



Biological Control of Coffee Berry Borer in Organic Coffee

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Summary

All inspection reports of Naturland organic coffee growers in Latin America (Mexico, Guatemala, Ecuador, Peru and Bolivia) comprising 29,673 organic coffee farmers with 85,376 ha of land, were checked for control methods of coffee berry borer. 33 % use cultural control by picking up infested berries from the ground or from the plant during and after harvest. 24 % do use biological control and further 33 % of the farmers do combine cultural control with biological control, counting 90 % of all Naturland organic farmers. The rest of farmers do not control at all (9 %), or are using other methods (1 %).

Therefore 57 % of the organic coffee growers control the coffee berry borer by biological control or combining biological control methods with cultural control. Biological control is mainly conducted by using *Beauveria bassiana*, mainly from laboratories, some use local strains of *Beauveria*.

Biological control methods using wasps *Cephalonomia stephanoderis* seems to have small impact, less than 4 % of Naturland farmers are rearing that wasp. Traps and other methods are used by less than 10 % of organic coffee farmers.

Introduction

The coffee berry borer (*Hypothenemus hampei*) is considered the most important insect pest and the greatest economic threat to coffee (Soto-Pinto, Perfecto & Caballero-Nieto, 2002). Endemic in Central Africa, it has now spread to most coffee growing regions in the world. Plantations at too low altitude are more prone to that pest (Naturland 2000). Conventional farmers still prefer to use the pesticide Endosulfan. This is a very toxic substance and workers seldom use protective clothing, likelihood of poisoning is high. Numerous cases of poisonings, hospitalizations and even deaths have been rumoured though not always documented. In many coffee growing countries authorities are particularly concerned because of contamination of fresh water since many coffee growing areas are within the water catchment area (CABI Bioscience 2003).

Organic farmers are using mainly methods like cultural control, simple hand collection of all ripe and over-ripe berries before, during and after harvest to break the cycle and leave little substance for immigrating coffee berry borer, which have been widely adopted not only by organic farmer but also conventional coffee farmers, biological control (mainly *Beauveria bassiana*) or other methods like traps. *Beauveria bassiana* is the most promising fungus for biological control, especially in humid areas. *Beauveria bassiana* is naturally present wherever the borer is encountered. Field studies in Colombia showed that natural levels of *Beauveria bassiana* are responsible for up to 80 % mortality of adults when they are attacking young berries and this means that the fungus is the largest biotic mortality factor for the coffee berry borer under these conditions of continuously humid climate (CABI Bioscience 2003).

The fungus can be cultured on rice grains in the laboratory, harvested, formulated and sprayed in a similar fashion to a chemical spray but with the advantage that it has no detrimental effects to humans or other wild life. (Baker, 1998). Recent work in Colombia suggests that concentrated spore solutions can kill a high percentage of borer.

The most promising and recognized parasitoid *Cephalonomia stephanoderis* is of African origin, has been extensively studied and released in a number of Latin American countries. However, available evidence suggests that its impact has been small, probably because the female of each species stays in one berry with her offspring (Baker, 1998).



Within the last years prototypes of traps to catch the coffee berry borer in coffee plantations have been improved in Central America (Lorio, 2004). Traps used in conventional coffee farming have chemicals inside a small bottle that attract the insects, in general either pesticides or alcohols. Coffee growers point out that traps are inexpensive to manufacture, favour the environmental protection and reduce the costs to control that pest (IICA, 2005).

Methodology

Inspection reports of all Naturland certified organic coffee growers or grower groups in Latin America, in total 101 groups or growers, were checked on how the coffee berry borer is controlled. Inspection for organic certification is conducted every year, the inspection reports of year 2003 were screened. More than 90 % of Naturland coffee farmers are small-scale farmers mainly organized in smallholder cooperatives. A total of 29,673 organic coffee farmers with 85,376 ha of land were checked for control methods of coffee berry borer.

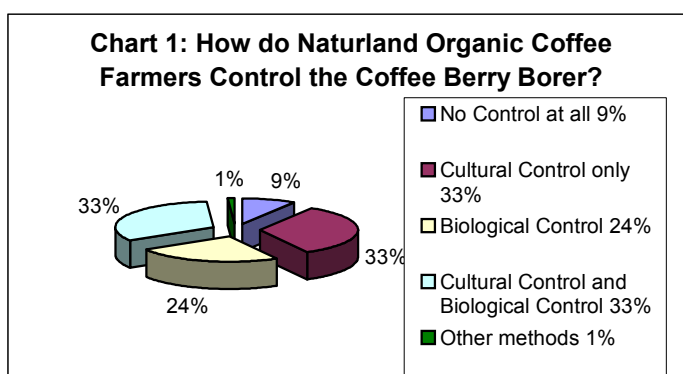
Countries	Number Naturland Coffee Farmers	Hectares Naturland Certified Organic Coffee
Mexico	15,979	43,285
Peru	10,412	35,504
Bolivia	1,065	2,418
Nicaragua	163	1,145
Guatemala	1,900	2,255
Ecuador	154	769
Total	29,673	85,376

Table 1: Number of Naturland farmers, hectares and countries

Discussion and Conclusions

Only 9 out of 101 organizations/farmers do not apply any treatment in order to control the coffee berry borer. This indicates that the pest is also predominant in coffee growing plantations of organic coffee farmers.

33 % organic coffee growers do use only cultural control to control coffee borer by picking infested berries from the coffee bush and picking up any coffee berries from the ground during and after harvest. 24 % do use biological control and further 33 % of the farmers do combine cultural control with biological control. Therefore 57 % of the organic coffee growers control the coffee berry borer by biological control or by combining biological control methods with cultural control.



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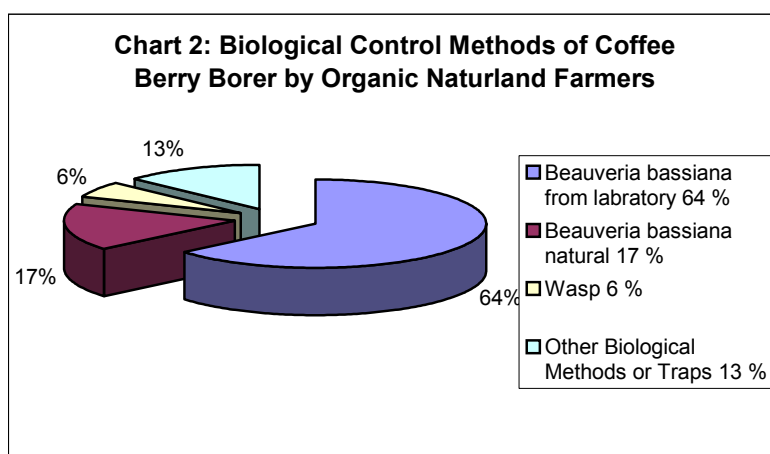


Biological control is mainly conducted by using *Beauveria bassiana* (81 %). This underlines the importance of *B. bassiana* as biological control method. 64 % of the farmers use *B. bassiana* cultured on rice grains in the laboratory, harvested, formulated and sprayed onto the coffee plants. More than 90 % of Naturland farmers are small-scale farmers organized in cooperatives. Well-organized extension service and laboratory facilities to culture effective strains of *B. bassiana* distinguish Naturland farmers. This is a great help for small-scale farmers to combat that pest with biological methods.

17 % do use natural strains of *Beauveria* established on the coffee plants without actively spraying the fungus. Naturland certification requires shade trees and different species of shade trees. This may help considerably to provide and conserve a humid climate where natural strains of *B. bassiana* are most promising for biological control.

Only 6 % of Naturland farmers using biological control methods decide to use the wasp *Cephalonomia stephanoderis* as biological control method, less than 4 % of the total of Naturland coffee growers. This finding confirms that the impact of that wasp is also small on Naturland coffee plantations. In addition, rearing the wasp is costly and some farmers have received *Cephalonomia stephanoderis* from state or private extension service organizations.

6 % of all Naturland farmers who represent 13 % of those who use biological control methods use other methods, mainly catching the insects with traps. There are various reports of effective control of coffee berry borer by traps. Traps to capture the coffee berry borer are a result of numerous research efforts. In general they have an attractant within a small bottle. Traps used by Naturland organic coffee farmers do not have pesticides neither do work with genetically modified organisms. The traps contain alcohols to give off odour to attract coffee berry borers.



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Cultural control methods and biological control methods are the main methods to combat the coffee berry borer, practised by 33% of the Naturland coffee growers and 24 % respectively. Further 33 % of farmers combat the coffee berry borer combining both methods, counting 90 % of all Naturland organic farmers. The rest of farmers either do not control at all (9 %), or use other methods (1 %).

Cultural control by simple hand collection of all ripe and over-ripe berries before and during harvest and picking up fallen berries from the ground to break the cycle and to leave little substance for immigrating coffee berry borer is indeed a labour intensive but very effective method, important for organic coffee growers. The majority of Naturland coffee farmers combine this method with biological control mainly using *Beauveria bassiana*. Also for organic coffee farmers *Cephalonomia stephanoderis* seems to have small impact, only few farmers (less than 4 % of all organic farmers) are rearing that wasp.

Traps and other methods are used by less than 10 % of organic coffee farmers. However, traps may play a more important role in the future not only for organic farmers. They are considered to be cost efficient and easy to handle. Still their effectiveness has to be proved in different regions.



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