INSECTICIDES AGAINST LARVAE OF THE CACAO WEBWORM *PANSEPTA TELETURGA* MEYRICK (LEPIDOPTERA : XYLORYCTIDAE)

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ABSTRACT

Thirty-five insecticides were screened for effectiveness against larvae of Pansepta teleturga*, a woodborer in cacao trees. Several of the more promising insecticides were selected for field trials, using 1 or 2 of 3 methods of application:*

(i) spraying onto the web,
(ii) application of systemic insecticides to the bark, and
(iii) swabbing a dilute solution onto the feeding area.

Swabbing was the only effective method. Endrin, azinophos-ethyl and dimethoate were the most effective insecticides when swabbed. Dimethoate is recommended because of its comparatively low mammalian toxicity.

INTRODUCTION

Pansepta teleturga is a woodborer of cacao trees in some cacao growing areas of Papua New Guinea. When many larval channels occur in a young tree they may cause death of branches. Sometimes, when there are many larval channels in the main stem or in the jorquette, the young tree may die. In trees older than about 3 — 4 years, severe larval channelling may cause death of some branches, but no tree deaths directly attributable to *P. teleturga* have been observed. Because the effects of *P. teleturga* on young cacao trees are much more severe than on older trees, the field trials reported in this paper were done on young trees.

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METHODS

Laboratory Screening

Thirty-five insecticides were used in this screening trial. They were chosen so as to include representatives of the main insecticide groups.

These insecticides were applied to field collected 4th and 5th instar larvae of *P. teleturga* in 2 series of tests.

(a) Contact toxicity: Larvae were dipped into each insecticide for 2 seconds, dried on paper towel and placed on a fresh cacao water shoot in a petri dish.

(b) Stomach/some contact toxicity: Cacao water shoots were dipped into the insecticide solution, then placed in a petri dish with untreated larvae.

Each insecticide was applied in concentrations of 0.01%, 0.05%, 0.1% and 0.3% of active ingredient respectively to 20 larval replicates. The mortality after 3 days was recorded.

Field Trials

Three methods of applying the insecticides were used:

(1) swabbing the larval feeding area with insecticide

(2) spraying, and

(3) painting systemic insecticide onto the bark of the tree.

A swab is made and the insecticide solution applied to the feeding area on the bark with a single movement, which removes the outer frass and simultaneously applies the insecticide to the feeding area.

The spray was applied as a high volume solution by a motor powered sprayer to the web, which was not removed.

The systemic insecticide was applied in a 5 cm band around the main trunk at a level just below the lowest web, or if there were no webs on the main trunk, then just below the jorquette.

Mortality was determined as follows. The webs from each tree in the trial were removed with a wire brush. On the following day the trees were inspected, and only those channels in which new web had been spun over the channel opening were recorded in the pretreatment count. This excluded channels in which there were pupae, dead larvae, or empty holes. Seven days after the treatment was applied the trees were inspected and the number of active channels was recorded.

Each treatment was applied to a block of 100 trees except the *Bacillus thuringiensis* treatment, which was applied to 20 trees. The trees were 2.5 — 4 years old.

RESULTS

In the screening trials no insecticide less concentrated than 0.3% gave greater than 90% mortality. The results of the screening trial shown in *Table 1* are for 0.3% insecticide solutions only.

Insecticides were chosen for field trials so as to include representatives of most groups of insecticides, and with high larval toxicity, low mammalian toxicity and locally available at moderate prices. B.H.C. was also included because it is commonly used by plantations against *P. teleturga*.

Six insecticides, shown in *Table 2* were chosen for the swabbing trial, and are ranked in order of their effectiveness. The best 3 were endrin, azinphos-ethyl and dimethoate which gave between 85% and 90% (in round figures) mortality.

The biological control agent, *Bacillus thuringiensis* was applied on a swab to larvae in 20 trees. It was found that in addition to dead larvae, many larval channels were empty (*Table 3*). In the control trees there were no empty channels. The fate of those larvae which vacated their channels is not known, but it is assumed that they died. Thus the total mortality in the treated trees was 50% compared with 3% in the control trees.

In the spraying trial, only 3 of the selected insecticides were used; the other 3 were considered too dangerous to human health to use as a spray. *Table 4* shows the results of spraying 3 insecticides into webs. The most effective, dimethoate, gave only 38% mortality.

Two insecticides, monocrotophos and acephate were used as systemics. Acephate was not available at the time that the screening trial was done, but it was included in this field trial because of reports that it had been successfully used as a systemic insecticide in cacao in West Africa. The results of this trial are shown in *Table* 5. A dilute solution (6%) of monocrotophos was found to be ineffective, while a concentrated solution gave about 67% mortality.

Table 1. — **Laboratory Screening: Mortality caused by insecticides applied to larvae of *P. teleturga*.**
Also shown are tabulated values of mammalian toxicity.

GROUP	INSECTICIDE	Larval Mortality From		Mammalian Toxicity ""	
		Toxicity Contact*	Stomach/ Some Contact Toxicity*	Oral LD 50 mg/kg	Dermal LD 50 mg/kg
1. Biological	*Bacillus thuringiensis*	L	M	0	0
2. Botanical	nicotine sulphate	M	M	70	140
	pyrethrin/ piperonyl butoxide	M	H	570	1,350 — 5,400
3. Arsenical	lead arsenate	L	M	10 — 100	2,400
4. Chlorinated hydrocarbon	B.H.C.	M	H	300 — 500	2,500
	chlordane	L	L	283	1,600
	D.D.T.	L	L	300 — 500	2,500
	dieldrin	L	L	40	100
	endosulphan	H	H	35	74 — 680
	endrin	H	H	3 — 6	60 — 120
	heptachlor	M	L	40	195 — 250
5. Carbamate	aprocarb	L	H	80	2,400
	carbaryl	L	M	400	500
6. Organo-Phosphate	azinphos-ethyl	H	H	9	280
	bromophos	L	L	1,600 — 8,000	5,000
	carbophenothion	L	H	7 — 30	800
	chlorfenvinphos	M	H	10 — 155	30 — 108
	coumaphos	M	L	13 — 180	860
	diazinon	L	L	300 — 600	500 — 1,200
	dichlorvos	M	M	25 — 30	75 — 900
	dicrotophos	H	M	15 — 45	42
	dimethoate	L	H	200 — 300	700 — 1,150
	"Dyfonate"	M	M	23	130
	fenitrothion	L	L	130 — 200	700
	fenthion	M	H	200	1,300
	formothion	L	L	400	400 — 1,680
	"Imidan"	H	H	113 — 245	1,550
	maldison	L	L	1,400 — 1,900	4,000
	mevinphos	H	H	3 — 5	90
	monocrotophos	H	H	17 — 21	112
	parathion	L	L	3 — 6	4 — 35
	phosalone	M	H	120 — 170	390
	"Schradan"	L	L	5	50 — 100
	T.E.P.P.	L	L	0.5	20
	trichlorphon	L	L	650	2,800

*L = low (0 — 50%) mortality M = medium (51 — 90%) mortality
H = high (91 — 100%) mortality "" From Ben-Dyke *et al* (1970)

Table 2. — Field Trial
Insecticides swabbed onto larval feeding area

Treatment	Pre-treatment Count (Larvae/100 Trees)	% Mortality (Corrected for Controls*)
0.3% endrin	1363	89.7
0.3% azinphos-ethyl	1124	85.9
0.3% dimethoate	1044	84.6
0.3% monocrotophos	2046	79.8
0.3% aprocarb	672	76.0
0.3% B.H.C.	1,146	16.7
control	917	(68.8)

* Using Abott's Correction (Busvine, 1957)

Table 3. — Field Trial
Bacterial solution swabbed onto larval feeding area

Treatment	Pre-treatment Count (Larvae/20 Trees)	%Dead	%Empty Channels
0.3% *Bacillus thuringiensis* ("Dipel" : Abbott)	120	31.7	18.3
Control	94	3.2	0

Table 4. — Field Trial
Insecticides sprayed onto web

Treatment	Pre-Treatment Count (Larvae/100 Trees)	% Mortality (Corrected for Controls*)
0.3% dimethoate	394	38.1
0.3% B.H.C.	411	24.3
0.3% aprocarb	341	17.3
control	917	(68.8)

* Using Abott's Correction (Busvine, 1957)

Table 5. — Field Trial
Insecticides painted onto bark

Treatment	Pre-Treatment Count (Larvae/100 Trees)	% Mortality (Corrected for Controls*)
6% monocrotophos	228	0
60% monocrotophos	117	66.9
Control	156	(27.6)
60% acephate	79	36.0
Control	104	(6.2)

* Using Abott's Correction (Busvine, 1957)

DISCUSSION

A number of insecticides gave good results when applied to larvae of *P. teleturga* in the laboratory. However, their effectiveness in the field depended upon the method by which they were applied.

Systemic insecticides would appear to be an ideal way of controlling wood-chanelling insects such as *P. teleturga*. However, the better systemic insecticide, monocrotophos, only killed 67% of larvae when applied as a 60% solution. It was noted that larvae which were distant from the point of application and those with channels close to the surface of the stem, survived the treatment. Some phytotoxic symptoms were also noted. It was thought that a more dilute solution (6%) might avoid the problem of phytotoxicity and also obviate the problem of unskilled workers handling concentrated insecticide. However, at 6% concentration, monocrotophos was ineffective.

There have been a number of attempts to use systemic insecticides in cacao trees, but the results have been variable. Bowman and Casida (1958) studied the passage of a number of insecticides through cacao trees in Costa Rica and found that they were distributed throughout the plant. However, these authors did not test the actual effectiveness of their insecticides against insects in the field. Dunn and Ward (1965) using radio-phosphorus in dimethoate, found that only 11% of the insecticide effectively entered the tree and, of this, 83% remained within 0.3 metres of the point of injection.

Spray application of insecticides was not effective because the insecticide did not penetrate the protective web to reach the feeding area. The most effective insecticide tested in this way, dimethoate, may have owed its superiority over others to a possible local systemic action.

The only method tested and found to be effective was by swabbing. This method has the advantage that the insecticide is applied directly to the feeding area. On the other hand, it is a labour-intensive method and it is probably not economically worthwhile to treat trees older than 4 — 5 years in this way.

Of the insecticides which were tested by swabbing, dimethoate (Rogor) is recommended because it is comparatively effective and somewhat less toxic than the others. Dimethoate is more expensive than some of the other effective insecticides. However, in plantation-scale swabbing operations it is estimated that the cost of insecticide is only a small part of the total cost of the operation.

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