Monitoring Western Grapeleaf Skeletonizer (WGLS)

Harrisina brillians in Wine grape Vineyards

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Western Grapeleaf Skeletonizer
Harrisina brillians Barnes & McDunnough

- Distributed through California, Arizona, New Mexico, Texas, Nevada, Utah, Colorado and Northern States of Mexico
- 1941- First found in California near San Diego
- 1961 - Found in backyard grapes near Fresno

Western Grapeleaf Skeletonizer Life stages

Eggs

Pupae

Larvae

Life cycle - larvae

First instar

Second instar

Fifth instar

Fourth instar

Third instar

Infected adults pass the virus to eggs


Healthy eggs


Healthy larvae ready to molt

Infected eggs are scattered and fail to hatch


Sick larvae


Infected eggs

Virus infection symptoms

- Abnormal growth
  - Discoloration
  - Larvae shrink and/or die
  - Hang onto leaf or fall to the ground
- Abnormal feeding

Early 1950's – A parasitic wasp and a parasitic fly were introduced and established in San Diego county

Tachinid fly, *Ametadoria misella*

Parasitic wasp, *Apanteles harrisinae*



Damage:

- Voracious feeding by the larvae causes defoliation
- Larvae have poisonous spines that cause skin welts on field workers

Excessive defoliation causes crop sunburn

IPM Approach

Inspection

Identification and Evaluation of the problem

Assessment of management options

Needs to continually be reviewed and improved

Rationale of the study

- WGLS monitoring utilizes Delta sticky traps with lures
- Insect counts are 7-10 days late, labor intensive, inaccurate and impracticable in population models
- Currently there is no communication mechanism to alert growers of the presence of WGLS in vineyards, or the timing to start a control program

Rationale of the study cont.

- The purpose of insect trapping is monitoring pest populations to determine the time the use of control methods to optimize efficacy of control.
- A trap with an optical sensor was developed.
- An evaluation to compare detection accuracy with commercially available Delta traps was needed.
- A Flight Sensor trap system will provide “alerts” with real time information.

Goal of the study:

- To develop a pest management decision tool utilizing Artificial Intelligence (AI) and Machine Learning (ML) combined with real-time insect data collection technology.

- Assemble a multidisciplinary team of experts in real-time insect data collection, Artificial Intelligence and Machine Learning, biostatistics, entomologists, pest control advisors, farm managers and winegrowers.

Western Grapeleaf Skeletonizer (WGLS) Trial

Trial Description

Paired comparison of 12 Delta sticky traps against FlightSensors baited with WGLS pheromone. FlightSensors were fitted with interior sticky cards to confirm insect.

Period of data collection 2022 and 2023

Trial Location Wine grape vineyards in Temecula, CA

Cooperators
Temecula and San Diego Winegrowers

Additional Info

UC IPM: https://ipm.ucanr.edu/agriculture/grape/western-grapeleaf-skeletonizer/


FARMSENSE

FlightSensor fitted with yellow sticky card

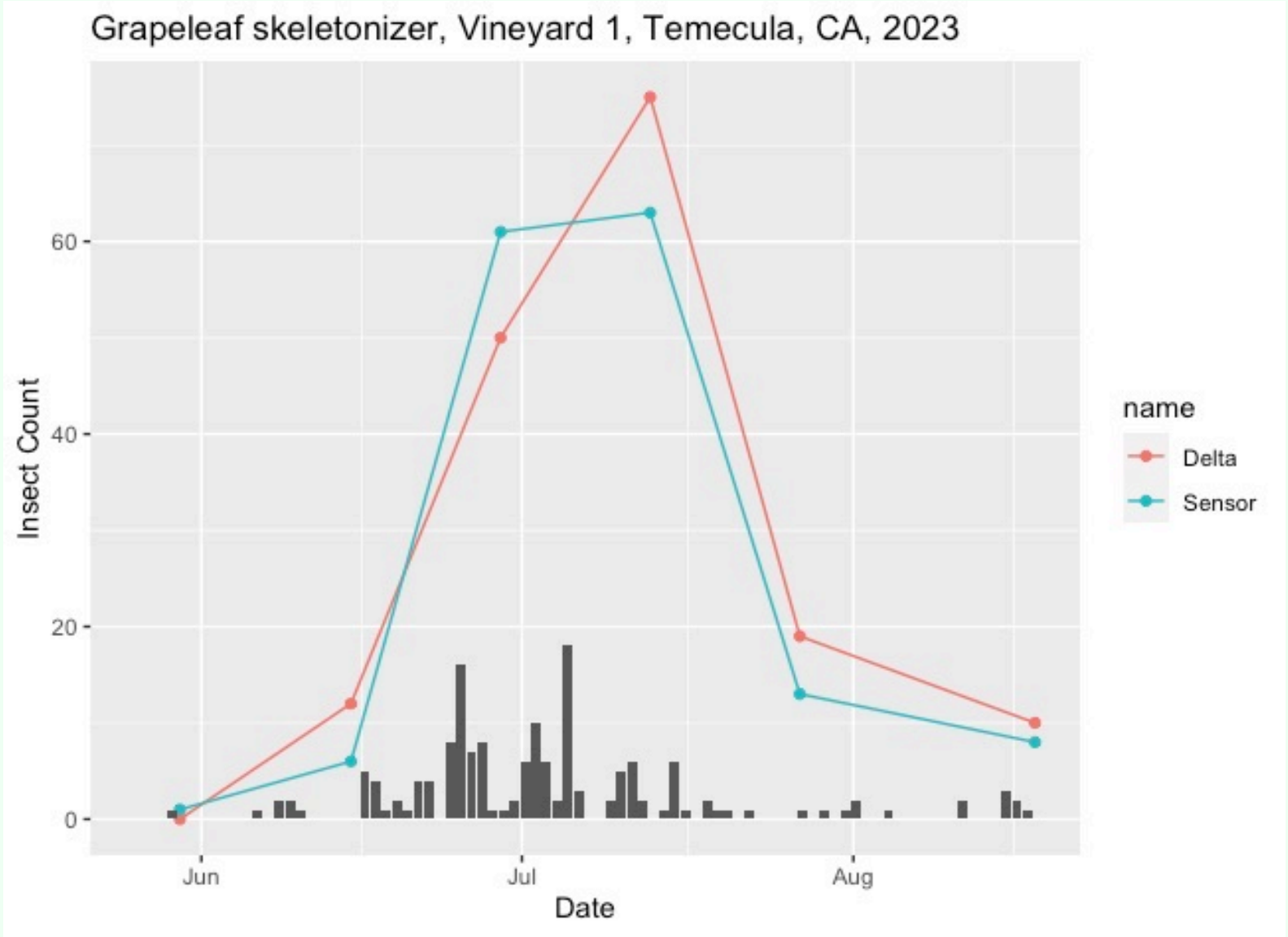
Look for infested leaves above the cordon zone

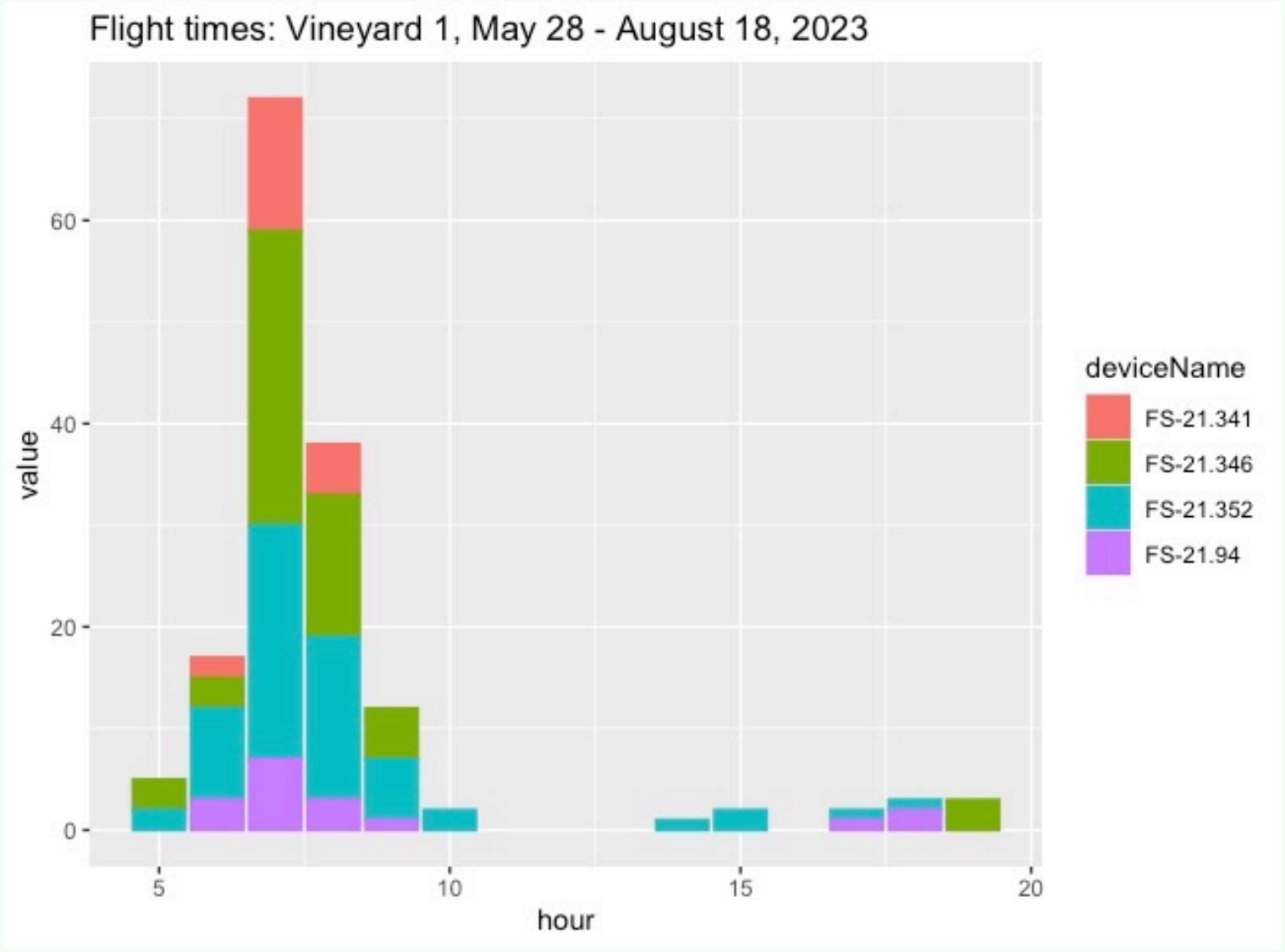

Eggs found June 29, 2023

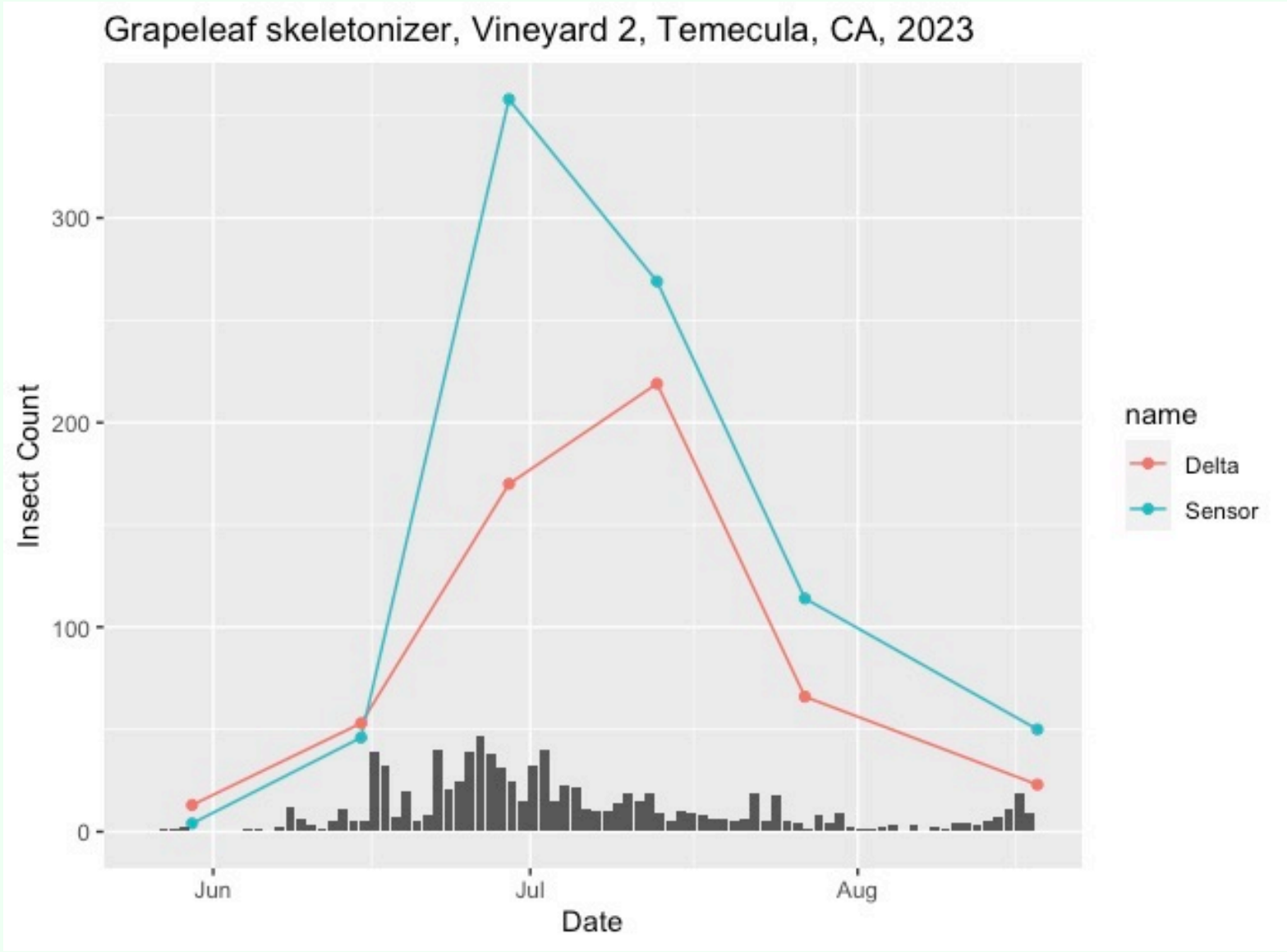
Question

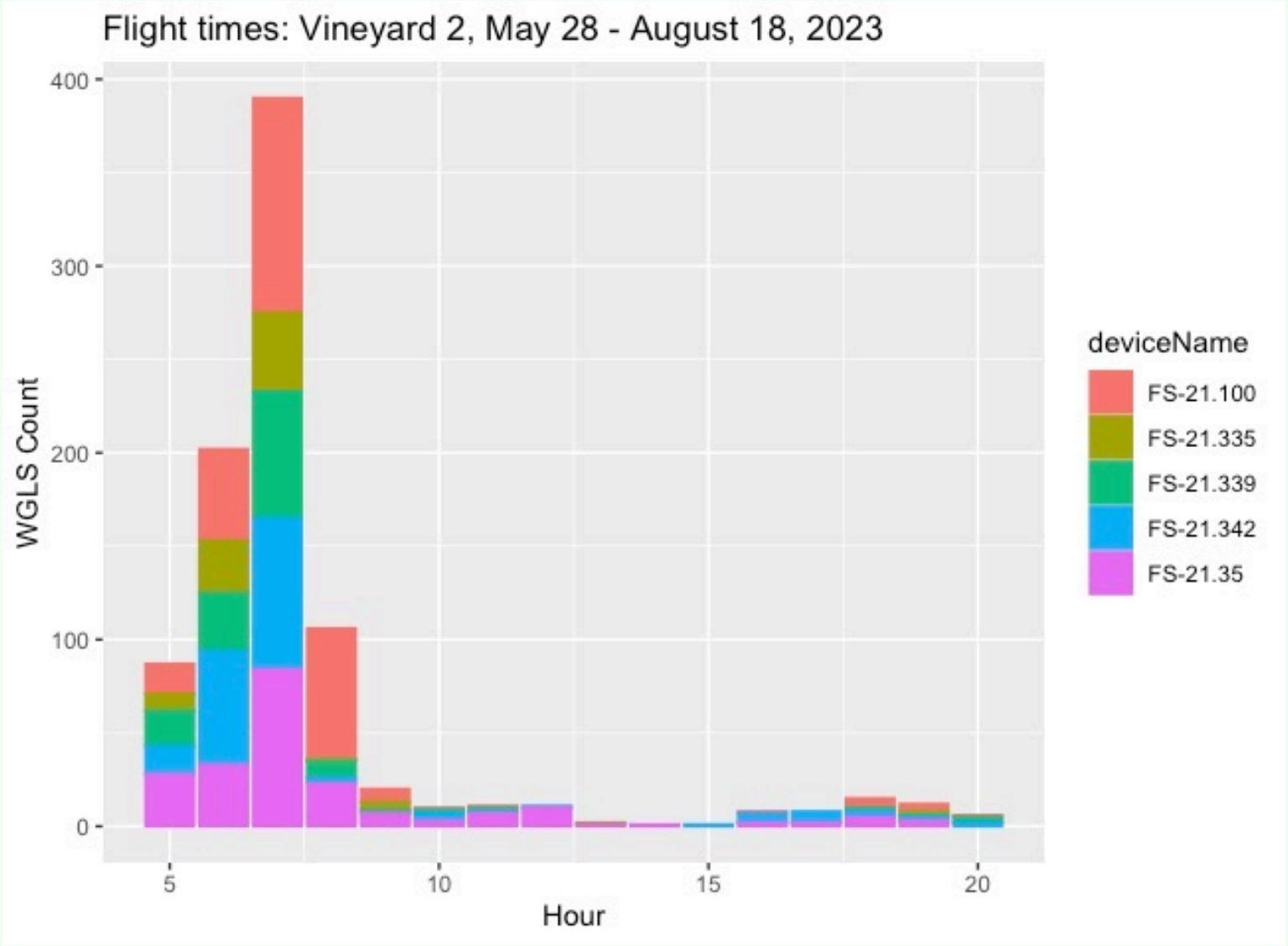
These are symptoms of skeletonizer infestation (mark all that apply)

a. Defoliation
b. Fruit sunburn
c. Leaves with bumps
d. Delayed budbreak


Grapeleaf skeletonizer, Vineyard 1, Temecula, CA, 2023
Insect Count
60
40
20
0
Jun
Jul
Aug
Date
name
Delta
Sensor


Flight times: Vineyard 1, May 28 - August 18, 2023
value
60
40
20
0
5
10
15
20
hour
deviceName
FS-21.341
FS-21.346
FS-21.352
FS-21.94


Grapeleaf skeletonizer, Vineyard 2, Temecula, CA, 2023
Insect Count
300
200
100
0
Jun
Jul
Aug
Date
name
Delta
Sensor


Flight times: Vineyard 2, May 28 - August 18, 2023
WGLS Count
400
300
200
100
0
5
10
15
20
Hour
deviceName
FS-21.100
FS-21.335
FS-21.339
FS-21.342
FS-21.35

Roltsch, W. J., and M. A. Mayse. 1993. Simulation phenology model for the western grapeleaf skeletonizer (Lepidoptera: Zygaenidae): development and adult population validation.
Environ. Entomol. 22: 577-586.

Degree-days

The total amount of heat required, between the lower and upper thresholds, for an organism to develop from one point to another in its life cycle is calculated in units called degree-days (°D).

Developmental thresholds

Degree-day accumulations required for each stage of development

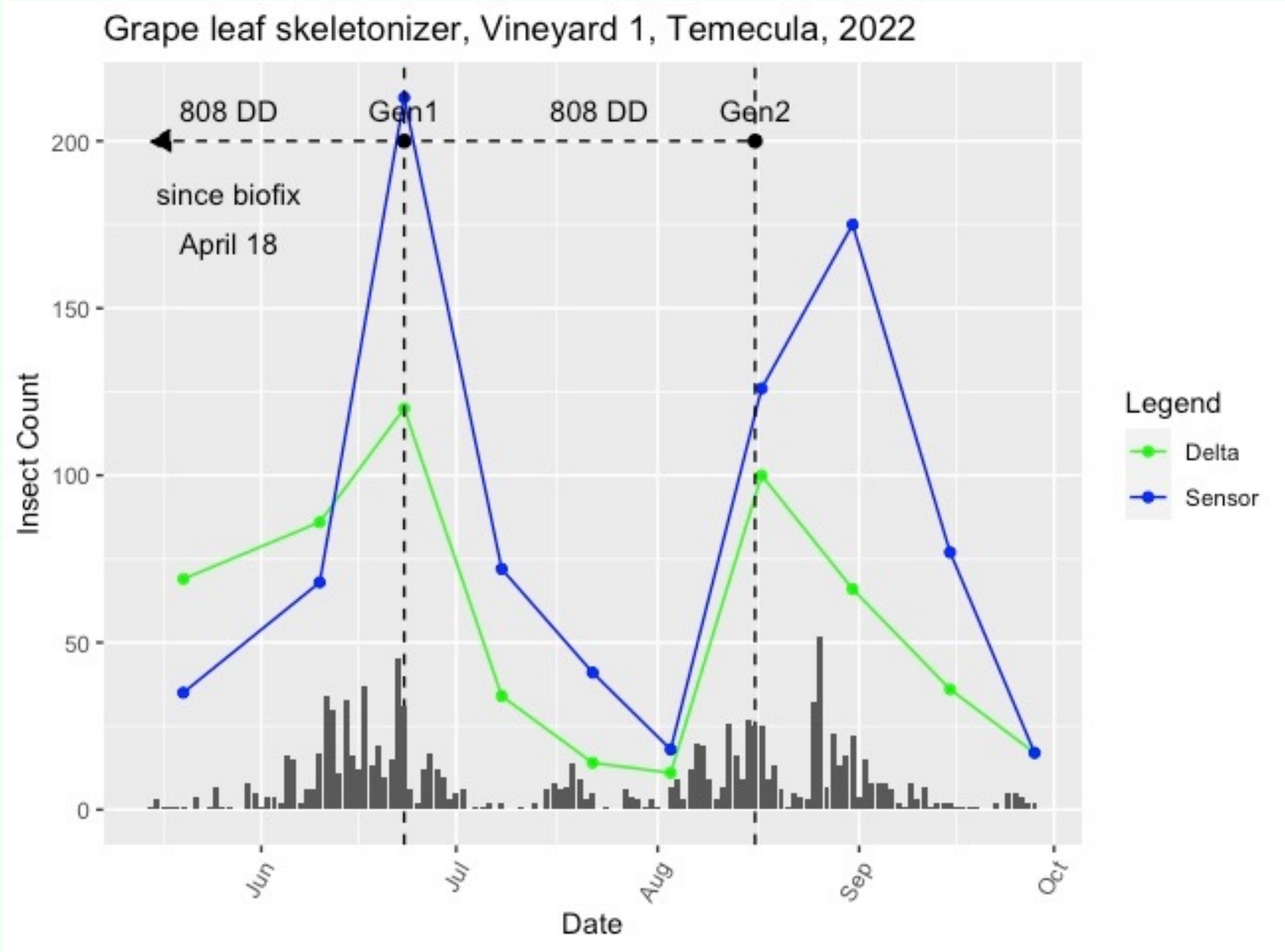
Location of study: California (laboratory and field studies)

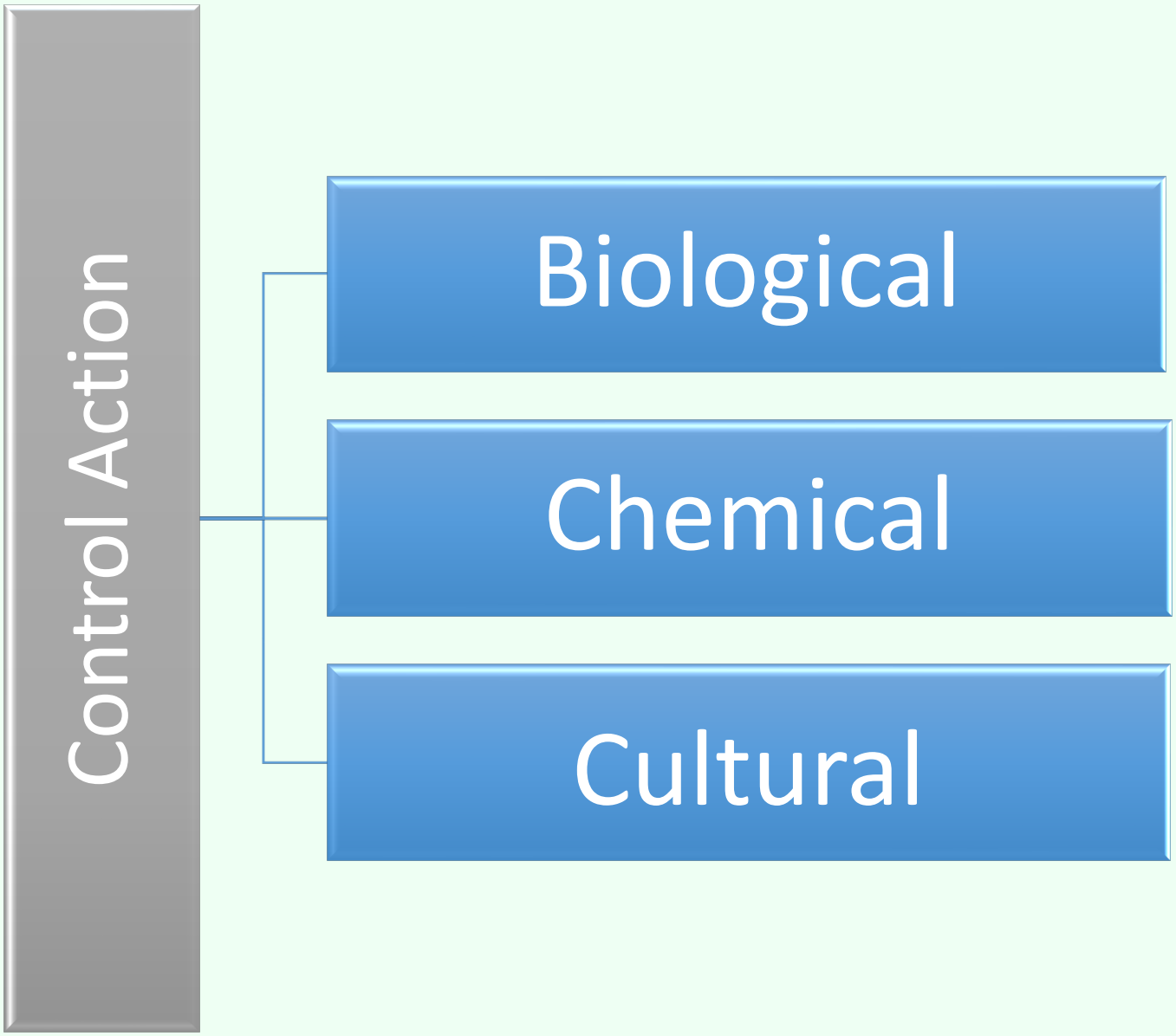
Biofix: First male moth from overwintering pupa captured in pheromone traps

Method of calculation:	Single Sine
Cutoff method:	Horizontal Cutoff

Lower:	48.2°F	(9.0°C)
Upper:	82.8°F	(28.2°C)

Host: Grapes	**DD (°F)**	**DD (°C)**
Eggs:	261.0	145.0
Larvae (instars 1-5):	693.0	385.0
Pupae:	500.0	278.0
Generation time:	1454.0	808.0


Grape leaf skeletonizer, Vineyard 1, Temecula, 2022
808 DD
Gen1
808 DD
Gen2
since biofix
April 18
200
150
100
50
0
Insect Count
Jun
Jul
Aug
Sep
Oct
Date
Legend
Delta
Sensor


Control Action
Biological
Chemical
Cultural

From UC IPM website

Insecticide common name	Trade name	Acceptable for organic production
METHOXYFENOZIDE	Intrepid	
CHLORANTRANILIPROLE	Altacor	
SPINETORAM	Delegate	
SPINOSAD	Entrust & Success	Entrust*
CRYOLITE	Kryocide	
*Bacillus thuringiensis**		Bt*
ACETAMIPRID	Assail	
ABAMECTIN	Agri-Mek SC	
IMIDACLOPRID	Admire Pro Soil & Foliar	
INDOXACARB	Avaunt	

Success for thrips control at bloom
Assail and Provado for leafhoppers and sharpshooters

Control of WGLS larvae with Reduced-risk insecticides* trial

(David Haviland, Walter Bentley, Jennifer Hashim and Carmen Gispert

- Insecticides tested on small and large larvae:
  - Assail, Avaunt, Dipel**, Intrepid, Provado, and Success.

- Assail, Provado and Sucess have a knock-down effect and provide excellent control regardless the size of the larvae.

* Reduced-risk insecticides have a lower toxicity on non-target organisms (birds, fish, plants) and low potential for groundwater contamination.

**Dipel: Biological insecticide that contains the *Bacillus thuringiensis* strain.

Conclusions from the insecticide trial

- There are no thresholds for this pest.

- The use of *Bacillus thuringiensis* (*B.t.*) needs to be timed to the presence of small larvae.

- The knock-down insecticides tested were highly effective against all sizes of WGLS larvae eliminating the need to time the control to small larvae.

Question

The bacterium *Bacillus thuringiensis* (Bt) is used to control:

a. Adults
b. Pupae
c. Larvae
d. All of them

Conclusions from the optical trap trial

- Remote detection with traps with optical sensors offers a promising approach to a more accurate and autonomous insect monitoring method.

- Real-time monitoring will help to improve monitoring and make better control decisions that will help to reduce the use of pesticides and labor.

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Thank you!