Coffee berry borer : scrambling for answers in Hawaii's unique agro-ecosystems

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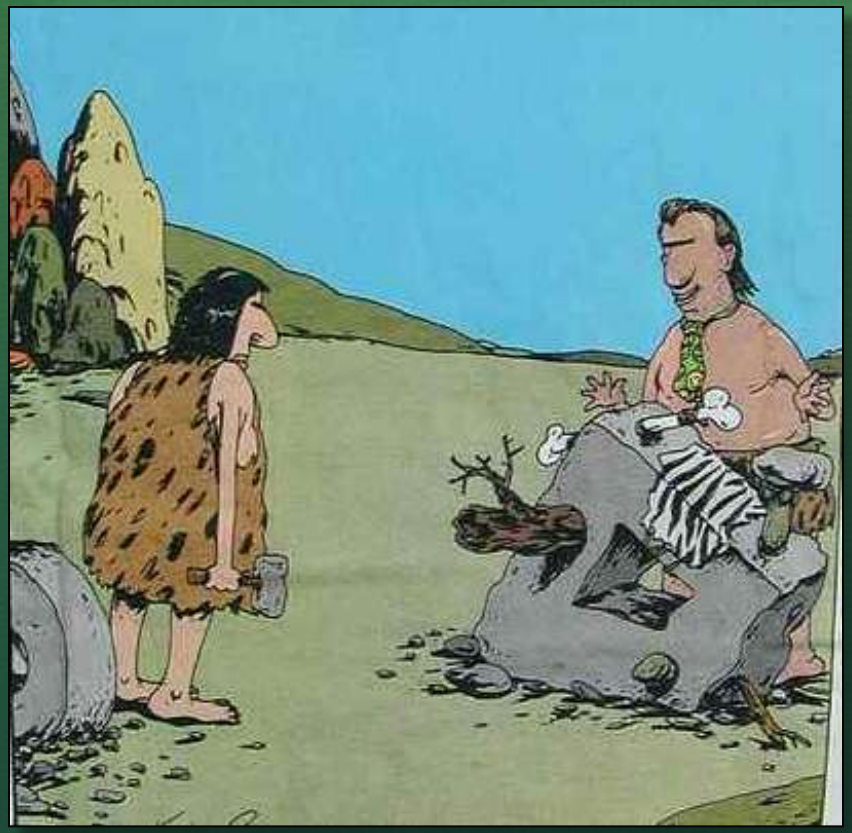
World distribution:

“Don’t re-invent the wheel….”



Traps: monitoring and control

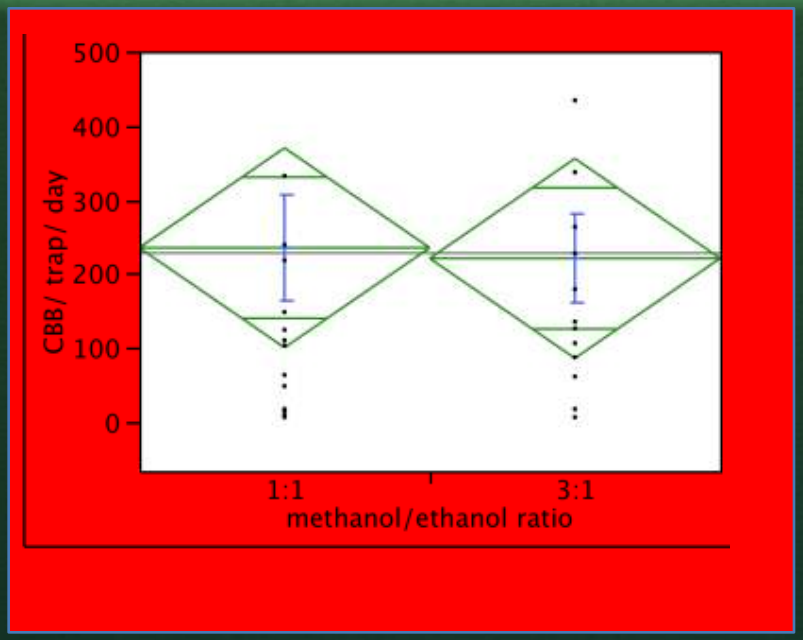
"All these studies with contradictory results justified new experiments designed to develop trapping techniques to control CBB populations."

Dufour & Frerot 2008

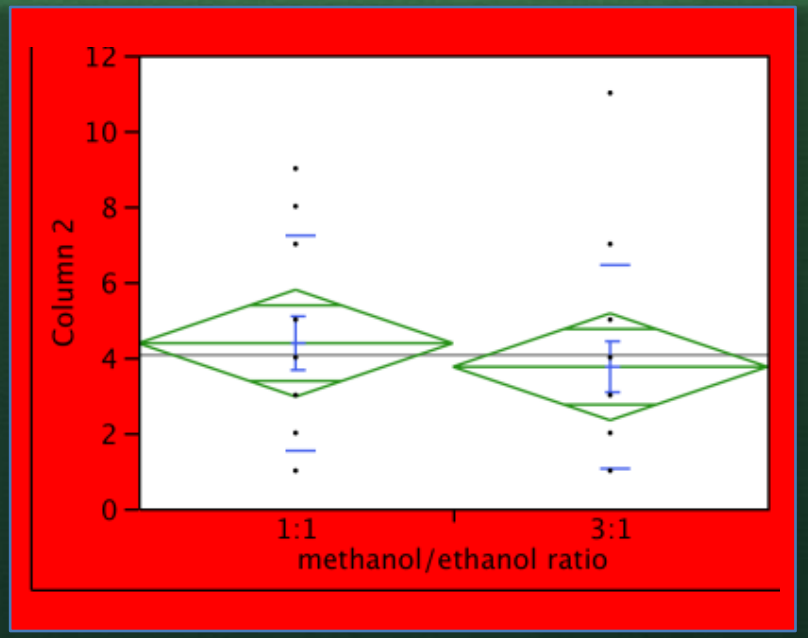
Optimal ratio of methanol: ethanol?

Reference	Location	1:1	2:1	3:1
Mendoza Mora 1991	Brazil	attracts	-	-
Mathieu et al. 1997	New Caledonia	attracts	-	-
da Silva et al. 2006	Brazil	231	339	333 ns
Dufour & Frerot 2008	El Salvador	111	92	101

Ratio of alcohols… Hawaii



t = 0.1532; P = 0.879



t = 0.6374; P = 0.528

Questions about traps…

- Are there differences in beetle specificity? (tropical nut borer, black twig borer, native species…).
- Is purity important? (laboratory vs reagent grade…).
- Is isopropyl alcohol attractive? (less expensive and more widely available).
- Hercon vaportapes vs. ethylene glycol?
- Trap color?

Sanitation….

Alternate host plants…..?

"Entomologists in other areas of the word have documented seasonal CBB refugia in many other host plants, especially in the Fabaceae and Rubiaceae" (Damon et al. 2000)

Comment: No, no, no, no!!!! Damon didn't look at the original papers. The research she reports was

Comment: This entire section is a long shot. You are basically saying that the insect will find an alternate host if berries are not around.

Alternate host plants…..?

Cesalpinia sp.(Fabaceae)

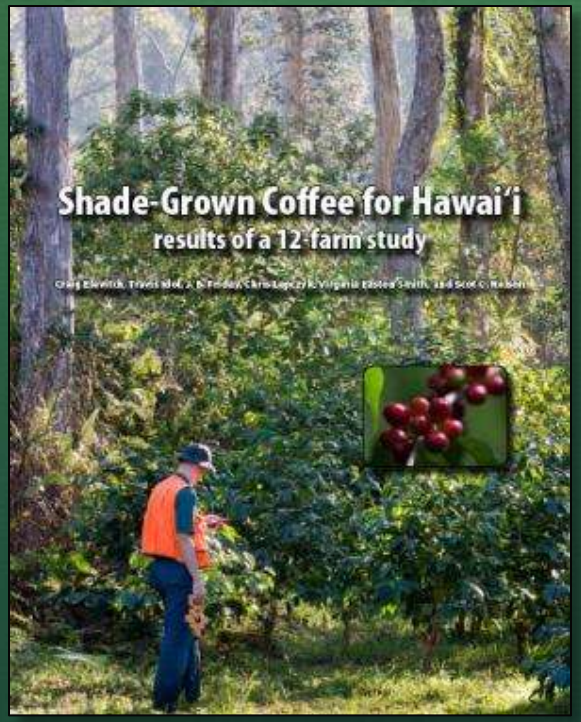
Desmodium sp. (Fabaceae)

Euphorbia cyathophora

Eugenia uniflora

Haole koa (*Leucaena leucocephala*)….

Effects of shade……?



ALIEN PEST ALERT!

Coffee Berry Borer

Hypothenemus hampei (Ferrari)

USDA U.S. Pacific Basin Agricultural Research Center

Department of Agriculture STATE OF HAWAII

College of Tropical Agriculture and Human Resources
University of Hawai'i at Mānoa

What you can do.

- Reduce heavy shade*
- Prune coffee to keep the bush as open as possible*

**to create a less humid environment for the beetle*

Effects of shade……?

- **For every 1.8º F. increase in temperature, the coffee berry borer became 8.5% more infectious.**

- **Not only did female beetles lay more eggs at higher temperatures, but they also drilled deeper into coffee berries, causing more physical damage.**

- **Higher temperatures also caused females to travel from berry to berry earlier in the season.**

Jaramillo et al. 2009 (PLoS ONE);

Jaramillo et al. 2010 (J. Econ. Entomol)

Effects of shade……?

Coffee grown under shade has increased levels of biodiversity when compared to non- shaded coffee

Perfecto et al., 1996; Greenberg et al., 1997a, 1997b; Moguel & Toledo, 1999; Hietz, 2005; Armbrecht & Gallego, 2007; Philpott et al., 2008.

The value of pest control provided by birds (via increased yield) to farmers in Jamaica averaged $75 per ha of coffee

Johnson et al. 2010 Animal Conservation 13: 140–147

Effects of shade……?

"Ants ……are more effective in controlling the CBB in densely shaded areas" (**Pardee** & Philpott 2010; Mexico)

"CBB…adults exposed to ants for 5 days suffered higher removal in shaded plantations" (**Armbrecht** & Gallego 2007; Columbia)

Parasitoids for biological control....

Bethylidae

Prorops nasuta

Cephalonomia stephanoderis

Cephalonomia hyalinipennis

Eulophidae

Phymastichus coffea

Hawaiian native scolytids: potential non-targets

58 records match
Records 21 to 40

Genus	Species	Describer	Order	Family	Display
Hypothenemus	ruficeps	Perkins	Coleoptera	Scolytidae	Full Record
Hypothenemus	seriatus	(Eichhoff)	Coleoptera	Scolytidae	Full Record
Librador	japonicus	(Chapuis)	Coleoptera	Scolytidae	Full Record
Ptilopodius	pacificus	Schedl	Coleoptera	Scolytidae	Full Record
Stephanoderes	hampei	(Ferrari)	Coleoptera	Scolytidae	Full Record
Xyleborinus	saxeseni	(Ratzeburg)	Coleoptera	Scolytidae	Full Record
Xyleborus	affinis	Eichhoff	Coleoptera	Scolytidae	Full Record
Xyleborus	agamus	Perkins	Coleoptera	Scolytidae	Full Record
Xyleborus	arcturus	Samuelson	Coleoptera	Scolytidae	Full Record
Xyleborus	dubiosus	Perkins	Coleoptera	Scolytidae	Full Record
Xyleborus	exsectus	Perkins	Coleoptera	Scolytidae	Full Record
Xyleborus	ferrugineus	(Fabricius)	Coleoptera	Scolytidae	Full Record
Xyleborus	hawaiiensis	Perkins	Coleoptera	Scolytidae	Full Record
Xyleborus	hiiaka	Samuelson	Coleoptera	Scolytidae	Full Record
Xyleborus	ignobilis	Perkins	Coleoptera	Scolytidae	Full Record
Xyleborus	kauaiensis	Perkins	Coleoptera	Scolytidae	Full Record
Xyleborus	lanaiensis	Perkins	Coleoptera	Scolytidae	Full Record
Xyleborus	littoralis	Perkins	Coleoptera	Scolytidae	Full Record
Xyleborus	mauiensis	Perkins	Coleoptera	Scolytidae	Full Record
Xyleborus	molokaiensis	Perkins	Coleoptera	Scolytidae	Full Record

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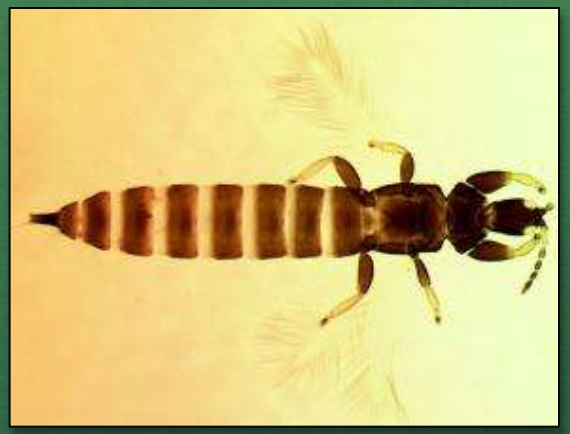
Predators of CBB……

- *Karnyothrips flavipes*



- white-footed ant
  Technomyrmex albipes

Insecticides……

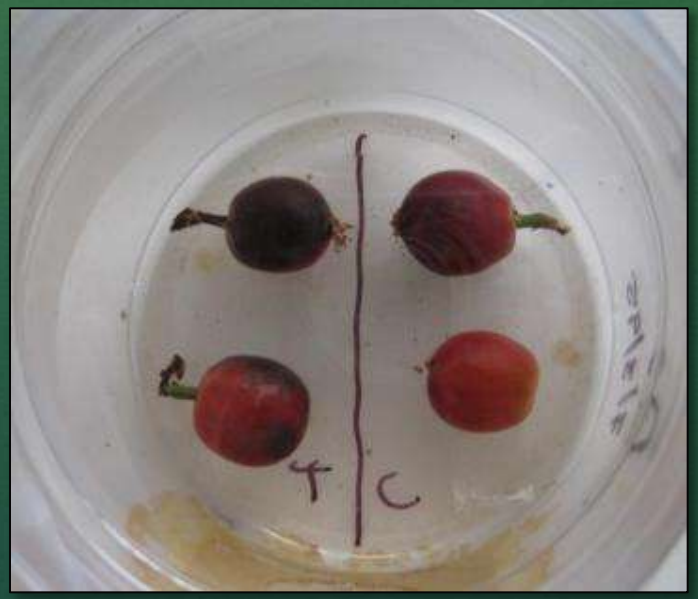
Oviposition deterrence….?

- Endosulfan at 1.5 kg ha had a marked and extended period of protection by repellency. Sponagel (1994)

- Neem oil ….65% mortality was observed after 3 applications; and a repellent effect was noted, ~80% of berries showing signs of having been rasped only superficially. Schmutterer (1990)

Oviposition deterrence….?

Oviposition deterrence….?



Oviposition deterrence….?

Table 1. Repellency Assay (Blue = significant difference between means.)

Conc (ul/ml)	Repellency (%)	Treatment mean (# of CBB's)	Control mean (# of CBB's)	ANOVA p value
Eucalyptus Oil				
1.0	1.82	10.8	11.2	0.64
10.0	5.36	10.6	11.8	0.216
20.0	9.47	8.6	10.4	0.037
50.0	32.04	7.0	13.6	0.0001
Rosemary Oil				
1.0	-11.83	10.4	8.2	0.03
10.0	16.85	7.4	10.4	0.062
20.0	18.28	7.6	11.0	0.057
50.0	-1.03	9.8	9.6	0.803
Eugenol				
1.0	-10.89	11.2	9.0	0.321
10.0	11.76	9.0	11.4	0.0076
20.0	27.27	7.2	12.6	2.04E-06
50.0	67.68	3.2	16.6	6.22E-08
Neem Oil				
1.0	13.73	8.8	11.6	0.015
10.0	17.65	8.4	12.0	0.008
20.0	21.90	8.2	12.8	0.002
50.0	38.00	6.2	13.8	2.57E-05

Re-invent the wheel……?

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