



Incorporating Biological Control into IPM Programs for SWD in Caneberries

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SWD Management in Berry Crops



Spotted Wing Drosophila (SWD): *Drosophila suzukii*

- From southeast Asia
- First detection in US: CA, 2008
- Detected in NC in 2010
- 30+ different crop and non-crop hosts
- Females with serrated ovipositor
- Pesticide resistance detected in some populations

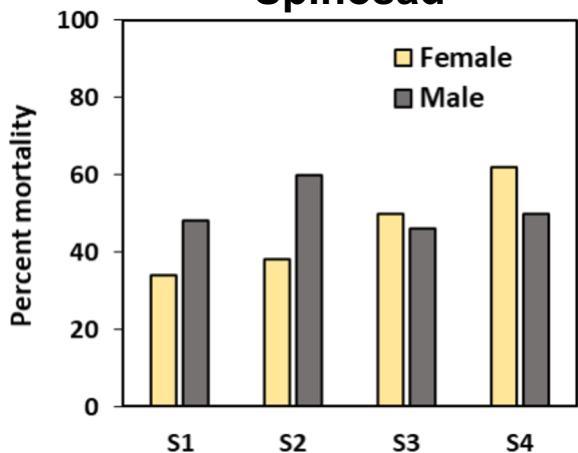


Resistance monitoring and detection

California strawberries 2020



Spinosad

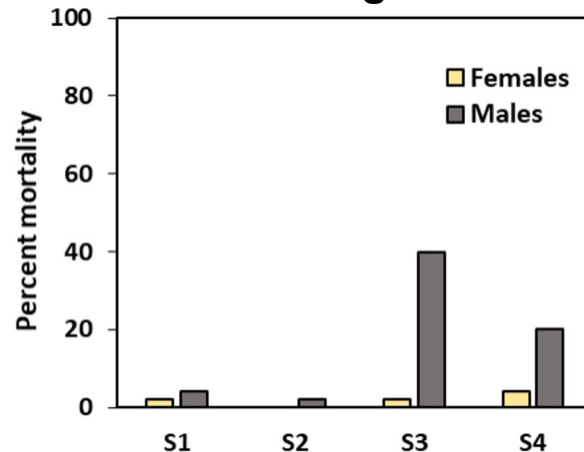


Percent mortality at:

847.77 ppm = LC90x8 for a susceptible population

927.94 ppm = LC99x2 for a susceptible population

Mustang Max



Percent mortality at 6.89 ppm =

LC99x2 for a susceptible population

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



Project Director: Ash Sial¹

Co Project Directors: Elizabeth Beers², Hannah Burrack³, Joanna Chiu⁴, Kent Daane⁵, Rufus Isaacs³, Miguel Gómez⁶, Cesar Rodriguez-Saona⁷, Vaughn Walton⁸

Co Principal Investigators: Philip Fanning⁹, Karina Gallardo², Greg Loeb⁶, Kim Hoelmer¹⁰, Kay Kelsey¹¹, Tobin Northfield², Frank Zalom⁴, Jim Walgenbach¹², Hannah Levenson¹²

¹University of Georgia; ²Washington State University; ³Michigan State University;

⁴University of California, Davis; ⁵University of California, Berkeley; ⁶Cornell University;

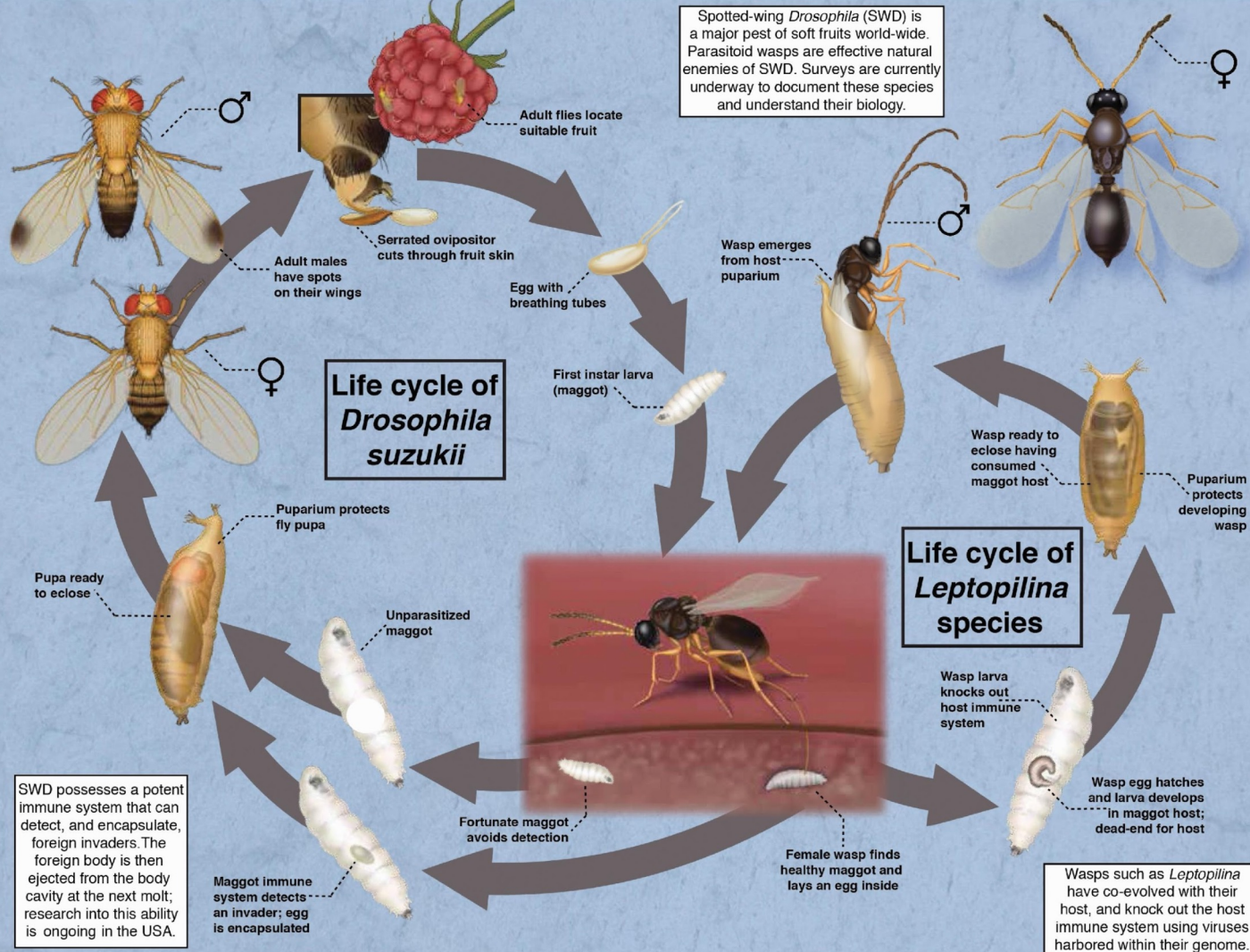
⁷Rutgers University; ⁸Oregon State University; ⁹University of Maine; ¹⁰USDA ARS;

¹¹University of Florida; ¹²North Carolina State University;

Ganaspis brasiliensis



Photo: Kent Daane



Main native parasitoids in North America after SWD invasion



Tested for augmentative control of SWD



*Pachychrepoideus
vindemmiae*



Trichopria drosophilae



Leptopilina heterotoma

Reviewed in Lee et al. 2019; Wang et al. 2020

Investigating exotic parasitoids



Asobara



Leptopilina



Ganaspis



From China and South Korea
SWD's native range

Investigating exotic parasitoids



Asobara



Leptopilina



Ganaspis



From China and South Korea

***more common in early fruit**

Investigating exotic parasitoids



Asobara



Leptopilina



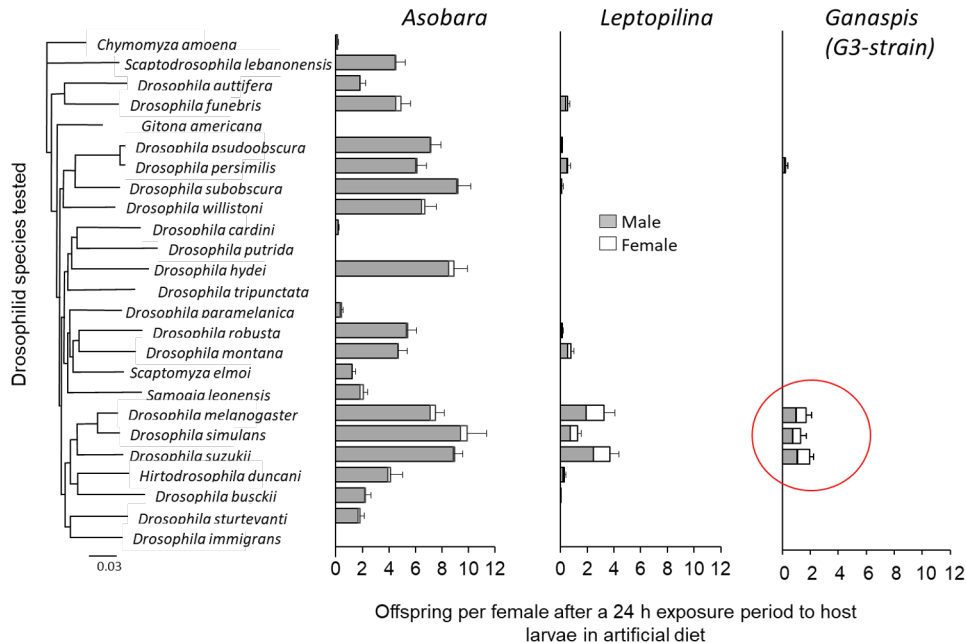
Ganaspis



*more common in later, rotted fruit

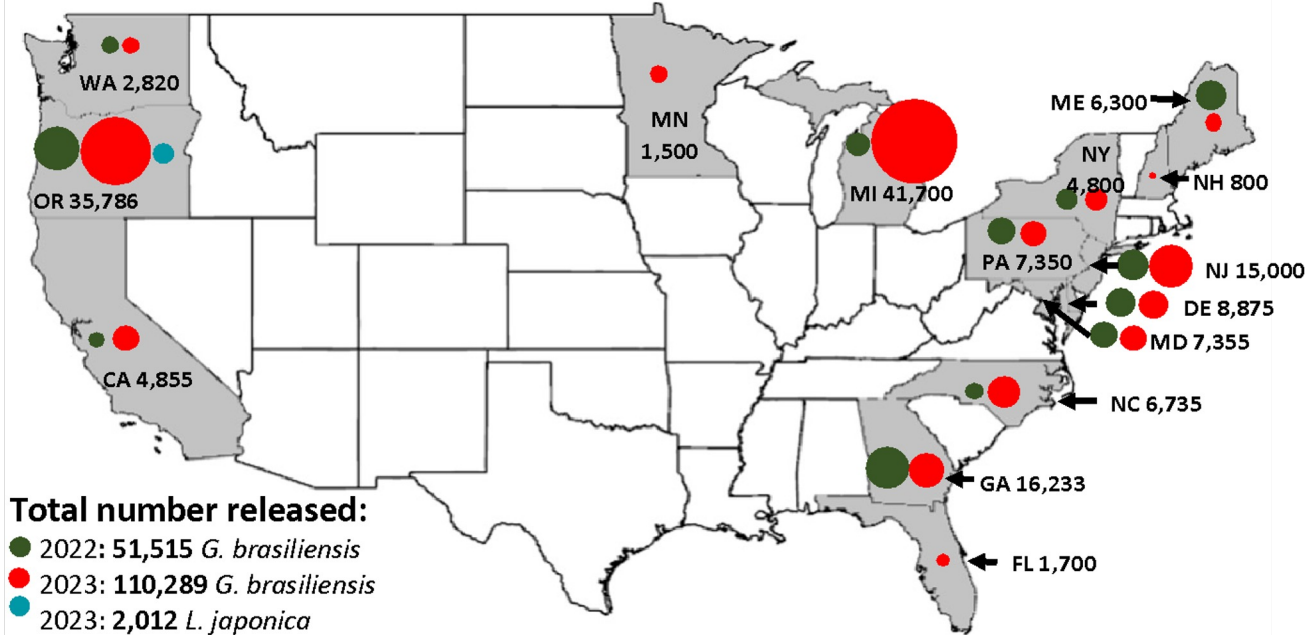
From China and South Korea

Quarantine work from 2014-2018



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Introduction of SWD Parasitoid



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North Carolina Introductions



North Carolina *Ganaspis brasiliensis* (Gb) Releases

- NCDA Team: Gb Colony and Gb Release
 - Greg Wiggins - Biological Control Administrator
 - Martha Flanagan - Research Specialist
- NCSU Team: Establishment Research
 - Hannah Levenson - Postdoctoral Research Scholar
 - Kayla Beckwith - Undergraduate Research Assistant

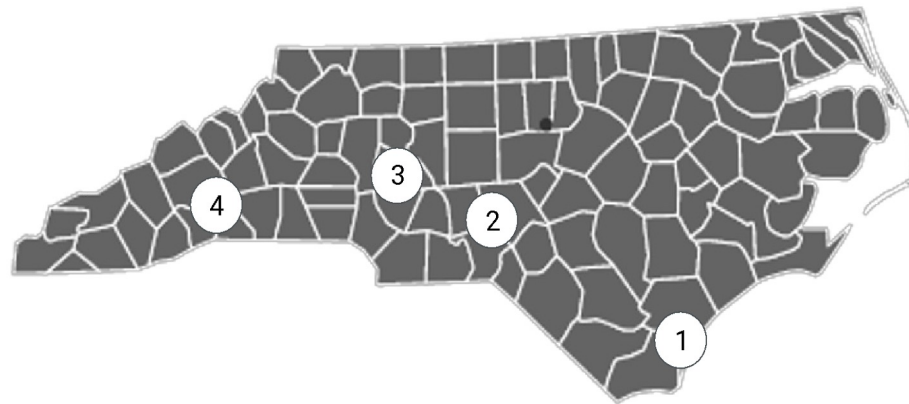
North Carolina Introductions

2022 - 2023



North Carolina Release Sites

1. Castle Hayne Research Station
2. Sandhills Research Station
3. Piedmont Research Station
4. Mountain Horticulture Research Station



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North Carolina Introductions



North Carolina Introductions



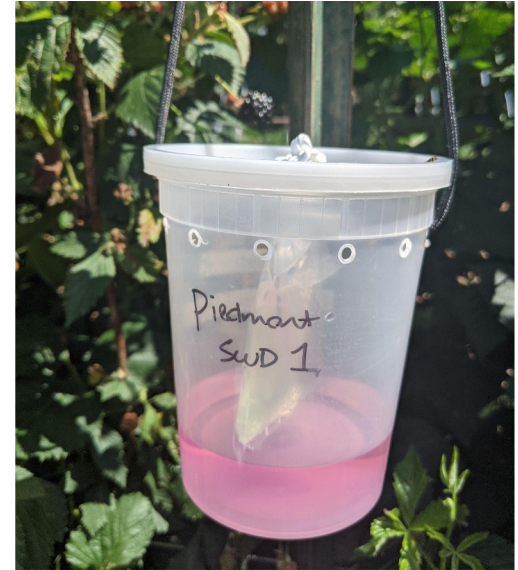
Fruit Sampling



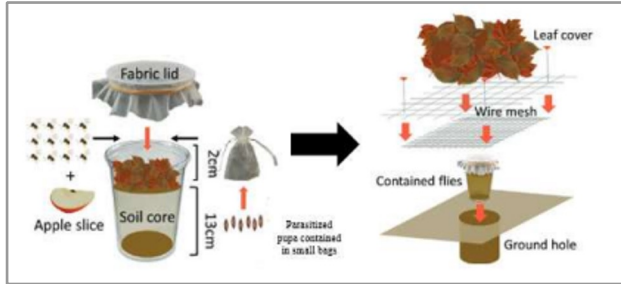
Sentinel Traps



Liquid Traps



North Carolina Introductions



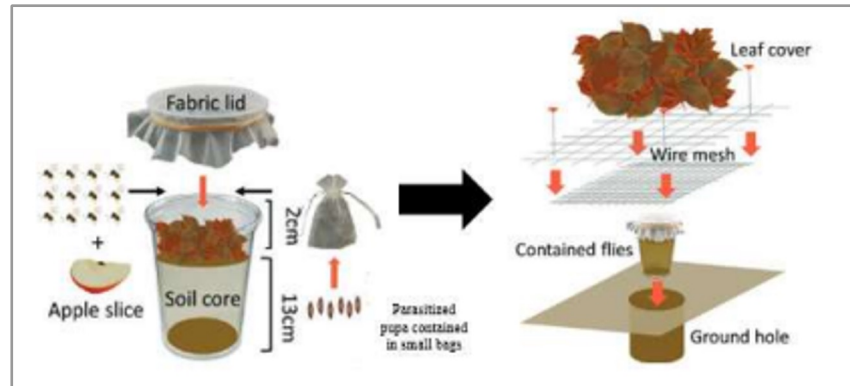
North Carolina Introductions - Results



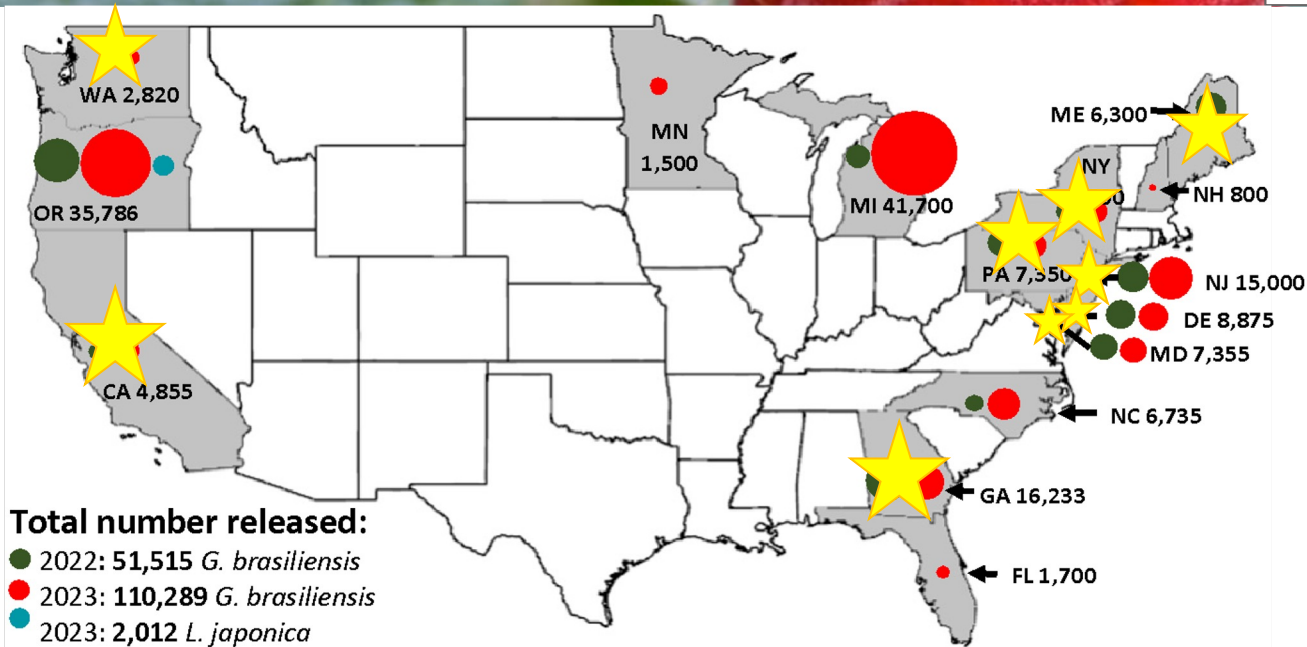
Establishment Research



Overwintering Research



Gb recovery



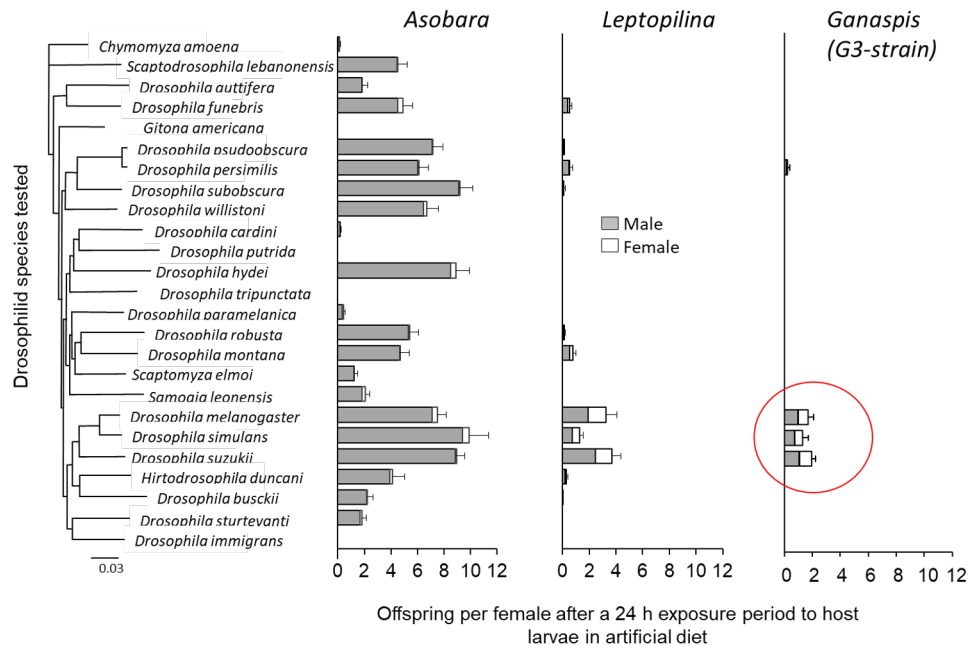
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Leptopilina japonica



Photo: Warren Wong

Wider host range assists with establishment



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Wide host plant use documented

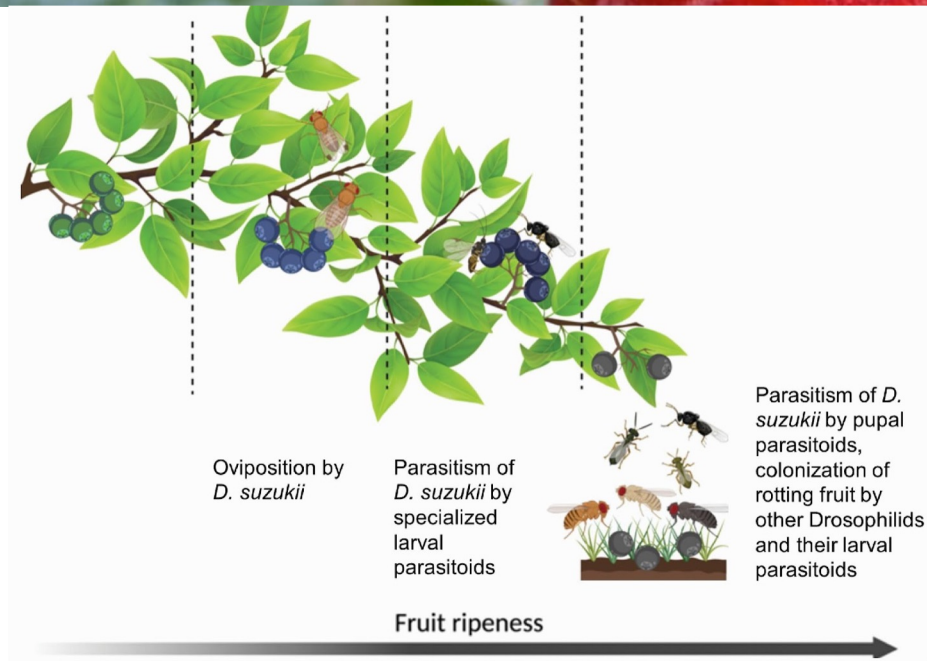


Common name	Family	Origin	LJ	GB
Autumn olive	Elaeagnaceae	Asia	✓	✓
Huckleberry	Ericaceae	North America	✓	
Honeysuckle	Caprifoliaceae	Asia	✓	
Honeysuckles	Caprifoliaceae	Asia	✓	
Pokeweed	Phytolaccaceae	North America	✓	✓
Red currant	Grossulariaceae	Europe	✓	
Sweet cherry	Rosaceae	Europe & Asia	✓	✓
Highbush blackberry	Rosaceae	North America	✓	✓
Himalayan blackberry	Rosaceae	Asia	✓	✓
Red raspberry	Rosaceae	Europe & Asia	✓	
Wineberry	Rosaceae	East Asia	✓	
Blackberries	Rosaceae		✓	
Blackberries/raspberries	Rosaceae		✓	✓
Highbush blueberry	Ericaceae	North America	✓	✓



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Eventual niche partitioning expected



Abram et al. 2022 *J. Econ. Entomol.*



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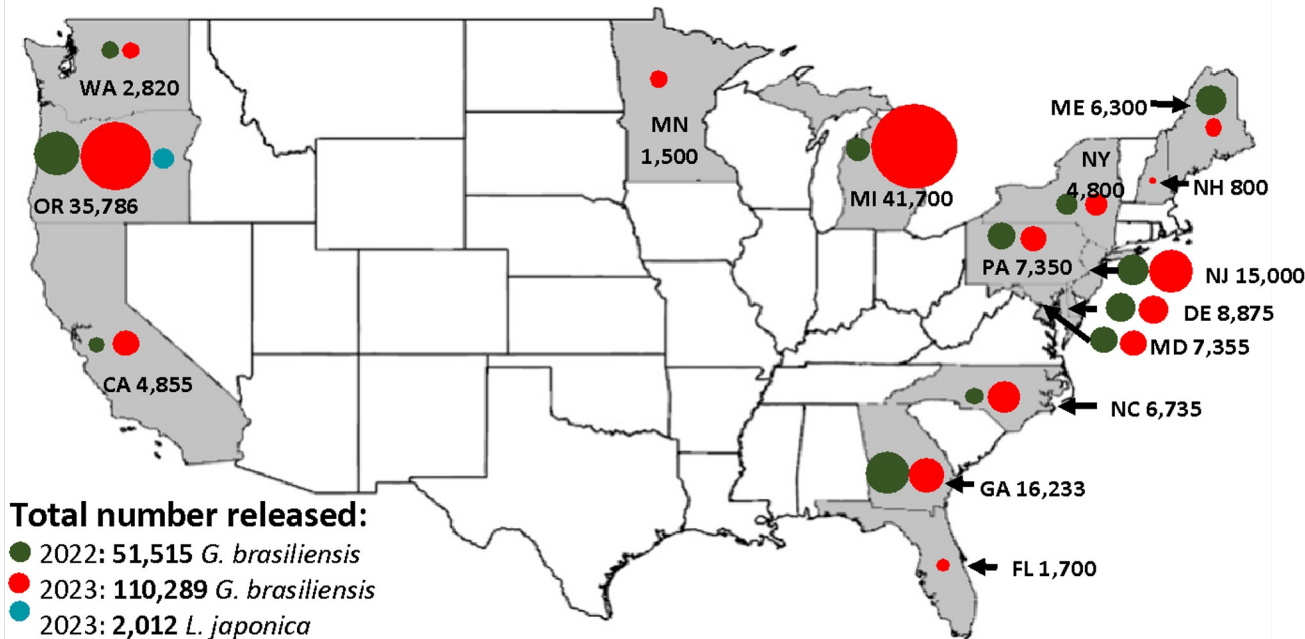
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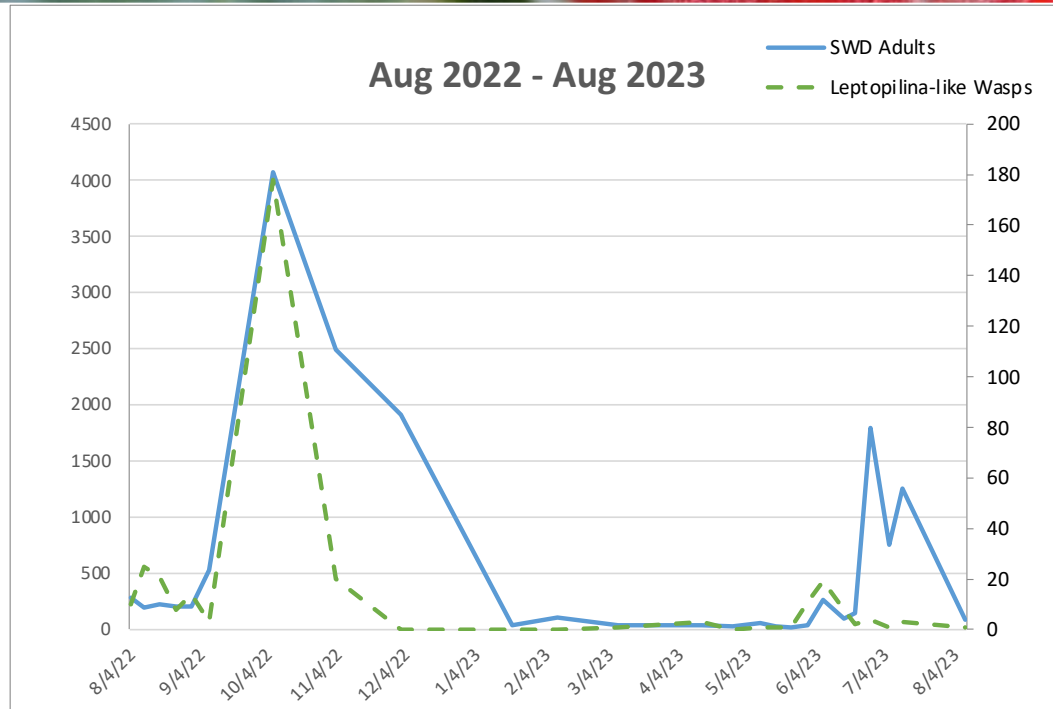
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Exploration of more parasitoid species

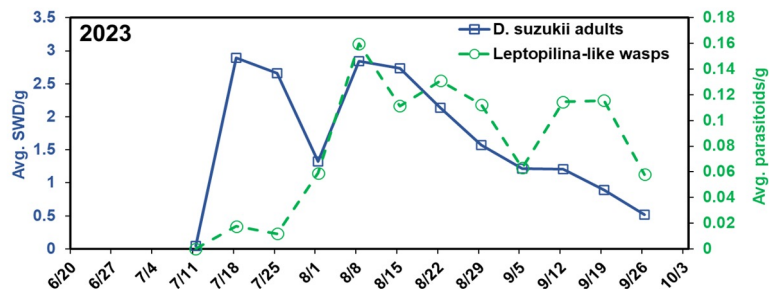


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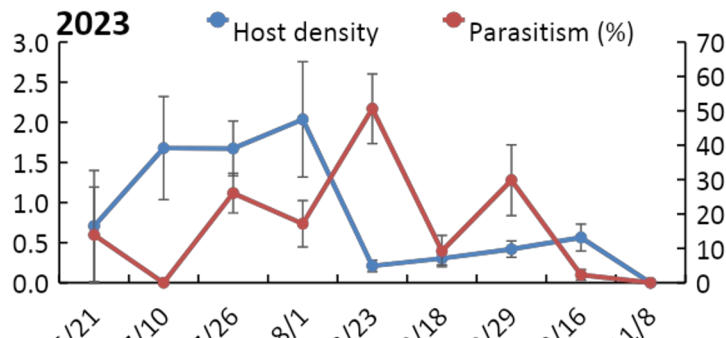


Incorporating Biological Control into IPM Programs



Michigan Data

(Steve Van Timmeren, Rufus Isaacs, Julianna Wilson, Andrew Jones, Juan Hang)



Delaware Data

(Xingeng Wang, Amanda Stout, Kim Hoelmer)

Incorporating Biological Control into IPM Programs



Ash Sial
UGA



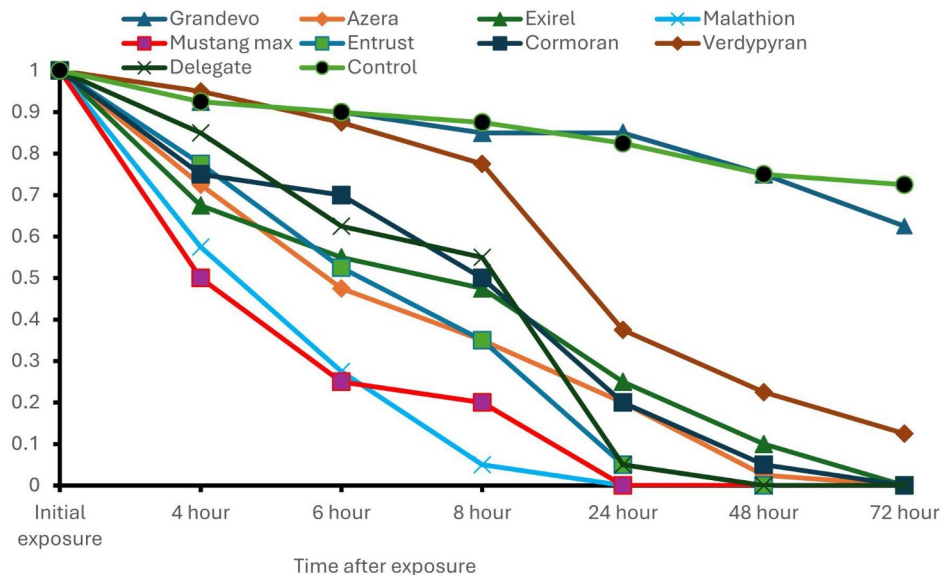
Cera Jones
UGA



Subin Neupane
UGA

- Malathion, Entrust, and Mustang Maxx most toxic
- Grandevo least toxic
- Entrust and delegate sub-lethal effects

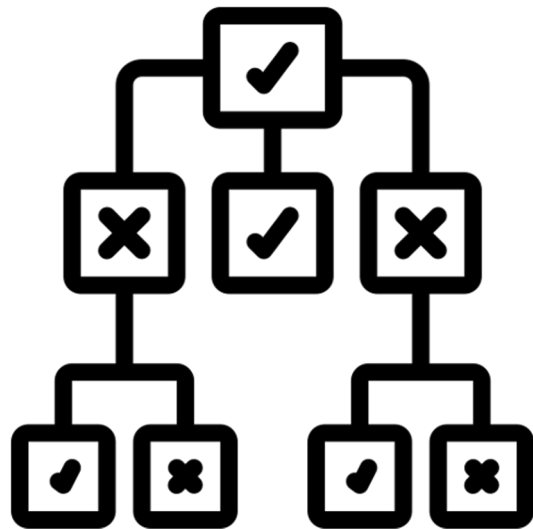
Proportion of surviving parasitoids



Incorporating Biological Control into IPM Programs



Decision Tree



Blueberry

Georgia – Arun Babu

Ash Sial

Maine – Ben Johnson

Phil Fanning

Michigan – Steve Van Timmeren

Rufus Isaacs

New York – Binita Shrestha

Greg Loeb

Oregon – Vaughn Walton

Blackberry

North Carolina – Hannah Levenson

Hannah Burrack

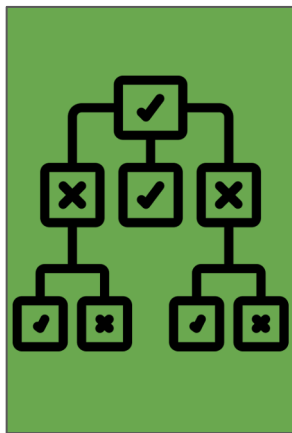
On-Farm Activities 2023



“Grower” Field



“Researcher” Field



2023 Summary

Georgia - reduced 1 spray

Maine - perimeter sprays

Michigan - reduced 1 - 2 sprays*

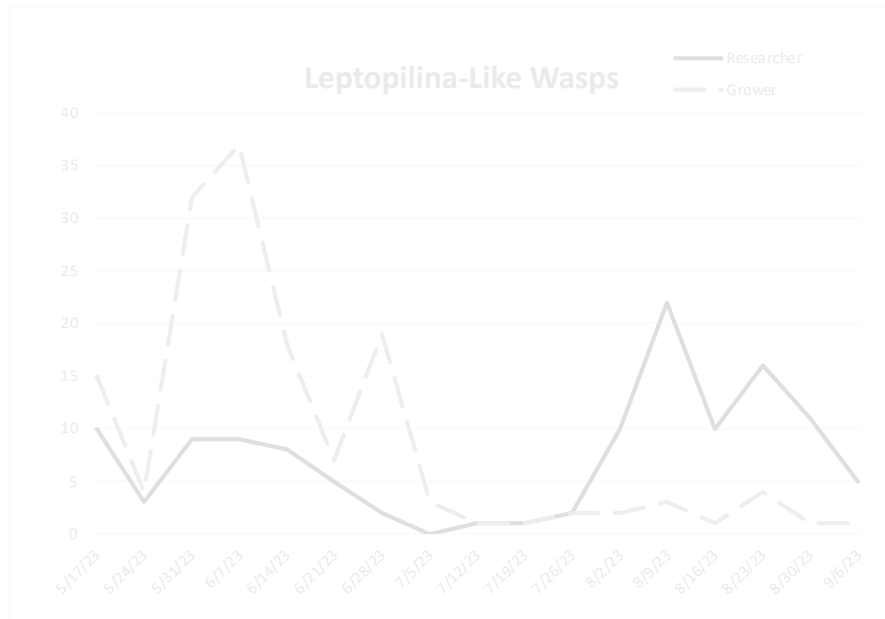
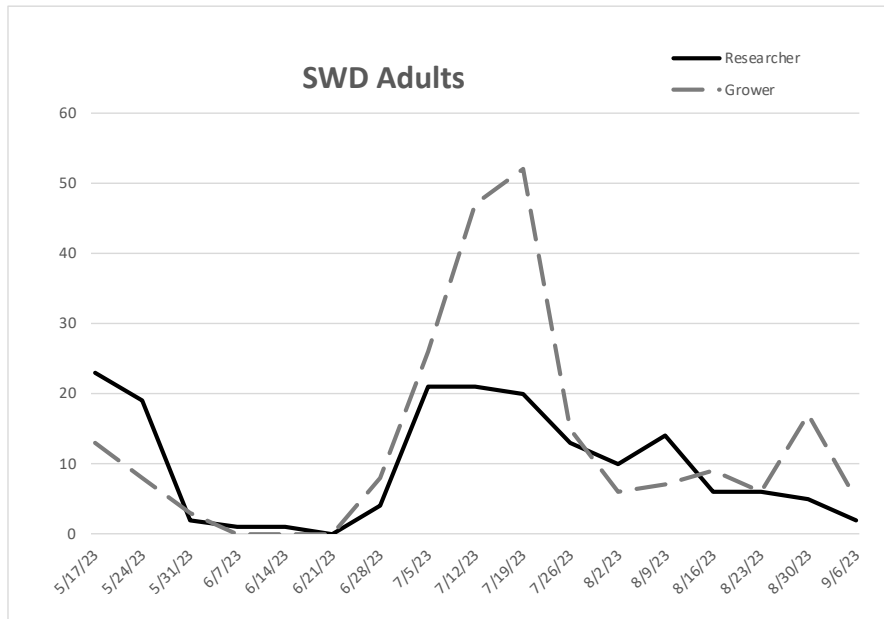
New York - reduced 1 spray + perimeter sprays

North Carolina - reduced 4 sprays

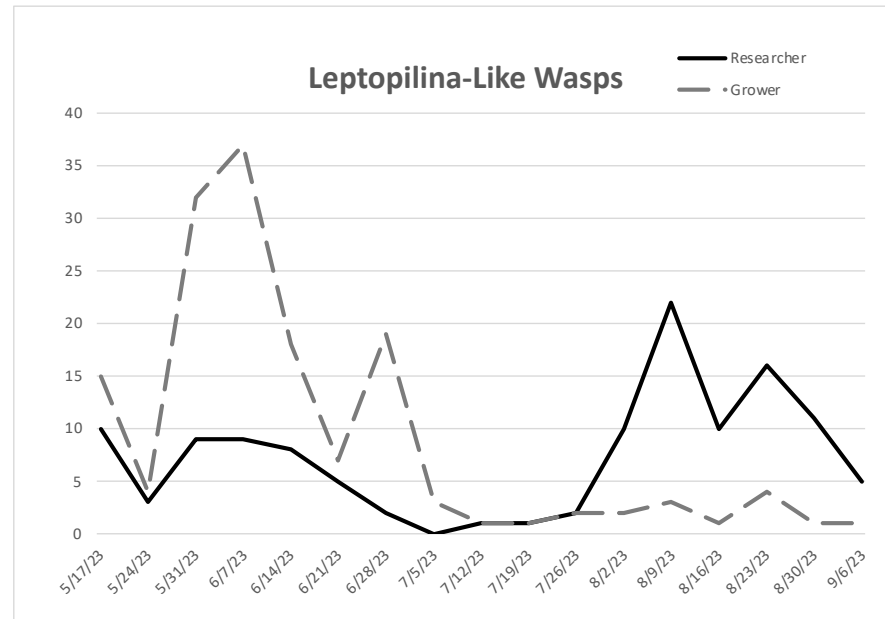
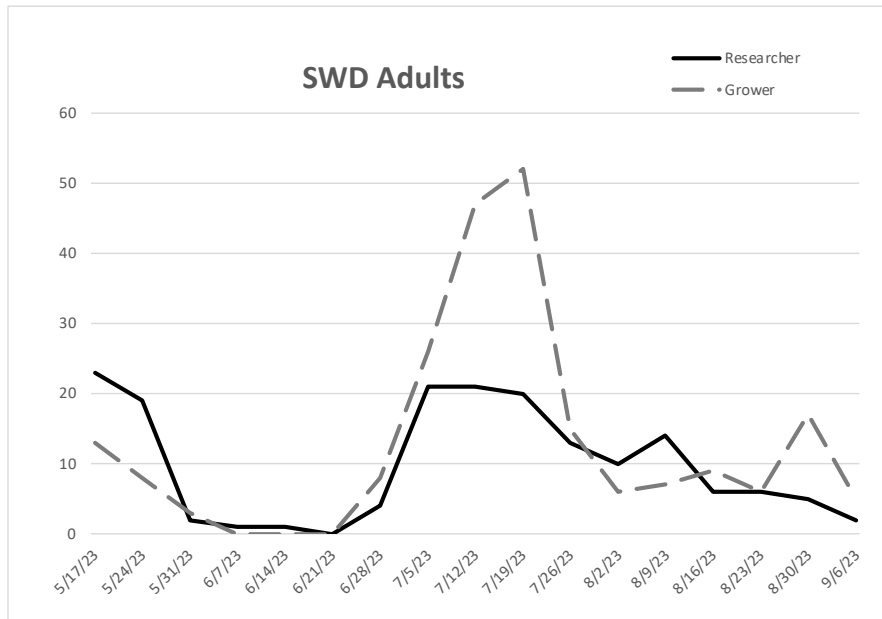
Oregon - reduced 10 - 15 sprays (from 2020 - 2023)

*depending on location, sampling in 2022 and 2023

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Incorporating Biological Control into IPM Programs



Considerations for IPM Programs



1. What habitat do I have for SWD and parasitoids on my farm?
2. How can I reduce sprays to protect parasitoid populations?
3. How can I time management actions (including cultural practices) to better fit parasitoid life cycle?

2024 Research Plans



1. Identify NC parasitoid specimens to species
2. Decision Tree On-Farm Trials
3. Gb releases
4. Gb rearing optimization
5. Evaluating impacts of SWD management on parasitoids

Contact Information:



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