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RECENT STUDIES ON THE CHEMICAL CONTROL OF RICE PESTS

By

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ABSTRACT

The relative effectiveness of 37 insecticides applied as seedling root dip (SD), 29 insecticides applied as foliar sprays after transplanting (DAT) and 19 insecticides applied into standing field water (SW) was evaluated against rice brown planthopper, stem borer, leaf folder and whorl maggot. Mephosfolan SD was effective against all the four pests tested, while azinphos-methyl, endosulfan, leptophos, monocrotophos and phosphamidon as SD were next best, showing effectiveness against two of them. As foliar sprays, ethyl parathion was effective against three pests while chlorpyriphos, chlorphenamidine, MIPC, methamidophos and phosalone were next best being effective against two of the pests tested. As standing water applications, BPMC and carbofuran followed by AC. 92,100, chlorfenvinphos, carbaryl + lindane, diazinon, endrin, mephosfolan and quinalphos were effective against three or two of the pests tested. On the whole, mephosfolan, followed by carbofuran, azinphos-methyl, diazinon and quinalphos were promising with broad spectrum effectiveness against the rice pest complex.

INTRODUCTION

The extensive cultivation of semi-dwarf indica rice from Taiwan and their derivatives, while providing the base for significant increases in India's rice production, has also created major insect pest problems. Several studies have been made in different centres to effectively control the pests with pesticidal treatment. Results of recent studies carried out at the Central Rice Research Institute on the identification of effective insecticides and methods of their application in the control of (1) the brown plant hopper, (2) the rice stem borers, (3) the rice leaf folder and (4) the rice whorl maggot are presented in this paper.

MATERIALS AND METHODS

Twentyfive day-old seedlings of rice variety *Jaya* were transplanted in 2.0 x 1.0 m sized field plots at 20 x 15 cm spacing during *rabi* 1975. Each plot representing an insecticidal treatment was separated from the other by an individual bund and a channel all round in order to avoid flooding, drainage or contamination. Six untreated checks per replicate served as

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controls for all insecticidal treatments replicated twice.

Three methods of application of insecticides viz., (A) seedling root dips, (B) foliar sprays and (C) application into standing field water were tested.

A. **Seedling root dips (SD):** Thirty-seven insecticidal chemicals (Table I) were tested as SD. Fresh insecticidal solutions to give 0.05 per cent concentration of active ingredient were prepared in water. Seedlings were uprooted carefully in the evening hours and after washing off soil from the root zone, they were kept for 12 hours with their root zones immersed in the insecticidal solutions. Seedlings with root zones immersed in fresh water constituted check treatments. Transplanting in field was carried out next morning in the respective treatments.

B. **Foliar sprays (FS):** Twenty-nine insecticidal chemicals (Table II) were applied as foliar sprays @ 0.4 kg a. i./ha thrice to crop at 10, 30 and 50 days after transplanting (DAT).

C. **Applications into standing water (SW):** Nineteen insecticidal chemicals (Table III) were applied into standing field water of transplanted crop @ 1.5 kg a.i./ha twice at 10 and 40 DAT.

Assessment of insect infestation/damage: Two area samples of 60 x 64 cm (3 hills x 4 hills) each were assessed for stem borer at 45 DAT (percentage of dead hearts against total tillers) and for whorl maggot and leaf folder at 40 DAT (percentage of infested leaves) while the brown planthopper nymphal and adult populations from 2 hills in each sample were counted by gently shaking the plants at 55 DAT in all insecticidal treatments.

RESULTS

The data on incidence of the pests in different treatments are presented in Tables I, II and III.

1. **Brown Planthopper:** Mephosfolan, azinphos-methyl, monocrotophos, phosphamidon, leptophos, diazinon and dicrotophos out of 37 applied as SD, ethyl parathion, carbofuran, phenthoate, phosalone, and MIPC = methamidophos, out of 29 applied as FS and MIPC, carbofuran = phorate, AC. 92,100, quinalphos, fenthion = carbaryl + lindane = endosulfan, endrin = BPMC, mephosfolan, diazinon, fenitrothion = chlorfenvinphos and dimethoate out of 19 applied as SW, resulted in significant reductions of brown planthopper nymph and adult populations (Tables I, II and III).

2. **Stem borer:** Mephosfolan = carbofuran, acephate, azinphos-methyl and quinalphos applied as SD, ethyl parathion, chlorphenamidine, chlorpyriphos, and dimethoate applied as FS and UC. 30045, diazinon, carbofuran fenthion, endrin, AC. 92100, BPMC and phorate applied as SW resulted in significant reductions of stem borer incidence (Tables I, II and III). UC. 30045 as SW was outstandingly superior to other effective insecticides.

TABLE I: Effectiveness of insecticides applied as seedling root dips against rice pests (*Rabi* 1975)

Insecticide	BPH	Stem borer		Leaf folder		Whorl maggot	
	No./hill	DH %	angles	% leaves affected	angles	% leaves affected	angles
AC. 92,100 (Counter)	40.0	7.9	16.23	2.0	7.77*	4.6	12.11
Acephate	22.5	3.2	10.28*	5.7	13.79	3.6	10.76
Azinphos-methyl	9.5*	3.6	9.72*	3.0	9.94	4.4	11.36
Benomyl	22.5	7.2	15.38	3.8	11.16	5.4	13.21
BPMC	20.0	5.1	12.11	4.3	11.96	7.0	14.84
BHC	26.5	5.1	13.02	1.9	7.92*	3.9	10.91
Carbaryl	20.5	5.1	13.10	2.6	9.33	5.8	13.35
Chlorpyriphos	21.5	10.8	19.18	4.6	11.99	5.5	13.13
Chlorfenvinphos	27.5	8.5	16.83	3.2	9.91	7.9	16.03
Carbaryl+Lindane	21.5	5.6	12.83	6.1	14.05	4.2	11.82
Carbofuran	18.0	2.7	6.78*	4.3	10.72	6.6	14.82
Chlorphenamidine	17.5	6.5	14.78	2.2	8.49*	4.9	12.43
Cartap	25.0	10.9	19.21	2.7	9.12	8.7	17.09
Dichlorvos	27.5	5.4	13.41	4.5	11.82	3.2	10.22
Dimethoate	31.5	5.6	13.54	5.2	13.11	5.7	12.75
Dicrotophos	15.0*	11.4	19.64	4.2	11.80	5.5	13.56
Diazinon	13.5*	11 0	19.32	5 7	13.62	3.6	10.62
Ethyl Parathion	29.0	1.18	23 19	4.1	11.60	4.2	11.07
Endrin	21.5	5.3	13.33	6.3	14.43	5.0	12.91
Endosulfan	17.0	8.7	15.34	2.0	7.71*	2.3	8.65*
Fenitrothion	22.5	6.8	14.89	4.8	12.57	2.7	9.43*
Fenthion	25.0	4.3	11.66	5.9	13.63	5.0	12.84
Fenitrothion+Malathion	20.0	10.1	18.19	2.6	8.99	5.8	13.83
Fensulfothion	19.0	6.6	14.90	3.8	10.98	3.7	10.94
Leptophos	12.0*	8.6	17.08	2.5	8.56*	4.2	11.84
Mephosfolan	7.5*	2.7	8.84*	2.1	8.31*	2.6	9.06*
MIPC	18.0	7.7	15 79	3.3	10.29	5.7	13.75
Macbal	16.5	8.5	16.74	3.8	11.10	3.6	10.69
Methamidophos	23.0	7.2	14.73	3.0	9.64	6 2	14.41
Monocrotophos	10.0*	8.4	16.46	2.7	9.37	2.5	8.93*
Phenthoate	40.0	7.2	15.27	2.3	8.61	6.8	15.01
Phosphamidon	11.5*	8.8	17.23	3.3	9.43	2.4	8.81*
Phosalone	19.0	7.1	15.40	3.5	9.35	7.6	15.88
Phorate	22.5	7.7	14.97	2.9	9.71	5.7	13.79
Quinalphos	17.5	3.8	11.30*	3.2	9.66	4.0	11.24
UC. 300,45	30.0	4.8	12.50	2.6	9.13	4.1	11.61
Vamidothion	21.5	9.6	17.76	5.0	12.79	5.5	14.02
Checks (average of 6 plots)	31.8	8.7	16.42	6.1	14.09	7.3	15.22
C. D (0.05)	16.7		5.08		5.50		5.76

Percentages and angular values are means of 2 replications

BPH: Brown planthopper nymphs and adults

DH: Dead hearts

TABLE II : Effectiveness of insecticides applied as foliar sprays against rice pests (*Rabi* 1975)

Insecticide	BPH No./hill	Stem borer DH %	Stem borer angles	Leaf folder % leaves affected	Leaf folder angles	Whorl maggot % leaves affected	Whorl maggot angles
Acephate	17.5	5.9	13.89	1.0	4.06*	6.7	14.91
Azinphos-methyl	25.0	4.5	10.64	1.4	6.66*	1.6	7.07*
Benomyl	35.0	7.7	15.50	3.7	10.74	6.4	14.62*
BHC	25.0	6.6	12.98	3.1	9.24	3.1	9.91
Carbaryl	45.0	13.4	21.46	2.7	9.29	4.8	12.61
Chlorpyriphos	20.5	1.9	5.69*	0.6	4.29*	5.1	13.42
Chlorfenvinphos	29.0	3.3	10.34	0.1	1.28*	3.9	10.93
Carbofuran	8.5*	7.6	15.83	2.6	7.80	3.7	10.04
Chlorphenamidine	21.5	1.5	7.02*	0.3	2.40*	2.2	8.51
Cartap	24.0	5.5	13.48	2.7	9.43	4.2	11.74
Dichlorvos	19.0	14.1	16.11	2.3	6.26*	5.0	11.55
Dimethoate	22.5	2.9	6.90*	1.6	7.31*	4.4	11.36
Dicrotophos	19.0	4.9	12.25	1.4	6.78*	4.3	10.98
Diazinon	19.0	8.0	16.06	0.5	4.05*	6.6	14.83
Ethyl parathion	2.5*	1.2	6.03*	0.4	3.79*	3.3	10.47
Endrin	22.5	4.5	12.05	3.1	10.04	6.2	14.23
Endosulfan	24.0	4.7	12.36	4.1	11.61	3.2	10.12
Fenitrothion	20.0	2.2	8.41	1.2	6.14*	5.5	13.42
Fenthion	34.0	10.2	18.22	2.9	9.09	7.4	15.72
Fenitrothion+Malathion	21.5	7.9	15.60	2.5	9.03	5.6	13.60
Leptophos	25.0	3.7	7.89	2.7	9.40	2.9	9.65
MIPC	16.5*	7.4	13.55	1.9	7.37*	4.1	11.31
Macbal	24.0	9.3	17.60	2.6	9.71	5.1	12.91
Methamidophos	16.5*	4.7	12.20	0.9	5.44*	5.4	13.43
Phenthoate	10.0*	4.7	12.51	3.7	11.31	5.7	13.55
Phosphamidon	20.0	10.5	18.33	0.9	4.91*	4.9	12.33
Phosalone	14.0*	8.6	16.76	1.3	4.64*	5.5	13.46
Quinalphos	25.0	5.9	13.71	0.1	1.28*	6.3	14.39
Vamidothion	19.0	10.8	19.18	5.6	13.04	4.6	12.11
Checks (average of 6 plots)	31.8	8.7	16.42	6.1	14.09	7.3	15.22
CD (0.05)	14.9		9.29		6.46		8.03

Percentages and angular values are means of 2 replications.

BPH: Brown planthopper nymphs and adults.

DH: Dead hearts.

3. **Leaf folder:** BHC, AC.92100, endosulfan, mephosfolan, chlorphenamidine, and leptophos applied as SD, chlorfenvinphos, quinalphos, chlorphenamidine, ethyl parathion, diazinon, chlorpyriphos, phosphamidon = methamidophos, acephate, fenitrothion, phosalone, dicrotophos = azinphos-methyl, dimethoate and dichlorvos applied as FS and carbofuran, mephosfolan, carbaryl + lindane BPMC and quinalphos applied as SW, were effective in reducing the damage by leaf folder (Tables I, II and III). Carbofuran applied into standing water was outstandingly superior to other effective insecticides.

4. **Whorl maggot:** Endosulfan, phosphamidon, monocrotophos, mephosfolan, and fenitrothion applied as SD, azinphos-methyl applied as FS and BHC and chlorfenvinphos as SW resulted in significant reductions in whorl maggot damage (Tables I, II and III).

DISCUSSION

In the present studies, the effectiveness of one SD for 12 hours in 0.05 per cent solution prior to planting, three as FS to transplanted crop done at 10, 30 and 50 DAT and two as SW done at 10 and 40 DAT, till the 55th DAT was evaluated against *N. lugens*. The effective insecticides, enumerated under results above manifested in preventing the BPH population to build up to the levels (31.8 per hill) as had occurred in untreated plots. While many effective chemicals were identified against BPH, it was significant to observe from the data that carbofuran and MIPC either as FS or as SW and diazinon and mephosfolan either as SD or SW were equally effective and thus offered promise in the control of BPH under Indian tropical conditions of rice culture. In areas endemic to BPH, other effective insecticides applied as SD such as azinphos-methyl, dicrotophos, leptophos, monocrotophos and phosphamidon also offered promise in view of the cheapness involved in this method which afforded protection for considerable time (55 DAT) in transplanted crop.

In the control of *T. incertulas* one SD prior to planting for 12 hours in 0.05 per cent solution, two FS done at 10 and 30 DAT and two standing water applications done at 10 and 40 DAT were evaluated at 45 DAT for their effectiveness in the present studies. The effective insecticides enumerated under results kept the stem borer infestation at significantly lower levels compared to check (8.7 per cent dead hearts) and those results were broadly in conformity with those obtained earlier (Rao and Israel, 1967, Prakasa Rao, 1972; Prakasa Rao and Israel, 1970; Kalode *et al.*, 1970).

It was, however, significant to observe that insecticides like acephate, azinphos-methyl and carbofuran applied as 0.05 per cent SD afforded adequate protection against stem borer till 45 DAT. Further, Carbofuran and mephosfolan applied either as SD or SW were equally effective till 45 DAT.

In the present studies, one SD treatment alone prior to planting or two foliar sprays at 10 and 30 days after

TABLE III. Effectiveness of insecticides applied into standing water against rice pests (*Rabi* 1975)

Insecticide	BPH	Stem borer		Leaf folder		Whorl maggot	
	No./hill	DH %	angles	% leaves affected	angles	% leaves affected	angles
AC. 92,100 (Counter)	5.0*	2.2	8.51*	1.6	11.77	6.7	14.37
BPMC	7.5*	2.4	8.69*	2.3	7.40	5.6	13.58
BHC	22.5	3.5	10.62	7.2	15.54	0.6	4.38*
Chlorfenvinphos	14.0*	2.9	9.84	3.3	10.39	2.3	6.19*
Carbaryl + lindane	6.5*	3.3	9.77	1.6	5.07*	4.8	12.50
Carbofuran	2.5*	0.7	4.80*	0.0	0.0*	2.5	9.10
Dimethoate	16.5*	11.8	14.60	3.1	10.12	7.5	15.81
Diazinon	10.0*	0.8	3.52*	6.8	13.90	3.9	11.25
Endrin	7.5*	1.9	7.95*	4.6	12.31	3.0	10.05
Endosulfan	6.5*	3.6	10.69	2.3	8.77	3.8	11.03
Fenitrothion	14.0*	3.7	11.00	4.9	12.68	6.1	14.09
Fenthion	6.5*	2.0	7.80*	2.6	9.13	7.3	14.72
Fensolfothion	17.0	4.9	12.68	5.0	12.71	2.4	8.79
Mephosfolan	9.5*	3.1	10.10	0.8	3.52*	2.6	9.58
MIPC	2.0*	6.0	12.22	4.1	11.61	4.5	12.23
Monocrotophos	24.0	7.5	15.88	4.4	11.97	4.5	12.22
Phorate	2.5*	2.5	9.06	2.3	8.77	3.8	11.03
Quinalphos	6.0*	4.7	12.32	1.8	7.54*	5.6	13.60
UC. 300,45	17.5	0.0	0.0*	3.5	10.69	3.4	9.49
Checks (average of 6 plots)	31.8	8.7	16.42	6.1	14.09	7.3	15.22
CD (0.05)	15.12		7.27		7.32		7.24

Percentages and angular values are means of 2 replications.

BPH : Brown planthopper nymphs and adults.

DH : Dead hearts.

planting or one SW done a 10 DAT with effective insecticides listed above under results, brought about significant reduction in leaf folder damage estimated at 40 DAT. It was significant to observe that certain insecticides like carbofuran, mephosfolan, carbaryl + lindane, BPMC and quinalphos, when applied into standing water, could also effectively control this leaf feeder, carbofuran being outstanding.

Further, in the control of leaf folder, it was of interest to note that chlorphenamidine as SD or FS, mephosfolan as SD or SW and quinalphos applied either as FS or as SW were all effective.

(In the control of whorl maggot, *Hydrellia philippina*, only 5 insecticides as SD, one insecticide as FS and two insecticides as SW proved effective till the 40th day after transplanting. Earlier investigations have revealed that chlorpyriphos, endrin and carbofuran as SD (Prakasa Rao, 1974) and acephate, carbofuran, AC. 64,475, mephosfolan, and diazinon placements at root zone, SW of carbofuran and diazinon and FS of monocrotophos, dimethoate etc. (Anon., 1973, 1974) were effective against this species.)

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