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THE CASE OF FARMERS, NATIONAL, REGIONAL AND INTERNATIONAL AGENCIES PARTNERING FOR THE MANAGEMENT OF THE COFFEE BERRY IN JAMAICA

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ABSTARCT: The Jamaican coffee industry suffers estimated annual losses of $US 2-3M because of damage to coffee beans by the coffee berry borer, *Hypothenemus hampei* Ferrari. Due to pressure from the international community, the Coffee Industry Board (CIB) is being forced to find alternatives to widely-used chemical control (involving application of an organochlorine insecticide, endosulfan) of the pest. In its effort to find alternatives, CIB initiated discussions with the Caribbean Agricultural Research and Development Institute (CARDI) Jamaica to implement the "Biological control of the coffee berry borer, *Hypothenemus hampei* Ferr. in Jamaica" project. Inputs in areas of finance, technical expertise, starting material, research and training were deemed necessary the successful implementation of this project. This was facilitated by strengthening already-existing partnerships. CIB provided financial support for the work to be carried out by CARDI Jamaica. The technical expertise was provided locally through the University of the West Indies (UWI), and internationally through PROMECAFE, a Latin American organization to which Jamaica belongs. PROMECAFE also provided stock cultures to begin rearing of the parasitoids in Jamaica. Field research was facilitated on coffee farms through cooperation of coffee farmers and CIB. Aspects of the laboratory research were conducted by UWI students for their final year research project course. The success of this project and its transformation to a national programme is dependent on stakeholders and interest groups being sensitized to the programme and trained in biological control and parasitoid rearing procedures. This was achieved through a partnership with the Rural Agricultural Development Authority, UWI, CIB and other members of the coffee industry. The partnerships that were strengthened during this project resulted in the successful development and implementation of the biological control of the CBB project. Three parasitoids were introduced and successfully reared in Jamaica, released in the field and their establishment confirmed. Rural rearing facilities have been established and over 110 Jamaicans trained/ sensitized about CBB biological control. It is expected that these fortified partnerships will help to ensure the sustainability of biological control as an integral component of an integrated approach to the management of CBB in Jamaica.

Key words: Coffee berry borer, *Hypothenemus hampei*, Management

INTRODUCTION

Coffea arabica was first introduced in Jamaica in 1728 and Jamaica has become renowned for its Blue Mountain coffee, which is the most expensive brand in the world, generating approximately US $ 0.8-1M annually from export alone. However, coffee production in Jamaica has been suffering economic losses estimated at US$2-3 M annually due to damage to

coffee beans from attack by the coffee berry borer, *Hypothenemus hampei* Ferrari (Coleoptera: Scolytidae).

Since the first reports of its presence in Jamaica in 1978, the major form of control of the CBB has been chemical (endosulfan, an organochlorine insecticide), with cultural practices, such as the complete removal of berries from trees at the end of the harvest period (stripping) and field sanitation, playing a minor role in most cases. While endosulfan has been effective in controlling the CBB, there have been negative ecological backlashes (resurgence, resistance, replacement) and environmental repercussions associated with its use. Data collected from different parts of the island suggest the development of resistance to endosulfan by CBB populations (Witter and Mansingh, 1997).

Residues of endosulfan (0.157 – 2,330 ppb) were detected in samples taken from river and coastal sediment, and in fauna in watersheds near major coffee and citrus growing areas (Witter et al., 1999) and Robinson (1997) found that, while the chemical was rapidly accumulated by *Tilapia* from contaminated water, it was eliminated at a much slower rate. Additionally, the Jamaica Pesticides Control Authority is gradually reducing the quantity of endosulfan allowed to be imported to the island. This growing evidence of ecological backlashes and environmental pollution resulting from endosulfan application to coffee, coupled with the high economic costs (an estimated US$75,000 is spent yearly to control the CBB) associated with the reliance on this insecticide, and the increased demand by consumers for safer coffee in the market place, prompted the Coffee Industry Board (CIB) to find alternatives to this insecticide.

Hence, the challenge facing the coffee industry is to find more sustainable approaches in the management of the CBB, such as biological control, physical control and use of biorationals. The CIB initiated discussions with the Caribbean Agricultural Research and Development Institute (CARDI) Jamaica Unit and in June 1999, CARDI Jamaica was contracted to implement the "Biological control of the coffee berry borer, *Hypothenemus hampei* Ferr. in Jamaica" project. The objectives of this three-year project were to (i) develop and refine protocol for mass rearing of biocontrol agents, (ii) release lab-reared parasitoids and monitor their establishment in the field, (iii) determine the potential of parasitoids to reduce coffee berry borer infestations in selected areas in Jamaica and (iv) train members of the coffee industry in the rearing and release of the parasitoids.

PROJECT APPROACH

It was determined that the successful implementation of the project required inputs in the areas of finance, technical expertise, starting material, research and training. This was facilitated by strengthening already-existing partnerships. The CIB contributed the majority (82%) of the total cost of the project, while contributions from CARDI and PROMECAFE (a Latin American organization to which Jamaica belongs) amounted to 12 and 6%, respectively.

Technical expertise for the project was provided locally through the University of the West Indies (UWI), and internationally through PROMECAFE. A Technical Advisory Committee was also formed, comprising of the relevant representatives from UWI (Technical Advisor to the project), PROMECAFE (experts in the rearing of the parasitoids), CARDI (Project Manager) and the CIB (Project Coordinator). The primary role of this committee was to give technical guidance by ensuring that all technical aspects of the project were acceptably

sound. Stock cultures of parasitoids were obtained from Honduras and Guatemala through PROMECAFE to begin rearing of the parasitoids in Jamaica.

Field research was carried out by CARDI on the establishment of the parasitoids and their efficacy in reducing CBB populations was facilitated on coffee farms through the cooperation of coffee farmers, CIB and UWI. Laboratory research on parasitoid biology was conducted at CARDI by a UWI student for his final year research project course.

There was both international and local training under the project, which would not have been possible without the collaboration of CIB, PROMECAFE, Rural Agricultural Development Authority (RADA), UWI and other members of the coffee industry.

PROJECT OUTPUTS

Rearing of *Cephalonomia stephanoderis*

Parasitoids were imported to Jamaica from Honduras in 1999. After two and a half years, the initial 3,100 *Cephalonomia stephanoderis* Betrem (Family: Bethylidae) had been successfully multiplied to 591,227 *C. stephanoderis* (Figure 1). This was an almost 200-fold increase during that period.

Field Establishment of *Cephalonomia stephanoderis*

The sites selected to carry out the studies were located at Rose Hill in the parish of St Andrew, Greenock in St Ann and Mountain Hill in St Catherine (Figure 2). The plots at Rose Hill were situated at 914 m ASL (above sea level) and received mean annual rainfall of 120.6 mm, while the plots at Greenock and Mountain Hill were situated at 551 m and 435 m ASL, respectively, and received mean annual rainfall of 103.2 and 127.5 mm, respectively.

One release of *C. stephanoderis* was made at each of the three experimental release plots. Monthly samples taken at each of the sites indicated that this parasitoid had become established at each sites as different stages of the parasitoid were recovered from coffee berries collected from the sites (Table 1).

Field Efficacy of *Cephalonomia stephanoderis*

The CBB populations declined in plots in which *C. stephanoderis* had been released (release plots) one to three months after the release of the parasitoids. At the end of the coffee harvest, it was determined that the coffee yield from trees in release plots was higher than in the control plots, in which no parasitoids had been released (Figure 3).

Laboratory studies

Biological studies on *C. stephanoderis* indicated that there was a significant ($P = 0.05$) difference in the number of parasitoid offspring produced when rearing cultures were established at ratios of one parasitoid: one CBB-infested berry and one parasitoid: four CBB-infested berries. Longevity studies carried out to determine how long the adults could be stored showed that the mortality of adults stored at 11.6°C increased with time.

Training

It was recognized that the success of this project and its eventual widening to a national programme was dependent on stakeholders and interest groups being sensitized to the programme and being trained in biological control and parasitoid rearing procedures. As was mentioned earlier, the cooperation of several organizations was critical in this aspect of the project. Two technicians (from CIB and CARDI) and one scientist (from CARDI) visited Honduras, Guatemala and Colombia where they received training in the rearing of three parasitoids of the CBB and were also able to visit coffee farms in these countries to view local production practices. Locally, three levels of training/sensitization were conducted by UWI, CARDI and CIB personnel for more than 110 persons drawn from RADA, CIB and the coffee industry. The training ranged from creating very basic awareness of biological control to intensive 3-4 week training in techniques used in rearing parasitoids, field data collection to monitor CBB population, and parasitoid establishment and field release of parasitoids. A rearing manual was produced as part of training tool, with information on CBB and parasitoids biology, how to rear CBB and parasitoids, methodology for field release of parasitoids and impact assessment. The audience targeted ranged from farm supervisors and workers to extension officers and specially selected farmers.

FUTURE DIRECTION

The partnerships that were strengthened during this project resulted in its successful development and implementation. It is expected that these fortified partnerships will help to ensure the sustainability of biological control as an integral component of an integrated approach to the management of the CBB in Jamaica. Such an approach should incorporate:

- biological control, through rearing and releasing of parasitoids, with the continued involvement of coffee farmers, CIB, CARDI, UWI and PROMECAFE,
- physical control, through use of CBB attractant traps, with the cooperation of coffee farmers, CIB and PROMECAFE,
- cultural control, by reemphasizing the need for stripping of trees and ground sanitation at the end of the harvest period, which would require the CIB continuing to work with the coffee farmers and
- chemical control, through judicious use of insecticides, including biorationals and botanical insecticides, which would include CIB, UWI, input suppliers and coffee farmers.

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Table 1. Numbers of *Cephalonomia stephanoderis* released and recovered after one year at three experimental sites in coffee farms in Jamaica

Experimental Site	Number of Parasitoids	
	Released	Recovered
Rose Hill	37,800	>117
Greenock	10,000	> 565
Mountain Hill	5,000	> 4,700

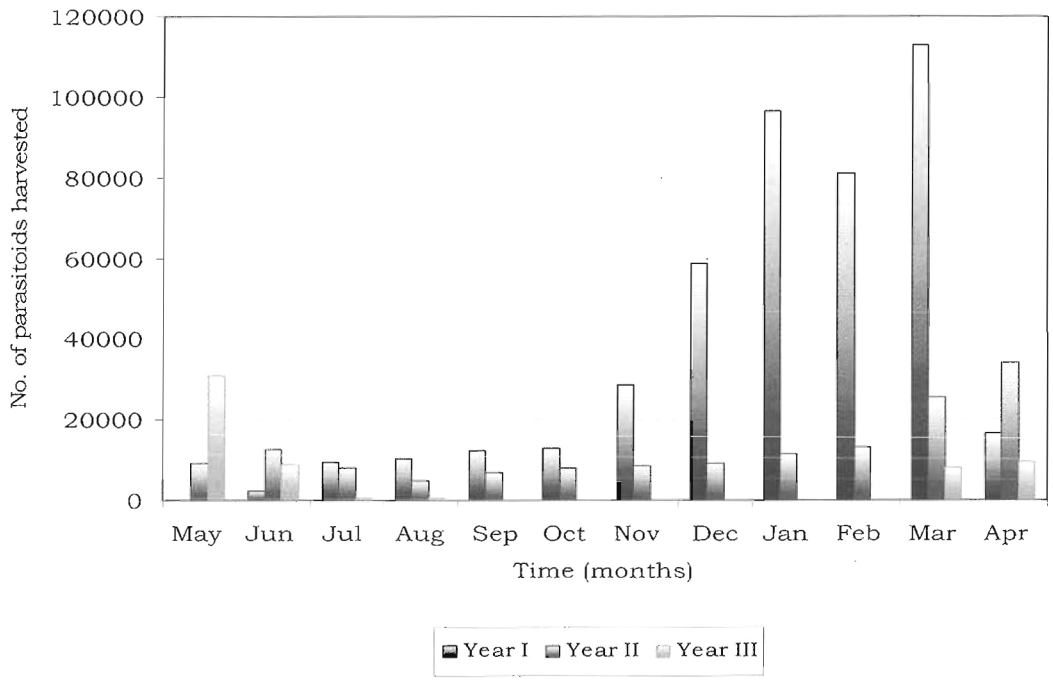

Figure 1. Production of *Cephalonomia stephanoderis* during the first three years of the project

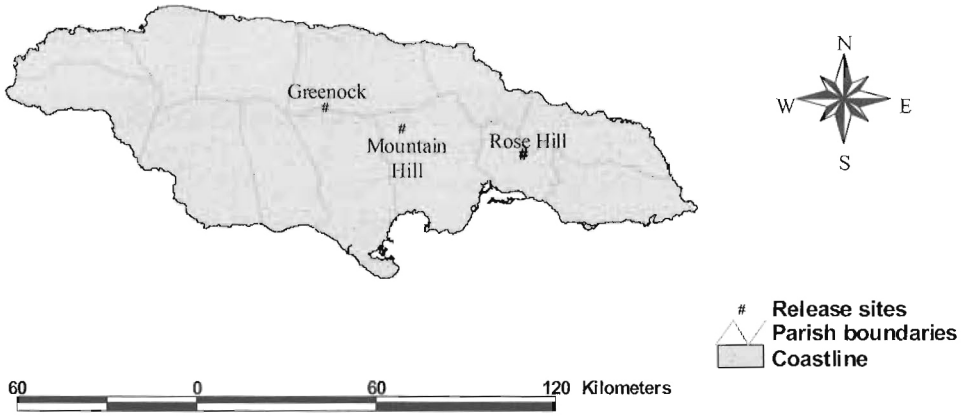

Figure 2. Map of Jamaica showing the study sites at Rose Hill in the parish of St Andrew, Mountain Hill in the parish of St Catherine and Greenock in the parish of St Ann

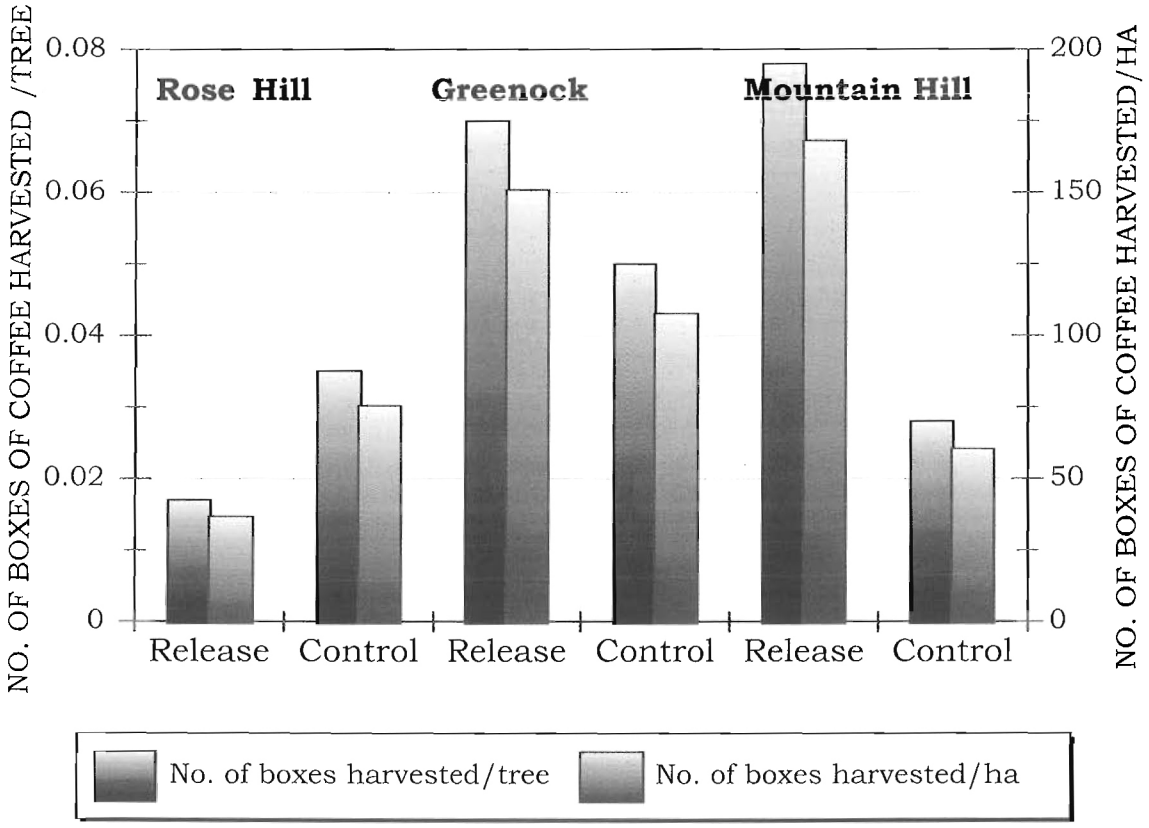

Figure 3. Mean coffee yields obtained from plots in Jamaica in which *C. stephanoderis* had been released (Release plots) and plots in which no releases (Control plots) were made