THE COFFEE BERRY-BORER IN CEYLON
(STEPHANODERES HAMPEI FERR.)

J. C. HUTSON, B.A., Ph.D.,
ENTOMOLOGIST

INTRODUCTION

THE coffee berry-borer was first discovered in Ceylon in June 1935 in the Balangoda district of the South-Western Division, but is now known to occur throughout the greater part of that Division, in the northern part of the Southern Division and in several places in the Central Division. The elevations of the various recorded localities ranging from about sea level up to about 3,000 feet. It is an introduced pest, but how or when it entered the Island is not known. Two possible sources of introduction are either coffee seed imported for planting or the ordinary market coffee entering regularly for consumption. Its widespread prevalence throughout many village coffee areas seems to indicate that this beetle has been here for several years. It has now become too well established for complete extermination to be practicable, but much can be done to reduce its prevalence to a minimum and the object of this preliminary note is to indicate how this can be done. The co-operation of all concerned is essential if any real progress in the control of this borer is to be made.

NATURE OF THE DAMAGE

This pest is a small shot-hole borer beetle (fig. 1) which bores into the coffee berries, making a small, neat, round hole about 1 m.m. in diameter, usually at the outer end or " nipple " (fig. 7c,d.), but occasionally in the side of a berry (fig. 7a.) or more rarely near the stalk end ; sometimes a berry may have two or three holes. The boring is done only by the female and while she is excavating inside a berry it may be seen that the hole is often partially hidden by frass (fig. 7b.). So far as is known, the berry is the only part of the plant to be attacked

by this beetle in its various stages and berries of different species and varieties of coffee are the only fruit known to be attacked so far in Ceylon.

Similar small holes found in diseased shoots and branches of coffee plants are made by other species of small shot-hole borers, notably *Xyleborus morstatti*, which are not known to attack the berries. The larger irregular holes occasionally found in dry or black fallen coffee berries are usually made by quite a different beetle, *Araecerus fasciculatus*, the grubs of which feed inside the beans and pupate there; in such cases these holes are made by the emerging beetles. Small surface scars or shallow pits in the pulp of coffee berries may be made by other biting insects.

In the case of *Stephanoderes hampei* the berries are bored only by the female beetle, mainly for the purpose of excavating an egg-chamber inside the beans as soon as these are sufficiently hard for the grubs to feed on. Therefore, immature green berries are rarely attacked, except under the conditions mentioned below, since the beans are too soft and watery to be suitable for the grubs. After the ripe crop of berries is removed, leaving mainly unripe or younger green berries, the females, in the absence of more mature berries, may bore into these immature berries possibly for feeding and to ascertain whether any are suitable for egg-laying.

After the berries are about four months old the female makes experimental borings possibly to test the condition of the beans, and in the process of boring doubtless some nourishment is absorbed. These immature bored berries become diseased and gradually turn black, but later become suitable for breeding, either on the bush or on the ground. When the beetle finds a berry in which the beans have begun to dry up and harden she continues her tunnel into one of the beans, excavates an egg-chamber and lays a few eggs. Ripening and ripe berries are also used freely for breeding, until the crop may be seriously affected, if the attack is heavy. All berries which are used for breeding have at least one bean attacked and riddled and if the breeding continues, both beans are thoroughly tunnelled and eventually reduced to powder in a large percentage of the berries which are thus rendered

useless for crop. A single bored berry may contain upwards of 100 individuals of the pest in various stages of development.

It will be seen that two main types of damage are done to the crop by this pest. First, indirectly by the females boring into green unripe berries mainly for feeding. These turn black and are useless for crop, but are prolific sources of breeding, provided the beans were sufficiently mature before the berries were attacked. Many berries turn black and dry up owing to disease or other causes before the beans are properly formed and these usually do not breed the beetle. This beetle attack on unripe berries is particularly severe after the ripe berries are picked or when the infestation of maturer berries is heavy and only immature berries are available for food. Secondly, the mature crop is directly injured by the boring of the females for egg-laying and by the subsequent feeding of the grubs and adults inside the beans, which are either completely destroyed or so damaged that they produce low-grade beans. During the washing of the beans after pulping all bored beans are " floaters " or " lights."

HABITS AND LIFE-HISTORY*

The female beetles (fig. 1) have well developed wings and can fly readily, while the males (fig. 2), with their smaller wings, are probably incapable of flight and usually remain practically all their lives inside the seeds in which they have developed. Mating usually takes place within the seed in which the life-cycle is completed, but it has been found in other countries that females may migrate to other infested berries for mating if no males are available in the original host berry.

As indicated by experiments at Peradeniya, the females may start egg-laying within one week after emergence or may delay this for about three weeks. As a result of these experiments it was found that females can live with food for periods ranging from about 5 to 10 weeks and during their lives they can lay an average of about 37 eggs at intervals, with a maximum of 56. Females kept without food or moisture after emergence lived only a few days at Peradeniya. The maximum duration of life of a female in any country seems to be about four months.

* I am indebted to Mr. M. P. D. Pinto for his work on the bionomics of this pest.

At Peradeniya the eggs (fig. 3) hatch in about 5 to 7 days and the grubs feed inside the bean (fig. 6), becoming full-grown (fig. 4) within 15 to 20 days, with an average of about 17 days. The pupal stage (fig. 5) lasts about 6 to 7 days including a a pre-pupal period of about 2 days, during which the grub stops feeding and decreases in size before pupating. The total life-cycle ranges from about 26 to about 34 days, occupying about 28 days on an average. The beetles emerge inside the beans and remain quiet for 5 or 6 days during which the body covering hardens and assumes its normal dark colour. Mating then takes place inside the beans and the females under field conditions emerge and fly off to feed elsewhere and start egg-laying in due course; the males usually remain alive inside the beans for two or three weeks.

The habits of the beetles under field conditions have not been completely studied so far in Ceylon, but from the information available in other countries it would appear that the females are usually in flight during the late afternoon, which indicates that any control picking should be done in the morning while many of the females are in the berries. It has also been found in other countries that the females are much more numerous than the males, the proportion being at least 10 to 1.

CONTROL MEASURES

The above notes have indicated that the coffee berry-borer is a small shot-hole borer beetle which attacks only the berries for feeding and breeding, making a small, circular clean-cut hole (fig. 7) in any berries that have attained a certain degree of maturity; black berries are also commonly used for breeding. Bored berries on the bush and all fallen berries are the ones to look for since they will usually contain several individuals of the pest in some stage or other.

For slight infestations.—In coffee areas where the berry-borer is only slightly prevalent, all bored green, ripening and ripe berries on the bush should be collected and burnt at least once a fortnight and at the same time all fallen berries, especially black berries, should be swept up and burnt. This collection and burning should be completed by early afternoon while the females are still in the berries.

If these collections cannot be burnt, they should be put into stout cloth bags which should be immersed in absolutely boiling water for *five* minutes to destroy the pest ; the contents of the bags can then be disposed of by burial or incorporating in compost pits.

All the remainder of the crop which it is desired to sell or use for consumption should be treated with absolutely boiling water as above, but only for *three* minutes, prior to drying and curing.

For heavy infestations.—In areas where the borer is found to be seriously prevalent, more drastic emergency measures are necessary, involving the destruction of the whole crop by burning.

Low-growing well-tended coffee bushes should be completely stripped of all berries and flowers. A special effort should be made to collect and burn all the stripped berries and all fallen berries, including black berries.

Unpruned coffee bushes, or those which have been allowed to grow into tall trees, should be cut back below the lowest fruit-bearing branch. All the prunings with the berries on them and all fallen berries, including black berries should be collected and burnt the same day.

When the next crop is developing it should be inspected carefully every two weeks and if the attack is only slight it can be controlled by the measures recommended above under slight infestations, special attention being paid to all fallen and black berries.

In areas which are liable to wash by flood water or heavy rain there are indications that the pest can be spread by transport of fallen berries in flood water to other areas. Therefore in such areas it is essential to see that the ground is cleared of all fallen berries at frequent intervals.