

ENTOMOLOGY

New Pests of Cocoa (*Theobroma cacao* L.) in Ghana following Applications of Insecticides

VARIOUS chlorinated hydrocarbon insecticides have been tested in large field trials in Ghana in recent years against the cocoa capsids *Sahlbergella singularis* Hagl. and *Distantiella theobroma* (Dist.). Great success has led to the widespread use of γ -BHC in routine control. One of the most persistent of these insecticides, 'Dieldrin', has also been used experimentally with great promise for controlling the principal vector of cocoa swollen shoot disease (the mealybug, *Pseudococcus njalensis* Laing) by decreasing the populations of its attendant ants¹.

The use of these chemicals however has been accompanied by increases in other noxious insects not normally important as pests, and we cite this as yet another example of the swift, adverse reactions which often follow a disturbance in insect population balance. Such new pests are, perhaps, not likely to cause losses in any way comparable to those associated with capsids and swollen shoot disease: but they can nevertheless have a very high incidence² (Table I) and may become very serious.

There was early indication of what can happen in 1955 near Bunsu, after a heavy spraying with γ -BHC at 6-8 oz. toxicant/acre in 1954: the stem borer, *Tragocephala nobilis* F. var. *castnia* Thoms. (Coleoptera, Cerambycidae) then increased in numbers, we think, as the result of spraying. In 1957 a spectacular increase in the pod-husk miner, *Marmara* sp. *unident* (Lepidoptera, Gracillariidae) followed six monthly applications of dieldrin at 4 oz. toxicant/acre as an anti-capsid spray at the West African Cacao Institute³. Similar outbreaks in other parts of Ghana also occurred, notably at Oyoko following two applications of 'Dieldrin' (1 lb./acre at approximately 3 months' interval) against the attendant ants of *P. njalensis*. This increase on sprayed compared with unsprayed areas and the diminution of incidence with distance from sprayed areas is discussed elsewhere². Both the *Tragocephala* and *Marmara* decreased when the concentration and frequency of sprays were reduced.

Early in 1959 after two further applications of 'Dieldrin' (1 lb./acre in June and August, 1958) against ants in the experiments at Oyoko two other insects became unusually prevalent. These were *Eulophonotus myrmeleon* Feld. (Lepidoptera, Cossidae), a borer in the main trunk and branches: and an unidentified lepidopteron (probably two species, both belonging to the Metarbelidae) whose larvae make a web, usually at branch junctions beneath which the bark is devoured; the stem is usually ring barked and the larvae make a short gallery into the heart-wood. Table 1 compares incidences in sprayed and unsprayed areas (200 acres each) eight months after the second spray: populations also diminished with distance from sprayed areas.

Estimates were made from the ground only and therefore are minimal. Counts on treated and control areas were made on 800 trees in each area, taken along diagonal transects. Counts at the three different distances from the margin of the treated area were on 600 trees at each distance (in 3 batches of 200 at separate sites).

Little is known of the mechanism of these increases: presumably natural enemies are destroyed. The new

Table 1

Distance from sprayed area (ft.)	Percentage of trees attacked	
	<i>E. myrmeleon</i>	<i>unident</i> sp.
within sprayed area	19.2	27.8
50-100	6.1	8.3
100-150	3.1	4.6
500-550	1.5	3.3
1 mile (unsprayed control area)	0.6	0.3

pests are borers or miners, presumably less exposed to the effects of spraying than their parasites. Normally 60-70 per cent of *Marmara* larvae are parasitized⁴ and destruction of parasites would be expected to produce a striking effect. Cocoa moreover supports many defoliators which have not, so far, increased after spraying, perhaps because host and parasite are both exposed.

Preoccupation with the control of the two outstanding pests of cocoa in West Africa, capsids and the mealybug vectors of swollen shoot disease, may have given the impression that control of these pests is all that is needed; the appearance of new pests following spraying underlines again the importance of a study of the ecology of not only actual but of potential pests of cocoa and of other, especially perennial crops. Furthermore, the conquest of capsids makes it possible to alter advantageously the methods of cocoa cultivation by reducing shade⁵: this has further repercussions on the pest populations and emphasizes the need for more biological work on the general insect populations of cocoa⁶ against the time when even more and newer insecticides may be called in to meet a changing situation.

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¹ Entwistle, P. F., Ann. Rep. West. Afr. Cacao Res. Inst., 31 (1957-8).

² Johnson, C. G., and Entwistle, P. F., Ann. Rep. West. Afr. Cacao Res. Inst., 38 (1957-8).

³ Quart. Rep. West. Afr. Cacao Res. Inst., No. 47, 9 (1957).

⁴ Quart. Rep. West. Afr. Cacao Res. Inst., No. 51, 9 (1958).

⁵ Cunningham, R. K., and Lamb, J., *J. Hort. Sci.*, 34, 14 (1959).

⁶ Johnson, C. G., in "Agriculture and Land Use in Ghana" (Oxford Univ. Press; in the press).

Hormonal Control of Selective Feeding in Female *Calliphora erythrocephala* Meig

Calliphora females will live on a sugar diet but will not reproduce unless protein-containing substances are also ingested¹. The selection of carbohydrate and protein diets in relation to reproduction has been investigated over the last three years.

Isolated females were allowed to feed on solutions of carbohydrate (100 gm. sugar in 100 c.c. water) and protein (5 gm. 'Marmite' in 100 gm. milk which for the sake of simplicity will be referred to as 'protein') contained in identical capillary tubes. The capillary tubes were held just off the horizontal position so that although surface tension prevented the solutions from overflowing, the liquids continued to flow down the tubes as the food was ingested. In this manner selective feeding could be studied in individual females for as long a period as was desired.

The total volume of food ingested each day over a complete reproductive cycle was found to be fairly constant. Within this total however, protein and carbohydrate were selected in quantities which varied with different phases of the reproductive cycle. Thus