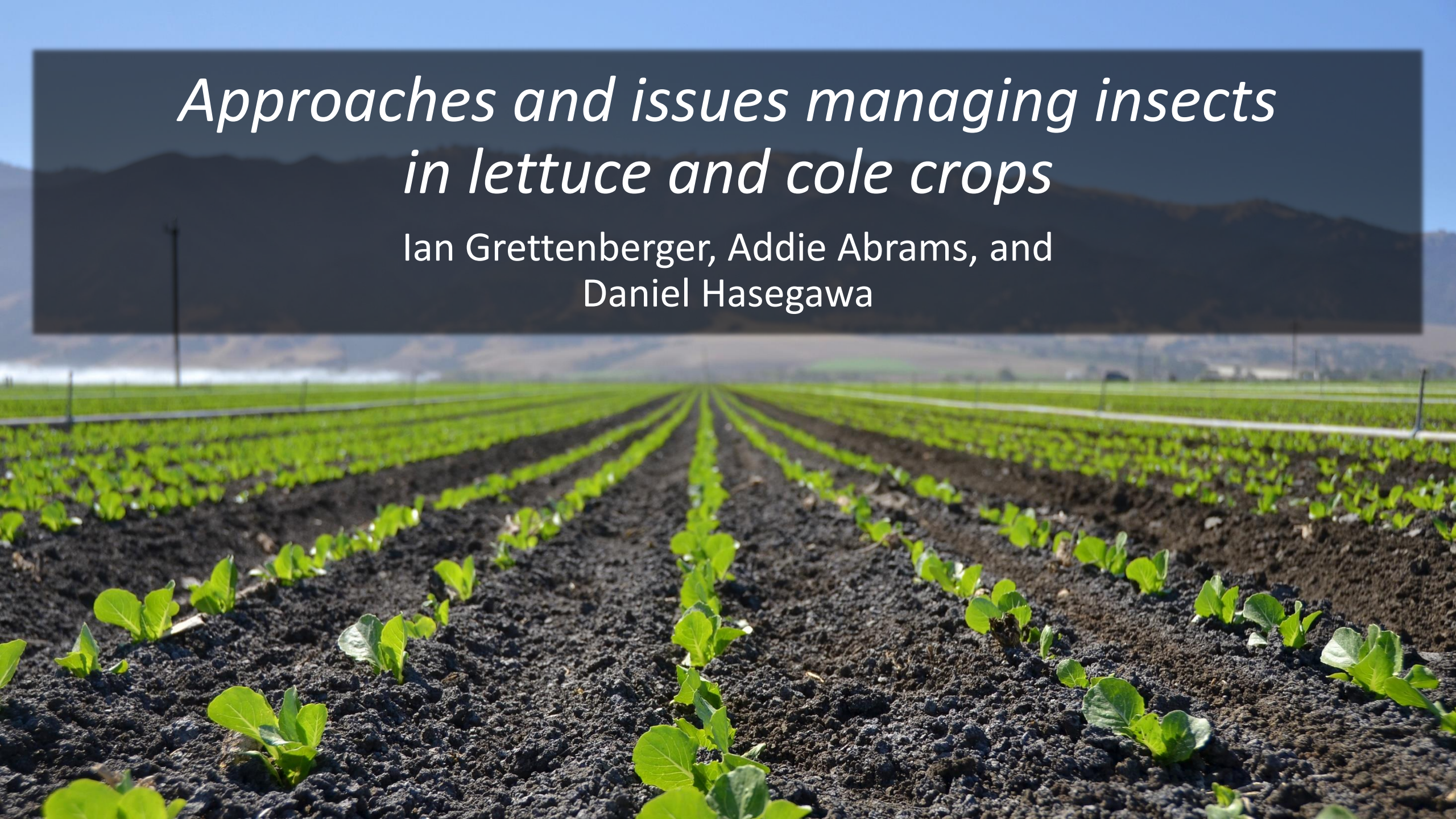
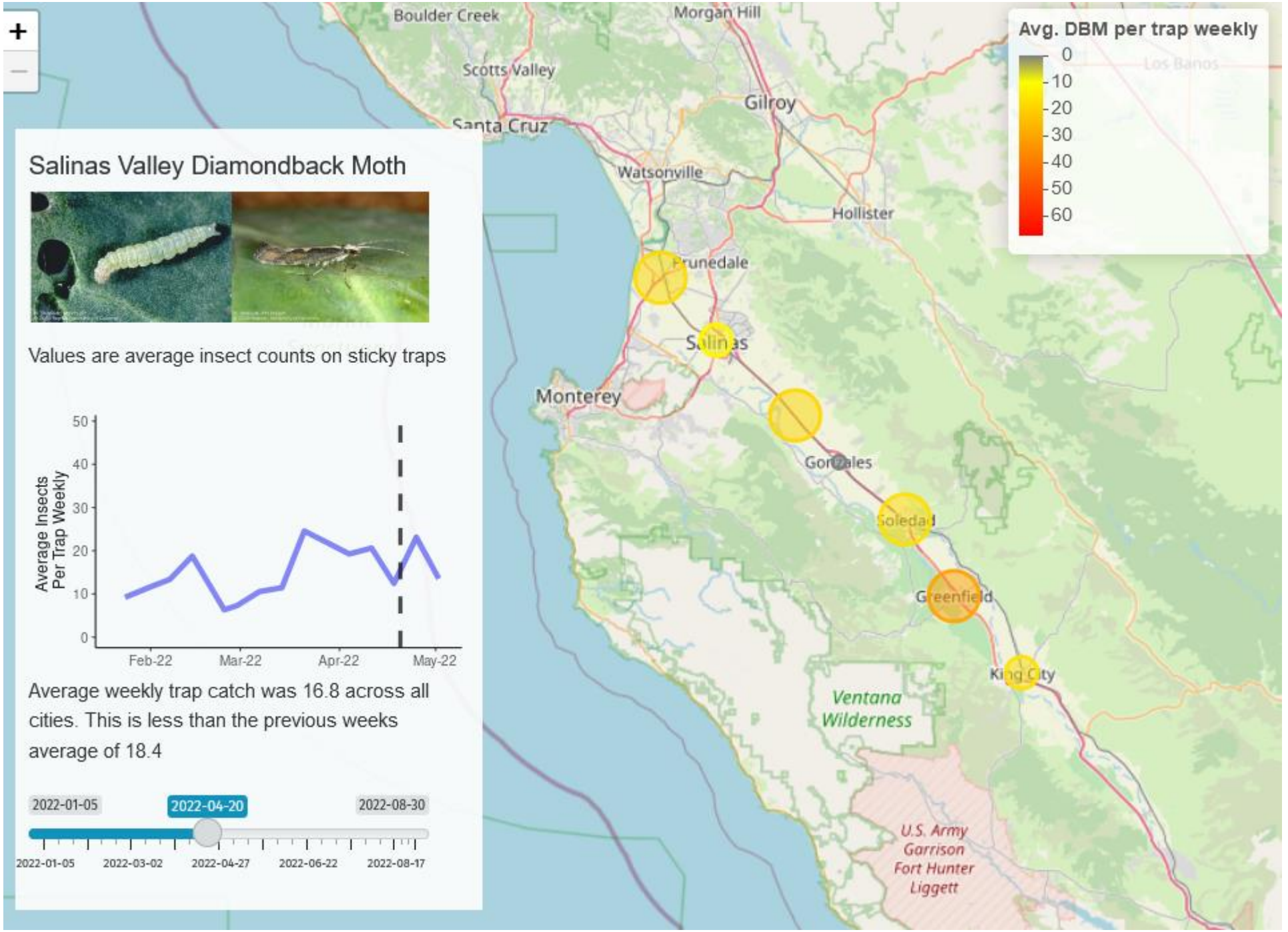
Approaches and issues managing insects in lettuce and cole crops

Ian Grettenberger, Addie Abrams, and Daniel Hasegawa

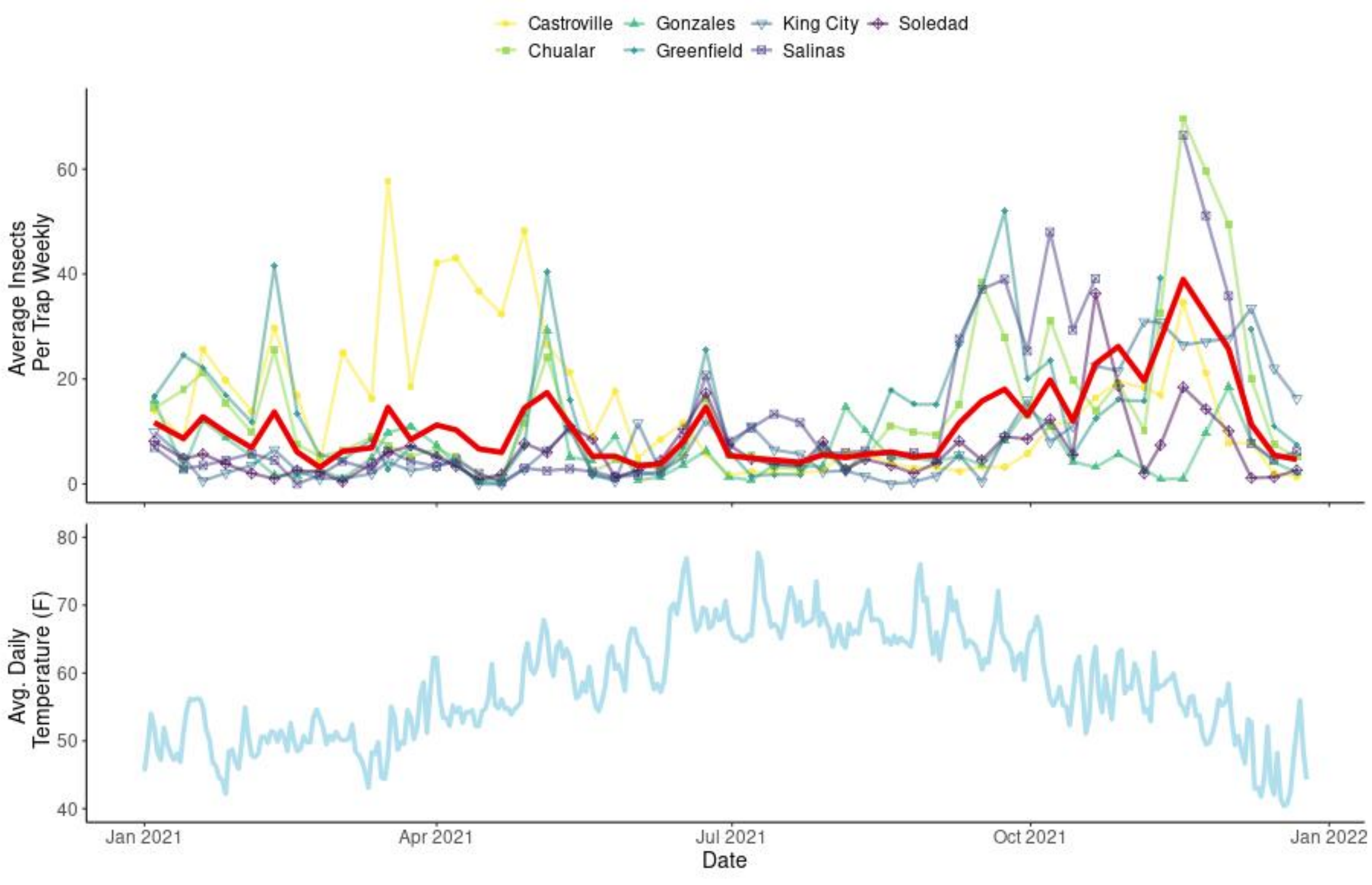



Daniel Hasegawa


UGA1328039



Developed by Ben Lee, Grettenberger lab, UCD


Castroville
Chualar
Gonzales
Greenfield
King City
Salinas
Soledad
Average Insects Per Trap Weekly
0
20
40
60
Avg. Daily Temperature (F)
40
50
60
70
80
Jan 2021
Apr 2021
Jul 2021
Oct 2021
Jan 2022
Date

UC CE Monterey County

Contact Us Newsletters

Salinas Valley pest monitoring

Below are links to a web-based app for a thrips, aphids, and diamondback moth trapping network. This tool will provide more seamless access to pest population data. The goal is to provide growers with a tool to view the most up-to-date lettuce/cole crop pest population data for the Salinas Valley. Our app can be used to quickly view current pest abundances, where pest populations are increasing the fastest, and how previous years' pest populations responded to changes in temperature

Google Scholar

diamondback moth insecticide resistance

About 19,700 results

Insecticide resistance of **diamondback moth** (Lepidoptera: Plutellidae) in North America

AM Shelton, JA Wyman, NL Cushing… - Journal of Economic …, 1993 - academic.oup.com

… role of **insecticide resistance** in management of diamondback **moth**, we surveyed susceptibility to commonly used **insecticides** … to the three most commonly used classes of **insecticides** …

☆ Save 99 Cite Cited by 215 Related articles All 7 versions

Assessment of **insecticide resistance** after the outbreak of **diamondback moth** (Lepidoptera: Plutellidae) in California in 1997

AM Shelton, FV Sances, J Hawley… - Journal of Economic …, 2000 - academic.oup.com

… newer **insecticides** and can also help explain the occurrence of outbreaks caused by factors … than **insecticide resistance**. KEY WORDS Plutella xylostella, **resistance**, **diamondback moth** …

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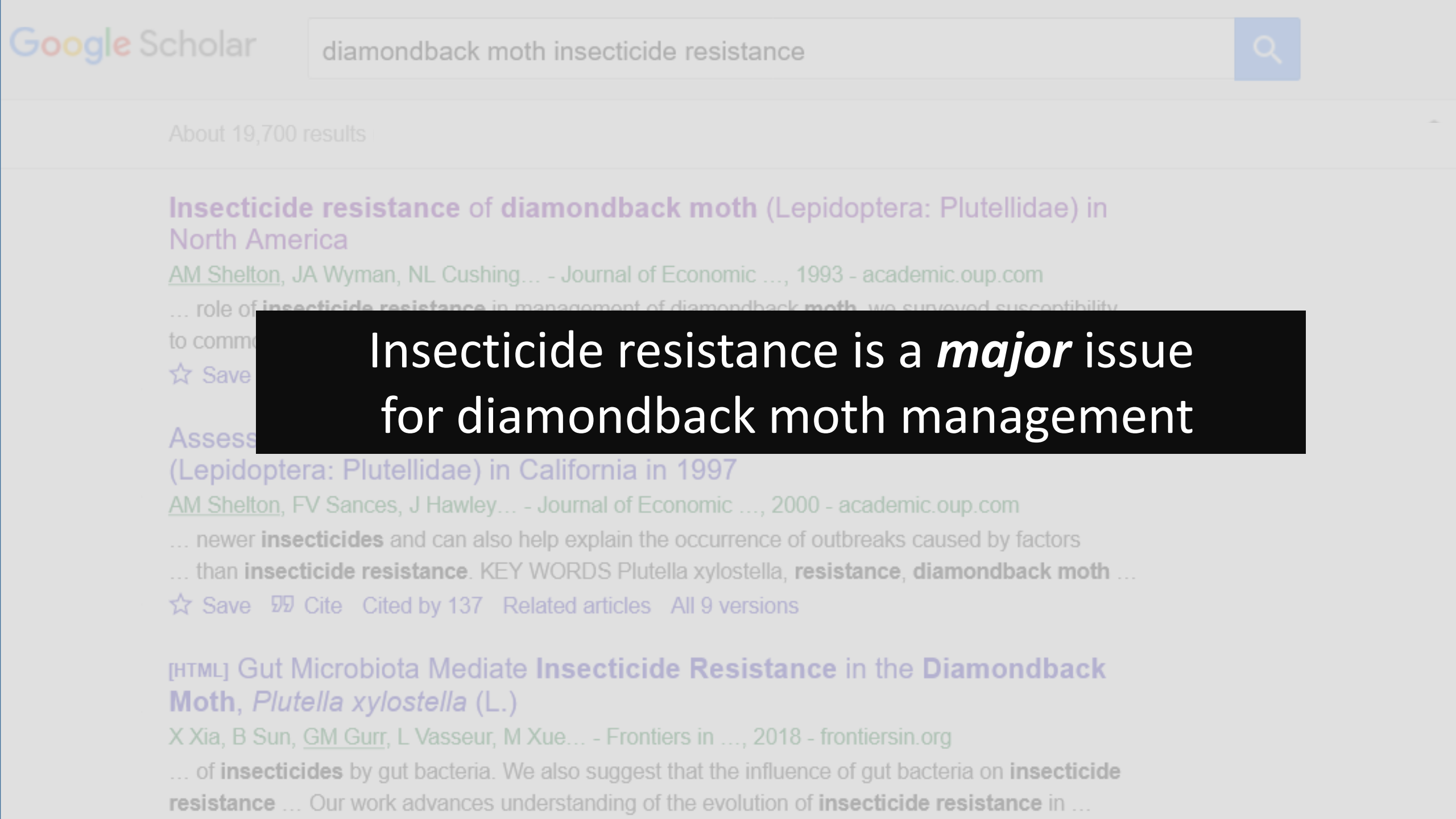
[HTML] Gut Microbiota Mediate **Insecticide Resistance** in the **Diamondback Moth**, *Plutella xylostella* (L.)

X Xia, B Sun, GM Gurr, L Vasseur, M Xue… - Frontiers in …, 2018 - frontiersin.org

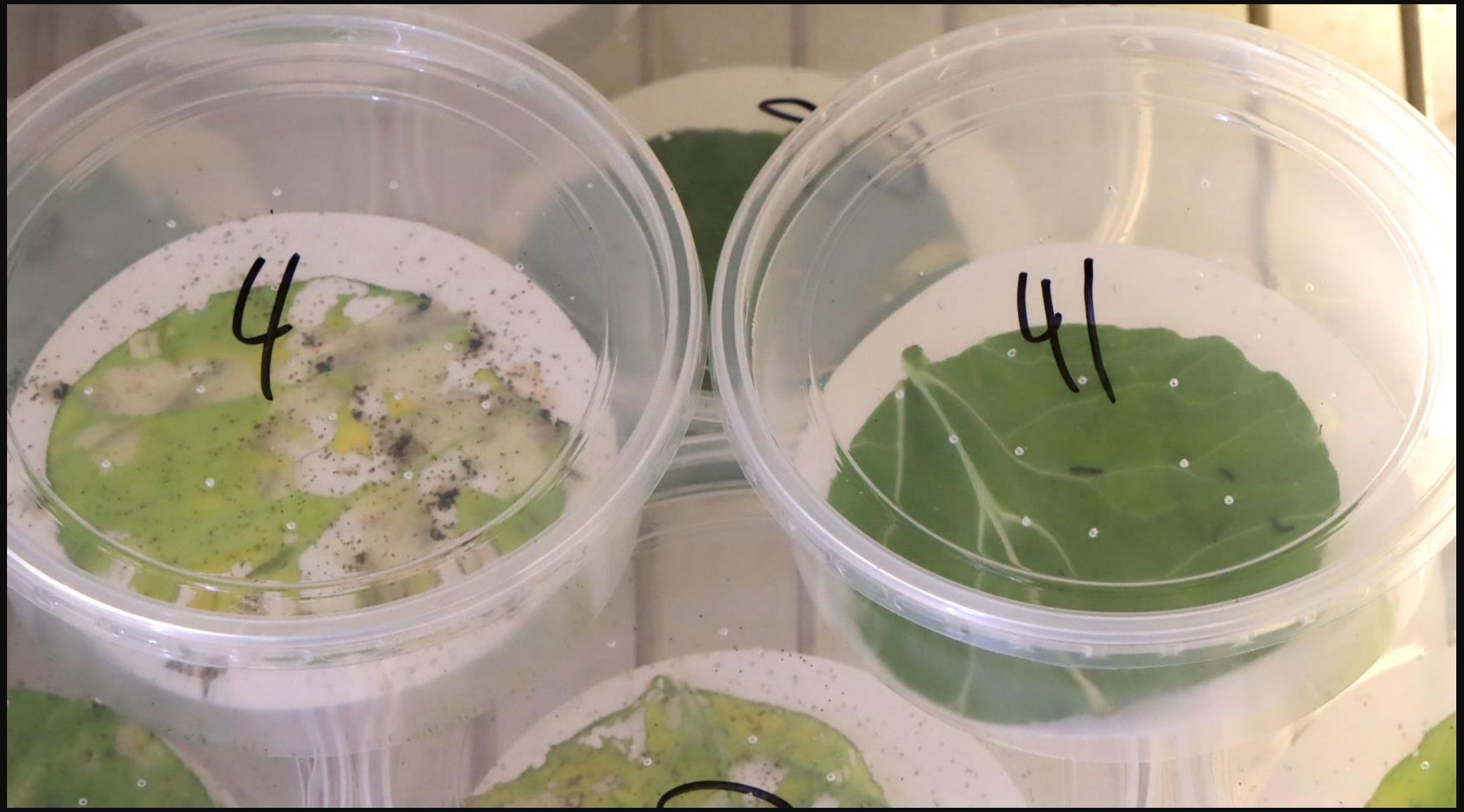
… of **insecticides** by gut bacteria. We also suggest that the influence of gut bacteria on **insecticide resistance** … Our work advances understanding of the evolution of **insecticide resistance** in …

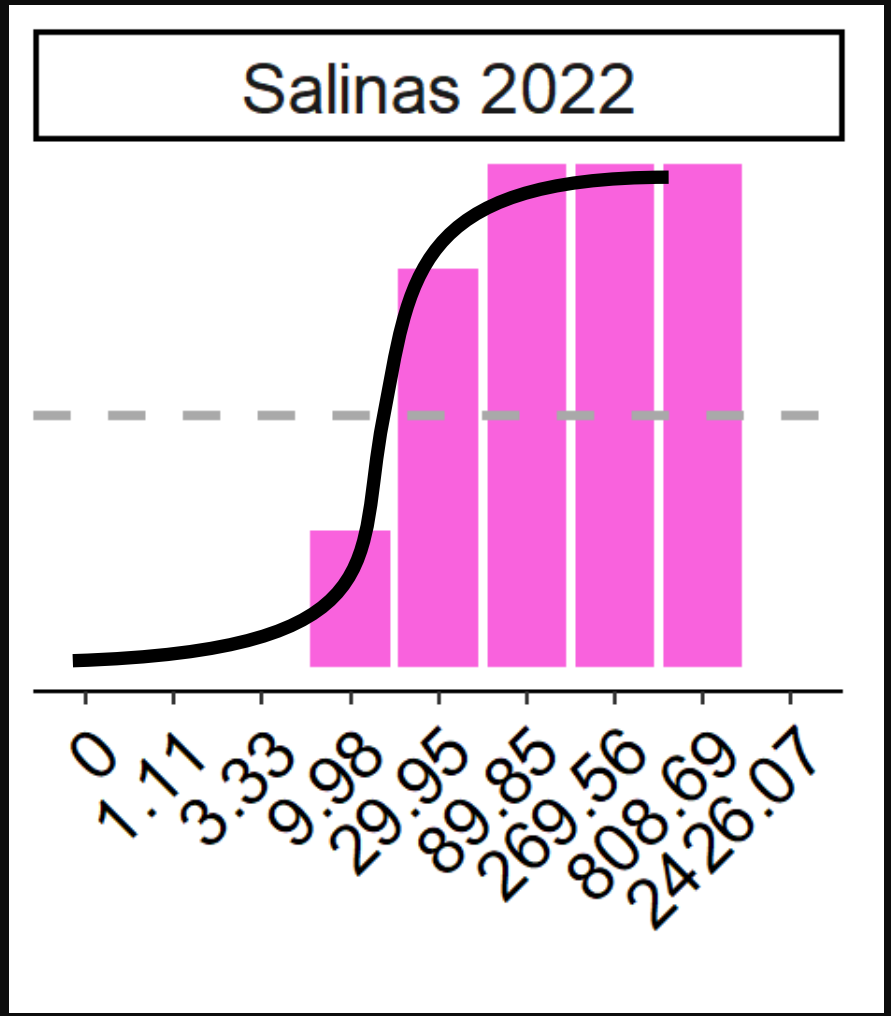


Insecticide resistance is a ***major*** issue for diamondback moth management

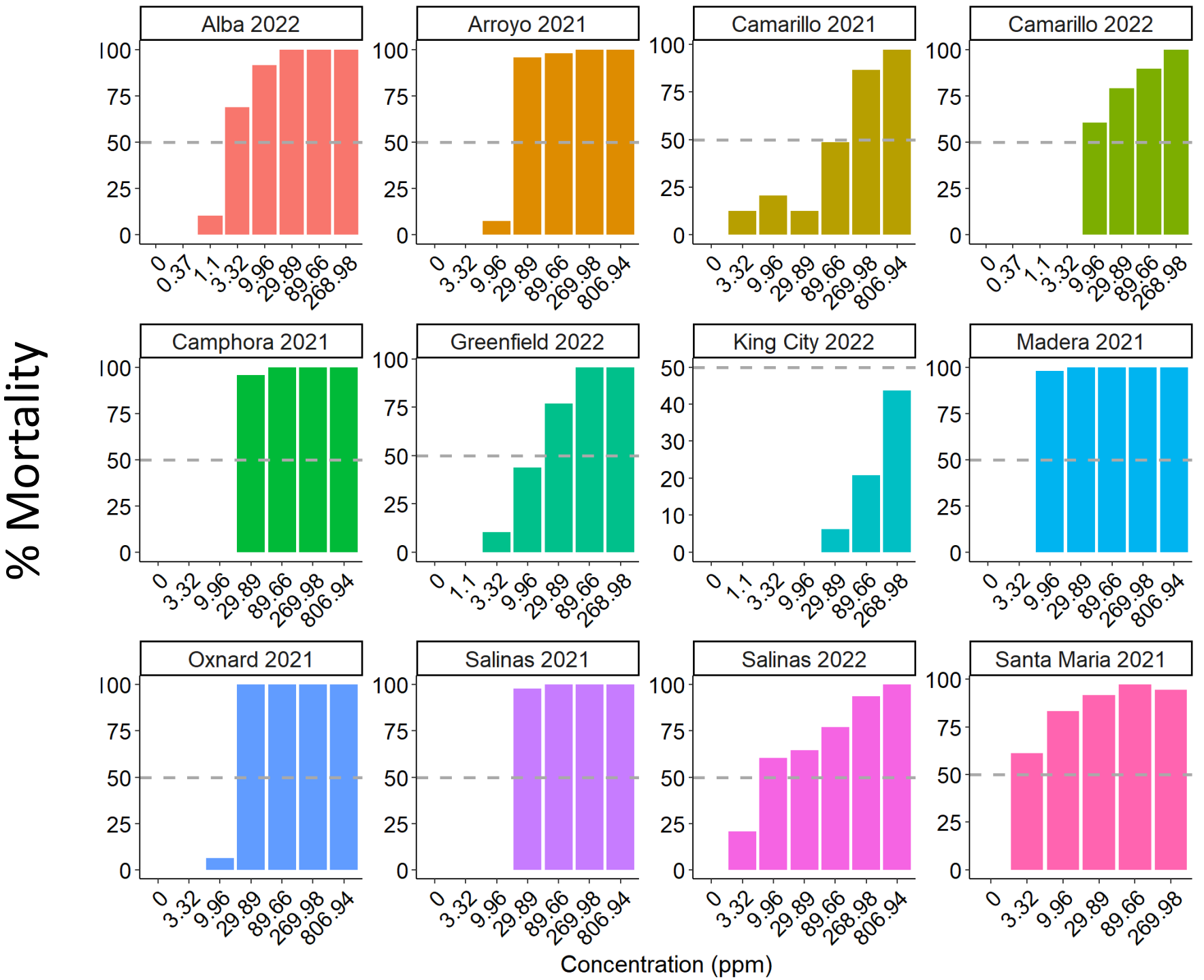

Central Valley & Bay Delta
Sierra Nevada & Cascades
Central Coast
Marine
Mojave Desert
South Coast
Colorado Desert

Resistance monitoring – leaf dip assay

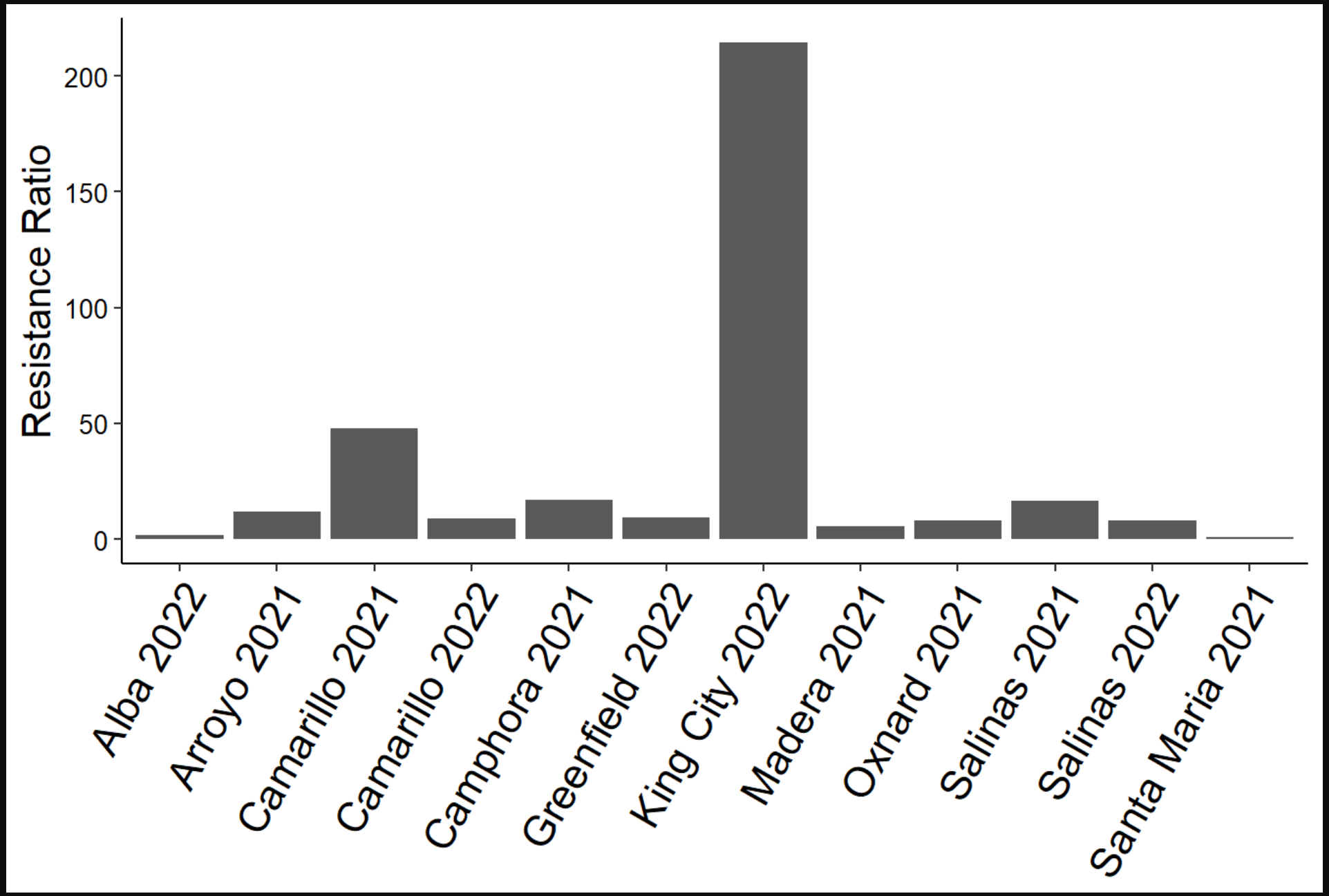



Salinas 2022
0
1.11
3.33
9.98
29.95
89.85
269.56
808.69
2426.07

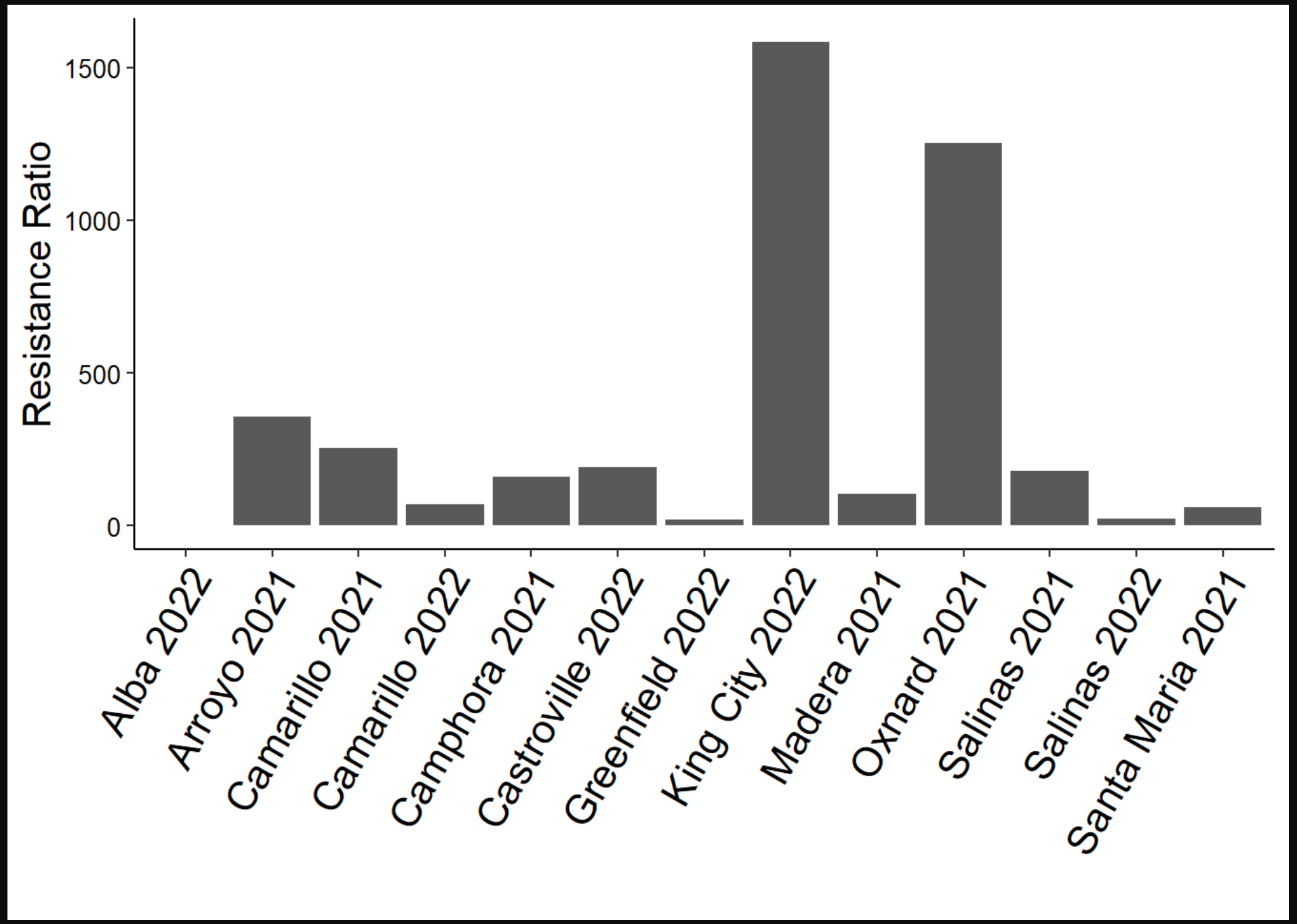
Cyantraniliprole (diamide)



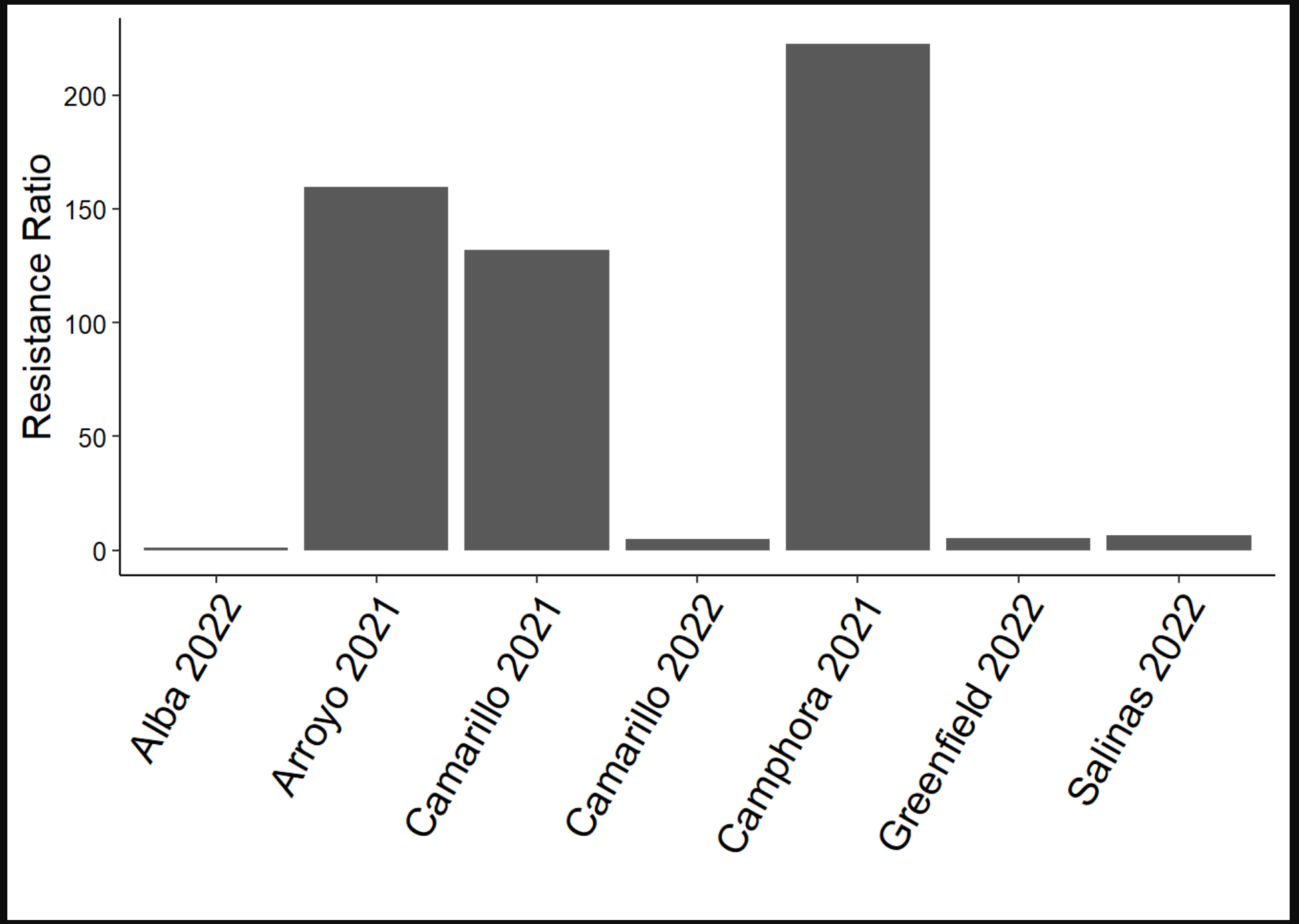
Cyantraniliprole (diamide)



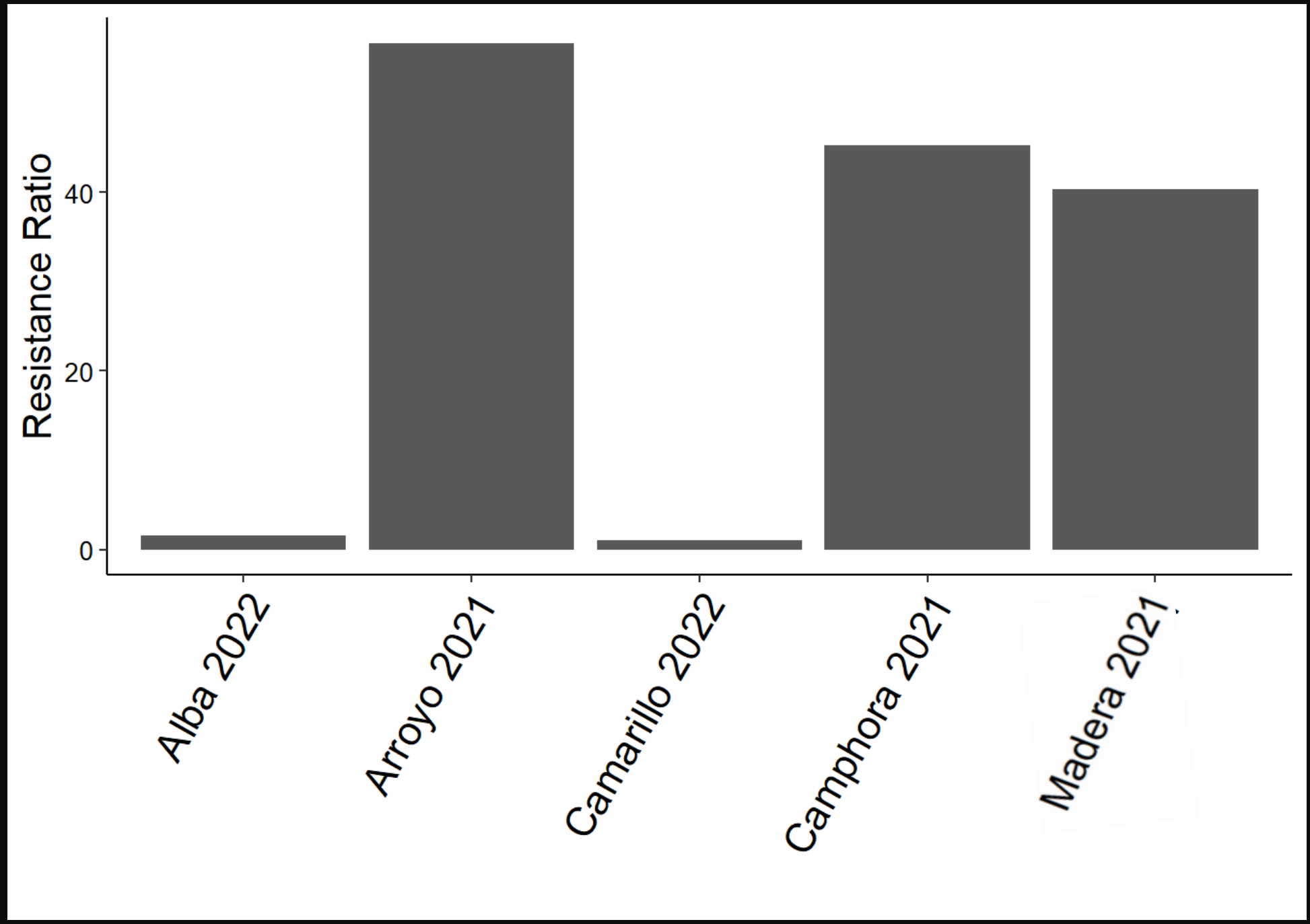
Chlorantraniliprole (diamide)



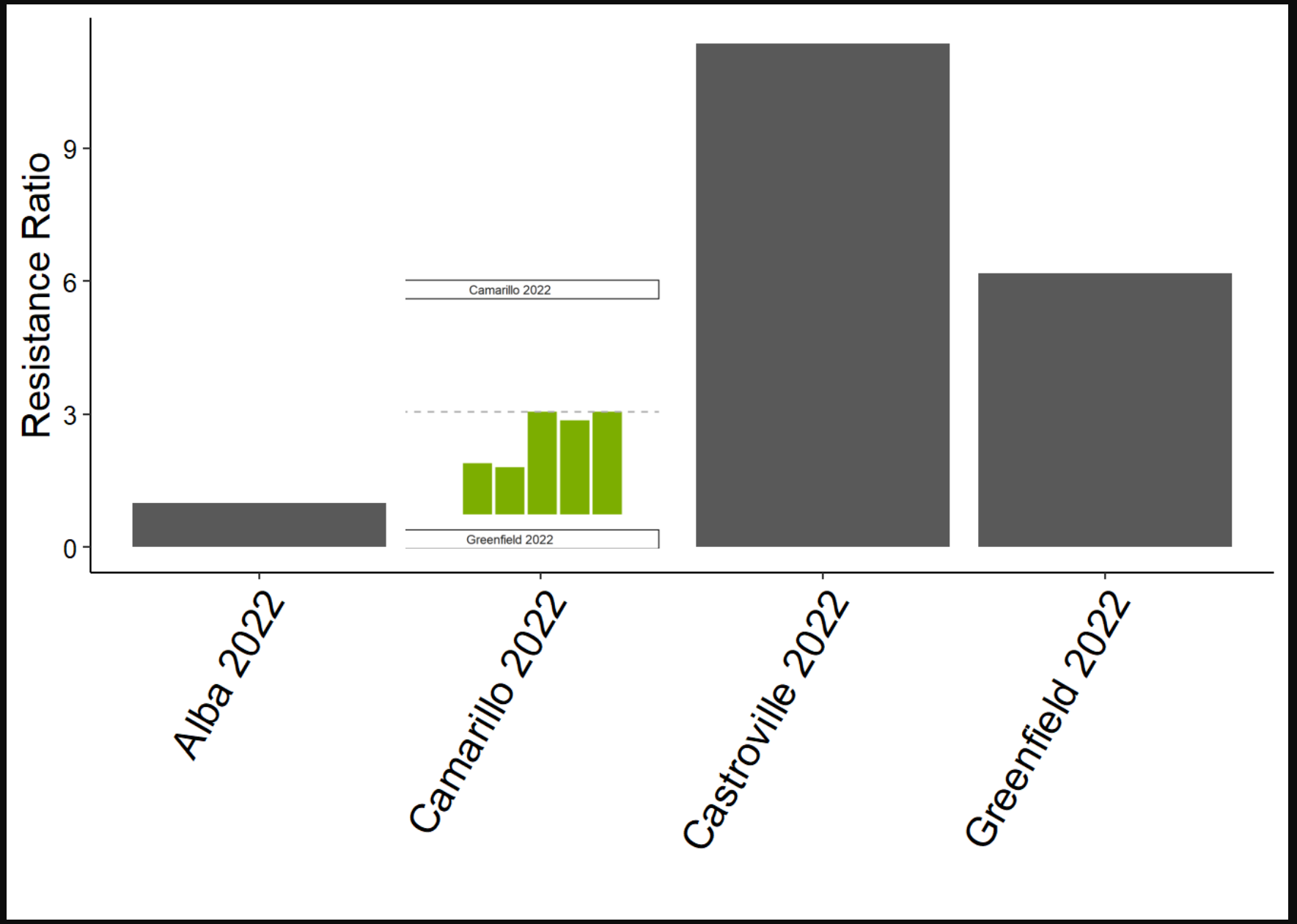
Spinetoram (spinosyn)



Emamectin benzoate



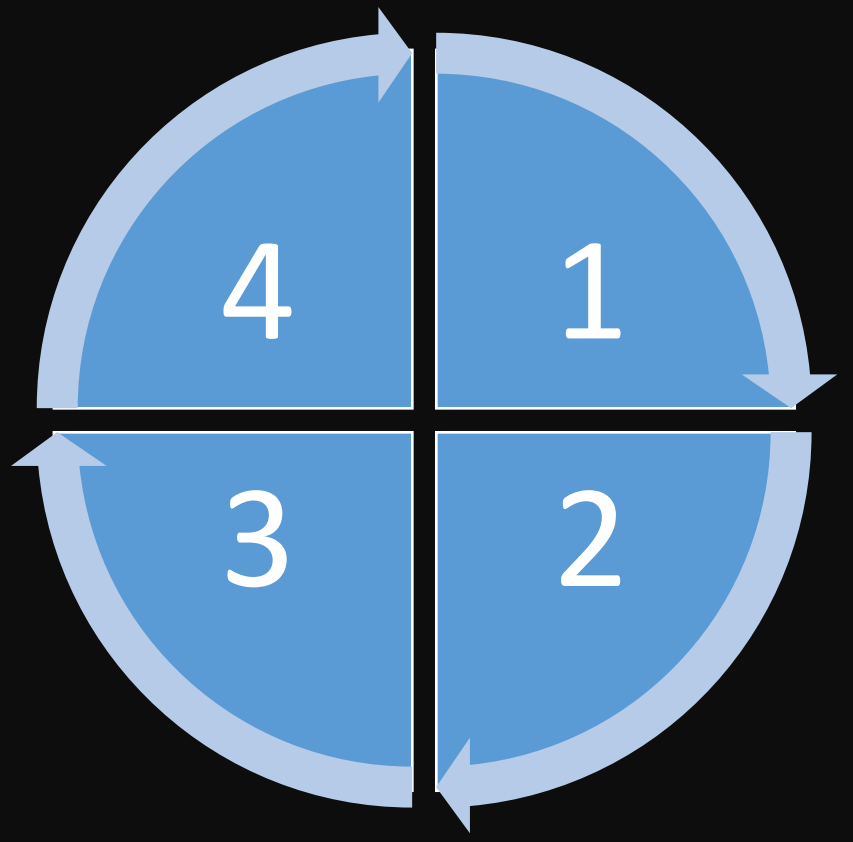
Bacillus thuringensis/Bt - aizawai



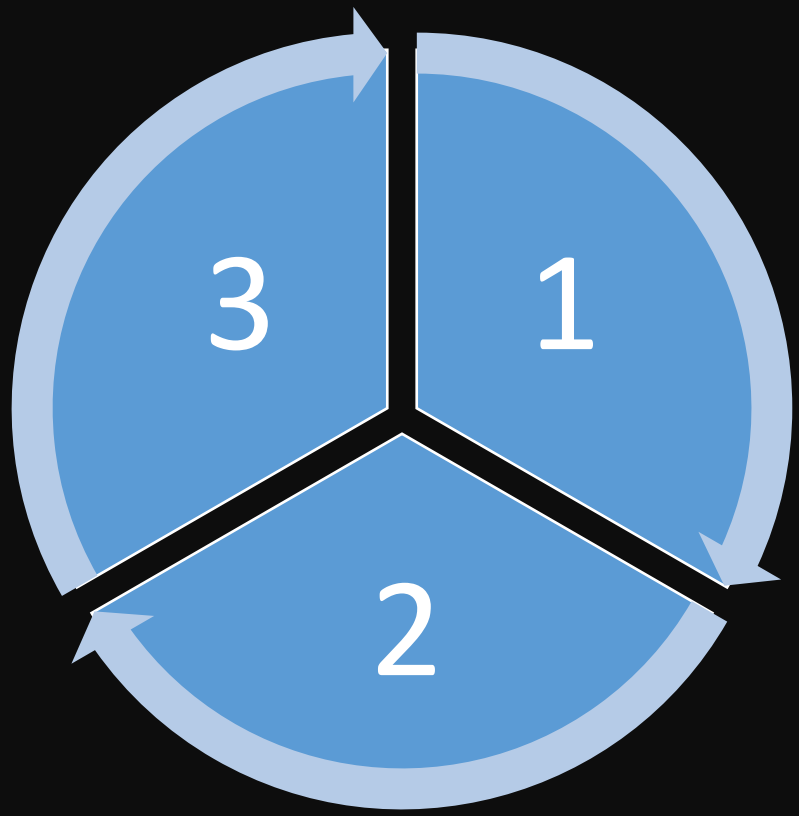
What can we do about insecticide resistance?


EXIT 12
Carefully planned resistance management
Seat-of-pants IPM
uh-oh

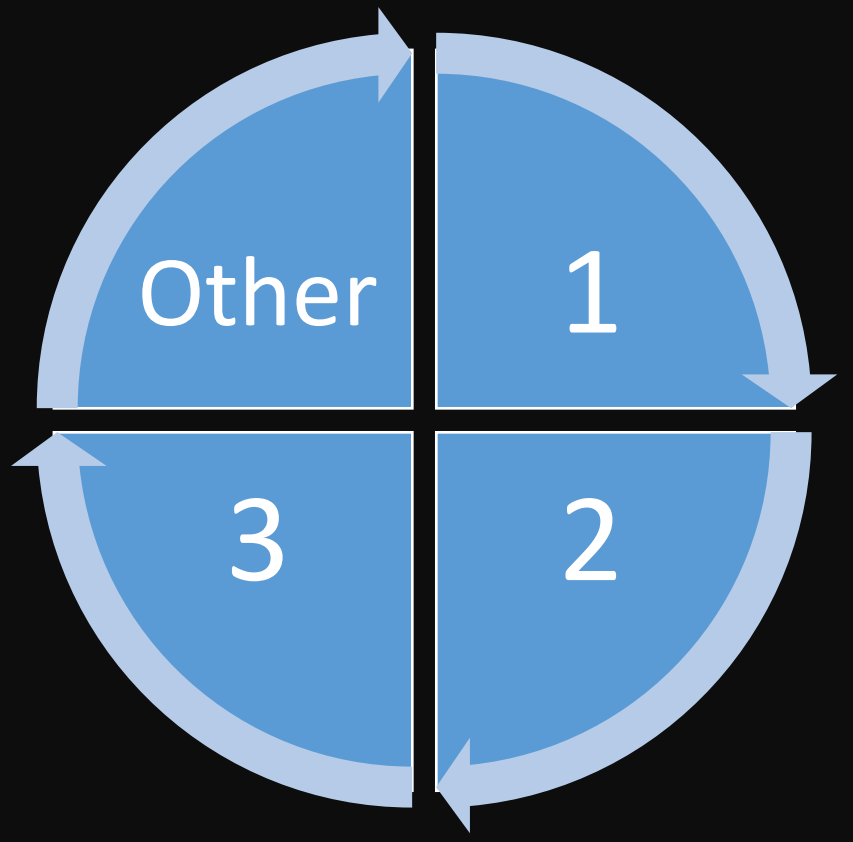
Rotation of modes of action is necessary



Rotation is necessary



Rotation is necessary



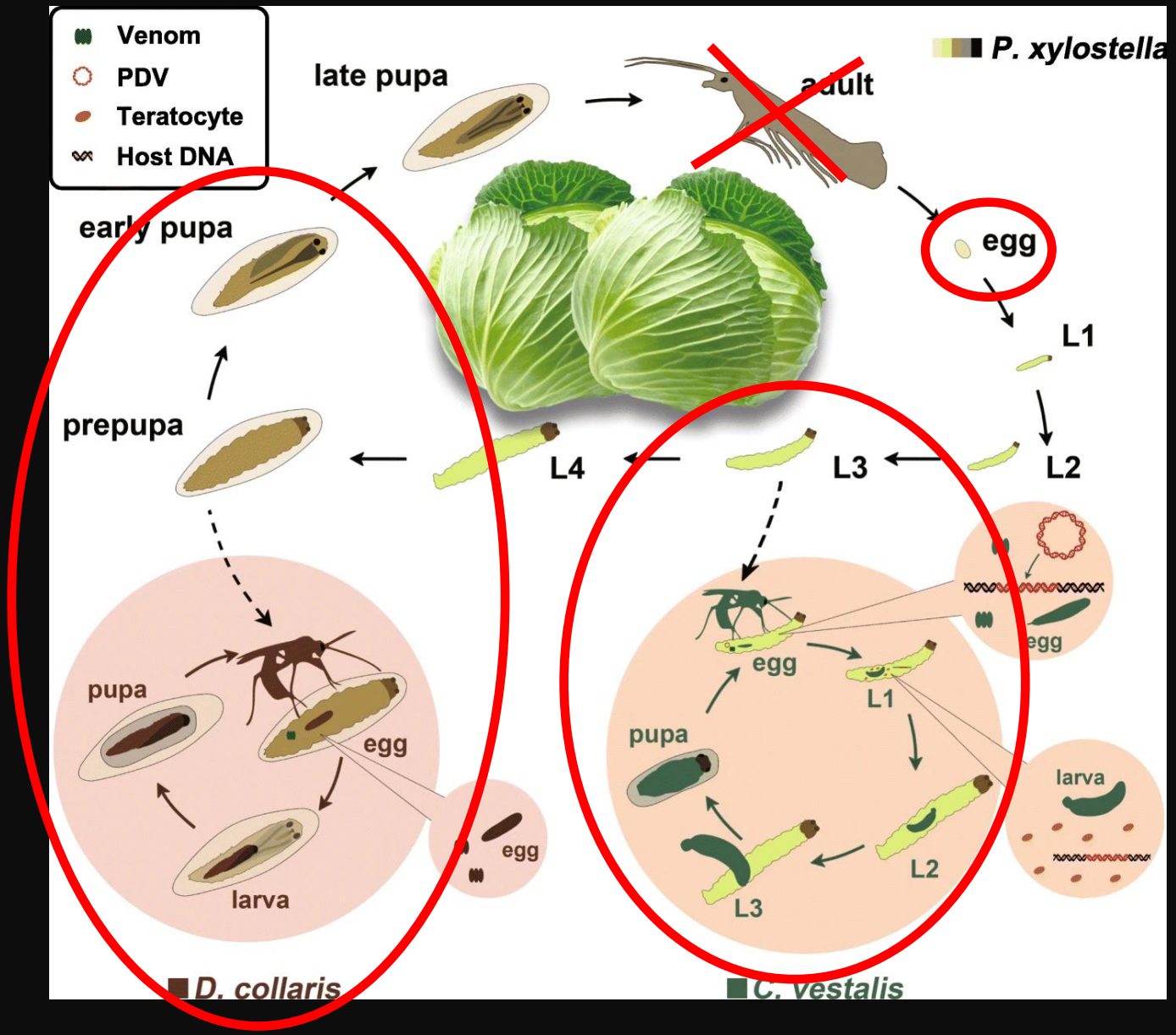
What about biological control?

Diadegma insulare – parasitoid wasp

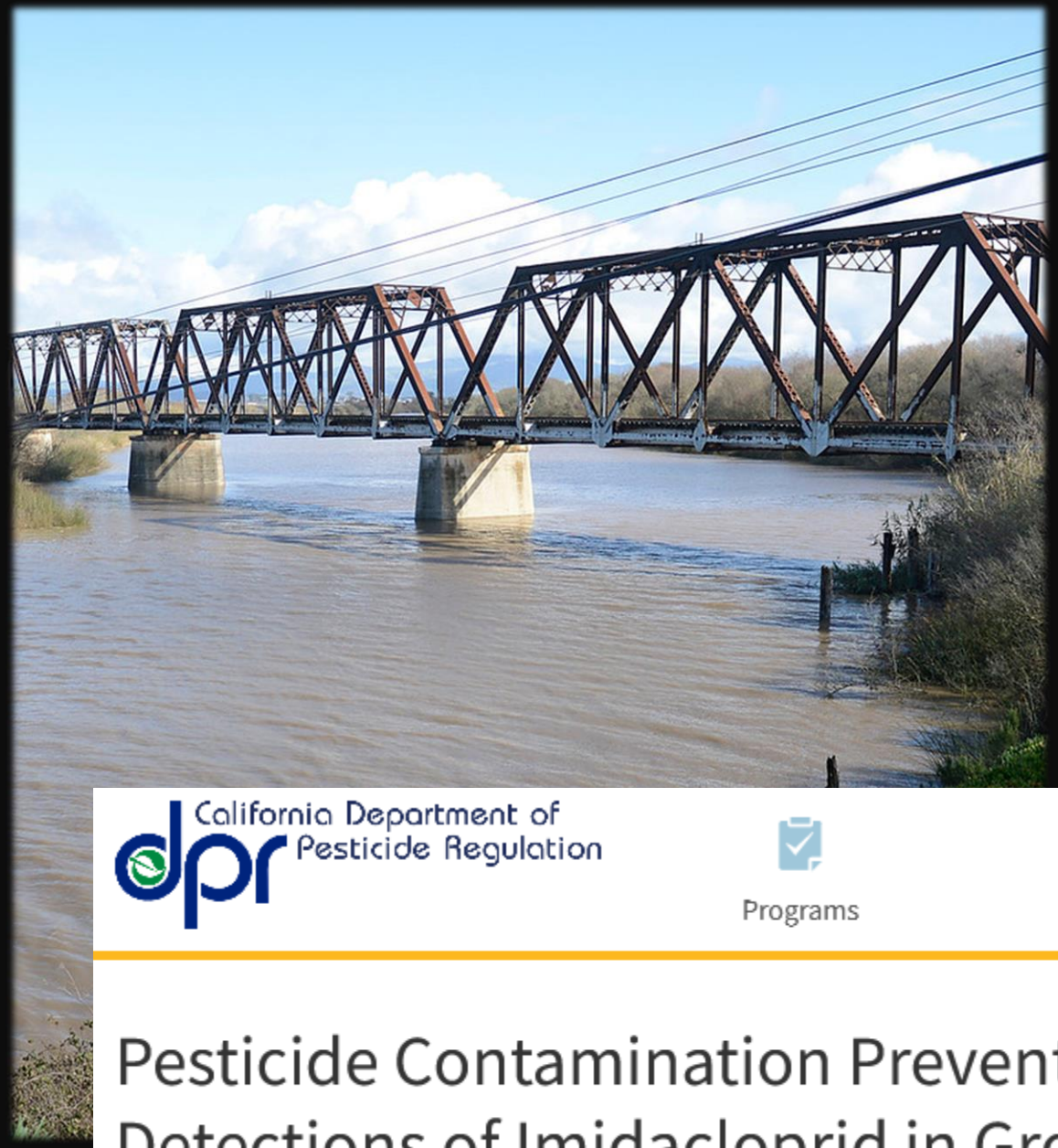
- Key natural enemy
- Native, present in CA
- Readily parasitizes DBM larvae
- Can suppress DBM populations

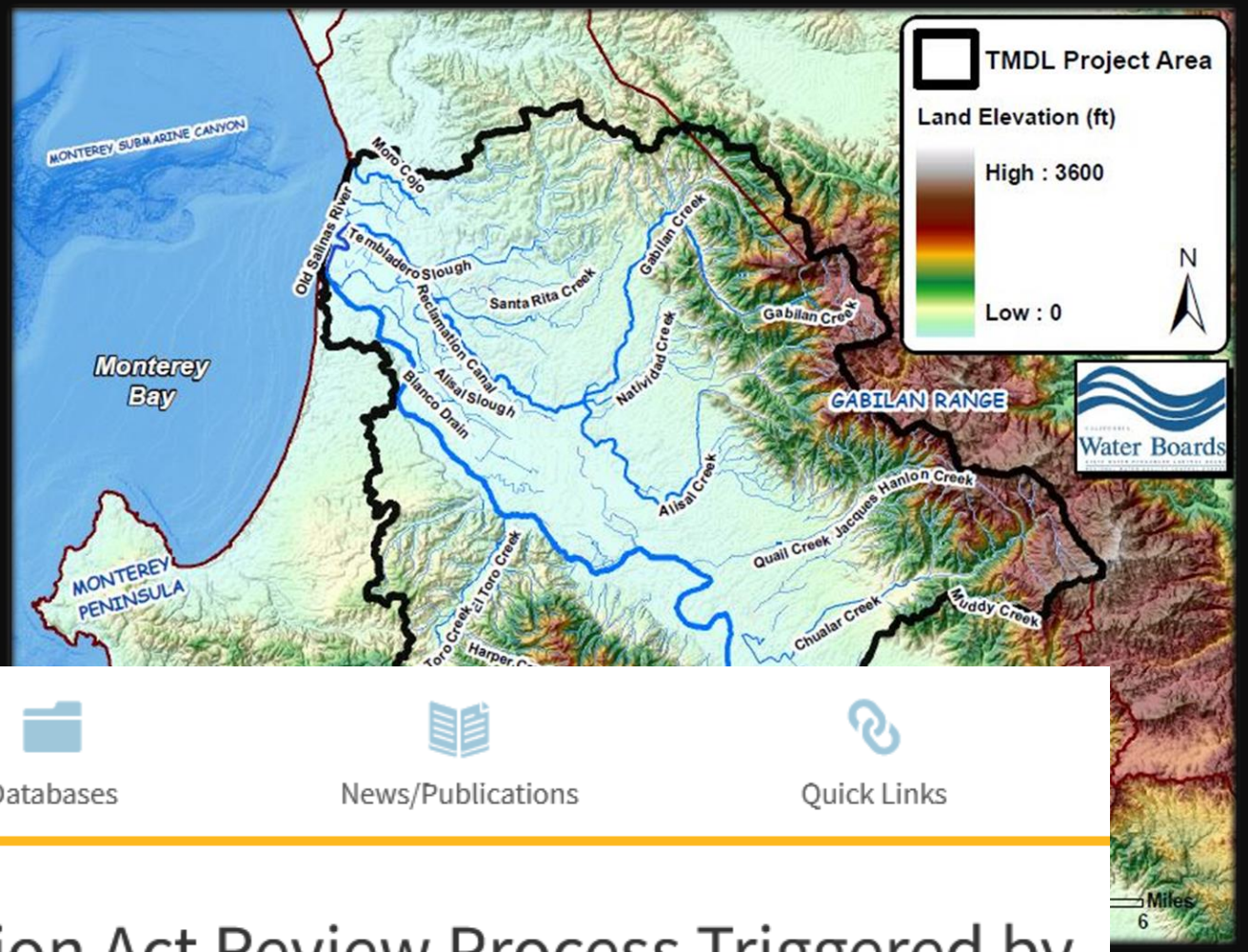
Types of DBM parasitoids

- 150+ of hymenopteran parasitoids recorded in the world.
- Egg: Trichogramma parasitoids
- Larval parasitoid: *Diadegma semiclausum*
- Pupal parasitoid: *Diadromus collaris*



The life history of *C. vestalis* and *D. collaris*. *C. vestalis* preferentially parasitizes second and third instar *P. xylostella* larvae (L2 and L3); and *D. collaris* parasitizes pupal stage hosts. Shi et al. 2019.





California Department of Pesticide Regulation

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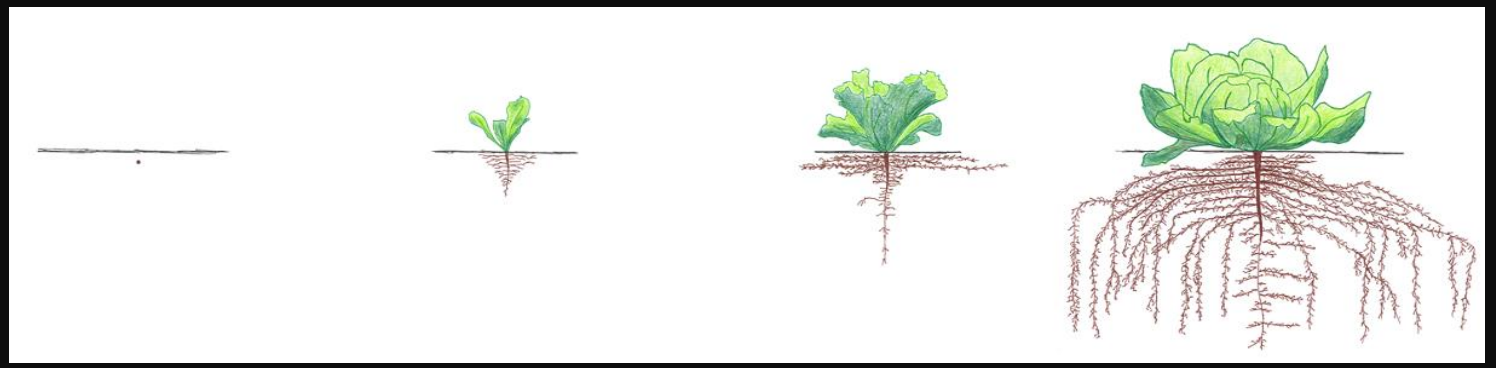
Pesticide Contamination Prevention Act Review Process Triggered by Detections of Imidacloprid in Groundwater



At-planting

- Untreated
- Seed slot application of imidacloprid
- Clothianidin seed-treatment
- Seed slot application of biologicals (*Beauveria* + *Trichoderma*)

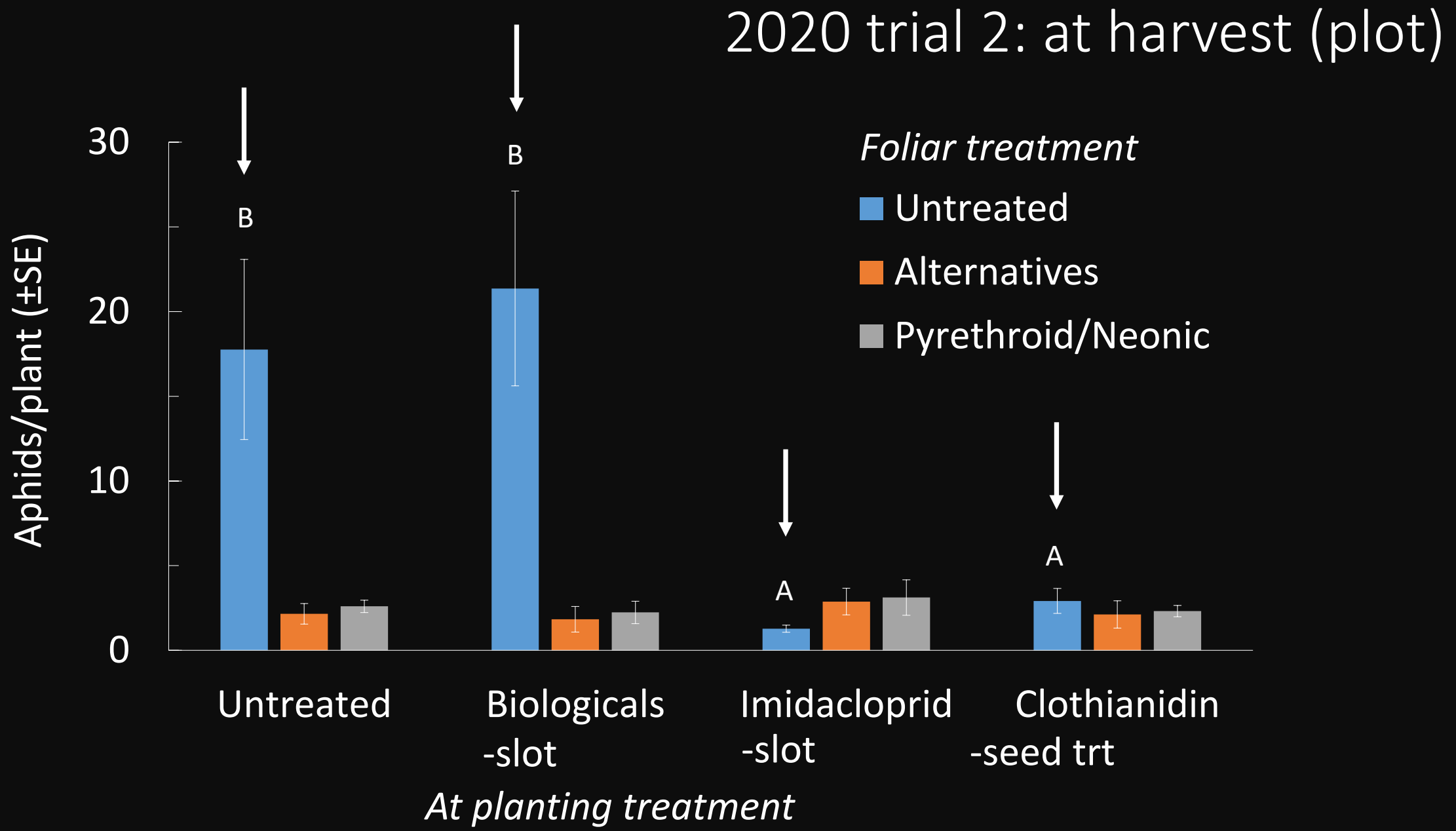
Foliar

- Untreated
- Pyrethroids + Neonicotinoids
- Alternatives

Thiamethoxam+ lambda-cyhalothrin	Zeta-cypermethrin+ imidacloprid	Thiamethoxam+ lambda-cyhalothrin

Sulfoxaflor	Spirotetramat	Flonicamid

2020 trial 2: at harvest (plot)



Addie's projects:

New tools for IPM of thrips and aphids in lettuce

How it started: Broadcast sprayer

Where it’s going: Mantis precision sprayer

mantis
ag technology

Mantis sprayer experiments

Organic insecticides for aphid and thrips control


2 trials

4 products tested

2 application systems

Conventional insecticide for aphid control

1 trial

2 products tested

2 application systems

Conventional insecticide for thrips control

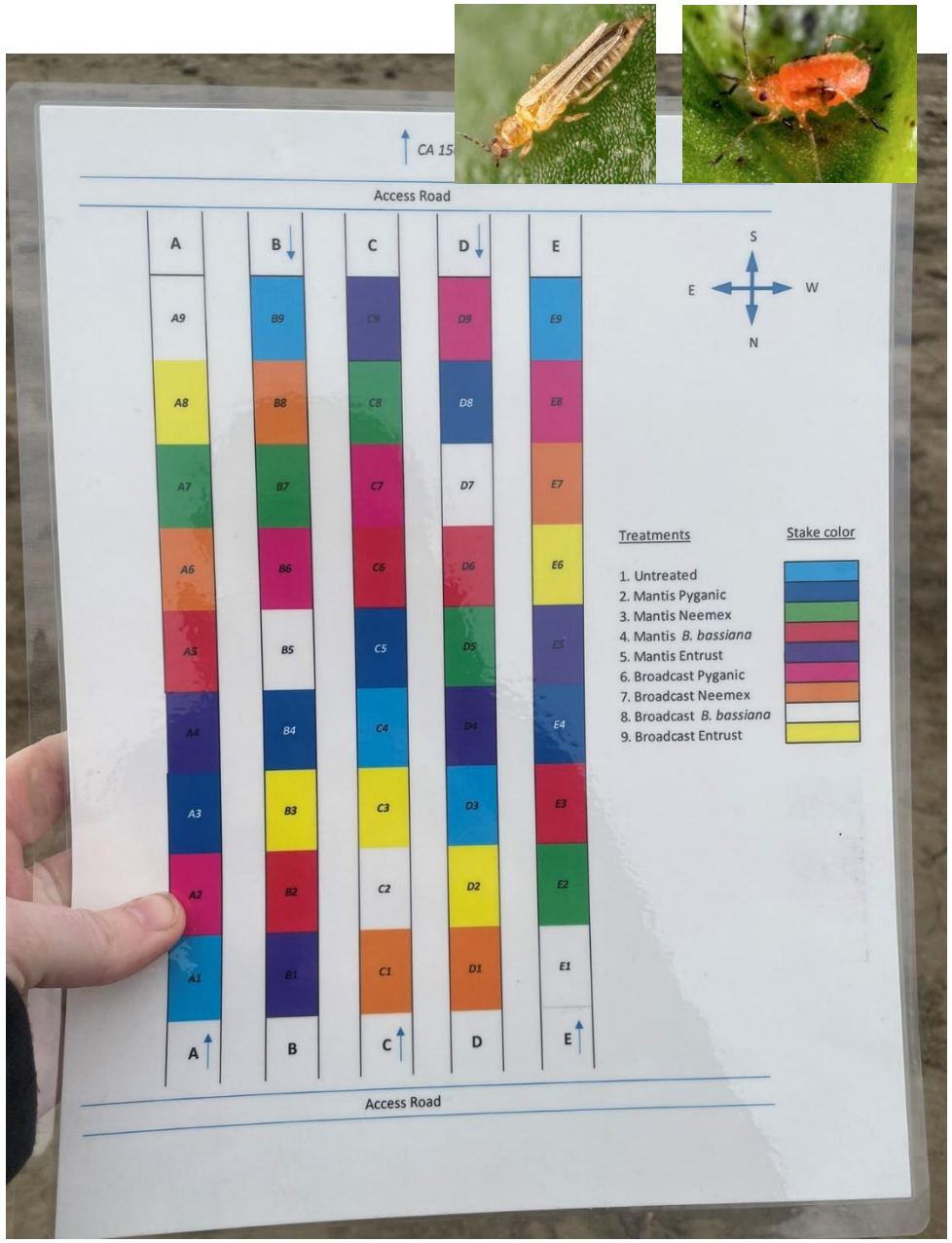
1 trial

1 product tested

2 application systems

Mantis with organic insecticides

- Organic romaine lettuce
- Two trials at different sites
- 2 applications
  - Manual thinning stage
  - 7-10 days after spray 1
- 4 products tested with both systems
  - Pyganic (pyrethrin)
  - Entrust (spinosad)
  - Neemex (azadirachtin)
  - Mycotrol ESO (B. bassiana)
- All products applied at per acre label max



Mantis with organic insecticides

Application 1 : Manual thinning stage

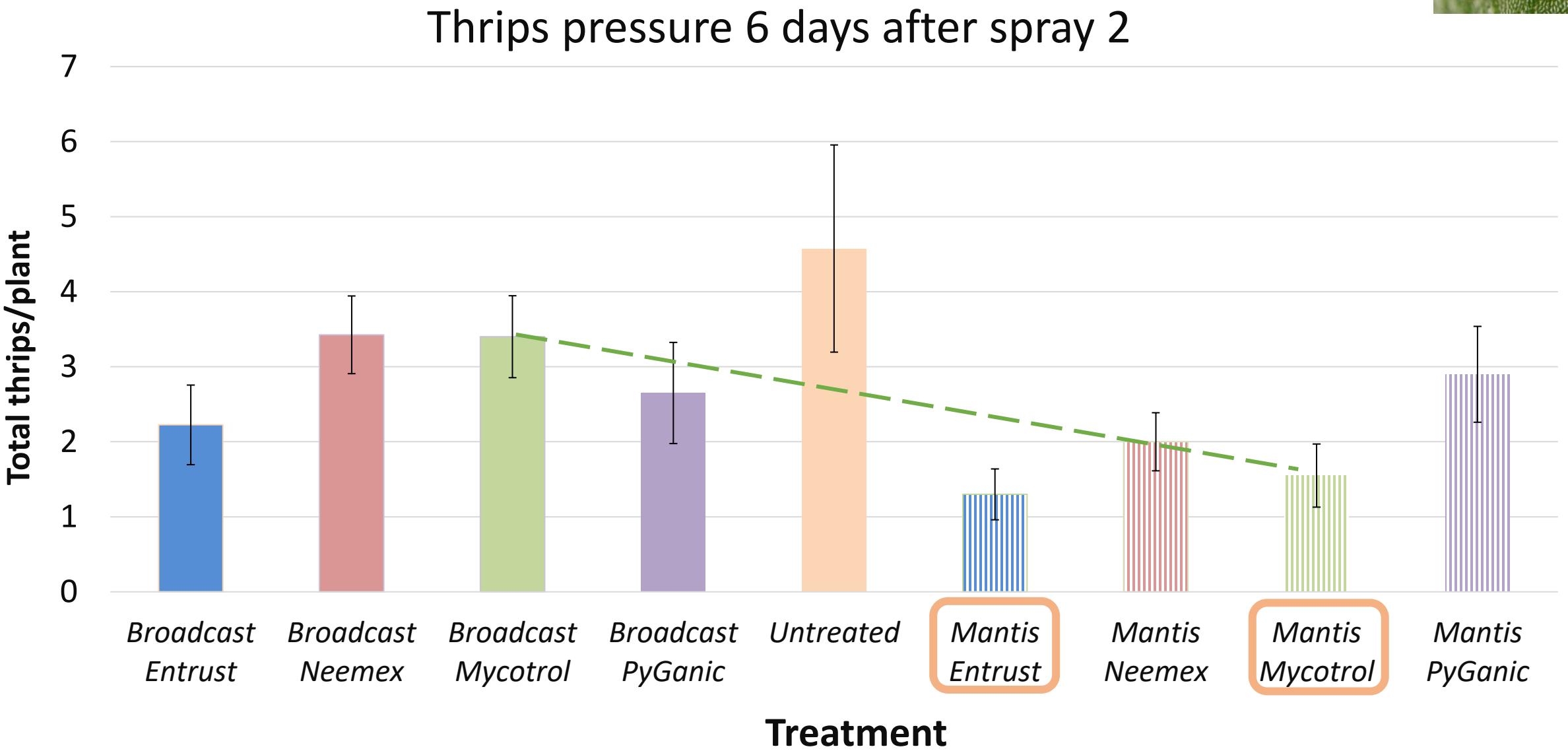
Application 2 : 7-10 days later

Mantis with organic insecticides

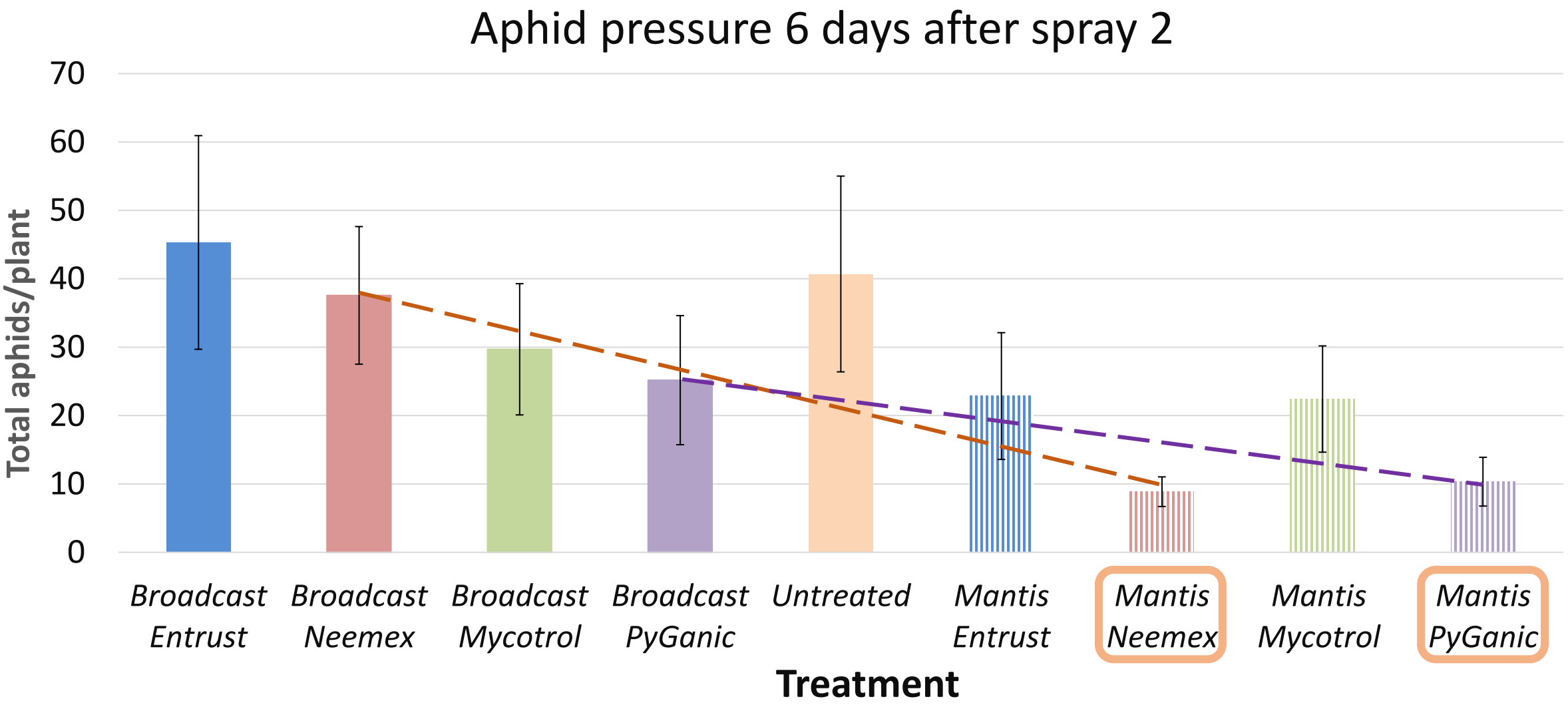
Sampling <24 hrs prior to and 6 days after each spray

Pre-harvest evaluation of INSV incidence

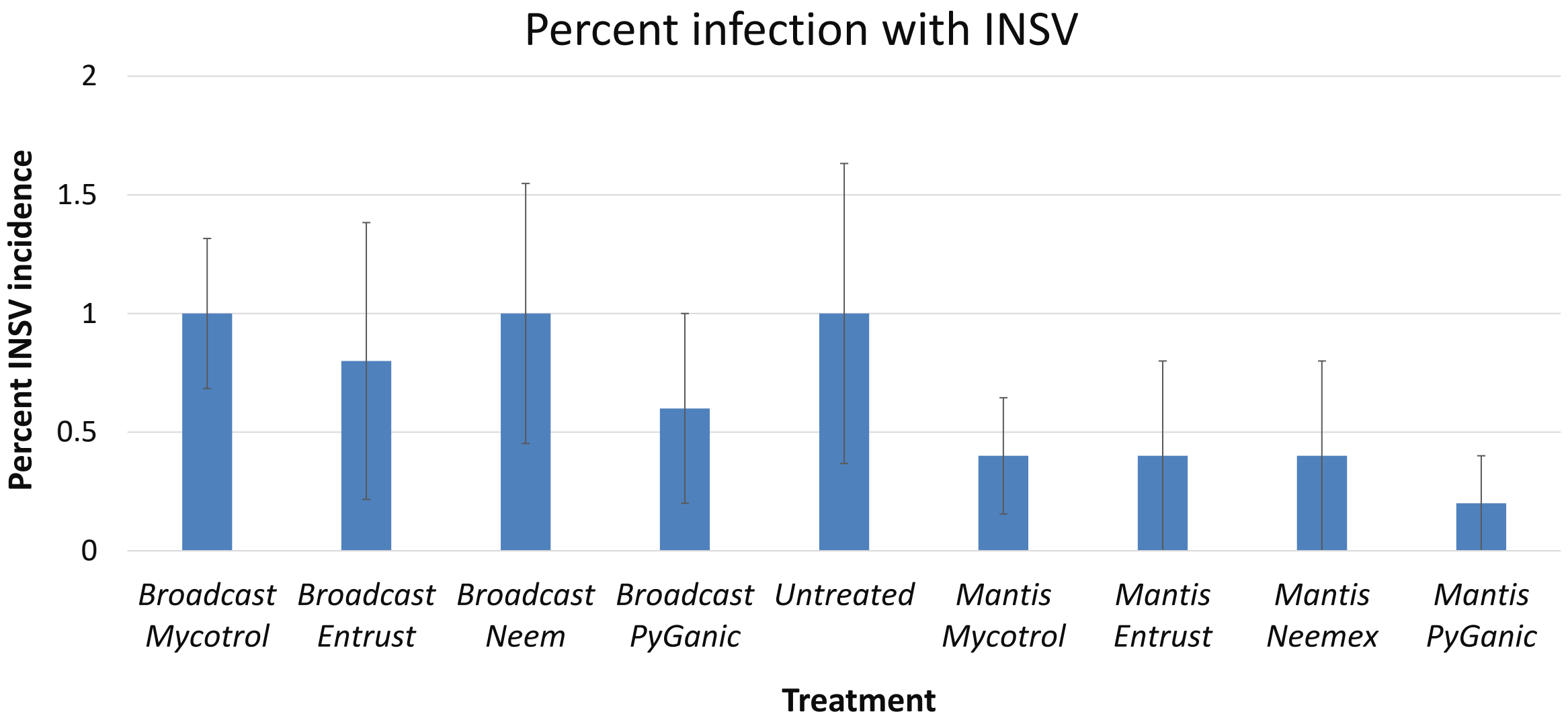
Preliminary results: Thrips



Preliminary results: Aphids



Preliminary results: INSV incidence



Aphid-targeted insecticide experiment

1 trial

- Conventional romaine lettuce
- Experiment replicated 5 times at each site
- 2 products
  Spirotetramat
  Thiamethoxam
- 2 application systems
- 3 rates
  - Max label rate
  - 1/3 label rate
  - 1/10 label rate
- Lettuce sampled <24 before and 7 days after each application

Thrips-targeted insecticide experiment

1 trial

- Conventional head lettuce
- Experiment replicated 5 times at each site
- Radiant (spinetoram)
- 2 sprays
  - Automated thinning stage
  - Manual thinning stage
- Lettuce sampled <24 prior to each application and 3 and 7 days after each application
- Evaluation <7 days before harvest (10/25, last week!) to determine INSV and sclerotinia incidence

Inundative releases of natural enemies using drones to control aphids and thrips in lettuce

Rotating cylinders with evenly spaced holes distribute predators at a consistent rate

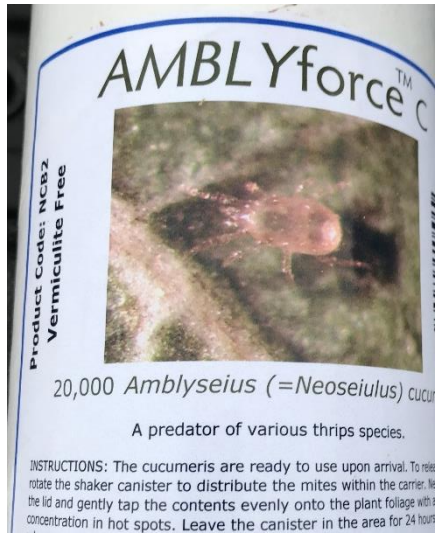
PARABUG


PARABUG

Drone release experiment


1 trial

- Organic romaine lettuce 4 weeks post-planting
- 2 predatory species released
  - Predatory mites (*Neoseiulus cucumeris*) ***125,000/ac***
  - Green lacewing (*Chrysoperla rufilabris*) ***20,000/ac***
- 3 releases spaced a week apart
- 1 insecticide spray 24 hrs after week 2 release
- Sampling <24 hrs before and 6 days after every release



Questions?

Special thanks to:

- *Daniel Hasegawa and crew*
- *Frank Heffren, Green Valley Farms/Pinnacle Spray and Mantis Ag Technology*
- *Parabug and Jaclyn and Chandler Bennett*
- *Juan Ramirez, Adrian Garcia, Eric Morgan and Braga Fresh*
- *Grettenberger lab assistants*
- *CA Leafy Greens Research Board*
- *CA Department of Pesticide Regulation research grants program - Funding for this project has been provided in full or in part through a Grant awarded by the Department of Pesticide Regulation*

mantis ag technolo_ _

PARABUG

braga FRESH FAMILY GROWN SINCE 1928

cdfa

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