Monitoring Cultural Practices for Coffee Berry Borer Hypothenemus hampei (Coleoptera: Curculionidae: Scolytinae) Management in a Small Coffee Farm in Colombia

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MONITORING CULTURAL PRACTICES FOR COFFEE BERRY BORER *HYPOTHENEMUS HAMPEI* (COLEOPTERA: CURCULIONIDAE: SCOLYTINAE) MANAGEMENT IN A SMALL COFFEE FARM IN COLOMBIA

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The coffee berry borer (CBB) *Hypothenemus hampei* Ferrari (Coleoptera: Curculionidae: Scolytinae) remains a major threat to coffee production throughout the world, as underscored by its discovery in Hawaii in 2010 (Hawaii Department of Agriculture 2010). Endemic to Central Africa, adult female CBB bore into developing berries, where they oviposit and the resultant larvae develop on the endosperm, reducing both yield and quality of the marketable product (Le Pelley 1968; Baker 1999; Vega et al. 2009). Because CBB spend the most of its life inside berries, control using insecticides is challenging.

In response to the CBB issue in Colombia, the National Coffee Research Center (Cenicafé) developed integrated pest management programs for coffee plantations. The strategies involved cultural, biological and, where needed, chemical controls as well as monitoring for CBB (Bustillo et al. 1998; Bustillo 2002, 2006). Cultural practices have focused on the efficient manual removal of all mature and dry (ripe and over ripe) berries, which serve as sources for new infestations. The continuous flowering/production cycle in Colombia's coffee plantations creates favorable habitat for the CBB throughout the year, making widespread control problematic (Baker 1999). Although labor intensive, regular harvesting and sanitation of mature berries removes developing CBB before they emerge to start another life-cycle (Baker 1999; Saldarriaga 1994; Bustillo et al. 1998).

Bustillo et al. (1998) reported that a single efficient harvest eliminates approximately 80% of the CBB populations. Saldarriaga (1994) reported that a sanitation picking reduced CBB infestation of berries from 70% to less that 6%. However, the effectiveness of regularly harvesting mature berries to control CBB depends on how efficiently they are removed. Bustillo et al. (1998) estimated that at low to moderate CBB densities, the manual removal of mature berries is a highly effective strategy when <5 such berries per coffee tree remain after one pass of harvesting, reasonably effective when 6-10 berries remain, and ineffective when >10 such berries are left on coffee trees. In two surveys about the adoption of IPM practices among Colombian coffee growers, cultural control was the method most commonly adopted, by >94% of respondents (Duque & Chaves 2000; Aristizábal et al. 2006). Yet, Aristizábal et al. (2006) reported that only 45% of respondents were employing cultural control effectively, according to the criteria of Bustillo et al. (1988).

This study reports efforts to implement effective cultural control practices for CBB in 'La Esperanza' farm, located in Quimbaya, Quindío Department in the central region of Colombia. Also this study endeavored to measure (1) the efficiency of efforts to harvest manually as many mature coffee berries as possible, and (2) the impact of diligent harvesting on the coffee berry population. The region is located at 1,450 m altitude, with 2,000 mm annual rainfall and average conditions of 20°C and 80% relative humidity. A plot planted with 4,700 trees of coffee cultivar, 'Colombia', was selected for evaluation of cultural control during its third harvesting year. To manage existing CBB populations, all mature and dry berries were collected every 2 or 3 weeks over a 2 year period. One additional sanitation pick ('repase') was made at the end of each major harvest period in each year. No additional control methods were employed. All harvesting was conducted by contract workers, following participatory training exercises in CBB management (Aristizábal et al. 2004). Harvest efficiency was evaluated on 50 randomly selected trees by counting the number of mature and dry berries left after each pass of berry pickers. Levels of CBB infestation were also evaluated from the remaining green berries according to established methods of Cenicafé (Bustillo et al. 1998). Final damage by CBB on parchment coffee (harvested product in which the dried parchment skin still adheres to the bean) was evaluated by the Coffee Grower Cooperative in Quimbaya.

Our surveys showed that the number of mature and dry berries remaining after harvesting ranged from 3 to 12.2 berries per tree, with an average 6.2 ± 2.1 over two years (Fig. 1). Populations of the CBB in the field remained low following each harvest, with between 1 and 3.9% green ber-

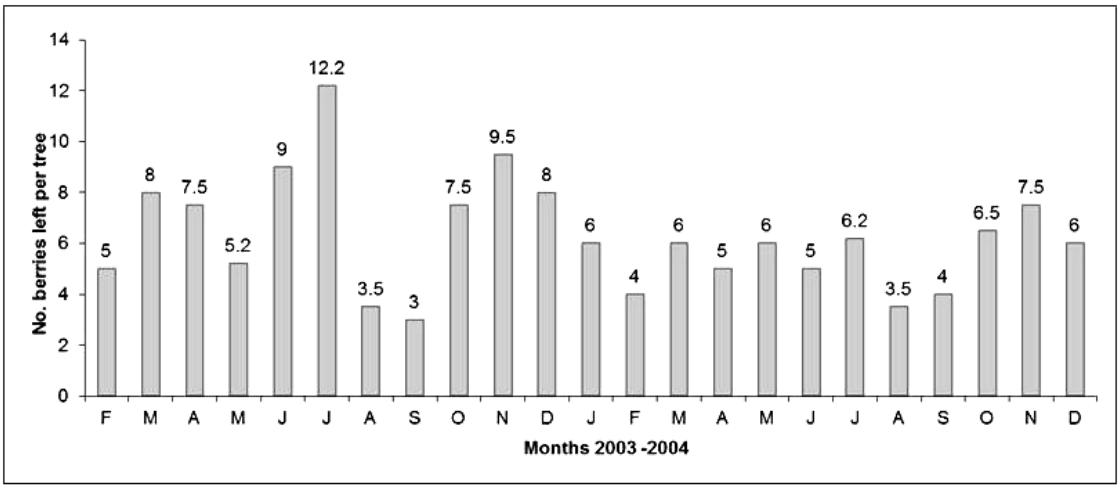

Fig. 1. Efficacy of harvesting labor (average number of mature coffee berries remaining from 50 coffee trees after each harvesting) during 2003 and 2004, in 'La Esperanza' farm, Quimbaya, Colombia.

ries infested and average of 2.3 ± 0.9% over 2 years (Fig. 2). In addition, % infestation of dried parchment coffee by the CBB (damage) from 'La Esperanza' was 1.5 ± 0.2%, and ranged from 1 to 2.2% (Fig. 2). Production was 5,062 and 4,700 kg of parchment coffee per hectare in 2003 and 2004, respectively. A breakdown of the variable costs of production over the 2 year study by the owner revealed the biggest expense was harvesting labor (73%), followed by fertilization (13%), utilities, transport and administration (7%), other labor (3%), CBB sanitation 'repase' (2%) and weed control (2%).

Our results show that the frequent removal of mature berries (every 15 or 20 days) was efficient according to the criteria defined by Bustillo (1998) and provides circumstantial evidence for the success of cultural program at La Esperanza. Concurrent surveys conducted in 2003 and 2004 revealed average CBB damage in the field in the central region was 4.6% (n = 12) (Aristizábal et al. 2004). In a questionnaire of 513 central region coffee growers, 51% of respondents reported CBB damage >2.5% in parchment coffee in 2003 (23% reported >5% damage) despite 62.3% using one or more insecticide sprays (Aristizábal et al. 2006). We also note that prior to our study and before worker training exercises had been conducted, inefficient harvesting practices were common in the region. Gomez et al. (2004) reported that an average of 15.9 mature berries/tree were left after harvesting

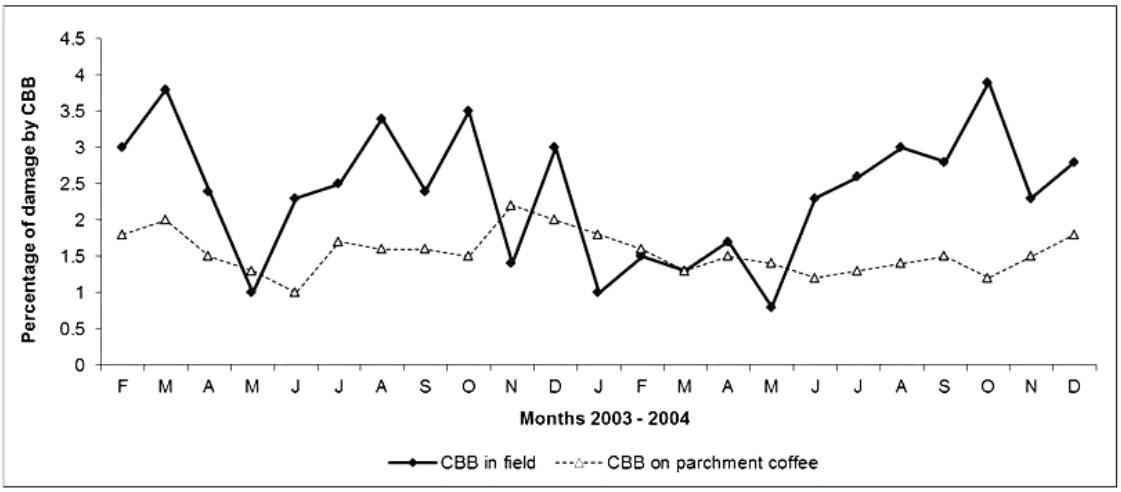

Fig. 2. Percent of coffee berries damaged by the coffee berry borer (CBB) in the field and on parchment coffee sold during 2003 and 2004 in 'La Esperanza' farm, Quimbaya, Colombia.

(recorded between 1998 and 2002 in the Quindío Department), which was higher than the national average of 9.2 berries/tree. Obviously it would have been very desirable to have had untreated controls in order to compare CBB infestation levels with and without thorough removal of berries. This would have required that several farms would have had to continue inefficient harvesting practices, and that the corresponding losses of the growers would have had to be compensated. Funds for compensation were not available.

Our findings substantiate reports by Zelaya & Vargas (1989) in Guatemala, Villanueva (1990) in Mexico and Diaz & Marin (1999), Benavides & Arévalo (2002), and Benavides et al. (2002) in Colombia that cultural practice is an important component of IPM for the CBB. As discussed by Baker (1999), while cultural control practice has environmental benefits and requires no special equipment, disadvantages of this approach include its high labor costs (which may be prohibitive in some countries), tedious nature (especially on larger trees), and its dependence on the quality of field workers.

Summary

In a commercial coffee farm planted with 4,700 trees of coffee cultivar, 'Colombia', a cultural program for CBB control focusing on frequent and efficient harvesting was evaluated over 2 years. An average of 6.2 mature berries per tree were left after each harvesting while CBB infestations in the field averaged 2.3% of berries and CBB damage in dried (processed) green coffee beans averaged 1.5%. In contrast average CBB damage in fields in the central region of Colombia was 4.6% (n = 12). Our findings show that trained workers can maintain high harvesting efficiency, which is important to prevent outbreaks of CBB and allow the production of exportable quality coffee.

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