



## Pacific Pests, Pathogens & Weeds - Fact Sheets

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### Coffee berry borer (118)



Photo 1. Adult coffee bean borer, *Hypothenemus hampei*, about 1.5 mm long and covered with stiff hairs.



Photo 2. Adult *Hypothenemus hampei*, about 1.5 mm long, showing its relative size to a coffee bean.



Photo 3. The life cycle of the coffee bean borer, *Hypothenemus hampei*, takes place in the coffee bean; this photo shows the frass that accumulates as the larvae and adults eat the beans.



Photo 4. Coffee beans damaged by the coffee bean borer, *Hypothenemus hampei*. Even a few bored beans lower quality, and if the consignment is not dried properly the beetles will continue to breed in storage and increase the damage.

#### Common Name

Coffee berry borer

#### Scientific Name

*Hypothenemus hampei*

#### Distribution

Worldwide: Asia, Africa, South and Central America, the Caribbean, Oceania. It is recorded from Federated States of Micronesia, Fiji (where it is one of the top ten pests), French Polynesia, New Caledonia, Northern Mariana Islands, Papua New Guinea, and US (Hawaii).

#### Hosts

*Coffea arabica*, *Coffea canephora*

#### Symptoms & Life Cycle

The adults (Photos 1&2) feed and breed inside the berries, and the damage done, plus the presence of decay organisms, causes the berries to fall prematurely.

The fertilised female flies to the ripening berries and bores into them. If the endosperm is still soft it may wait in the fruit for it to become firm, or visit other berries. Eggs are about 0.6 mm long, and are laid in chambers chewed out of the beans, each female producing 30-50 eggs in 2-7 weeks. Eggs hatch within a week or so and the larvae start eating the beans. After about 2 weeks and two moults, the larvae reach maturity, develop into pupae and 4-9 days later emerge as adults. The entire life cycle is about 4 weeks.

There are about 10 females for every male. Males have short wings and do not fly; they remain in the berries for the 3 months of their lives. Females are fertilised a few days before they leave the berries to find other berries in which to lay their eggs. Some females remain and lay eggs in the same berry. Females live on average 150 days, much longer than the males. Many beetles occur in a single berry, up to 100 (Photo 3).

The adults are black, about 1.5 mm long by 0.4 mm wide, covered in short stiff hairs. Other noticeable features are short club-shaped antennae, and bristles on the legs that are used for tunneling through the coffee berries. The females can fly for about 30 minutes; they also swarm, perhaps using updrafts of air to achieve long-distance travel. During times when the crop is low or non-existent, the beetles remain inactive in dry berries or in those on the ground.

## Impact

The damage varies, but berries can be completely destroyed by the adults and their larvae so that all that remains is frass or faeces. It is not uncommon for 100% of the berries to be attacked. Further damage occurs if the beans are not properly dried before being stored. Even if only a few of the beans are infested, the damage affects quality, and the beans will be difficult to market (Photo 4).

## Detection & inspection

Look for brown frass over the holes. Look for holes in beans by rubbing them between the hands to remove the parchment (a skin over the seed). Cut open the berry to find the female in tunnels in the endosperm (the starch deposit in the seed).

Sample as follows: (i) sample according to age of the trees; (ii) randomly select 30 trees for every 5000, (iii) select a branch in the middle of a tree, containing 30-100 developing berries, (iv) examine all green berries for coffee berry borer holes, (v) count the number of green berries, (vi) go to next tree in a zig-zag pattern, (vii) calculate percentage infestation. In Colombia, more than 2% and the trees are sprayed. Sampling in this way is carried out monthly.

## Management

### QUARANTINE

It is important that seed coffee imported into countries yet free from the beetle is treated appropriately. Fumigation before entry and inspections should be mandatory.

### NATURAL ENEMIES

Several wasps (eulophyds and braconids) have been introduced from Africa to Central and South America, and elsewhere, but without noticeable impact (but see below). Ants, predatory beetles and nematodes also occur, but none has sufficient potential to control *Hypothenemus* populations. By contrast, 80% mortality of adults occurs with the fungus, *Beauveria bassiana*, in countries with continuous high humidity.

IPM for coffee berry borer includes sampling/monitoring, cultural practices, use of *Beauveria bassiana*, post-harvest control, and release of parasitoids. In Mexico, organic coffee production uses *Beauveria bassiana*, the parasitic wasps *Prorops nasuta*, *Phymastichus coffea*, and *Cephalonomia stephanoderis*, attractant traps removing dried berries from the bushes to interrupt the pest's life cycle, and neem<sup>1</sup>. The traps contain methyl or ethyl alcohol.

### CULTURAL CONTROL

During growth:

- Pick berries as they ripen, increasing to every 2-3 weeks in "hot-spots".
- Collect blackened berries from the ground or bushes - those decayed by fungal infections and beetles - and burn them. The aim is to leave less than five ripe, over-ripe or raisin berries per tree.
- Alternatively, do the following for 3 months to break the life cycle:
  - Remove all berries from the ground and bushes after harvest, and continually remove young berries.
  - Strip all berries from the bushes.
- Check with local authorities to find out if parasitoids are important; if they are, do the following:
  - Pick all ripe berries at least every 2 weeks (more often, if practical).
  - Leave fallen berries as reservoir for parasitoids (where numbers fallen are low).
  - Increase shade (there may be more predators where shade is present, but this varies locally).

- Maintain healthy trees using correct type and amounts of fertilizer, control of weeds, and pruning.

After harvest:

- Prune bushes after harvest, removing branches on which berries are too high to reach.
- Destroy bushes in abandoned plantations, as they are sources of infestation.

#### RESISTANT VARIETIES

Differences exist between *Coffea* species and between varieties of *Coffea arabica* and *Coffea canephora*, but are probably not sufficient as a basis for developing resistant varieties.

#### CHEMICAL CONTROL

Insecticides are effective if applied early when the female is in the entry tunnel, but not later when berries are mature and the female has penetrated the endosperm. Fallen berries are particularly difficult to treat. Pirimiphos-methyl is recommended. (Note that endosulfan previously used extensively in Central and South America is banned under the Stockholm Convention, April 2011.) Fenthion has also been de-registered by the APVMA - Australian Pesticides and Veterinary Medicines Authority. In Hawaii and South America, a commercial preparation of *Beauveria* (the GHA strain) is used. Sprays are recommended when monitoring shows "hot-spots" with more than 2% infestation.

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Information from Waterhouse DF, Norris KR (1989) *Biological Control Pacific Prospects - Supplement 1*. ACIAR Monograph No. 12. Inprint Limited, Brisbane; and <sup>1</sup>Evaluation of non-chemical alternatives to endosulfan (2012) UNEP/POPS/POPRC.8?INF/14/Rev.1. UN/UNEP; and from Aristizabal LF, *et al.* (2016) Integrated pest management of coffee berry borer: strategies from Latin America that could be useful for coffee farmers in Hawaii. *Insects* 7(1). 24pp. (<http://www.mdpi.com/2075-4450/7/1/6>). Photo 1 Georg Goergen, IITA-Benin. Photo 2 Peggy Greb, USDA, ARS. Photo 3 Save Kona coffee! Fighting the coffee berry borer. (<http://marcoinkona.com/2012/04/21/save-kona-coffee-fighting-the-coffee-berry-borer/>). Photo 4 Forest and Kim Star. Coffee Berry Borer parchment seeds with damage sample at Kula Community Centre, Maui, Hawaii. (<https://www.flickr.com/photos/starr-environmental/32087834650/>).

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