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FIELD EVALUATION OF GRANULAR INSECTICIDES AGAINST RICE STEMBORERS IN WEST MALAYSIA

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RINGKASAN

Lapan belas racun-racun serangga jenis bijian, yang ditaburkan dengan sukatan 1.1 kg/ha pada 15, 40 dan 70 hari selepas ditanam, telah dinilaikan untuk mengawal ulat-ulat batang padi disawah. Prethylene 3G., Padan 10G, Birlane 5G, Furadan 3G., Terracur P 5G., Cytrolane 10G., Thiodan 5G., BHC 6G. dan Bayrusil 3G. didapati berkesan terhadap ulat-ulat batang padi. Diantaranya Prethylene 3G. adalah terbaik sekali.

Berkaitan dengan kuasa pembunuhan terhadap ikan, Thiodan 5G. dan Furadan 3G. diperhatikan lebih membahayakan dari Prethylene 3G., Cytrolane 10G. dan Birlane 5G.

INTRODUCTION

Rice stemborers are serious insect pests of rice in West Malaysia. Four main species have been recorded *viz. Tryporyza incertulas* (Walk.),*Chilo polychrysus* Meyr.,*Chilo suppressalis* (Walk.) and *Sessamia inferens* (Walk.) (KOYAMA, 1964; KOK & VARGHESE, 1966; KIMURA, 1965; LIM, 1972). In Province Wellesley, 80% of the larval population was found to be *T. incertulas* (KOYAMA, 1964), while in Krian and Kedah, *C. polychrysus* was the dominant species (KOYAMA, 1964; KIMURA, 1965; OOI & OOI, 1974). In recent studies the following species composition was observed in Bumbong Lima:

Species	Main Season 1973/74	Off Season 1974
Tryporyza incertulas	83.2%	91.2%
Chilo polychrysus	15.5%	5.7%
Chilo suppressalis	0.0%	1.8%
Sesamia inferens	2.3%	1.3%

Stemborers have been observed to cause significant yield loss in several occasions in Malaysia (WYATT, 1957; YUNUS, 1967; KIMURA, 1965). WYATT (1957) estimated the losses to as high as 70%.

It has been noted that during high infestations, insecticidal protections are generally necessary to prevent or reduce severe crop losses. To date, chemicals found effective and most commonly employed are restricted mainly to BHC and endosulfan. Thus a search for new or better insecticides was given emphasis and the findings obtained since 1972 are presented in this paper. Results on toxicity to paddy field fish for some insecticides are also given.

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MATERIALS AND METHODS

Eighteen different insecticides *(Appendix 1)* were evaluated between April 1972 and September 1974 on *Bahagia* variety transplanted at 25–30 cm apart. The plot–size ranged from 5m x 5m to 5.7m x 5.7m and was replicated 4 times in a randomised block design. Each chemical was broad–casted by hand 15, 40 and 70 days after transplanting at the rate of 1.1 kg ai/ha on each occasion.

Damage in the experiments carried out between 1972 and 1973 was assessed by counting the number of white heads per plot. In the 1973/74 experiments the percentage of dead hearts and white heads was determined according to the following computation by GOMEZ (1972):

$$P = \frac{I}{nx + (N-n)y} \times 100$$

where P is the percentage of incidences; I, the total number of infected tillers from all infested hills; x, the average number of tillers per hill from all infested hills; y, the average number of tillers per hill from 10 uninfected hills; n, the total number of infested hills and N, the total number of hills (infested and uninfested) in the plot.

In the study on fish toxicity, plots of 6.0m x 7.5m were planted with padi and separated from each other by wire nettings of about 40 cm high. These were treated with different insecticides *(Appendix 1)* in two replicates at the rate of 1.1 kg/ha at 15, 40 and 65 days after transplanting. Two days before the first application, 25 Sepat Siam *(Trichogaster pectoralis* (Regan)*)* were introduced into each plot and their mortality recorded daily.

RESULTS

Trials conducted in the Off Season, 1973 (April–September) and Main Season, 1972&73 (October–February) showed that all the chemicals tested have significantly ($p < 0.05$) lower number of white heads per plot than the control *(Table 1)*. Among them, Prethylene, Cytrolane, Birlane, Padan and Furadan were noted to be most effective.

Differences in yields between the plot were found to be not significant ($p > 0.05$) in the Off Season 1972 experiment. However yield increases of 28.2% and 27.8% were recorded in plots treated with Prethylene and Birlane respectively. In the Main Season 1972/73, yield of plots treated with BHC, Birlane, Prethylene, Cytrolane, Endrin, Furadan, Hoe 2960, Padan Terracur P and Thiodan were significantly higher than that of the control. Increase in yeild of 27.5%, 26.2% and 26.1% were recorded in plots treated with Prethylene, Birlane, Thiodan and Endrin, respectively.

In both the 1973/74 Main Season (October–February) and 1974 Off Season (April–September) trials, the percentage dead hearts at 60 days after transplanting was observed to be significantly ($p < 0.05$) lower than the untreated control *(Table 2)*. Bayrusil, Furadan, Padan, Thiodan and Prethylene were most effective in preventing dead heart formation. With regards to white heads, low precentages were observed in plots treated with Prethylene, Padan, Furadan and Cytrolane in both the trials.

TABLE 1 : EFFECT OF GRANULAR INSECTICIDES APPLIED AT 1.1 KG/HA AT 15, 40 AND 70 DAYS AFTER TRANSPLANTING FOR THE CONTROL OF RICE STEMBORERS. BUMBONG LIMA 1972 – 1973

Insecticides		White heads per plot*		Yield (kg/ha)		% increase in yield**	
		O.S. 1972	M.S. 72/73	O.S. 1972	M.S. 72/73	O.S. 1972	M.S. 72/73
Azodrin	5G	10.2	–	2644.2	–	9.3	–
BHC	6G	–	23.0	–	3998.1	–	23.2
Birlane	5G	6.8	5.0	3091.2	4093.3	27.8	26.3
Cytrolane	10G	4.3	3.5	2006.0	3773.9	– 17.1	16.3
Dowco	5G	–	42.5	–	3076.6	–	– 5.2
Ekalux	5G	–	39.5	–	3242.1	–	0.0
Endrin	2G	9.2	45.2	2536.2	4082.3	4.8	25.8
Furadan	3G	3.5	6.8	2519.2	3983.3	4.4	22.8
Hoe 2960	5G	18.8	13.8	2877.7	3978.9	19.0	22.7
Imidan	5G	9.2	23.5	2146.0	3480.9	– 11.2	7.3
Padan	10G	2.5	3.8	3000.0	3601.4	24.0	11.0
Phovel	5G	–	40.0	–	3408.6	–	5.1
Prethylene	3G	2.5	5.3	3100.6	4134.9	28.2	27.5
Terracur P	5G	5.0	14.8	2939.9	3972.3	21.5	22.5
Thiodan	5G	5.5	39.3	2715.3	4089.9	12.2	26.1
Control		40.0	62.5	2419.1	3244.0	–	–
LSD 5%		1.1	10.8	ns	322.4	–	

M.S. = Main Season; O.S. = Off Season; ns = not significant

* Plot size : 5.7 m x 5.7 m

** Negative values indicate decrease in yield

Yields in all the treated plots were significantly higher ($p < 0.05$) than the control. Increases of 44.1% and 40.3% were obtained in plots treated with Prethylene and Padan respectively in the Off Season, 1974.

It is noted that there were some inconsistencies and variations in effectiveness of some of the chemicals when tested in the different seasons. They however, were slight and could be attributed to seasonal differences in climatic conditions, different degree of stemborer infestation and distribution. In general it is observed that chemicals which gave high yield increases in the Main Seasons also showed similar tendency in the Off Seasons.

TABLE 2 : EFFECT OF GRANULAR INSECTICIDE APPLIED AT 1.1 KG/HA AT 15, 40 AND 70 DAYS AFTER TRANSPLANTING FOR THE CONTROL OF RICE STEMBORERS. BUMBONG LIMA 1973 – 1974

Insecticides	% Dead Heart at 60 DAT		% White Head		Yield (kg/ha)		% Increase in yield	
	M.S. 73/74	O.S. 1974	M.S. 73/74	O.S. 1974	M.S. 73/74	O.S. 1974	M.S. 73/74	O.S. 1974
Bayrusil 3G	0.3	1.4	0.5	2.7	3546.7	2956.4	21.2	35.1
BHC 6G	1.3	1.3	0.7	2.0	3837.8	2854.8	31.1	31.1
Birlane 5G	0.4	–	0.2	–	3575.2	–	22.2	–
Cytrolane 10G	1.5	1.1	0.2	2.2	3725.9	2725.6	27.3	25.4
Furadan 3G	0.0	0.5	0.0	3.1	3678.8	2993.2	25.7	37.7
Hoe 2960 5G	0.6	–	0.3	–	3636.6	–	24.3	–
Padan 10G	0.3	1.4	0.0	2.4	3546.7	3048.4	21.2	40.3
Prethylene 3G	0.4	1.6	0.0	2.3	3680.9	3132.4	25.8	44.1
Sumithion 3G	–	1.2	–	2.3	–	2820.8	–	29.8
Terracur P 5G	0.3	3.2	0.3	2.4	3929.1	3734.0	34.3	25.8
Thiocarb 8G	–	1.5	–	2.8	–	2997.9	–	37.9
Thiodan 5G	0.3	1.4	0.6	3.0	3552.7	2983.1	21.4	37.2
Control	7.3	20.9	0.5	3.1	2926.6	2173.6	–	–
LSD 5%	0.2	0.4	0.1	0.1	128.7	57.6	–	–

M.S. = Main Season
O.S. = Off Season

On the relative toxicity of the chemicals to Sepat Siam, Thiodan and Furadan were found to be more toxic that Cytrolane, Birlane and Prethylene *(Figure 1)*. At 24 hours after the application, 34% and 20% mortality were observed in plots treated with Thiodan and Furadan respectively, while not more than 8% was obtained in the remaining treatments.

DISCUSSION

It is evident that most of the chemicals tested were effective against rice stemborers. Several were found to be highly effective in preventing the formation of dead hearts and white heads and in increasing yield. These include Prethylene, Padan, Birlane, Furadan, Terracur P, Cytrolane, Thiodan, BHC and Bayrusil. Among these, Prethylene was observed to be outstanding; generally higher yield increase than the others was obtained in all the trials.

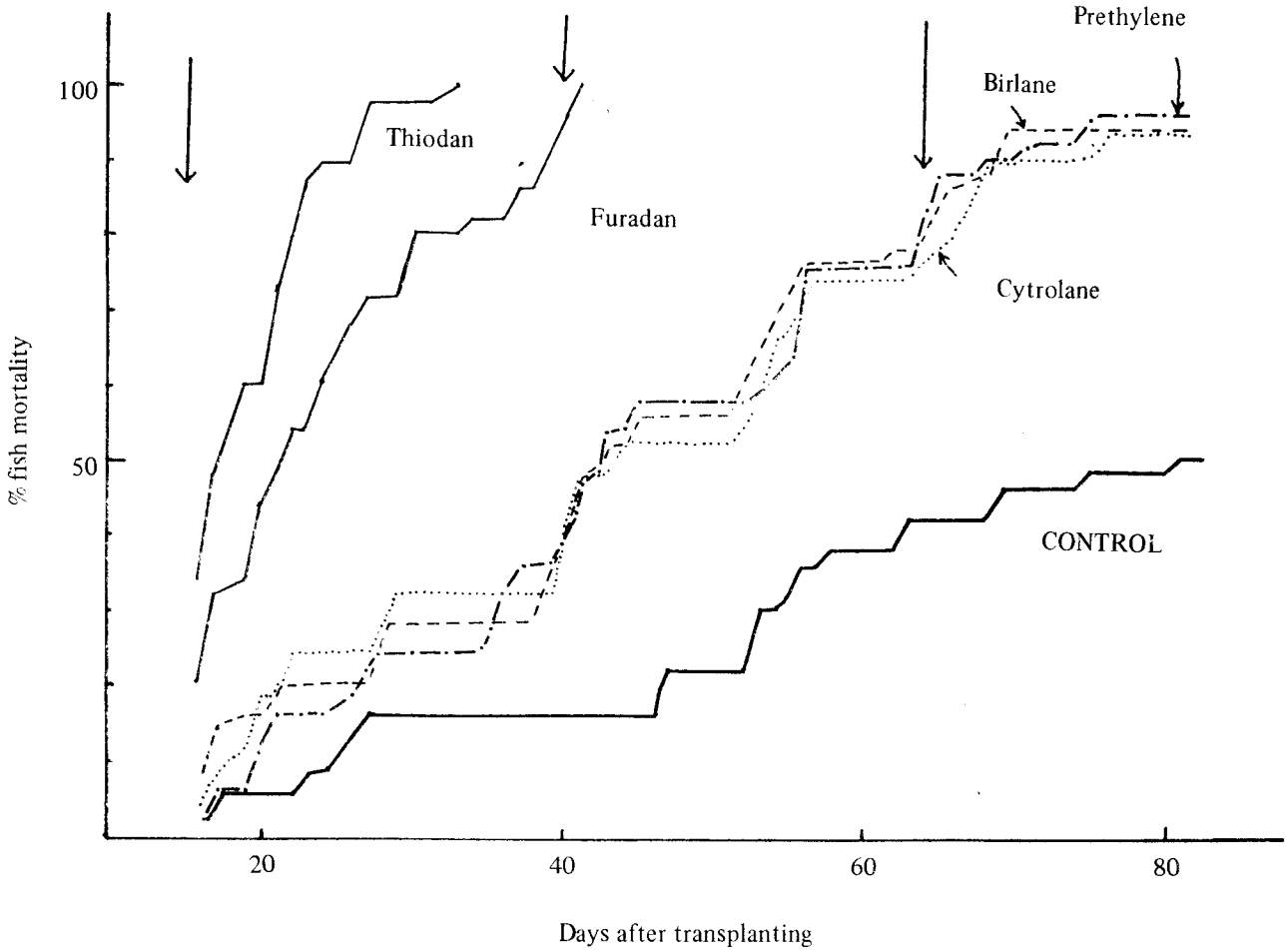

Figure 1. Effect of granular insecticides on fish (Sepat Siam). Insecticides were applied at the rate of 1.1 kg/ha at 15, 40 and 65 days after transplanting (Arrows indicate time of insecticide application).

In relation to fish toxicity, Thiodan was observed to be highly hazardous. This confirms several of the earlier findings (YUNUS & LIM, 1971; TAN *et al.*, 1973; MOULTON, 1973). Being such, its use in rice pest control was recommended to be restricted to areas where fish culture is considered unimportant (YUNUS & LIM, 1971; MOULTON, 1973). On the other hand BHC is found to be relatively less toxic to fish (KOK & PATHAK, 1966; YUNUS, & LIM ,1971; TAN *et al.*, 1973; MOULTON, 1973) and is therefore more used in areas where fish is important. This, however, creates concern over the possible deletrious effect of cumulative BHC particularly since it is noted to be less biodegradable. Recent studies have revealed gamma BHC residues to be as high as 18, 22 and 100 ppm respectively in the flesh, viscera and ova of fish exposed to BHC granule treatment (TAN, *et al*, 1973).

In view of the above it is evident that some of the insecticides presently found to be effective in controlling stemborers while relatively safe to fish would offer scopes for possible use in the areas where fish is considered important. Existing use of insecticides that exhibit piscidal effects could be discontinued and substitution by safer and equally effective ones would seem desirable. These should include Prethylene, Cytrolane, Padan and Birlane which were observed to be much safer to fish than Thiodan and Furadan.

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SUMMARY

Eighteen granular insecticides, broad-casted by hand at the rate of 1.1 kg/ha at 15, 40 and 70 days after transplanting, were evaluated for the control of rice stemborers in the paddy field. Prethylene 3G., Padan 10G., Birlane 5G., Furadan 3G., Terracur P 5G., Cytrolane 10G., Thiodan 5G., BHC 6G. and Bayrusil 3G were found to be effective against rice stemborers. Among these Prethylene 3G. was most outstanding.

In relation to fish toxicity, Thiodan 5G. and Furadan 3G. were observed to be more hazardous than Prethylene 3G., Cytrolane 10G. and Birlane 5G.

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APPENDIX 1 : INSECTICIDES USED IN THE EXPERIMENTS

Trade Names	Common Names	Chemical Names
Azodrin	monocrotophos	3–(dimethoxyphosphinyloxy)–N–methyl cis–crotonamide
Bayrusil	diethohinalphion quinalphos	O, O–diethyl–O–(2–quinoxalyl)–thiophosphate
Birlane*	chlorfenvinphos	(Cis–plus–trans–) isomers of 2–chloro–1–(2, 4–dichlorophenyl) vinyl diethyl phosphate
BHC	gamma BHC	1,2,3,4,5,6–hexachloro cyclohexane
Cytrolane*	mephosfolan	diethyl N–(4, methyl–1,3–dithiolan–2–ylidene) phosphoroamidate
Dowco 214	chlorpyrifos–methyl	O, O–dimethyl O–(3,5,6–trichloro–2–pyridyl) phosphorothioate
Ekalux	See Bayrusil	
Endrin	endrin	1,2,3,4,10, 10–hexachloro–6,7, –epoxy–1,4a, 5,6,7,8, 8a–otahydro–1, 4–endo, endo–5, 8–dimethanonaphthalene
Furadan*	carbofuran	2,3–dihydro–2, 2–dimethyl benzofuran–7–yl methylcabamate
Hoe 2960 Hostathion	triazophos	1–phenyl–3–(O, O–diethylthionophosphoryl) –1,2,4–triazole
Imidan		N–(mercaptomethyl) phthalamide S–(O–O –dimethyl phosphoro–dithioate)
Padan	cartap	1,3–bis (carbamoyly thio) 2–(N, N–dimethyl amino)–propane Hydrochloride
Phosvel	leptophos	O–(2,5–dichloro–4–bromophenyl O–methyl) phenyl thiophosphonate
Prethylene* Spanone Galecron	chlordimeform chlorphenamidin	N–(4–chloro–O–tolyl)–N, N–dimethyl)–formamidine–Hydrochloride
Sumithion	fenitrothion	dimethyl 3–methyl–4–nitrophenyl phosphoro= thionate
Terracur P	fensulfothion	O, –diethyl O–(4–methylsulfinylphenyl) monothiophosphate
Thiocarb	endosulfan 5% BPMC 3%	See Thiodan 2–sec–butylphenyl N–methyl carbamate
Thiodan*	endosulfan	6,7,8,9,10, 10–hexachloro–1,5,5a,6,9, 9a –hexahydro–6,9, –methono–2,4,3–benzo (4) dioxanthiepin–3 oxide

*Evaluation of fish toxicity conducted