Proceedings:
2018 Coffee Berry Borer Conference

Editors:
Jennifer Burt, Andrea M. Kawabata, Matthew Miyahira, and Alyssa Cho

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On April 25, 2018, a second Coffee Berry Borer (CBB) Conference was held for participants to learn about ongoing Hawai'i and Puerto Rico CBB research and farmer projects and about State and Cooperative Extension efforts, and to provide networking opportunities.

Sixteen researchers, educators, industry leaders, project investigators, and support personnel involved with CBB research, education, and outreach in Hawai'i and Puerto Rico presented to 115 coffee industry producers, stakeholders, and other participants. Each speaker conducted a brief PowerPoint presentation followed by a small-group question-and-answer session. This event was co-hosted by UH CTAHR researcher Alyssa Cho, UH-CTAHR coffee and orchard crop Extension agent Andrea Kawabata, and technical supports Jennifer Burt and Matthew Miyahira at the Courtyard King Kamehameha's Kona Beach Hotel in Kailua-Kona. On the following day, three farm tours were organized by Kona Cooperative Extension for visiting researchers and educators from Puerto Rico. This provided an opportunity to learn about coffee production in Kona.

The PowerPoint presentations provided by the CBB Conference speakers are compiled into the following 2018 CBB Conference Proceedings.

Acknowledgements
Event co-hosts would like to thank USDA, UH CTAHR, and University of Puerto Rico for providing funding assistance for this event, which supports the dissemination of Extension, research, and outreach activities that are so vital to Hawai'i and Puerto Rico's coffee industries. They would also like to thank Crop Production Services, now known as Nutrien Ag Solutions, for sponsoring coffee breaks during the conference. Additionally, they would like thank USDA-ARS DKI PBARC and UH CTAHR staff and administration for providing equipment, materials, supplies, and support staff to host the conference. They send their appreciation to Kona Earth, Paradise Found Hawaii, and Lehu'ula Farms for hosting the farm tours, and to all event participants and presenters, as their work is invaluable to the coffee industries. Lastly, they thank the Office of Research Services for their assistance in the review and publication of these proceedings.

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Abstract: Areawide IPM for Coffee Berry Borer Control in Hawai‘i and Puerto Rico

Marisa M. Wall
Center Director
United States Department of Agriculture, Agricultural Research Service
Daniel K. Inouye U.S. Pacific Basin Agricultural Research Center, Hilo, HI 96720

Hawai‘i and Puerto Rico coffee industries are facing their toughest challenge ever with the invasion of the coffee berry borer (CBB). The most devastating insect pest of coffee worldwide, it was first reported in Puerto Rico in 2007, on Hawai‘i Island in 2010, on O‘ahu in 2014, and on Maui in 2016. USDA-ARS established an areawide integrated pest management (AW-IPM) effort in August 2013 in collaboration with the State Department of Agriculture, local coffee-farming communities, and university collaborators. The initial goal was to help growers deal with the CBB problem by adapting control practices used in other coffee-growing countries to the microclimates and cultural practices unique to Hawai‘i and Puerto Rico. Some of the original objectives included optimizing the dose and use of the commercial biopesticide *Beauveria bassiana*, mapping the area and extent of the infestation, understanding the insect phenology, synchronizing coffee blooms for harvest and sanitation, providing area-wide education and outreach, and developing an economic analysis of CBB effects. Additional objectives included reducing field populations of CBB using semiochemicals, entomopathogenic nematodes (EPNs), predators, and pruning styles; improving quarantine treatments; and implementing preventative and/or management measures on additional islands. This AW-IPM phase 1 effort (2013–2015) was supported with $2.7 million from USDA-ARS. The AW-IPM phase 2 project (2016–2020) continued the success of phase 1 and is adapting the existing CBB control activities to the complex and variable landscape of the coffee-growing regions of Hawai‘i and Puerto Rico. A comprehensive monitoring system backed by sensors and GIS data integrated with ground data collection has been used to collect spatially explicit information on coffee farms for 3 years. This large dataset on CBB population dynamics, coffee phenology, weather, and farm management in Hawai‘i and Puerto Rico will be used to provide growers with real-time data and projections on CBB populations and will be invaluable to decision-support models, optimizing monitoring for management, and the application of cost effective IPM for CBB. The first 2 years of the AW-IPM phase 2 project have been funded with $1.5 million.

The complete presentation may be viewed and downloaded by clicking **here**.

Abstract: The Farmers' Experience: Managing CBB in 2017–2018

Melanie Bondera
CBB Pesticide Subsidy Program Coordinator
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Captain Cook, HI 96704

Hawaii Department of Agriculture, in collaboration with University of Hawai'i at Mānoa's College of Tropical Agriculture and Human Resources, collected data from coffee growers who received a subsidy for their *Beauveria bassiana* spray costs. Growers provided demographic, farm production, and business information, as well as specifics about their CBB IPM practices. These details benefit researchers and Extension agents as they continue updating their work to make it more relevant to the farmers.

175 farmers were included in this survey summary for the 2017–2018 program year. Their answers reflect the 2016–2017 coffee growing season. According to the survey, farmers had more fully adopted the practice of stripping trees of berries at the end of the harvest season to cause a break in the beetle lifecycle. Monitoring was moving back to the 30 Trees method. The majority of spraying was done 1x per month for 5–6 months at 32oz/acre. Farmers found the fungus spray to be effective and other insecticides ineffective.

The complete presentation may be viewed and downloaded by clicking **here**.

Abstract: After the Fall: Did Coffee Plants in Puerto Rico Survive the 2017 Hurricanes?

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Hurricanes Irma and Maria hit Puerto Rico in September 2017. According to initial estimates, 90% of coffee plants were destroyed. We surveyed damage to coffee plants in 81 plots throughout the coffee-growing area of west-central Puerto Rico. Overall, 64% of plants were healthy, 16% were defoliated, and 20% were fallen. Damage varied greatly between plots and even within plots. Spatial orientation was significantly related to damage; altitude and distance from the storm were not. Coffee berry borer populations decreased after the hurricanes but recovered quickly. Understanding patterns of damage and their causes may help suggest ways to protect the coffee industry from future natural disasters.

The complete presentation may be viewed and downloaded by clicking **here**.

Abstract: Improving Quality Coffee of Puerto Rico and the Impact of Irma and Maria Hurricanes on Coffee Production and Its Potential Effect on Education in the Control of CBB

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During the month of September 2017, Hurricanes Irma and Maria impacted Puerto Rico, severely damaging the infrastructure of housing, transportation, and communication, electric power generation, access to food, fuel, and potable water. The agricultural sector and the natural resources of soil, water, flora, and fauna were also significantly impacted. The coffee-producing area in the mountains of the island received some of the greatest damage. According to preliminary data, losses in coffee production were estimated to be more than 70%. It was preliminarily reported that there would be more than 90% loss of new coffee plantations. The recovery of coffee production will be accompanied by the establishment of new plantations, which provides the Agricultural Extension Service of the UPR-Mayagüez with an opportunity to reinforce the farmers' education in CBB-control practices. The recovery of the coffee production offers a unique opportunity to gather information on the behavior of the CBB post-hurricanes and to establish an educational control program addressed at farmers, their families, and other agricultural workers.

The complete presentation may be viewed and downloaded by clicking **here**.

Abstract: 2017–2018 Cooperative Extension Outreach and Overview and Other CBB-Related Projects

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Do we have a better understanding of Coffee Berry Borer (CBB) management?
Since 2013, CBB education has been an ongoing effort that has brought together in collaboration coffee organizations, farmers, and producers; USDA; UH CTAHR; Hawai'i Department of Agriculture (HDOA); the Synergistic Hawaii Agriculture Council (SHAC) program; and other UH Extension faculty and staff. Five years after USDA funding for Area-wide Mitigation and Management for Coffee Berry Borer began, outreach efforts have proven fruitful. Hawai'i coffee farmers have a better understanding of CBB than in the 2012–2013 coffee season.

According to CBB surveys, producers have adopted and are implementing integrated pest-management strategies taught by UH CTAHR's Kona Cooperative Extension faculty and staff during workshops, field days, and farm visits. More than 80% of farmers are strip-picking their trees, which is an extremely important tactic in starting the season with low CBB infestation levels. Growers are monitoring their coffee with sampling techniques they have been taught and spraying with *Beauveria bassiana* products to maintain control of CBB populations. CBB 101 classes for new and beginning farmers, CBB update workshops for established farmers, CBB videos, and field days for hands-on learning activities have been important for information dissemination. CBB and coffee activities and information can be found at www.HawaiiCoffeeEd.com.

2017–2019 CBB-related projects:

1. The Long-term Responses of Coffee Rootstocks to Root-knot Nematode in Kona: Coffee root-knot nematode (*Meloidogyne konaensis*) affects coffee tree health, yield, and long-term survival. By 2004, 34% of Big Island farms were found to be affected, showing a more extensive problem than had previously been understood. This County of Hawai'i grant is in collaboration with USDA ARS DKI PBARC and CTAHR faculty, staff, and volunteers. Begun in 2006, this project looks at the long-term effect of nematode infestation on 9 different rootstocks in the 10th through 12th (three seasons) years of production. Preliminary data shows significant yield loss and decline of non-grafted 'Typica' trees, whereas trees grafted onto *Coffea liberica* var. dewevrei rootstocks have improved nematode tolerance, yield, and survivability in infested soils. Monitoring of CBB in this small field, which was stumped in 2015, reveals the importance of field sanitation and spraying early in the season for CBB control and shows that early CBB hotspots remain throughout the season. Variability of flowering between the different varieties and species in the same plot increases challenges for CBB control.

2. Demonstration of Pruning Techniques to Increase Farm Profitability for Coffee Producers:
   This 2017–2019 HDOA R&D grant is in collaboration with USDA PBARC and the Kona Cooperative Extension and Research Station. This project demonstrates four different coffee pruning techniques 1) stump with nurse vertical, 2) hedging with a single vertical, 3) hedging with two verticals, and 4) Kona-style. The intention of this project is to increase coffee producers' profitability by increasing farm revenue through improved yields.

3. Insecticide Residue Tolerance in Coffee Green Beans:
   This USDA TASC project is in collaboration with faculty and staff of the Kona Cooperative Extension and Research Station, UH IR-4 Program, and Greenwell Farms. Use of PBO-containing pesticides poses a risk of rejection of Hawai'i green coffee in the foreign market due to insecticide residues exceeding maximum residue level (MRL) tolerances. The objective of this project is to reduce the risk of export rejections by meeting MRL tolerances of green coffee export markets. There are two parts to this research project. Part 1: Determine when growers should stop spraying insecticides containing PBO in order to attain a zero-residue level of PBO. Part 2: Confirm if a 14-day pre-harvest interval is sufficient to ensure no violative residues in green bean coffee of four other insecticides that are registered or will be registered for use in coffee in the US.

The complete presentation may be viewed and downloaded by clicking **here**.

Abstract: Invasive Pest and Host Plant Dynamics Across a Heterogeneous Landscape: Insights from Area-Wide Monitoring of Coffee Berry Borer on Hawai‘i Island

Melissa Johnson
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Coffee berry borer (CBB), *Hypothenemus hampei*, is an invasive insect pest that is found throughout major coffee-growing regions of the world. CBB was first detected on Hawai‘i Island in 2010 and has since spread to nearly every coffee farm in the Kona and Ka‘ū districts, two areas that are world renowned for the premium quality of their coffee products. We have implemented comprehensive monitoring of CBB and host plant dynamics as part of an Area-Wide project. The extreme heterogeneity in climate, topography, and cultural practices in Hawai‘i necessitates Integrated Pest Management (IPM) that is customized to each location. We report findings from a multi-year study that examines plant phenology, CBB population biology, infestation rates and stages, climate variables, mortality of CBB from *Beauveria bassiana* fungus, and management practices in a landscape context.

The complete presentation may be viewed and downloaded by clicking **here**.

Abstract: Coffee Berry Borer (*Hypothenemus hampei*) Rates of Development: Can We Predict Future Movement Events With Degree Days?

Lindsey Hamilton
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Daniel K. Inouye U.S. Pacific Basin Agricultural Research Center, Hilo, HI 96720

The speed at which coffee berry borer (CBB) completes a full life cycle influences timing of emergence and the initiation of new infestation cycles. We measured CBB rates of development from time of infestation to adult maturity in Kaʻū and Kona, under variable field conditions. Field data, complemented by existing laboratory development data, allowed us to estimate cumulative degree days required for a CBB to complete an entire life cycle. Our findings provide an additional tool for CBB population and movement monitoring and have potential to improve site-specific timing of population-control efforts.

The complete presentation may be viewed and downloaded by clicking **here**.

Abstract: Where Do CBB Live Between Seasons on Managed Farms?

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Research Support
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The aim of this study was to monitor and estimate coffee berry borer populations on the ground and in the trees at coffee farms following the 2016 harvest season and into the 2017 growing season. This study was conducted between February 2017 and June 2017 on six different farms on Hawai'i Island. Samples of berries that had fallen to the ground and raisins that were left on the trees from the last harvest season were collected and dissected to estimate total farm CBB populations. CBB populations were found both in the trees and on the ground at all farms, and population estimates ranged from thousands to hundreds of thousands per acre. This study emphasizes the impact that farm sanitation can have on the CBB population potentially available to infest next season's crop and suggests that efforts to reduce CBB populations on the ground could have a critical impact on next season's infestation.

The complete presentation may be viewed and downloaded by clicking **here**.

Abstract: Managing CBB on a 155-Acre Mechanized Farm

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Waialua Estate Coffee and Chocolate
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Waialua Estate Coffee is located in the lower elevations of O‘ahu’s North Shore between 450 ft and 750 ft. ‘Typica’ is the main variety planted there. Coffee berry borer (CBB), *Hypothenemus hampei*, was found on O‘ahu in 2014. Managing CBB on a large mechanized farm has its advantages and disadvantages. Isolation from other coffee farms and having a full-time labor crew and adequate equipment are advantageous to our IPM system, but important CBB-management practices such as strip-picking, hand-pruning, and orchard cleanliness are extremely labor intensive. Mechanized harvesting means that not all berries are picked, and a lot fall to the ground. The integrated pest-management system used at Waialua Estate is similar to those used on other non-mechanized farms. A final harvest is followed by strip-picking. Approximately 20% of the orchard is stump-pruned in large sections. Fallen berries are hand-raked to the middle of the row, and the pruned plant materials are then mulched using a flail mower. Traps and visual inspections are used to monitor CBB activity as well as make decisions on machinery movement and hotspot control. Knockdown rounds of *Beauveria bassiana* are used to control the CBB population early in the season, and monthly sprays begin in the spring; however, the hot and dry summer weather is not optimal for *Beauveria*. A late-season harvest to mechanically strip-pick and “clean” trees was attempted, but a considerable amount of flower buds were knocked off. Areas of focus going forward include further modifications to mechanize the operation to better manage CBB in large areas by continuing farm-based research and development. The farm is currently testing a front-mounted Edwards Equipment Brush Spider to clear weeds and move fallen coffee from under the trees.

The complete presentation may be viewed and downloaded by clicking **here**.

Abstract: Scope of Non-Insecticidal Fruit Coatings in Reducing Infestations of Coffee Berry Borer in Hawai‘i

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It has been well documented that coffee berry borer shows strong affinity towards alcohol-based lures (methanol:ethanol mixtures), and traps with these lures have been widely used to monitor CBB throughout the major coffee-growing regions of the world. There are several published research studies that document attraction of the borer towards volatile compounds extracted from developing and mature coffee berries. These studies indicate that CBB relies heavily on olfactory cues from the host to find its way around. We hypothesized that masking volatile compounds from developing berries by applying encapsulating organic/inorganic substances could reduce the infestation by hindering the ability of the beetle to find the host. We tested two proprietary products, alone and in combination with *Beauveria bassiana*, against a control treatment in two independent field trials. Significant treatment differences were observed in our preliminary analyses when the percent infestations after the treatments were compared with the control. The three treatments tested (test product, test product + *B. bassiana*, and *B. bassiana* alone) reduced infestation rate significantly compared to control treatment (water) in both trials. No treatment differences were observed among these three treatments. The study also indicates that sprays of *B. bassiana* might be preventing infestations because of the inactive ingredients in the formulations.

The complete presentation may be viewed and downloaded by clicking **here**.

Abstract: Realities Behind Coffee Plantations Regarding the Management of Coffee Berry Borer in Kona and Kaʻū Districts, Hawaiʻi

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Independent Consultant. M. Sc. Entomologist & Specialist on Tropical Agro-Ecology
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Since the coffee berry borer (CBB) was detected in Hawaiʻi in 2010, coffee growers from the Big Island are facing losses in coffee production, quality, and price. Integrated Pest Management (IPM) for CBB is a concept that needs to be understood by coffee growers so they can determine what strategies of control need to be applied in each specific coffee farm situation. There is no general management protocol that applies to all coffee farms, since there are different microclimates that make the coffee season different from one location to another. Coffee farms from Kona are different depending on the elevation at which they are located, and weather conditions in Kona are different from those in Kaʻū. Here, realities observed in commercial coffee plantations by visiting coffee growers over two years are discussed. Knowledge of CBB biology, as well as of coffee plant phenology (timing of flowering, fruiting, and ripening) and its relationship with weather conditions, is key to controlling the pest. Monitoring CBB populations may contribute to successful control of CBB, since it can help coffee growers make effective decisions. However, the reality is that few coffee growers understand and apply a sampling plan for monitoring CBB. Instead, most rely on calendar applications of *Beauveria bassiana*, alone or in combination with other products, for control of the pest. This lack of specificity makes the control more expensive and in some cases ineffective. Establishing an economic and feasible IPM for CBB under Hawaiian conditions should be the goal, not just for coffee growers, but also for Extension agents and research technicians.

The complete presentation may be viewed and downloaded by clicking **here**.

Abstract: Controlling CBB With Pruning

Tom Greenwell
General Manager
Greenwell Farms
Kealakekua, HI 96750

At Greenwell Farms, most of our coffee berry borer (CBB) control is done with hand labor (pruning) and spraying *Beauveria bassiana*, which is a significant proportion of our costs in production. In the past five years, we have been incorporating pruning as a major part of our Integrated Pest Management system and have compared various pruning styles to see which method will lower CBB infestation rates and increase yields.

First, we compared the traditional Kona-style method of pruning (Field 2) to a modified Beaumont-Fukunaga method (Field 1, 3, 4, and 5). In a traditional Beaumont-Fukunaga (BF)-pruned orchard, every 3rd row is pruned to an 18" stump. Here, we have modified the method by stumping large, pre-determined areas (block stump method). All pruned fields were stripped at the end and the beginning of the season. These fields also received *Beauveria bassiana* (Bb) fungal applications throughout the year, though application frequency varied. Sampling was done to determine average % CBB infestation for each field. Field 1 was stumped and in its second year of production. This field received one application of Bb at the beginning of the season and had a CBB infestation greater than 20%. Field 2 underwent the Kona-style method of pruning. This field received 4 applications of Bb and had a CBB infestation greater than 15%. Field 3 (stumped and in 1st year of production), Field 4 (stumped and in 2nd year of production), and Field 5 (stumped and in 1st year of production) each received 3 applications of Bb. Fields 3 and 4 had a CBB infestation under 10%, and Field 5 was under 5%.

Next, we looked at the hedging method. In the hedged field, each tree was topped 6.5 feet above the ground. All lateral branches were pruned back to two nodes, and any remaining leaves were removed. The hedging method of pruning is more time consuming than the BF method; however, hedging appears to foster significantly greater regrowth than stumping. This improvement in regrowth will potentially give us increased yields in the first year of production. Using the BF method, Greenwell Farms has seen crop yields as high as 18,000 to 20,000 lb/acre in the first year of production and 6,000 to 10,000 lb/acre in the second year of production. Crop yield from the hedged trees has yet to be announced (2019), but initial production is promising.

The complete presentation may be viewed and downloaded by clicking **here**.

Abstract: Small-Farm Economics of CBB

Suzanne Shriner
Farm Manager
Lions Gate Farms
Captain Cook, HI 96704

What have we learned in nearly a decade of CBB? Coffee prices have nearly doubled since the beetle's arrival, but our field costs have gone up, too. Are we evaluating our income against costs, or are we over-spraying because we are still afraid of damage? This discussion is rooted in a basic ag-economic principle known as the *economic injury level*. Each farm has a different injury threshold that dictates when a spray event should happen, based on variables such as infestation levels, labor, cherry price, weather, and other factors. It's important to optimize your practices against your actual threshold. Based on field research performed during the SHAC CBB subsidy grant, there was little to no difference in quality between Farmer A spraying 11 times and Farmer B spraying 4 times (with sprays focused during peak beetle periods of April–July in Kona). Since those additional sprays cost money, Farmer B is making considerably more money. Each grower should keep a simple spreadsheet to track the value of their crop and determine how CBB will realistically impact it.

The complete presentation may be viewed and downloaded by clicking **here**.

Abstract: Review of CBB Economic Decision Models

Stuart T. Nakamoto
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We briefly review our earlier economic models, developed to assess CBB-management strategies at the policy level and to assist growers in their decision-making. The decision to spray or not spray a biological insecticide, *Beauveria bassiana*, is based on the expected damage from not spraying versus the cost to spray. If damages are greater than the cost to spray, then it is beneficial to spray in order to reduce damage to the crop.

The Decision Tree model traces the results of each decision over the entire crop. It provides a monthly recommendation as to whether or not to spray, but industry is unable to use it because the information necessary to run the model is not available. A second model using Markov-Chains and Dynamic Programming was developed to deal with the problem of weak data.

Findings and implications from the models:

1. Starting the season with low CBB infestation is key to successful CBB management and profitability.
2. The window of opportunity to start spraying closes early in the season.
3. Some of the IPM recommendations are not cost effective.
4. Individual farm results will vary with their yield.

The models also allow us to estimate immediate and long-term impacts of the *Beauveria* subsidy program.

The complete presentation may be viewed and downloaded by clicking **here**.

Abstract: Optimizing the Use of the Commercially Available Entomopathogenic Fungus *Beauveria bassiana* GHA to Control CBB in the Kona Coffee-Growing Region of Hawai'i

Lisa Keith
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Beauveria bassiana is the most important natural enemy of CBB. Although research with this fungal pathogen has been carried out in other countries, results vary due to differences among strains of *B*. *bassiana* and environmental conditions. Much of the research for mitigation and management of CBB in the Kona coffee-growing region of Hawai'i Island has gone into assessing the effectiveness of commercially available *B*. *bassiana* GHA (BotaniGard®). *B*. *bassiana* GHA applications were evaluated for both efficacy and persistence across an altitudinal gradient to assess how the material worked under varying environmental conditions. Comparisons were made between monthly applications, applications triggered by action thresholds (10% A/B alive), applications linked with pre-season strip-pick sanitation protocols, and applications linked with early-season suppression sprays. Reasonable levels of control at high and low elevations were observed in all cases throughout the production season, with damage levels held to 5% (adult beetles in C/D position) even when CBB pressure (adult beetles observed in A/B position) was above 50% incidence early in the season. Combining well-timed *B*. *bassiana* GHA spray applications with strip-picking was found to be the most effective treatment tested. Monitoring and assessing infestation levels as a trigger for *B*. *bassiana* GHA sprays should be continued as the standard means of CBB control.

The complete presentation may be viewed and downloaded by clicking **here**.

Abstract: Evaluation of Local Strains of *Beauveria bassiana* to Control the Coffee Berry Borer

Yobana Mariño-Cárdenas
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The coffee berry borer (CBB) is the most devastating coffee pest throughout the world. The CBB was first detected in Puerto Rico in 2007 and now is well established throughout the coffee-growing area in the island. The fungus *Beauveria bassiana* is one of the most important natural enemies for the CBB. In Puerto Rico the fungus is applied using the commercial product Mycotrol®; however, the occurrence of local strains is common in the coffee farms. Local strains are genetically different than the strain from Mycotrol®, but it is unknown whether these genetic differences are reflected in pathogenicity. In laboratory experiments, we compared the virulence of twenty local strains and measured the field survival of two local strains and the Mycotrol® strain. In the laboratory we exposed groups of ten adult female CBB to spores; mortality was evaluated daily for eight days. In the field, we sprayed spores on ten trees for each strain; survival of the fungus was assessed every two weeks. Laboratory tests showed that local strains have virulence levels higher than or equal to Mycotrol®, while in the field local strains survived better than Mycotrol®. Our results suggest local strains of *B. bassiana* may be better adapted to conditions in Puerto Rico.

The complete presentation may be viewed and downloaded by clicking **here**.

Abstract: Biological Control of CBB: Next Steps

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The square-necked grain beetle, *Cathartus quadricollis*, is a naturally occurring predator of CBB commonly found on Big Island coffee farms. Predator starter kits were distributed to coffee farmers and instructional videos were developed to help farmers raise and release home-grown predators to increase their numbers. These starter kits require that we maintain predator colonies for distribution, but we wanted to develop a more sustainable tool for farmers that takes us out of the equation. A predator breeding station consisting of a screened and sheltered enclosure, a pheromone–fungal blend lure, and food (100 g, 4:1 cracked corn:cornmeal) was developed to augment predator numbers in coffee fields. During a 7-month field test this past season, wild *Cathartus quadricollis* were attracted to breeding stations where they reproduced and multiplied on the provided food and dispersed back into coffee. The breeding station will soon be commercially available through our cooperator Alpha Scents, which manufactures the *Cathartus* lure. Future biological control research at ARS will focus on *Phymasticus coffea*, a tiny parasitoid that attacks adult CBB. Host range testing of this parasitoid in quarantine will begin soon to determine if it is safe to release in Hawai‘i.

The complete presentation may be viewed and downloaded by clicking **here**.