



## COFFEE BERRY BORER IN EAST AFRICA

The coffee berry borer (CBB) (*Hypothenemus hampei*) (Figure 1), is a significant pest in coffee-producing countries around the world. It originates from low-altitude robusta coffee in Central and West Africa and has invaded nearly all the coffee producing regions around the world.



**Figure 1:** Adult Coffee Berry Borer  
© Bioexploradores Farallones / inaturalist



**Figure 2:** Entry holes of CBB on unripened berries  
© Whitney Cranshaw / bugwood

### Damage caused by the CBB

#### 1. Premature berry drop:

The adult beetles can attack and damage the young, unripened berries (Figure 2) when the availability of ripe berries is low at the beginning of the season or during the harvest season. This can cause the young berries to have stunted growth, decay, or fall from the tree, reducing yield and quality.



**Figure 3:** Entry holes of CBB on ripe berries  
© Whitney Cranshaw / bugwood



**Figure 4:** Signs of galleries created by CBB  
© Whitney Cranshaw / bugwood

### 2. Reduced bean quantity and quality:

The damage to the berries is done by creating a hole at the bottom end of the berry (Figure 3) and forms galleries (Figure 4) in the seed. The boring and feeding activities by the adults and the younger generations reduce yield and quality.

### 3. Vulnerability to other diseases:

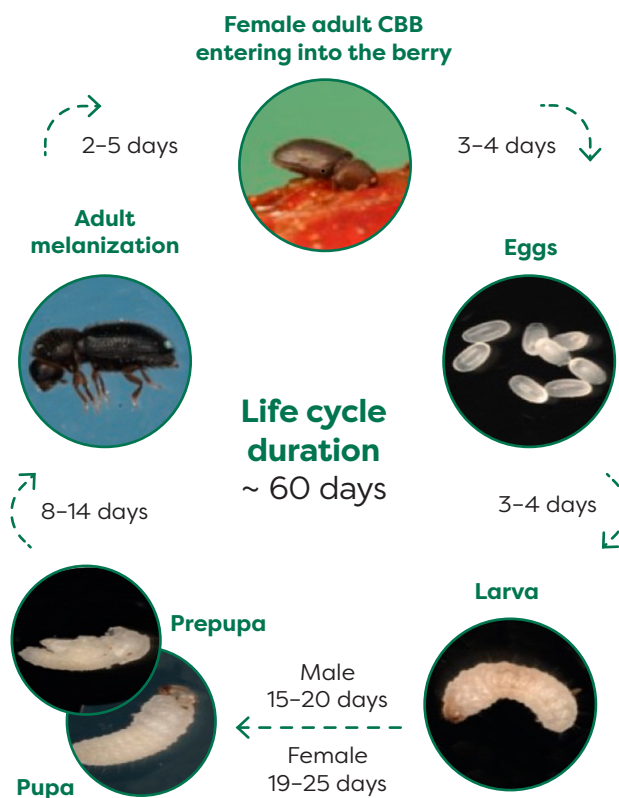
The physical damage to the berries' exterior surface makes them susceptible to other infections by bacteria and fungi, as the damage acts as an entry point for other pathogens. Furthermore, the coffee berry borer has the ability to detoxify caffeine which usually acts as a natural repellent for the other pests.

## Lifecycle

The life cycle (Figure 5) of the CBB lasts for about 2 months. In this period, the CBB goes through various stages of its lifecycle: After laying its eggs, it hatches as a larva. As a larva it feeds on coffee beans and causes great damage. It then pupates inside the coffee bean and develops into an adult beetle.

Female beetles, which are usually double the size of the male beetles, have an average life span of 68 days, while males have an average life span of 48 days under optimum temperatures between 20° to 30° C and relative humidity between 70 to 90 %.

The CCB use caffeine as a source of carbon and nitrogen due to a symbiotic *Pseudomonas* bacteria. This mechanism facilitates the CBB to feed and complete its entire lifecycle inside the coffee seed, which is unique among other *Hypothenemus* species.

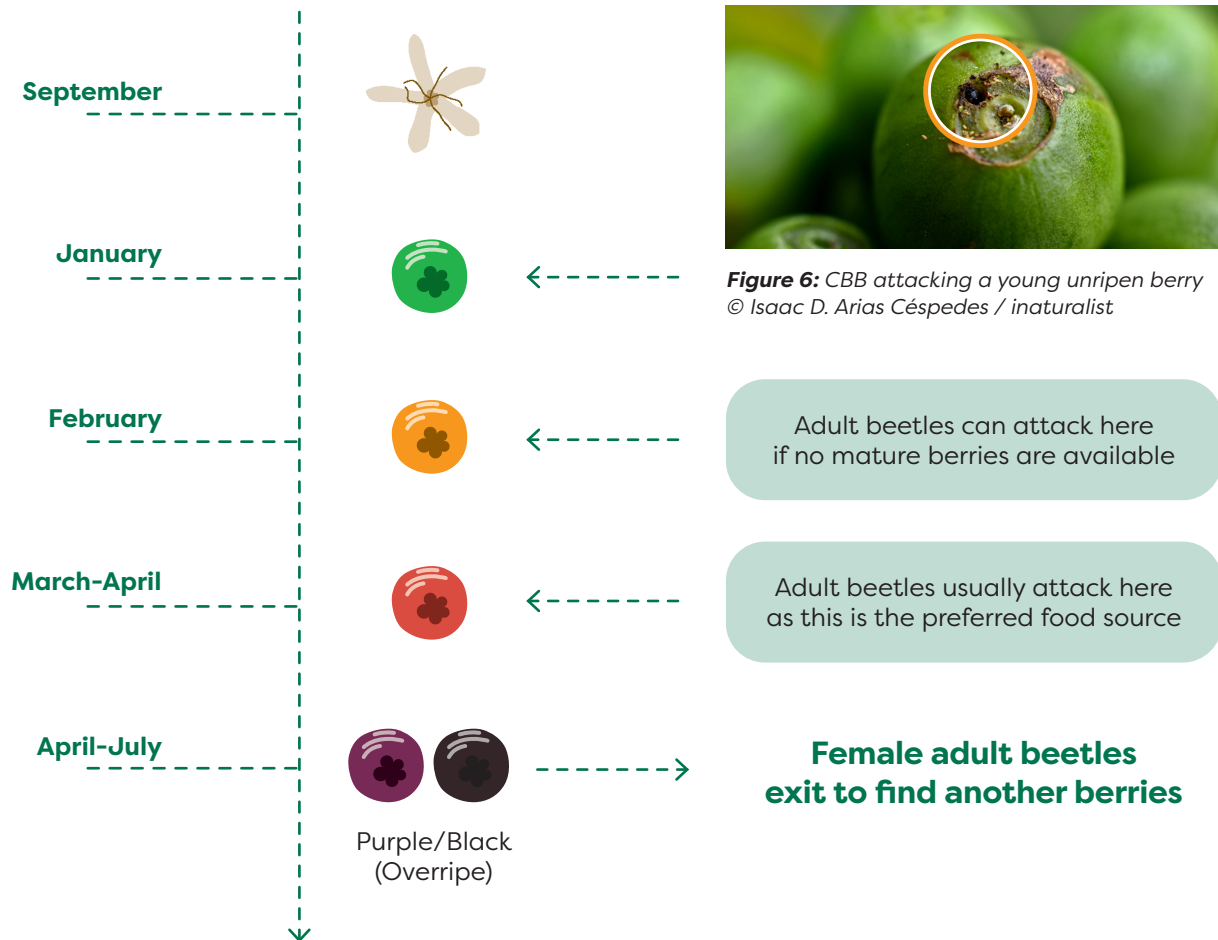


**Figure 5:** Life cycle of the CBB. Illustration adapted from Góngora, Carmenza E., et al. (2023)

## CBB attacking patterns

Usually, a single female beetle is found in one berry. More than one female beetle per berry can be found under heavy infestations.

Adult beetles usually attack the ripe red berries as it is their preferred food source (Figure 7), but if no mature berries are available, they also attack green and immature berries (Figure 6). As the lifecycle is about 45–60 days, the CCB can attack the berry in several stages and can complete up to two “generations” within one season.



**Figure 6:** CBB attacking a young unripen berry © Isaac D. Arias Céspedes / inaturalist

**Figure 7:** Stages of coffee berry susceptible to CBB infestation.

## Control strategies: Cultural control

Cultural practices on the farm refers to various practices on the farm when adopted can create inhabitable environment for the pests and make it difficult for them to multiply and attack the crops. These practices are generally used to **prevent** the pests from attacking which saves a lot of resources and time for the farmers (Figure 12).

### 1. Pruning:

Proper pruning of coffee trees should be done where dry and dead branches are removed and cutting branches which are too high for harvesting allows for better airflow and sunlight penetration throughout the field. As CBB favours high temperature and humidity for its growth and development, fields without proper pruning could potentially provide suitable conditions for it. Pruning should be done after the final harvest and before the onset of flowering for the next season. This also minimizes the potential breeding sites for the adult beetles which could hide in the old berries.



## 2. Shade management:

Even though shade is very important for coffee trees, excessive shade can be harmful as it can create a warm and humid microclimate that favours CBB. So, an optimum level of shade of 40% (Figure 8) must be maintained.

## 3. Desuckering:

Remove young suckers which are second main stems which arise from the same tree (Figure 9) to reduce the number of stems and branches to minimize the potential breeding grounds for CBB. This also directs the plant resources to produce more healthy berries.

## 4. Clean farm:

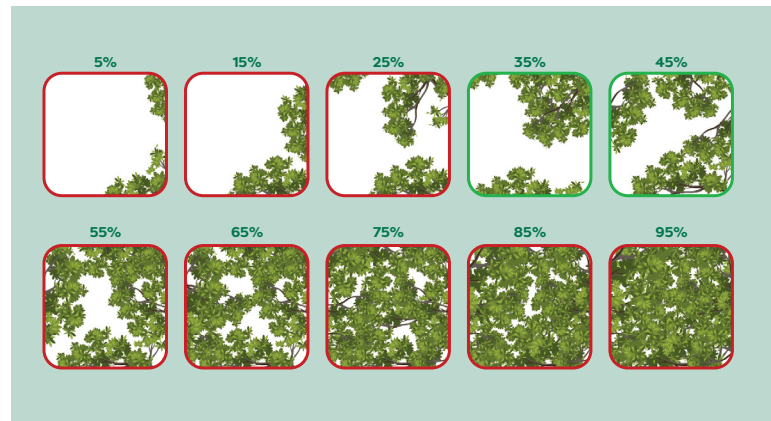
The farm should be kept clean without any residual waste of coffee berries from previous harvest both on the trees and on the ground. This will eliminate the potential breeding sites for CBB.

## 5. Harvesting:

**Conduct frequent harvesting:** Harvesting should be done every 2 to 3 weeks during peak season. Frequent and thorough harvesting is essential to prevent CBB. Only ripe and old berries should be picked while leaving others on the tree to develop further.

**Separate contaminated berries:** Place all the red, black (overripe) and raisin (old) berries into water. If the berries sink to the bottom of the container, they are ripe and healthy. If the berries float to the top of the container, they are overripe or infected (Figure 10).

It is important to separate infected and healthy berries (Figure 11) to prevent contamination. Store contaminated berries in a plastic lined bag to prevent CBB from escaping. Store healthy berries in a separate bag. Burying the infected berries underground and far away from the field to prevent further infections.



**Figure 8:** Different levels of shade © La Disciplina de Fitotecnia en Cenicafé



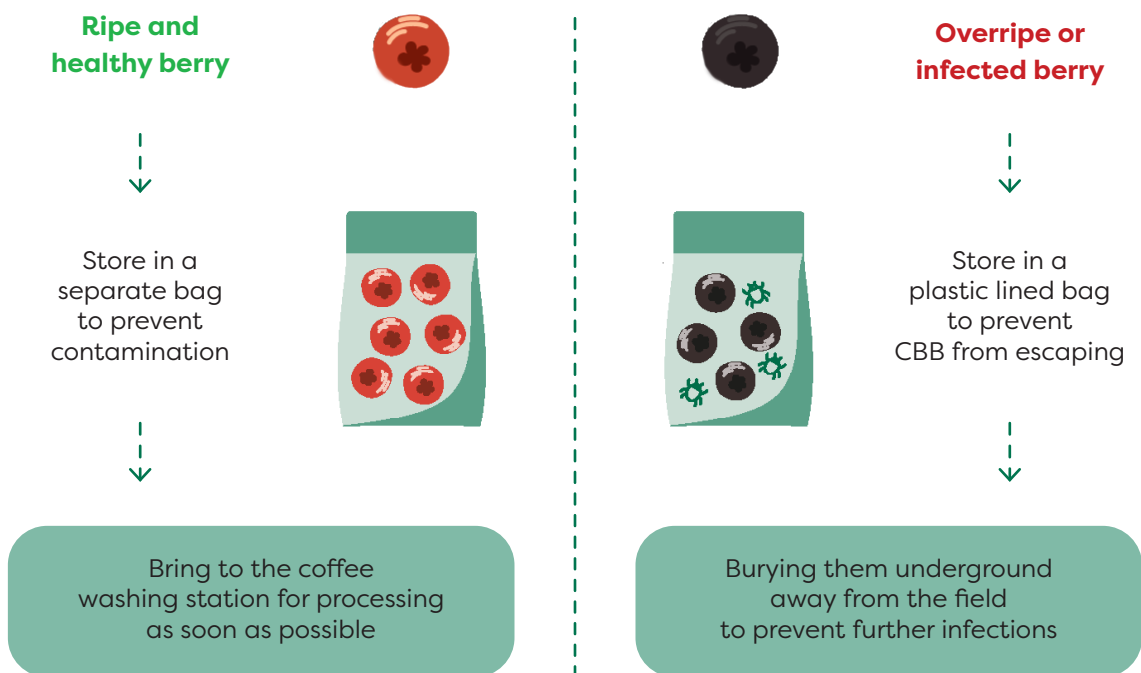
**Figure 9:** A desuckered coffee plant © Hannah Vernon

After each harvesting before sending the berries to the coffee washing station it is advised to put the berries in boiling water to kill any remaining beetles and other immature stages from developing further.

After harvesting the ripe berries must be sent for processing as soon as possible to prevent the CBB from spreading to other berries.



**Figure 10:** Float test with infected and overripe berries floating & healthy and ripe berries at the bottom.  
© Amanda Bensef



**Figure 11:** Separation of infected and healthy berries after harvesting

*Do final harvest by strip picking:* The final harvest of the season should be done by strip picking, so that all the remaining berries will be stripped from the trees. The final harvest should be done before the pruning is done otherwise, the overripe and old raisins could fall down and act as a reservoir for CBB for next year.

**6. Remove all the remaining berries after final harvest:**

After the final harvest, remove all the remaining berries on the trees that were not suitable for processing, as well as the fallen berries around the trees, and destroy them by burying them underground far away from the field, as they can act as reservoirs for adult female beetles.

### 7. Planting flowering plants:

Planting flowering plants such as Marigold (Nyiramunukanabi) and vegetables such as Onions (Ibitunguru) around the borders of the farm can attract natural enemies to the CBB.

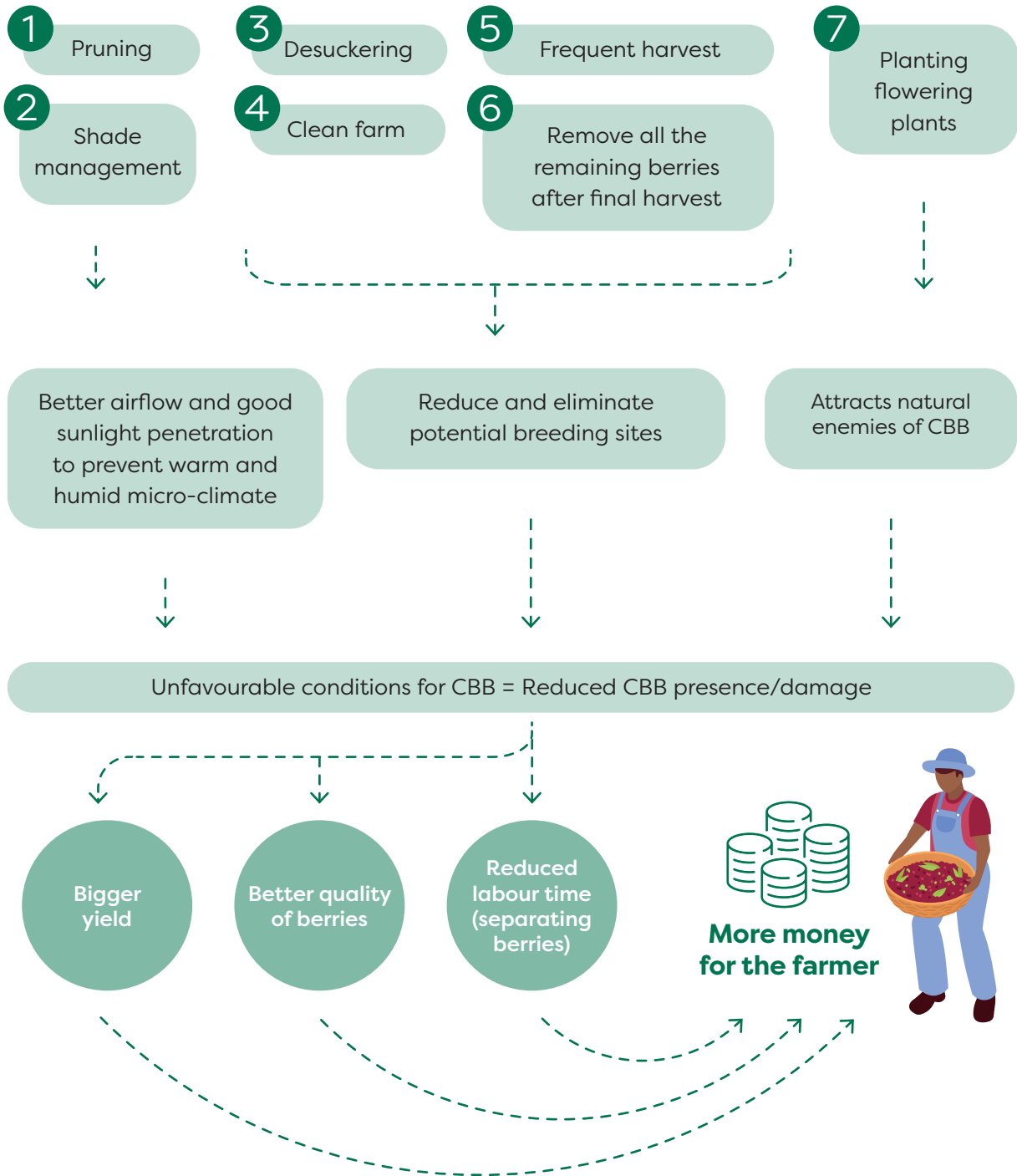


Figure 12: Summary of the effects of cultural practices to control CBB.

### Control strategies: Biological control

Biological control on the farm refers to using various living organisms usually natural predators of the pests to control them. These organisms might be present naturally on the farms but sometimes they need to be introduced artificially which might be expensive.





**Figure 13:** *Beauveria bassiana* infecting and killing the adult CBB © Luis Miguel Constantino



**Figure 14:** Ant attacking an adult CBB. © G.Hoyos / Cenicafé

### 1. Parasitic wasps:

Parasitic wasps such as *Cephalonomia stepheneris*, *Prorops nasuta* and *Phymaticus coffea* can parasitize the immature stages of CBB and feed on the adult females.

### 2. Entomopathogenic fungi:

*Beauveria bassiana* is the most commonly used biological agent for controlling CBB. It infects the female CBB (Figure 13) before they enter the berry and can kill up to 70 % of them under optimum environmental conditions.

### 3. Entomopathogenic nematodes:

These nematodes are natural enemies of CBB, found in the soil, and can control infestations that might occur from fallen berries. *Steinernema carpocapsae* and *Heterorhabditis spp.* can infect larval and adult CBB stages.

### 4. Ants:

Depending on the species, ants (Figure 14) can attack both immature and adult stages of CBB. They can reach the CBB by climbing the tree or attacking the fallen berries.

The biological control methods to control CBB might not be appropriate for all the farms. The introduction of biological control agents and biological pesticides into the farms will be expensive, requires labour and proper equipment for their application. The level of effectiveness might not be the same every time as it will depend on the severity of infection, climate, optimal conditions for the biological agents to multiply etc.,. But farms with **agroforestry systems** can create and maintain favourable conditions for diverse communities of natural enemies such as birds, ants, wasps, spiders etc., which can effectively reduce CBB population.

Greater effort should be placed on **preventing the infection** by following the cultural practices (Figure 12) and disrupting the lifecycle of the CBB to multiply further. This will increase the quantity and quality of the berries which will increase the income for the farmer.

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