
An aerial photograph of a large agricultural field, likely a lettuce field, with rows of crops stretching towards the horizon. In the background, there are rolling hills and mountains under a clear sky. A semi-transparent black rectangular box is overlaid on the center of the image, containing white text.

*Management of insect pests in lettuce  
and cole crops - research update*

Ian Grettenberger, Cooperative Extension Specialist

*UC Davis Dept. of Entomology & Nematology/  
UC Cooperative Extension*



*Daniel Hasegawa, Eric Brennan, Danny Karp, Dylan Beal*

*Erika Bueno, Caroline Donohew, Anna DiPaola, Briley Mullin*







# Thrips populations and thrips INSV infection in nurseries





as 1st Free  
aptist Church

Th  
of

Highlighting agricultural developments, problems, research, & issues for central coast CA

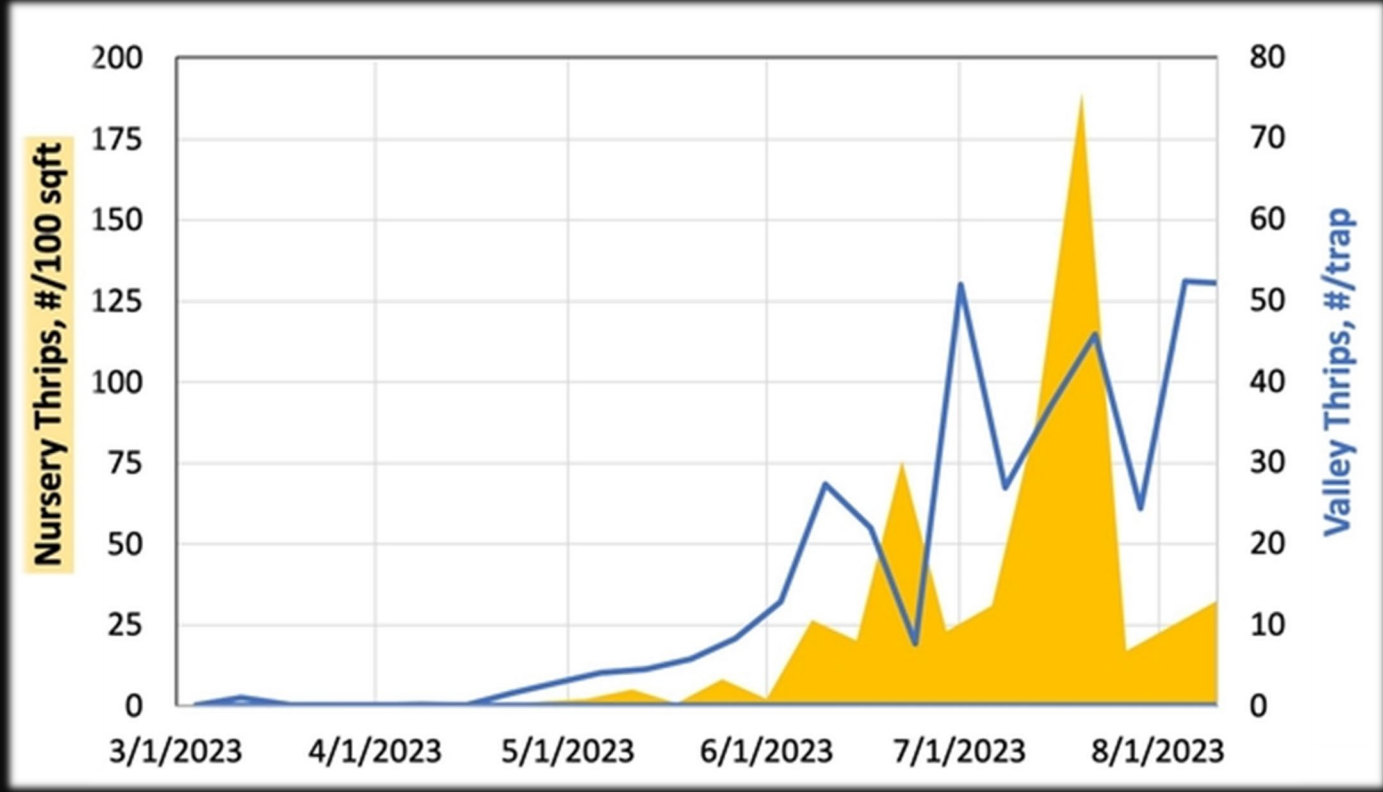
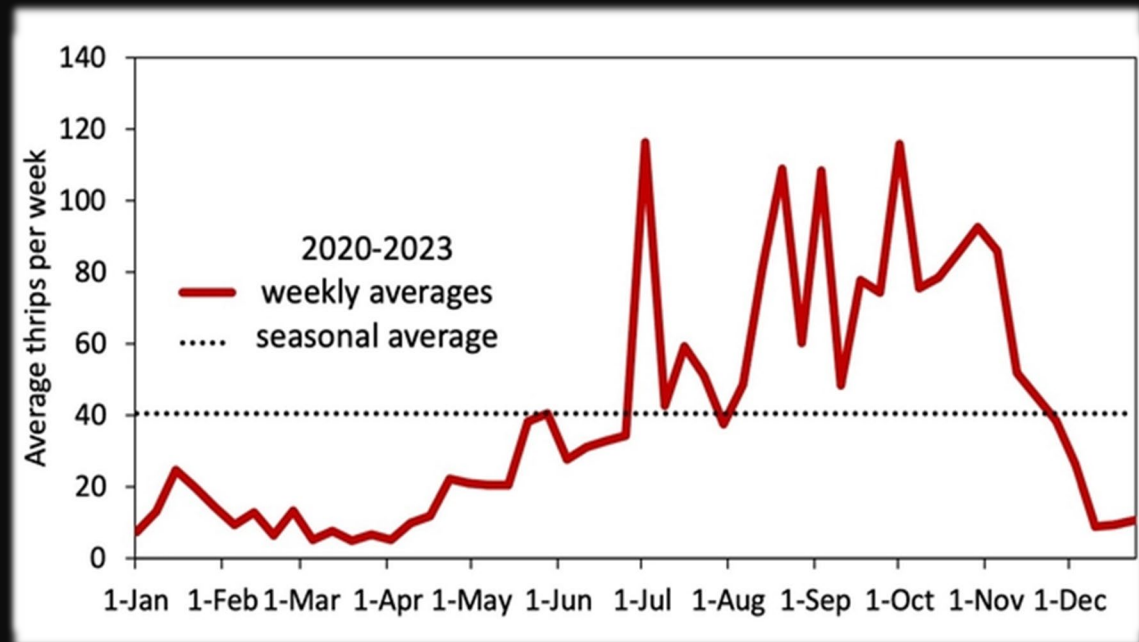
## Research Update: Sampling for INSV+ thrips in vegetable transplants

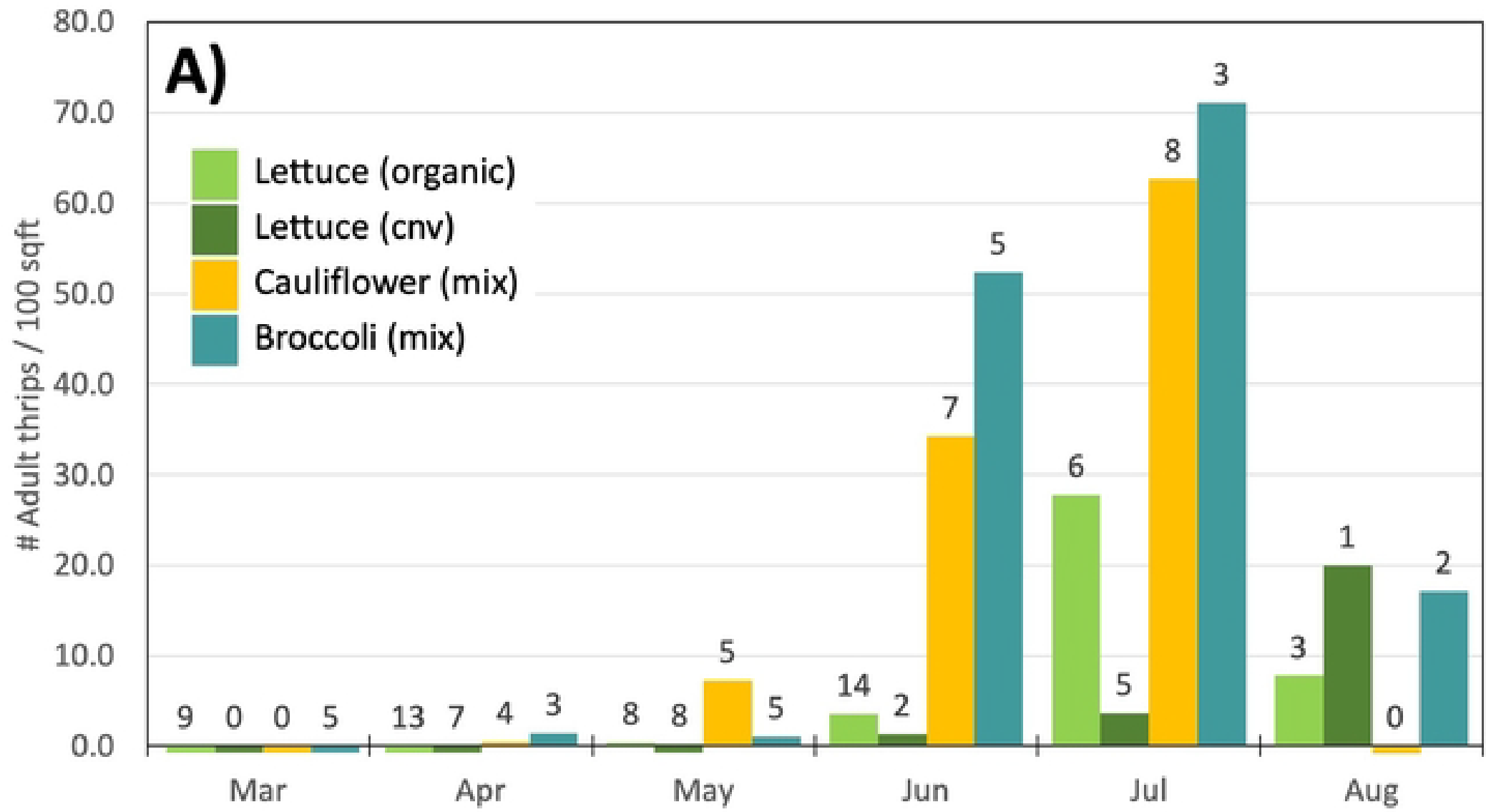


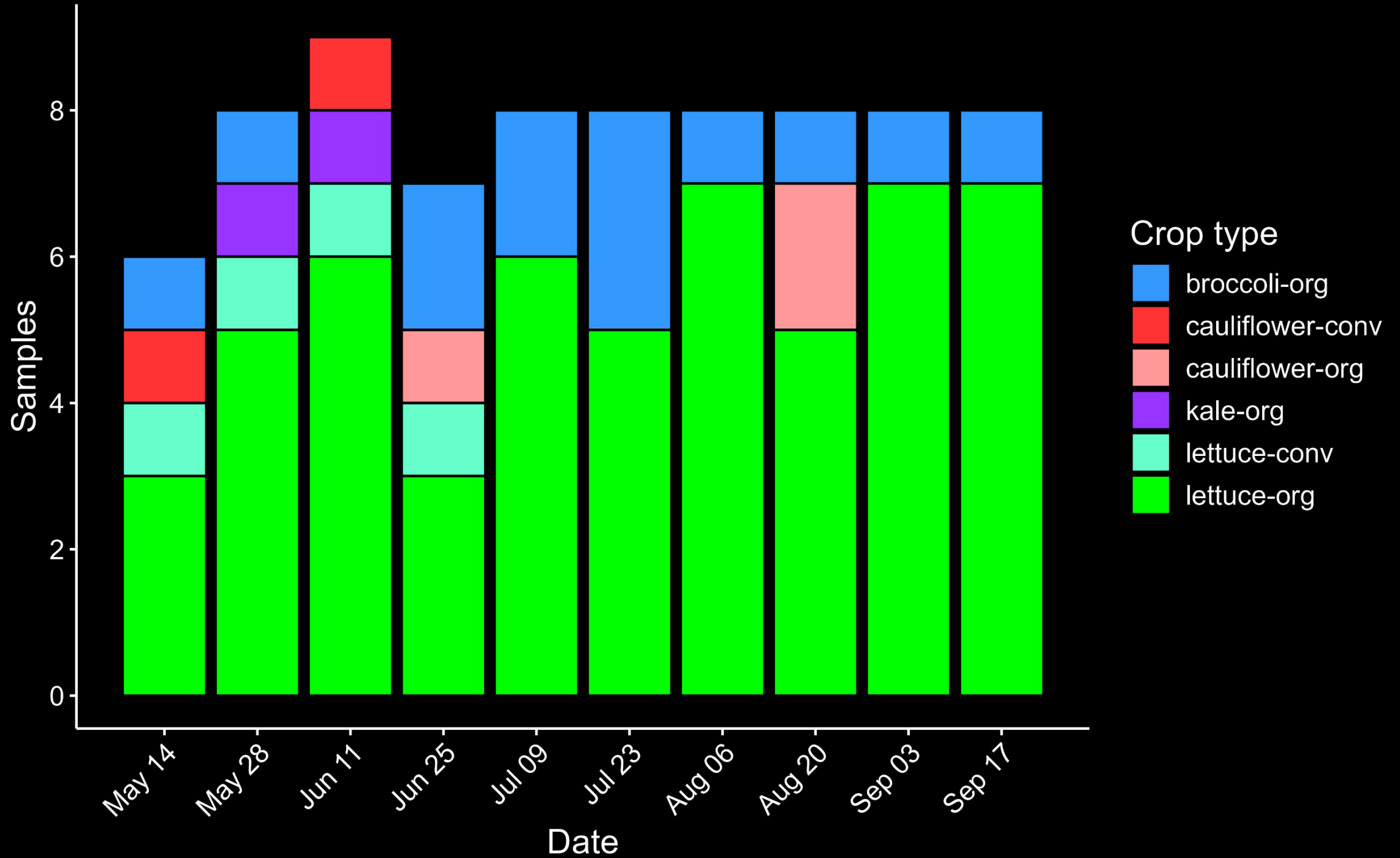
Author: Kirsten Ann Pearsons

Published on: October 10, 2023









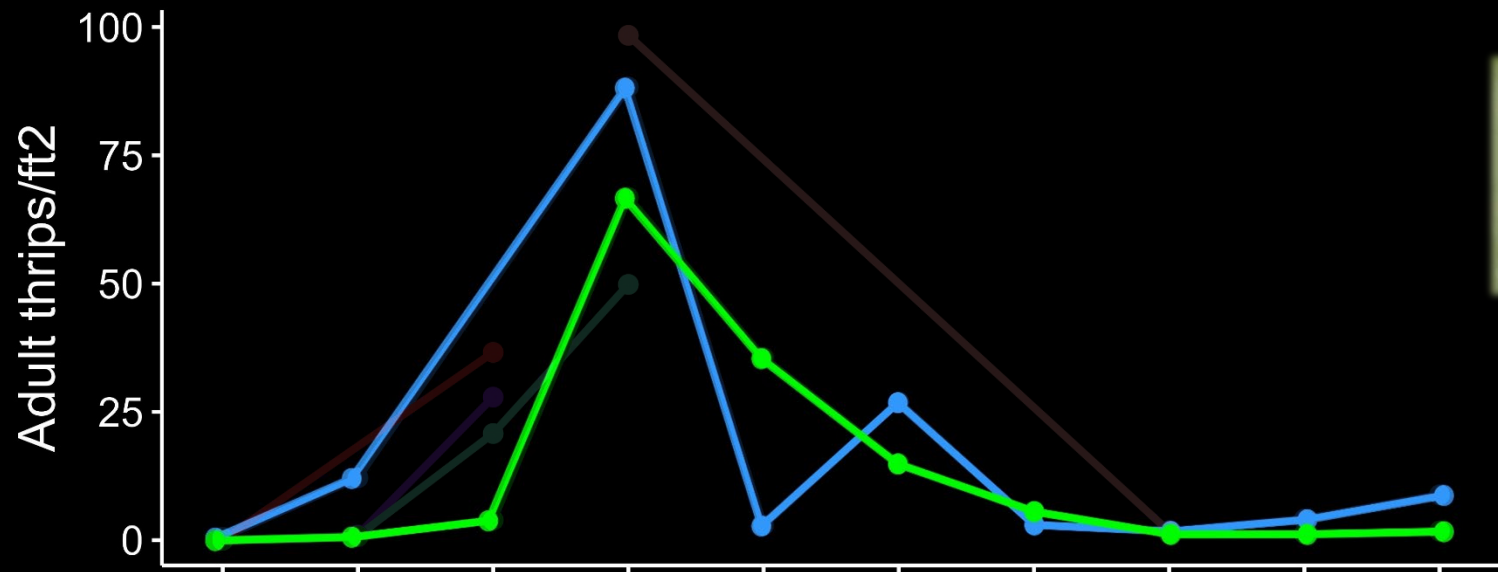




88,450  
**60,138**

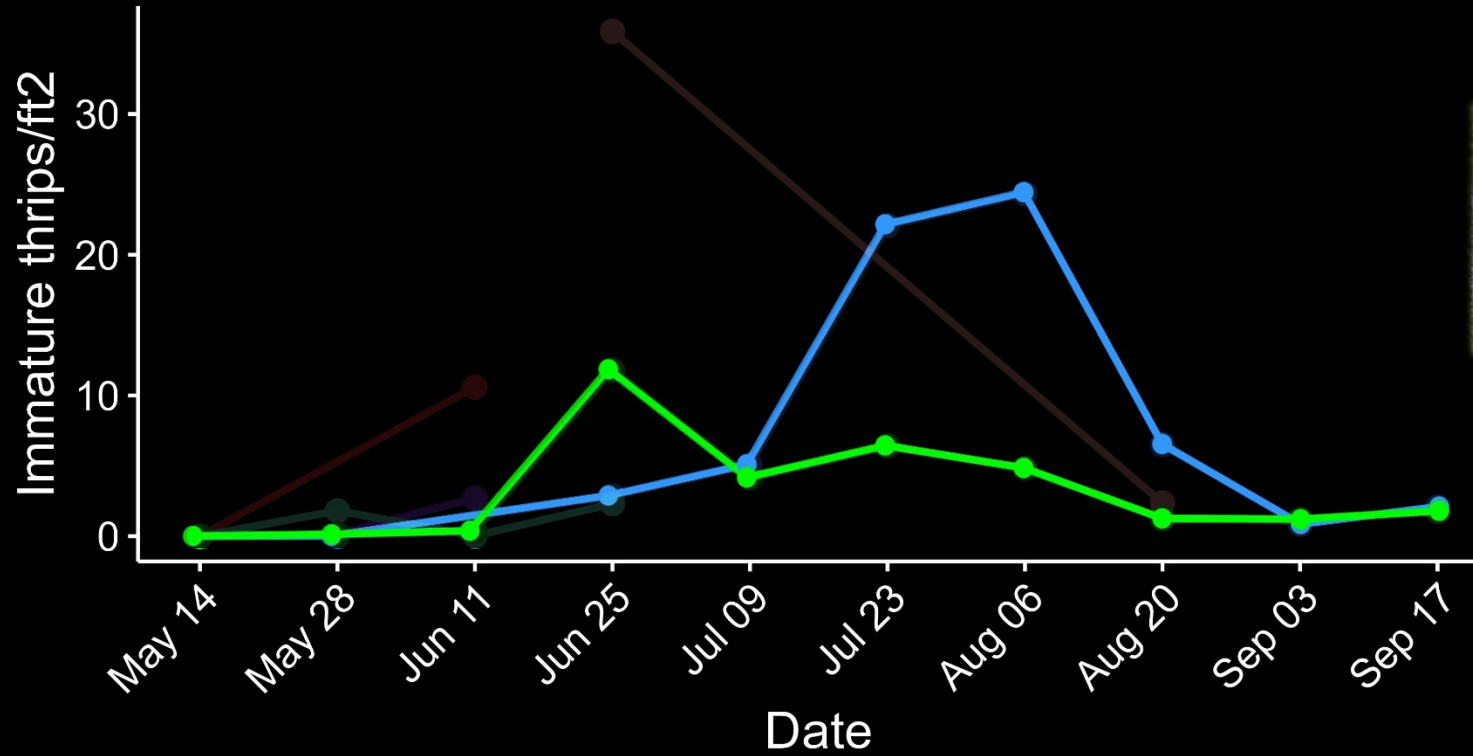


26,426  
**23,649**

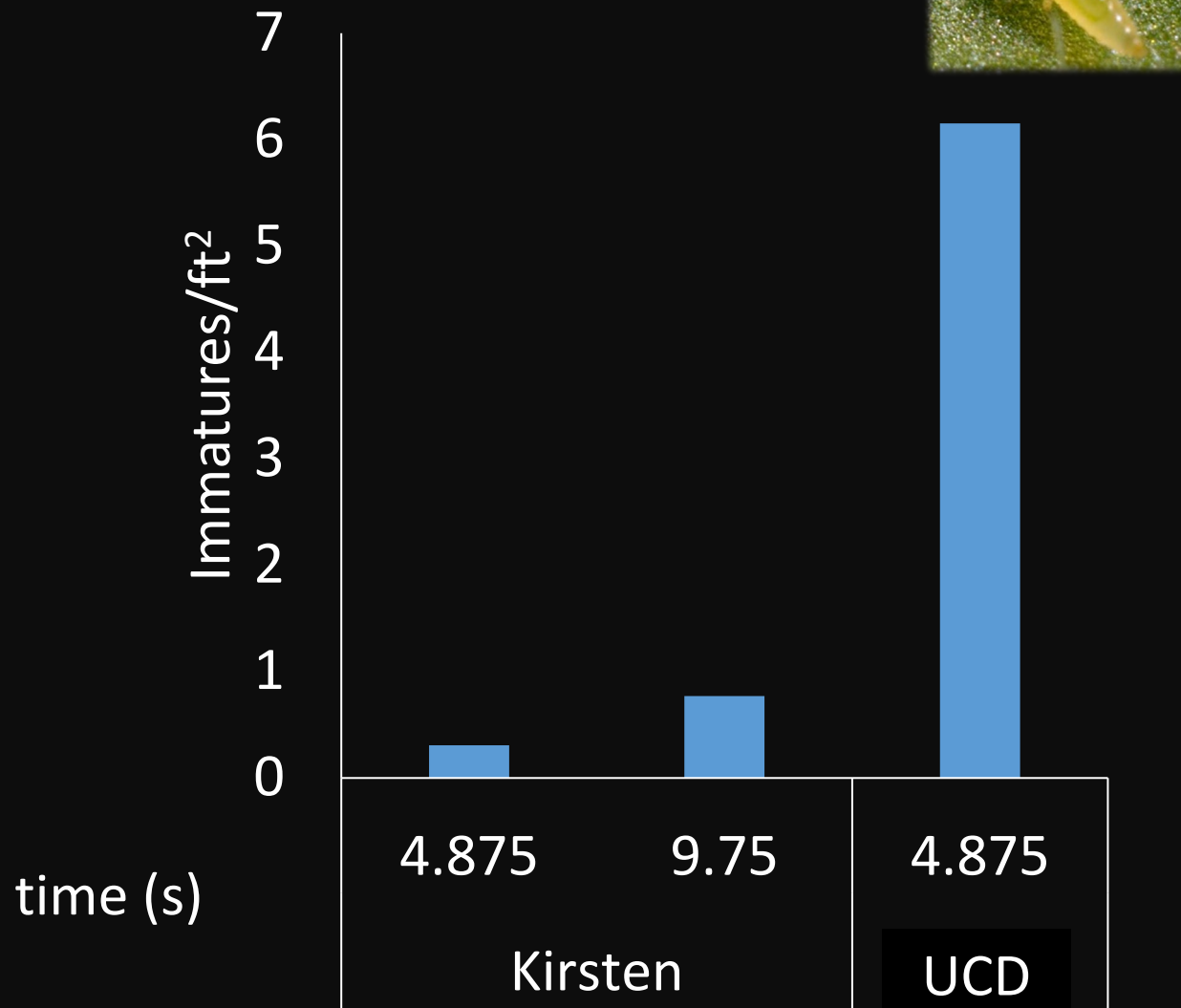
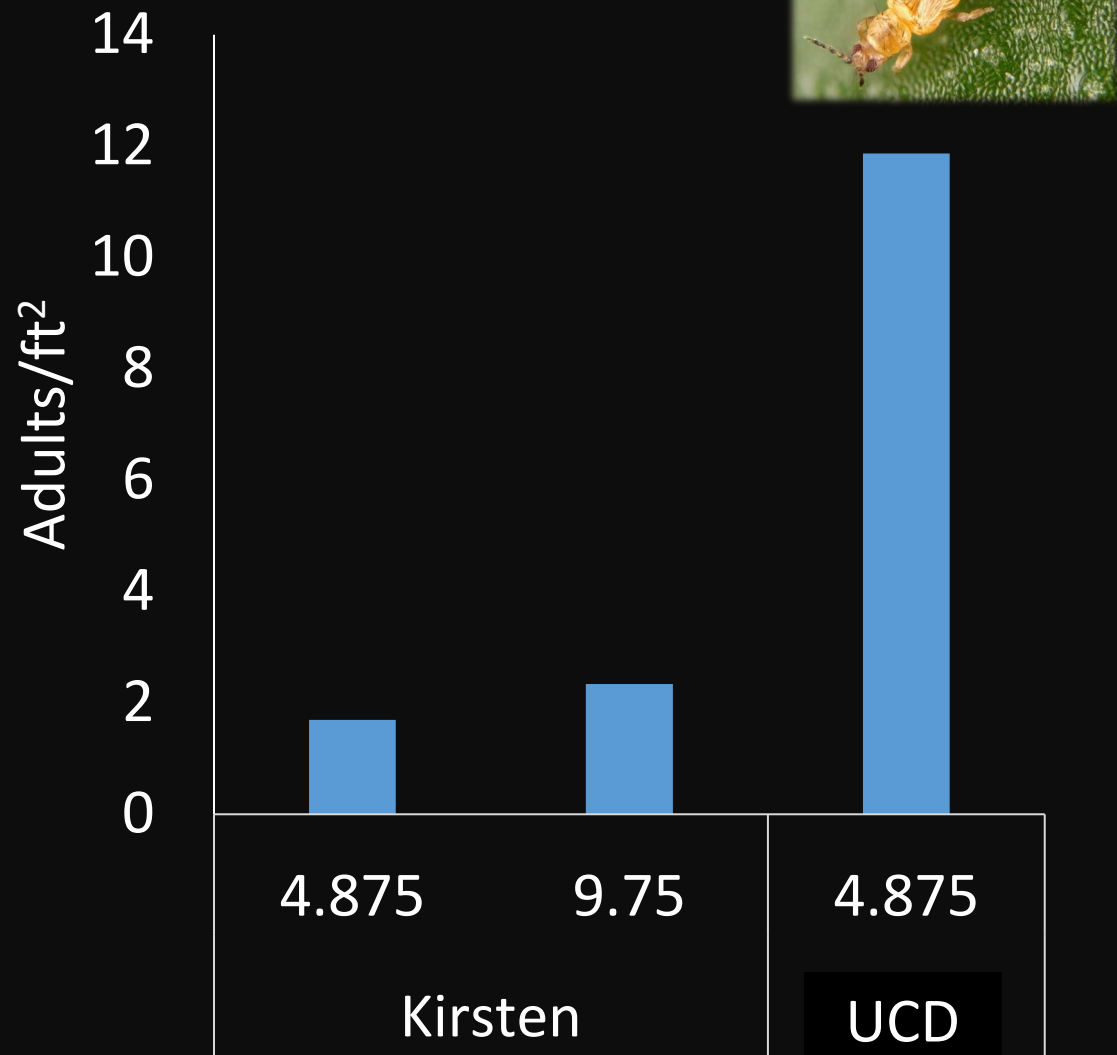


Crop type

● broccoli-org



● lettuce-org



# INSV/thrips species testing

- **Little INSV**

- 5/122 samples – 4.1% - group testing

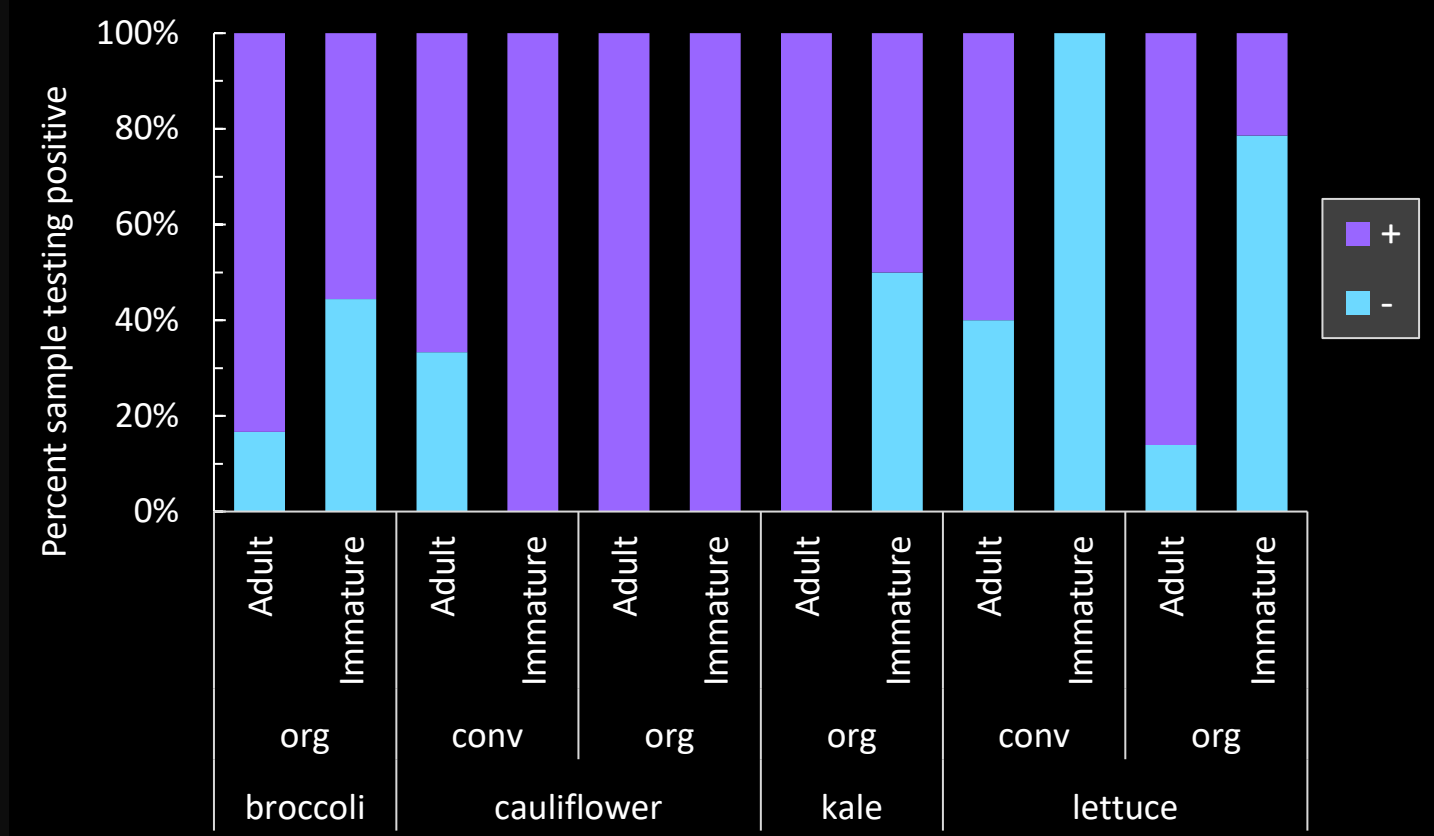
- Wester flower thrips in all samples

- Onion thrips present

- Negative on TSWV



Sub-samples with onion thrips





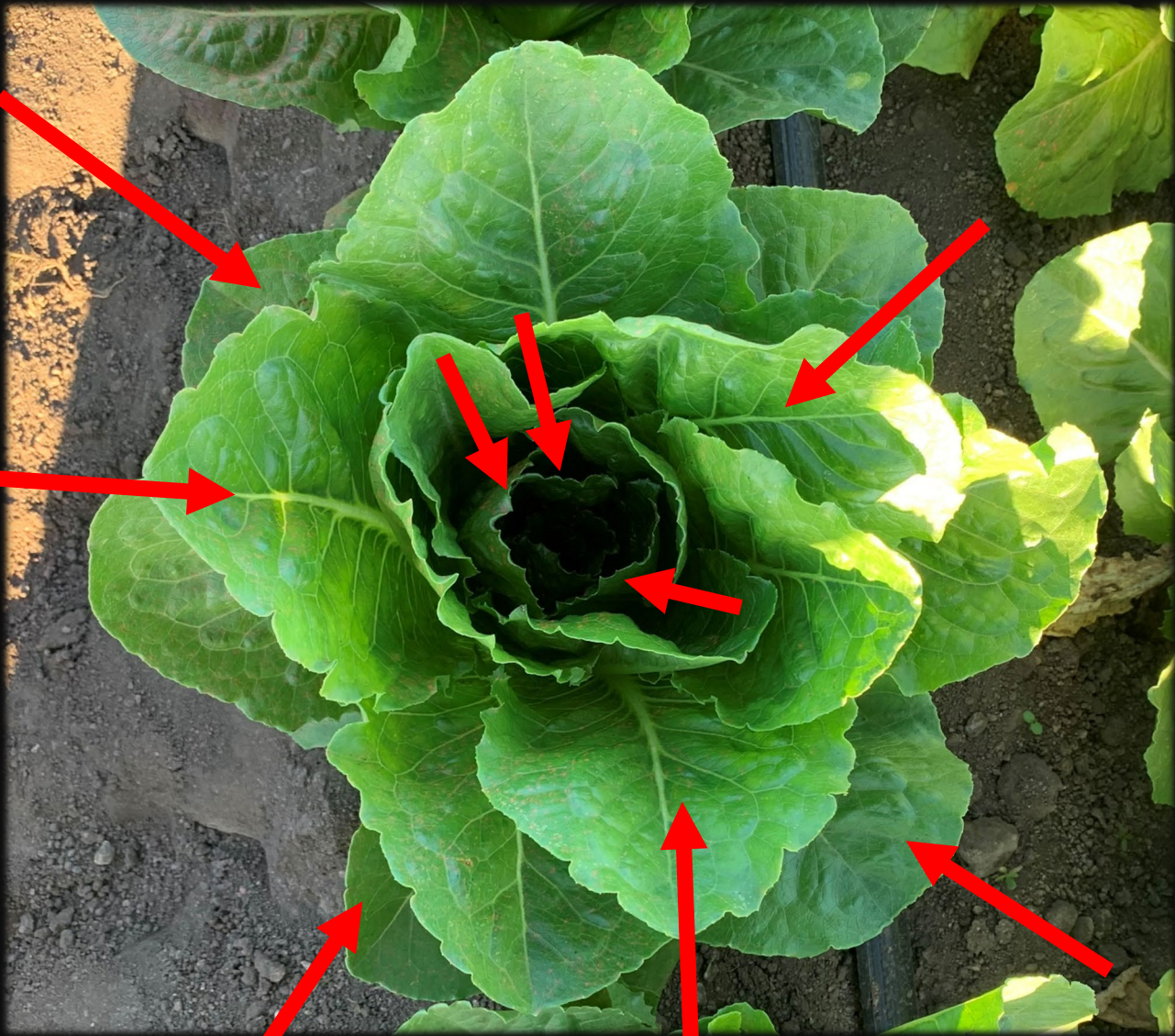


Coverage:

Adjuvant × Volume × Leaf location

- 3 Adjuvants
  - Embrece-EA (16 oz/100gal)
  - SYL-COAT (8 oz/100gal)
  - ~~Dyne-Amic (16 oz/100gal)~~
- 2 Volumes
  - 60 GPA
  - 90 GPA
- 2 time points





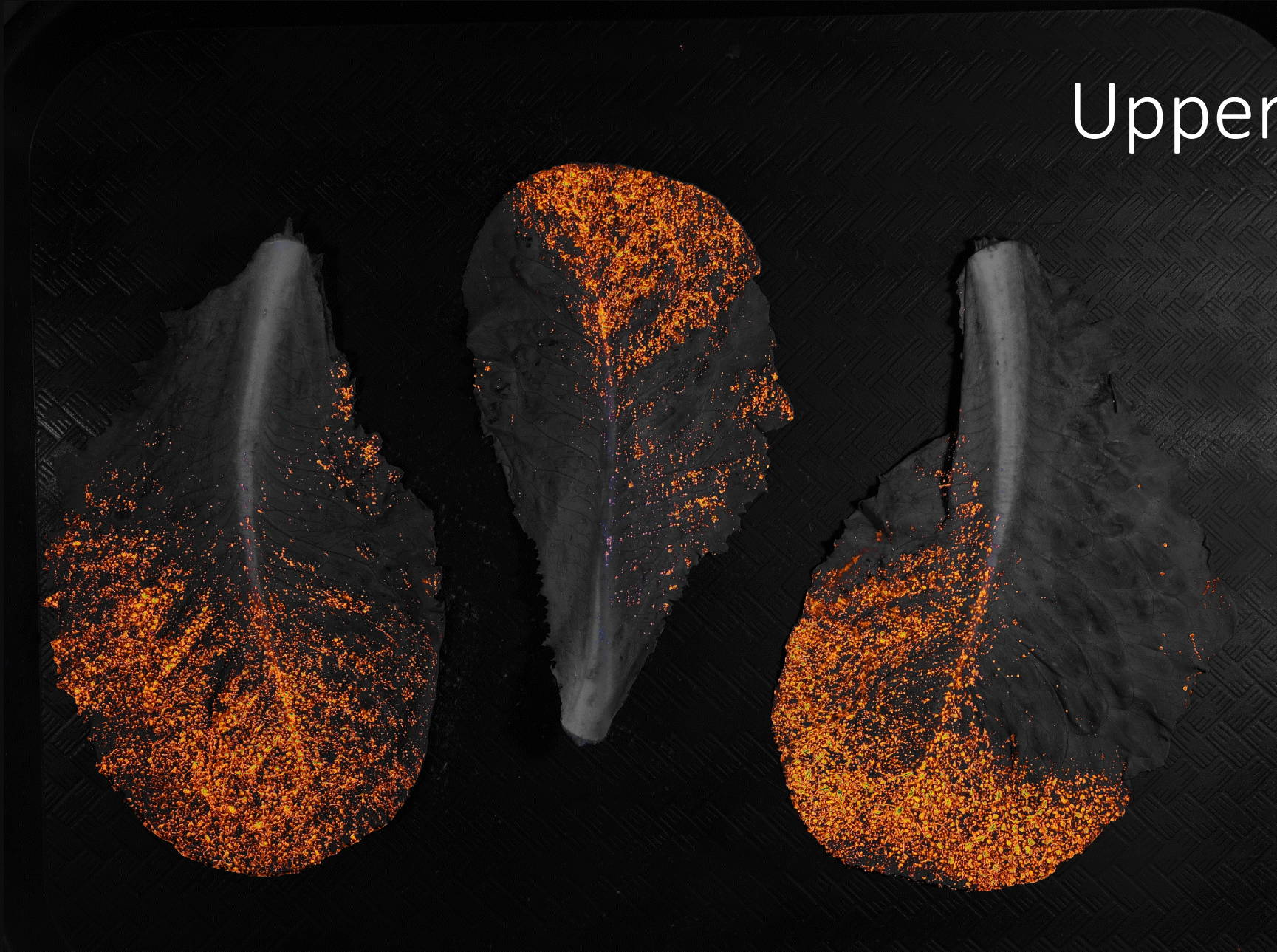
Outer

Middle

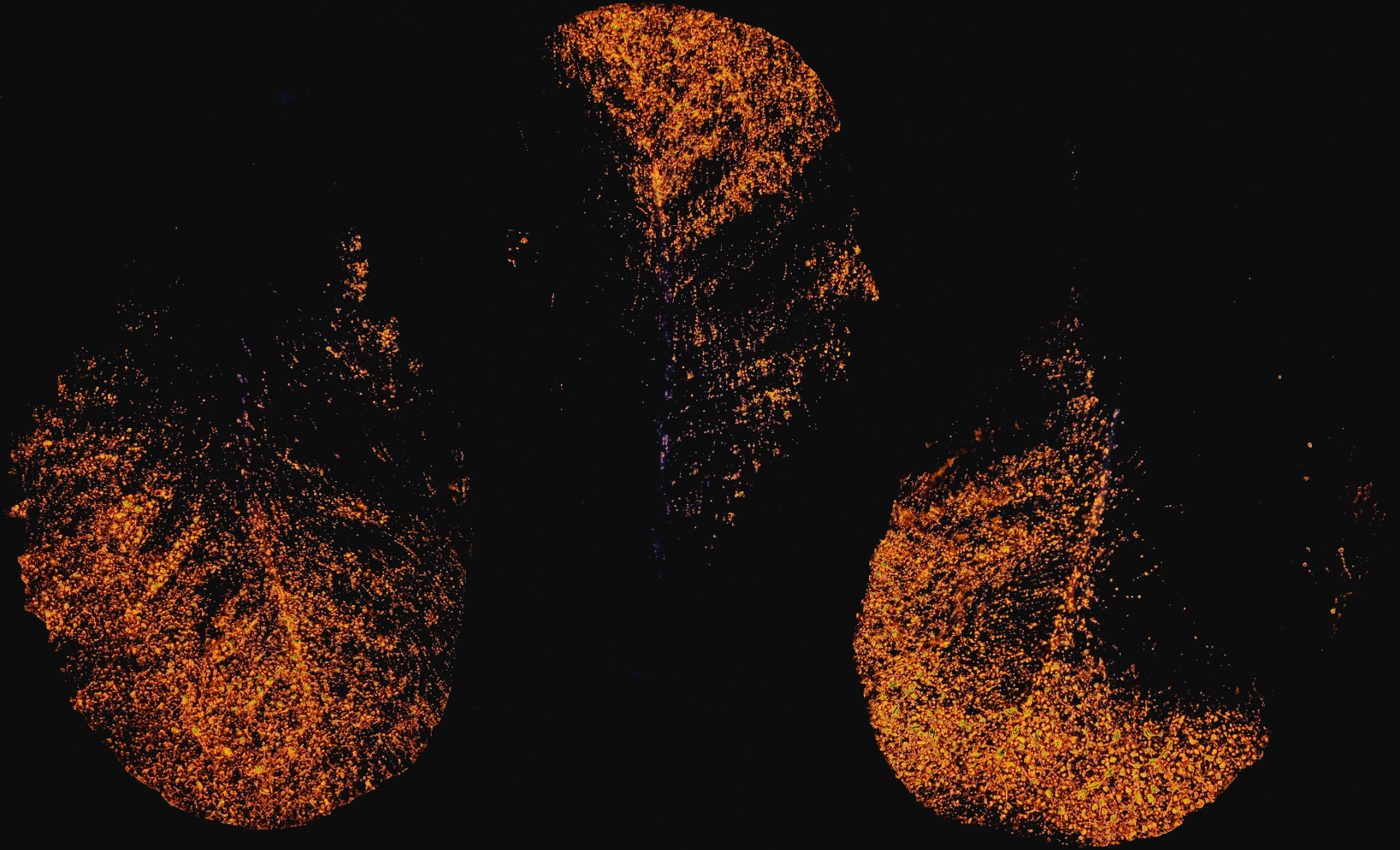
Inner



Outer  
Upper surface

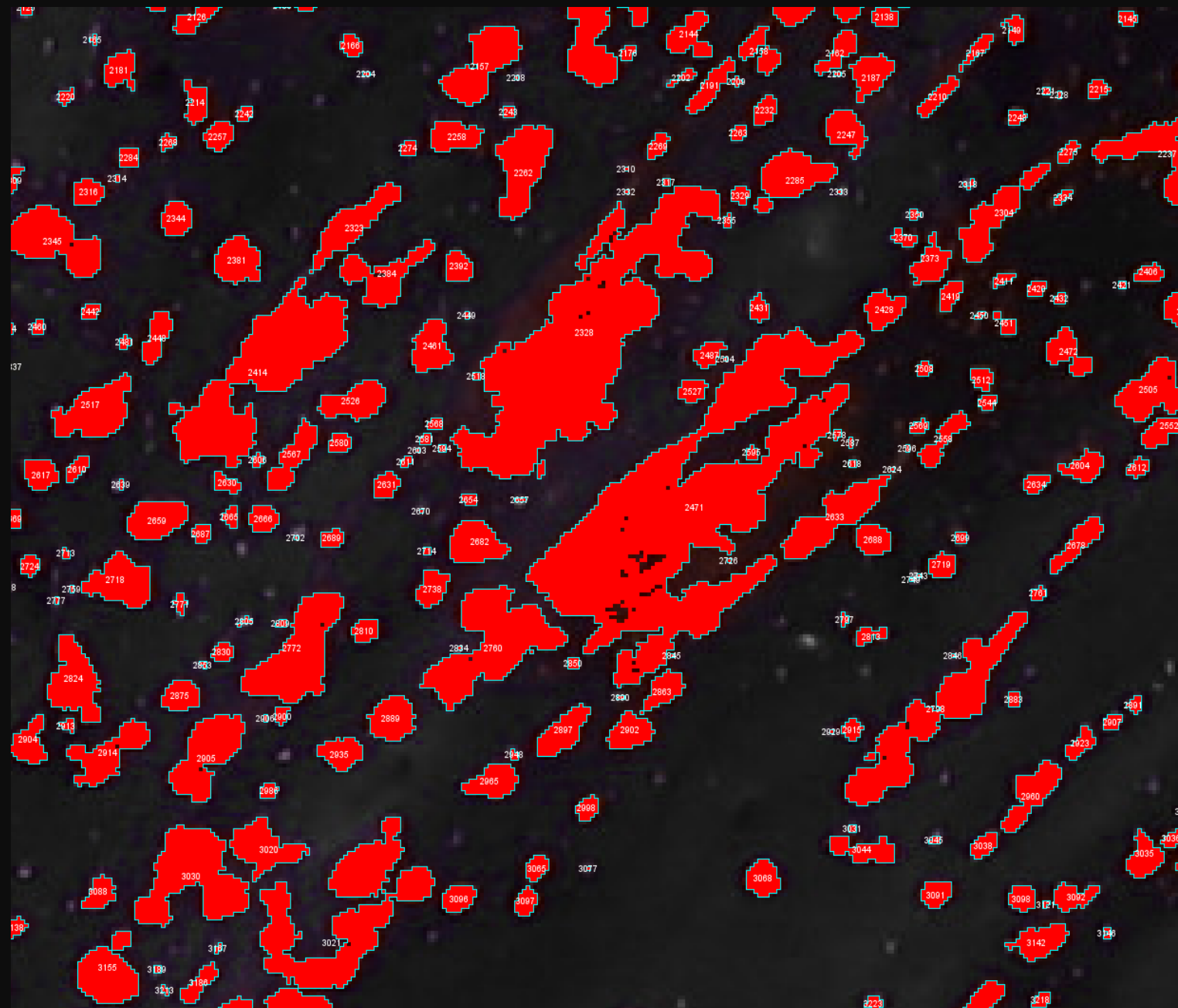


Outer  
Upper surface



Outer  
Lower surface

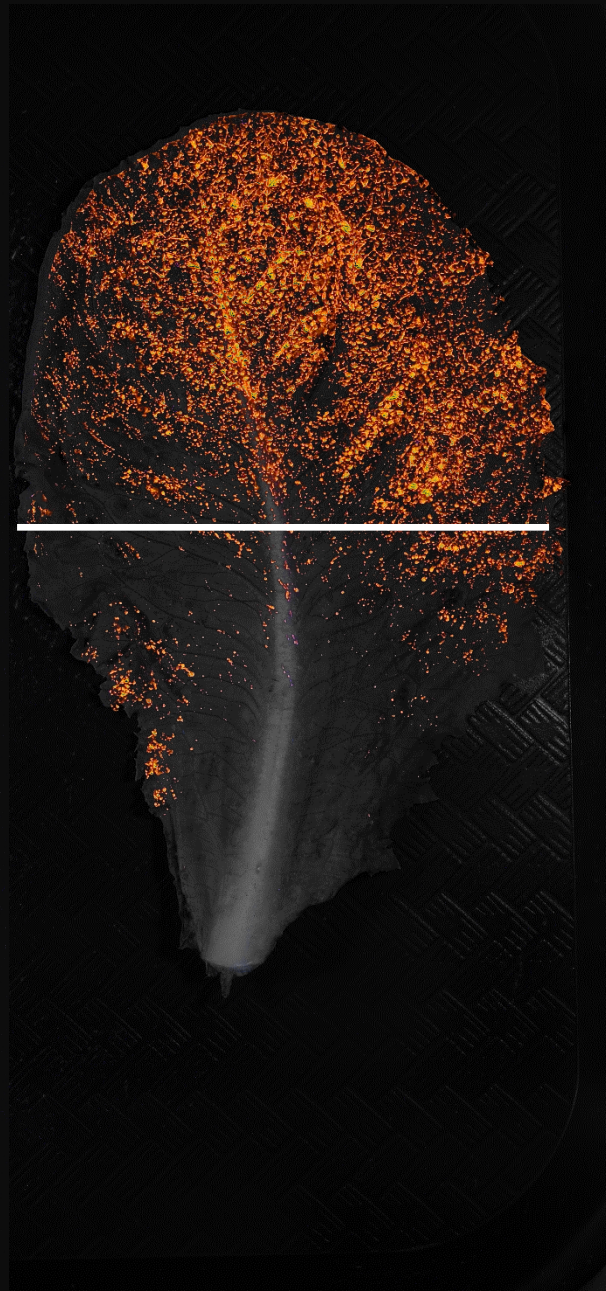




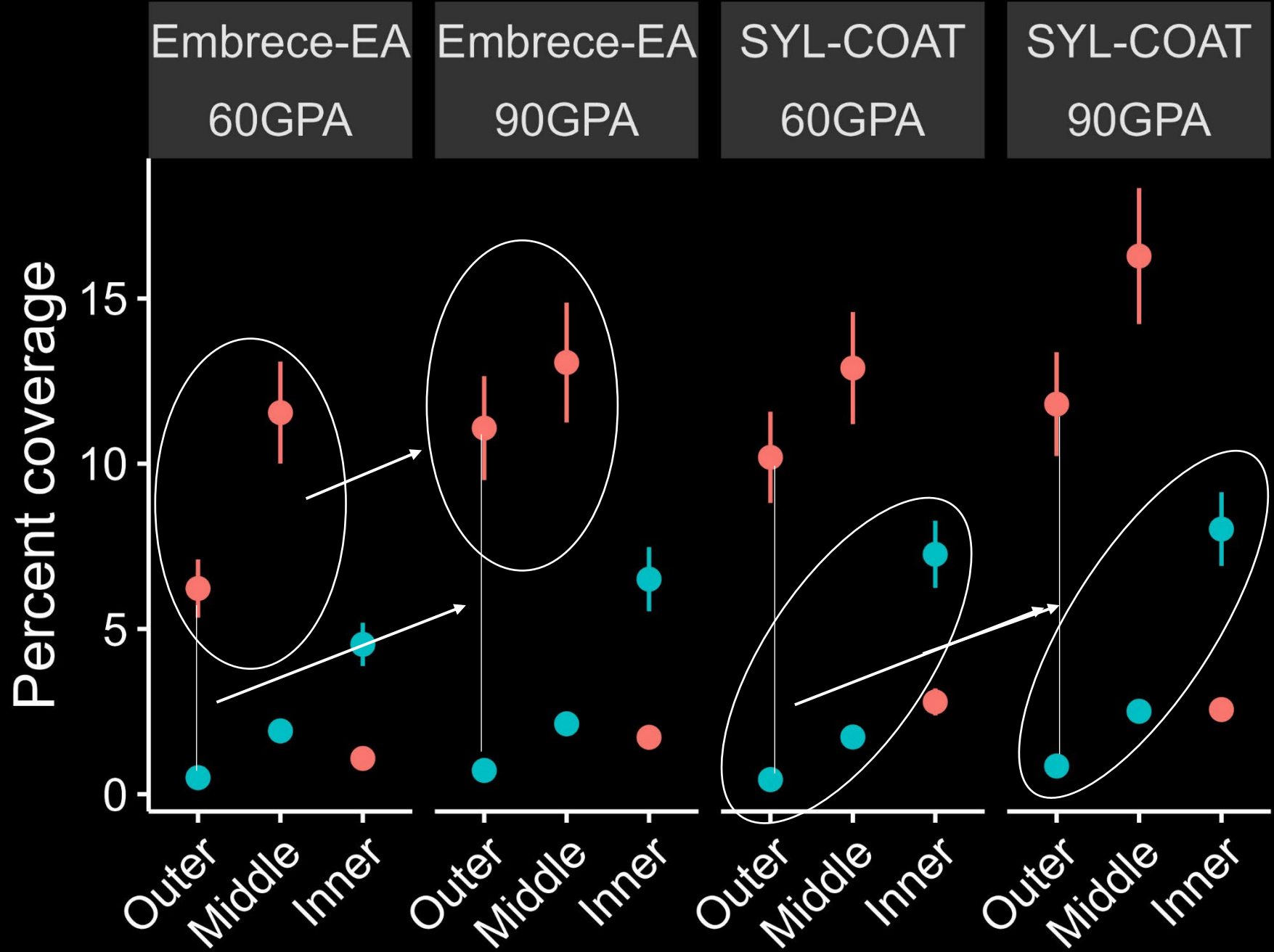
Outer  
Upper

Top half

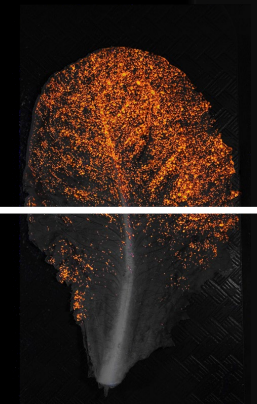
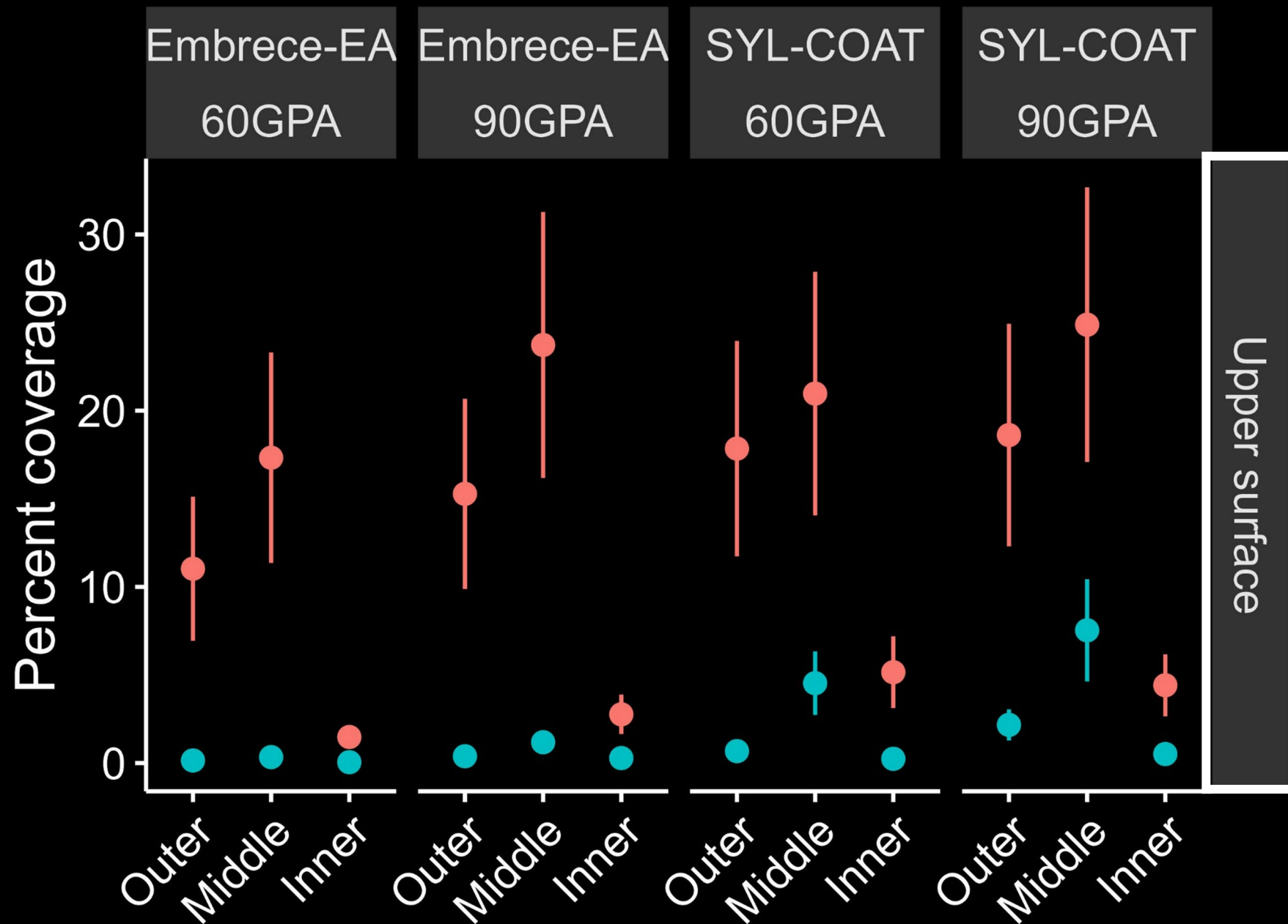
Bottom half



# FULL



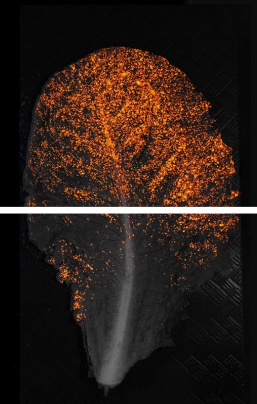
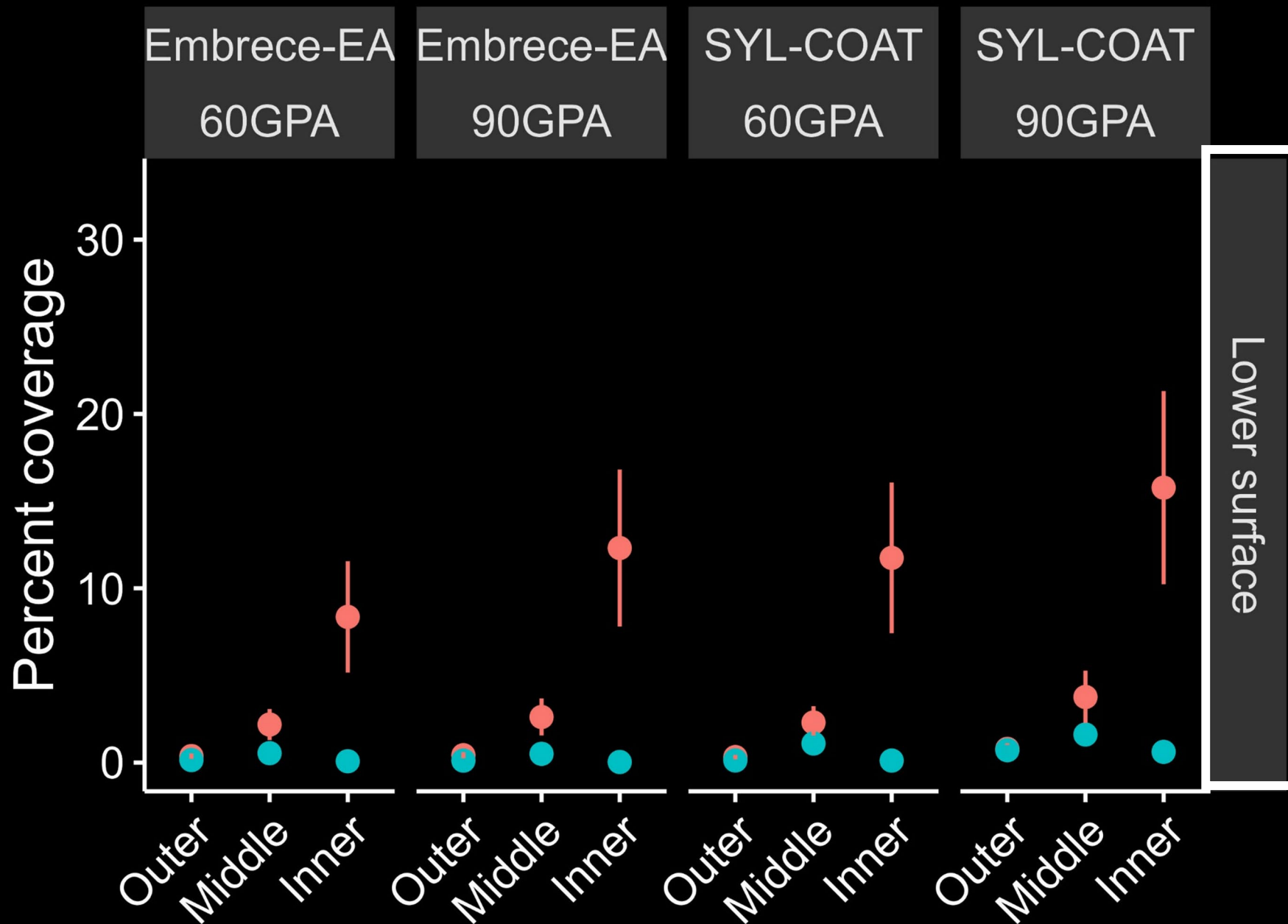
# HALF



Half

- Top half
- Bottom half

# HALF



Half

- Top half
- Bottom half

Lower surface

# *Habitat and Biocontrol (CDFA)*

*PIs:*

Daniel Hasegawa, Eric Brennan, Ian Grettenberger, Danny Karp

*Key personnel:*

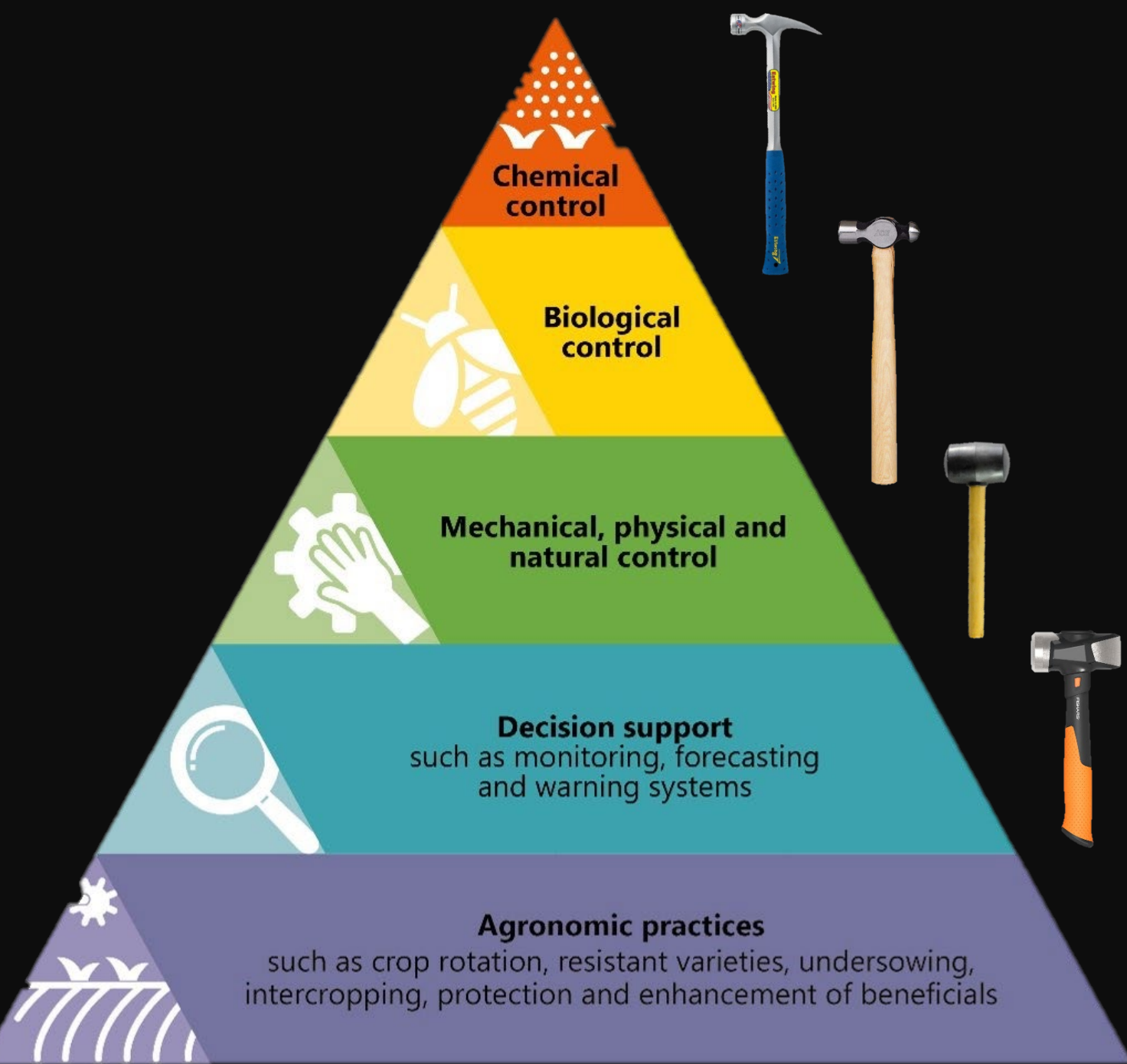
- Anna DiPaola (Postdoctoral researcher)
- Briley Mullin (PhD student)
- Jasmin Azad-Khan (Asst. Specialist)

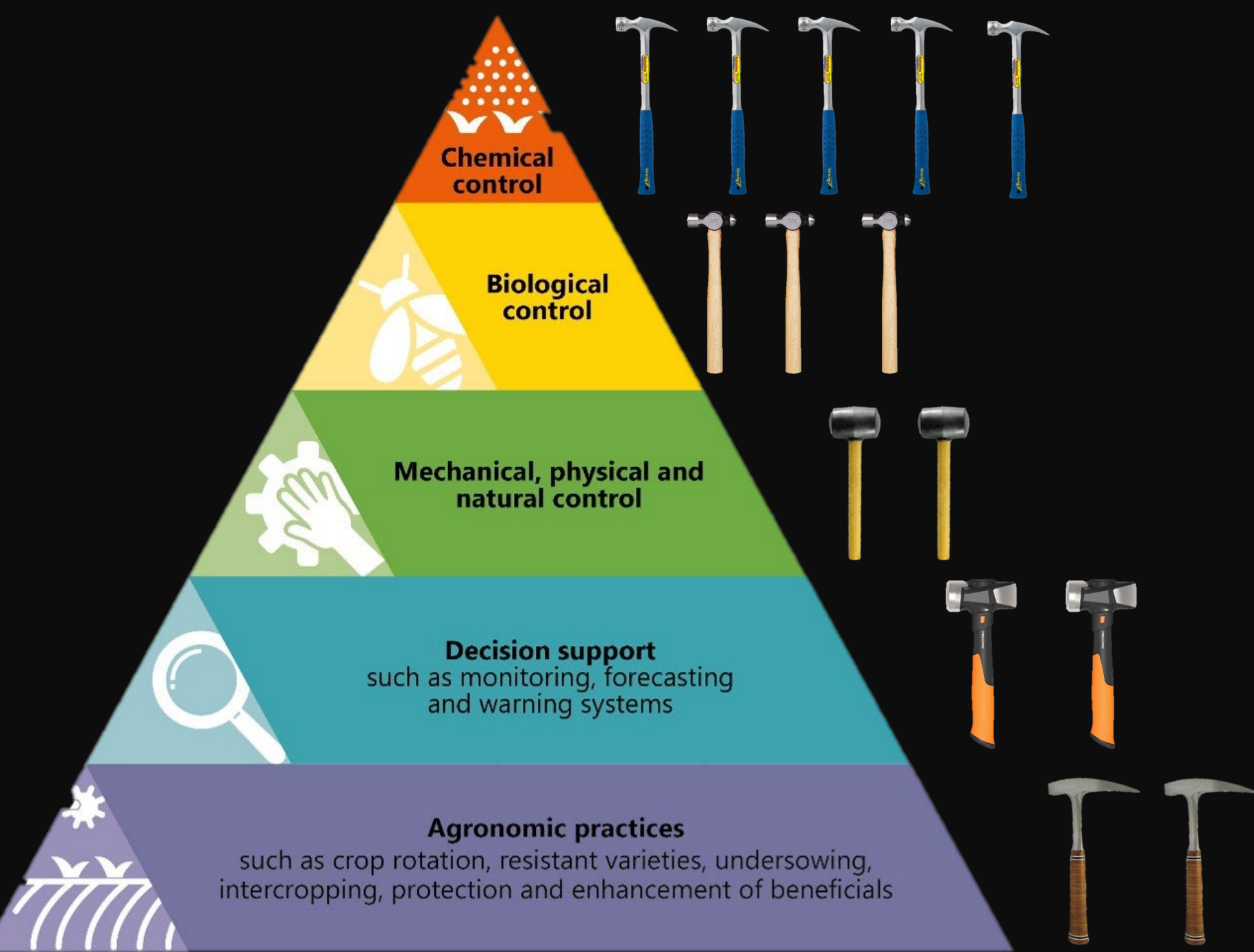






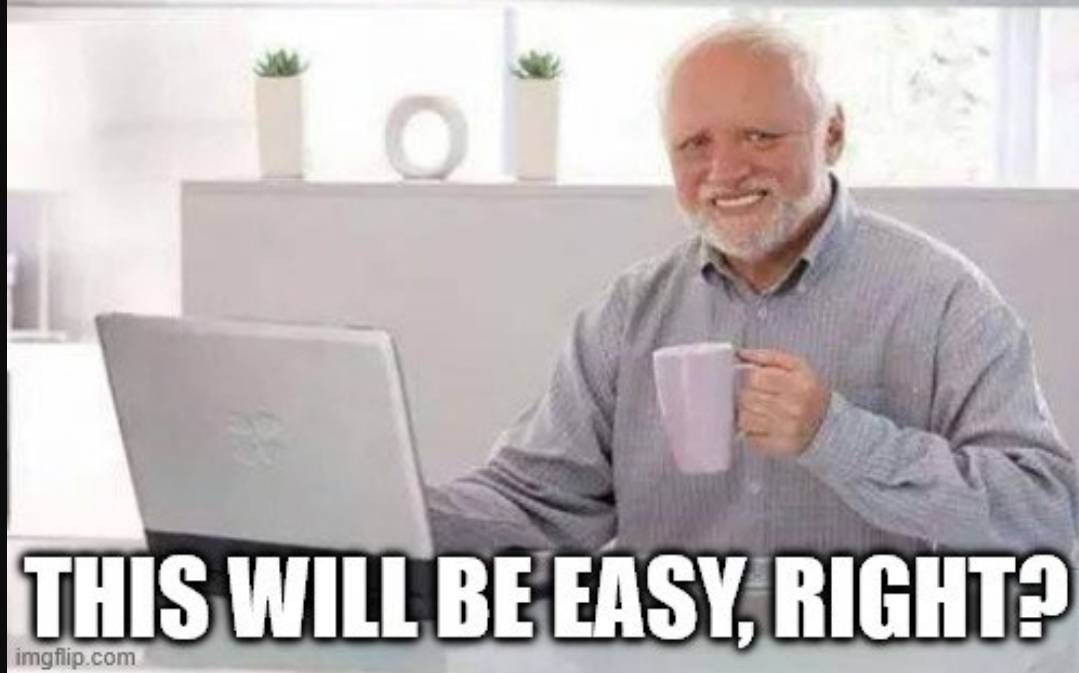








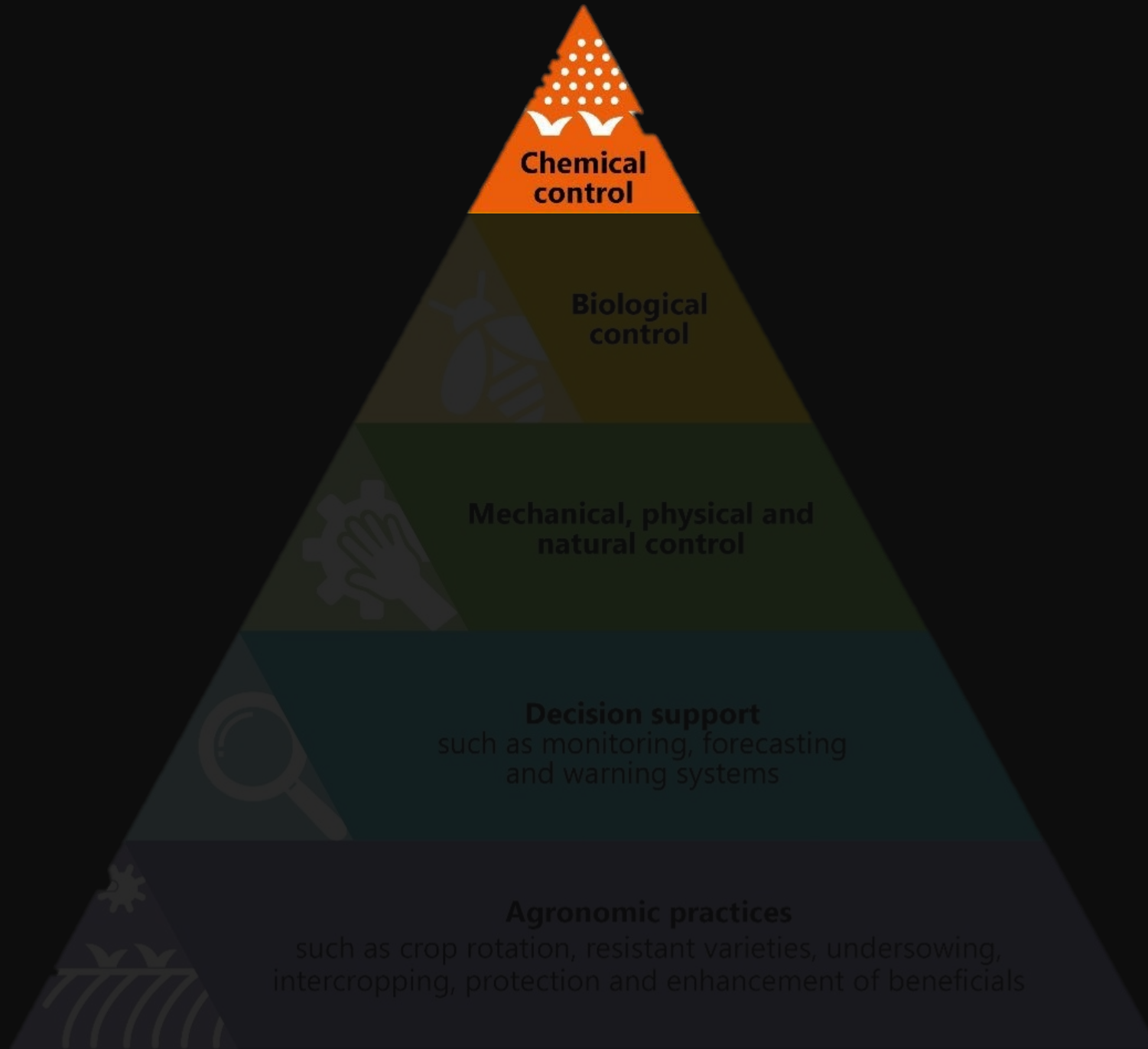
**GETTING READY TO MANAGE DIAMONDBACK**

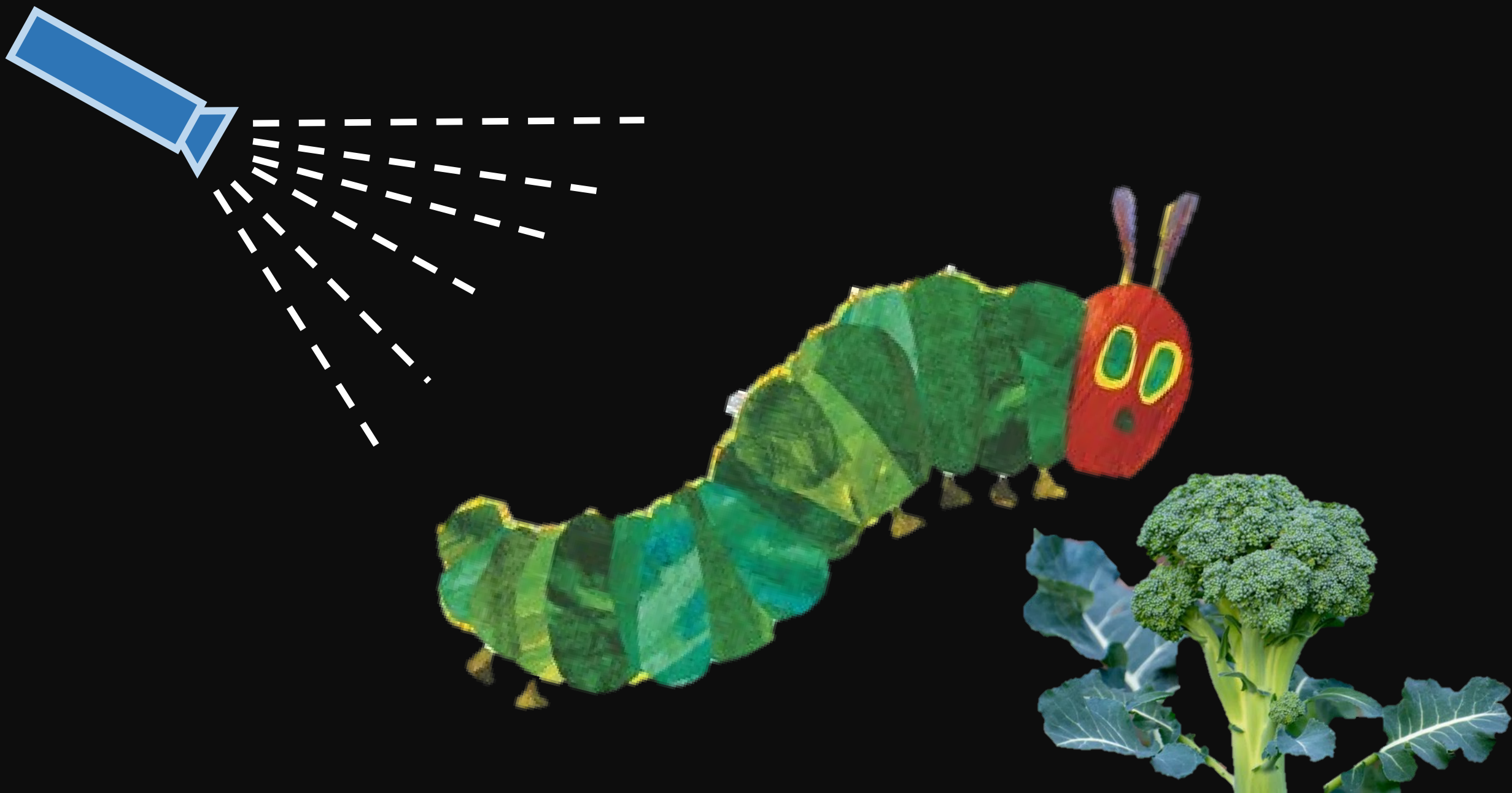


**THIS WILL BE EASY, RIGHT?**



Insecticide resistance

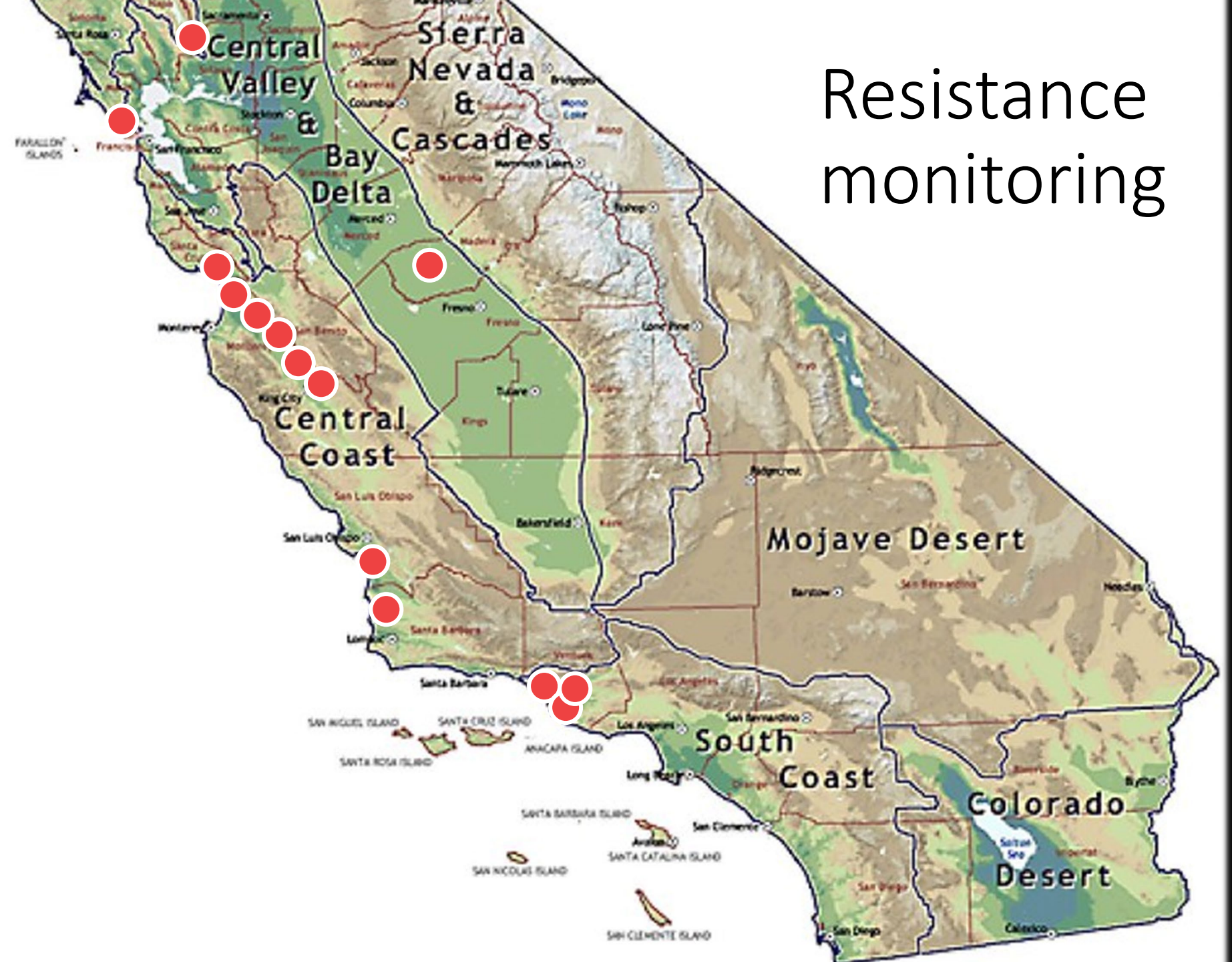




Problem: Insecticide-resistant diamondback moths



# Resistance monitoring



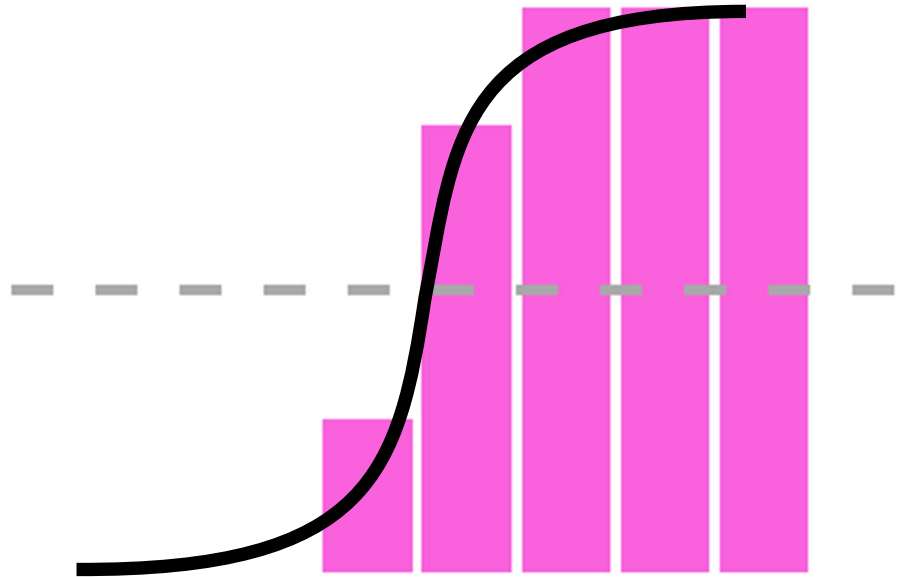
# Resistance monitoring – leaf dip assay





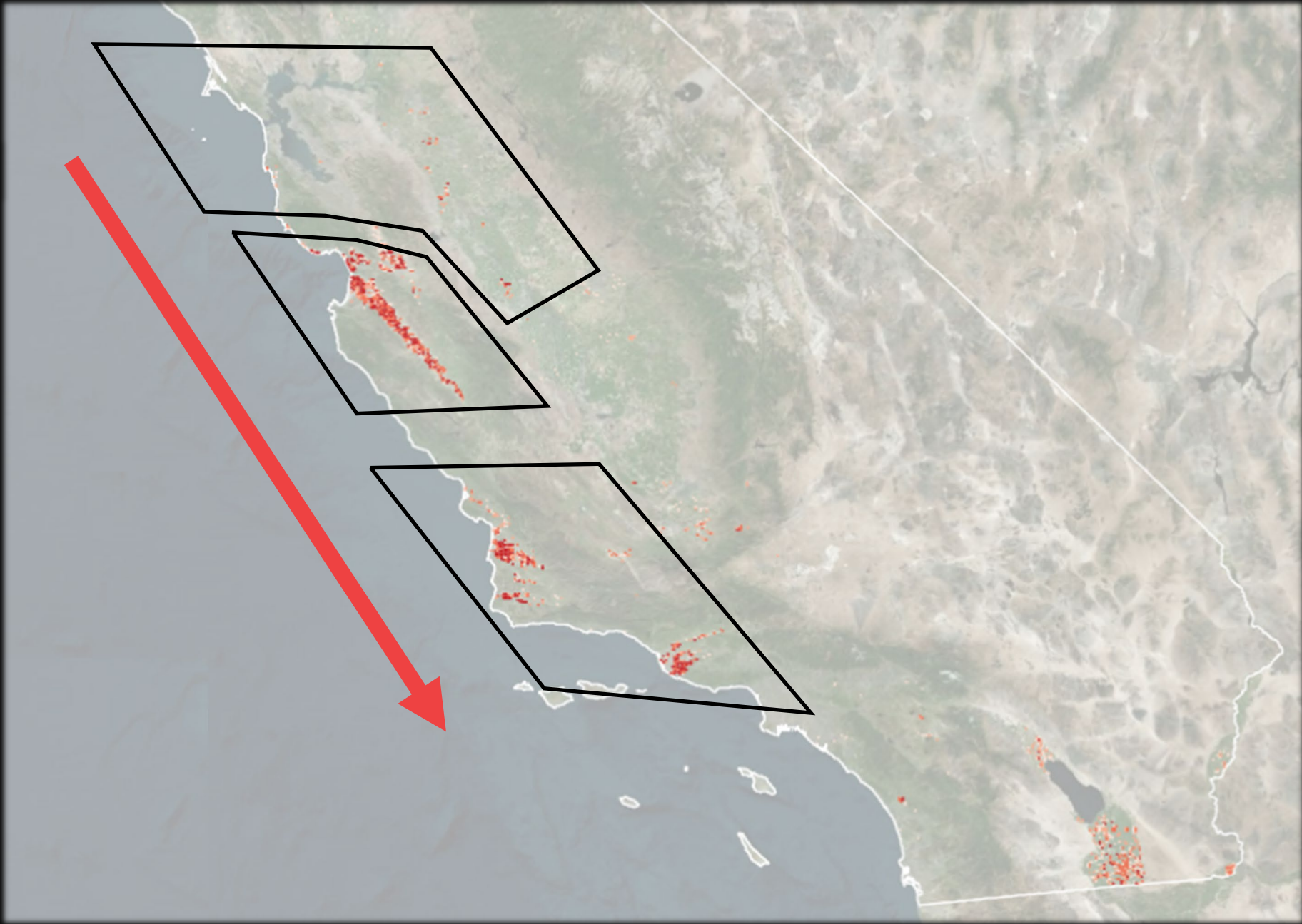
# Salinas 2022

% Mortality

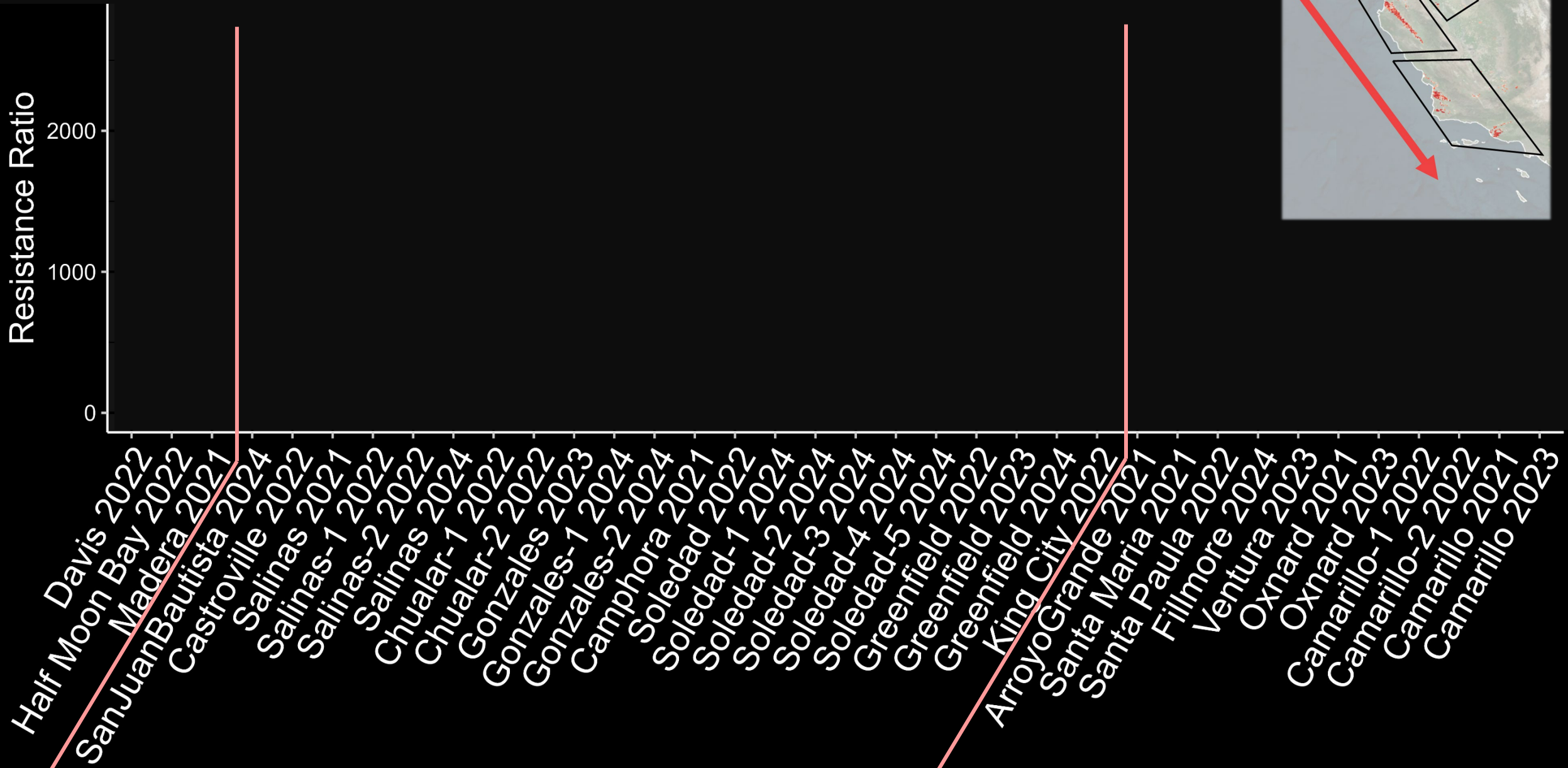


0  
1.77  
3.33  
9.98  
29.95  
89.85  
269.56  
808.69  
2426.07

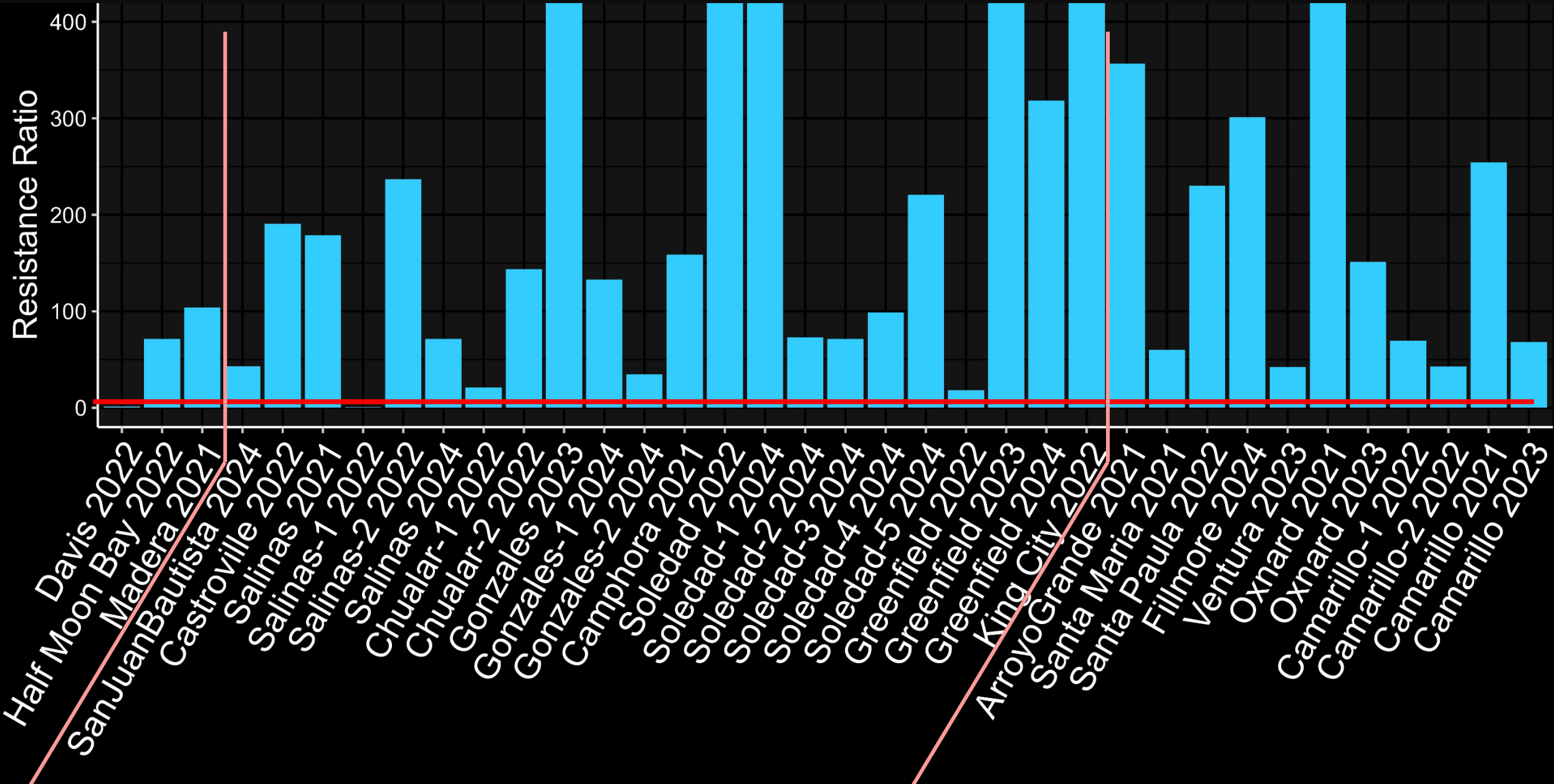
Concentration



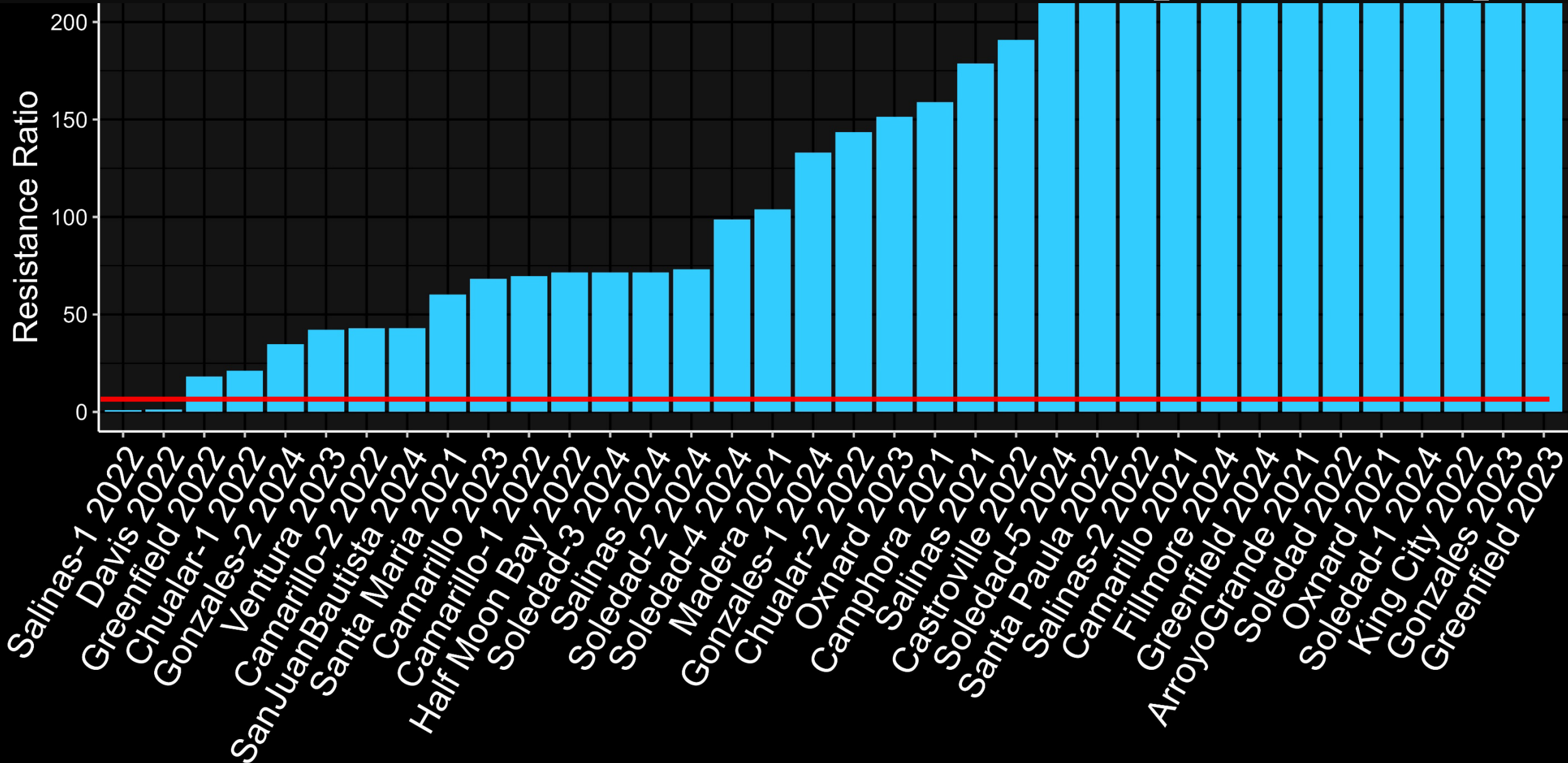
# Chlorantraniliprole – Coragen (diamide)



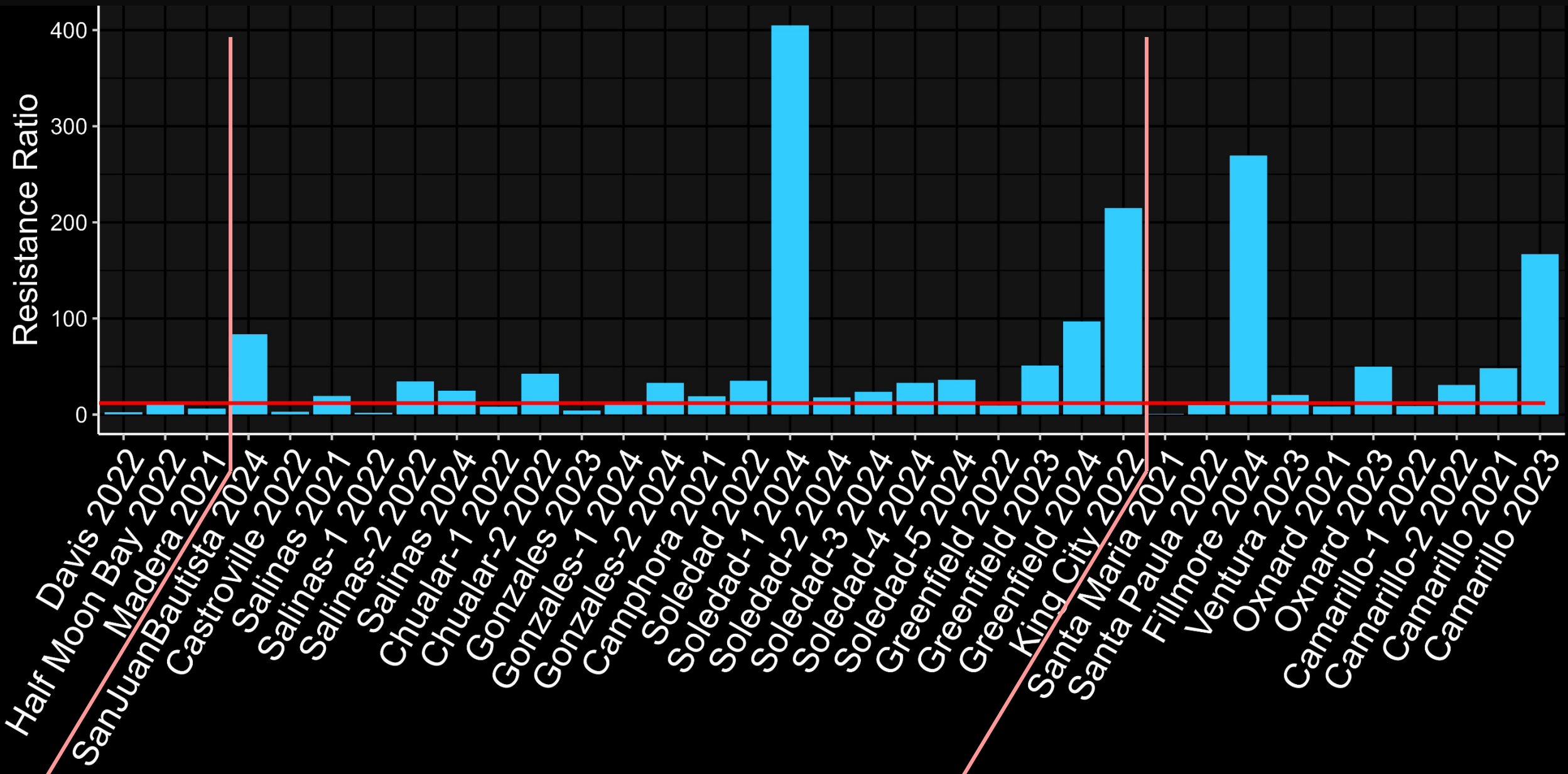
# Chlorantraniliprole – Coragen (diamide)



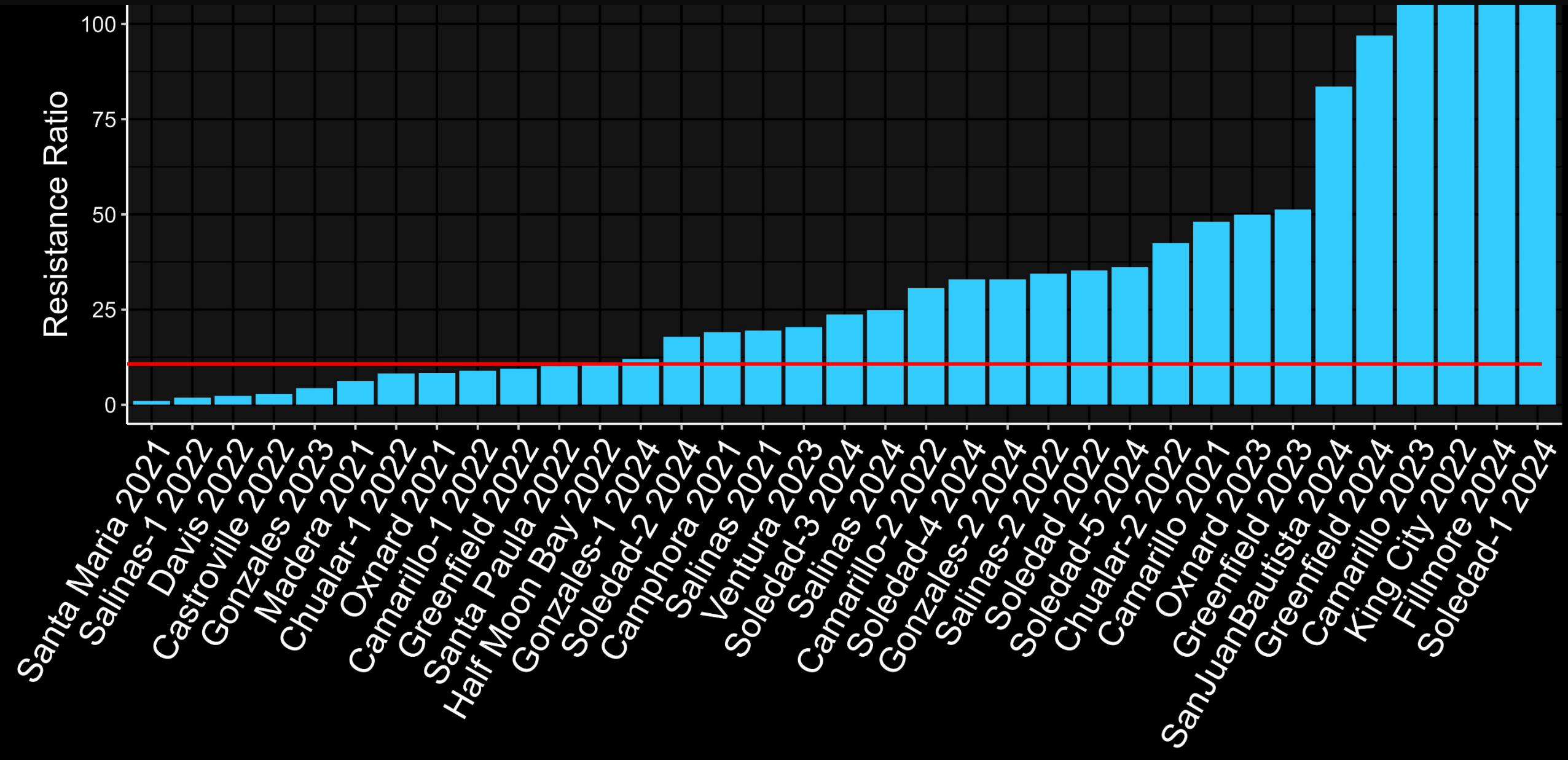
# Chlorantraniliprole – Coragen (diamide)



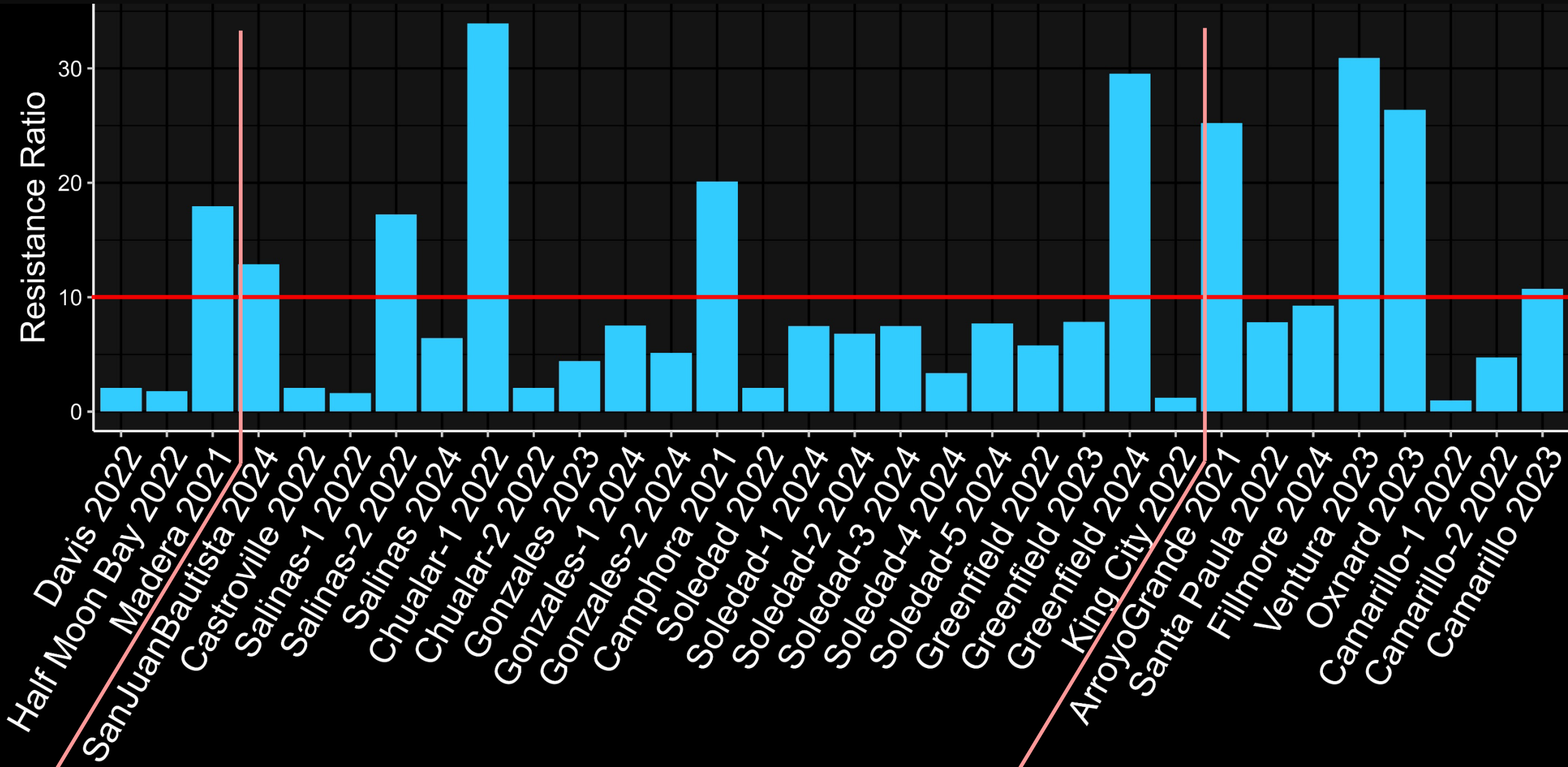
# Cyantraniliprole – Exirel/Verimark) (diamide)



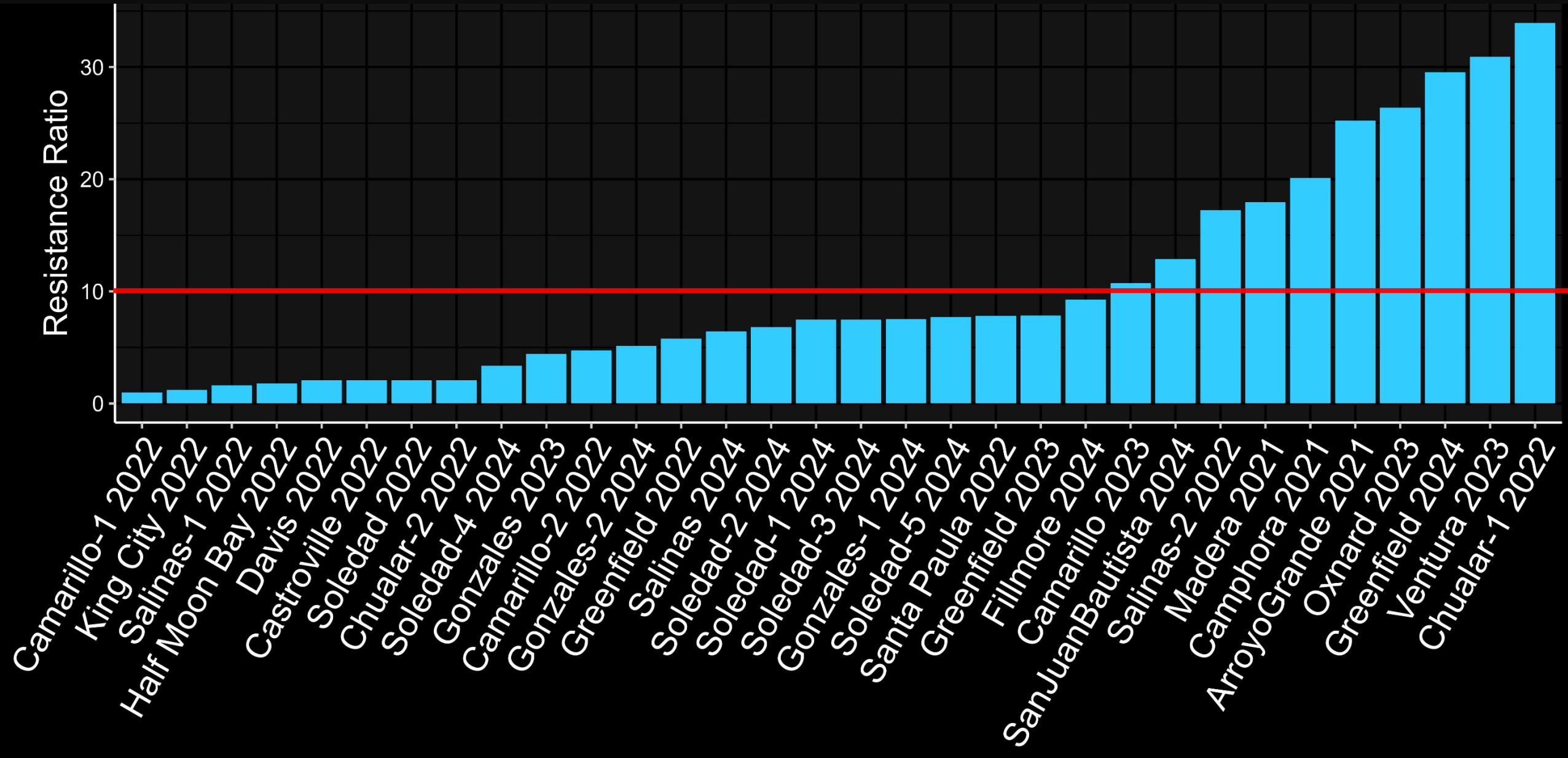
# Cyantraniliprole – Exirel/Verimark) (diamide)



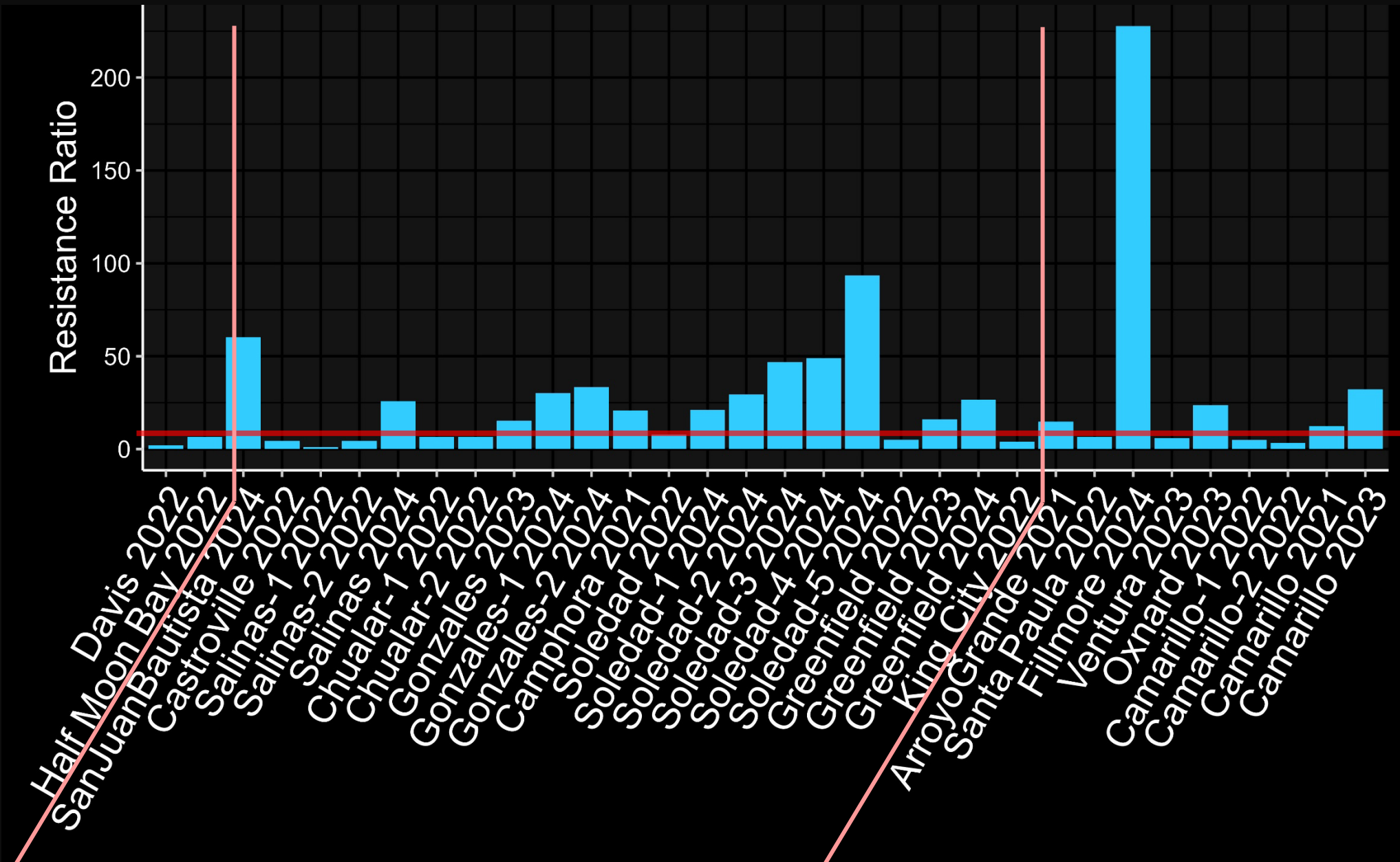
# Emamectin benzoate - Proclaim



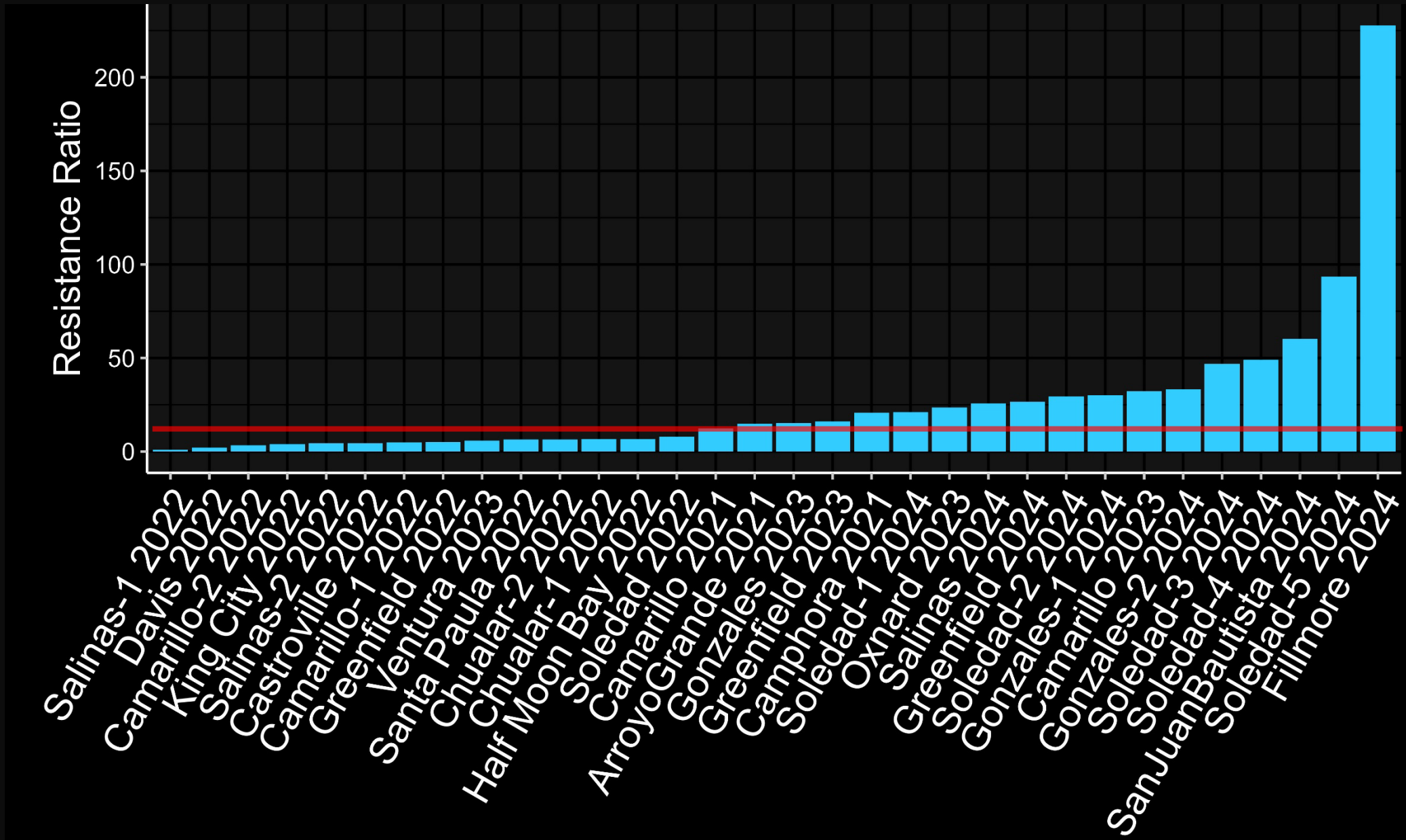
# Emamectin benzoate - Proclaim



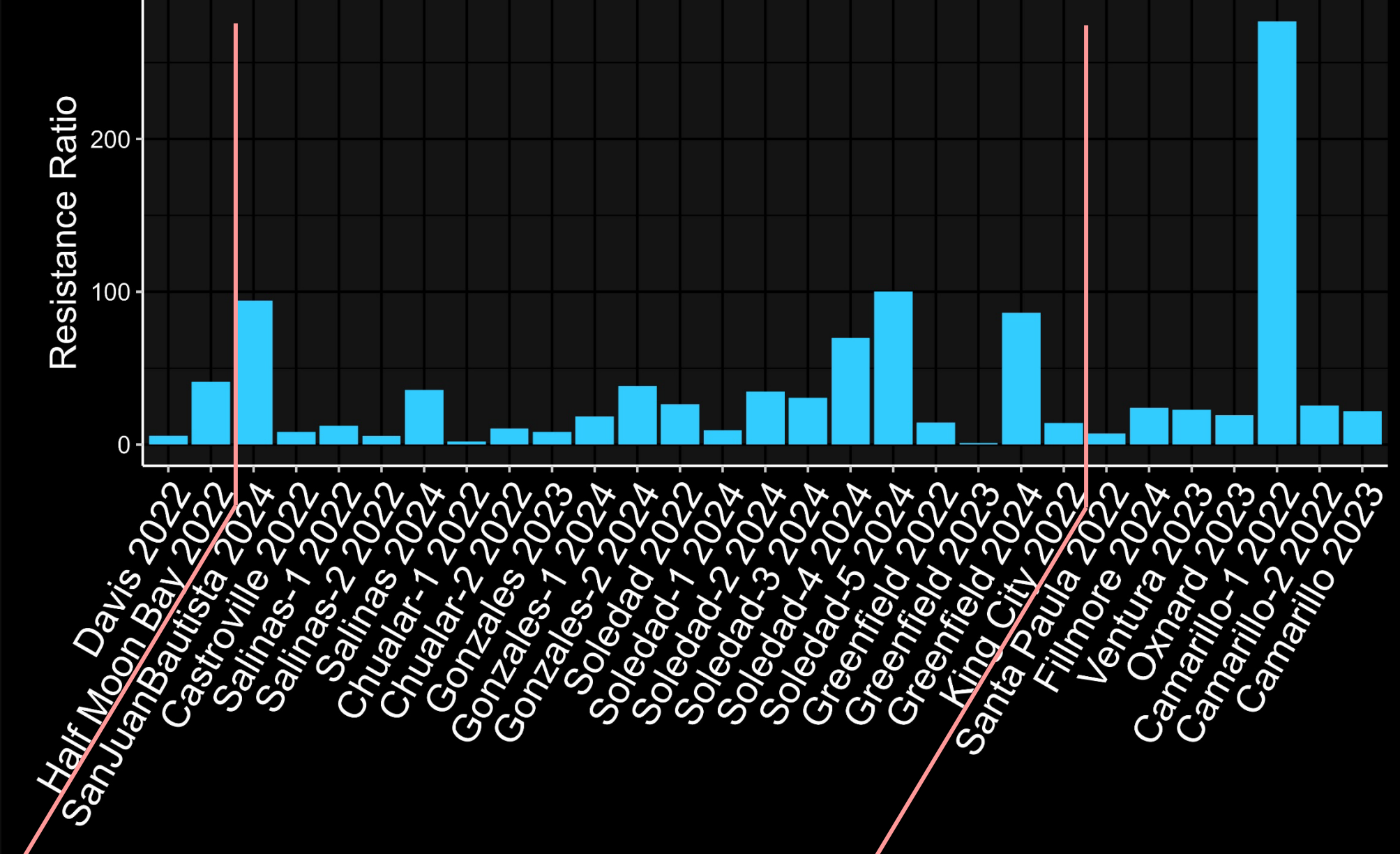
# Spinetoram – Radiant (spinosyn)



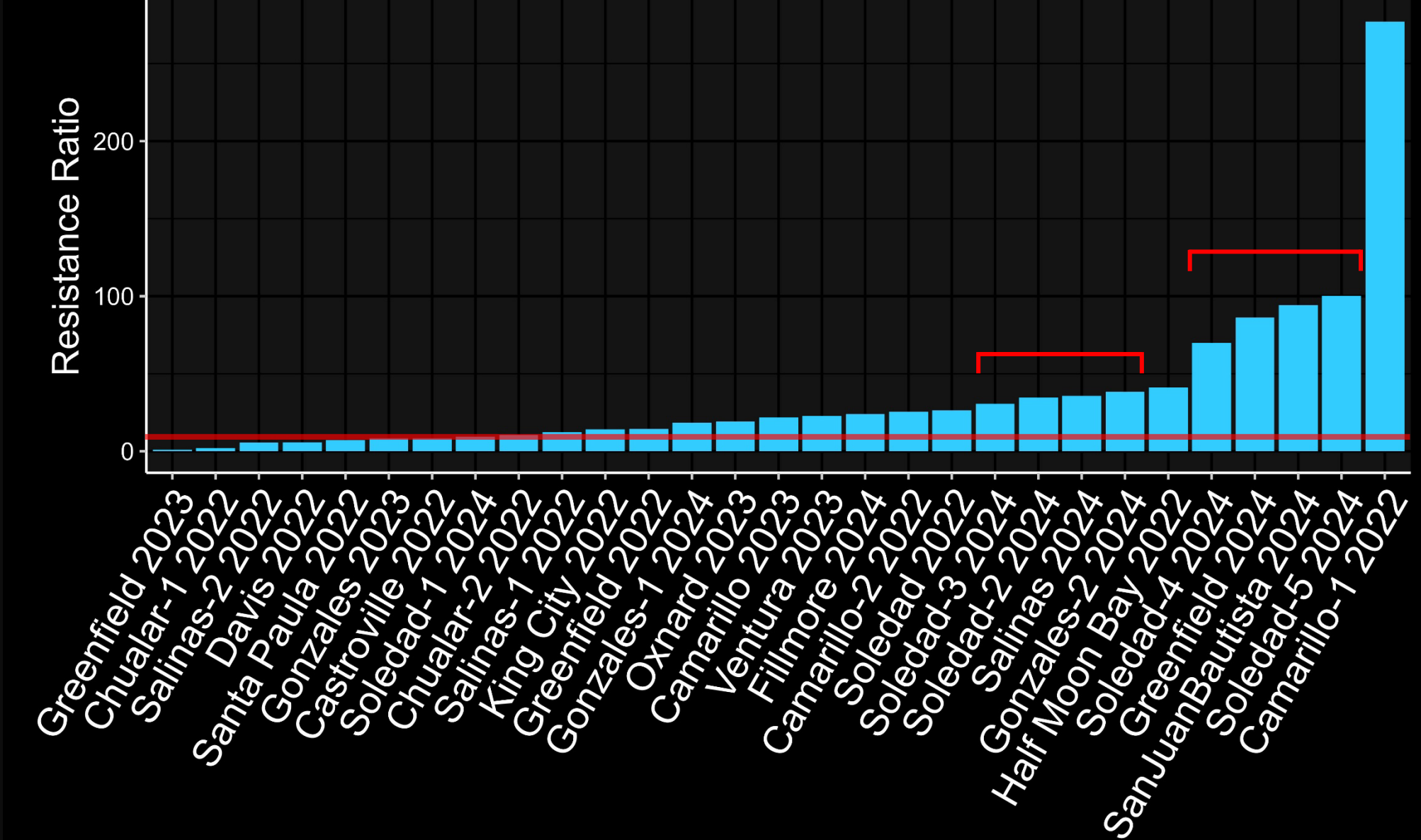
# Spinetoram – Radiant (spinosyn)



# Bacillus thuringiensis/Bt aizawai - XenTari

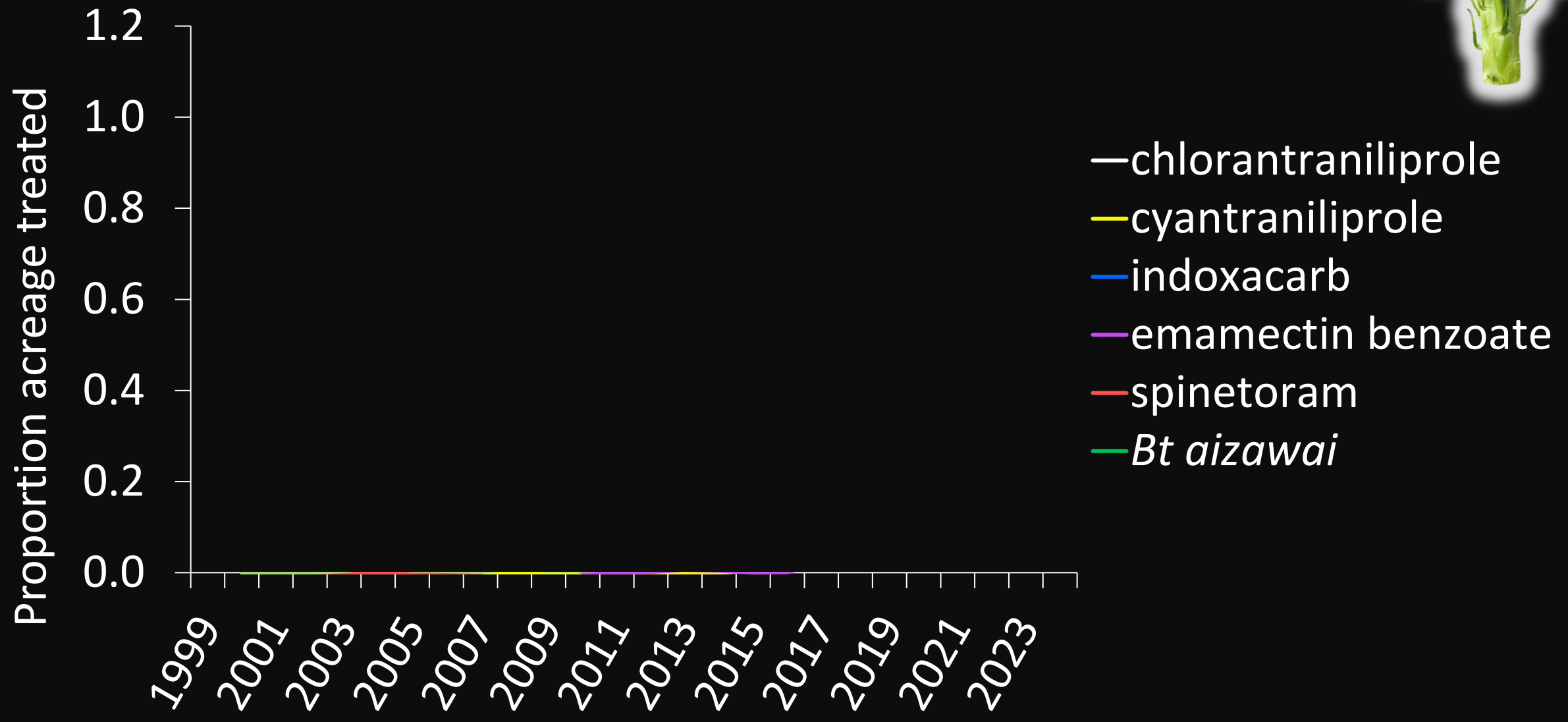


# Bacillus thuringiensis/Bt aizawai - XenTari





# Monterey Co. - broccoli



Spray  
1

Proclaim

*Bt*

Spray  
2

Radiant

*Bt*

Spray  
3

Exirel

*Bt*

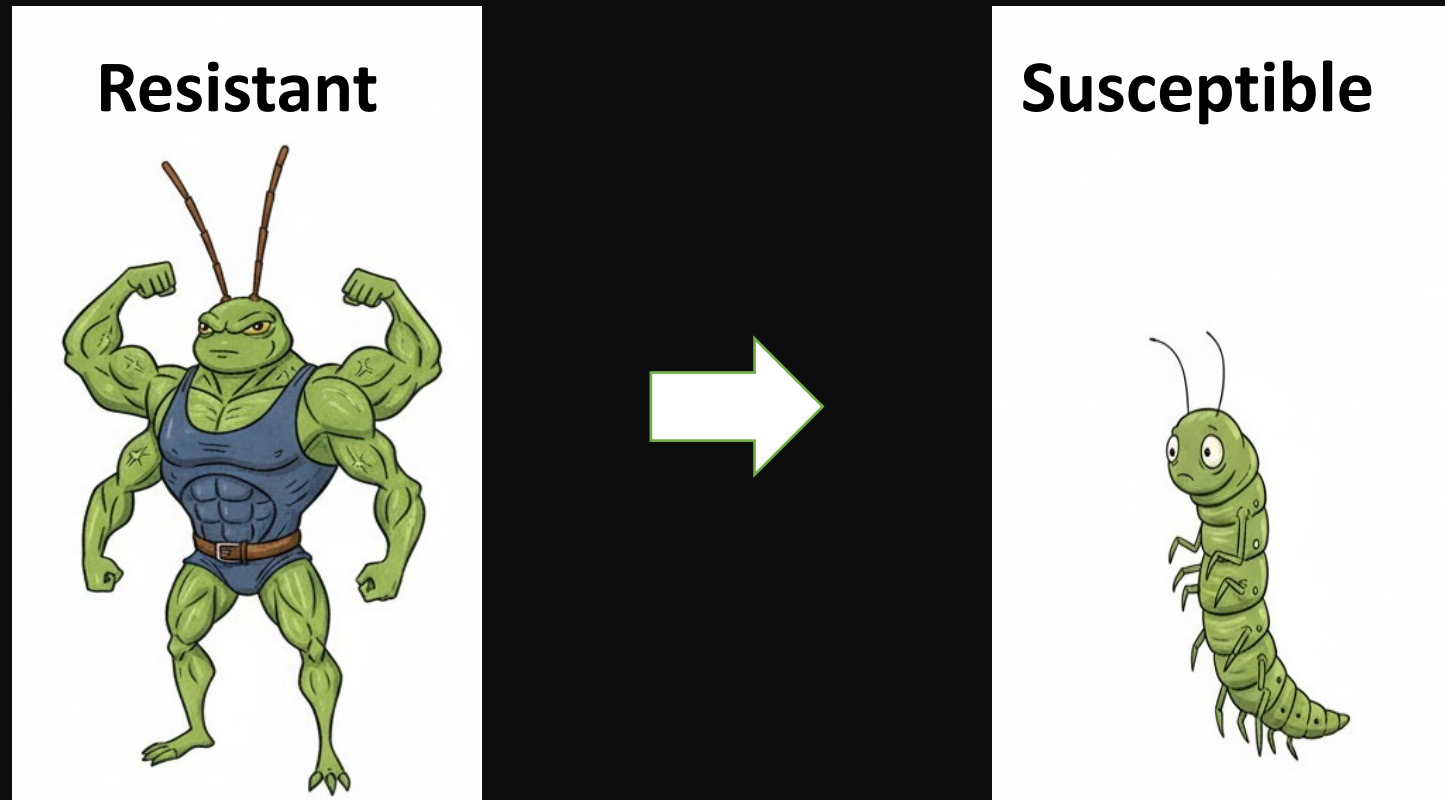
Spray  
4

Proclaim

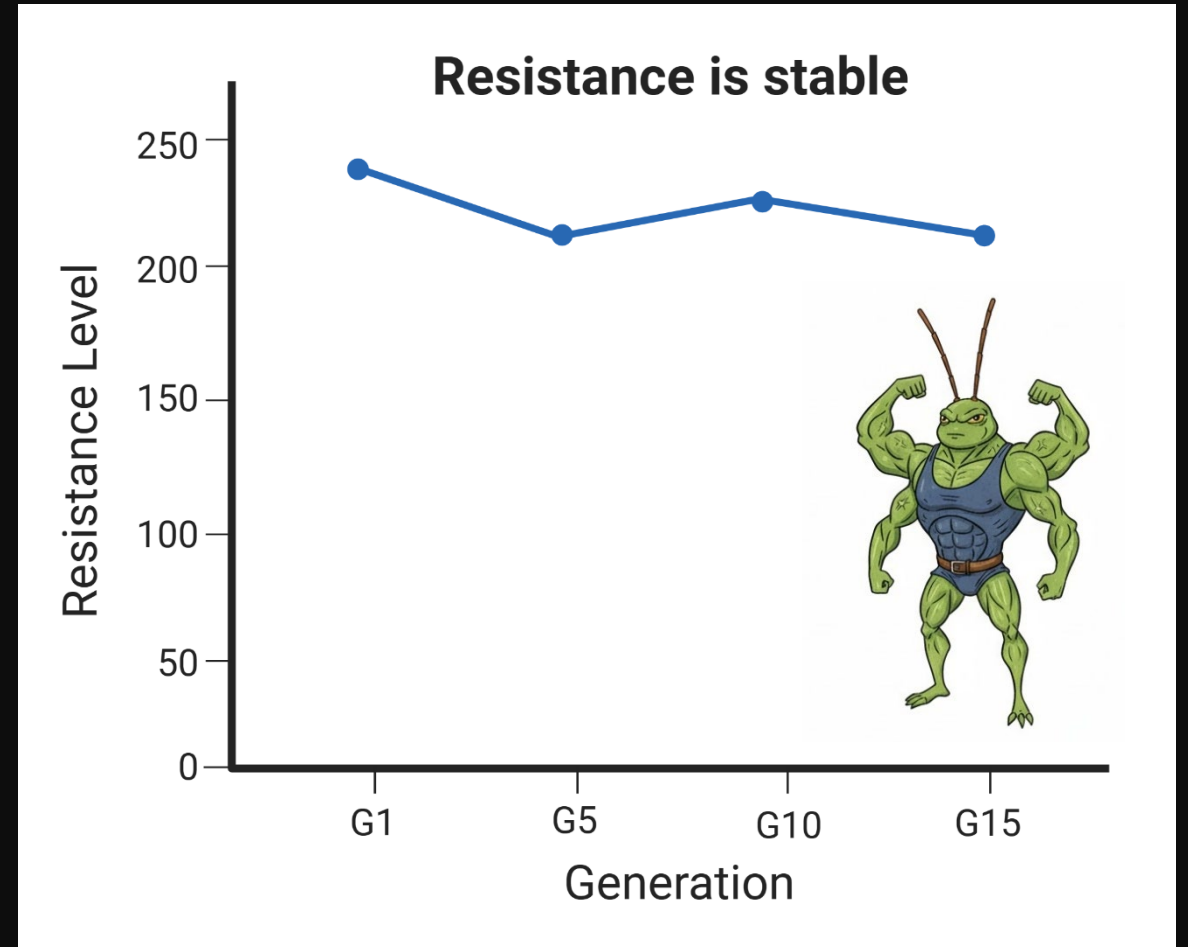
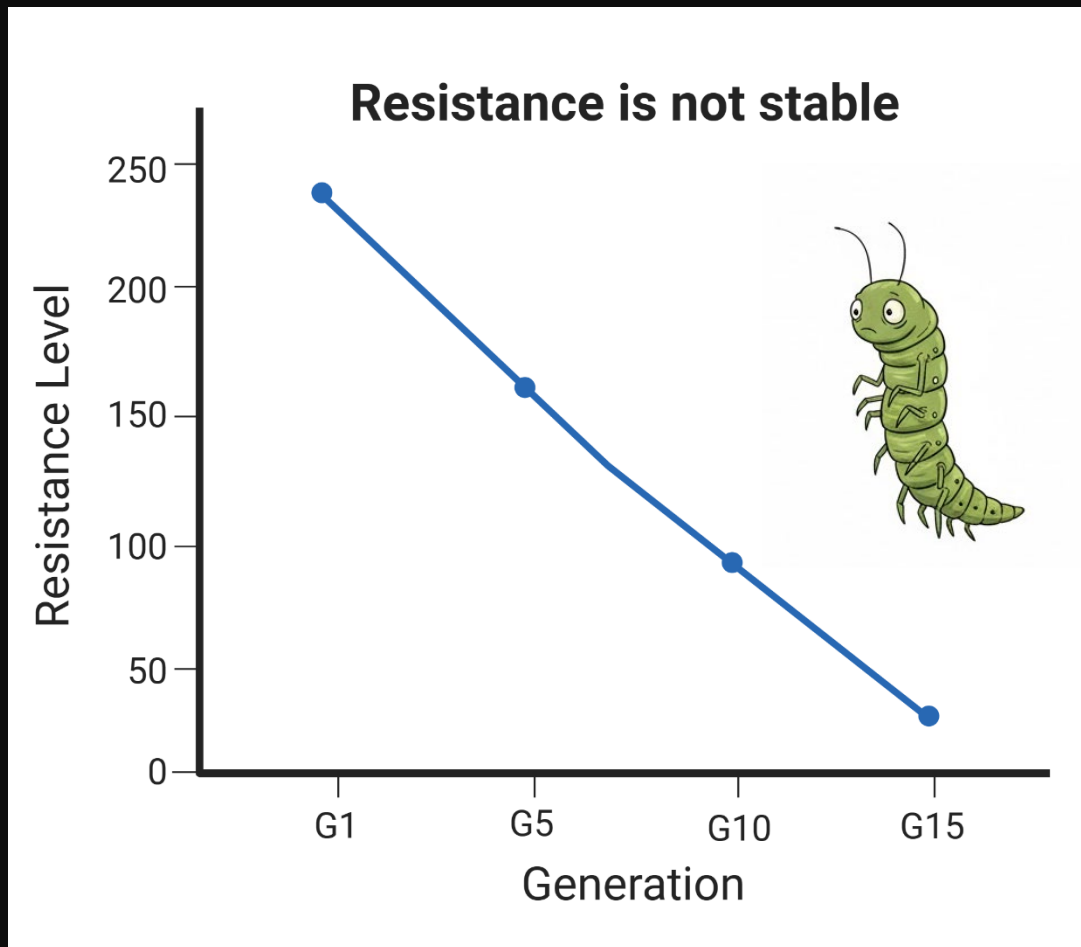
*Bt*

# Resistance stability: Does resistance stick around?

- Tells us whether pests stay resistant or become susceptible again after we stop using a product



# Resistance stability: Two scenarios

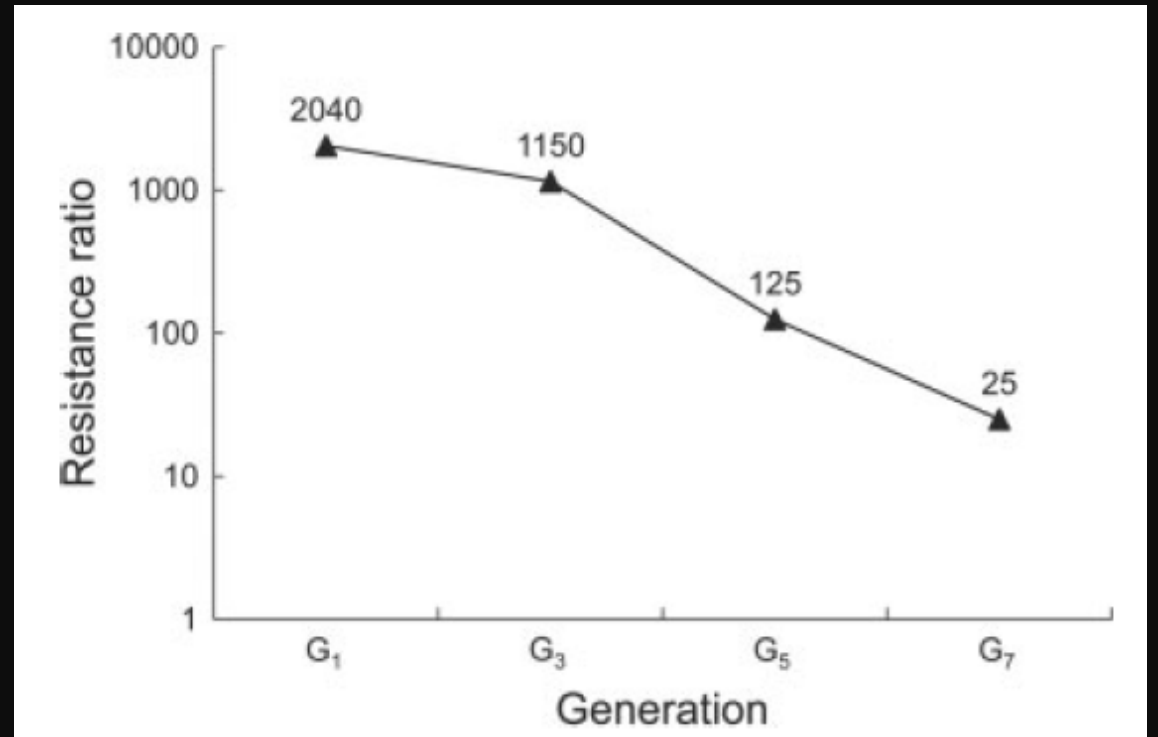


# Why study resistance stability?

- It tells us whether rotating chemistries will actually work.
  - Rotation only restores susceptibility **if resistance is unstable**.
  - If resistance is stable, rotations may not be effective.
- How valuable is a product long-term?
  - Stability determines whether older chemistries are worth saving or replacing.

# Resistance stability in DBM

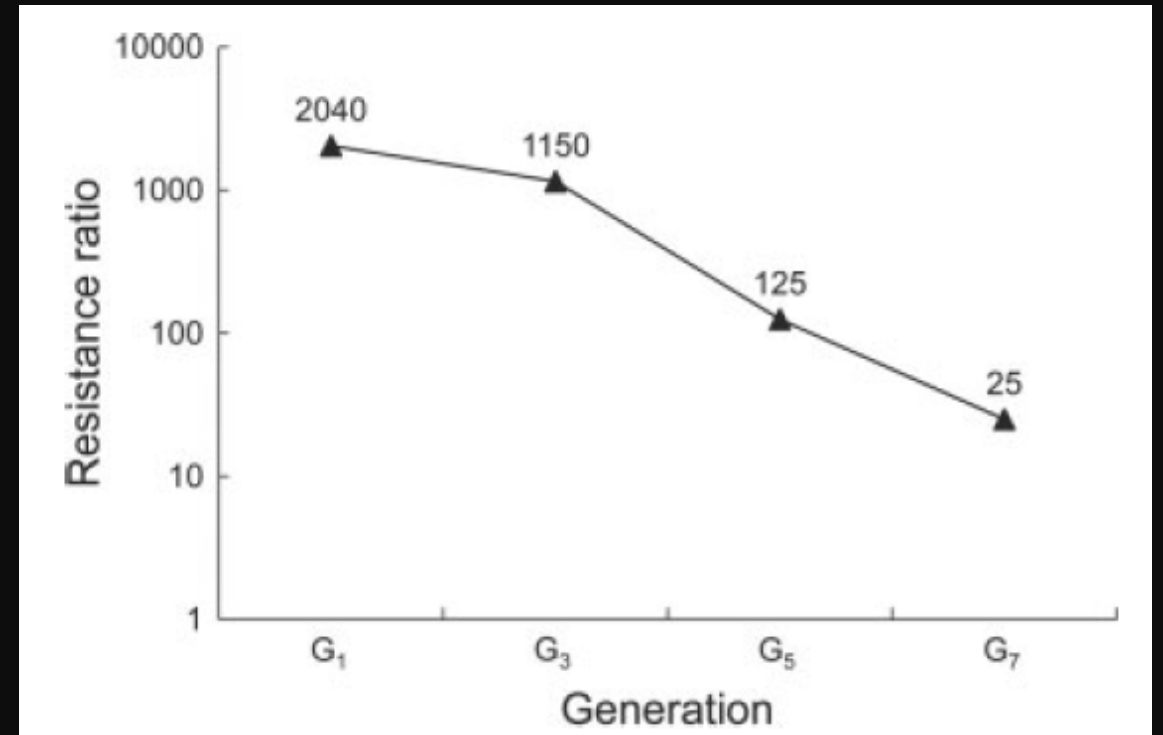
- DBM population from China (Wang et al. 2012)
  - No exposure to the Diamide Chlorantraniliprole for 7 generations
  - Resistance is unstable



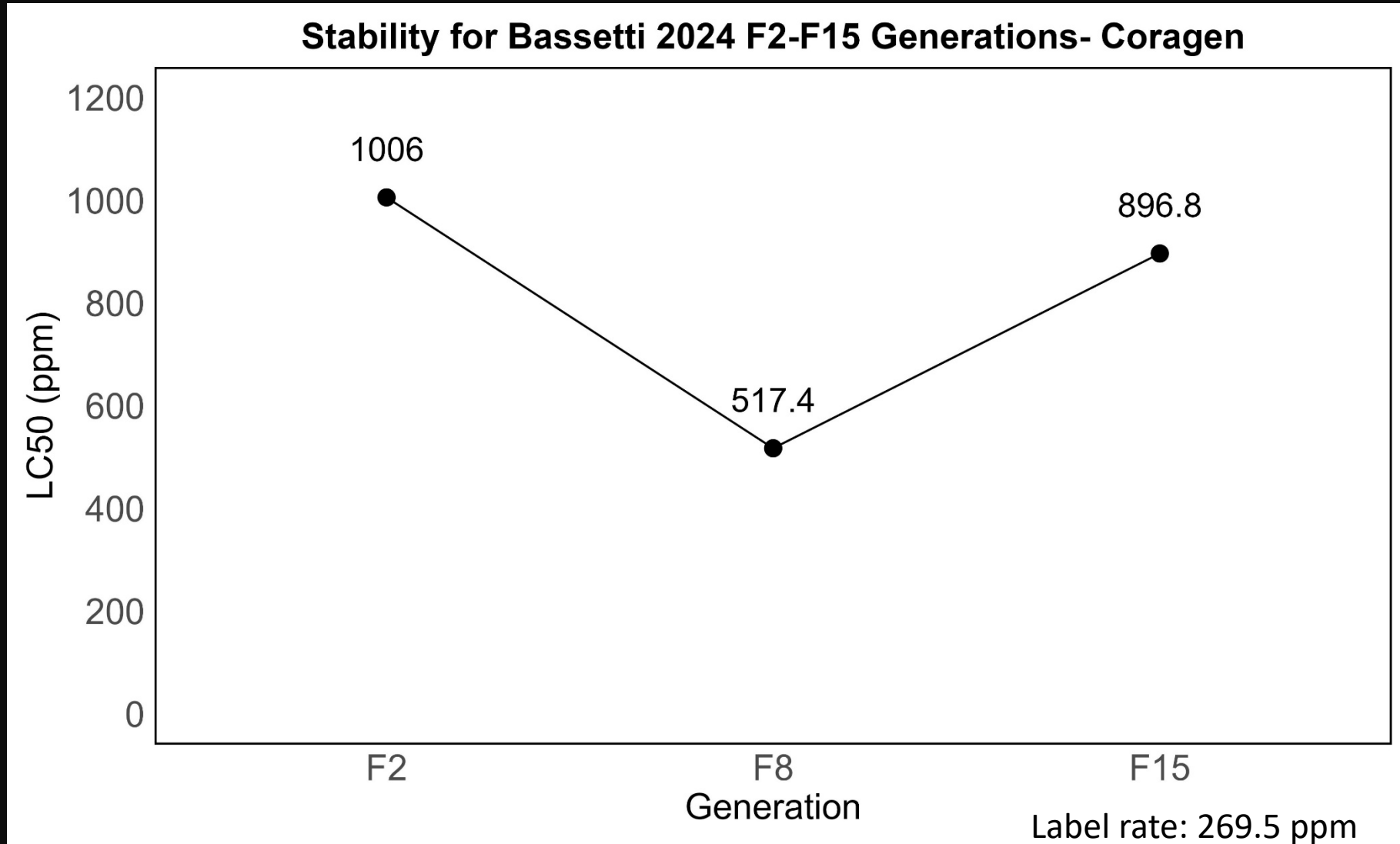
# Resistance stability in DBM

- DBM population from China (Wang et al. 2012)
  - No exposure to the Diamide Chlorantraniliprole for 7 generations
  - Resistance is unstable

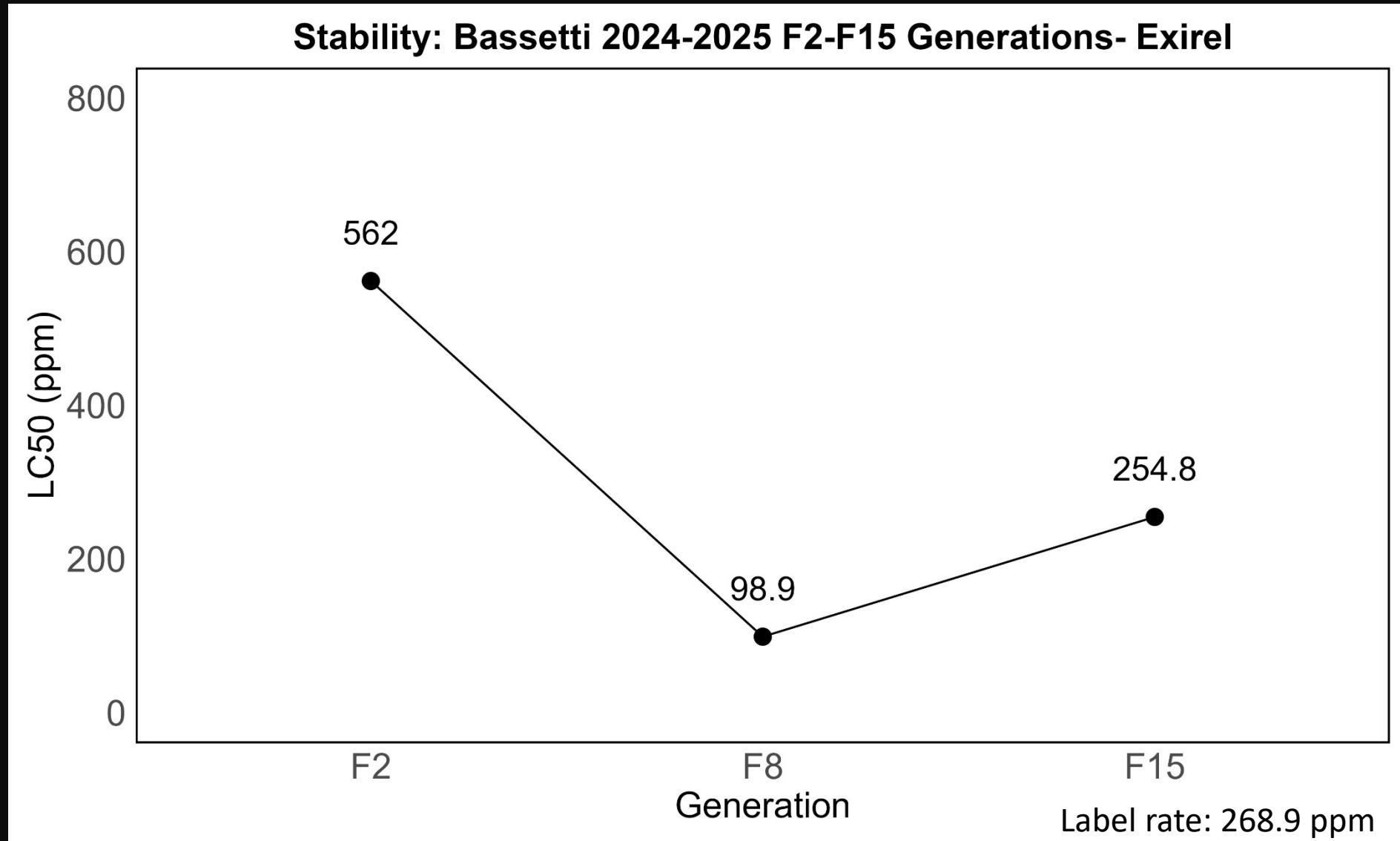
**But this is only one example, what about DBM populations in CA?**



# Resistance to Coragen after 13 generations in a Salinas Valley population



# Resistance to Exirel after 13 generations in a Salinas Valley population



# Take-home message

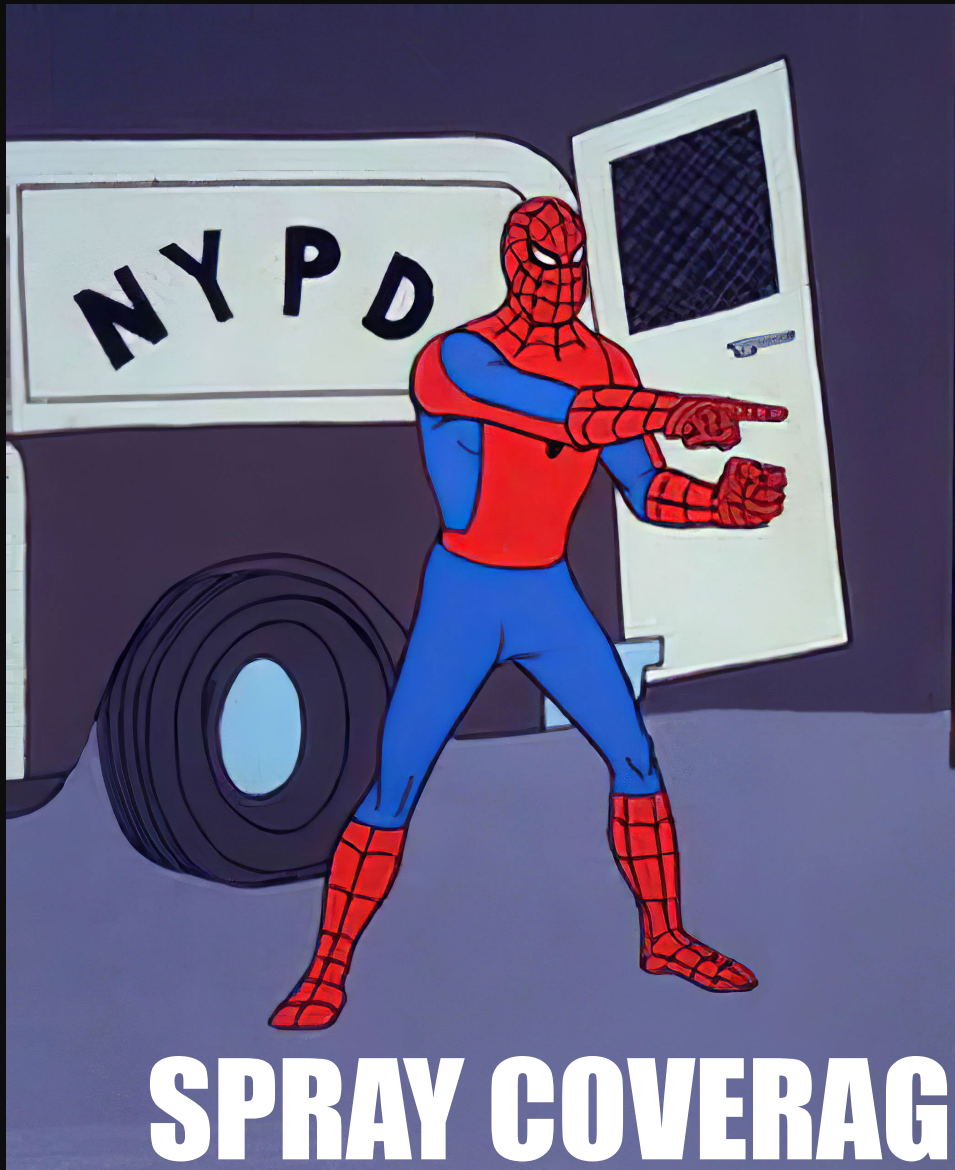
- Diamide resistance in this population does not disappear quickly
- Like resistance, stability may also vary by location and population
  - Other populations may exhibit different trends
- More data is needed to confirm whether resistance to diamides is stable for this population and others!











**SPRAY COVERAGE**



**INSECTICIDE  
RESISTANCE**





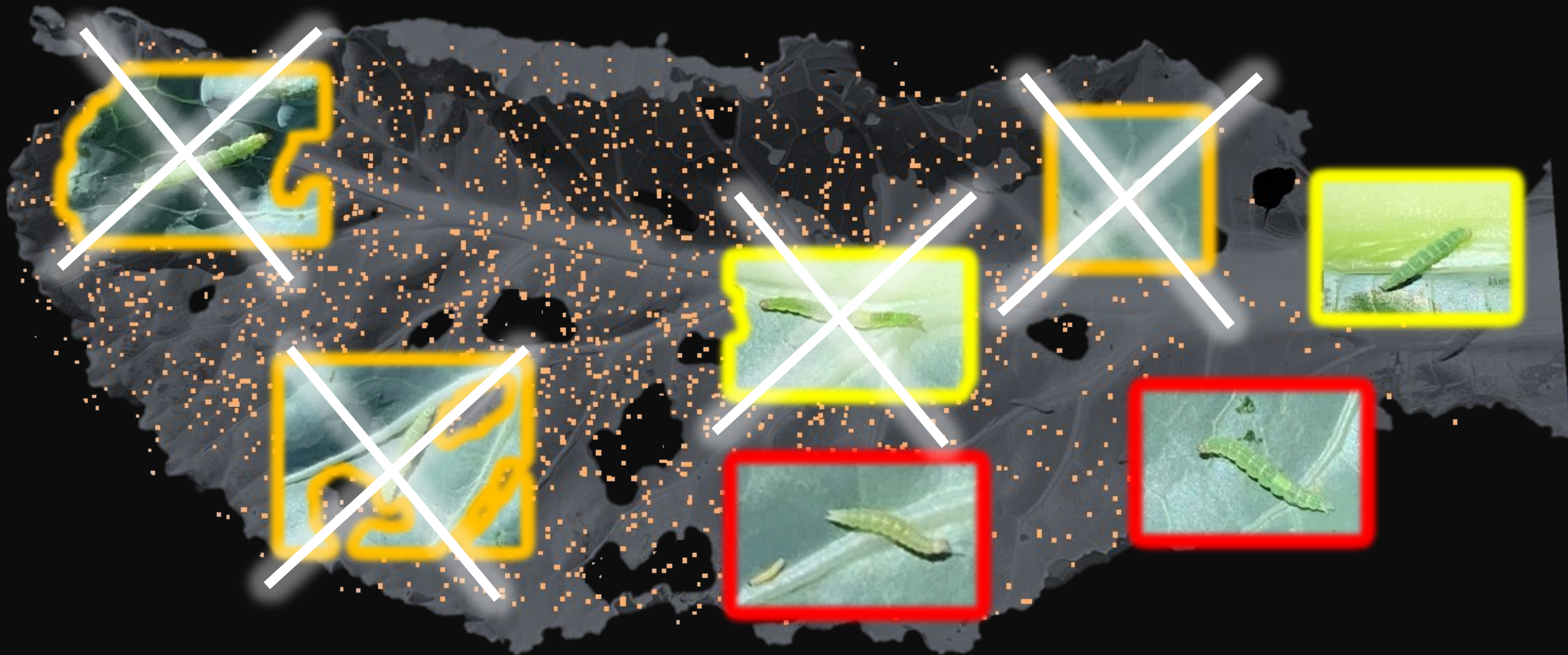
Susceptible



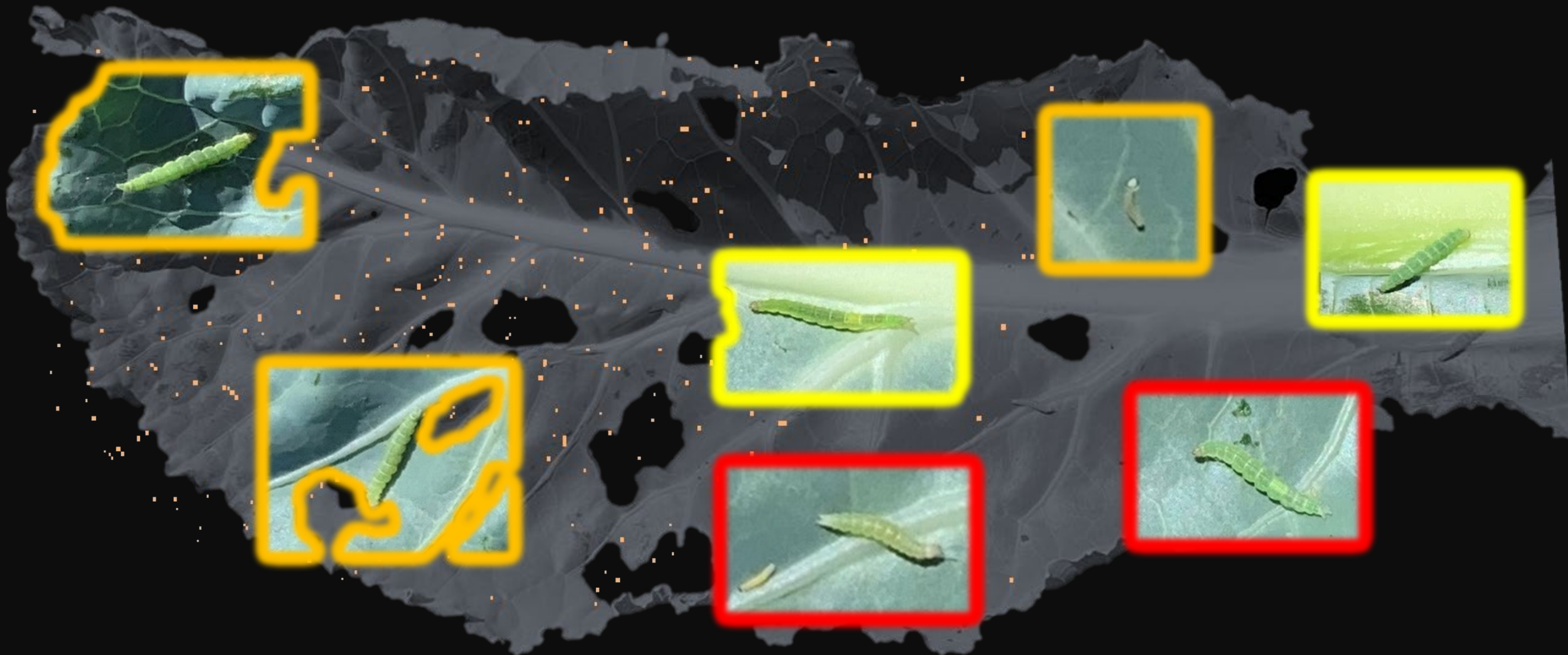
Susceptible



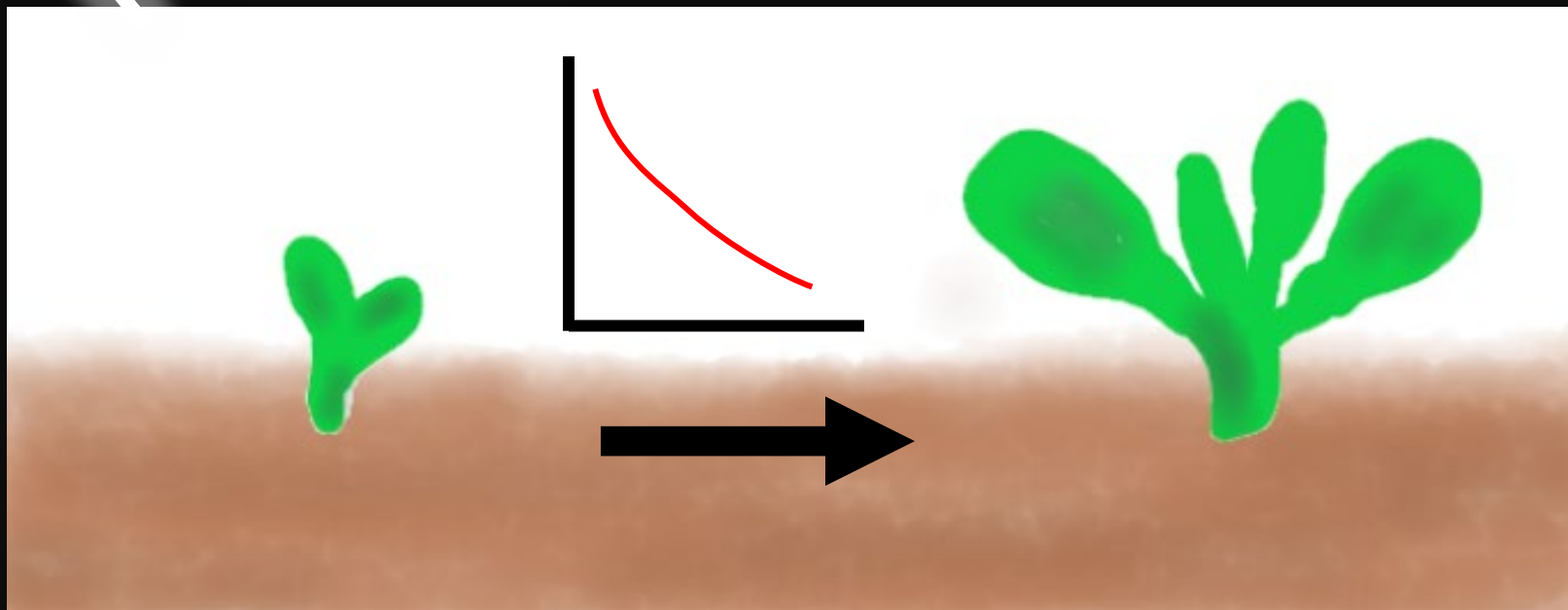
Resistant



# Resistant



# Transplants and tray drenches



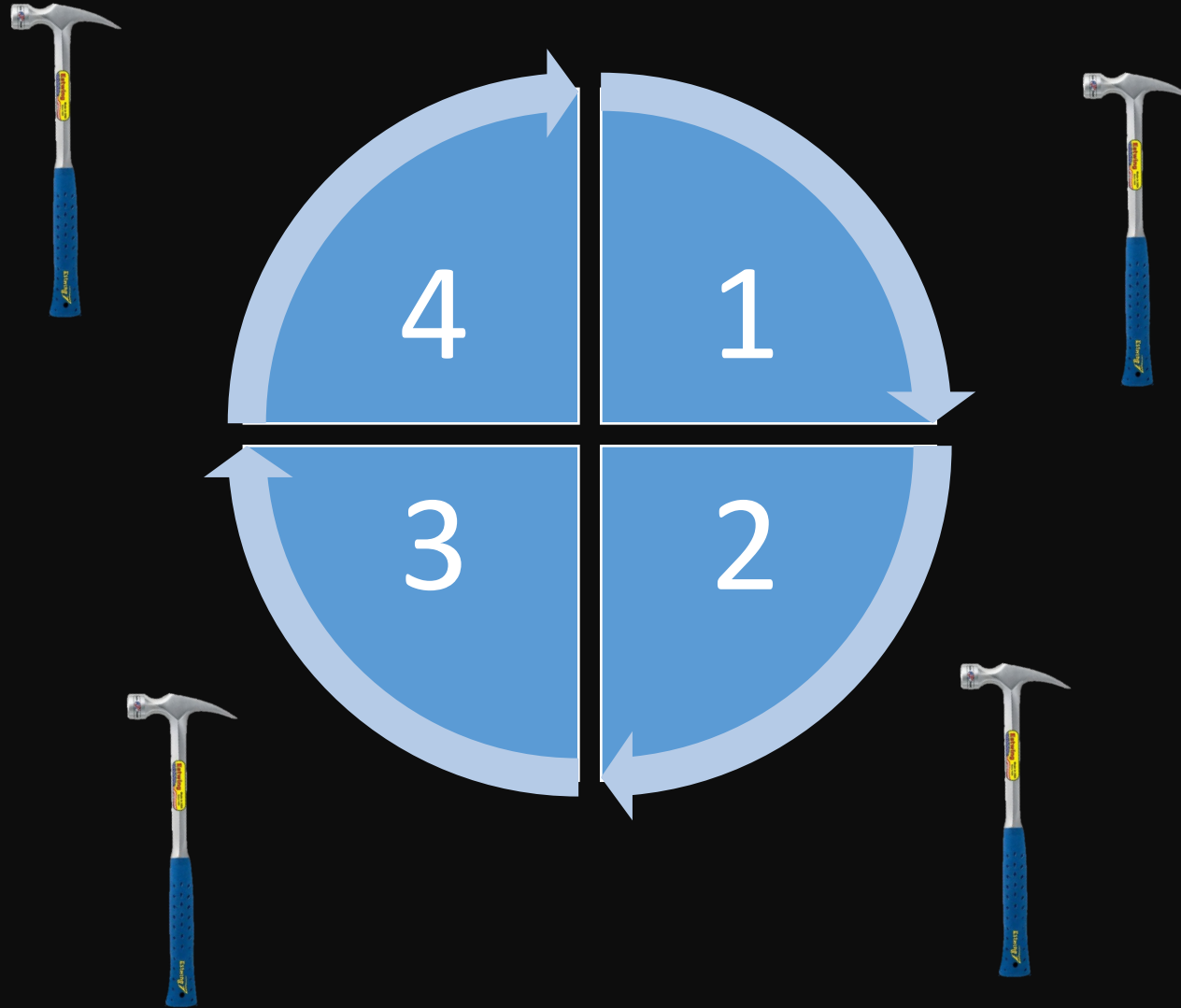
What can we do?



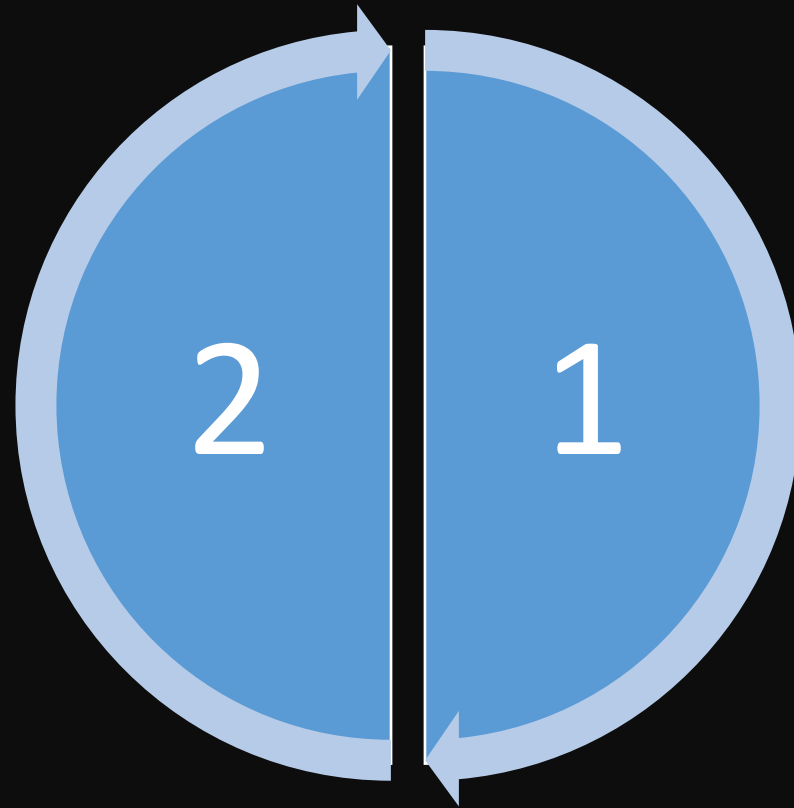




# Rotation



# Rotation





**Many years +  
Uncertainty**

Can we avoid the icebergs?





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Ricky Lara  
CDFA

Matt Greishop  
Cal Poly SLO

Oleg Daugovich  
UCCE Ventura

Hamutahl Cohen  
UCCE Ventura



Caroline Donohew  
UC Davis

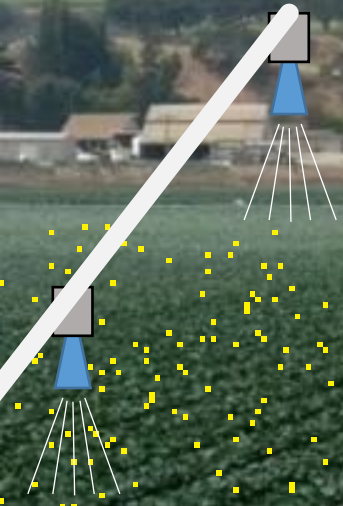
Erika Bueno  
UC Davis

Dylan Beal  
UCCE Monterey/Santa Cruz/San Benito

# Mating disruption



# Mating disruption



# Mating disruption



# Mating disruption



# Mating disruption



400/acre

# Mating disruption

4/acre



32/acre

# Mating disruption

2600/acre



3000/acre



# Mating disruption









**SCENTRY**  
WING TRAP  
Pyle 22-7

SCENTRY BIOLOGICALS, INC.  
Bozeman, Montana 59717  
810 Central Expressway





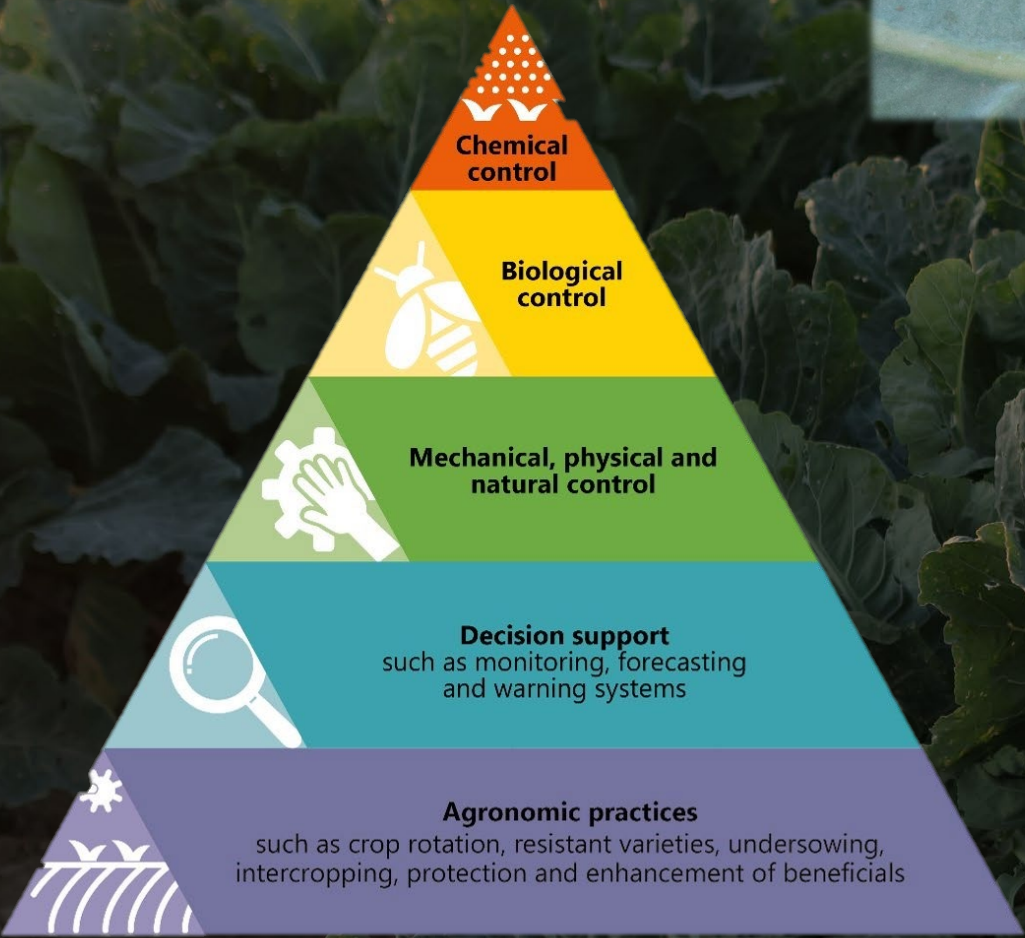




# Biological control – resident parasitoids

*Diadegma insulare*





# Acknowledgements



- Kevin Goding, Sophie Allen, Litzy Jacuinde
- Field-Vegetable IPM lab undergraduates
- Nursery cooperators
- Industry cooperators/FMC
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- Rafael Alfaro + Merrill Farms
- Reed Worthy
- Kim Horton + Taylor Farms
- Joe Padilla + Lakeside farms
- Jaylen Calabro + Braga Fresh Family Farms
- Other PCA/grower cooperators

Questions?

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