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Coffee Berry Borer, Hypothenemus Hampei (Ferrari): A Review

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Abstract:
Coffee berry borer, Hypothenemus hampei Ferrari is a major havoc to coffee in all coffee growing countries. The small black beetle cause damage to beans and leads to crop loss. Damage impairs the quality and fetches low price in market. Integrated pest management comprises several factors which altogether helps the pest under suppression The review describes the origin, distribution, life cycle, damage and management of coffee berry borer.

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

1. Origin and Distribution

Coffee berry borer is native to Central Africa and has now invaded many coffee producing countries worldwide with exception of Nepal and Papua New Guinea (Le pelley, 1968). Borer specimens were obtained from trade coffee and described by Ferrari in 1867. It was first noticed in the field only during 1901 in the coffee plantations of Gabon, West-Central Africa. From the native, it has crossed all the geographical barriers to reach other continents. CBB has since spread to many coffee producing countries and has been reported in Uganda, Congo, Benin, Togo, Ivory coast, Kenya, Nigeria, Angola, Ethiopia, Brazil, Colombia, Guatemala, Ecuador, Nicaragua, Honduras, Mexico, Malaysia, Indonesia, Sri Lanka, Jamaica, New Caledonia, India and other countries (Vega et al., 1999). The coffee berry borer was found in the district of Kona on the island of Hawaii in August 2010 and appears to be restricted to that area (Hawaii Department of Agriculture, 2010a).

2. Coffee Berry Borer in India

In India the CBB was first encountered in Gudalur, Nilgiri district of Tamilnadu during February 1990, and in March 1990 in the adjoining district Wayanad in Kerala (Kumar, et al., 1990). The pest made its entry to Kodagu district of Karnataka in 1991. Further spread of this pest was noticed in the Pulney hills of Tamilnadu and Idukki district of Kerala. In India it is introduced accidentally, probably through seeds brought by refugees from Sri Lanka or through illegally imported coffee seeds (Singh & Ballal, 1991).

3. Taxonomy and Morphology of Berry Borer

Coffee berry borer belongs to the beetle family Curculionidae in the Order Coleoptera. The insect was earlier known as Stephanoderis hampei. Adult borer is a black beetle with females measuring about 1.5 mm in length. Males are smaller measuring 1.0 mm and are incapable of flight.

4. Lifecycle

According to different authors there is a great variation in the lifecycle which is attributed to the temperature, humidity and location. After entering the berry through a pinhole CBB make galleries and lay eggs. Females lay 20-60 eggs. According to a study in Brazil females lay 74 eggs in average (Bergamin1943). Within a suitable berry a female is capable of laying 31-119 eggs (Damon, 2000). The eggs hatch in about 4-9 days. Larval period lasts for 10-26 days. There is a prepupal period of 2 days and a pupal period of 4 days. Total life cycle from egg to adult completed in 25-35 days (Le pelley, 1968). Adult male emerges from pupa earlier than females. Short wings of males make them flightless. Males remain inside the berries and fertilize the emerging females. Each male can fertilize two females in a day and 30 females in their life time. If males are absent in the progeny females search males in other berries. Fertilized females remain in the same bean for 3-4 days to attain sexual maturity. They leave the parental berry through the pin

hole in search of other berries to lay eggs. Egg laying starts after a preoviposition period of 4-20 days (Waterhouse, 1998). Female to male ratio is 1:10(Hargreaves,1935). An adult female averages 157 days while males live for 20-87 days. Annual cycle of H. hampei is closely associated with coffee crop (Damon, 2000).

5. Hosts Plants

Berry borer find its shelter in many leguminous plants like Crotalaria, Tephrosia sp, Phaseolus lunatis, Centrosema, and seeds of Hibiscus sp, berries of Vitis lanceolaria Liqustrum pubinerve and Oxycanthus sp (Le pelley, 1968). Though it harbours on other plants feeding and breeding is possible only on coffee berries. All the cultivated varieties of coffee are attacked by the borer without any preference (Anonymous, 2003).

6. Symptoms of Attack and Damage

A pinhole at the naval region indicates the presence of borer in the berries. Borer attacks coffee during any stage of berry development from pepper size to ripe berries. After making a circular whole borer waits outside till the endosperm becomes hardens (Anonymous, 2003). Colonizing females bore a hole in the coffee berry and deposit eggs within galleries, followed by larval feeding on the coffee seed. This reduces both yield and quality of coffee, which in turn affects the income of coffee growers (Damon 2000; Jaramillo et al., 2006).Usually single bean is attacked by the borer. Heavy infestation leads to complete damage of beans. Heavy infestation could be easily identified by the powdery particles on the whole (Anonymous, 2003). Very few progenies developed in berries of 60 and 90 days growth. For good development, the CBB requires more than 120 days old berries (Baker, 1999) with more than 20% dry weight (Baker et al., 1992). When there are berries of different maturity on the same branch, the preference was towards berries with more than 25% dry weight (Baker, 1999). Coffee grown in low altitudes is severely affected than at higher elevation (Murphy and Moore, 1990).

7. Crop Loss

The damage caused by H. hampei is mainly a decrease of coffee yield due to abscission of berries, loss of weight, and a decrease on coffee quality and, therefore, coffee price. It has been estimated that there is a weight loss of 55% on coffee grains attacked by H. hampei (Montoya 1999); however, the decrease of weight of the total coffee production is about 18% (Borbón 1990).Crop loss of up to 96% has been reported to occur in some Eastern African countries (Magina, 2005).

8. Management

Integrated pest management is recommended for the management of borer which includes cultural and sanitary measures, mechanical, chemical and biological control.

9. Cultural and Sanitary Measures

In Africa CBB is successfully managed by adoption of cultural measures (Bardner, 1978). Collection of berries on the ground that reduce coffee berry borer levels is a common cultural practice in America (Bustillo et al., 1998).Lack of berries in plantations could reduce the breeding and further development of CBB. Clean, complete and timely harvest is one of the most important practices followed to reduce the CBB incidence. Use of picking mats reduces the gleanings which is a major source of infestation. Maintaining optimum shade is very important in the control of CBB (Anonymous, 2003). Proper drying of coffee beans also helps in reducing the CBB infestation (Le Pelley, 1968; Baker, 1999).

10. Mechanical Control

Brocatraps baited with brocalure (ethanol: methanol) in 1: 4 ratio traps borer in mass. Dipping infested berries in boiled water kills all the life stages (Anonymous, 2003).

11. Biological Control

Natural enemies like parasitoids, predators and pathogens of berry borer are reported from native land as well as from the introduced regions. Several parasitic hymenopterans attack berry borer viz, Cephalonomia stephanoderis and Prorops nasuta (Hymenoptera: Bethylidae), Phymastichus coffea (Hymenoptera: Eulophidae) and Heterospilus coffeicola (Hymenoptera: Braconidae).The first coffee berry borer parasitoid reported in the literature was the bethylid Prorops nasuta (Waterson) (Hargreaves,1926). The braconid Heterospilus coffeicola Schmiedeknecht was discovered by Hargreaves (1926,1935) in Uganda, and is believed to be distributed throughout most coffee producing countries in Africa.

12. Predators

Ants, birds and thrips are reported as predators of berry borer. Several authors have reported a close association of ants with coffee berry borer (Velez et al., 2000, 2003; Gallego-Ropero and Ambercht, 2005; Velez-Hoyos et al., 2006; Philpott and Ambrecht, 2006; Ambrecht and Gallego, 2007). According to Varon et al (2004) ant predation in the laboratory might not necessarily be replicated in the field.

13. Pathogenic fungus

Beauveria bassiana (Balsamo) Vuillemin, Metarhizium anisopliae(Metschn.) Sorokin, Isaria farinose Wize, Lecanicillium lecanii(Zimm.) Zare and Gams, and Ophiocordyceps entomorrhiza (Dicks) are pathogenic fungus which attacks CBB (Bustillo et al., 1998, 2002; Vega et al., 1999).

14. Plant Extracts and Plant Resistance

In Tanzania, extracts of Neem and Tephrosia are used to control CBB (Magina, 2005). Induced resistance of plants control the attack of pest. Jayaraj (1967) reported that the nutrients content of a plant played an important role in determining its susceptibility or resistance to insect pests. Low growth index of coffee berry borer was observed with the application of organic manures and amendments and high in NPK as inorganic form (Irulandy et al., 2010).

15. Chemical Control

Chemical spray against borer has limited effectiveness due to the cryptic nature of pest. It must be applied before the beetle enters into the hardened bean (Mugo, 2006). Several insecticides have been recommended for the management of borer (Le Pelley, 1968), with some reported to reduce populations of biological control agents (Wanjala, 1976). Application of Chlorpyriphos 20 EC @ 600ml/L of water is highly effective when berries are waiting outside (Anonymous, 2003).

16. Conclusion

Research studies on biocontrol aspects are still progressing to tackle the pest with the main objective of eliminating the use of chemicals in the field.

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