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LABORATORY SCREENING OF SOME INSECTICIDES FOR THE CONTROL OF THE CACAO POD BORER, *CONOPOMORPHA CRAMERELLA* (SNELLEN)[1]

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ABSTRACT

Seventeen commercially available insecticides were tested in the laboratory for their effectiveness against the destructive cacao pod borer, *Conopomorpha cramerella* Snellen at the Davao Experiment Station of the Bureau of Plant Industry of Davao City. Four of these, namely; deltamethrin and cypermethrin applied at 0.0012 percent A.I. and azinphos-ethyl and azinphos-ethyl + BMPC applied at 0.025 per cent A.I. were found to possess excellent ovicidal, larvicidal and fumigant activities against the same pest.

Key words: Cacao pod borer, *Conopomorpha cramerella*, control, deltamethrin, cypermethrin, azinphos-ethyl, azinphos-ethyl + BMPC.

INTRODUCTION

The cacao pod borer, *Conopomorpha cramerella* (Sn.) is considered the most serious pest of cacao in the Philippines. Infested pods produce malformed and inferior quality beans and low weight as a consequence of larval feeding on the pulp and placenta. Reduction in yield attributed to this pest could go as high as 60-80 per cent.

It has been generally argued that the ultimate solution to the cacao pod borer (CPB) problem requires an integrated management approach employing the combination of chemical, cultural and biological means. Chemical control still plays a crucial role in formulating integrated management scheme. The practice gained considerable acceptance among the big and progressive cacao planters constituting more than 90 per cent of the cacao producers in Southeastern Mindanao.

Published accounts during the last two decades on insecticidal control of the CPB (Laoh, 1954; Eloja and Gandia, 1962) demonstrated the effectiveness of organochlorines such as DDT, aldrin, dieldrin and gamma BHC. However, due to their toxicity and environmental hazards, these were banned for agricultural use by the Fertilizer and Pesticide Authority. In early 1980, Vanialingam et al. (1981) reported that gamma BHC with deltamethrin were highly promising for the control of the cacao pod borer. Locally available insecticides were evaluated for their efficacy against the different stages of the CPB for eventual recommendation to small-scale cacao growers. This study was undertaken at the Davao Experiment Station, Bureau of Plant Industry, Davao City.

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MATERIALS AND METHODS

Mass production technique for CPB eggs:

Screening insecticides for ovicidal and larvicidal activities and formulating economic threshold level for CPB require mass production and availability of sufficient number of eggs. Ordinarily, CPB eggs could be retrieve from the rind of mature cacao pods placed inside an oviposition cage, but it is difficult to collect eggs attached on the pod surface. Mechanical handling of eggs using a single strand camel's hairbrush causes 90 to 95 per cent mortality. This difficulty was somehow corrected by adopting a simple technique developed by artificially mass-producing eggs of the CPB in the laboratory. The technique consisted of wrapping a 10-13 week old cacao pod with an ordinary single-ply tissue paper moistened with the aid of a wash bottle and air dried inside an 11 x 11 x 5 cm. oviposition cage. Field collected female moth released inside the cage were induced to lay eggs on the surface of the tissue paper. After two days, eggs were separated individually by cutting-off the portion of the tissue paper containing the eggs with a surgical scissor.

Adoption of this procedure achieved an estimated 93.34 per cent egg hatchability and 98.75 per cent success of burrowing into the inner cacao pod surface by the emerging first instar larvae.

Experimental procedure:

Seventeen insecticidal compounds were evaluated for their ovicidal activities in the laboratory. Organophosphate and carbamate groups of insecticides were tested at three concentrations namely: 0.017, 0.025 and 0.05 per cent active ingredients (AI). On the other hand, synthetic pyrethroid-based insecticides were evaluated at concentrations of 0.0006, 0.0012 and 0.0024 per cent AI.

Ovicidal tests:

Ten eggs were singly placed on circular filter paper the size of a peso coin previously soaked in formulated insecticidal solution. The control consisted of a similarly prepared filter paper soaked in water before introducing the same number of eggs. The experiment was replicated four times following an RCB design. Eggs that failed to hatch were automatically considered dead.

Larvicidal tests:

All the insecticides used in the preceeding test, except dimethoate and diazinon, were further evaluated for their larvicidal activities against the emerging first instar larvae. The test was made on 17-19 week old caged pods of cacao trees. Batches of ten day old eggs were introduced separately on these caged pods of few hours, 7 and 14 days after chemical spray application with the use of an atomizer. The tissue paper containing the eggs was secured by pasting it on the surface of the treated pods with the sticky sap from cacao cherelle pods. To differentiate eggs introduced at varying intervals, the filter papers containing the eggs were cut into triangular, square and trapezoidal shapes.

Synthetic pyrethroid at 0.0012 percent AI and the remaining insecticides at 0.025 per cent AI were used during the experiment. Larval mortality count was

recorded a week after the third batch of egg was introduced or 21 days after spray treatment. This was done by employing the destructive sampling method of carefully dissecting the cacao pod with a sharp scalpel. With the aid of a binocular microscope, the extent of the entry punctures inflicted by the burrowing first instar larvae on cacao pod surface was determined. Absence of any signs of initial tunelling was assumed to indicate death of the first instar larvae while feeding on the surface of treated pods.

Fumigant action:

The fumigant action of four promising insecticides, namely, azinphos-ethyl, azinphos-ethyl + BMPC, deltamethrin and cypermethrin which are reported to possess with ovicidal and larvicidal properties were evaluated in the laboratory following the procedure described by Valencia and Heinrichs (1981) 1982.

Leaves attached to secondary branches were sprayed with the insecticidal solutions then air-dried and placed inside the lower compartment of the cage. Thereafter, ten field collected adult moths were released inside the upper compartment of the nylon cage. Ten per cent sugar solution saturated in a wad of cotton was placed at the center of the floor at the upper compartment as food source. Moth mortality was recorded 24 hours after release. The experiment was replicated four times in an RCB design.

RESULTS AND DISCUSSION

Ovicidal evaluation:

All seventeen insecticides tested except diazinon and dimethoate possessed good ovicidal activity against the CPB. Synthetic pyrethroids and the other insecticides tested caused more than 80 per cent mortality at low dosages of 0.0006 and 0.017 per cent AI (Table 1).

Larvicidal evaluation:

Further tests, using the insecticides with good ovicidal activity against the emerging first instar larvae, indicated that the first four compounds found as highly promising are deltamethrin, cypermethrin, azinphos-ethyl + BMPC and azinphos-ethyl. These insecticides caused mortality exceeding the 80 per cent level 14 days after spray application (Table 2).

Fumigation evaluation:

When used for their fumigant action against the adult stage of the CPB, both azinphos-ethyl and azinphos-ethyl + BMPC treatments at 0.012 and 0.025 per cent AI caused significantly higher mortality compared to either deltamethrin and cypermethrin applied at 0.0006 and 0.0012 per cent, respectively (Table 3.)

The efficacy of deltamethrin, cypermethrin, azinphos-ethyl and azinphos-ethyl + BMPC as ovicide, larvicide and fumigant against the CPB had also been similarly noted by several cacao entomologists. Vanialingam, et al. (1982) reported the effectiveness of azinphos-ethyl and deltamethrin when applied against the eggs and adults of the CPB. Deltamethrin and cypermethrin were reported by Sidhu (1984) as highly consistent in their performance in reducing CPB infestation and

yield loss. Lim, et al. (1986) reported that application of deltamethrin and cypermethrin reduced the level of CPB infestation by as much as 40 per cent over that of the control primarily because of their excellent fumigating properties against adults found at the underside of jorquette branches.

Table 1. Percent mortality of cacao pod borer eggs exposed to different insecticide concentrations under laboratory condition. Bago Oshiro, Davao Experiment Station.

INSECTICIDES	CONCENTRATION (% AI)[1]		
	.05	.025	.017
Azinphos-ethyl + BMPC	100.0 a	100.0 a	100.0 a
Carbaryl EC	100.0 a	100.0 a	100.0 a
Methomyl	100.0 a	100.0 a	100.0 a
Hawk 500 E	100.0 a	100.0 a	100.0 a
Triazophos	100.0 a	97.2 a	100.0 a
Phenthoate + BMPC	100.0 a	100.0 a	97.2 a
Azinphos-ethyl	100.0 a	97.2 a	96.9 a
Malathion	100.0 a	96.9 a	96.9 a
Methyl Parathion	100.0 a	97.2 a	94.0 ab
Endosulfan	100.0 a	100.0 a	85.7 ab
Monocrotophos	100.0 a	97.2 a	81.4 b
Phenthoate	100.0 a	100.0 a	97.2 a
Diazinon	100.0 a	91.7 a	57.4 c
Dimethoate	50.0 b	31.7 b	28.0 c
	0.024	0.0012	0.0006
Deltamethrin	100.0 a	100.0 a	97.5 ab
Cypermethrin	100.0 a	95.0 a	92.2 ab
Permethrin	100.0 a	97.2 a	85.7 ab
Control	0	0	0

[1]Average of four replications, each replicate containing 10 treated eggs. Within a column, means followed by the same letter are not significantly different from each other at 5% by DMRT. Egg mortality was recorded 7 days after treatment and data adjusted using Abbot's formula.

Table 2. Per cent mortality of first instar *C. cramerella* larvae exposed to cacao pods treated with insecticides. Bago Oshiro, Davao Experiment Station.

INSECTICIDES	DURATION AFTER SPRAY APPLICATION[2]		
	Just after spraying	7 days	14 days
Deltamethrin	100.0 a	98.8 a	96.4 a
Cypermethrin	100.0 a	94.5 ab	92.3 a
Azinphos-ethyl + BMPC	100.0 a	94.5 ab	86.5 a
Azinphos-ethyl	100.0 a	98.0 a	81.8 ab
Penthoate + BMPC	100.0 a	90.5 abc	44.9 bcd
Carbaryl EC	93.7 a	64.2 bcde	44.6 bcd
Malathion	100.0 a	80.0 abcde	42.7 cde
Methomyl	100.0 a	72.6 abcde	30.3 de
Endosulfan	96.9 a	70.0 abcde	21.5 de
Triazophos	96.9 a	74.8 abcde	20.2 de
Methyl Parathion	100.0 a	60.0 cde	16.5 de
Penthoate	100.0 a	52.9 ef	15.6 de
Hawk 500 E	100.0 a	88.3 abcd	12.5 de
Monocrotophos	93.7 a	46.8 f	0. e
Control	0. b	0. g	0. e

[1]Synthetic pyrethroid insecticides and others were tested at 0.0012% and 0.025%AI, respectively.

[2]Average of four replications each replicate containing 10 eggs. Within a column, means followed by the same letter are not significantly different from each other at 5 per cent by DMRT. First instar larval mortality was recorded 7 days after the third and last egg introduction or 21 days after spraying and data adjusted using Abbott's formula.

Table 3. Per cent mortality of adult moth cacao pod borer, *C. cramerella* by four insecticides tested as fumigant at two levels of concentration. Bago Oshiro, Davao Experiment Station, BPI.

INSECTICIDES	CONCENTRATION (AI)	PER CENT MORTALITY	CONCENTRATION (AI)	PER CENT MORTALITY[1]
Azinphos-ethyl	0.012	80.0 a	0.025	90.0 a
Azinphos-ethyl + BMPC	0.012	75.0 a	0.025	90.0 a
Deltamethrin	0.0006	50.0 b	0.0012	70.0 b
Cypermethrin	0.0006	45.0 b	0.0012	70.0 b
Control	-	0. c	-	0 . c

[1]Average of four replications consisting of 10 adults per replicate. Treatments with the same letter are not significantly different from each other at 5% level by DMRT. Adult mortality was recorded 24 hours after treatment and data adjusted using Abbott's formula.

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