Effectiveness of the Brocap Trap in Controlling the Coffee Berry Borer (*Hypothenemus hampei* Ferr.) in Indonesia

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SUMMARY

A trial on coffee berry borer (CBB, *Hypothenemus hampei*) control with the Brocap trap was conducted in a robusta coffee plantation in Lampung Province, Indonesia, from 2005 to 2007. The aim of the trial was to evaluate the effectiveness of the Brocap trap in controlling CBB in robusta coffee smallholdings. Brocap traps effectively captured CBB adults and the number of CBB caught depended on the degree of infestation in the field. In one plot, the largest number of CBB captured four months after the initial installation reached, on average, up to 1064 CBB/week/trap. After four months, the number of CBB trapped decreased drastically to fewer than 20 insects per trap per week. The effect of Brocap traps on CBB infestation was shown after 4 months, with a 22.10% to 72.62% reduction in infestation. While the Brocap traps were in place, infestation and the CBB population were significantly lower in the treatment plots compared to the control plots, even for parchment and green coffee. Green coffee production increased by 19.06% in a plot containing Brocap traps. This trial also showed that the attractant substance diffused for 137 to 156 days, hence longer than in trials conducted in El Salvador (Latin America).

INTRODUCTION

The coffee berry borer (CBB, *Hypothenemus hampei* Ferr.) is the most serious insect pest on coffee in Indonesia. It causes significant yield losses in terms of coffee production, but also reduces coffee bean quality, resulting in low productivity and the poor quality of Indonesian coffee. On average, CBB infestation on Indonesian coffee is more than 20%, and it results in yield losses of more than 10%. With an average national yield of 448.3 kg/ha/year, yield losses per hectare caused by CBB are about 50 kg/year. With a total Indonesian coffee acreage of 1.25 million hectares, the financial loss caused by CBB can reach more than 625 billion rupiahs per year (around 6.7 million USD). Globally, annual losses caused by this pest have been estimated at over $ 500 million (Anon., 2004; Vega et al., 2002).

Until now, the technology for controlling CBB in Indonesia was integrated pest management (IPM) by application of the biocontrol agent *Beauveria bassiana*, sanitation harvesting of the CBB food source (coffee berries) left on the trees and on the soil surface after harvesting, and application of insecticides if infestation is very severe. However, the efficiency of this control method is not yet entirely satisfactory. The main problem with *B. bassiana* application has been the mass production and quality control of the fungus. Since the area planted to coffee is very large, a greater quantity of *B. bassiana* is needed to achieve effective CBB control. The recommended application rate for *B. bassiana* per hectare is more than 2.5 kg of solid culture (in maize medium) per application, and it requires three applications per harvesting period. The Indonesian Coffee and Cocoa Research Institute (ICCRI) has formulated *B. bassiana* in

pure spore powder form, and the recommended rate is 100 g per ha per application. Sanitation harvesting of coffee berries after the harvest is very laborious and very difficult to carry out in some coffee areas, since harvesting occurs throughout the year. The method can only be implemented in large plantations with a good management system.

Using traps is the new CBB control method and the Brocap trap is a trap specially designed for *Hypothenemus hampei* developed by CIRAD and PROCAFE in El Salvador (Dufour, 2002; 2008). The trap is considered as a useful addition to IPM for CBB control in Indonesia. Before using the Brocap trap in Indonesia, ICCRI and CIRAD considered it important to validate the trap under local conditions. We present the results from a Brocap trapping trial for CBB control in Indonesia

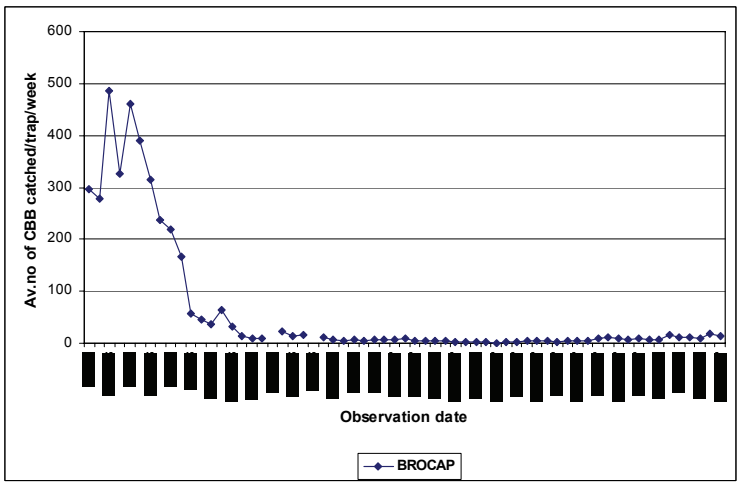
MATERIALS AND METHODS

The Brocap trap trial was conducted in Tanggamus district, in Lampung province, Indonesia. Two treatments were compared in this trial: Brocap trap versus control (without Brocap trap). Each treatment was replicated four times, so there were four locations comprising treatment and control plots. Each plot had an area of 6400 m^2 (80 m x 80 m) of robusta coffee plants and was set up with 16 Brocap traps for the treatment plots. Both treatment and control plots consisted of 16 coffee trees for observation of CBB infestation and the population. Observations focused on the CBB captured in Brocap traps, CBB infestation and the population, CBB infestation on parchment and green coffee at the final observation, and green coffee production. The CBB caught in the Brocap traps were collected and counted every week by directly counting the insects if there were fewer than 1000, and by conversion from the volume of CBB obtained. Based on previous observations, the average volume of 1000 CBB adults is 1.37 ml. So, if the volume of CBB trapped amounts to 5.7 ml, it will contain about (5.7/1.37) x 1000 = 4161 insects. The duration of attractant evaporation was also observed during the trial, to see know how long the attractant lasted under the trial area conditions.

CBB infestation was determined by counting the percentage of berries infested on four branches in sample trees or in a sample of 100 harvested berries from all trees in the plot if berries on the tree were scarce. CBB populations were observed by dissecting infested berries in the laboratory and counting all stages of CBB development. The effect of the Brocap trap treatment on green coffee production was estimated by counting 100 g of green coffee as per Delabarre (2001). The data obtained were analysed using the SAS program and were tested by the Student Newman and Keuls (SNK) test at the 5.0% level to determine the differences between treatments. CBB distribution per trap was fitted to a binomial negative law using the XLSTAT program based on the number of CBB captured on the initial observation.

RESULTS AND DISCUSSION

A large number of CBB was captured over the four months from the initial observation; in plot A, the number in one trap reached 2786 insects per week. On average, the largest number was found for the observation in July, after harvesting (Figure 1). Four months after trap installation, the number of CBB captured decreased substantially until the next harvesting season.



Av. nb. CCB caught/trap/week

Figure 1. Number of CBB captured over 14 months of Brocap trap installation in Lampung, Indonesia.

The differences between the number of CBB trapped at the outset and at the end of the trial may have been caused by the condition of the CBB population in the field. The largest population occurred when the Brocap traps were first installed, then decreased slowly, as many insects had been caught in the Brocap traps. The other reason was that the actual CBB population in the field was small due to limited food, because most of coffee berries were still at the pinhead developmental stage and were not yet suitable as food for the insects.

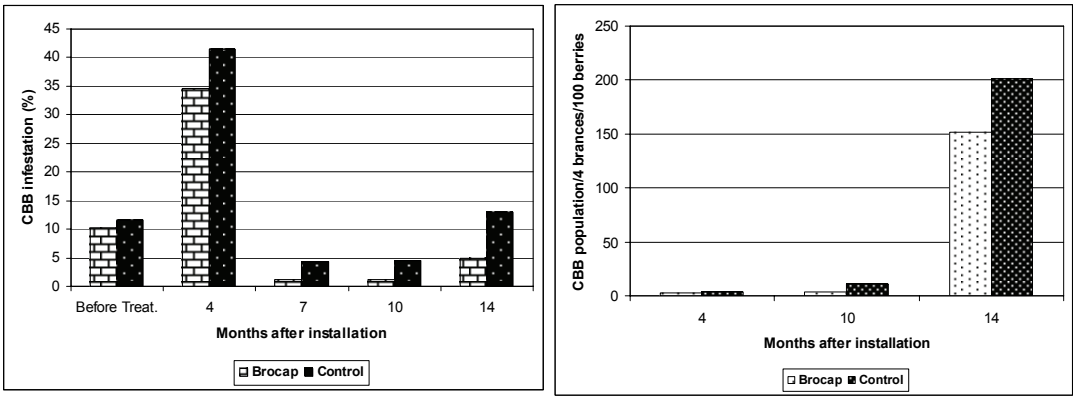
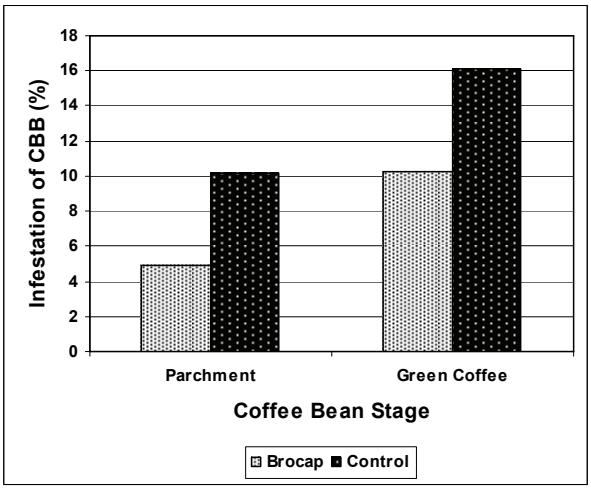


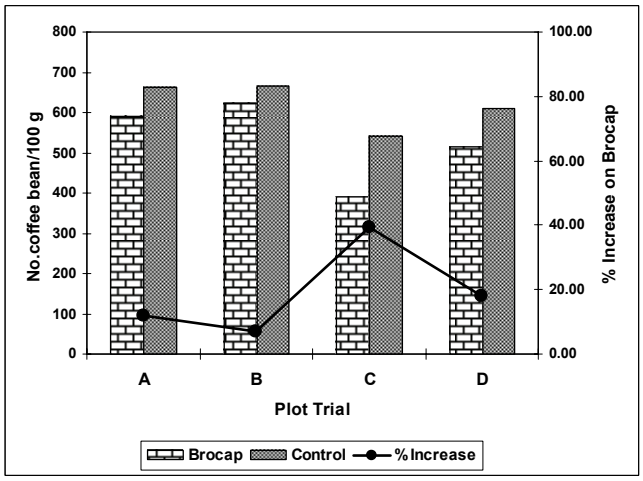
Figure 2. CBB infestation (left) and population (right) during the Brocap trap trial in Lampung, Indonesia. NS = Not Significant and (*) = Significantly different according to the SNK test at the 5% level.

The effects of Brocap traps on CBB infestation and the population are shown in Figure 2. CBB infestation before trap installation was not significantly different between the treatment and control plots. However, from four months after trap installation up to the last observation, the figures for the treatment plot were significantly lower compared to the control, both for infestation and population size.

As regards infestation on parchment and green coffee, it was found that infestation was also significantly lower in treatment plots compared to the control plots (Figure 3).



CBB infestation



Nb coffee beans/100 g
Trial plot
% increase in Brocap

Figure 3. CBB infestation on parchment and green coffee (left) and effect of Brocap trap on green coffee production (right) processed from coffee samples taken on the last observation in the Brocap trap trial in Lampung, Indonesia. Treatment and control plots were significantly different according to the SNK test at the 5.0% level.

Coffee production in the treatment plots was significantly higher than in the control plots and the production increase was, on average, 19.06%. The distribution analysis results revealed that the CBB population was fitted to a negative binomial distribution, both for the high population early in the trial and for the low population at the end of the trial. From this trial it can also be seen that the attractant diffused for 137 to 156 days with an average of 146.33 days, which was longer than in trials conducted in El Salvador (Latin America) (Dufour, 2008).

REFERENCES

Anon. (2004). Stopping the Coffee Berry Borer from Boring into Profits. http://www.ars.usda.gov/is/AR/archive/nov04/coffee1104.pdf. p.10-11.

Delabarre M. (2001). Efficacy of the BROCAP® trap under the agroclimatic conditions in El Salvador (based on the original work by Bernard Dufour). National Workshop on Hypothenemus hampei, Bangelore, India, 11-12 December 2001.12 pp.

Dufour B.P. (2008). Coffee berry borer: Triple-action integrated pest management. IICA-PROMECAFE, El Salvador. 8 pp.

Vega F.E., Frankui R.A. and Benavides P. (2002). The presence of coffee berry borer, *Hypothenemus hampei* in Puerto Rico: fact or fiction ? Journal of Insect Science, 2.13. 3 pp.