U.S. Pacific Basin Agricultural Research Center

Coffee Berry Borer Research Update

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PBARC's response to CBB

- Participated in informational meetings, along with CTAHR, HDOA, APHIS and other organizations
- Participated in Incident Command Structure set up by HDOA
- Participating on Coffee Berry Borer Task Force/Science Advisory Panel (Eric Jang, Tracie Matsumoto)
- Organized a symposium on Coffee Berry Borer held here at Waikoloa in March (Eric Jang and Robert Hollingsworth), which included the participation of a USDA-ARS expert on CBB (Fernando Vega) and an expert on the use of *Beauveria* (Stefan Jaronski, who later gave a separate presentation to Kona growers on considerations for use of *Beauveria*).
- Coordinated a grant application which included CTAHR and PBARC scientists (Tracie Matsumoto)
- Provided scientific data and testimony in support of successful *Beauveria* registration efforts which were guided by HDOA (Robert Hollingsworth, Tracie Matsumoto)

Research Activities

- Carried out research related to freezing tolerance (Eric Jang, Robert Hollingsworth, Peter Follett, with additional cooperation from other PBARC scientists)
- On-going studies related to improved traps (Eric Jang)
- On-going flower synchronization studies (Tracie Matsumoto)
- Carried out *Beauveria* efficacy trial in heavily infested coffee in Honomalino (Robert Hollingsworth, Tracie Matsumoto, Elsie Burbano, Marc Meisner, Mark Wright)
- On-going *Beauveria* persistence and efficacy trial in Captain Cook (Tracie Matsumoto, Lisa Keith, Robert Hollingsworth)
- On-going laboratory and field trials testing feasibility of entomogenous nematodes (*Steinernema carpocapsae*) against CBB (Roxana Cabos, Robert Hollingsworth)

Research on Freezing as a Potential Quarantine Treatment for Green Coffee

1. Cherries frozen for 1-5 days at different temperatures
2. Cherries dissected to determine survival of beetles

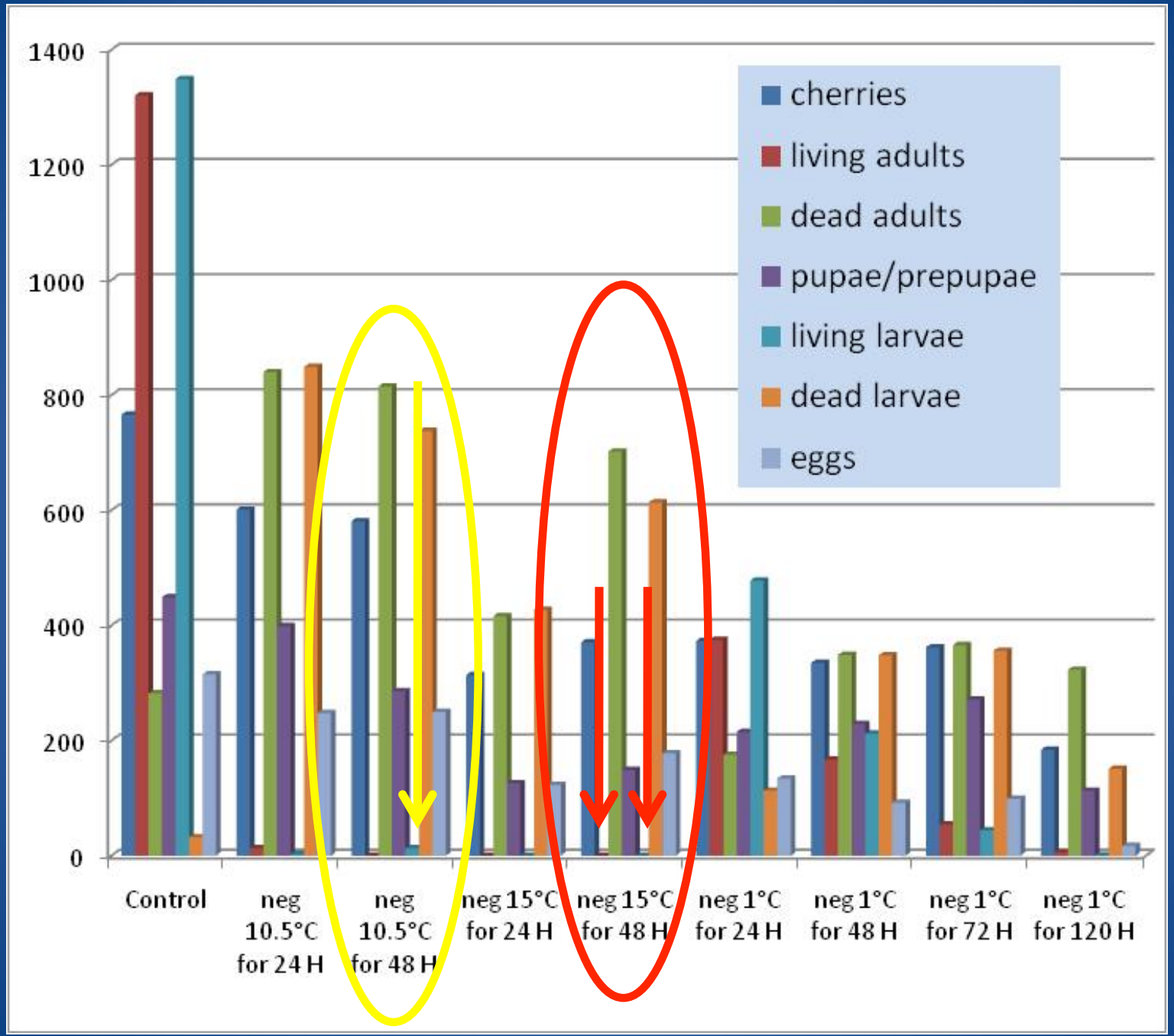
Research on Freezing as a Potential Quarantine Treatment for Green Coffee: >15,000 insects examined

Coffee Berry Borer Freezing Experiment

Mar-11

containers	freezer	cherries	living adults	dead adults	pupae/ prepupae	living larvae	dead larvae	eggs	sum across life stages
15	Control	766	1321	282	449	1349	32	315	[illegible]
8	neg 10.5°C for 24 H	601	13	840	399	3	849	248	2352
8	neg 10.5°C for 48 H	581	0	815	286	13	738	250	2102
5	neg 15°C for 24 H	314	0	416	126	0	427	123	1092
5	neg 15°C for 48 H	371	0	702	149	0	614	178	1643
4	neg 1°C for 24 H	373	375	175	215	478	113	134	1490
4	neg 1°C for 48 H	335	167	349	229	212	348	92	1397
4	neg 1°C for 72 H	362	54	366	271	44	356	99	1190
4	neg 1°C for 120 H	184	6	323	113	1	151	17	611
57	TOTALS	3887	1936	4268	2237	2100	3628	1456	15625

Note: Containers were small, round ventilated plastic cups (about 500 ml) with a 2-cm thick layer of plaster of Paris/activated charcoal at 9:1 ratio in the bottom. Containers were half-filled with coffee cherries before being placed into freezer.


1400
1200
1000
800
600
400
200
0
cherries
living adults
dead adults
pupae/prepupae
living larvae
dead larvae
eggs
Control
neg 10.5°C for 24 H
neg 10.5°C for 48 H
neg 15°C for 24 H
neg 15°C for 48 H
neg 1°C for 24 H
neg 1°C for 48 H
neg 1°C for 72 H
neg 1°C for 120 H

Coffee Berry Borer Trapping (Eric Jang, Lori Carvalho)

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

New area of research:

(1) Pher- emit dispenser

(2) Scentry Sticky traps

Evaluations are on-going

Scentry 1

Scentry 2

Bucket 1

Brocap

Coffee Berry Borer Trapping

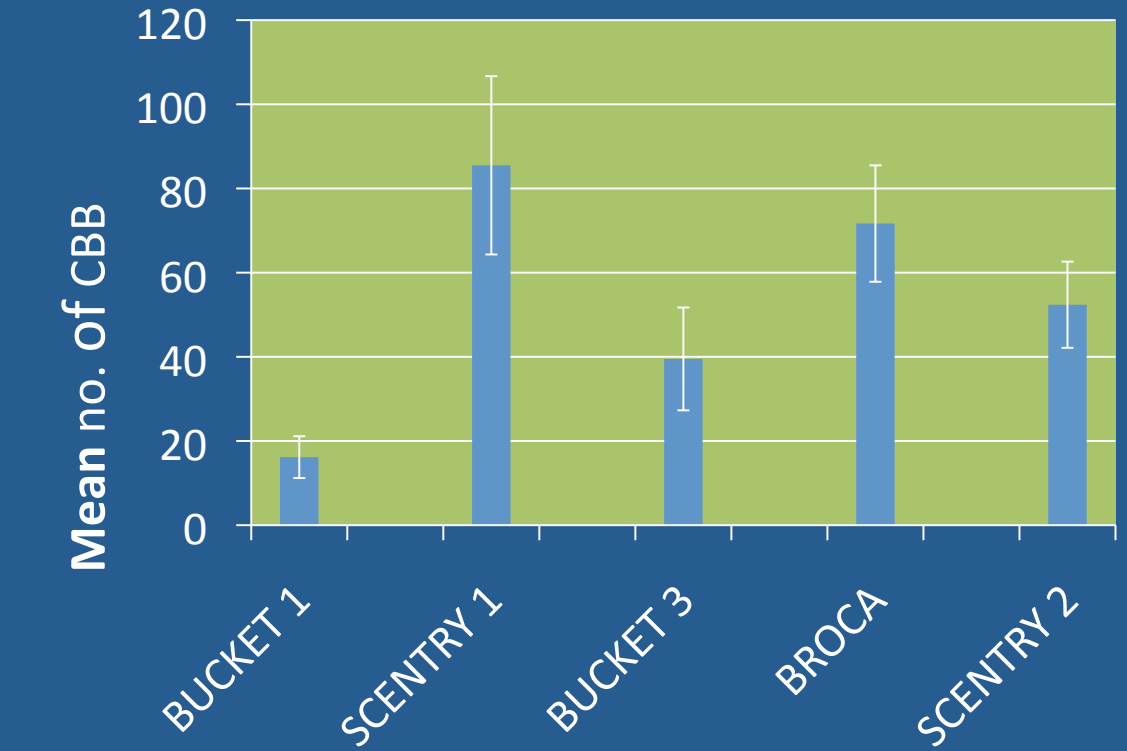
Location: Coffee Farm in Kainaliu. Traps were placed 15 m apart

Lures: Coffee Berry Borer Pouches from Scentry (11g)

Trapping period: April – July 2011

Results :

Scentry 1 and Scentry 2 paper traps did just as well as the plastic Brocap® trap. The bucket traps did not capture as many CBB as the other trap types but trap captures were increased with three entry windows compared to one entry window.



Control of Coffee Flowering to reduce CBB levels in field – Tracie Matsumoto

Without sanitation coffee berries will always be present in this field

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*

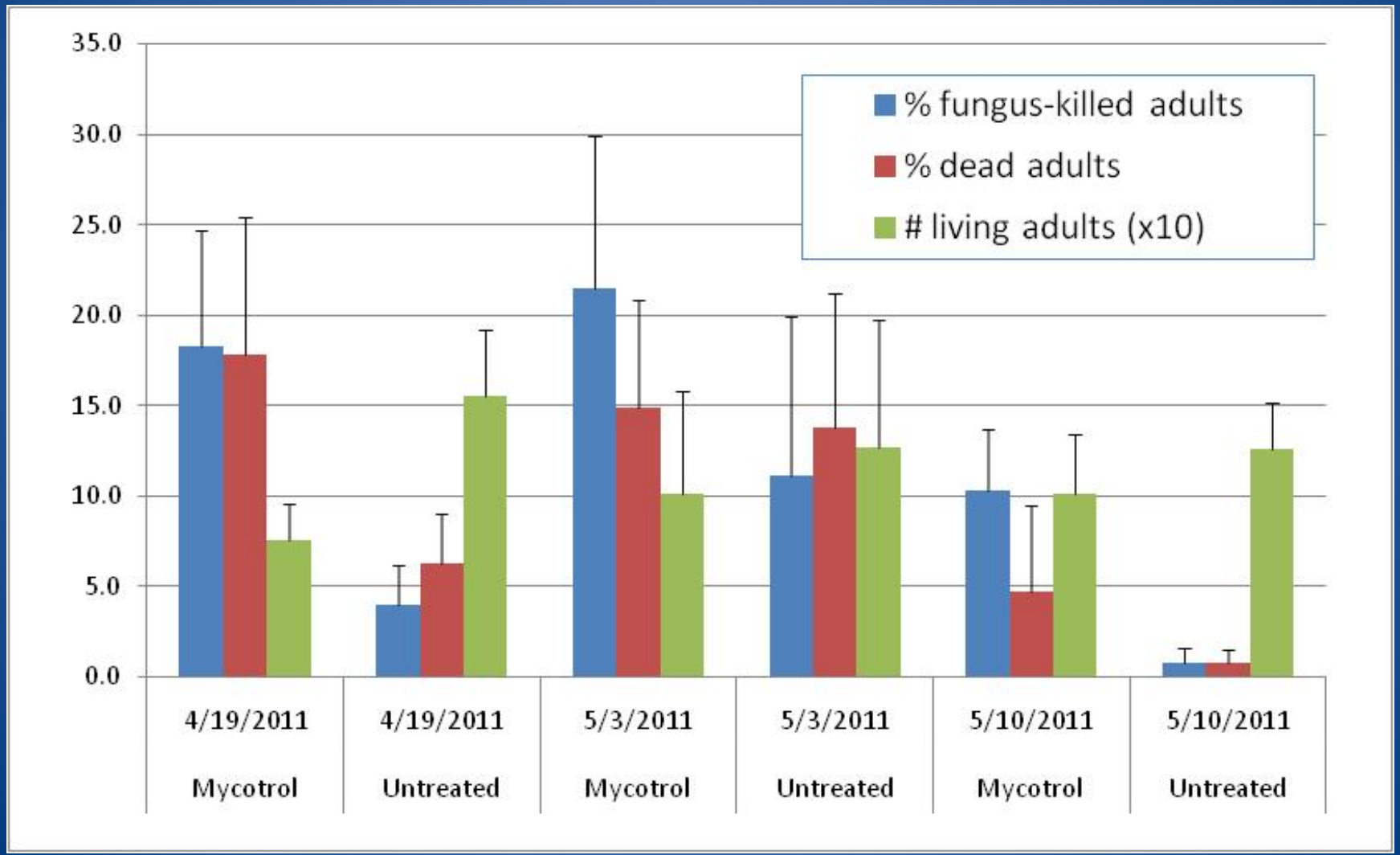
- Versus -

(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



Field Plot: Greenwell 1

Beauveria persistence (Lisa Keith), Strain Identification (Tracie Matsumoto) and Efficacy (Robert Hollingsworth)

10 trees

3 trees

Spray rate = 1.5 qt/acre

Control; "no spray"

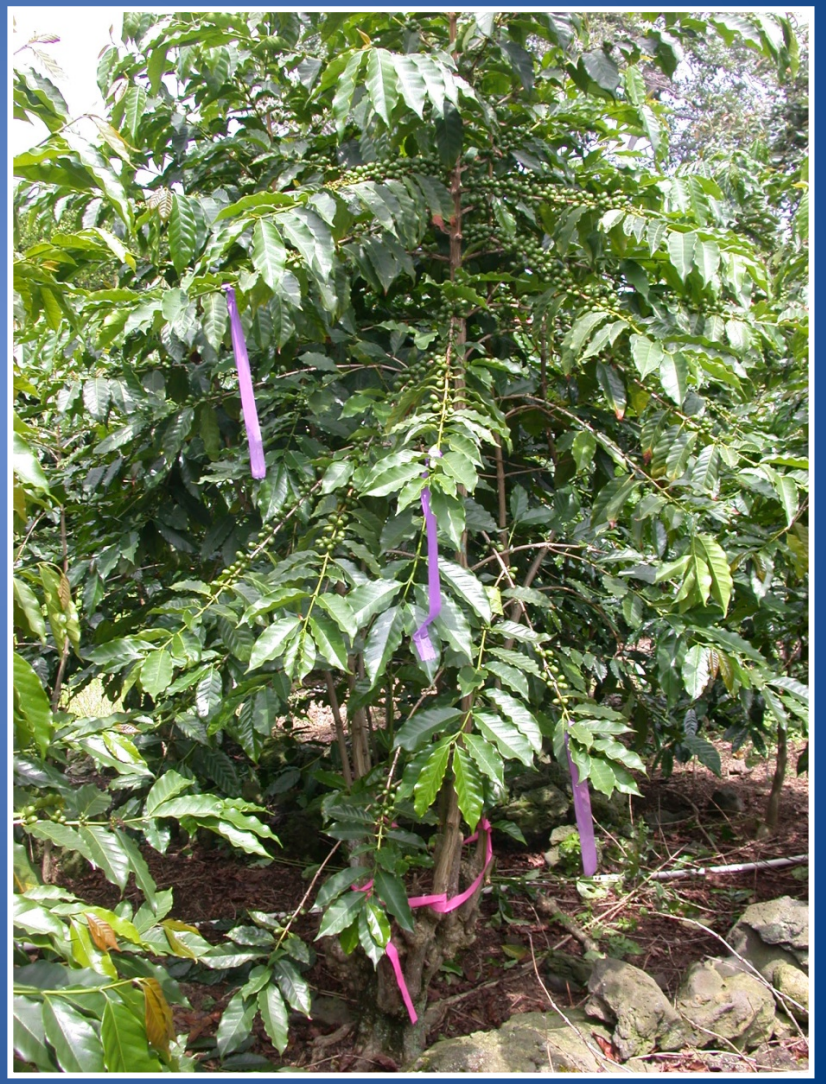
Field Sample (Tree 6)

- Lisa Keith

high

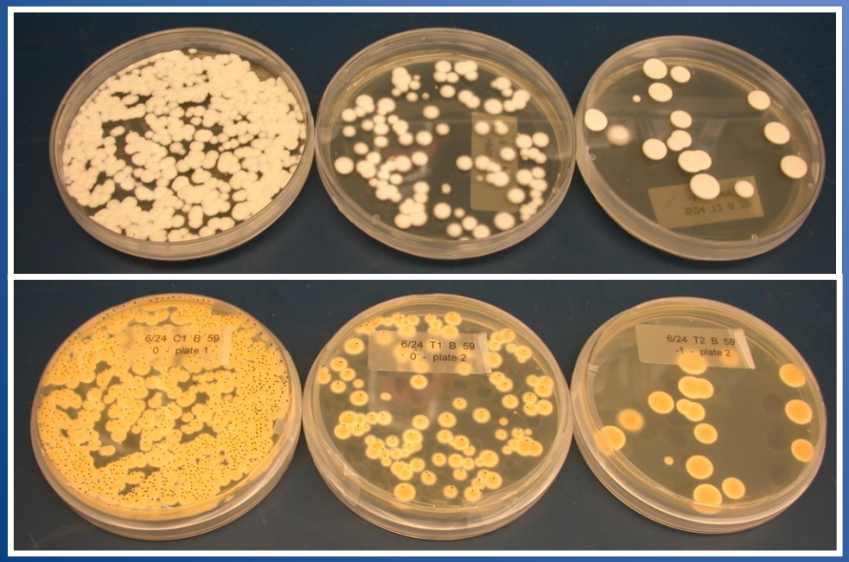
middle

low



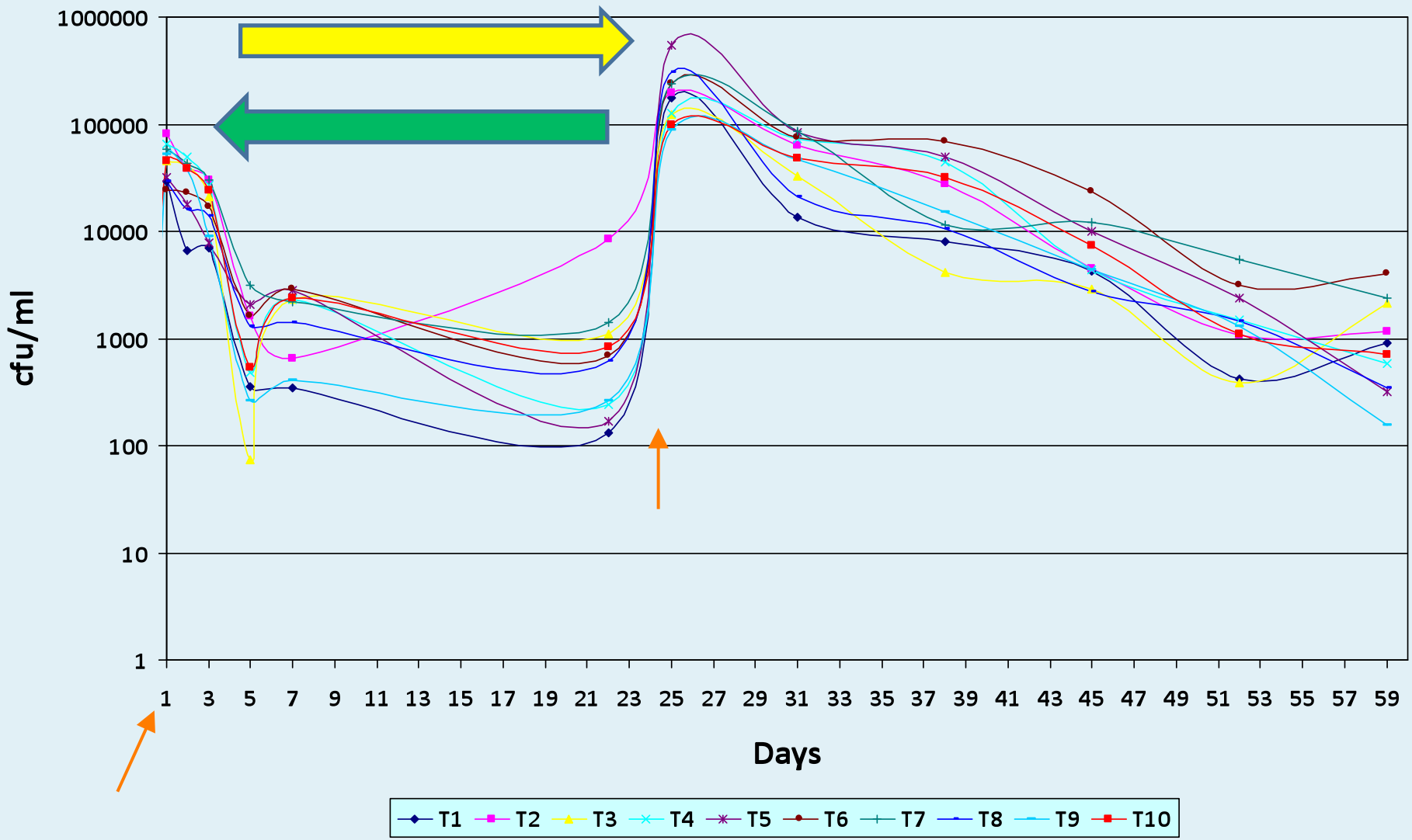
1 sample = 15 berries
5 berries/branch

Laboratory Results - Lisa Keith



B. bassiana GHA field persistence on coffee berries at Greenwell 1

[Sprayed on Day 0 (4/25/11), Day 24 (5/19/11)]

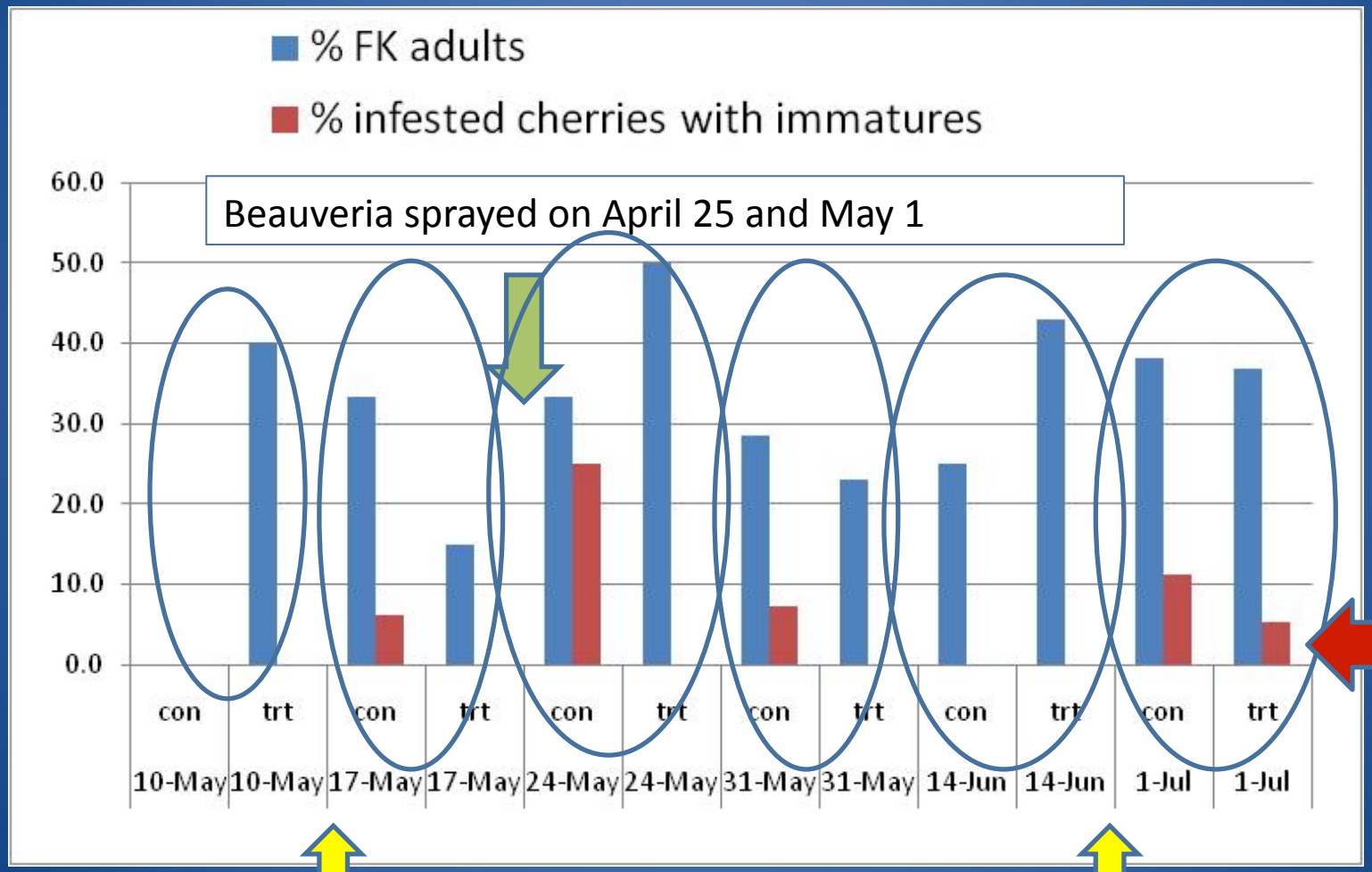


15 berries randomly selected from 3 branches/tree/time point; washed with 1x wt/vol water + Silwet; diluted, plated & counted

GHA Strain Field Persistence Results

- Trends indicate:
  - *B. bassiana* GHA strain persisted longer in the field than expected (detected 23 days post 1st spray and 35 days post 2nd spray)
  - ~ 1-2 log GHA decrease within first week after sprays
  - Cumulative effect observed after second spray (field baseline for GHA became higher)

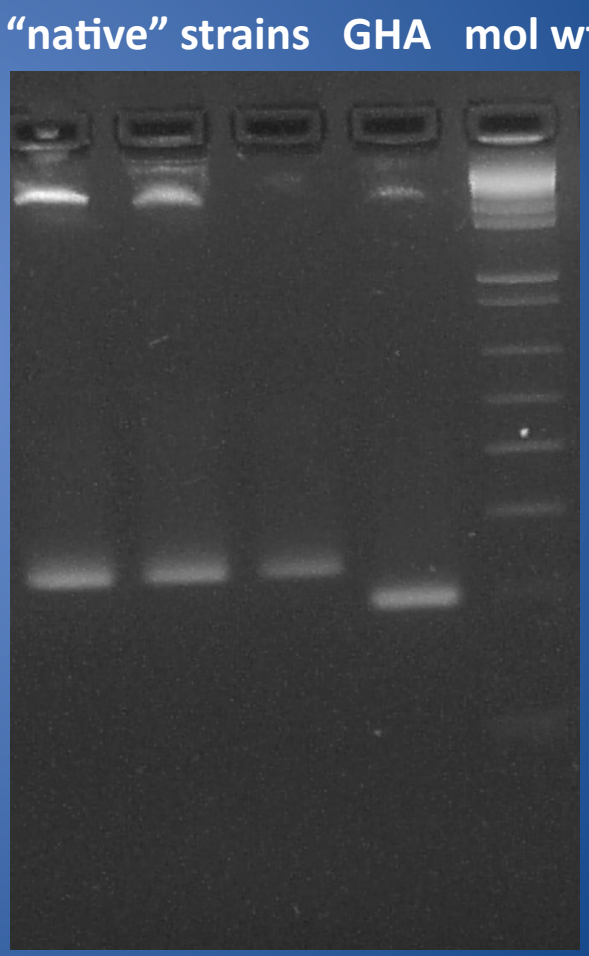
% fungus-killed adults and % cherries with immatures – Robert Hollingsworth



GHA Strain Molecular Identification

- Tracie Matsumoto

- In progress:
  - Look at the relative representation of GHA vs "native" *Beauveria* isolates on coffee berries
  - Determine the relative numbers of beetles killed by GHA vs "native" *Beauveria* isolates



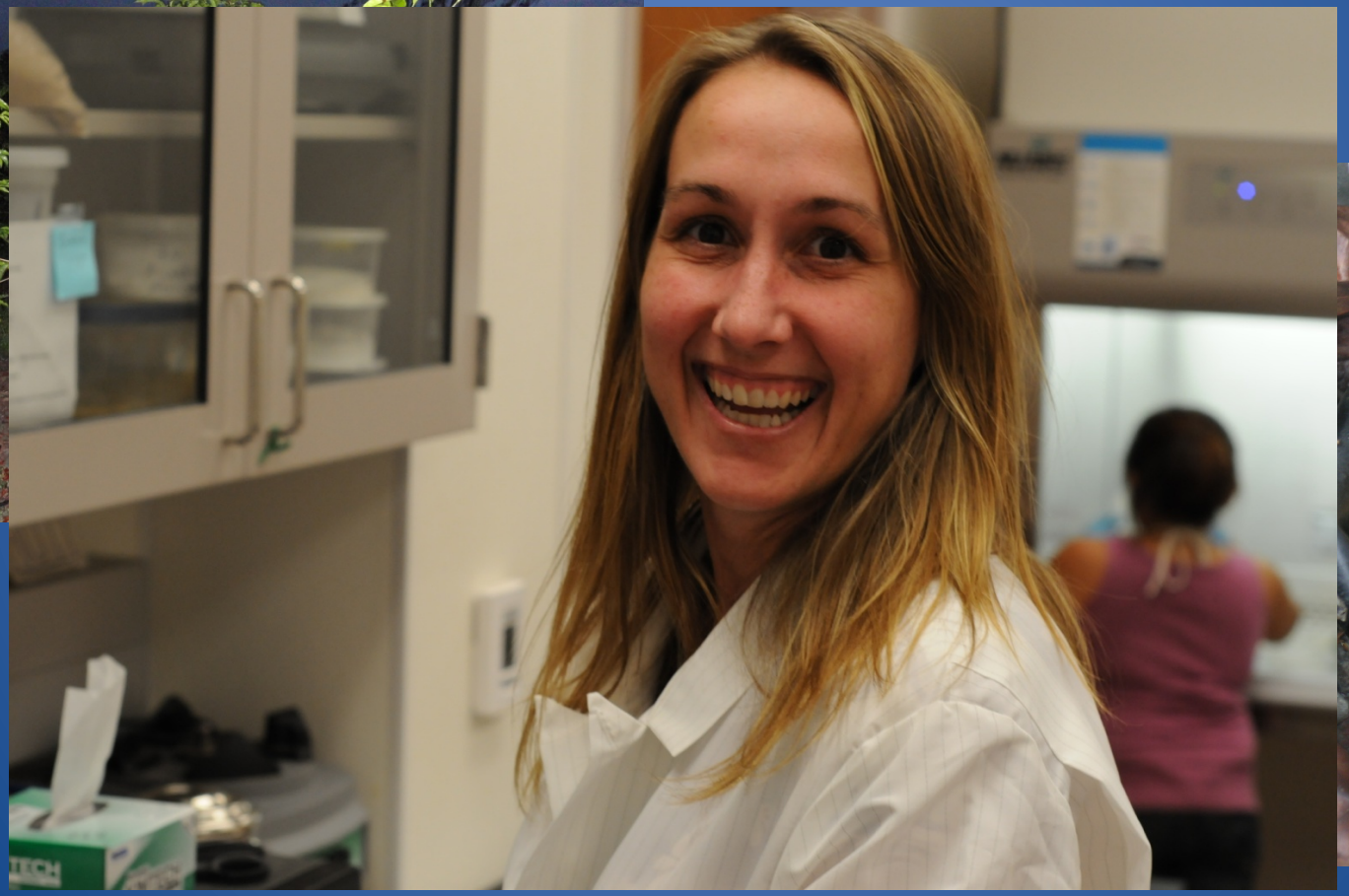
Primer set Ba12

Entomopathogenic Nematodes

- Roxana Cabos, Robert Hollingsworth

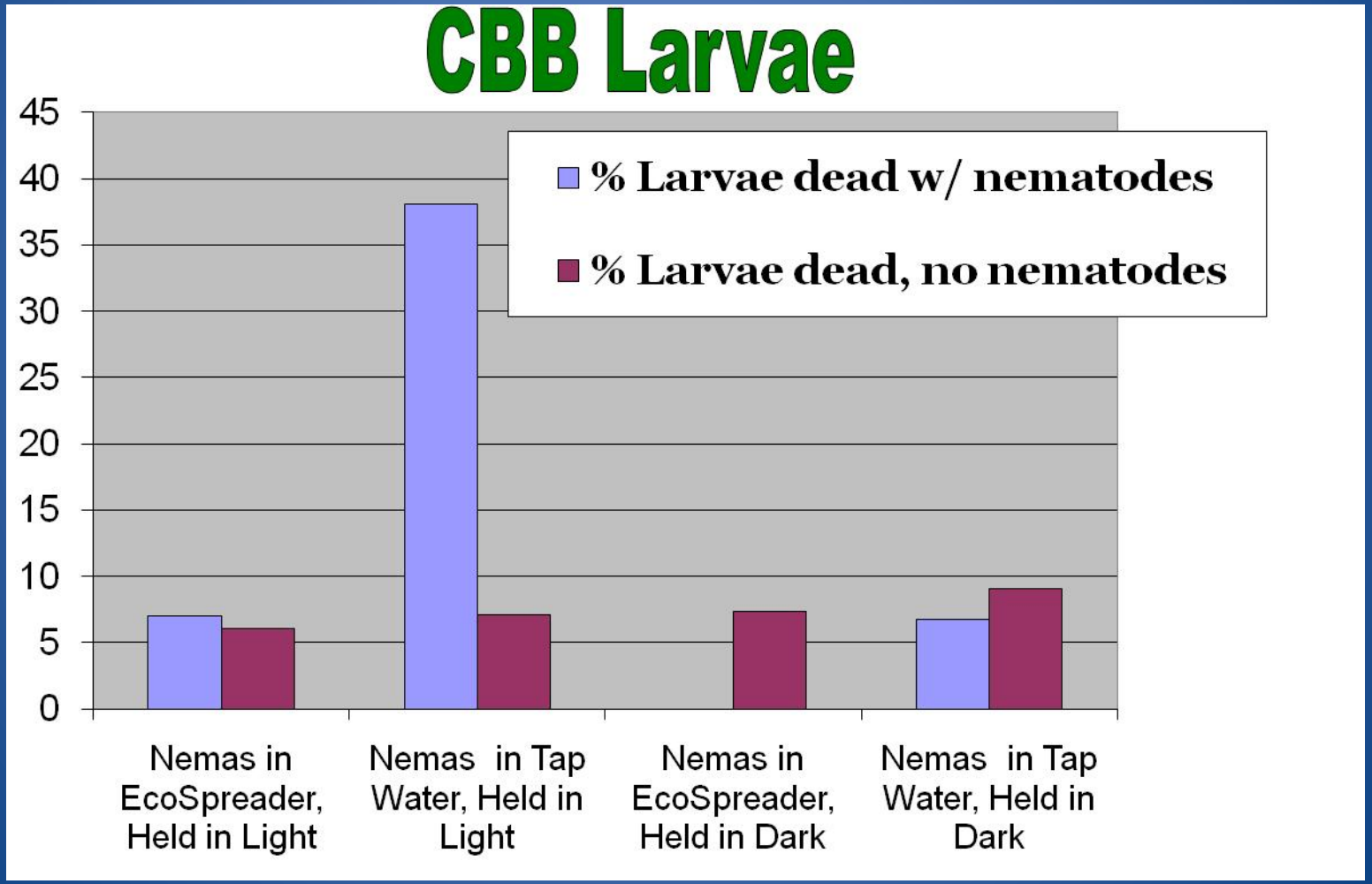
Juveniles exiting body of decomposing CBB larvae

Nematode field test was a bust



Roxana Cabos

Efficacy of nematodes depending on light and liquid carrier



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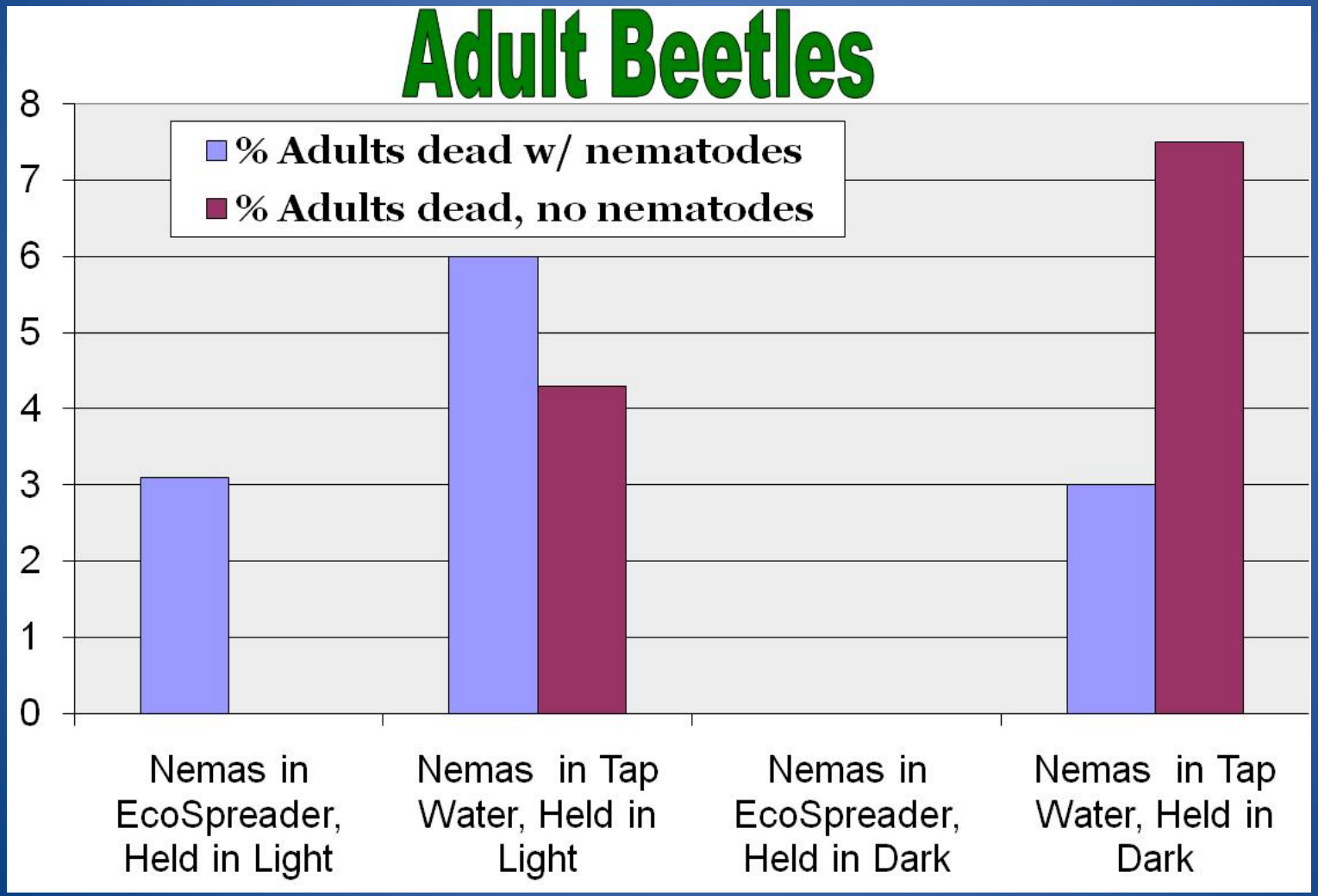
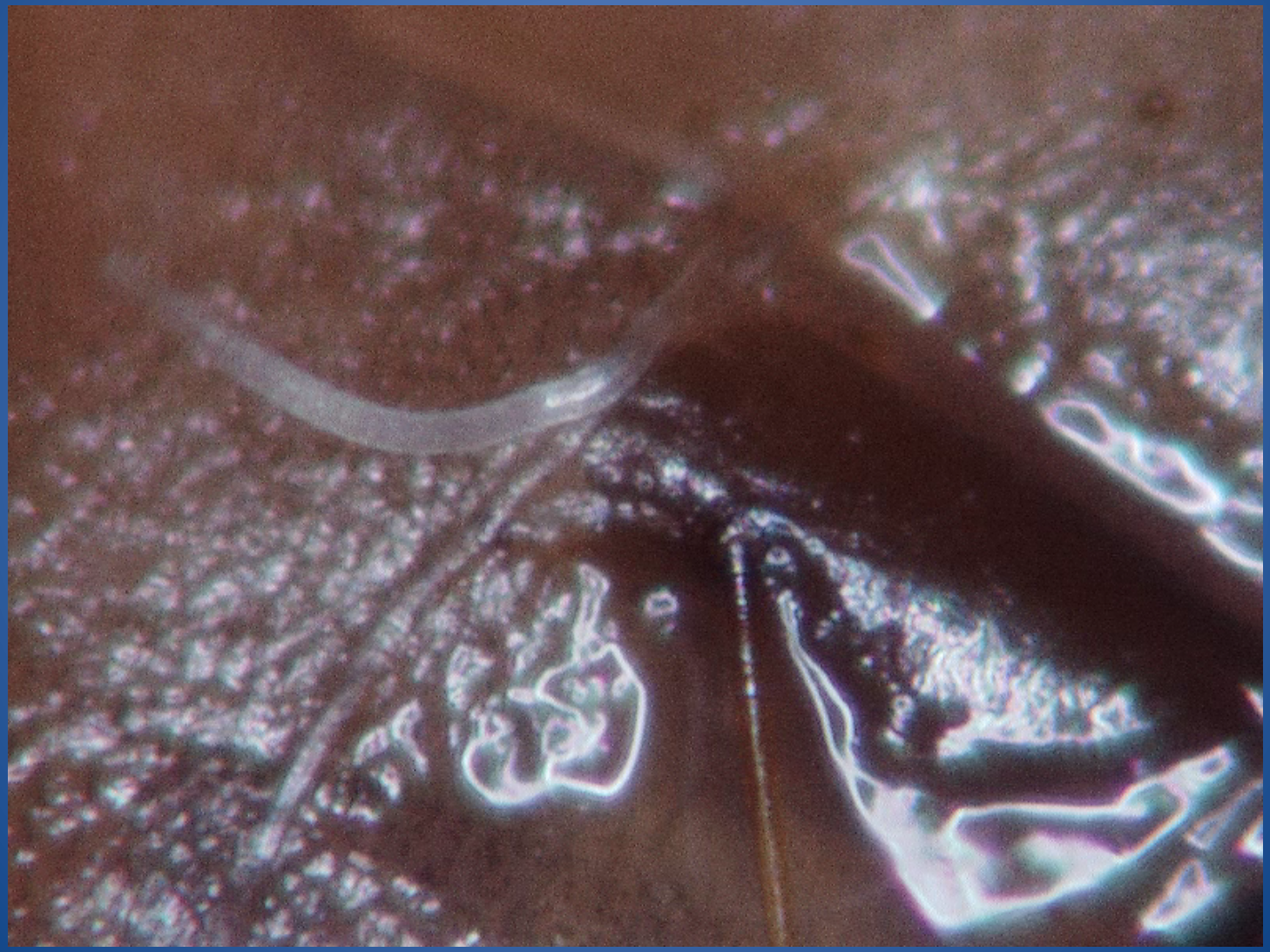


Coffee Berry Borer Larva in Action

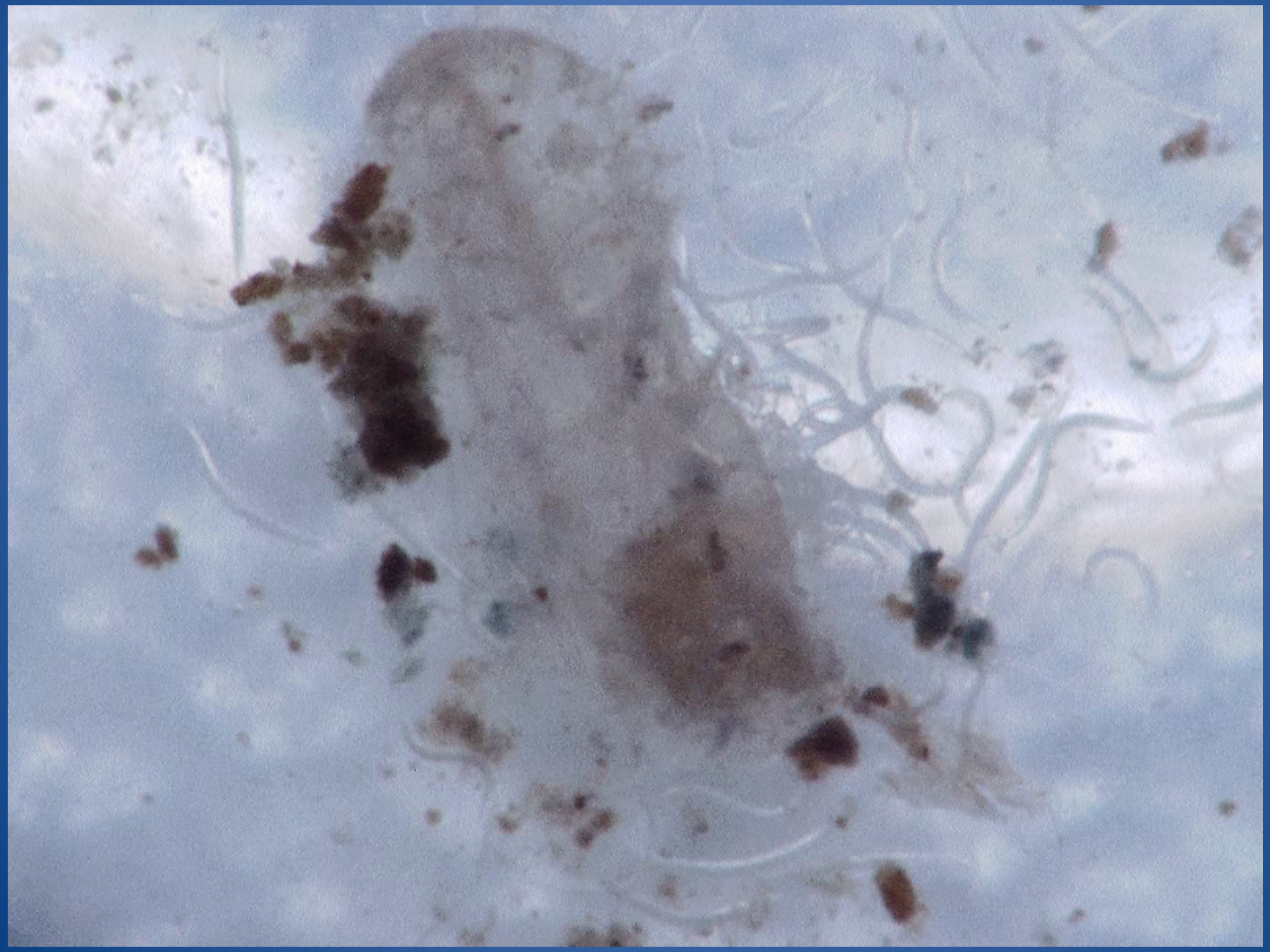
nematode video three.MOV

Nematodes getting ready to break free of Mom

Nematode searching for Host Insect



Nematodes wiggling after spilling out of dead CBB larva



Predator Thrips

Adult

Larva of predatory thrips

***Karnyothrips flavipes*, a predator thrips, is a biological control agent for Coffee Berry Borer in Kenya.**

***Karnyothrips* lay eggs inside infested coffee beans. Adults and larva thrips feed on CBB eggs and larvae.**

Monitoring effectiveness of naturally occurring and sprayed *Beauveria*

- If anyone within the Captain Cook – Holualoa area is interested in having us monitor levels of *Beauveria* infection in infested coffee cherries, call Robert Hollingsworth at 808-959-4349 or write to robert.hollingsworth@ars.usda.gov
- (1) We will collect and dissect 20 coffee cherries every two weeks from an ordinary part of your field and also from unsprayed "experimental control" trees you agree to leave alone
- (2) We will ask you when you last sprayed *Beauveria*
- (3) We will dissect the cherries and let you know the percentage of beetles which are fungus-killed

We are only looking for 3-4 farms

Acknowledgments:

- Guidance and assistance from US-PBARC Center Director Dennis Gonsalves, HDOA Plant Industry Administrator Lyle Wong and Plant Pest Control Branch Manager Neil Reimer, CTAHR Special Research Director and Entomologist Ken Grace, UDSA-ARS Entomologist Fernando Vega, USDA-ARS Entomologist Stefan Jaronski, and coffee growers Pepe Miranda, Tom Greenwell, and Andres Magana