



Using *Beauveria* as part of an integrated approach for control of coffee berry borer

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Outline of Talk

Relative importance of
Beauveria to coffee berry
borer control

- Practical considerations for
the use of *Beauveria* in Hawaii



Main control measures for CBB

- Trapping using ethanol/methanol traps
- Spraying *Beauveria bassiana*
- Practicing good sanitation (thorough and frequent picking, not allowing cherries to fall to ground)
- If you had to select just one control measure, which would it be?

**MONITORING CULTURAL PRACTICES FOR COFFEE BERRY BORER
HYPOTHENEMUS HAMPEI (COLEOPTERA: CURCULIONIDAE:
SCOLYTINAE) MANAGEMENT IN A SMALL COFFEE FARM IN COLOMBIA**
Florida Entomologist: <http://journals.fcla.edu/flaent/article/view/76568/74184>

2011. LUIS F. ARISTIZÁBAL, MAURICIO JIMÉNEZ 2 , ALEX E. BUSTILLO 3
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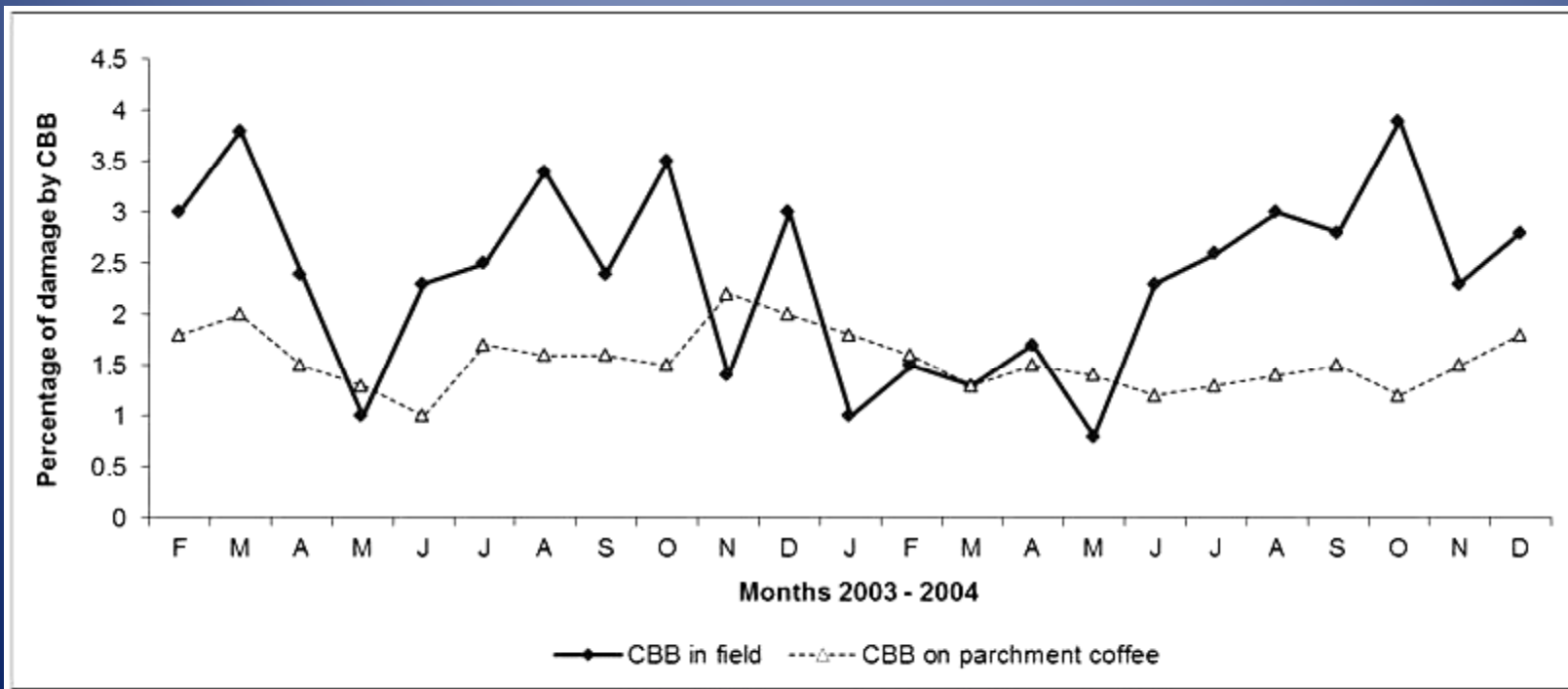
All mature and dry berries were collected every 2 or 3 weeks over a 2 year period.

One additional sanitation pick made at the end of each major harvest period in each year.

No additional control methods were employed.

MONITORING CULTURAL PRACTICES FOR COFFEE BERRY BORER *HYPOTHENEMUS HAMPEI* (COLEOPTERA: CURCULIONIDAE: SCOLYTINAE) MANAGEMENT IN A SMALL COFFEE FARM IN COLOMBIA

Number of **mature and dry berries** remaining after harvesting ranged from 3 to 12.2 berries per tree, with an average **6.2 per tree**. CBB infestation averaged 2.3% on green berries remaining after harvest and 1.5% on parchment coffee



Coffee Berry Borer Trapping

Trap Types:

Scentry 1 = paper trap w/ sloped roof

Scentry 2 = paper trap w/ flat roof. Developed by Scentry Biologicals, Billings, Montana

Bucket 1 = one entry window (15cm tall, 15 cm in diameter, 7.5 X 7.5 cm window; red pepper Krylon Fusion spray paint)

Bucket 3 = three entry windows

Brocap® = developed by CIRAD and PROCAFE



Scentry 1



Scentry 2

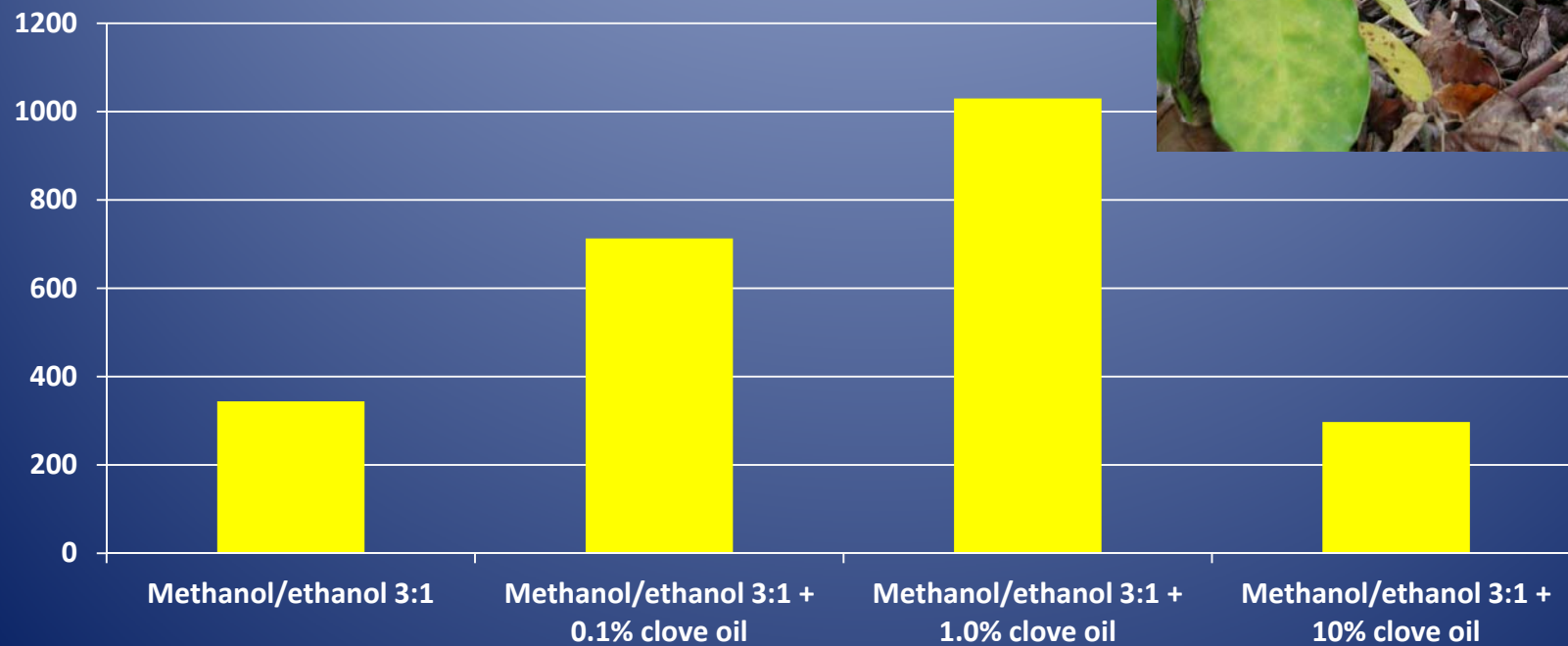


Bucket 1



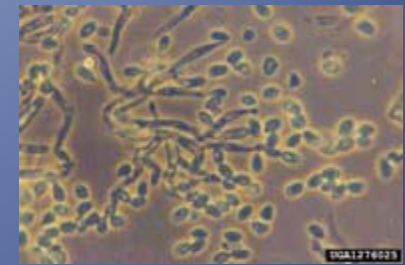
Brocap

Number of CBB borers caught in 5 milk-jug traps over 7 days (Captain Cook)



Beauveria bassiana –what is it?

- A generalist fungal pathogen of insects
- Thousands of strains from around the world represented in entomopathogen collections.
- Commercial products are available
- For most insect pests affected: works well in the lab or greenhouse; frequently does not work in the field. Needs high humidity; broken down by UV light.



Does spraying **Beauveria (GHA strain)** on cherries actually work?

- *B. bassiana* has been shown to be the major natural mortality factor affecting CBB in Columbia.
- Up to 80% mortality can be achieved in sprays when CBB are attacking young berries (Duque-O and Baker 2003).
- Efficacy may depend on timing of sprays or weather conditions or strain (little information about GHA strain on CBB)
- Spraying *Beauveria* to protect cherries is different from spraying after the cherries have already become infested





- The growth of the insect (from egg to adult) takes between 24 and 45 days. Female drills the berry through the central disc.
- Two days after the access, the beetle lays 35–50 eggs, which produce ~10 females for each male.
- The lifespan for females is 35–190 days and for males 40 days. The new insects mate inside the seed.



Beauveria efficacy trial in heavily infested coffee in Honomalino



Beauveria efficacy trial in heavily infested coffee in Honomalino

Sprayed:

(1) **Mycotrol** (at 1 qt/acre)
+ EcoSpreader (silicone spreader),
~350 ml spray solution
(15 seconds) per tree

- Versus -

(2) **Unsprayed**

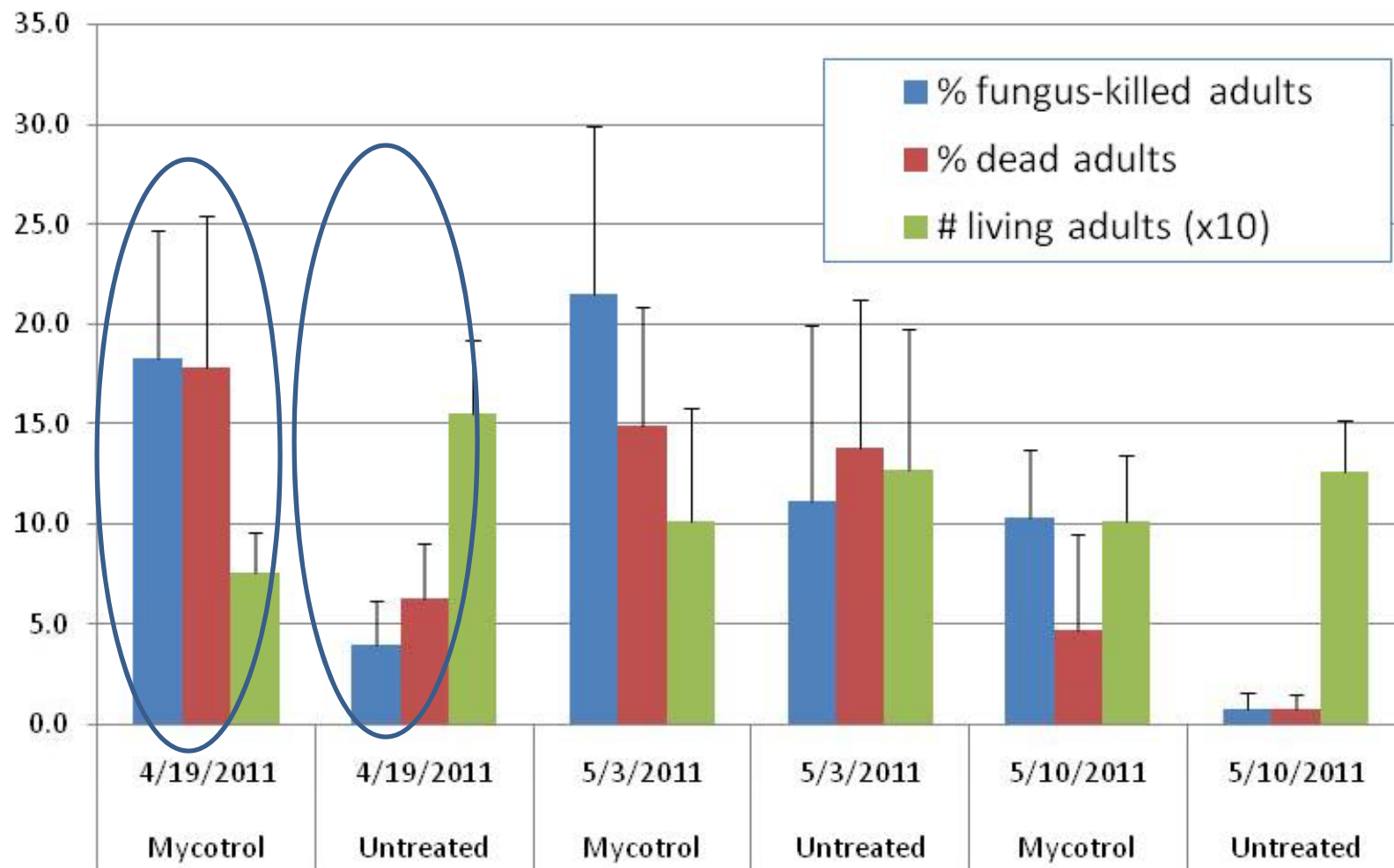
Harvested cherries the next day.

•*Held the cherries in the lab for 7 days, then started dissections*

Second and third collections of cherries from same trees made 2 and 3 weeks later; started dissecting the day after collection



Beauveria efficacy trial in heavily infested coffee in Honomalino in 2011



How much *Beauveria* should be sprayed?

- 7.0 ounces *Beauveria* product (Botanigard or Mycotrol) and 3.5 ounces of silicone spreader per acre is recommended by BioWorks
- Some people use 1-3 quarts per acre
- Is there any data?

What does it cost to spray *Beauveria* over one acre of coffee?

- 7.0 ounces Beauveria product at \$16.50
- 3.5 ounces Silicone Spreader (Widespread, Silwet or Ecospreader) at \$4.00
- Labor at \$20/hr x 2 hours using backpack: \$40.00
- Total minimum cost, one spray: \$60.50
- Need at least 4 sprays over the season
- Total cost per acre per year: **Minimum of \$242**

Experiment: Waialele Farm

- How well does *Beauveria bassiana* control CBB when sprayed on coffee trees prior to infestation?
 - When sprayed:
 - At the recommended rate? (7 ounces per acre)
 - At 3X recommended rate?
 - With an attractant essential oil?
 - With a repellent essential oil?

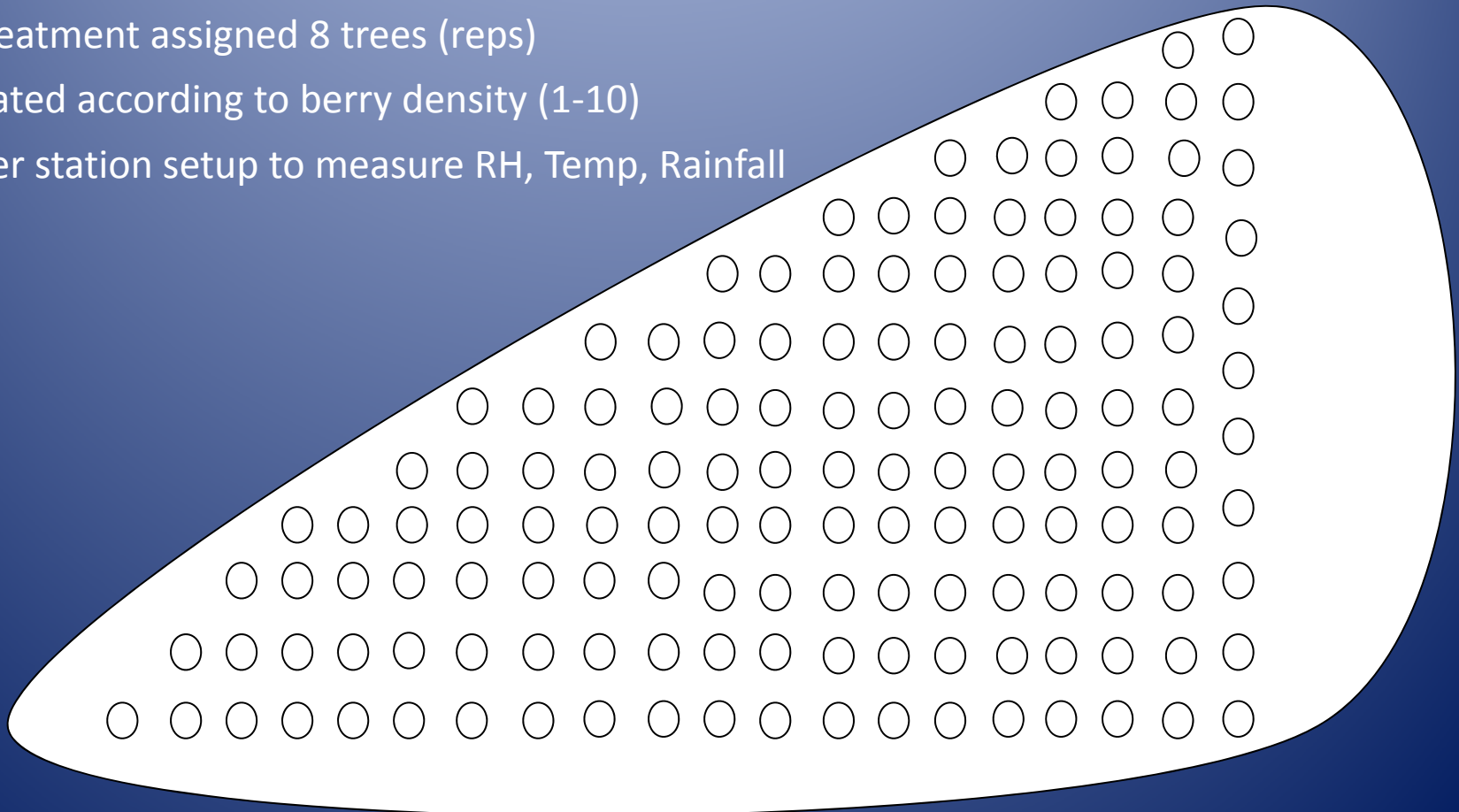
Experiment: Waialele Farm

- **Hypotheses**

- Trees sprayed with triple concentration will have higher %FKA (fungus-killed adults) than those sprayed with recommended rate
- Trees sprayed with attractants would have higher infestation
- Trees sprayed with repellants would cause more movement of beetles, causing them to pick up more *B. bassiana* spores

Experimental Design

- Trees numbered left to right (1-48)
- Randomly assigned to a treatment according to spatial orientation
- Each treatment assigned 8 trees (reps)
- Trees rated according to berry density (1-10)
- Weather station setup to measure RH, Temp, Rainfall



Treatments

T1 - Low Rate *Beauveria* + 0.1% EcoSpreader

T2 - High Rate *Beauveria* + 0.1% EcoSpreader

T3 – Low *Beau*+ 0.1% EcoSpreader+ 0.1% Eugenol

T4 - Low *Beau*+ 0.1% EcoSpreader+ .5% Caryophyllene

C1 - H₂O Only

C2 - 0.1% EcoSpreader Only



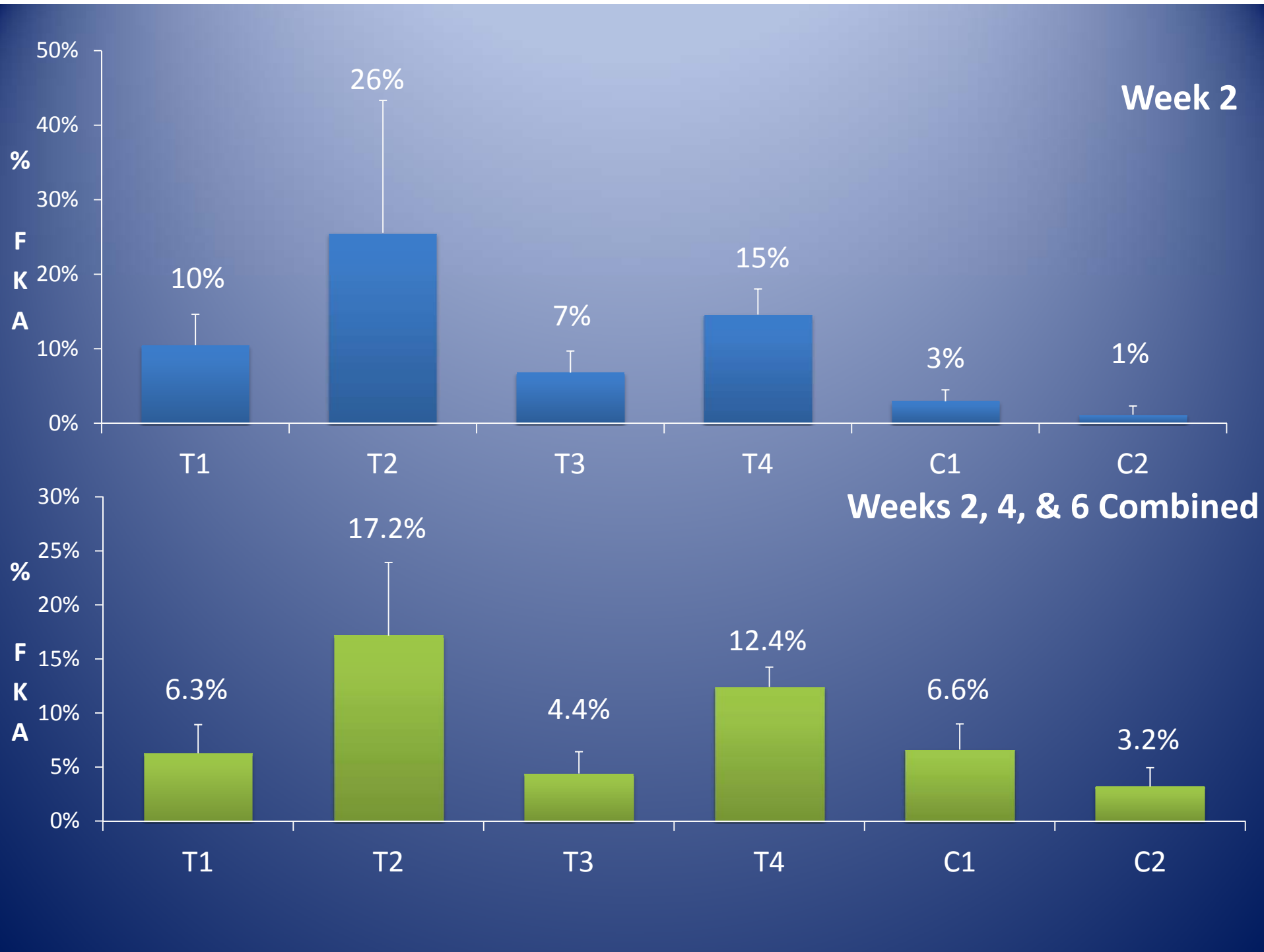
Methods

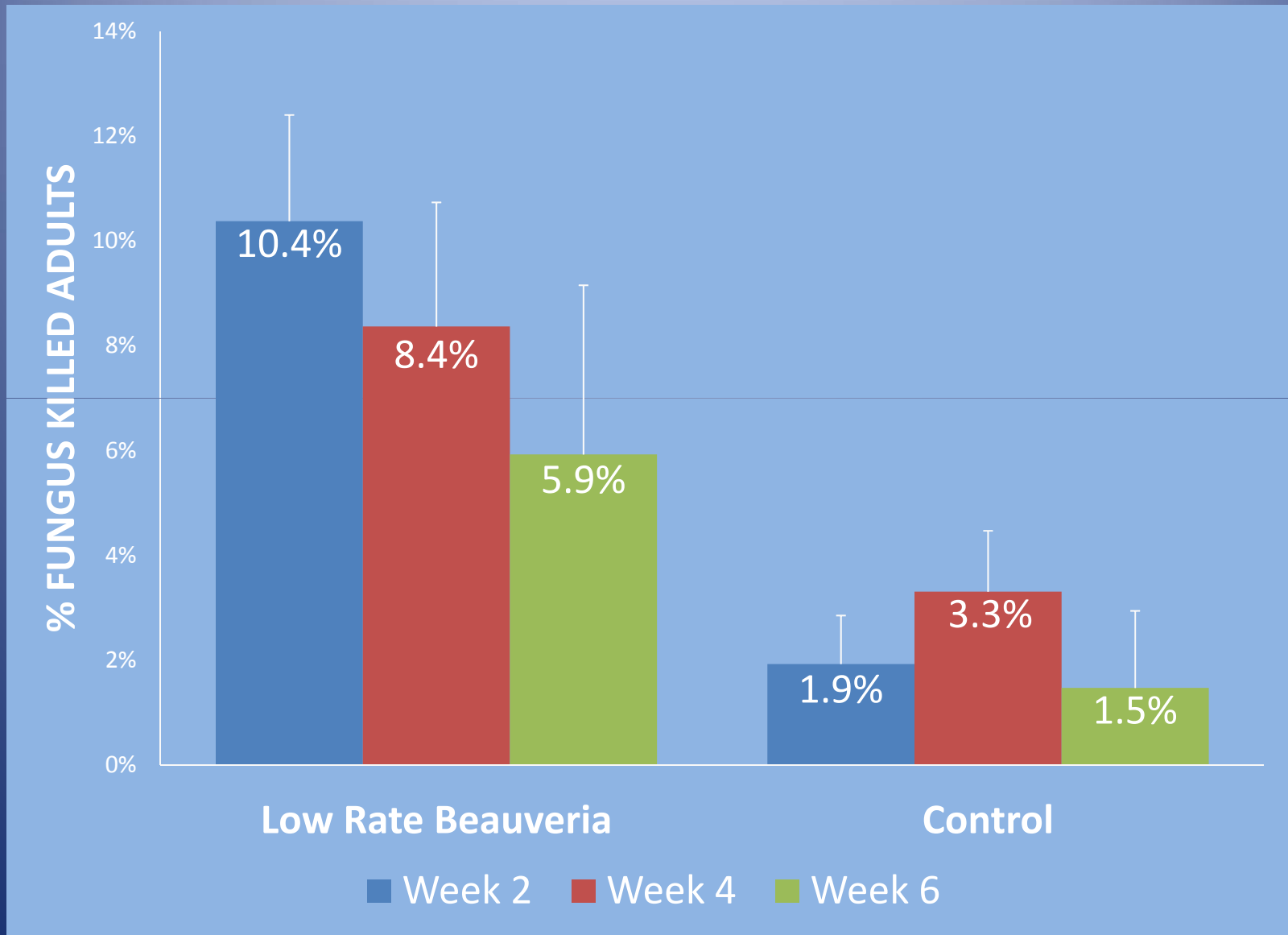
- All infested berries were removed prior to spray
- Trees sprayed with essential oils first
 - Backpack sprayer
- *Beauveria* applied using mist blower
- All newly infested berries were harvested 2, 4, and 6 weeks following spray



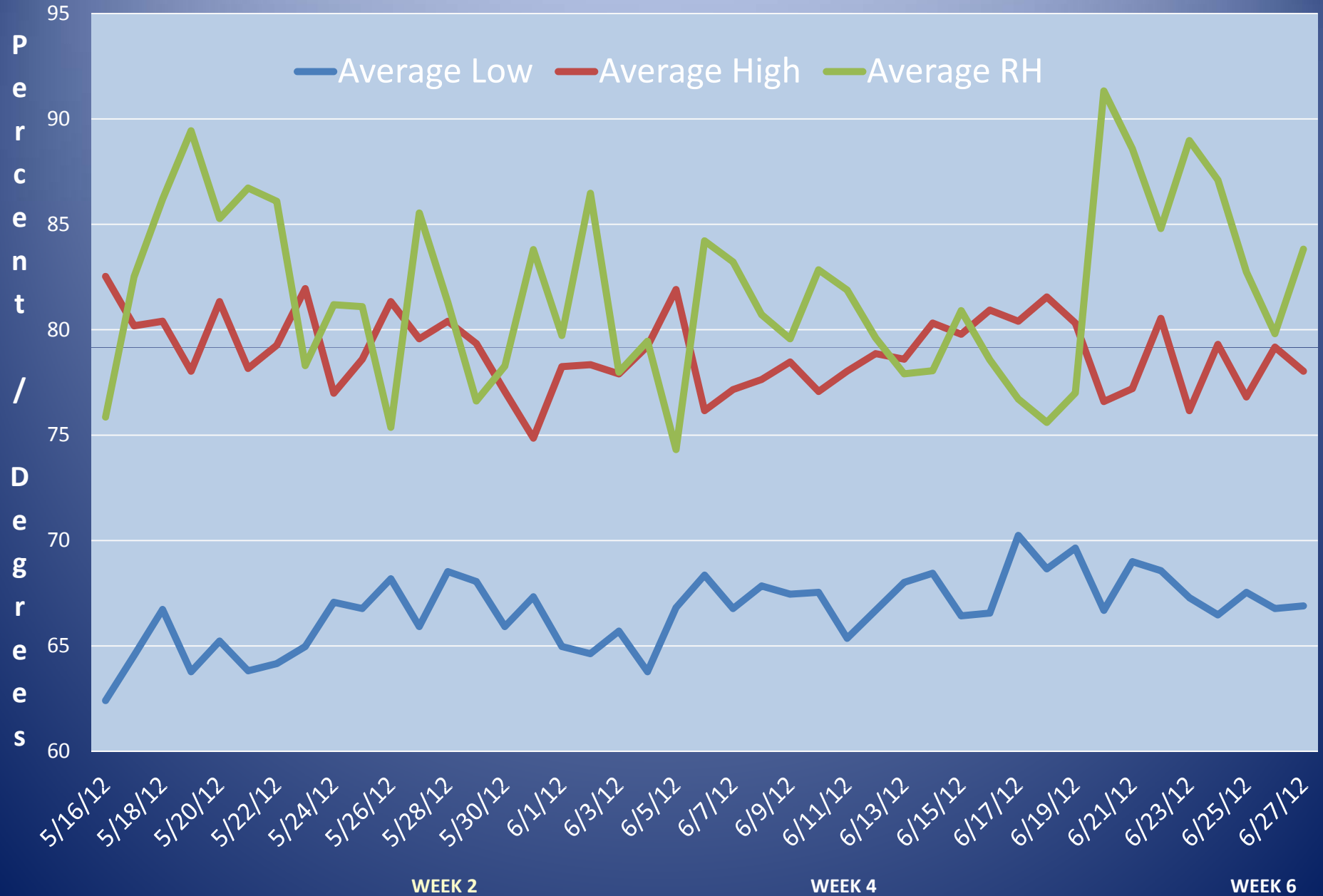
Data Collection

- All harvested berries were frozen prior to dissection
- Dissected and recorded for **# Dead Adults** and **# FKA**
- Also measured environmental parameters (RH, temperature, and rainfall) using weather station





Environmental Parameters



What we've learned about *B. bassiana*

- Natural *Beauveria* infection is playing an important role in causing mortality of CBB.
- *Beauveria* sprays are helpful but are not a substitute for sanitation.
- Sprays persist fairly well, but dose matters, and sprays should probably be repeated every 4-6 weeks for best results.



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