Bee Nutrition & Varroa Control

Oregon State University

Ramesh Sagili

ramesh.sagili@oregonstate.edu

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OUR BUSY BEES
Kendra DelToro
Ann Bernert
Jon Dempster
Emily Mock
Bri L
Bri P
Mustafa Bozkus
Max Simon
Kate Taormina
Bryan William

Overview of Presentation

- Basics of bee nutrition
- Nutritional challenges facing bees
- Efforts to improve bee habitat
- Varroa Control Strategies

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Colony Survival

Varroa

Nutrition

You Are What You Eat

- **Nutrition is the first line of defense**

- **Optimal nutrition boosts: (a) immune system & (b) detoxifying enzymes**

HONEY BEE NUTRITION

MACRONUTRIENTS

Carbohydrates (nectar/honey)

Proteins (pollen)

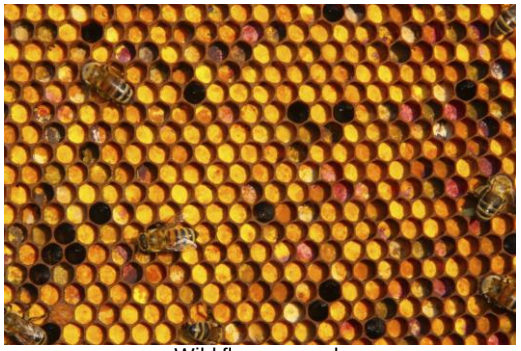
Micronutrients

Vitamins

Lipids (e.g. *sterols*)

Minerals


Honey bee suite


Wild flower meadows

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Pollen (Protein)

Pollen is the primary source of protein

Crude protein and Amino acids

Most pollens: 10% to 40% protein

Also a source of lipids (e.g. Sterols), minerals, vitamins

Nutrition (especially protein) is crucial when the colonies are rearing winter bees (diutinus bees)

Sterols

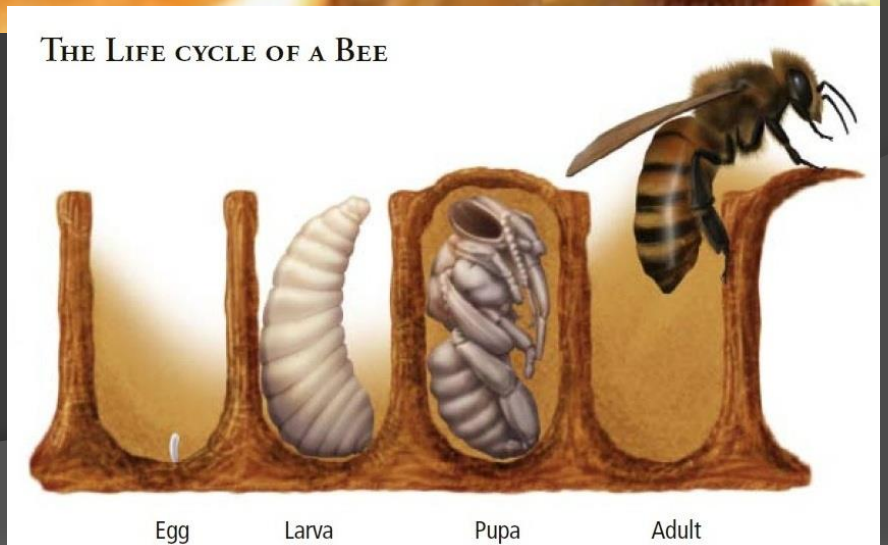
- Role of sterols in insects: (1) components of cell membrane (2) precursors of molting hormones

- All insects including honey bees get sterols from diet.

- 24-methylene cholesterol- Major sterol source - Obtained from Pollen.

Molting Hormones

(Ecdysone & Juvenile hormone)



Evaluating requirement of 24-MC

Annals of the Entomological Society of America, 113(3), 2020, 176–182
doi: 10.1093/aesa/saz067
Advance Access Publication Date: 6 December 2019
Research

Research

OXFORD

Evaluating Effects of a Critical Micronutrient (24-Methylenecholesterol) on Honey Bee Physiology

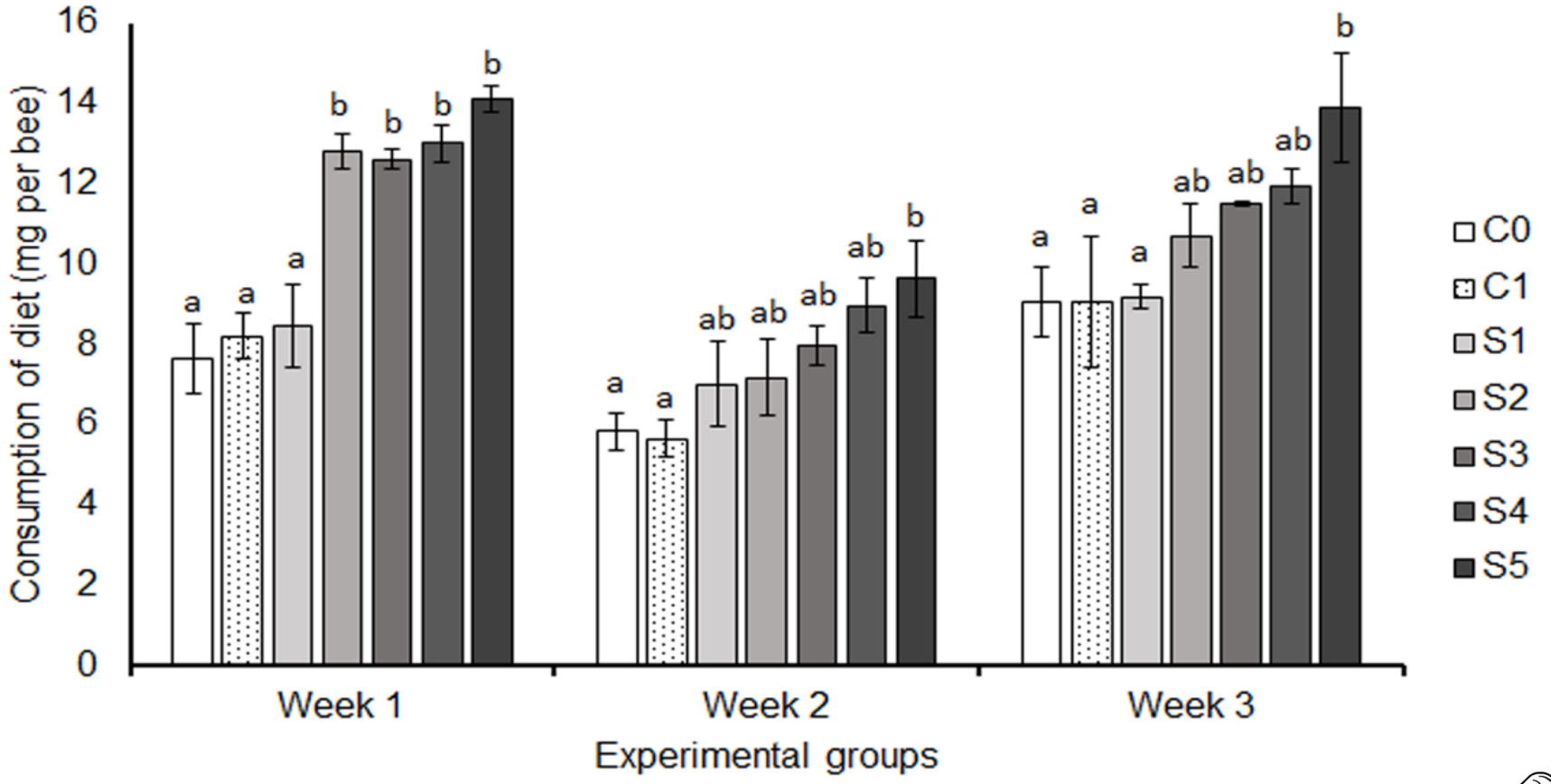
Priyadarshini Chakrabarti,[1] Hannah M. Lucas, and Ramesh R. Sagili

Evaluating requirement of 24-MC

C1: Control
S1: 0.1% sterol diets
S2: 0.25% sterol diets
S3: 0.5% sterol diets
S4: 0.75% sterol diets
S5: 1% sterol diets

Synthetic diets containing 24-methylenecholesterol

Diet Consumption



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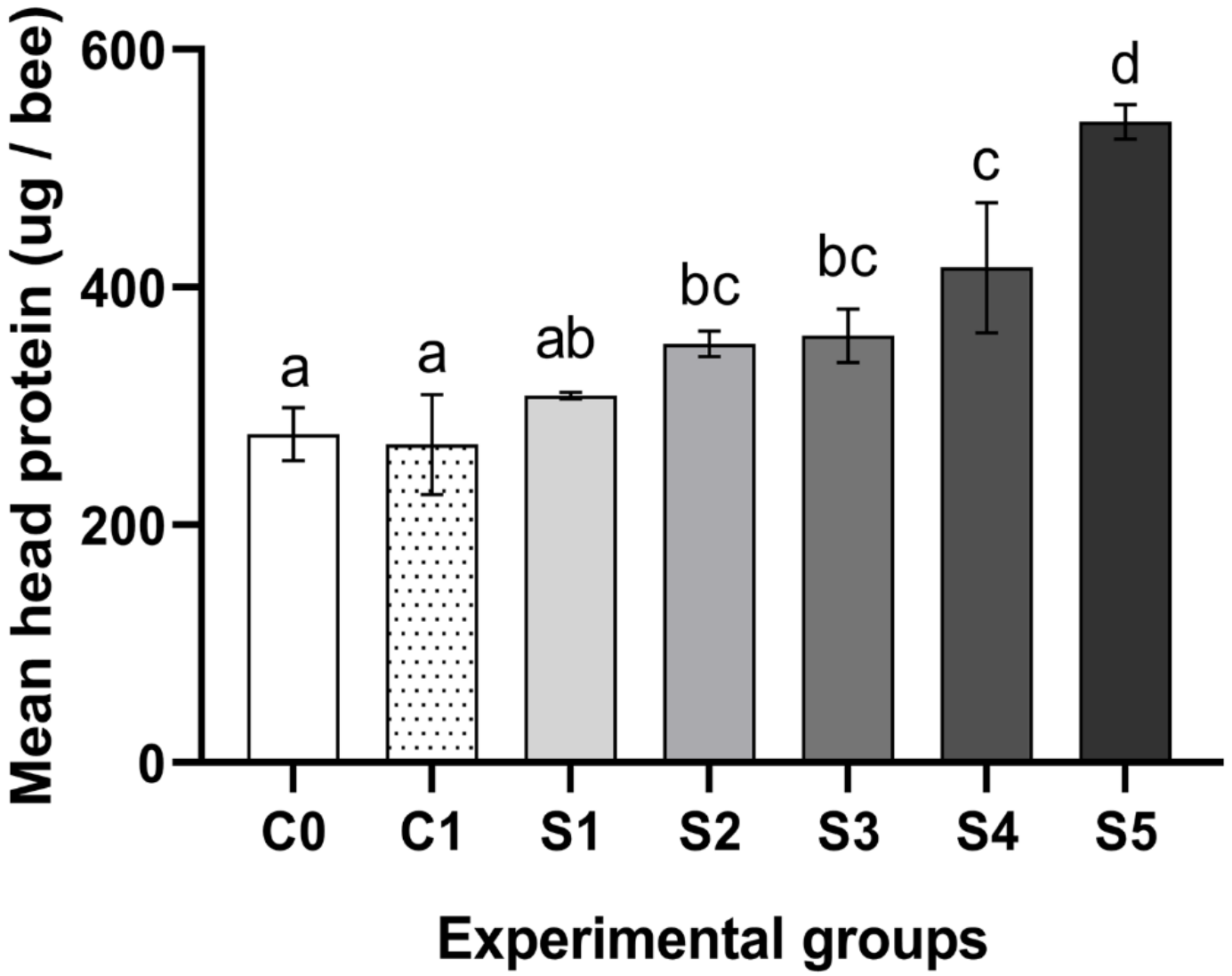
Mean Head Protein



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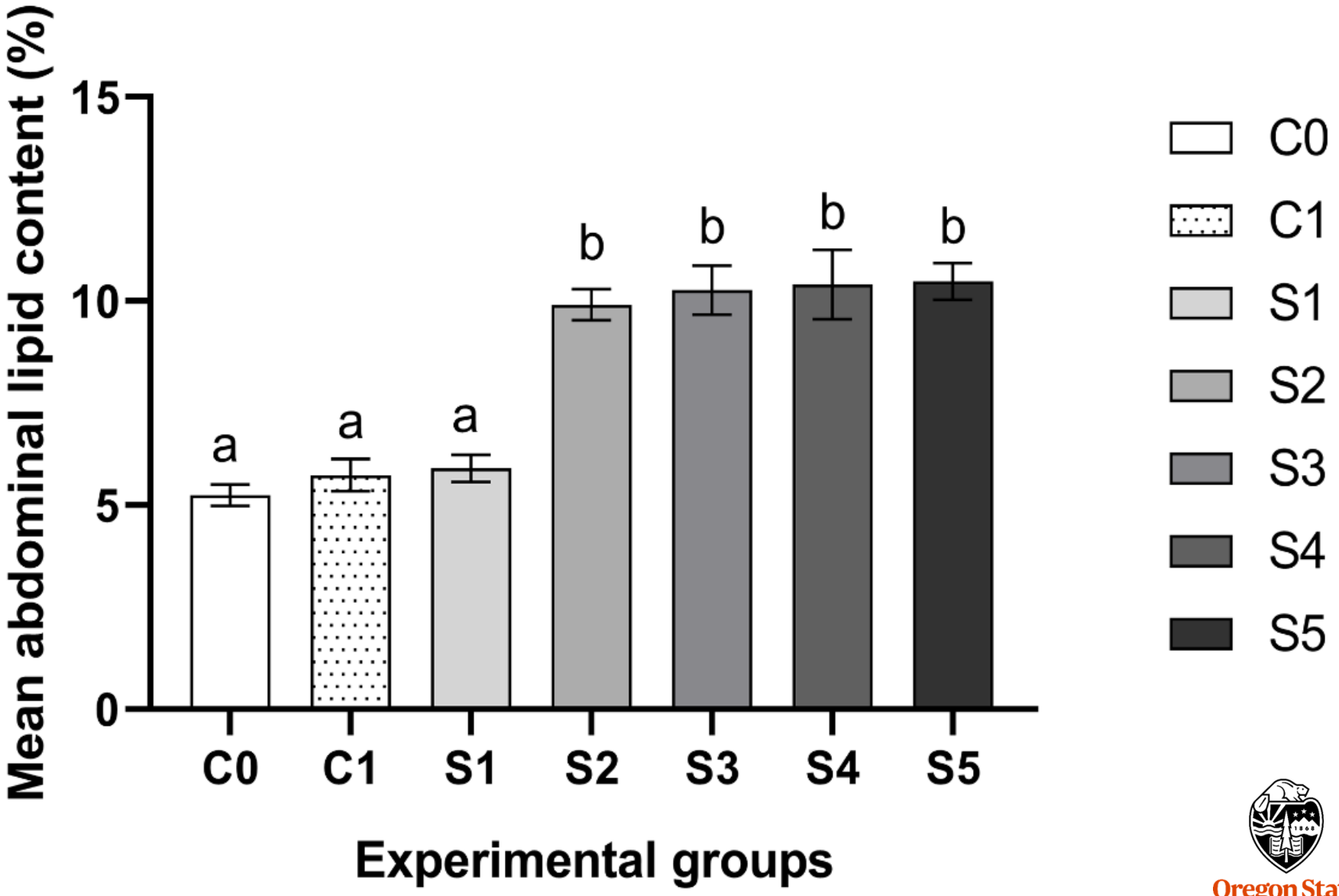
Mean Abdominal Lipid



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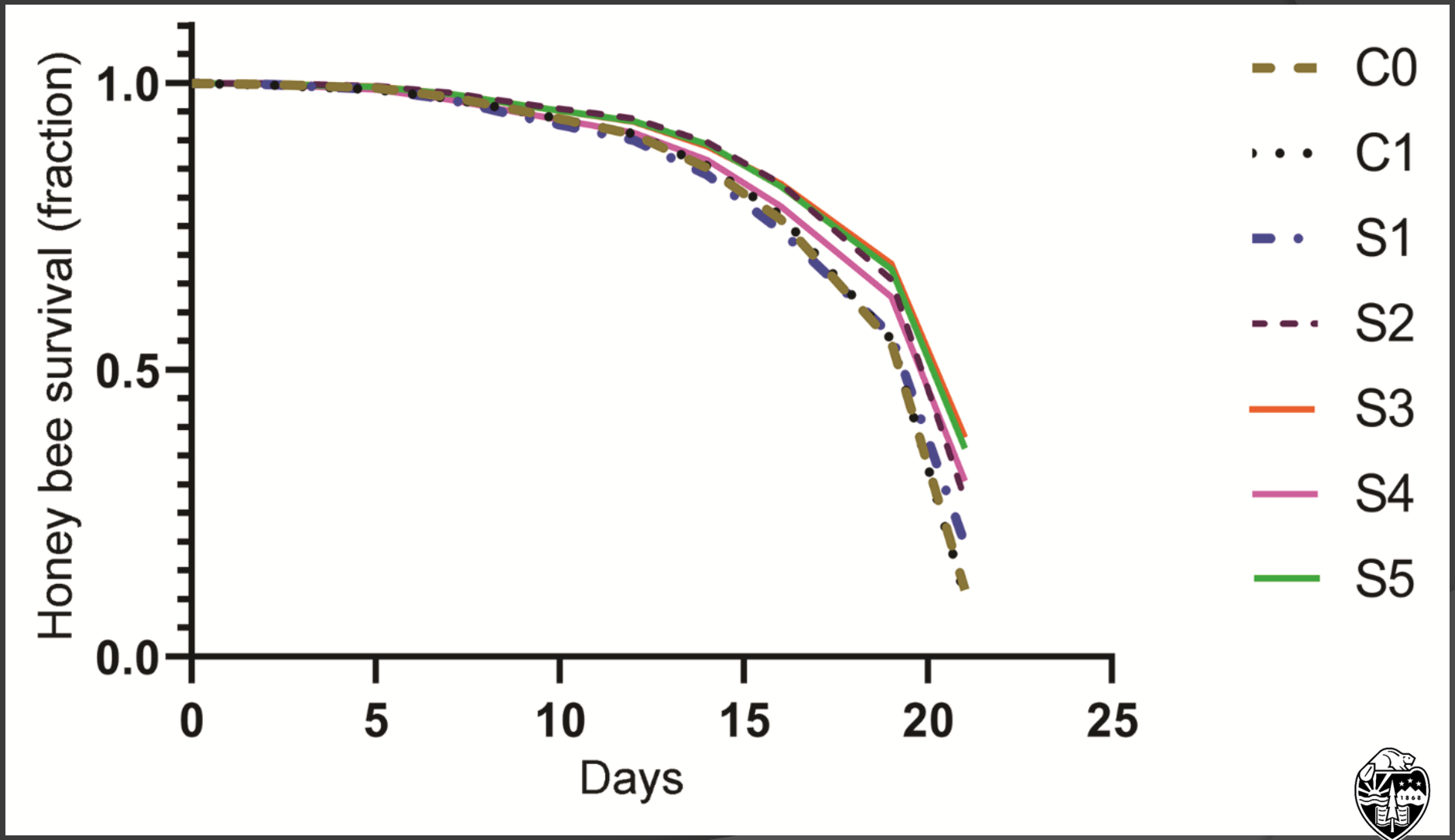
Survival



Take Home Message

- Bees consumed larger quantities of diets that had higher 24 MC
- Highest survival was observed at 0.5% concentration of 24 MC.
- Head protein content was higher in bees that consumed diets with higher 24 MC.

Why is it important to understand the role of micronutrients?

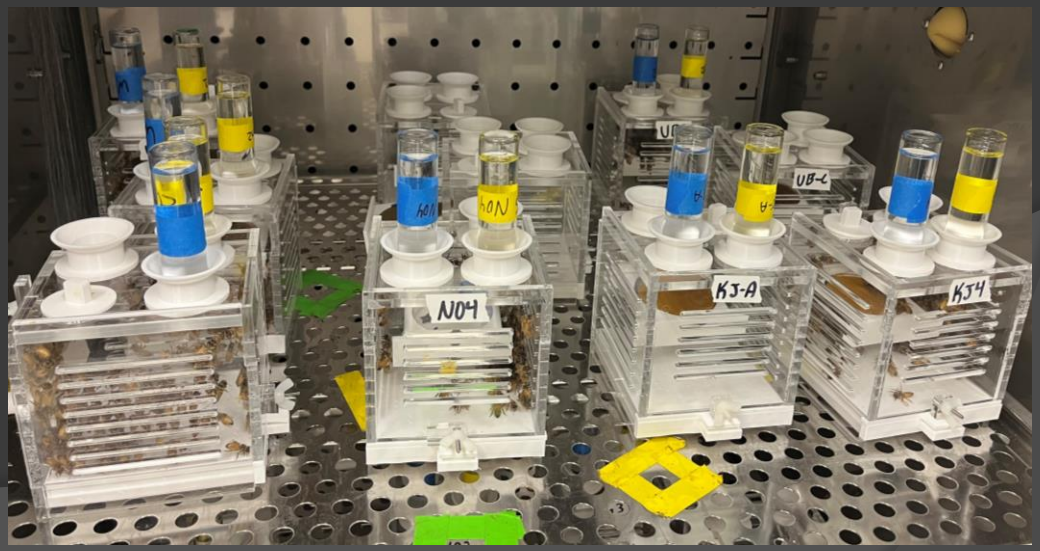
To improve our currently available protein supplements

Efficacy of Protein Supplements

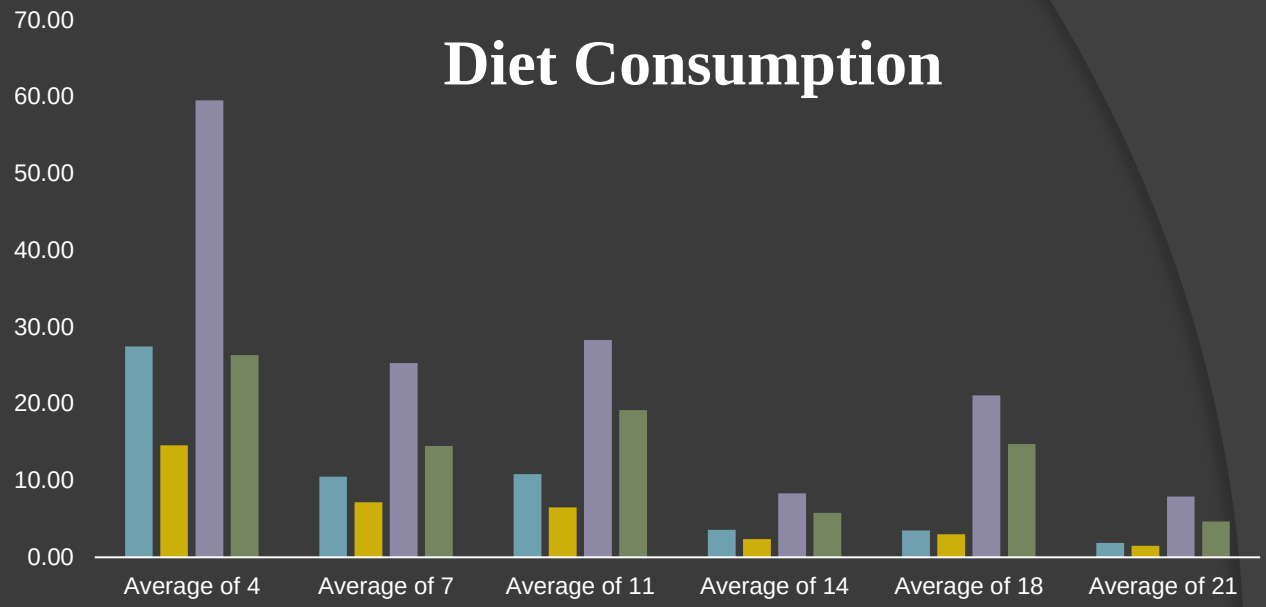
Evaluated 3 different protein supplements

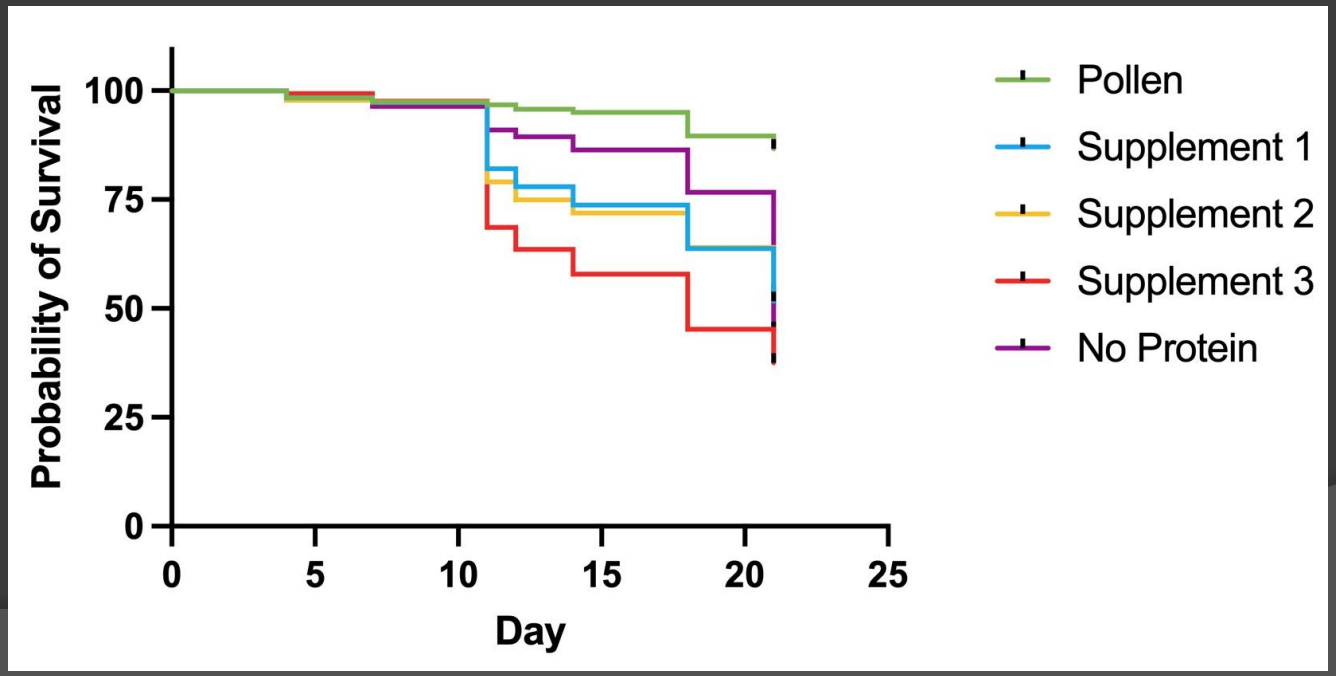
Digestibility

Assimilation



Diet Consumption





Survival Probability

When to feed protein supplements?

During pollen dearth: late fall (winter bees are being raised)

Stimulate colony growth during spring or winter

Commercial beekeepers: feed about 2 lbs. of protein supplement per week

Indicators of pollen dearth?

Courtesy: Alex Wild

Well fed larvae

Starving larvae

HABITAT IMPROVEMENT FOR BEES

HABITAT FOR BEES

Both in Urban and Agricultural Landscapes

Develop a Pollen Nutritional Composition Data Base

We are seeking assistance from citizen scientists for pollen collection

Does attractiveness always equate to best nutrition?

French Fries

Salad

Current basis for selection of plants for bees: attractiveness (bee visitation)

Basic Search

Scientific Name Go

Characteristics Search
Duration Search
Fact Sheets/Plant Guides
Group Search
Growth Habit Search
Image Search
Invasive/Noxious Search
Rarity Search
State Search
Wetland Search

Filtering Options

State/Province
- Alabama (411)
- Alaska (166)
- Alberta (271)
- Arizona (409)
- Arkansas (406)

Show More

Nativity Status
- Native - L48 (918)
- Native - CAN (471)
- Introduced - L48 (160)

You are here: Home/Fact Sheets & Plant Guides

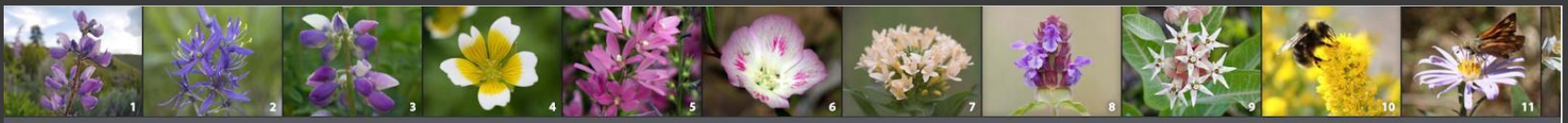
Your search matched 1085 records. Only accepted plants are included in this count. - Download Entire Set

« 1 2 3 4 5 ... 44 »

Showing 1 through 25 of 1085 records.

Symbol	Scientific Name	Common Name	Fact Sheets/Plant Guides	Photos
ABAM	*Abies amabilis* (Douglas ex Loudon) Douglas ex Forbes	Pacific silver fir	• Plant Guide (doc) (pdf)	(16)
ABBA	*Abies balsamea* (L.) Mill.	balsam fir	• Fact Sheet (doc) (pdf)	(15)
ABCO	*Abies concolor* (Gord. & Glend.) Lindl. ex Hildebr.	white fir	• Fact Sheet (doc) (pdf) • Plant Guide (doc) (pdf)	(28)
ABGR	*Abies grandis* (Douglas ex D. Don) Lindl.	grand fir	• Plant Guide (doc) (pdf)	(12)
ABLA	*Abies lasiocarpa* (Hook.) Nutt.	subalpine fir	• Plant Guide (doc) (pdf)	(18)
ABFR3	*Abutilon fruticosum* Guill. & Perr.	Texas Indian	• Fact Sheet (doc) (pdf)	

Xerces Society: Plant List



Bloom Period		Common Name	Scientific Name	Life Cycle*	Flower Color	Max. Height†	Water Needs	Notes
		Forbs				(Feet)	L: low; M: medium; H: high	*Life Cycle abbreviations: A: annual; P: perennial; B: biennial. †Max. Height is an average, individual plants may vary.
Early	1	Bigleaf lupine	*Lupinus polyphyllus*	P	blue	3–5	M	Visited extensively by bumble bees and hummingbirds; prefers moist soils; a host plant for various blue (*Icaricia* spp.)
	2	Common camas	*Camassia quamash*	P	blue	1–3	H	Slow to establish from seed; establishes better from bulb; prefers moist soil, drought-tolerant after bloom; bulbs attrac
	3	Riverbank lupine	*Lupinus rivularis*	A, B, P	blue	4	M	Short-lived and very aggressive; include at a low rate in seed mixes; frequently biennial; a host plant for various blue b
Early–Mid	4	Douglas meadowfoam	*Limnanthes douglasii*	A	white/ yellow	1	M–H	Easy to establish from seed; highly attractive to syrphid flies, mining bees, and mason bees; color variable among sub
	5	Meadow checkermallow	*Sidalcea campestris*	P	pink	2–6	M	Hardy, long-lived plant; a host plant numerous butterflies and skippers, including west coast lady (*Vanessa annabella*)
	6	Slender clarkia	*Clarkia gracilis*	A	purple	1.5	L	Fast-growing; easy to establish from seed; highly variable with numerous subspecies; prefers open, well-drained sites
Mid	7	Large-flowered collomia	*Collomia grandiflora*	A	pink	1–3	L–M	A very showy native that prefers partial shade and dry soils; bees collect bright blue pollen from the blossoms
	8	Selfheal	*Prunella vulgaris* ssp. *lanceolata*	P	purple	1.5	M	Easy to establish from seed; fast-growing ground cover that will tolerate mowing or grazing; highly attractive to vario
	9	Showy milkweed	*Asclepias speciosa*	P	pink	1.5–5	M	Slow to establish from seed; host plant for the monarch butterfly and a high-quality nectar source for a wide variety o
Late	10	Canada goldenrod	*Solidago canadensis*	P	yellow	3–6	M	Slow-growing, rhizomatous plant; significant resource for honey bees and late-season native bees, such as bumble bee
	11	Douglas aster	*Symphyotrichum subspicatum*	P	purple	4	M	Establishes better from transplant; visitors include leafcutter bees and the woodland skipper butterfly (*Ochlodes sylva*
	12	Hall's aster	*Symphyotrichum hallii*	P	purple	3	M	Establishes better from transplants; drought-tolerant rhizomatous plants; one of the latest fall-blooming plants

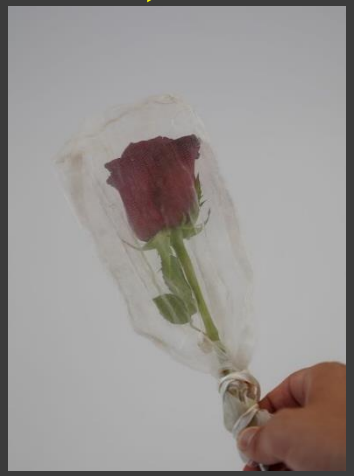
This list of pollinator plants for the Maritime Northwest Region Region was produced by the Xerces® Society. For more information about pollinator conservation, please visit www.xerces.org.

Pollen Nutritional Composition
Crude Protein: X%

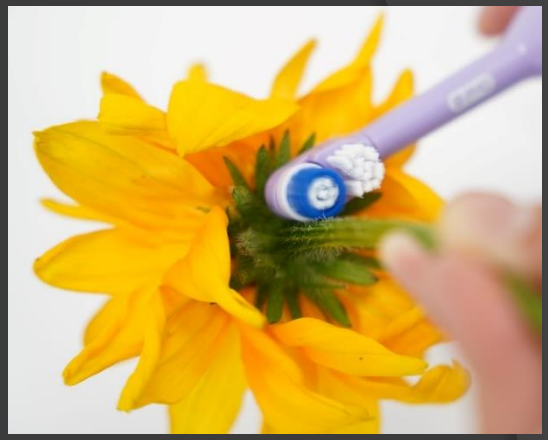
Plant lists are not based on empirical research

How to collect pollen from flowers manually (hand collection) and from bees

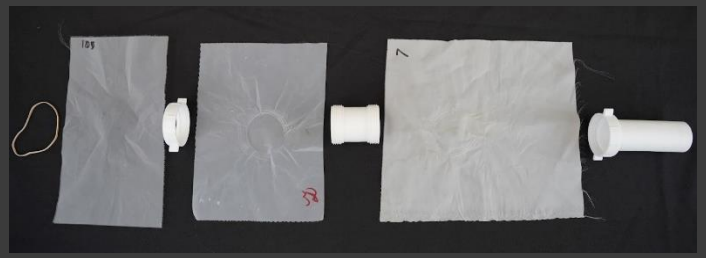
Inverting and twisting



Bagging



Sonication



Pollen Vacuum

https://oregonstate.app.box.com/s/wl8tngbid8qmkofovcvfd29uqndbfxit

Citizen Science Volunteers Needed

ramesh.sagili@oregonstate.edu

Value of Supplemental Forage

- Improved Bee Health
- Improved Crop Yield
- Win-Win for Beekeepers and Growers

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Optimal Nutrition

More larvae equates to high concentration of Brood pheromone

Stimulates foraging for resources especially pollen

Higher number of foragers

Increased pollination / yield

Oregon State University

Take Home Message

- **Make sure your bees have access to adequate pollen throughout the brood rearing season.**
- **Use protein supplements with 5 or 10 percent pollen rather than supplements with no pollen.**
- **Adequate nutrition (especially protein) is critical during Fall and Late Fall when winter bees are being raised in colonies.**
- **Winter bees need utmost attention (ideal nutrition and health) for successful overwintering.**

Tips: Collecting and storing your own pollen

Front porch pollen trap

Bottom mount pollen trap

Select the strongest colonies for trapping pollen (preferably ones that get morning sun)

Seal all alternate entrances except the main entrance.

Install the trap and wait at least a day to engage the trap, (to allow bees acclimate to the trap) / install

Trap pollen from each colony only for 2 to 3 days.

Collect pollen from traps and store in freezer (-20 C).

jove

Collection and Identification of Pollen from Honey Bee Colonies

Ellen Topitzhofer[1], **Hannah Lucas**[1], **Emily Carlson**[1], **Priyadarshini Chakrabarti**[1], **Ramesh Sagili**[1]

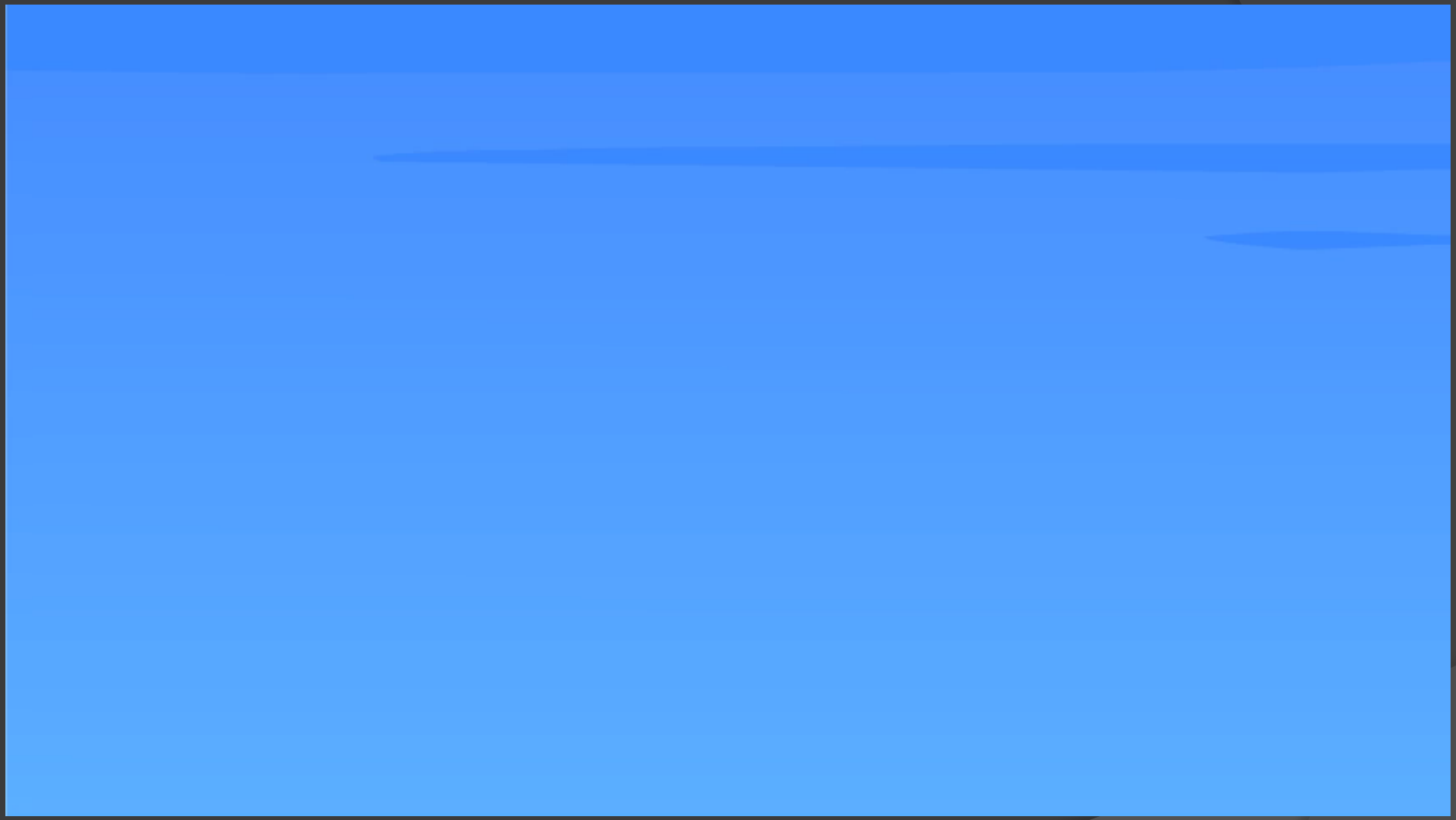
[1] Department of Horticulture, Oregon State University

Journal of Visualized Experiments (167), e62064,doi:10.3791/62064 (2021)

Varroa Biology

Phoretic Phase

Reproductive Phase



Courtesy: Kashyap Basu

Varroa mites primarily feed on fat body tissue of honey bees

Fat body

Strategy # 1

- **Frequent monitoring of mite levels from Spring to Late Fall.**

- **Instead of calendar based *Varroa* treatment we should focus on *Varroa* population dynamics based treatment.**

[Early brood rearing means early mite control strategies to be implemented]

Monitoring for Mites

www.youtube.com/watch?v=97OekT-6ziE

- **Alcohol Wash**

(percentage of mites)

- **Sugar Shake**

(percentage of mites)

- **Sticky Boards**

Strategy # 2

- Use combination of available mite control products that have been documented to be effective.

(example: Amitraz during spring; Formic Acid during summer/fall and Oxalic Dribble during winter. Also, Oxalic Vapors if feasible during spring/summer).

- Monitor mites after treatment

- To avoid mite migration between colonies treat all surrounding colonies.

Current *Varroa* treatment options

Apivar (Amitraz)

Formic PRO (Formic Acid)

Apiguard (Thymol)

Oxalic Acid

Sample Treatment R

Apivar (Spring)

Formic Pro
(1 pad application)

Formic Pro
(2 pads application)

Apivar
(Follow up treatment)

Oxalic Dribble (Nov/Dec)

Strategy # 3

- If possible get queens from queen producers that have some documentation of mite tolerance/resistance.

- Make sure your colonies are not facing other stressors (poor nutrition, pesticide exposure).

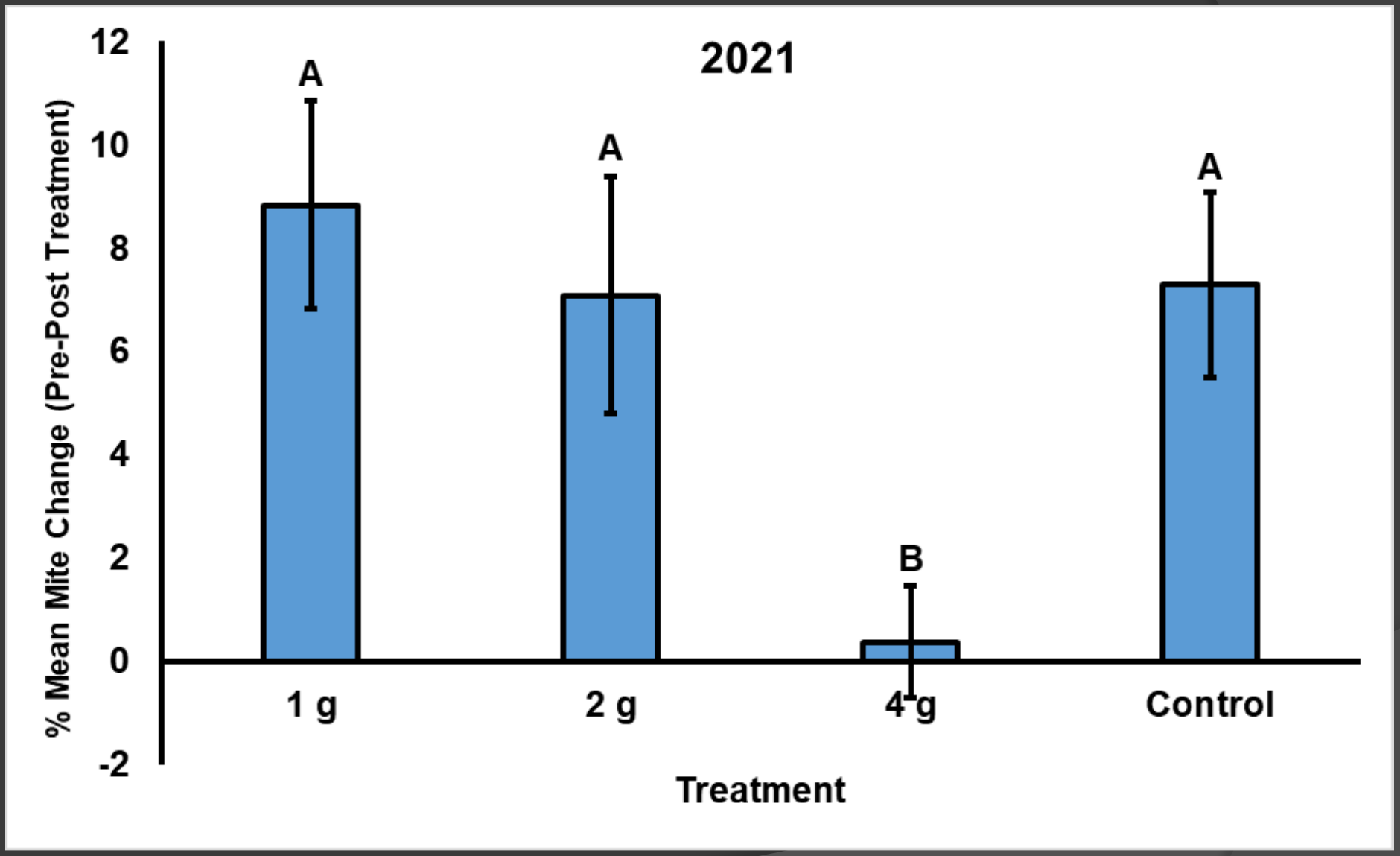
2021 Oxalic Vapor Study

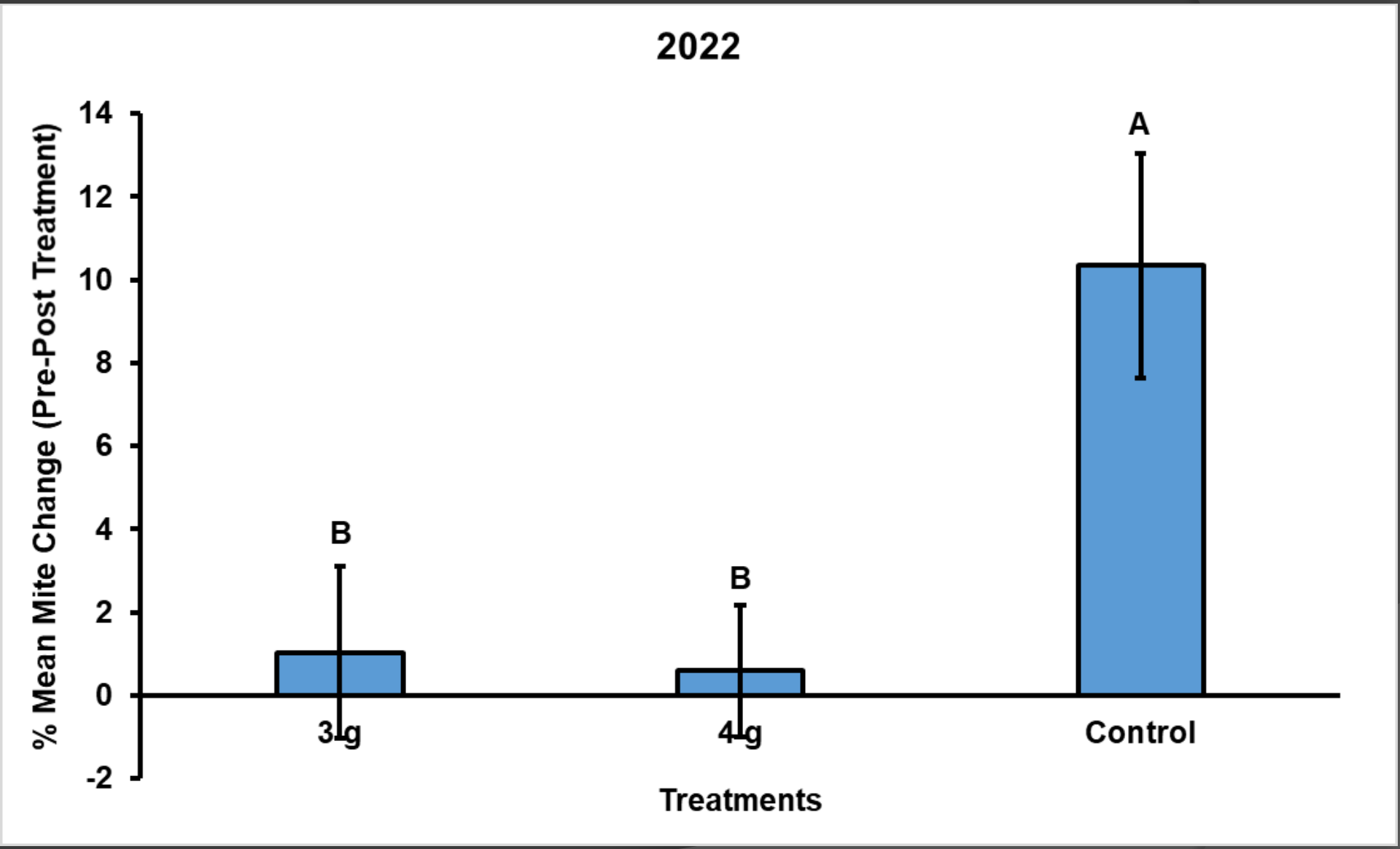
- OA dosage tested: 1 gm, 2 gm and 4 gm per brood chamber
- 3 applications (one week apart)

- *Parameters measured:*
- Mite infestation (alcohol wash & sticky boards)
- Colony evaluations (bees and brood)
- Worker bees sampled to evaluate oxidative stress and damage to appendages
- Queens collected at the end of the study

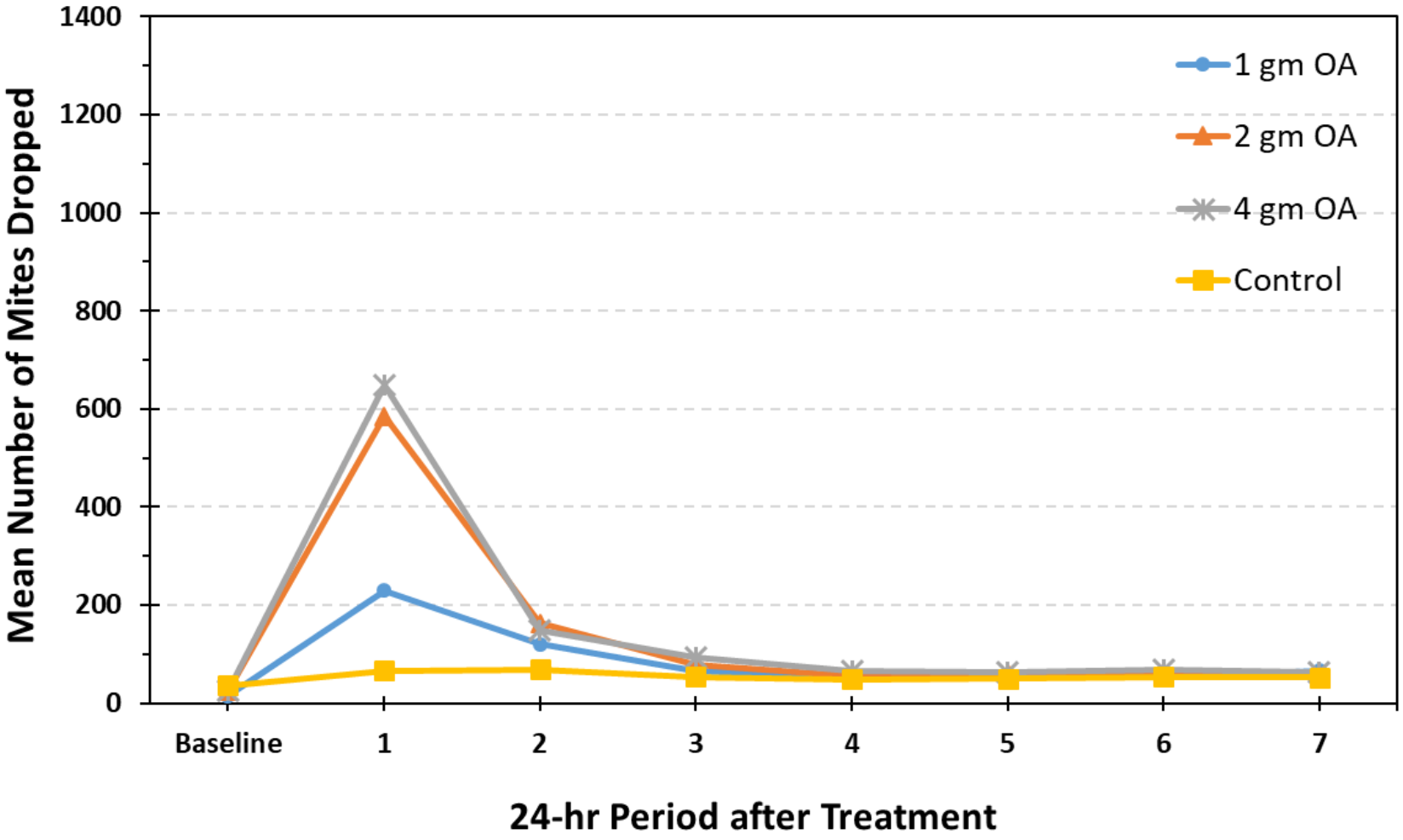

ARROX

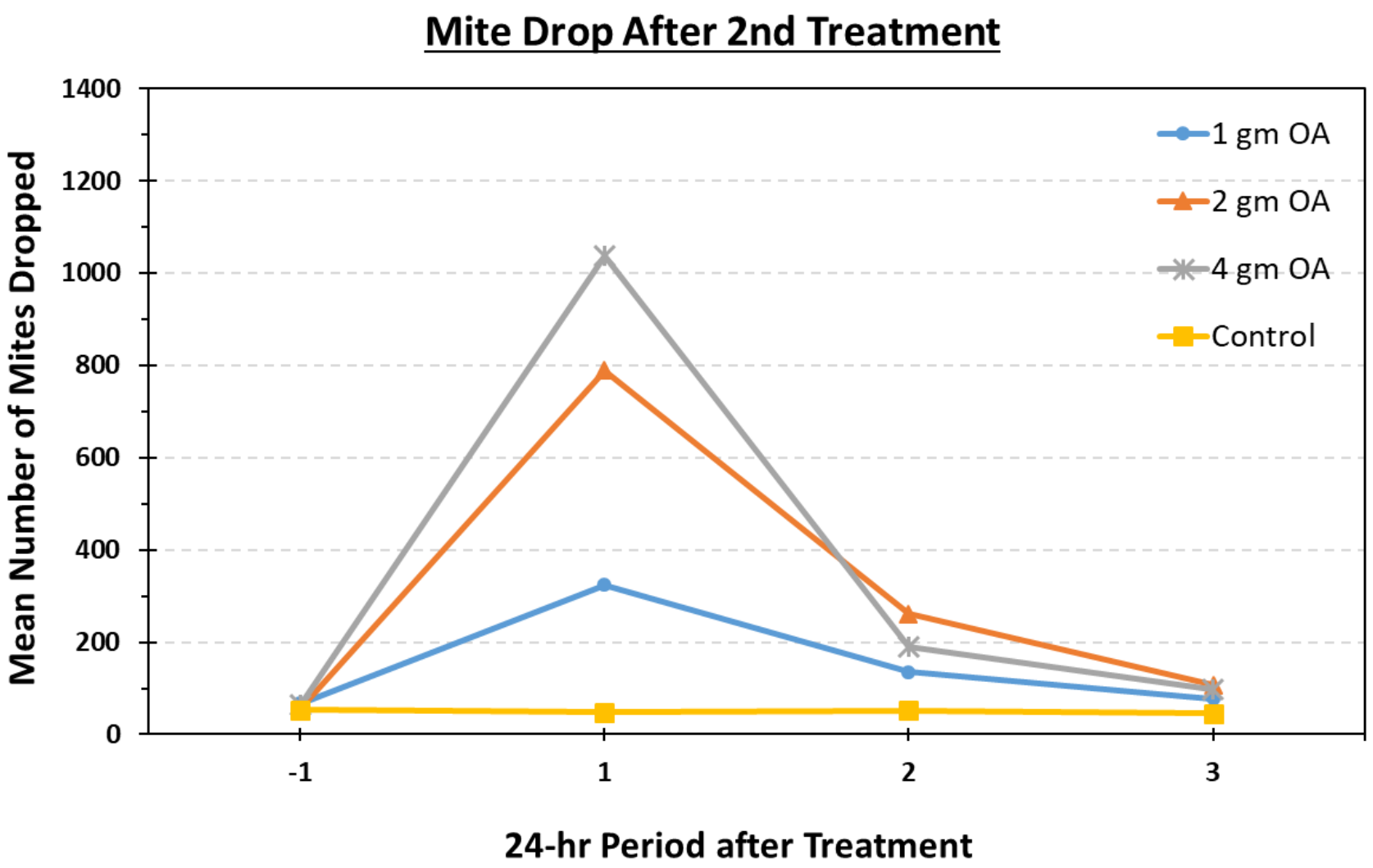

8

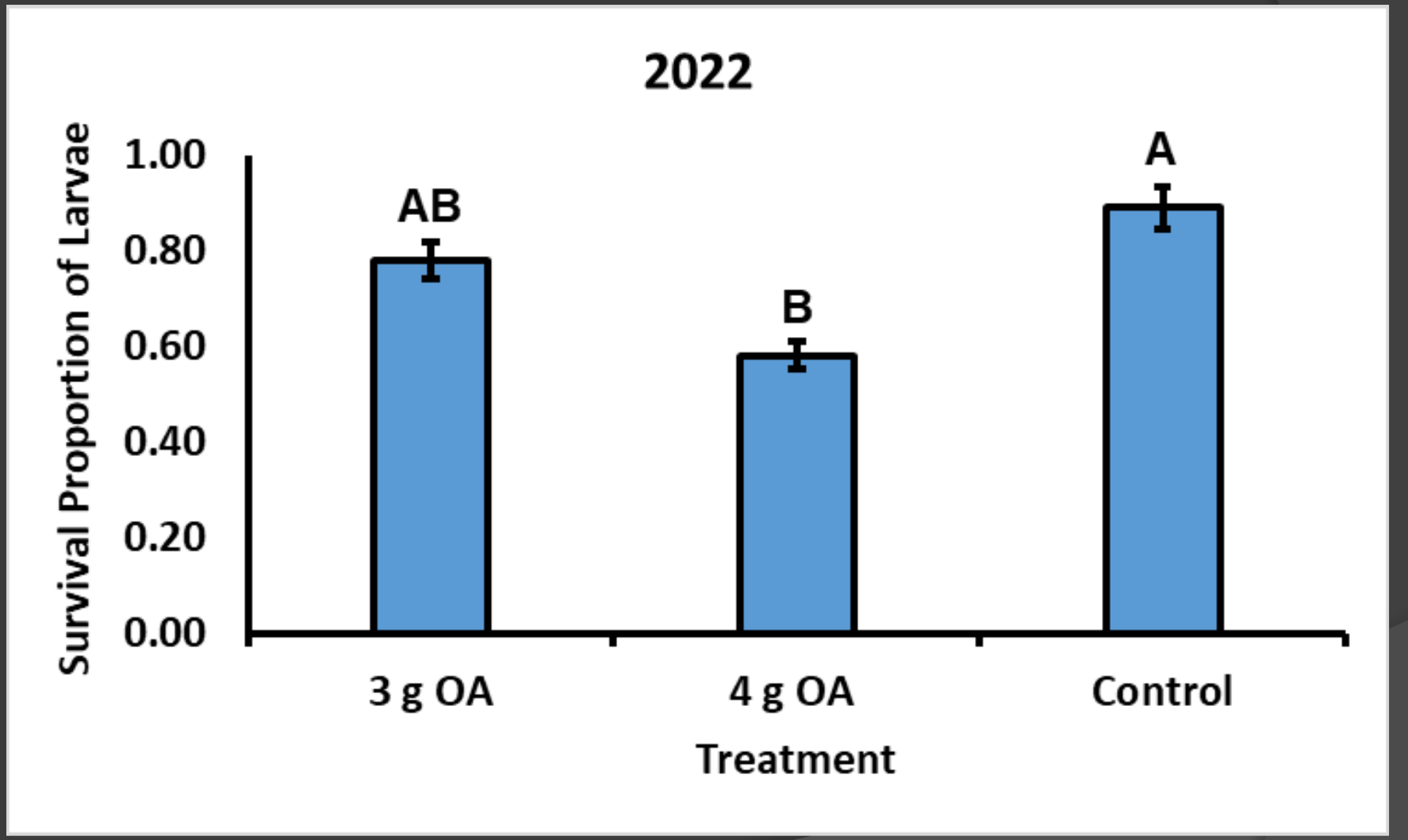

2021
% Mean Mite Change (Pre-Post Treatment)
12
10
8
6
4
2
0
-2
A
A
B
A
1 g
2 g
4 g
Control
Treatment


2022
% Mean Mite Change (Pre-Post Treatment)
14
12
10
8
6
4
2
0
-2
A
B
B
3g
4g
Control
Treatments

Mite Drop After 1st Treatment




Mite Drop After 2nd Treatment
Mean Number of Mites Dropped
1400
1200
1000
800
600
400
200
0
-1
1
2
3
24-hr Period after Treatment
1 gm OA
2 gm OA
4 gm OA
Control


2022
Survival Proportion of Larvae
1.00
0.80
0.60
0.40
0.20
0.00
AB
B
A
3 g OA
4 g OA
Control
Treatment

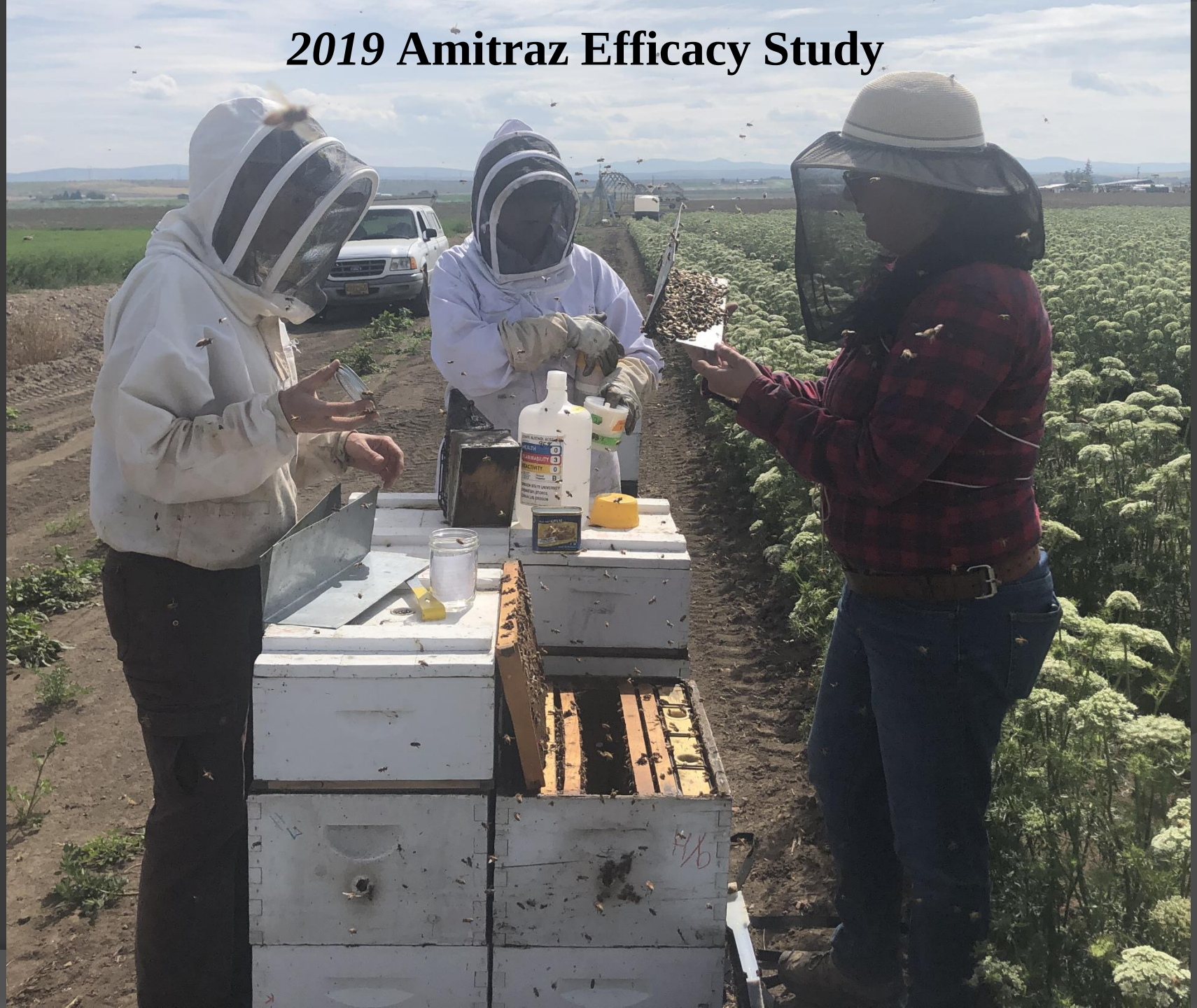
Take Home Message

3 grams per brood chamber appears to be an effective and safe dose for oxalic acid vaporization

Future Studies

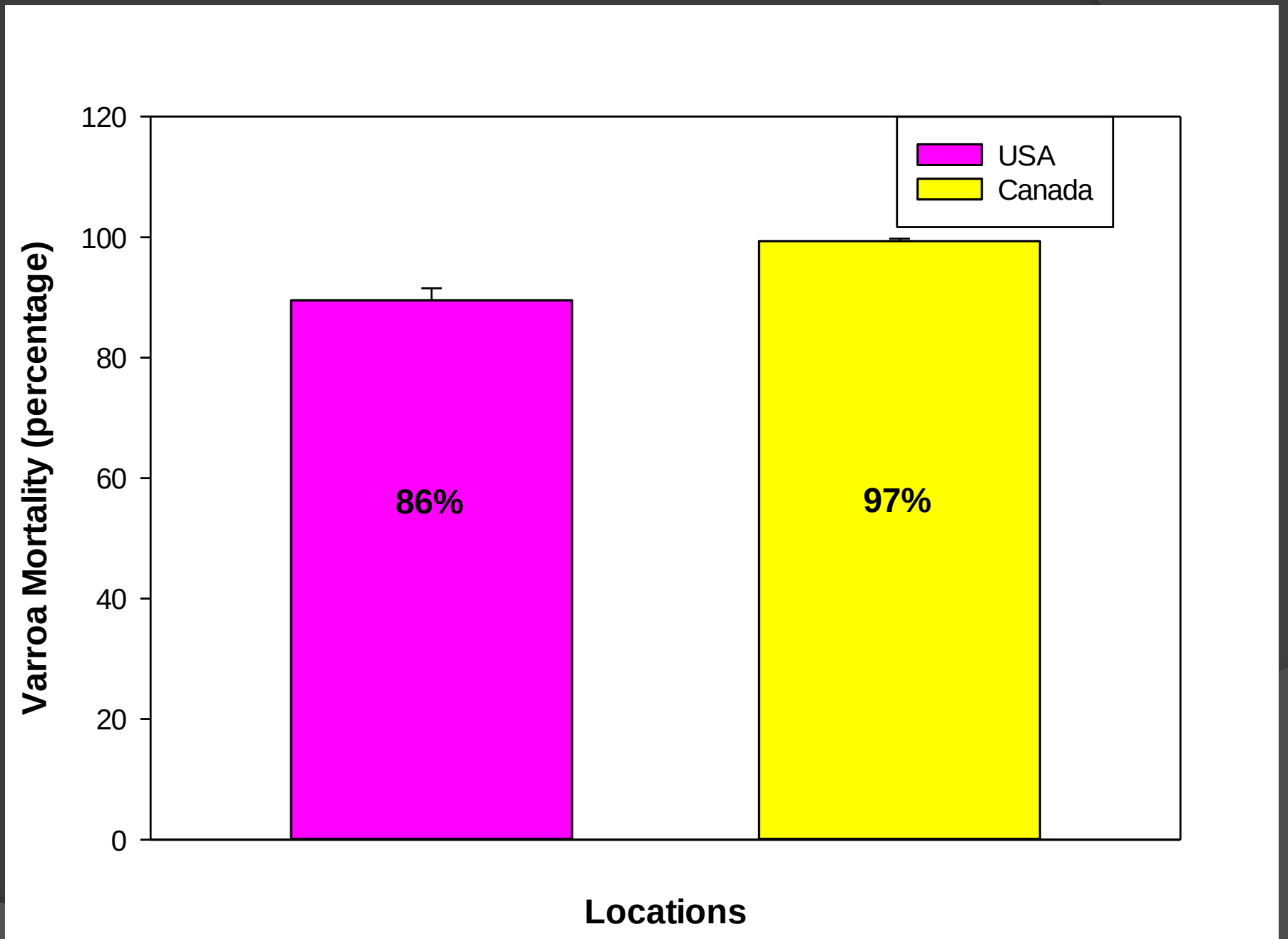
Amitraz (Apivar) Resistance

2019 Amitraz Efficacy Study

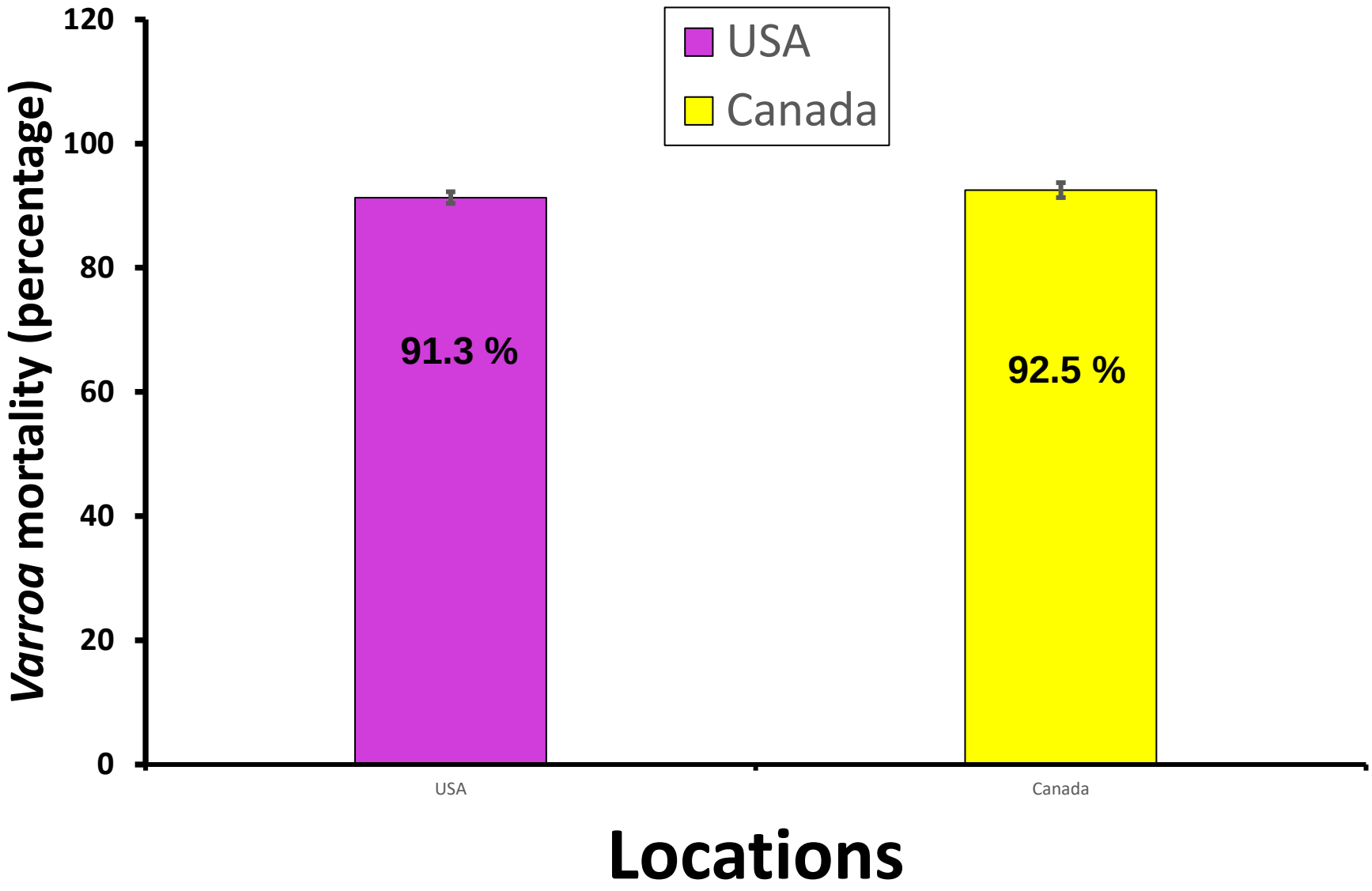


Documenting mite drops on the road

2018 DATA


120
100
80
60
40
20
0
Varroa Mortality (percentage)
USA
Canada
86%
97%
Locations

2019 DATA

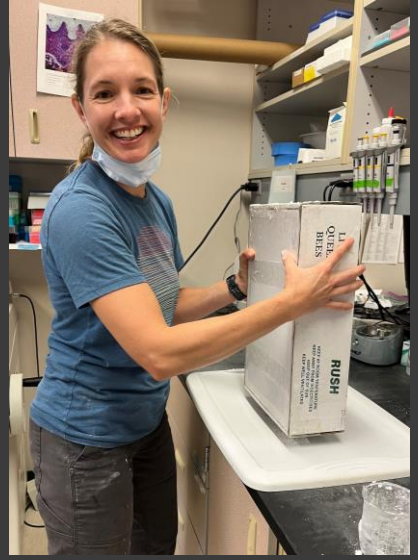

120
100
80
60
40
20
0
Varroa mortality (percentage)
USA
Canada
91.3 %
92.5 %
USA
Canada
Locations

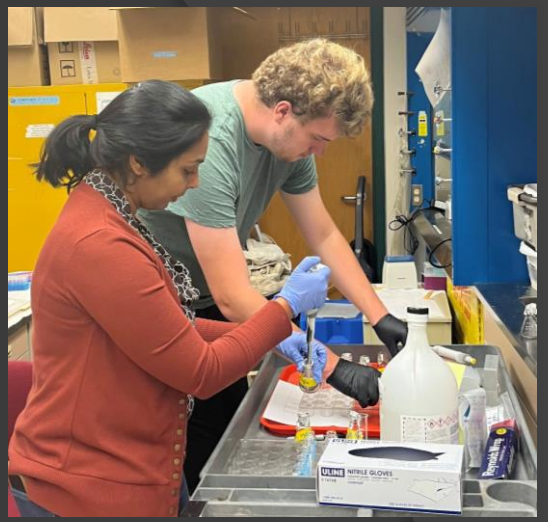
Beekeeping Operation	Mean Varroa Mortality	Mortality in Outlier Samples
A	91%	50%
B	92%	50%
C	87%	56%
D	86%	63%
E	90%	63%
F	87%	67%
G	91%	69%

Varroa Destruction Team

2023 Apivar Efficacy Study

Varroa Vial Bioassay for testing Amitraz resistance



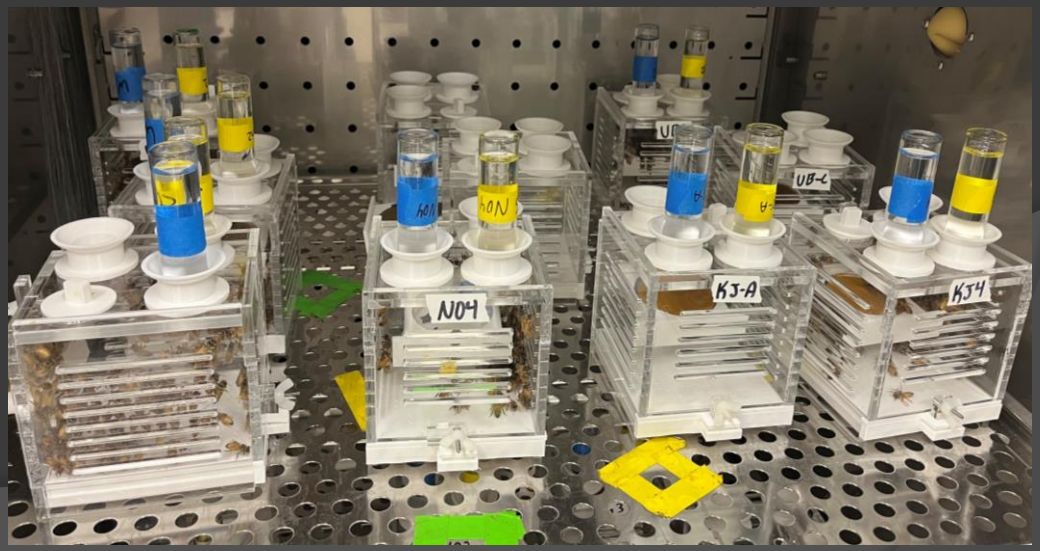


Efficacy of Protein Supplements

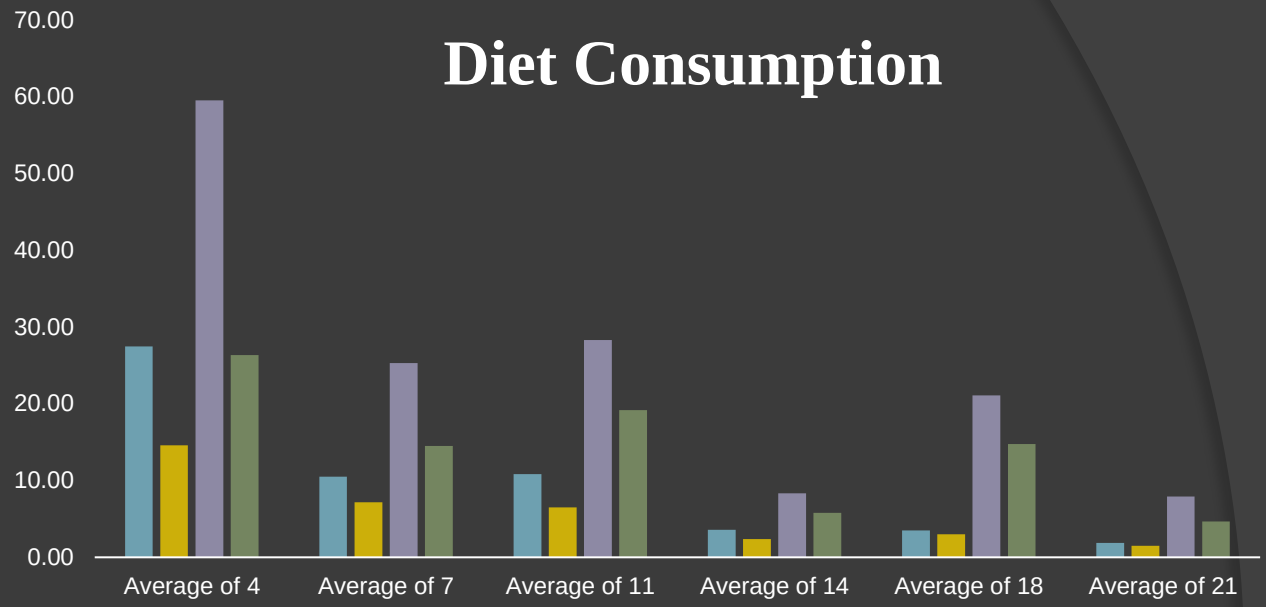
Evaluated 3 different protein supplements

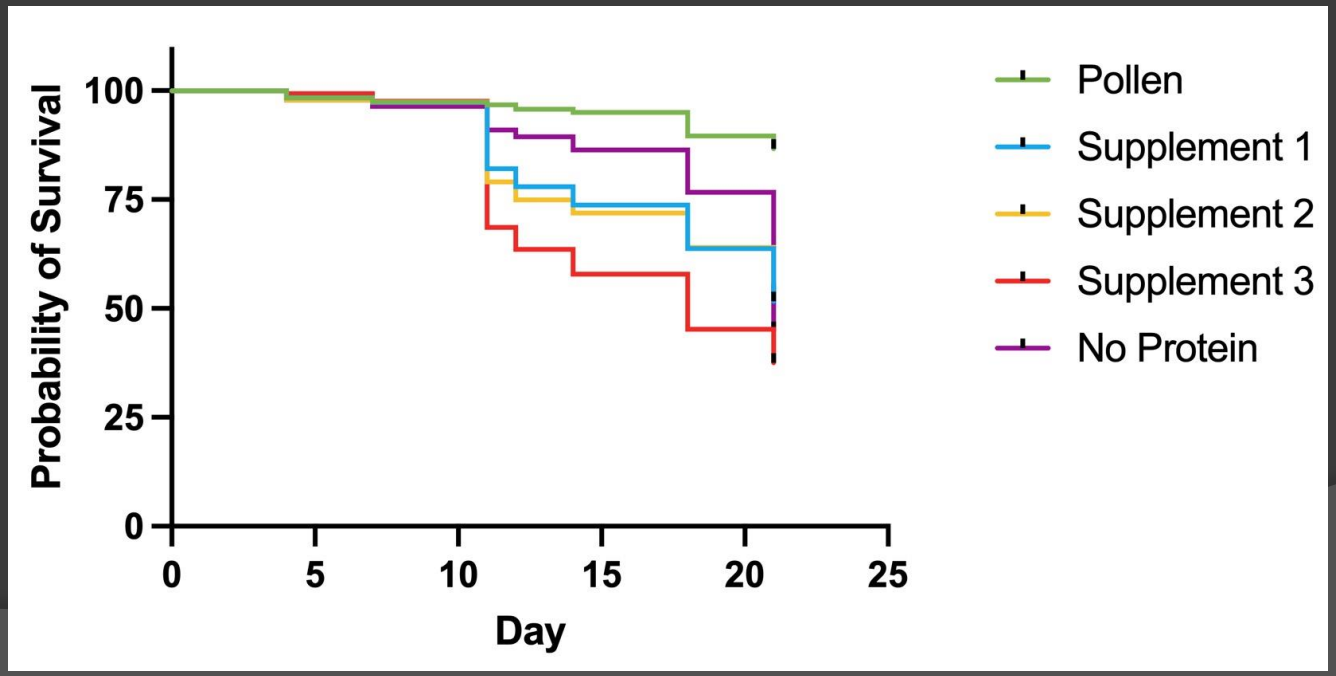
Digestibility

Assimilation



Diet Consumption





Survival Probability

Thank You !!

Questions??