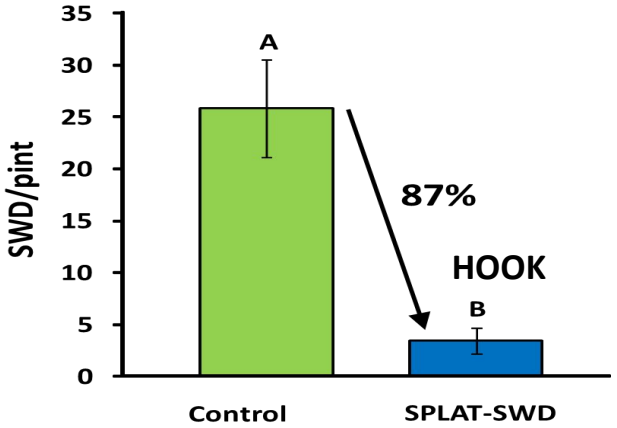
A slow-release “attract-and-kill” formulation (SPLAT/HOOK SWD) shows promise under field conditions [*Not yet commercially available*]

Cesar Rodriguez-Saona
Rutgers University





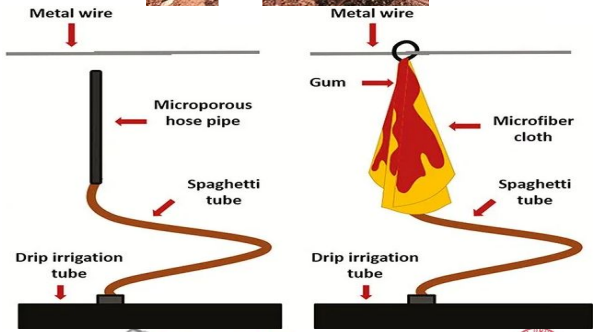
* Significantly different, ANOVA, Fisher LSD ($p<.05$)

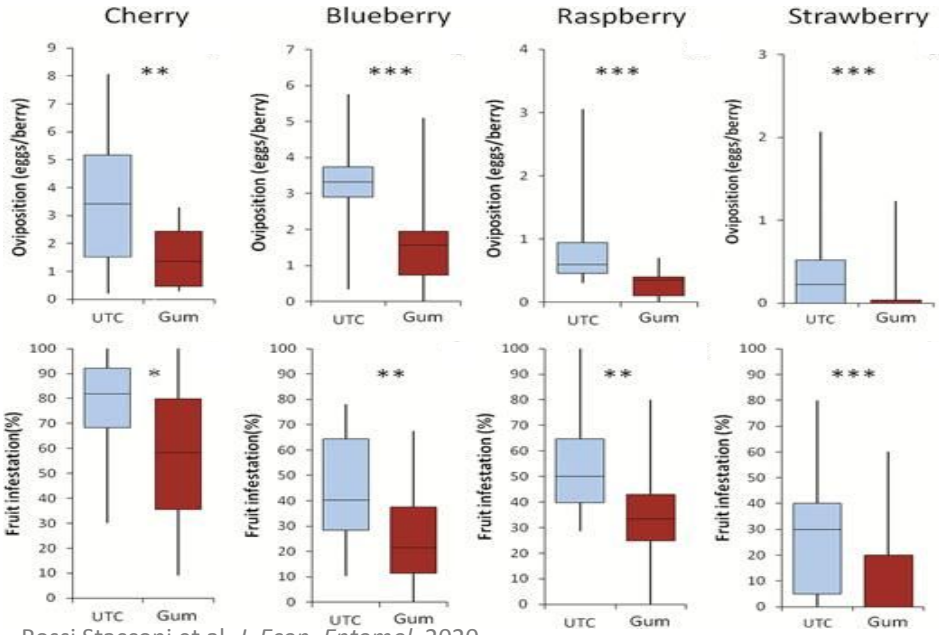


Klick et al. *J. Insect Science*. 2019

A new “Food-Grade Gum” reduces SWD oviposition and fruit infestation under field condition [*Not yet commercially available*]

Vaughn Walton
Oregon State University





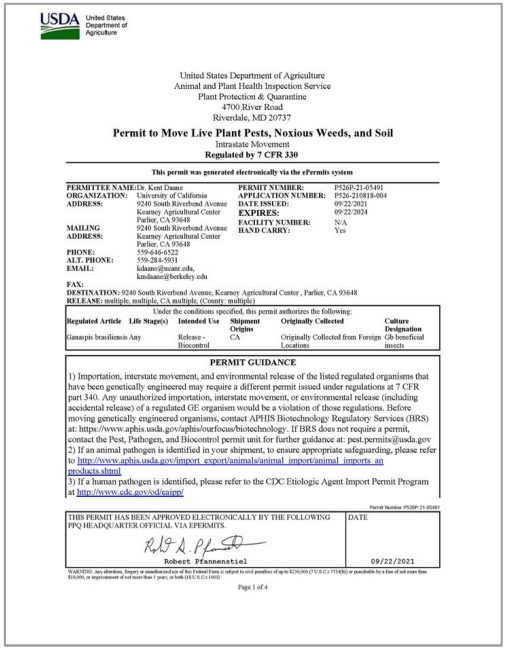
Rossi Stacconi et al. *J. Econ. Entomol.* 2020

Introduction of Biological Controls: Parasitoid Wasps

Kent Daane
UC Berkeley

USDA APHIS petition complete, releases in 2022

Permits for:
CA, DE, FL, GA, ME, MD, MI, NJ, NC, OR, VA, WA, WV



USDA United States Department of Agriculture

United States Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection & Quarantine
4700 River Road
Riverdale, MD 20737

Permit to Move Live Plant Pests, Noxious Weeds, and Soil
Intrastate Movement
Regulated by 7 CFR 330

This permit was generated electronically via the ePermits system

PERMITTEE NAME:	Dr. Kent Daane	**PERMIT NUMBER:**	P526P-21-05491
ORGANIZATION:	University of California	**APPLICATION NUMBER:**	P526-210818-004
ADDRESS:	9240 South Riverbend Avenue Kearney Agricultural Center Parlier, CA 93648	**DATE ISSUED:** **EXPIRES:**	09/22/2021 09/22/2024
MAILING ADDRESS:	9240 South Riverbend Avenue Kearney Agricultural Center Parlier, CA 93648	**FACILITY NUMBER:** **HAND CARRY:**	N/A Yes
PHONE:	559-646-6522		
ALT. PHONE:	559-284-5931		
EMAIL:	kdaane@uoanr.edu, kmdaane@berkeley.edu		

FAX:
DESTINATION: 9240 South Riverbend Avenue, Kearney Agricultural Center , Parlier, CA 93648
RELEASE: multiple, multiple, CA multiple, (County: multiple)

Under the conditions specified, this permit authorizes the following:

Regulated Article	Life Stage(s)	Intended Use	Shipment Origins	Originally Collected	Culture Designation
Ganaspis brasiliensis	Any	Release - Biocontrol	CA	Originally Collected from Foreign Locations	Gb-beneficial insects

PERMIT GUIDANCE

1) Importation, interstate movement, and environmental release of the listed regulated organisms that have been genetically engineered may require a different permit issued under regulations at 7 CFR part 340. Any unauthorized importation, interstate movement, or environmental release (including accidental release) of a regulated GE organism would be a violation of those regulations. Before moving genetically engineered organisms, contact APHIS Biotechnology Regulatory Services (BRS) at: https://www.aphis.usda.gov/aphis/ourfocus/biotechnology. If BRS does not require a permit, contact the Pest, Pathogen, and Biocontrol permit unit for further guidance at: pest.permits@usda.gov
2) If an animal pathogen is identified in your shipment, to ensure appropriate safeguarding, please refer to http://www.aphis.usda.gov/import_export/animals/animal_import/animal_imports_an products.shtml
3) If a human pathogen is identified, please refer to the CDC Etiologic Agent Import Permit Program at http://www.cdc.gov/od/eaipp/

Permit Number P526P-21-05491

THIS PERMIT HAS BEEN APPROVED ELECTRONICALLY BY THE FOLLOWING PPQ HEADQUARTER OFFICIAL VIA EPERMITS.	DATE
Robert Pfannenstiel	09/22/2021

WARNING: Any alteration, forgery or unauthorized use of this Federal Form is subject to civil penalties of up to $250,000 (7 U.S.C. 7734(b)) or punishable by a fine of not more than $10,000, or imprisonment of not more than 5 years, or both (18 U.S.C. 1001).

Page 1 of 4

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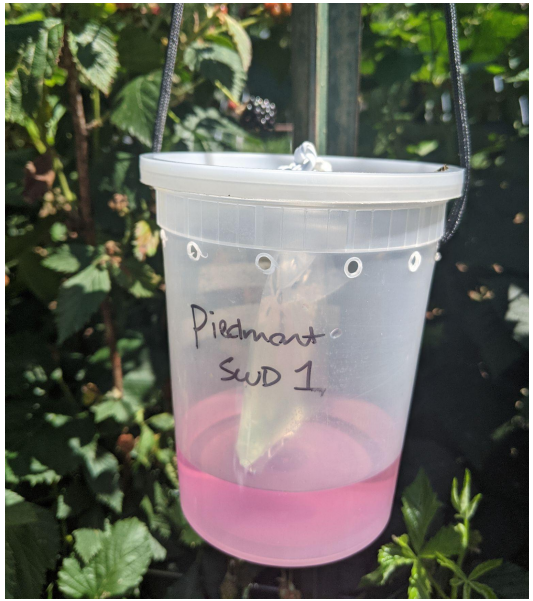
How does fruit infestation relate to SWD populations?



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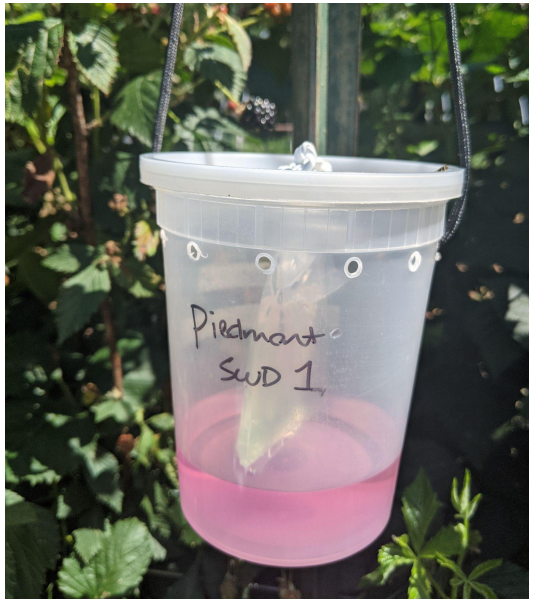

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Adults (F) vs Larvae

Sustainable SWD Management
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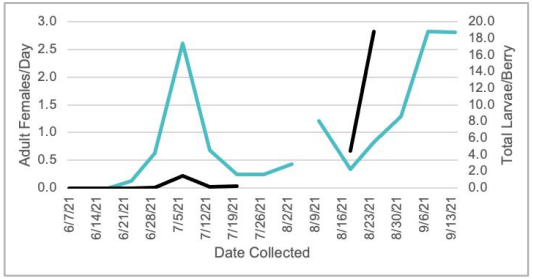
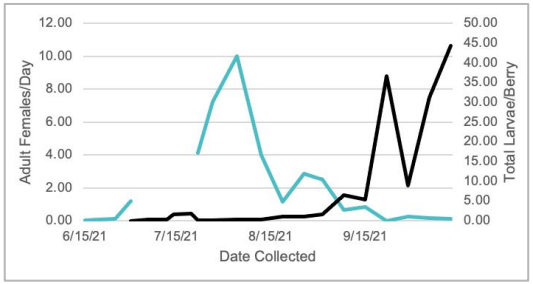
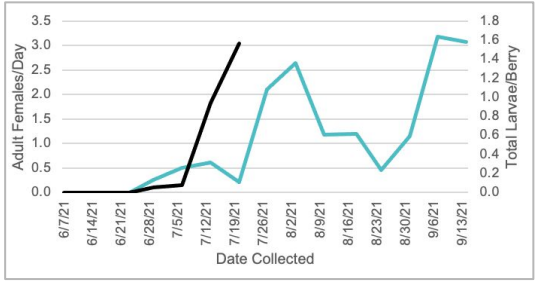
Site 1



Site 2



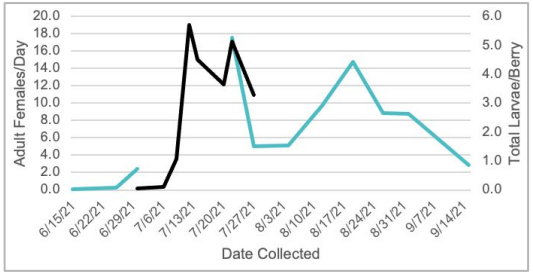
Site 3



adult

larvae

Site 4



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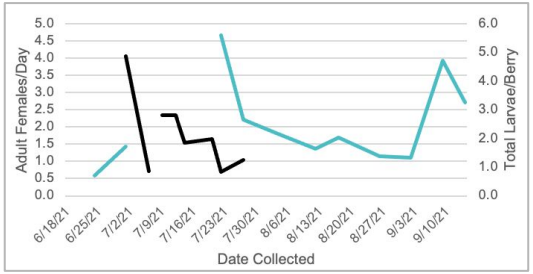
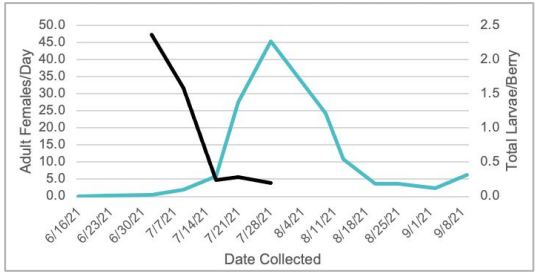


Site 6



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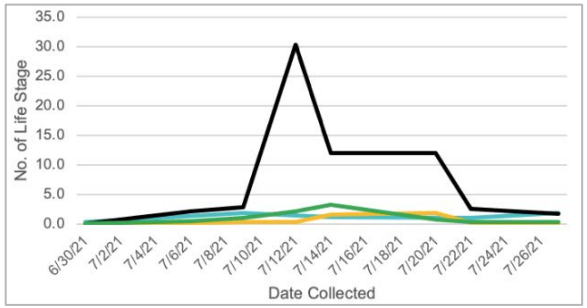
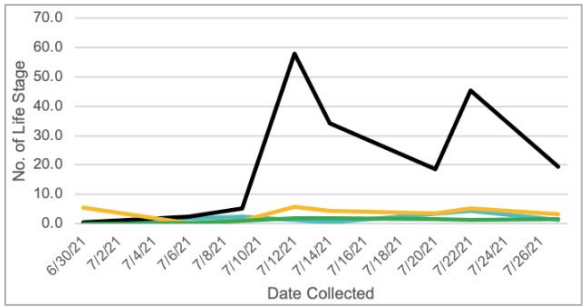
Populations Over Time

adult egg larvae pupae

Site 2



Site 4



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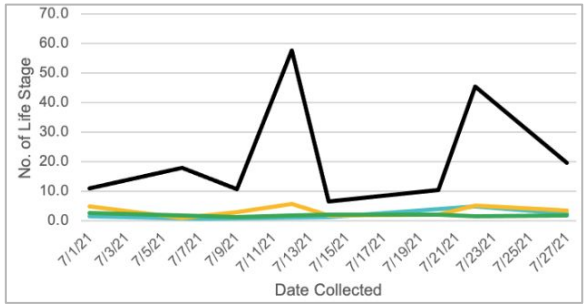


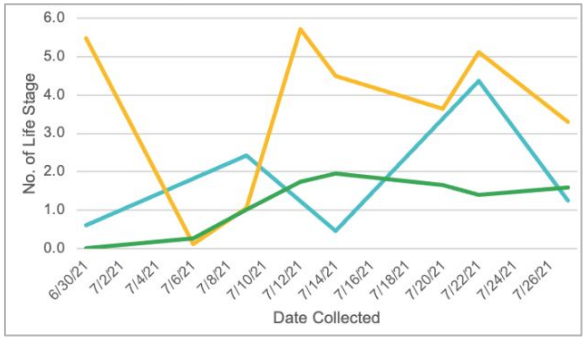
Populations Over Time

Sustainable SWD Management
Project # 2020-51181-32140

adult egg larvae pupae

Site 2

Site 4



Site 6

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Populations Over Time

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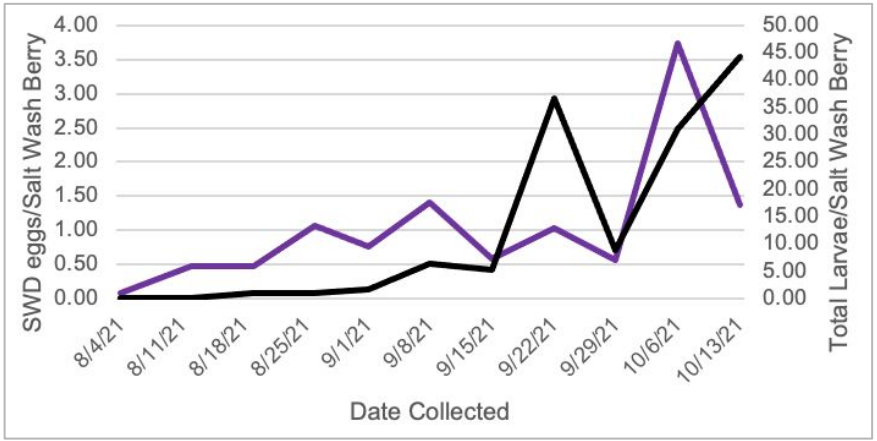
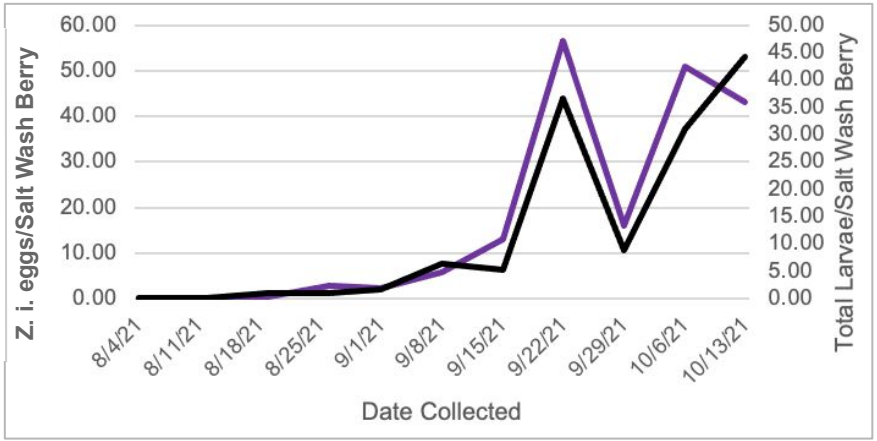
Larvae vs SWD Eggs in Basket



Larvae vs Fig Fly Eggs in Basket



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Populations Over Time

D. suzukii
-
Spotted Wing Drosophila

Z.indianus
-
African Fig Fruit Fly

D. melanogaster
D. simulans
-
Fruit Fly

D. hydei
-
Vinegar Fly

Other Flies

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Other Flies

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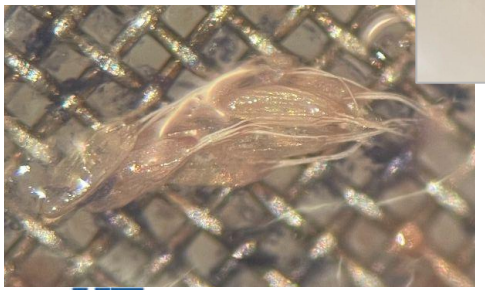
Populations Over Time

Spotted Wing Drosophila - *Drosophila suzukii*

African Fig Fruit Fly - *Zaprionus indianus*



Optimizing Salt Wash Protocol for Blackberries

Journal of Integrated Pest Management, (2017) 8(1): 23; 1–7
doi: 10.1093/jipm/pmx019
Recommendations

A Filter Method for Improved Monitoring of *Drosophila suzukii* (Diptera: Drosophilidae) Larvae in Fruit

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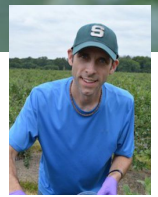
Optimizing Salt Wash Protocol for Blackberries



Steve Van Timmeren
Michigan State University

Journal of Integrated Pest Management, (2017) 8(1): 23; 1–7
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OXFORD

A Filter Method for Improved Monitoring of *Drosophila suzukii* (Diptera: Drosophilidae) Larvae in Fruit

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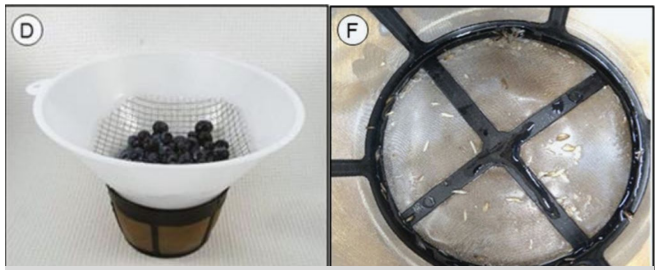
Optimizing Salt Wash Protocol for Blackberries

Step 1: Collect Berries

Step 2: Soak Berries



Step 3: Rinse Berries

Step 4: Count Larvae

Optimizing Salt Wash Protocol for Blackberries

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We tested:

- Different washes
- Different soak times
- Different mesh sizes
- Different fruit processing

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Optimizing Salt Wash Protocol for Blackberries

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Preliminary Findings in Blackberries:

- 1 cup salt/1 gallon water
- 60 minute soak
- 10 mesh
- No fruit squeeze

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Future Projects

Flowers and ripe fruit simultaneously

Future Projects

Flowers and ripe fruit simultaneously

Future Projects

Flowers and ripe fruit simultaneously

Sustainable SWD Management
Project # 2020-51181-32140

Contact Information:

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Dr. Hannah Burrack : burrackh@msu.edu

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Survey

We are conducting this survey to better understand what resources grower communities use and how to improve science communication.

- 5 minutes to complete
- Participation is voluntary and can be stopped at any point
- Information will be kept confidential

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