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Ovicidal Effects of Some Chemicals on the White Rice Leafhopper, *Tettigella spectra* (Dist.) and Red Cotton Bug, *Dysdercus cingulatus* F.

K. GUNATHILAGARAJ[1] and S. JAYARAJ[2]

The efficacy of eleven granular and six emulsion concentrates of insecticides was evaluated on the eggs of white rice leafhopper, *Tettigella spectra*. Carbofuran was found to be the most effective ovicide among the granules, while quinalphos was least effective ovicidally. Foliar sprays of thiometon + endrin and thiometon were superior to other emulsion concentrates while thiometon, thiometon + endrin and methyl demeton were found to be better among the emulsion concentrates for use as soil drench. Phosphamidon was the least effective emulsion concentrate as an ovicide.

No appreciable ovicidal action could be seen in the case of 17 chemicals tested in the dipping method on the eggs of red cotton bug, *Dysdercus cingulatus*.

Susceptibility of insect eggs to insecticides has not been studied on any insect pest of importance in this country, and resurgence of insect pests is often due to the failure of chemicals to kill the eggs. Studies were therefore made on the effectiveness of certain insecticides on the eggs of the white jassid of rice, *Tettigella spectra* (Dist.) and stainer bug of cotton, *Dysdercus cingulatus* F. In the case of the former species the eggs are laid inside the leaf tissues under the epidermis, and in the latter they are deposited on or near the plant. Placement of eggs within the tissues of the host plant might prevent the possibility of direct application of insecticides, but the egg may still be accessible to toxicants having fumigant or systemic action. Hence insecticides of different modes of entry and formulations were tested on the two test insects.

MATERIALS AND METHODS

Mating pairs of the white rice leafhoppers were introduced into separate cages on rice plants for two days for oviposition and applied with insecticides. In all, eleven granular insecticides and six emulsion concentrates were tested (Table I, II). The granular insecticides were applied to the soil around the plants in two doses of 2.0 and 2.5 kg a.i./ha. The emulsion concentrates were applied as sprays and through irrigation water at 0.1, 0.05 and 0.025 % concentrations at the rate of 250 ml per pot. Each concentration was replicated four times and suitable controls were also included. A minimum of

1-2 : Department of Agricultural Entomology, Tamil Nadu Agricultural University, Madurai - 625104.

nine days was allowed for the hatching of eggs, three days more than needed. Counts were made on eggs which failed to hatch by the end of nine days from the date of application of insecticide and were considered dead. Most of the embryos which could not emerge out after completing their development inside the eggs were considered dead. Some of the eggs did not show any sign of development at all and they were also counted as dead embryos. The eggs from which the nymphs were able to hatch and free themselves completely were counted as survivors.

TABLE I. Effect of granular insecticides on the eggs of *Tettigella spectra* Distant

Mean of 4 observations

S. No.	Insecticides (Kg a.i./ha)		% Mortality
1.	Phorate	2.0	61.5 (51.8)
2.	,,	2.5	73.6 (59.4)
3.	Chlorfenvinphos	2.0	50.4 (45.3)
4.	,,	2.5	65.8 (54.2)
5.	Carbofuran	2.0	96.1 (78.6)
6.	,,	2.5	97.2 (81.8)
7.	Lindane	2.0	22.8 (28.5)
8.	,,	2.5	25.4 (30.3)
9.	Fenthion	2.0	69.3 (56.4)
10.	,,	2.5	73.6 (59.2)
11.	Quinalphos	2.0	21.3 (27.5)
12.	,,	2.5	22.8 (28.5)
13.	Fensulfothion	2.0	35.3 (37.6)
14.	,,	2.5	53.3 (46.9)
15.	Disulfoton	2.0	34.7 (36.0)
16.	,,	2.5	46.8 (43.1)
17.	Fenitrothion	2.0	44.1 (41.6)
18.	,,	2.5	52.6 (46.5)
19.	Lindane+Carbaryl	2.0	50.6 (45.4)
20.	,,	2.5	51.8 (46.1)
21.	Endrin	2.0	44.8 (42.0)
22.	,,	2.5	52.2 (46.2)
23.	Control		4.8 (12.6)
	C.D. (P=0.01)		(11.50)

(Figures in parentheses represent arc sine inversion values)

Mass culturing of *Dysdercus cingulatus* F. was done according to the method of Geering (1956). The bugs were provided with fresh cotton seeds soaked in water periodically. The females oviposited in the petridishes containing moist filter paper and the eggs were removed daily. The ovicidal action of 17 chemicals (Table III) on the eggs was tested by the dipping method. The eggs were taken in a coffee filter using camel hair brush and dipped in chemicals at different concentrations, viz. 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9 and 1.0% for different times of 10, 30, 60, 90, 120, 150 and 180 seconds in four replications and for the check the eggs were dipped in distilled water. The eggs were removed from the filter to clean petri dishes and kept for eight days for observations, for the egg stage of this insect lasts 4-7 days. Counts were made on the eighth day of treatment for the mortality of the eggs.

RESULTS AND DISCUSSION

1. Effect on rice white leafhopper

i) Toxicity of Granular Insecticides: Of the eleven granular insecticides applied through soil, only carbofuran showed high ovicidal action, causing 96.1 and 97.2 per cent mortality respectively at the doses of 2.0 and 2.5 kg a.i./ha (Table I). Efficient translocation in the plant is chiefly a function of water solubility of the compound (Mitchell *et al.*, 1960). Carbofuran is water soluble to the extent of 700 ppm. So the results on systemic ovicidal action of carbofuran strongly indicate that the chemical was translocated to all the plant parts readily (Donoso-Lopez and

Grigaric, 1969) and was taken up by the developing egg from the adjoining leaf tissue. However, this finding is in contrast with that of Donoso-Lopez and Grigaric (1969) who observed that when carbofuran granules were incorporated as a pre-plant soil treatment at rates from 0.25 to 1.00 lb a.i./acre, it resulted in mortality of only the adults of the rice root weevil, *Lissorhoptrus orzyophilus* Kuschel but not of eggs. It is possible that the root weevil egg laid in the soil may be much hardy compared to the leaf-hopper egg laid inside plant tissue. It has been reported that the homopteran eggs laid inside the plant absorb moisture and that the turgidity of plant is important for the egg development. In view of these, the possibility of penetration of systemic insecticides into the eggs of *T. spectra* is much greater.

Carbofuran is followed by phorate,

TABLE II. Effect of emulsion concentrates of insecticides on the eggs of *Tettigella spectra* Distant
Mean of 4 observations

Sl. No.	Treatments		% Mortality Foliar spray	Soil drench
1.	Phosphamidon	0.1%	17.6 (24.8)	31.4 (33.9)
2.	,,	0.05%	26.7 (31.0)	24.9 (29.9)
3.	,,	0.025%	1.8 (7.4)	8.9 (17.3)
4.	Methyl demeton	0.1%	45.0 (42.1)	86.4 (68.5)
5.	,,	0.05%	35.8 (36.6)	80.2 (63.6)
6.	,,	0.025%	32.7 (34.1)	53.3 (9.64)
7.	Dimethoate	0.1%	47.4 (43.5)	48.9 (44.4)
8.	,,	0.05%	33.8 (35.5)	37.0 (37.4)
9.	,,	0.025%	23.1 (28.7)	34.9 (36.2)
10.	Dicrotophos	0.1%	35.3 (36.4)	74.2 (59.9)
11.	,,	0.05%	12.1 (20.0)	68.4 (55.8)
12.	,,	0.025%	9.8 (17.9)	42.4 (40.6)
13.	Thiometon	0.1%	56.7 (48.9)	87.3 (69.5)
14.	,,	0.05%	32.7 (34.8)	81.5 (64.9)
15.	,,	0.025%	11.1 (18.7)	66.7 (54.8)
16.	Thiometon + endrin	0.1%	61.8 (51.9)	76.9 (61.5)
17.	,,	0.05%	32.1 (32.8)	60.1 (50.8)
18.	,,	0.025%	12.8 (20.9)	39.6 (39.0)
19.	Control		4.8 (12.6)	4.8 (12.6)
	C. D. (P=0.01)		(7.80)	(2.34)

Figures in parentheses represent arc sine inversion values fenthion, chlorfenvinphos, fensulfothion, endrin and lindane + carbaryl which had medium ovicidal action (Table I). Phorate is also a systemic soil insecticide. If water solubility of the chemical is taken as the criterion for the ovicidal action of the chemical in question, lesser ovicidal action of phorate than carbofuran might be due to lower water solubility of phorate (85 ppm) compared to that of carbofuran (700 ppm) at 25°C. Eventhough phorate is low water soluble, it is metabolised within a few hours to more soluble sulfoxide and sulfone derivatives. So the systemic ovicidal action of phorate may be explained that phorate and/or its metabolites were translocated to all the plant parts and were taken up by the developing eggs. A strong ovicidal effect of phorate was reported by Saini and Curkomp (1967) on the eggs of six-spotted leafhopper, *Macrosteles fascifrons* (Stal.) in foliar, soil and vapour phase applications. Disulfoton, lindane and quinalphos are only very weak ovicides, causing less than 35 per cent kill of eggs (Table I).

In the eggs treated with carbofuran, it was observed that complete nymphal development occurred in the eggs that did not hatch. The embryo apparently developed normally to the point of hatching and then died. This was obvious with all the effective chemicals used. Smith (1952) observed a similar phenomenon with peach tree borer eggs treated with parathion. As in the case of organophosphates, embryonic development in carbamate-treated eggs continues normally until just before eclosion when death occurs (Chapman and Avens, 1948; Kerr and Brazzel, 1960; Samy, 1964). It is possible that the effect of carbofuran on the embryo of white rice leafhopper follows the general pattern of carbamate poisoning.

ii) **Toxicity of emulsion concentrates to the eggs :** The emulsion concentrates of insecticides were evaluated by foliar and soil drench applications for their ovicidal action. Apparently, foliar application of systemic insecticides did not seem to have marked ovicidal action on the eggs of white rice leafhopper. No chemical was able to produce high ovicidal action in this method of application (Table II). Only thiometon and thiometon + endrin had medium ovicidal action. The remaining four emulsion concentrates viz., dimethoate, methyl demeton, dicrotophos and phosphamidon exhibited only very weak ovicidal action, phosphamidon being the least effective ovicide.

In the soil drench, application of insecticides, three emulsion concentrates, viz., thiometon, thiometon + endrin and methyl demeton showed high ovicidal action causing more than 75 per cent mortality of eggs. Medium ovicidal action was recorded in the soil drenching of dicrotophos, and dimethoate and phosphamidon were weak ovicides causing less than 50 per cent mortality of eggs (Table II).

Normally ovicidal effects of foliar application may involve direct contact and possibly some systemic effect. Most of the rapidly absorbed systemic insecticides are lipoid soluble and are absorbed directly through the cuticle of the leaf (Mitchell *et al.*, 1960). Since the emulsion concentrates tested in the study are all systemics, the ovicidal effect of these chemicals on *Tettigella spectra* can largely be attributed to systemic action followed by penetration through leaf. The fact that embryos of *T. spectra* died without emerging would indicate that these chemicals must have been absorbed by the eggs from the surrounding aqueous medium. Here again, the embryos developed normally to the point of eclosion and then died.

TABLE III. Percentage mortality of eggs of *Dysdercus cingulatus* treated with insecticides at different concentrations

Mean of 28 observations in seven times of dipping and 4 replications

S. No.	Treatments (Mean of 10 concentrations from 0.1 to 1.0%)	Mean % mortality
1.	Phosphamidon	10.2 (15.18)
2.	Endrin	8.0 (13.06)
3.	Malathion	5.8 (10.14)
4.	Dichlorvos	7.6 (12.44)
5.	Fenitrothion	5.2 (9.40)
6.	Ethyl parathion	16.3 (21.66)
7.	Methyl demeton	6.4 (10.30)
8.	Methyl parathion	6.6 (11.49)
9.	Thiometon	7.5 (12.54)
10.	Formothion	6.1 (10.13)
11.	Fenthion	19.8 (25.44)
12.	Dicrotophos	10.6 (14.82)
13.	Dimethoate	8.7 (12.56)
14.	D. D. T. (W. P.)	8.9 (12.87)
15.	D. D. T. (E. C.)	7.7 (12.31)
16.	Carbofuran	6.9 (12.14)
17.	Endosulfan	4.6 (8.90)
18.	Control	6.5 (10.96)
	C. D. (P=0.05)	(1.52)

(Figures in parentheses represent arc sine inversion values)

Dimethoate, dicrotophos and phosphamidon did not have marked ovicidal effect as has also been reported in the case of the eggs of green lace wing, *Chrysopa carnea* Stephens (Bartlett, 1964). Possibly, the eggs of white rice leafhopper may not be susceptible to these chemicals or the chemicals would not have penetrated in sufficient toxic quantities.

2. Effect on eggs of red cotton bug

A perusal of the data presented in Table III would show the variation in the effect of 17 different chemicals tested each at ten concentrations on the eggs of the red cotton bug. Surprisingly, none of them had any appreciable ovicidal action. Only four of the seventeen chemicals showed very weak ovicidal action inflicting 10-20% mortality at high concentrations. Fenthion recorded the maximum of 19.8 per cent mortality of eggs followed by ethyl parathion (16.3%) (Table III). But this was in contrast to the earlier finding by Abo-El-Ghar (1965) that fenthion was ovicidally very effective on the egg masses of *Spodoptera littoralis* F. Ethyl parathion on the other hand was found to have no ovicidal action on the eggs of paddy stemborer, along with dimecron (Rao and Israel, 1964).

REFERENCES

ABO-EL-GHAR, M.R. 1965. The effect of certain insecticides against the cotton leafworm (*Spodoptera littoralis*) *Prodenia litura* F. *Bull Soc. ent. Egypte* **48** : 303-10.

BARTLETT, B.R. 1964. Toxicity of some pesticides to eggs, larvae and adults of the green lace wing, *Chrysopa carnea*. *J. econ. Ent.* 57 : 366-69.

CHAPMAN, P.J. and A.W. AVENS. 1966. The toxicology of 4, 6 dinitro-o-cresol as an aphid ovicide. *Ibid.* 41 : 190-98.

DONOSO-LOPEZ, J.G. and A.A. GRIGARIC. 1969. An evaluation of carbofuran for control of several stages of the rice water weevil in green house tests. *Ibid.* 62 : 1024-28.

GEERING, Q.A. 1956. A method for controlled breeding of cotton stainers, *Dysdercus* spp. (Pyrrhohocoridae). *Bull. ent. Res.* 46 : 743-46.

KERR, W.P. and J.R. BRAZZEL. 1960. Laboratory tests of insecticides against eggs and larvae of the cabbage looper. *J. econ. Ent.* 53 : 991-92.

MITCHELL, J.W., B.C. SMALE and R.L.METCALF. 1960. Absorption and translocation of regulators and compounds used to control plant diseases and insects. *Adv. Pest. Contr. Res.* 3 : 359-436.

RAO, Y. S. and P. ISRAEL. 1964. Recent developments in and future prospects for the chemical control of the rice stem borer in India. In *"The major insect pests of the rice plant"*. The Johns Hopkins Press, Baltimore, Maryland.

SAINI, R.S. and L.K. CUTKOMP. 1967. Effects of phorate on eggs of six spotted leafhopper. *J. econ. Ent.* 60 : 191-95.

SAMY, O. 1964. Effect of insecticides on the eggs of certain cotton insects. *Agr. Res. Rev.* 42 : 11-25.

SMITH, E.H. 1952. Tree spray oils. *Adv. Chem. Ser.* 7 : 3-11.