COCOA PESTS AND THEIR CONTROL

By E.S.C. Smith, Entomologist
Lowlands Agricultural Experiment Station, Keravat

INTRODUCTION

There are probably more insects associated with cocoa *Theobroma cacao* than with any other tropical or temperate crop. In Papua New Guinea, over 300 different insects have been recorded from cocoa trees, but fortunately only very few of these are considered pests. Throughout the country, the two greatest cocoa problems are *Pantorhytes* weevils and black pod disease, although vascular streak dieback disease can be a very serious threat to cocoa growing in many areas.

In most parts of the country there are six or seven pest species which often cause serious crop losses or tree damage, but many others may occasionally increase to large numbers and cause a loss of production.

The main pests of cocoa will be briefly discussed under the following headings: flush and foliage feeders, pod feeders, vertebrate pests and wood borers.

FLUSH AND FOLIAGE FEEDERS

1. Caterpillars

   Several species of moth larvae (caterpillars) attack the mature leaves and flush (soft, young growth) of cocoa. In a severe attack, the growing points and the bark of young shoots are eaten, and often killed, and this damage may cause a lot of side branches to form. Caterpillar damage is generally more troublesome under *Leucaena* trees or very shaded cocoa, and only minor outbreaks of nettle caterpillars have been recorded on cocoa interplanted with coconuts.

   Usually, the caterpillar and pupal stages of these pests are heavily attacked by wasps and flies, or are eaten by other insects, so that large outbreaks rarely occur.

   The use of insecticides to control these pests is not recommended since cocoa can tolerate quite heavy leaf loss and the caterpillar outbreaks are generally brought under control by natural parasites. If insecticides have to be used, however, spot spraying affected trees or areas with 0.2% carbaryl will give control.

Species which may cause defoliation of cocoa are:

Cocoa loopers	(Family Geometridae)	*Ectropis sabulosa*
		Hyposidra talaca
Cocoa army worm	(Family Noctuidae)	*Tiracola plagiata*
Cocoa false-looper	(Family Noctuidae)	*Achaea janata*
Nettle caterpillars	(Family Limacodidae)	*Pinzulenza kukisch*
		Mambara inconspicua

The life cycle of most of these species takes about 6 weeks.

2. Rhyparids (Family Chrysomelidae)

Adults of these small brown to black beetles feed on young cocoa leaves causing a characteristic 'shot hole' effect, and may damage the leaf margins. Economic damage only occurs in cocoa younger than three years old, and is especially serious in areas where grass is not often cut because the larvae feed on grass roots. Spot spraying with 0.2% carbaryl will give effective control if necessary.

3. Grey weevils (Family Curculionidae)

Again, it is the adult weevils which cause damage to young cocoa, since the larvae feed only on the roots of weeds. The beetles chew the bark and growing points of young cocoa shoots. This often causes multiple branching to occur which leads to a poorly formed tree. The insects are difficult to kill with insecticides, but applications of 0.2% acephate have given good results after about 4 days. Several species of weevils are involved.

4. Mealy bugs (Family Pseudococcidae)

Mealy bugs are minor pests of cocoa in most areas of Papua New Guinea. The common species are *Planococcus citri* and *Ceroplastodes chiton*. Larvae and adult females feed on chupons, pod stems, flowers and cherelles (young pods). They are tended by ants which are attracted to the honeydew produced by the mealy bugs. Malformation of the growing point occasionally occurs when large numbers of mealy bugs are found on very young seedlings in the field. If necessary, a spray containing 0.05% malathion plus 1% white oil will give control.

POD FEEDERS

1. Mirids (Family Miridae)

The cocoa mirids (often called cocoa capsids) can cause very heavy damage to pods and shoots if infestations are severe and control is not practised.

Adults and nymphs feed on cherelles and pods (and sometimes shoots). They feed by piercing the tissue with their long mouth parts, injecting saliva which breaks down the cell contents, and then sucking up the juices. Fresh feeding scars have a "watersoaked" appearance and then turn brown and

finally black. A small number of these scars may cause the death of cherelles. It is not easy to recognize and appreciate the direct loss of production resulting from the loss of these cherelles.

The eggs of cocoa mirids are laid beneath the surface of the pods or shoots on cocoa trees, and hatch in 7-12 days. The The nymphs, which begin feeding immediately, take about two weeks to develop into adults. Thus, all stages of these insects are found on cocoa trees.

Four specises of cocoa mirids may cause damage to cocoa in Papua New Guinea. These are: *Helopeltis clavifer*, *Pseudodoniella laensis*, *Pseudodoniella pacifica* and *Pseudodoniella typica*.

The first two species are found widely on the mainland, while the last two occur mainly in the island provinces. *Helopeltis* has a very wide host range and may attack many other economic crops, but *Pseudodoniella* has only been found on cocoa and wild fig trees.

Parasites and predators appear to play only a small part in controlling this pest and insecticide control is necessary.

Control measures are:-

(i) Spray every second line of cocoa with lindane 16% emulsifyable concentrate at 75-100 g a.i./ha in 28 *l* /ha water using a motorised sprayer.

Spraying with lindane should be done during dry weather and after the leaves have dried out in the morning. A follow-up spray is essential, 14-16 days after the first one, to kill any mirids which have emerged since the first treatment. After this, a close watch should be kept for any new mirid damage.

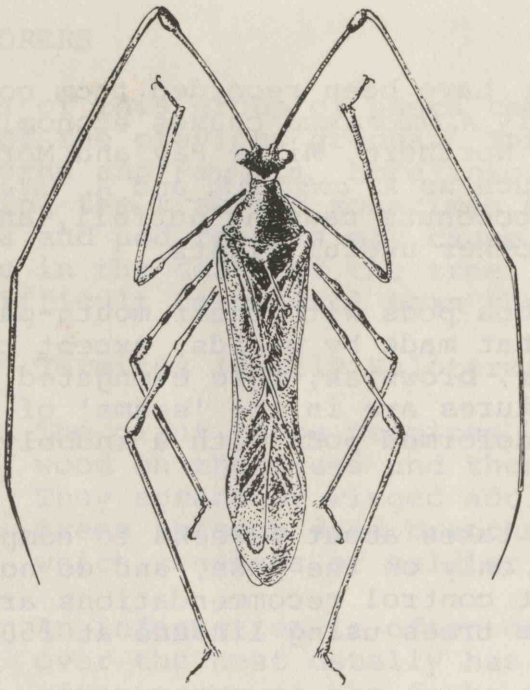
OR

(ii) Dust every second line of cocoa with either gamma BHC dust (1.3% or 2.6%) or BHC dust, using a hand duster. This method will be more suitable for use by farmers as no mixing of insecticides is required.

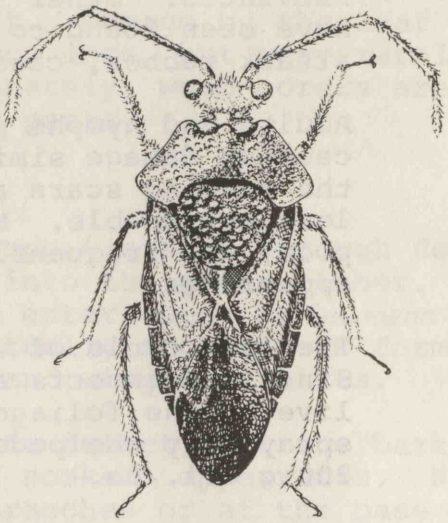
Dusting should be done during dry weather and early in the morning. The dew on the cocoa trees will help the dust to stick to them. One 25 kg bag will be enough to dust two hectares.

A second dusting round is essential after 14-16 days and as with spraying, a close watch should be kept for signs of a new outbreak.

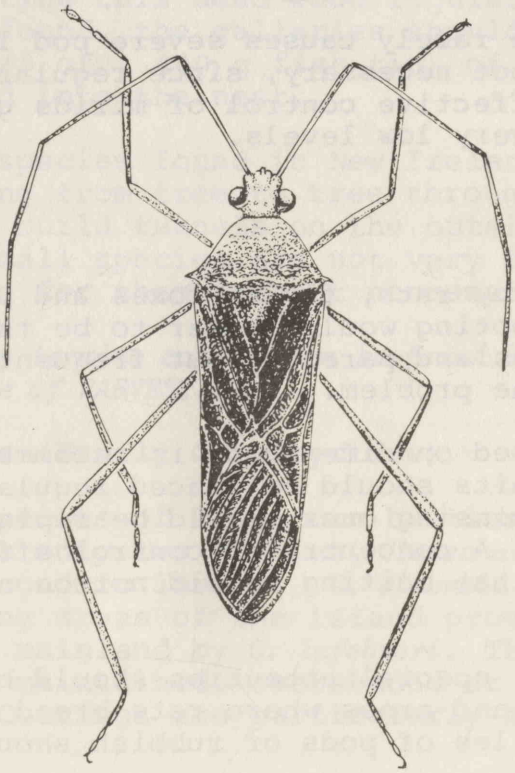
The reason for spraying or dusting only every second line of cocoa trees is that these chemicals have a strong fumigant effect. This means that although some cocoa trees have not been sprayed or dusted the mirids on them will be killed by insecticide spreading through the air from the treated trees in the next row.



Helopeltis clavifer. *This cocoa mirid is shown 9 times its natural size in the diagram*



Pseudodoniella laensis. *This cocoa mirid is shown 6 times its natural size in the diagram*



Amblypelta theobromae. *This diagram shows the insect at 4 times its natural size*

2. *Amblypelta* (Family Coreidae)

Several species of *Amblypelta* have been recorded from cocoa in Papua New Guinea, but only *A.theobromae* causes economic damage and then only in the Northern, Milne Bay and Morobe Provinces. Other species such as *A. cocophaga* and *A. lutescens* have been found to feed on coconuts causing nutfall, and to attack rubber, cassava and other useful plants.

Adults and nymphs pierce cocoa pods with their mouth-parts causing damage similar to that made by mirids, except that the feeding scars are larger, brownish, more elongated and less noticeable. Most punctures are in the 'seams' of the pods, and frequently cause deformed pods with a knobbly appearance.

The life cycle of *Amblypelta* takes about 6 weeks to complete. Since the insects are found only on the pods, and do not live in the foliage, present control recommendations are to spray only the pods on cocoa trees using lindane at 150-200 g a.i./ha.

3. Pod borers (Family Tortricidae)

The pod borers, *Olethreutes* sp. and *Cryptophlebia* sp. can attack pods at any stage of development, but most frequently are found in almost mature pods. Larvae of the moths bore into the outer pod husk, and this damage may allow entry of fungi. Damage is generally greater when associated with mirid infestations.

Infestation rarely causes severe pod loss, and control measures are not necessary, since regular harvesting of ripe pods and effective control of mirids generally reduces damage to very low levels.

VERTEBRATE PESTS

Damage to ripe pods by rats, flying foxes and parrots can occasionally be severe. Shooting would appear to be the only method of control for flying foxes and parrots, but frequent harvesting of ripe pods would lessen the problem.

The use of baits based on difenacoum is recommended for severe infestations of rats. Baits should be placed regularly throughout the affected area, and missing ones should be replaced at weekly intervals for 2-3 weeks. A concentrated control effort should reduce the population so much that baiting should not be necessary for the following 12-18 months.

During infestations, special attention should be paid to general plantation hygiene, and areas where rats breed or shelter, such as weedy drains, and piles of pods or rubbish should be cleaned up or heavily baited.

It is also important that natural predators or enemies of rats such as owls, hawks and snakes, should not be killed unnecessarily.

WOOD BORERS

Members of this group of pests cause much more serious damage than those of the previous groups. Termites and the larvae of *Pantorhytes*, longicorns and *Pansepta*, bore into the trunk and branches, permanently weakening the tree and sometimes killing it. Damage by the leaf defoliators and pod feeders may cause heavy crop loss, but very rarely results in the death of the tree. Unfortunately, wood borers are more difficult to control than these other pests.

1. Termites (Family Kalotermitidae)

   The giant cocoa termites *(Neotermes* spp.*)* attack through dead wood on the trees and then tunnel into the green timber. They spread by winged adults which enter cocoa or *Leucaena* trees through dead branches. Eventually a colony is formed which consists of soldier, worker and winged termites.

   An infestation is often difficult to detect, but the bark over the nest usually has a 'water soaked' appearance. Nests often occur at the forks of main branches or at the base of the tree, and frequently the first signs of an infestation are breaking branches or the tree falling over at ground level. If the wood is broken open, termite channels will be found.

   Control is largely a matter of preventing attacks by pruning off all dead wood with clean cuts to prevent stumps remaining, and inspecting this dead wood regularly. Where an infestation is found, the galleries should be opened and about 300 ml (2/3 of a 440 g fish tin) of 0.2% chlordane should be poured into the nest.

   A second giant species found in New Ireland attacks through the roots, moving from tree to tree through the soil. Two smaller species build tunnels on the outside of the cocoa trees. These small species are not very damaging and special control measures for them are not necessary.

   More information on termite control can be found in Entomology Bulletin No. 2 in this issue of HARVEST.

2. Longicorn borers (Family Cerambycidae)

   Although many species of longicorn beetles attack cocoa in Papua New Guinea only two species, *Glenea aluensis* and *Glenea lefebueri* cause economic losses. *G. aluensis* is found in all the cocoa growing areas of the island provinces, but is replaced on the mainland by *G. lefebueri*. The heaviest attacks occur in poorly maintained, overshaded or poorly drained cocoa blocks. Cuttings are particularly susceptible to attack.

   The adult beetle lays a single egg on the lower part of the trunk or occasionally of the branches. After hatching, the young larvae tunnel under the bark and later move deeper into the sapwood. Since the grubs move in a horizontal or spiral direction, young trees may be ringbarked, or the combined

attack by several larvae may either kill a tree or branch, or severely weaken it so that it may break in wind or heavy rain. In localised pockets, damage to trees may be very severe if infestations are not noticed and treated.

The channels are easily noticed by the mass of fibrous wood chips, produced in foamy, rusty coloured lumps, which are pushed out of ventilation holes at the edge of the channels and by the dark moist areas caused by sap coming out of smaller holes.

It is also becoming increasingly evident that longicorn channels provide a point of entry for the fungus which causes bark canker in cocoa. This canker disease may become very important in neglected plantations or in trees more than 12-15 years old and may result in heavy tree deaths in older, neglected blocks.

Longicorn larval channels can be distinguished from those of *Pantorhytes* by the masses of fibrous frass (droppings) pushed out from the tunnels. The frass from *Pantorhytes* channels is usually clear, very wet and contains no fibrous matter.

It is recommended that a 1.5% solution of dichlorvos or fenthion in 25% white oil be used to paint the larval channel. After removing the dried frass from the channel openings, the bark immediately over the channel should be scrubbed with a stiff brush and the insecticide solution should be applied with a brush. The roughening of the bark and the white oil in the mixture will assist in the penetration of the insecticide.

More information on the control of these longicorns is presented in Entomology Bulletin No. 3 in this issue of HARVEST.

Another species, *Oxymagis vitticolis*, has recently begun to damage cocoa trees in the North Solomons Province. The larvae of this species tunnels through the pith and sapwood of branches causing them to die back from the tip. The first symptoms of damage are clusters of dead leaves in the outer canopy and, on closer inspection, the end of the branch is found to have died. If the branch is then split, the larval channel can be seen. Five or more branches per tree can be attacked. Where such damage is noticed, it is recommended that each tree is inspected and that infested branches are pruned off every 3-4 days for one month. A regular fortnightly inspection and pruning round should then be maintained. Infested branches should be burnt or split open and the larvae should be destroyed. If a bounty (reward) is paid for the larvae, this will encourage people to remove them from the trees.

3. The cocoa webworm (Family Xyloryctidae)

Eggs of this moth *Pansepta teleturga* are laid on the green outer branches of cocoa trees. The larvae feed on the bark and burrow into the wood of these branches. The feeding area is

covered by a silken web mixed with frass. During heavy infestations, larvae may completely ringbark branches which then die. These infestations usually occur under conditions of very light shade. The cocoa webworm occurs on the Papua New Guinea mainland and on some of the islands of the Bismarck Archipelago. It has been recorded as a pest of cocoa only on New Britain, where infestations may be severe.

There are a number of parasites which control natural *Pansepta* populations. However, in some areas, these are only partially effective.

Long term control may be achieved by maintaining higher levels of shade. Other control measures, although not fully effective, consist of painting the damaged areas with a 0.3% solution of dimethoate. It is only considered necessary to do this for infestations in young cocoa which still has an unclosed canopy.

4. Coffee stem borer (Family Cossidae)

The larva of this moth *Zeuzera coffeae* bores along the centre of young stems or branches and may kill them. It is more damaging where shade is light, but infestations are rarely very serious. Regular rounds of pruning and burning affected branches will control this pest.

5. Cocoa weevils (Family Curculionidae)

The cocoa weevils *Pantorhytes* are the most important pests of cocoa in Papua New Guinea, and one or more species of *Pantorhytes* can generally be found in any of the cocoa growing areas.

Eggs are laid in roughened bark or cracks in cocoa trees, after the trees have branched. Some younger trees may also be attacked near ground level. When the eggs hatch, the larvae bore into the sapwood of the trunk and main branches, causing serious structural weakening. Production drops markedly and frequently, heavily bearing branches will split from the main trunk at the jorquette, or the branches will be ringbarked. Many of the attacked trees die, either directly from the *Pantorhytes* damage or from canker infections which are associated with the larval channels.

More information on canker in cocoa is given in LAES Information Bulletin No. 25.

Larvae can live for 6-14 months in the trees and the adults survive on the trunk and foliage for up to two years. They feed on chupons, flush branches or the husks of pods and cherelles and can cause considerable damage to young cocoa replants if numbers are high. The females continue to lay eggs for most of their adult life.

Pantorhytes are the most difficult of Papua New Guinea insect pests to control culturally and insecticide spraying is difficult, long term and expensive. However, it has been shown that cocoa grown under coconuts is generally much less severely attacked by *Pantorhytes* than that grown under shade

trees such as *Leucaena*. Also, where populations are low, or *Pantorhytes* have recently invaded a block, hand collection and destruction of adults and painting insecticide on larval channels is useful in preventing a rapid build up in numbers and in keeping damage at a low level.

D.P.I. policy has been to develop an approach to *Pantorhytes* control using many methods, in the hope of achieving low and stable pest populations. The use of different shade levels and of enemy ant colonies are two of the methods used. The current recommendations for *Pantorhytes* control are:

(i) Reduce or prevent the spread of *Pantorhytes* into new or established plantings by removing alternative host plants (other plants they can eat) and establishing a barrier of plants they can't eat between uncleared regrowth or primary bush and cocoa blocks. The adults are flightless and are reluctant to walk across these barriers. It is therefore recommended that the alternative host plants *Pipturus argenteus*, *Melochia odorata* and *Schuurmannsia* sp. are removed, and that a barrier strip, 15 m wide, of *Pueraria*, *Mimosa* or grass be planted.

(ii) In areas of the country where *Pantorhytes* are likely to be damaging, all new cocoa blocks should be interplanted under coconuts which are at least 4 years old. Interplanted cocoa is usually much less severely attacked by *Pantorhytes*. Palms should be at least 4 years old so that they can provide enough shade and not be 'overtaken' by the growth of the young cocoa.

(iii) In blocks of sole planted cocoa already heavily infested with *Pantorhytes*, colonies of crazy ants should be introduced. It has been shown many times that crazy ants and *Pantorhytes* cannot live together in cocoa. Where crazy ants occur in large numbers, *Pantorhytes* is never a significant pest. It has also been demonstrated that if crazy ants move into cocoa then *Pantorhytes* will be forced out. However, the introduction and establishment of crazy ants may not be easy and may often be unsuccessful.

The way in which crazy ants drive out Pantorhytes, *and a suggested method of introducing the ants to infested cocoa blocks is described in Entomology Bulletin No. 4 in this issue of HARVEST.*

(iv) In blocks of cocoa which are only lightly infested with *Pantorhytes* weekly hand collection and destruction of adults, plus painting larval channels with a 1.5% solution of dichlorvos or fenthion in 25% white oil (as for longicorn larvae) will give adequate control. Larval channel painting rounds should be carried out about every 2 weeks.

More detailed information on the control of Pantorhytes *in cocoa is given in LAES Information Bulletin No. 26.*

FURTHER READING

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Entomology Bulletins (in *Harvest* 5(3))

No. 2 - Control of termites in cocoa. (From *LAES Information Bulletin No. 17).*

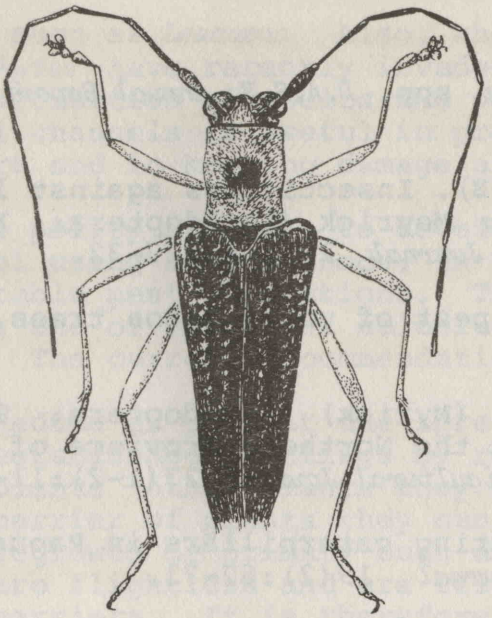
No. 3 - Control of trunk longicorns in cocoa. (From *LAES Information Bulletin No. 18).*

No. 4 - The use of crazy ants in the control of *Pantorhytes* in cocoa. (From *LAES Information Bulletin No. 16*).

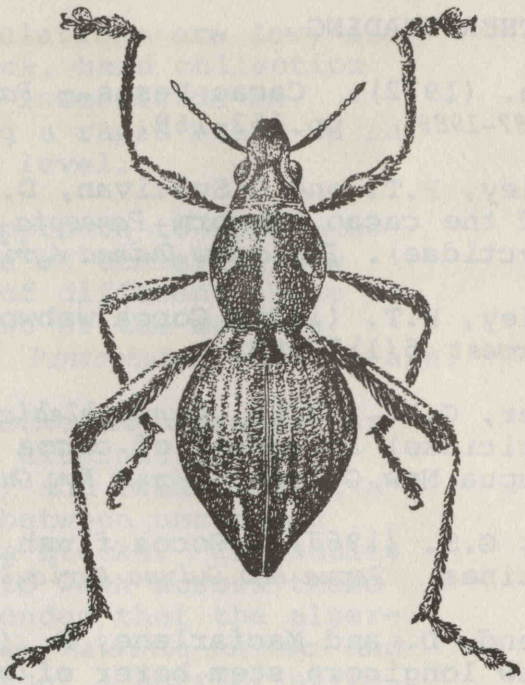
LAES Information Bulletins

No. 25 Canker in cocoa.

No. 26 Recommendation for the control of *Pantorhytes* in cocoa.



The longicorn borer Glenea aluensis *shown 4 times bigger than life size*



The cocoa weevil Pantorhytes plutus. *This insect is only one quarter the size shown in the diagram*