COCOA INSECTS IN THE SANGARA SETTLEMENT AREA OF THE NORTHERN PROVINCE

By E.S.C. Smith and P.M. Room

During 1972 a trial was conducted to obtain information on the abundance of many of the important cocoa pests and their distribution in relation to other insect or environmental factors. The information gathered, when analysed by a computer, indicated which of the biological and environmental factors were the most important in determining the distribution and abundance of the pests, and enabled guidelines for future research work in controlling the pests to be proposed.

Over the past 15 to 20 years, cocoa trees growing in the Northern Province have been severely damaged by a variety of insects. At present, the *Pantorhytes* weevil and the podsucking bug *Helopeltis* are the most important pests, but many other insects can cause damage by feeding on the pods or leaves of the cocoa trees.

Most of the cocoa produced in the Northern Province is grown under *Leucaena* shade trees, but in some blocks, this shade has been removed to prevent outbreak of the cocoa armyworm *Tiracola plagiata* and other leaf-eating caterpillars. Some small areas of cocoa have been planted under rubber, coconuts or *Erythrina* sp. shade, and there are a few blocks of cocoa planted directly into thinned primary forest.

During 1972, a study was made of the abundance and distribution of many of the important cocoa insect pests, and other factors in the cocoa environment which might affect them. These other factors might be for example shade, cocoa flush, other insects etc.

This information, when analysed, showed which factors were probably important in affecting the distribution and abundance of the pests, and so gave a guide to future research work. For instance, if it was found that a certain insect pest was associated only with cocoa grown under one type of shade tree and no connection with other factors was found, then it would be reasonable to suggest that by stopping the use of the shade tree, the particular cocoa pest problem would not be as bad, or might not occur.

Before recommending the use of a different shade tree, however, the associations of all the other pest insects to the new shade tree would have to be examined in case the new conditions

especially suited a different insect pest, and so created a new problem.

The results of this study can of course only be applied directly to cocoa grown in the Sangara Soldier Settlement Area of the Northern Province and the particular pests found there.

SAMPLING METHODS

Sampling was carried out on one day every two weeks between December 1971 and January 1973. On each day, four trees were sampled in the morning from one block, and a further four trees from a different block were sampled during the afternoon. The blocks were selected from maps of the cocoa-growing area, and chosen so that the afternoon block was situated a long way from the morning block, thus giving representative samples covering the whole land settlement area.

Trees were selected at random within each block, and at each sample tree, the number of *Pantorhytes* larvae and the larval predator-parasite *Nephrotoma* found in trunk channels were recorded.

Environmental factors were also recorded at this time, and included weather conditions, type and amount of shade, the degree of damage by various insects and the condition of the cocoa canopy.

Trees were sampled either as "canopy samples", in which a white sheet 3 metres square was spread on the ground under the canopy space between four trees, or as "trunk samples" when a different sheet with a split in it was placed around the trunk of the tree.

A quick-acting insecticide (pyrethrum) was sprayed into the cocoa trees above the sheets, and all the selected pests, predators and parasites which fell onto the white sheets during the next 30 minutes were collected as shown in *Plate I*, and taken to the laboratory.

There the insects were sorted, identified and counted *(Plate II)*.

RESULTS

The pest insects collected from 200 trees and their abundance are shown in *Table 1*.

Pantorhytes weevil was by far the most abundant pest, occurring on 65% of all trees sampled, followed by *Helopeltis*, *Ectropis* and *Tiracola*. *Amblypelta* occurred in a large number of samples, but usually only in low numbers. The figures for these adult *Amblypelta* bugs were low since they fly from the tree as soon as spraying begins, and so are missed in the sampling.

The other pest species listed were less common.

The records for predators, parasites, condition of trees, environmental factors and shade tree species are shown in *Table 2*.

In addition to the insects mentioned above, a further nine predators of either *Pantorhytes* or *Helopeltis* and a further three parasites of *Pantorhytes* were recorded. These insects occurred in such low numbers that they were not included in the analysis.

All the data collected were analysed using a computer, which showed whether any of the factors recorded (either insect or environmental) were associated with any of the other factors.

If, for example, a certain pest was found on more than 95 out of 100 cocoa trees under a particular kind of shade tree, but under any other shade tree was found to a much lesser extent, then the computer would show that the pest was associated with the first shade tree species. This would mean that of any other 100 cocoa trees sampled under that shade tree, 95 would be expected to contain the pest insect. In this case the pest is "positively associated" with the shade tree, but if the pest was found in less than five out of the hundred cocoa trees under the shade tree species, it would be termed "negatively associated" with the shade tree.

The actual analyses were much more complicated than the simple description above. The levels of greater than 95% or less than 5% associations were set as limits in this study. The main positive (+) and negative (-) associations between factors are shown in *Table 3*. Columns having neither a + nor a- sign indicate nonsignificant associations between factors.

In addition, all four flush-eating insects were positively associated with one another. The analysis did not reveal any associations between months and only a few between quarters (three monthly records combined) and any of the insect or environmental factors. This suggests that the effects of changing seasons on the factors recorded are fairly slight compared with the effects acting between factors. The quarterly associations showed that the proportion of samples with sunshine, podsucker damage, *Tiracola* and *Achaea* increased during the first nine months of 1972, and then decreased in the final three-month period. Cocoa flush, present in a steady 38% of the samples in the first three quarterly periods, increased dramatically during the last quarter. This is probably associated with the breaking of an abnormally severe dry season drought lasting from July to October 1972.

DISCUSSION AND CONCLUSIONS

The aim of the project was to obtain information on the abundance of the main cocoa pests, and their distribution in relation to other insect and environmental factors. *Pantorhytes* was by far the most abundant pest sampled. This insect is the most damaging pest of cocoa trees since the larvae bore into trunks and branches of the trees, permanently weakening them and often killing them. Podsuckers and flush-eating caterpillars, however, rarely cause the death of bearing trees, but may very seriously lower crop production.

Table 3 shows two factors which are negatively associated with *Pantorhytes* — coconut shade and *Anoplolepis* (crazy ants). This means that where cocoa is either grown under coconut shade, or is

infested by crazy ants, *Pantorhytes* in damaging numbers are usually not present.

The positive association of *Pantorhytes* with *Nephrotoma* was to be expected since the crane fly is a parasite of *Pantorhytes* larvae.

The positive association of *Pantorhytes* with no shade was also expected, since another worker has previously reported that heaviest populations of *Pantorhytes* occur in cocoa grown without shade (Hassan: *Harvest* Vol. 1 No.3).

Leucaena shade is unsuitable for cocoa as is shown by the positive association with podsuckers *(Helopeltis)* and leaf-eating caterpillars.

No methods of growing completely pest-free cocoa are suggested by the results. They do indicate however several ways of growing cocoa in which *Pantorhytes* populations may be kept at a low level, and in which direction research into the pest problem could proceed. Such work could include -

1. Investigation into the use of coconuts as a shade tree for cocoa in the Northern Province. The results described here are strengthened by previous findings that:-

   (a) Populations of *Pantorhytes* under coconut shade stabilize at a level which does not result in economic damage to the trees.

   (b) In the New Guinea islands, where cocoa is grown under coconut shade, no caterpillar attack has occurred.

   (c) *Helopeltis* populations were consistently lower, and of little economic importance on cocoa grown under coconut shade when compared with cocoa grown under *Leucaena* or without shade.

2. Investigations into the use of crazy ants in controlling *Pantorhytes*-

   (a) Previous work has described how crazy ants drive *Pantorhytes* adults from an infested area, and prevent recolonization by the weevil while the ants are present.

   (b) Some planters in the Northern Province have successfully used this method of control for some time, but have encountered problems with maintaining ant populations.

3. Investigations into the biology of the predator-parasite *Nephrotoma* as a means of controlling *Pantorhytes* larvae.

Some work has begun in the Gazelle Peninsula on the first two of the above points.

The investigation also suggests that the insecticide knockdown method could be extremely useful to analyse pest situations in other crops. However care must be taken in crops previously unstudied not to project results gathered from small plots directly into large scale areas, as conditions may be completely different from these experienced in a large area of the same crops.

FURTHER READING

Room, P.M. and Smith, E.S.C. (1975). Relative abundance and distribution of insect pests, ants and other components of the cocoa ecosystem in Papua New Guinea *J. appl. Ecol., 12:* 31 - 46.

Plate I. - The entomology team collecting all insects knocked down from the cocoa trees by the pyrethrum insecticide.

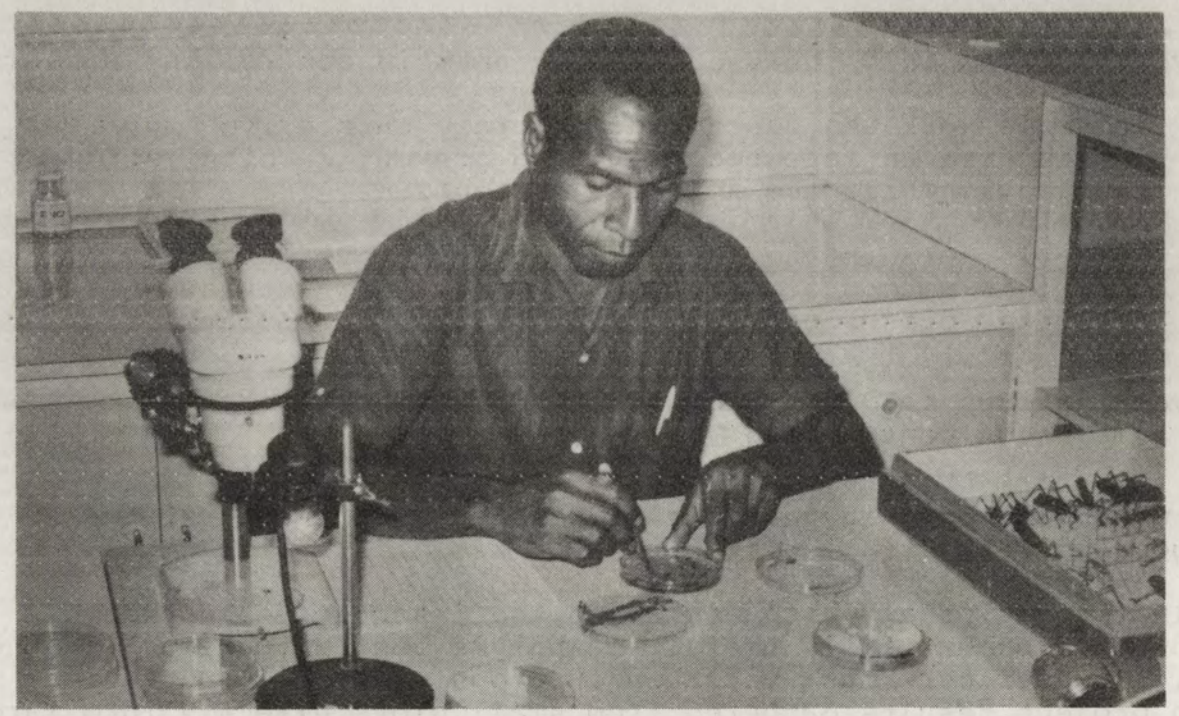

Plate II. - Sorting the collected insects in the laboratory.

TABLE 1. - ABUNDANCE OF PEST INSECTS IN 200 COCOA TREE SAMPLES

Pest	Type of damage		Number of recordings	% occurrence	Total no. insects collected	Mean no. insects per recording
Pantorhytes szentivanyi (cocoa weevil)	Adult	Chews young growth	130	65	1 064	8.2
	Larva	Bores into trunk and branches.	88	44	262	3.0
Helopeltis clavifer (cocoa mirid)	Adult and nymph	Suck pods	88	44	512	5.8
Amblypelta theobroma (amblypelta)	Adult and nymph	Suck pods	62	31	119	1.9
Pseudodoniella laensis (red capsid)	Adult and nymph	Sucks pods	2	1	2	1.0
Tiracola plagiata (cocoa armyworm)	Larva	Flush defoliator	40	20	667	16.7
Ectropis sabulosa (cocoa looper)	Larva	Flush defoliator	60	30	454	7.6
Hyposidra talaca (cocoa looper)	Larva	Flush defoliator	30	15	163	5.4
Achaea janata (cocoa false looper)	Larva	Flush defoliator	17	9	46	2.7

Table 2 - FACTORS PRESENT DURING THE SAMPLING OF 200 COCOA TREES

Factor	No. of recordings	% occurrence
Pest predator		
Technomyrmex albipes (black ant)	114	57
Anoplolepis longipes (crazy ant)	80	40
Oecophylla smaragdina (kurukum)	28	14
Pristhesancus femoralis (assassin bug)	31	16
Euagorus sp. (assassin bug)	22	11
Pest parasite		
Nephrotoma spp. (crane fly)	43	22
Shade tree		
Leucaena leucocephala	136	68
No shade	52	26
Coconuts	19	10
Thinned forest	16	8
Cocoa conditions		
Good canopy	122	61
Flush present	89	45
Podsucker damage heavy	14	7
Environmental factors		
Top shade heavy	52	26
Sample taken with sun shining	124	62
Sample taken in morning	105	53
Canopy sample	100	50

Table 3 - THE MAIN POSITIVE (+) AND NEGATIVE (-) ASSOCIATIONS BETWEEN FACTORS.

	Pantorhytes adult	*Pantorhytes* larva	*Helopeltis*	*Amblypelta*	*Tinaola* *	*Ectropis**	*Achaea**	*Hyposidra**	*Technomyrmex*	*Anoplolepis*	*Oecophylla*	*Nephrotoma*
Leucaena			+	+	+	+	+	+			-	
No Shade		+	-		-		-	-	-			+
Coconut Shade	-	-										
Thinned bush shade			-			-				+		
Good canopy	-		+	+			-		-	+	-	
Cocoa flush	-	-	-		-							-
Technomyrmex	+				+					-		
Anoplolepis	-	-							-		-	-
Oecophylla			-							-		-
Nephrotoma	+	+			+		+			-	-	

* All four flush defoliators are positively associated with each other
Columns having neither a + nor a - sign indicate non-significant associations between factors