CBB Efforts at PBARC

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KCFA Expo 2015
Topics

• Area-wide CBB Program

• Summary of work at DKI-PBARC

• 2014 data \textit{(currently unpublished)}

• Conclusions
Area-wide CBB Program

- An area-wide mitigation and management program for CBB control was established by PBARC in August 2013 with funds received from ARS ($1M) in collaboration with the University of Hawaii at Manoa.

- 2014, Federal Grant, $703,358

- Team: 13 members
  - (6 CTAHR, 6 DKI-PBARC, 1 ARS Ithaca)
Area-wide CBB Program

- **Original Objectives:**
  - Optimize the dose and use of commercial *Beauveria*
  - Map the area and extent of the infestation
  - Understand insect phenology
  - Synchronize coffee blooms for harvest and sanitation
  - Area-wide education and extension outreach
  - Economic analysis of CBB effects and cost/benefit of control measures
  - Analyze the CBB genome to better understand CBB biology
Area-wide CBB Program

- **Additional Objectives:**
  - The use of more effective *Beauveria* strains
  - Reduce field populations of CBB using
    - Semiochemicals
    - Entomopathogenic nematodes (EPNs)
    - Predators
    - Pruning styles
  - Improved quarantine treatments
  - Implement preventative and/or management measures to additional islands
PBARC Scientists Involved With CBB

Lisa Keith
Tracie Matsumoto
Nicholas Manoukis
Eric Jang
Peter Follett
Roxana Myers
Steve Wraight (Ithaca, NY)

* Integrated Management for Control of Coffee Berry Borer (CBB)
* PBARC working cooperatively with CTHAR, HDOA and others
* Participation as key members of the CBB Task Force, SHAC and many farming groups
Map the Area and Extent of the Infestation of CBB

- Developed a database for documenting and data sharing amongst CBB researchers
- Field work has included collection of preliminary ground-based spectral signature data from coffee plants
- Remote detection of coffee
- Working on a decision support tool for growers
- Dr. Nicholas Manoukis
Synchronize Coffee Flowering as a Harvest Management Tool

- Goal: to reduce crop losses for sanitation and reduce CBB populations in the field
- Plant growth regulator treatments have been applied; harvest data is being collected, and CBB infestation levels are being examined
- Presence of CBB in fallen cherries is being monitored

- Dr. Tracie Matsumoto
Develop and Deploy *B. bassiana*

- Improved efficacy data (rate of infection; correlation between efficacy and environment)
- Isolate and characterize naturally occurring isolates of *Beauveria* spp.
- Assess the activities of GHA vs. local strains

- Dr. Steve Wraith (ARS Ithaca)
Use of Entomopathogenic Nematodes (EPNs) as an Alternative to Sanitation

- A CBB colony was established on artificial diet in the laboratory
- *Heterorhabditis* strains were mass reared on mealworm beetle larvae

- Dr. Roxana Myers
Chemical Ecology Perspective of CBB Control Strategies

• Utilize semiochemicals to reduce field populations of CBB
• Work continues on the HS-GC-MS analysis of bioactive volatiles from coffee plant tissues and CBB at different development stages
• Use of repellents; “Push-Kill”

• Drs. Eric Jang & Yang Yu
Utilize Predators to Reduce Field Populations of CBB

- Square-necked grain beetle, *Cathartus quadricollis*
- Dr. Peter Follett with Ms. Andrea Kawabata

An Introduction to Beetle Predators of Coffee Berry Borer (CBB) in Hawaii Workshop - Kona

Saturday, February 7, 2015 (2 sessions are available)
**Morning**: 9:30 AM – 12:00 PM
**Afternoon**: 2:00 PM – 4:30 PM
Sheraton Keauhou Resort & Spa – Bayview Rooms
(78-128 Ehukai Street; Kailua Kona, HI 96740)

Seating is limited. RSVP to Gina at ginab@hawaii.edu or 322-4892 by Thursday, February 5, 2015.
Beauveria/CBB Research: Persistence & Efficacy
Goals for 2014

• Determine how timing and frequency of commercial Beauveria applications effect persistence and efficacy
  • Elevation: 1869 ft, 1547 ft, 624 ft (shade)

• Strip Pick

• Compare 2014 to 2013
  • Dr. Lisa Keith
Coffee Data Collected

- Field plot maps/Strip pick
- Persistence: *Beauveria* GHA
- Efficacy (Destructive method)
  - % AB, % AB Dead, % CD, % Infestation
- Efficacy (Non-destructive method)
  - % Infestation, % Beauveria
- Environmental
  - Temp, % RH, Leaf moisture, Rainfall, UV
- Quality/Harvest
### 2014 Spray Schedule

**Rate = 1 qt/100 gal**

Spray late afternoon/early evening

Once/month spray (#1)

Twice/month spray (#2)

Strip pick + once/month spray (#3)

#### Beauveria Spray Dates

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#### 1st Beauveria spray

**2013**

Honaunau Low: 4/8

Honaunau High: 5/6

**2014**

Honaunau Low: 5/19

Honaunau High: 3/10

Sampling occurs before and after *Beauveria* sprays.
Field Samples per Tree

**Persistence**

- high
- middle
- low

1 subsample = 15 berries
10 trees

**Efficacy:** Destructive & Nondestructive

- middle

1 subsample = 10 green berries
4 trees

© L. Keith
Laboratory Results - Persistence

Weigh
Wash
Dilute
Plate
Count *Beauveria*
Laboratory Results – Efficacy, Destructive Method

Dissect berries
Count beetles

AB alive/dead
CD
Beauveria

© L. Keith
# Data: Stripped

## Honaunau Low
**Stripped 2/20/14**

14,619 sq ft; 13 people, 2 hours

<table>
<thead>
<tr>
<th>weight (g)</th>
<th>Hole</th>
<th>No-Hole</th>
<th>Unsorted</th>
<th>Total</th>
<th>% Infested</th>
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6683.3g
14.7lb

## Honaunau High
**Stripped 3/7/14**

8,404 sq ft; 8 people, 6 hours

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<td>4950.7</td>
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12213.4g
26.9lb
Persistence, 2014

Honaunau Low *B. bassiana* GHA field persistence on coffee berries, 2014

2 or 3 sprays

strip pick (HL3)
Persistence, 2013

Honaunau Low B. bassiana GHA field persistence on coffee berries, 2013

9 or 15 sprays  once/month spray (HL1)
                twice/month spray (HL2)
Persistence, 2014

Honaunau High *B. bassiana* GHA field persistence on coffee berries, 2014

14 or 25 sprays  
twice/month spray (HH2)  
strip pick + once/month spray (HH3)
Persistence, 2013

Honaunau High B. bassiana GHA field persistence on coffee berries, 2013

11 or 19 sprays
once/month spray (HH1)
twice/month spray (HH2)
Persistence, 2014

Plot S B. bassiana GHA field persistence on coffee berries, 2014

7 sprays
Efficacy: Destructive method, Honaunau Low, 2014

\[ \% \text{ AB} = \text{Alive} + \text{Dead} + \text{Absent (hole only)} \]

strip pick (HL3)
Efficacy: Destructive method, Honaunau Low, 2014

% CD

strip pick (HL3)
% infested = % AB + % CD

Efficacy: Destructive method, Honaunau Low, 2014

strip pick (HL3)
Efficacy: Destructive method, Honaunau High, 2014

% AB = Alive + Dead + Absent (hole only)

once/month spray (HH1)
twice/month spray (HH2)
strip pick + once/month spray (HH3)
Efficacy: Destructive method, Honaunau High, 2014

% AB = Alive + Dead + Absent (hole only)

once/month spray (HH1)
twice/month spray (HH2)
strip pick + once/month spray (HH3)
Efficacy: Destructive method, Honaunau High, 2014

% CD

- once/month spray (HH1)
- twice/month spray (HH2)
- strip pick + once/month spray (HH3)
Efficacy: Destructive method, Honaunau High, 2014

- once/month spray (HH1)
- twice/month spray (HH2)
- strip pick + once/month spray (HH3)
Efficacy: Destructive method, Honaunau High, 2014

\[ \% \text{infested} = \% \text{AB} + \% \text{CD} \]

- once/month spray (HH1)
- twice/month spray (HH2)
- strip pick + once/month spray (HH3)
Efficacy: Destructive method, Honaunau High, 2014

% infested = % AB + % CD

once/month spray (HH1)
twice/month spray (HH2)
strip pick + once/month spray (HH3)
% AB = Alive + Dead + Absent (hole only)
Efficacy: Destructive method, Plot S, 2014

% CD
Efficacy: Destructive method, Plot S, 2014

\[ \% \text{infested} = \% \text{AB} + \% \text{CD} \]
Efficacy: Non-destructive method, Honaunau Low, 2014

% infested = a hole  
strip pick (HL3)
Efficacy: Non-destructive method, Honaunau High, 2014

% infested = a hole

strip pick (HL3)
Data: Harvest, 2014

Hole vs No-Hole, % infestation

- once/month spray (HH1)
- twice/month spray (HH2)
- strip pick + once/month spray (HH3)
- 7 sprays (S1)
- 2 or 3 sprays (HL1, HL2)
- strip pick + 2 or 3 sprays (HL3)

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Conclusions/Observations

- Difficult to give a precise recipe for success
- Only *Beauveria*: Not the silver bullet
- Only stripping: Not the silver bullet
- Timing versus number of applications
- Location specific for persistence and efficacy
- Environmental Data:
  - Locations are unique
  - Seasons can vary
- All data necessary for CBB Model

(Thanks to Nicholle, Lionel, Jim, Glenn and John for excellent technical help)
What Does The Data Tell Us?

• Knock back the existing CBB population early (strip; *Beauveria*)
• Spray in the late afternoon
• *Beauveria* doesn’t persist as much during the harvest months
• *Beauveria* sprays: monitor visually; spray when necessary
• “% infested” doesn’t necessarily mean you have a high % of damaged beans

Thank You Field Cooperators!