Lygus bugs
A Major Pest of Strawberry

UC ANR Experts Forum

June 5, 2024

Format of Today's Talk

- Biology of lygus
- Damage of lygus to the strawberry
- Predator complex of the field
- Biological solutions?
- Pheromones
- Utility of the "bug-vac"
- Chemicals
- Closing comments

Why study lygus?

- Go to a great many crops, alfalfa, canola, lentils, tree fruits, vegetables, strawberries, caneberries, potatoes and even some weed species.

Introduction

Incomplete metamorphosis

Lygus egg; inserted into tissue

Life cycle statistics for lygus

- 3-10 eggs per day, between 50-400 in a lifetime.
- Average lifespan; 10-20 days from egg to adult, adults live from 10 to 50 days, depending on temperature.

Degree day model for lygus

Amount of heat over 54° F accumulated over 24hour period

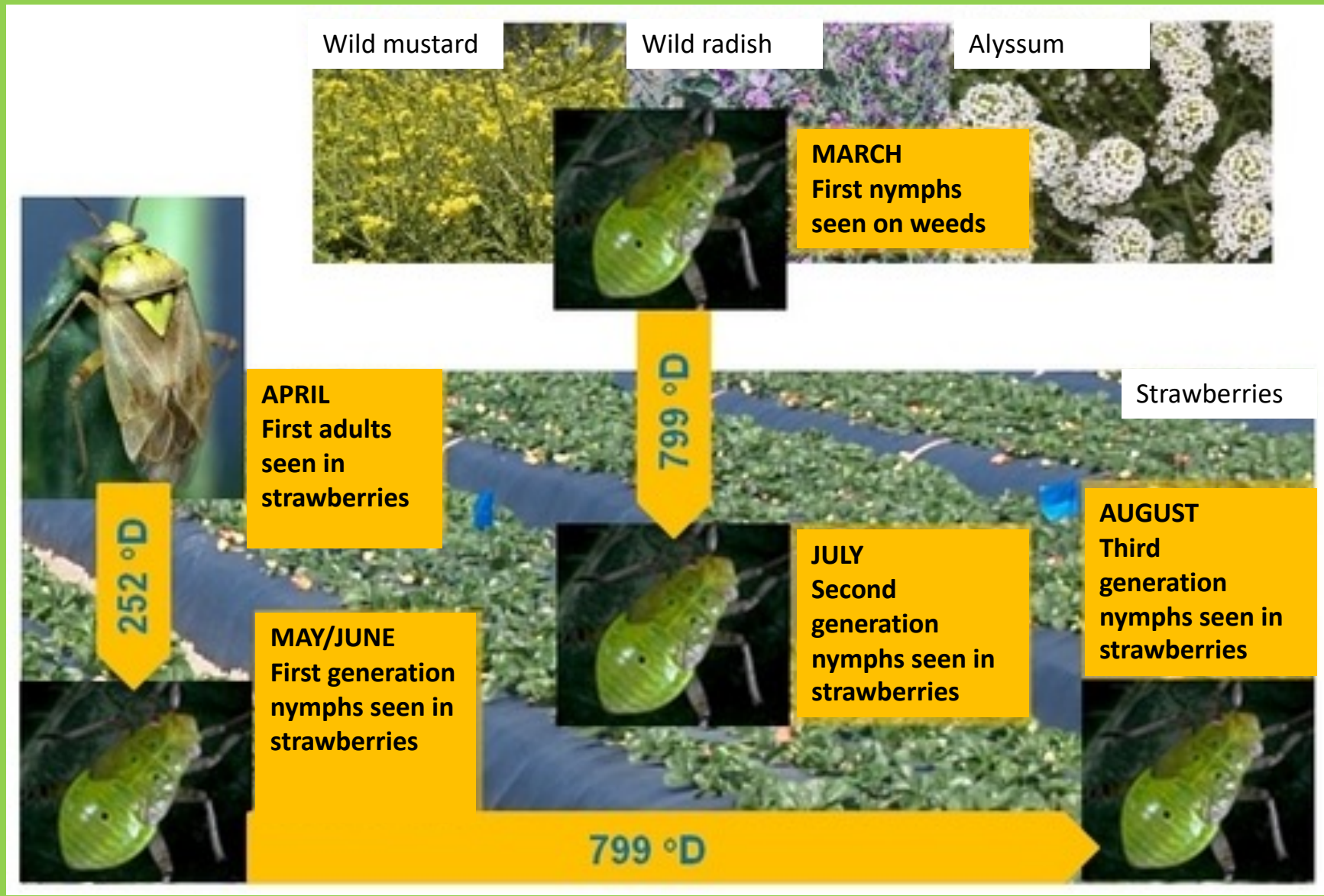
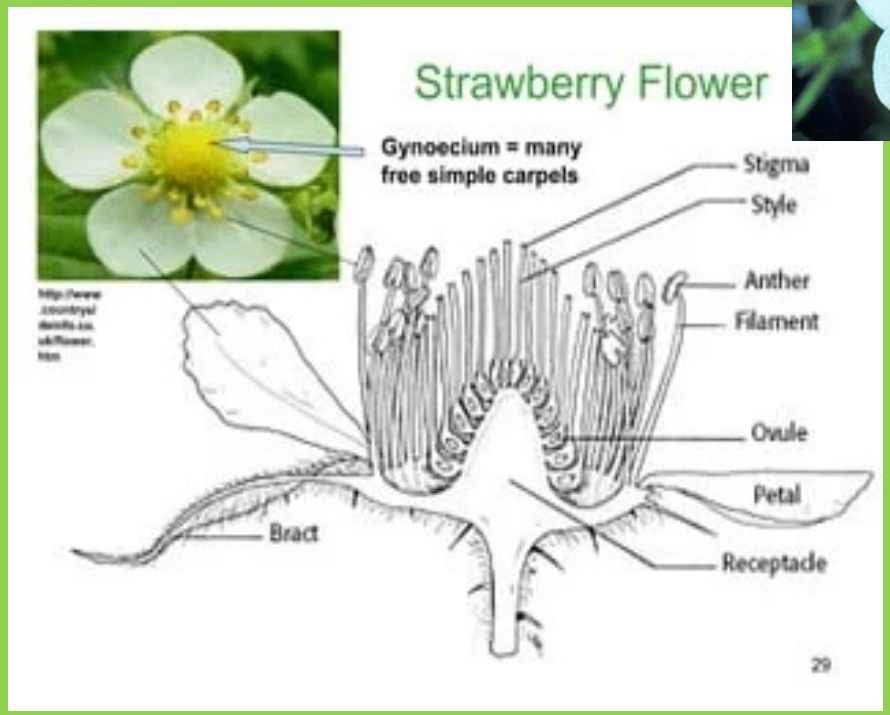


Photo UC IPM

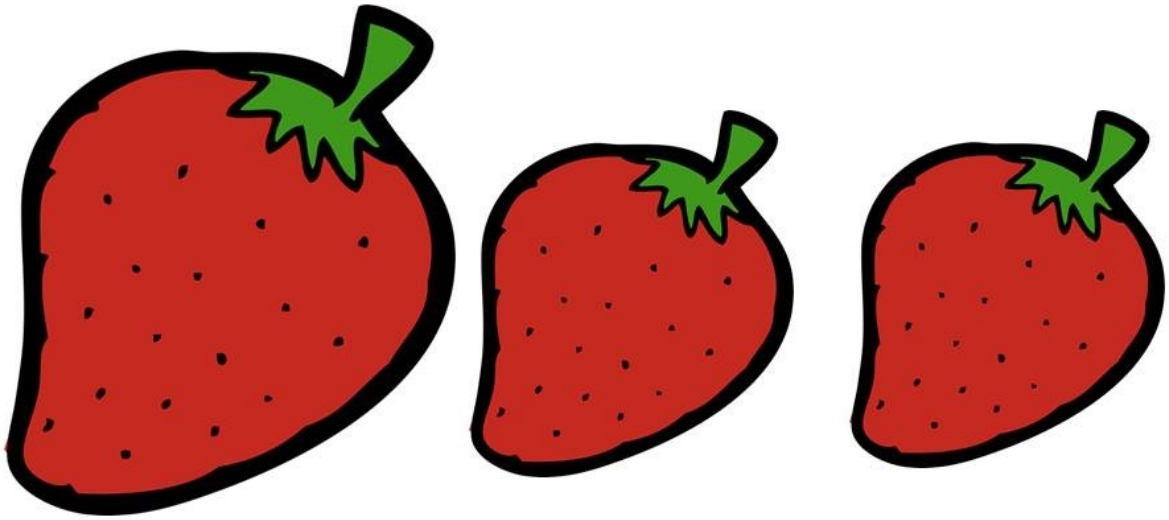
Photo courtesy CalPoly Strawberry Center

How does lygus cause this damage?



Interesting: Near total elimination of lygus results in larger fruit.

Fruit Size Comparison



Very few lygus	Many lygus – grower check	Many lygus – untreated check
Avg fruit size 22.5 g	**Avg fruit size 16.2 g**	**Avg fruit size 15.8 g**

Interesting: Near total elimination of lygus results in larger fruit.

Question #1

- Which stage of lygus bugs is known to cause damage to the strawberry flower and subsequently the fruit?

  A. egg

  B. nymph

  C. adult

Predator complex

Spiders

Assassin bugs

Parasitoids

Peristenus digoneutis

Released commenced 2003,
establishment in several areas by 2005

Use of pheromones?

"We first started working on Lygus in the 1990s and identified a lot of compounds and did a lot of testing," he said. "But we never really got anywhere and didn't see any light at the end of the tunnel, so we put it aside."

Jocelyn Millar, UC Riverside, working together with Kent Daane of UC Cooperative Extension

Effectiveness of bug vacs

Efficacy

TABLE 1. Mean number of Lygus nymphs and adults, and number of cat-faced fruit per 50 large green fruit in 1989 trial of single-row bug vacuum used weekly

Treatment	Mean (standard deviation) Lygus per 10-beat sample		No. damaged fruit per 50 fruit
	Nymphs	Adults	
Vacuum weekly	2.2 (0.5) b*	0.13 (0.1) b	16.3 (0.9) b
Bifenthrin†	1.4 (0.3) c	0.35 (0.1) ab	11.0 (1.1) c
Untreated	2.4 (1.2) a	0.45 (0.2) a	19.8 (1.9) a

*Means in columns followed by the same letter are not significantly different ($P > 0.05$).
†Bifenthrin, 0.1 lb. ai/acre, applied on 5/19/89.

TABLE 2. Mean number of Lygus nymphs and adults, and number of cat-faced fruit per 50 large green fruit, in 1989 trial of three-row bug vacuum used weekly or after reaching the treatment threshold

Treatment	Mean (standard deviation) Lygus per 10-beat sample		No. damaged fruit per 50 fruit
	Nymphs	Adults	
Vacuum weekly	3.9 (1.7) b	0.5 (0.2) b*	14.7 (2.0) b
Vacuum at threshold	4.9 (0.9) ab	0.7 (0.3) ab	18.1 (3.5) ab
Bifenthrin†	0.4 (0.3) c	0.1 (0.1) b	5.8 (0.9) c
Untreated	6.8 (1.9) a	1.9 (0.6) a	23.3 (0.3) a

*Means in columns followed by the same letter are not significantly different ($P > 0.05$).
†Bifenthrin, 0.1 lb. ai/acre, applied on 5/19/89 and 7/10/89.

TABLE 3. Mean number of Lygus nymphs and adults, and number of cat-faced fruit per 50 large green fruit, in 1990 trial of two-row bug vacuum

Treatment	Mean (standard deviation) Lygus per 10-beat sample		No. damaged fruit per 50 fruit
	Nymphs	Adults	
Bifenthrin*	9.0 (0.3) d	1.7 (0.04) a	4.4 (0.3) d
Vacuum weekly	26.7 (0.4) a	1.3 (0.1) a	10.8 (1.3) bc
Vacuum twice weekly	18.0 (0.5) bc	2.3 (0.1) a	11.8 (1.7) ab
Vacuum + malathion†	14.5 (0.4) cd	1.0 (0.2) a	9.2 (1.3) bc
Malathion†	21.2 (0.2) ab	2.3 (0.2) a	8.1 (0.9) c
Untreated	19.5 (0.4) bc‡	2.8 (0.2) a	13.0 (1.5) a

*Bifenthrin, 0.1 lb. ai/acre, applied on 5/8/90 and 6/13/90.
†Malathion, 1.25 lb. ai/acre, applied on 5/30/90 and 7/11/90 at treatment threshold.
‡Means in columns followed by the same letter are not significantly different ($P > 0.05$).

TABLE 4. Comparison of weekly vacuuming, twice weekly vacuuming, vacuuming plus malathion, malathion, and bifenthrin treatments on mean number of Lygus bug nymphs and adults, and number of cat-faced fruit in 1990 trial of three-row bug vacuum

Treatment	Mean (standard deviation) Lygus per 10-beat sample		No. damaged fruit per 50 fruit
	Nymphs	Adults	
Bifenthrin*	0.8 (0.5) a	2.0 (0.8) b	5.3 (2.1) c
Vacuum weekly	24.2 (5.9) b	6.0 (1.6) ab	17.2 (3.3) b
Vacuum twice weekly	26.0 (3.7) b	7.5 (1.3) a	18.1 (3.7) b
Vacuum + malathion†	20.7 (7.6) b	3.7 (0.9) ab	17.5 (4.0) b
Malathion†	24.7 (3.3) b	4.3 (0.9) ab	16.0 (2.0) b
Untreated	52.5 (18.4) a‡	9.5 (2.1) a	27.3 (3.0) a

*Bifenthrin, 0.1 lb. ai/acre, applied on 5/6/90 and 7/10/90.
†Malathion, 1.25 lb. ai/acre, applied on 5/6/90 and 7/10/90.
‡Means in columns followed by the same letter are not significantly different ($P > 0.05$).

Cost

- $1350 v spray program at $1311, including miticides, fungicides and larvicides.
- Non-residual method of control, meaning it must be repeated; in a 2014-15 study done by the Strawberry Commission, even a field intensively vacuumed (2x week) a rapid rebound of lygus populations in regions of the field gave cause to thinking that even more frequent vacuuming would be necessary.

Chemical Management

- Can be efficacious
- Problems of resistance
- Difficulty in registering new materials.

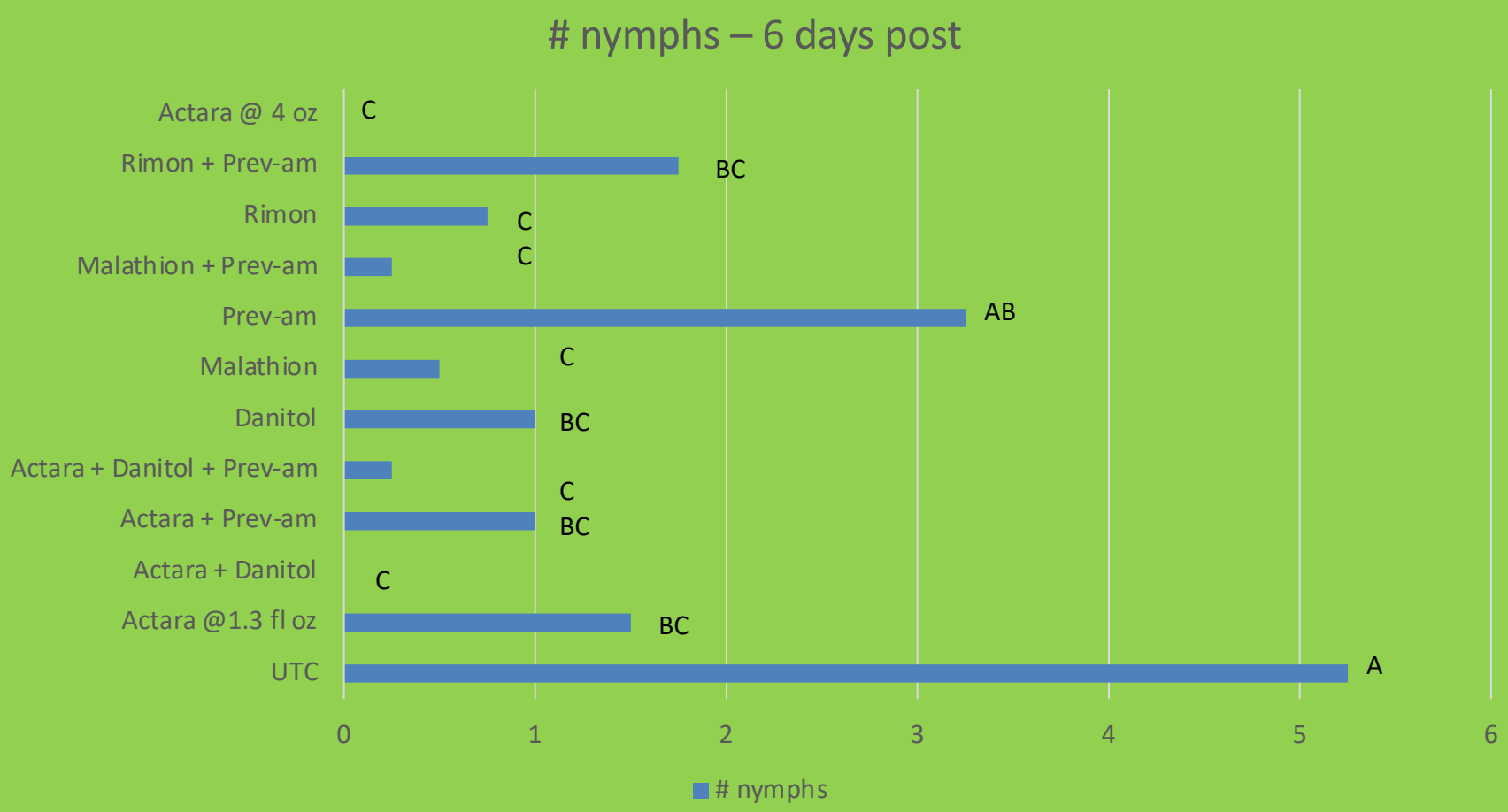
Classes of chemicals effective on lygus

- Pyrethroids – Danitol, Brigade
- Organophosphates – malathion
- Carbamates – Sevin (carbaryl)
- Newer active ingredients – Novaluron (Rimon), flonicamid (Beleaf)

2006 Efficacy Trial

Commonly Used Insecticide with/without Oil

Water carrier rate 100 gal/A



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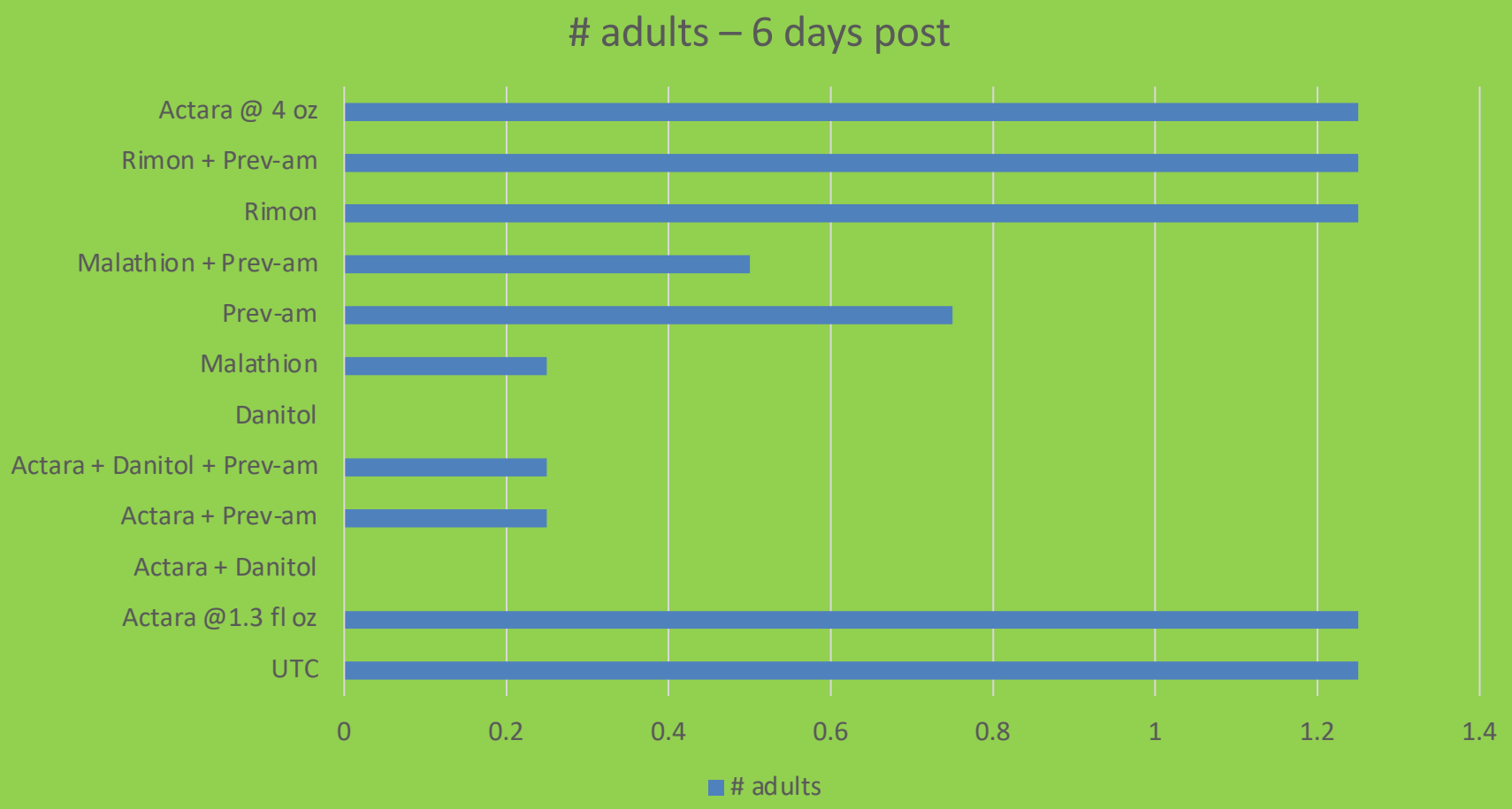

2006 Efficacy Trial
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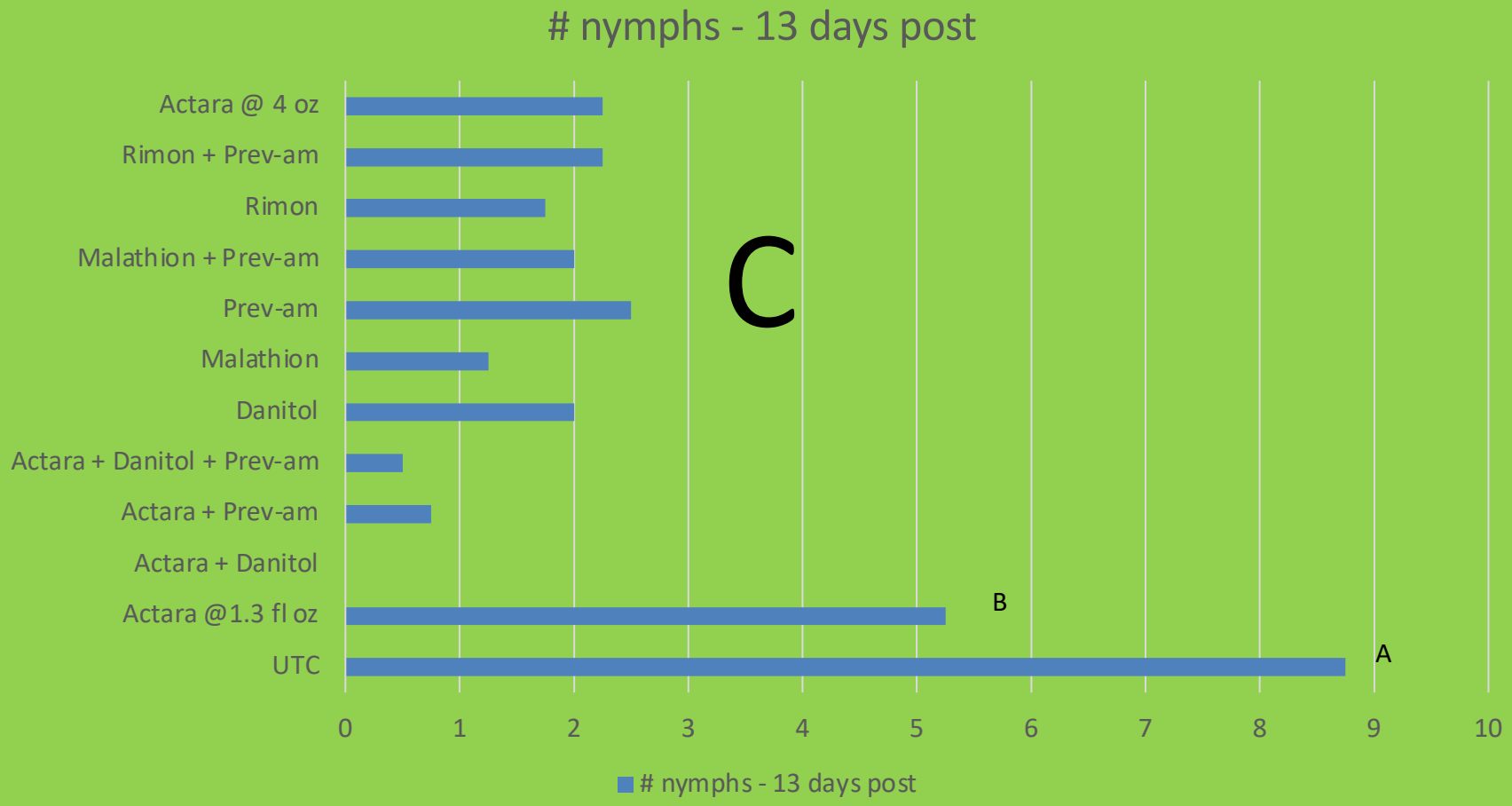


Lygus adults from same sampling date – no significant differences; numbers range from 0 to 1

Question #2

- What is the best stage of lygus bug to spray?

  A. eggs

  B. nymphs

  C. adults

2021-2024 Lygus work

Applications
Plinazolin

- 2021: June 9, June 21 and June 29
- 2022: June 11, June 19, and June 25
- Plot sizes rather large, 600 sq ft each, very likely the minimum required for obtaining good treatment separation.

Test Materials 2021
Water carrier rate 150 gal/A

- Plinazolin at 2.05 fl oz
- Plinazolin at 3.05 fl oz
- Plinazolin at 4.11 fl oz
- Cormoran (acetamiprid + novaluron) at 12 fl oz
- Mustang Max (zeta-cypermethrin) at 4 fl oz
- Untreated control

* All treatments applied with ¼ fl oz per gallon water carrier Dyna-mic surfactant

Test Materials 2022
Water carrier rate 150 gal/A

- Plinazolin at 2.05 fl oz
- Plinazolin at 3.05 fl oz
- Plinazolin at 4.11 fl oz
- Mustang Max (zeta-cypermethrin) at 4 fl oz
- Untreated control

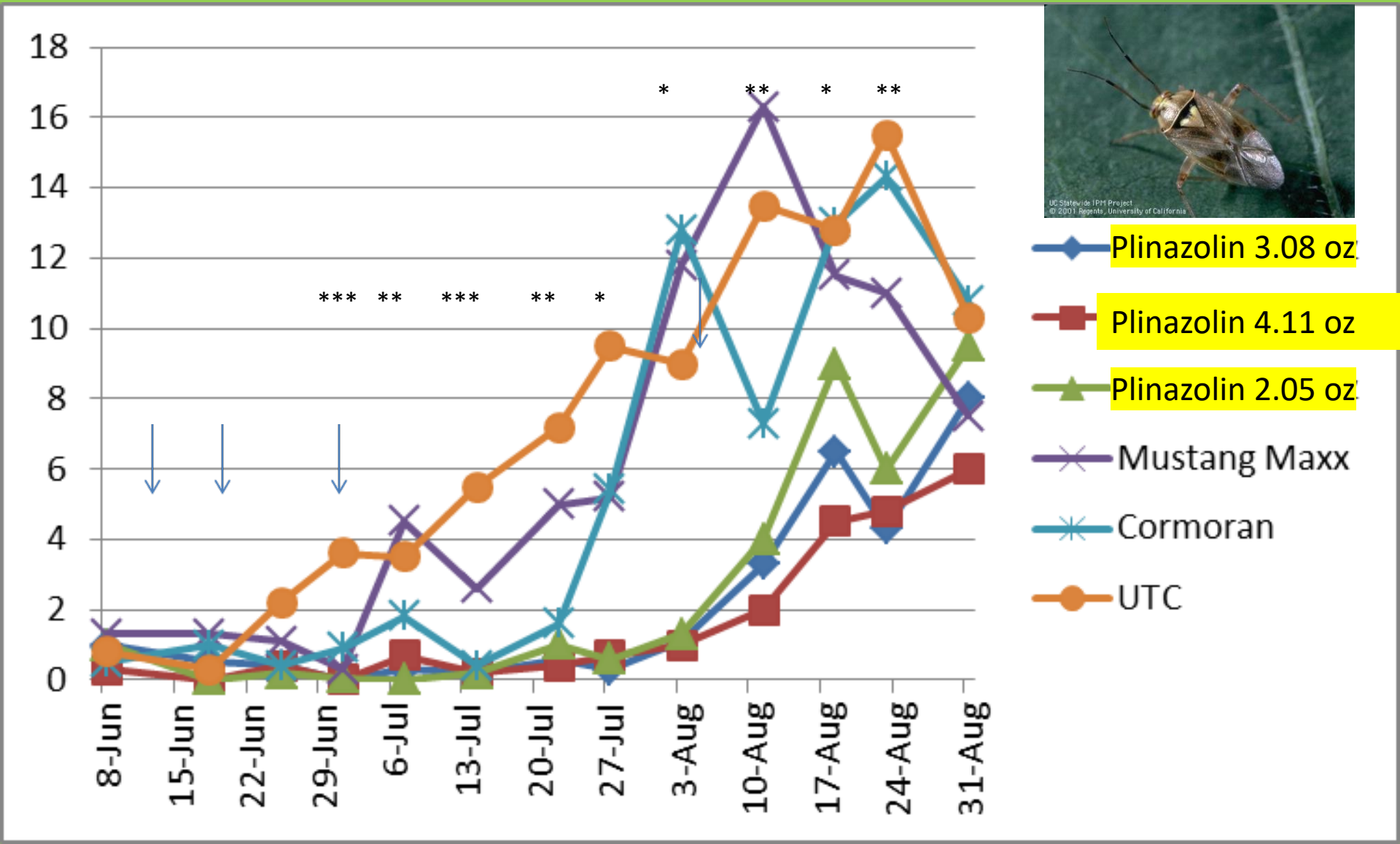
* All treatments applied with ¼ fl oz per gallon water carrier Dyna-mic surfactant

Evaluations 2021 & 2022

- Inside of center two beds sampled, alternating from left to right; weekly
- Bugs collected by beat box method, with 11" x 16" Rubbermaid container, twenty plants. Each beat three times firmly on side of plant.
- To maintain sampling integrity, all samples were taken between 10 am and noon.
- Collected samples bagged, frozen and evaluated under dissecting scope.
- In 2022, harvest taken from intermediate Plinazolin rate, UTC and Mustang Maxx.

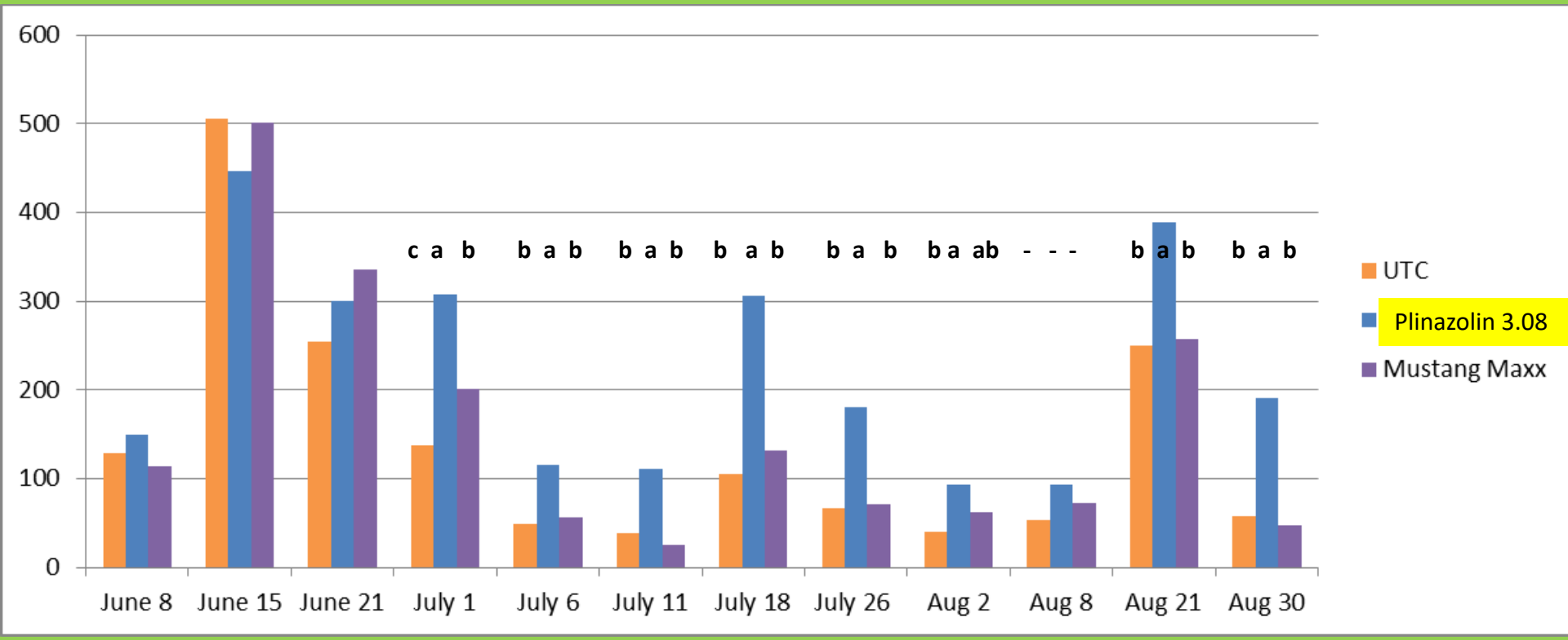
Lygus nymphs 2021

Lygus adults 2021



Fruit Twisting 2021

2022: Yields respond to very low lygus numbers 8# boxes per Acre



	Totals
UTC	1685 box/A
ISM555 3.08 fl oz/A	2679 box/A
Mustang Maxx	1874 box/A

Treatment List 2023

- Application dates August 3, 10 and 17.
- Plinazolin Technology at 2.05 and 3.08 fl oz
- Sefina at 14 and 28 fl oz
- Beleaf ⇨ Avaunt Evo ⇨ Avaunt Evo
- Grower standard = Rimon ⇨ Malathion ⇨ Danitol + Actara
- Untreated check

All treatments applied w/ Widespread Max 6 fl oz/100 gal

Applications 2023

- August 3, August 10 and August 18
- Sprays done early in the day, near windless conditions
- 150 gal per acre water carrier

Evaluations

- Lygus + beneficials evaluated weekly by sweep netting and counting in the field.
- Cat-facing measured weekly starting several weeks after the last application

Treatment replicates 6 beds x 28 ft long

Tee Jet 80015 VK nozzles125 psi

2023 Lygus nymphs

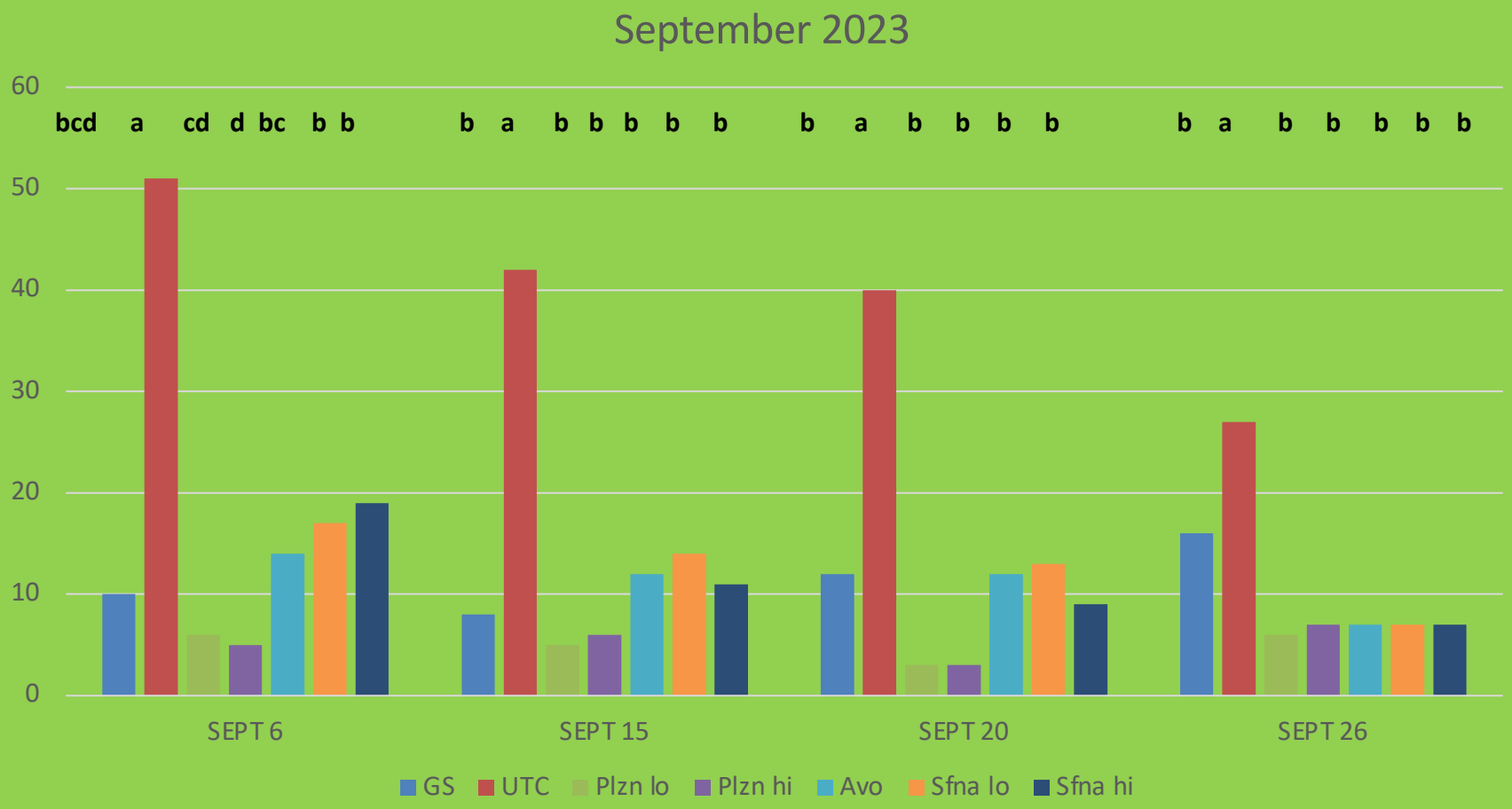
2023 Lygus Adults

2023 Total Lygus

2023 Spiders

2023 Minute Pirate Bugs

Cat facing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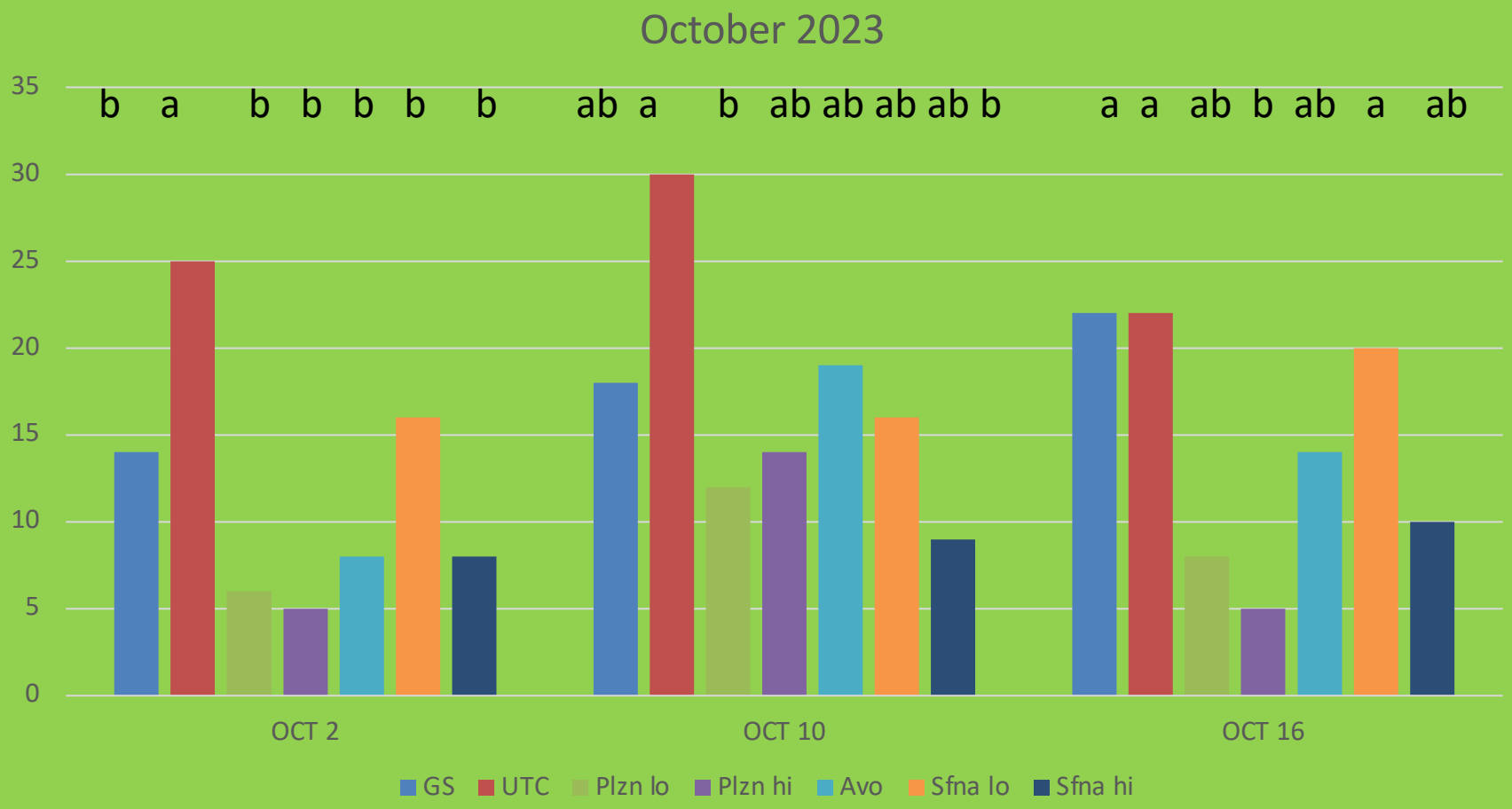
Cat facing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Sfna lo
Sfna hi

2024 lygus work

William Allen and Malcolm Douglas, UC Berkeley 1974:"In time we hope to have data that will show how much catfacing can be expected from various population levels of lygus."

Current study, will test season long effects of highly effective treatments, grower standards and an untreated control.

Conclusion

- Lygus, being a native insect to California, will never be eliminated so we need to continue to learn to manage it.
- Beneficials, while nice to have around because they eat lygus, do not exert enough pressure on lygus to be economically viable as a control.
- Impact to beneficials can be driven by factors outside of the insecticide sprays.
- No one method should be seen as the only approach in a management plan.