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Effect of chlorpyrifos 20ec on predatory green lacewing *Chrysoperla zastrowi* Sillemi under laboratory condition

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Abstract

Chlorpyrifos were slightly harmful to the predator, *Chrysoperla zastrowi*. Higher egg mortality was recorded with chlorpyrifos at 2000, 1500, 1000 and 750 ml/ha (65.00%, 62.00%, 61.33% and 56.00% respectively). The low grub mortality was observed in chlorpyrifos 20 EC 750 ml/ha (51.00%) at 48 hours of treatment whereas it was high in chlorpyrifos 20 EC 2000 ml/ha (82.50%) followed by chlorpyrifos 20 EC at 1500 ml/ha (77.50%), chlorpyrifos 20 EC 1000 ml/ha (60.00%) and Dursban 20 EC 1000 ml/ha (62.50%). Treatment II also showed that, the per cent mortality after 48 h due to the concentration of chlorpyrifos 20 EC at 1000, 750, 500 and 250 was 70.00, 66.67, 60.00, 44.00, whereas it was also high in Dursban 20 EC 500 ml/ha recorded 63.33 per cent mortality compared to dimethoate 500 ml/ha 46.67 per cent mortality.

Keywords: *Chrysoperla zastrowi*, Chlorpyrifos 20ec

Introduction

Pesticides have been the first line of defense of crop protection since 1950. The pesticides currently used are mostly non selective and affect the biotic component of the environment. The indiscriminate use of pesticides created a number of problems such as environmental pollution, resistance in insect pests, upsurge of the secondary pests due to elimination of their natural enemies increased cost of production and hazards for human beings and animals. However, it is essential to assess the safety to natural enemies before recommending them. In the present study, the safety of chlorpyrifos 20 EC was tested against predatory green lacewing *Chrysoperla zastrowi* Sillemi under laboratory condition.

Materials and Methods

Studies were conducted at the Department of Agricultural Entomology, Tamil Nadu Agricultural Entomology, Coimbatore in a completely randomized design with six treatments repeated four times and seven treatments repeated thrice along with a control water spray as Table 1 and 2 respectively.

Table 1: The insecticides used in the present investigation and their dosages were as follows.

S. No	Treatment	Dose (g.a.i./ ha)	Product (ml/ha)
1	Chlorpyrifos 20 EC	100	750
2	Chlorpyrifos 20 EC	200	1000
3	Chlorpyrifos 20 EC	300	1500
4	Chlorpyrifos 20 EC	400	2000
5	Dursban 20 EC	200	1000
6	Untreated Check	-	-

Table 2: The insecticides used in the present investigation and their dosages were as follows.

S. No	Treatment	Dose (%)	Product (ml/ha)
1	Chlorpyrifos 20 EC	0.01	250
2	Chlorpyrifos 20 EC	0.02	500
3	Chlorpyrifos 20 EC	0.03	750
4	Chlorpyrifos 20 EC	0.04	1000
5	Dursban 20 EC	0.02	500
6	Dimethoate 30 EC	0.03	500
7	Untreated check	-	-

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a) Effect of chlorpyrifos 20 EC on eggs of *Chrysoperla zastrowi*

The relative toxicity of insecticides was tested as per the method described by Krishnamoorthy (1985) [2]. The eggs along with stalk collected on brown paper strips were sprayed with various dilutions of insecticides using an atomizer. Each replication was tested with 25 eggs. Untreated check was maintained by spraying distilled water. The eggs were allowed for hatching. Eggs were constantly observed for hatching for three days and observation on egg hatchability made. The number of grubs hatched from each treatment was recorded and per cent hatchability was worked out by the formula,

$$\text{Per cent hatchability} = \frac{\text{No. of grubs hatched}}{\text{Total number of eggs}} \times 100$$

b) Effect of chlorpyrifos 20 EC on grubs of *Chrysoperla zastrowi*

The relative toxicity of insecticides was tested by Dry film method described by McCutchen and Plapp (1988) was adopted with modifications as per Chelladurai (1999) [1]. Different insecticidal concentrations were prepared in acetone: water (80:20). Glass scintillation vials of 20 ml capacity were evenly coated with 0.5 ml of insecticide solution dissolved in acetone and dried by rotating the tube horizontally on a table with palm. Second instar predatory lacewing grubs were released into the vials @ 10 per vial and covered with muslin cloth secured with a rubber band. After 1h exposure of the grubs, they were released in test tubes and 1cc *Corcyra* eggs was given as feed. Observations were made on grub mortality (6, 12, 24 and 48 h after treatment).

$$\text{Per cent grub mortality} = \frac{\text{No. of grubs dead}}{\text{Total no. of grubs treated}} \times 100$$

Results and Discussion

Egg hatchability and mortality

The results on the effect of chlorpyrifos 20 EC (table 3) on *C. zastrowi* eggs are furnished in Table 3. Chlorpyrifos 750, 1000, 1500, 2000 and Dursban (standard check) 1000 ml/ha recorded higher egg mortality (46.00 to 65.00%) when compared to untreated check (6.00).

Chlorpyrifos 1000 ml/ha recorded the mortality of 50.00 per cent when compared to standard check Dursban 1000 ml/ha (52.00%). However, higher dose of chlorpyrifos 2000 ml/ha recorded higher mortality of 65.00 per cent as against chlorpyrifos 1500 ml/ha (62.00%) and chlorpyrifos 750 ml/ha (50.00%). The lower dose of chlorpyrifos 750 ml/ha recorded egg mortality of 46.00 per cent. The maximum egg hatchability was observed in untreated check (94.00%) followed by chlorpyrifos 750ml/ha (54.00%) and chlorpyrifos 1000 ml/ha (50.00%). Treatment II showed that, Chlorpyrifos 250, 500, 750, 1000, Dursban (standard check) 500 ml/ha and dimethoate 500 ml/ha recorded higher egg mortality (37.33 to 61.00%), compared to untreated check (3.67%) (Table 5). The minimum per cent mortality was observed with dimethoate 500 ml/ha which recorded lower

egg mortality (37.33%) followed by chlorpyrifos 250 ml/ha (40.00%).

Chlorpyrifos 1000 ml/ha recorded higher mortality 61.33 per cent in comparison with chlorpyrifos 750 ml/ha (56.00%) and chlorpyrifos 500 ml/ha (45.33%). The maximum egg hatchability was observed in untreated check (96.33%) followed by dimethoate 500 ml/ha (62.67%) and chlorpyrifos 250 ml/ha (60.00%)

Grub mortality

The results revealed that all the doses of chlorpyrifos (table 3) significantly affected the grubs, 24 and 48 hours after treatment (Table 4). Low mortality was observed in chlorpyrifos 20 EC 750 ml/ha (51.00%) at 48 hours of treatment whereas it was high in chlorpyrifos 20 EC 2000 ml/ha (82.50%) followed by chlorpyrifos 20 EC at 1500 ml/ha (77.50%), chlorpyrifos 20 EC 1000 ml/ha (60.00%) and Dursban 20 EC 1000 ml/ha (62.50%).

Treatment II registered that, the per cent mortality after 48 h due to the concentration of chlorpyrifos 20 EC at 1000, 750, 500 and 250 was 70.00, 66.67, 60.00, 44.00, whereas it was also high in Dursban 20 EC 500 ml/ha recorded 63.33 per cent mortality compared to dimethoate 500 ml/ha 46.67 per cent mortality (Table 6).

All the treatmental doses of chlorpyrifos were slightly harmful to the predator, *Chrysoperla zastrowi* (Table 3). Higher egg mortality was recorded with chlorpyrifos at 2000 and 1500 ml/ha (65.00% and 62.00% respectively). Lower doses recorded 50.00, 46.00 per cent egg mortality by chlorpyrifos at 1000 and 500 ml/ha respectively and standard check was on par with these two lower doses. Higher doses of chlorpyrifos were slightly harmful and the recommended, lower doses were harmless to the predator. Higher egg mortality was recorded with chlorpyrifos at 1000 and 750ml/ha (61.33 and 56.00% respectively) (Table 3). Lower doses recorded 45.33, 40.00 per cent egg mortality by chlorpyrifos at 500 and 250 ml/ha respectively and standard check was on par with these two lower doses. However, all the higher doses of chlorpyrifos 20 EC were slightly harmful to *C. zastrowi* grubs, the per cent mortality ranging from 60.00 to 82.50 (Table 4). The lower dose recorded 51.00 per cent mortality and it was on par with the standard check. Results are akin to the observation of Nasreen *et al.* (2005) [5] who observed that chlorpyrifos recorded the lowest LC 50 value when treated with the second instar grubs of *C. carnea*. Chlorpyrifos (Dursban 48 EC at 10ppm) was more toxic to second instar grubs of green lacewing followed by profenofos (Sabry and EI-Sayed, 2011). So these insecticides can be used when the population density of *C. zastrowi* is low in field. All the higher doses of chlorpyrifos 20 EC were slightly harmful to the *C. zastrowi* grubs with mortality ranging from 60.00 to 70.00 per cent (Table 4). Dimethoate at 500 ml/ha was harmless to the grubs. Sunitha Devi *et al.* (2006) [7] observed that endosulfan (0.07%) was the least toxic to *Chrysoperla carnea* followed by dimethoate (0.05%) and cypermethrin (0.01%). Mizell and Schiffhauer (1990) [4] also observed that pyrethroids were not toxic to larvae and adults of *Chrysoperla rufilabris* but organophosphates and carbamates were toxic. Dimethoate was less toxic to the larvae but highly toxic to the adults of *Mallada boninensis* (Mani, 1993) [3].

Table 3: Effect of chlorpyrifos 20 EC on eggs of *Chrysoperla zastrowi*

Treatment	Dose (ml.ha ⁻¹)	After three days (n = 25)		Corrected mortality (%)
		Egg hatchability * (%)	Mortality (%)	
Chlorpyrifos 20 EC	750	54.00 (47.30) ^b	46.00 (42.70) ^b	42.55
Chlorpyrifos 20 EC	1000	50.00 (45.00) ^c	50.00 (45.00) ^c	46.81
Chlorpyrifos 20 EC	1500	38.00 (38.05) ^d	62.00 (51.95) ^d	59.57
Chlorpyrifos 20 EC	2000	35.00 (36.25) ^d	65.00 (53.75) ^d	62.77
Dursban 20 EC (standard check - ES)	1000	48.00 (43.85) ^{bc}	52.00 (46.15) ^{bc}	48.94
Untreated check	-	94.00 (76.02) ^a	6.00 (13.98) ^a	-

Mean of four observations * n - No of insects treated

ES – Existing source

Figures in parentheses are arcsine transformed

Means in a column followed by the same superscripts are not significantly different according to DMRT at P=0.05.

Table 4: Effect of chlorpyrifos 20 EC on grubs of *Chrysoperla zastrowi*

Treatment	Dose (ml.ha ⁻¹)	After 6h*		After 12 h*		After 24 h*		After 48 h*		Mean mortality (%)
		Mortality (%) (n = 10)	Corrected mortality (%)	Mortality (%)	Corrected mortality (%)	Mortality (%)	Corrected mortality (%)	Mortality (%)	Corrected mortality (%)	
Chlorpyrifos 20 EC	750	7.00 (13.83) ^b	7.00	27.50 (31.55) ^b	27.50	35.00 (36.06) ^b	31.58	51.00 (45.57) ^b	48.42	30.13
Chlorpyrifos 20 EC	1000	10.00 (15.86) ^b	10.00	35.00 (36.00) ^{bc}	35.00	45.00 (42.05) ^{bc}	42.11	60.00 (51.64) ^{bc}	57.89	37.50
Chlorpyrifos 20 EC	1500	12.50 (20.47) ^b	12.50	45.00 (42.12) ^c	45.00	60.00 (50.83) ^c	57.89	77.50 (62.30) ^c	76.32	48.75
Chlorpyrifos 20 EC	2000	12.50 (20.47) ^b	12.50	47.50 (43.56) ^c	47.50	62.50 (52.27) ^c	60.53	82.50 (65.47) ^c	81.58	51.25
Dursban 20 EC (standard check - ES)	1000	10.00 (18.43) ^b	10.00	37.50 (37.73) ^{bc}	37.50	47.50 (43.56) ^{bc}	44.74	62.50 (52.27) ^{bc}	60.53	39.38
Untreated check	-	0.00 (0.28) ^a	-	0.00 (0.28) ^a	-	5.00 (6.64) ^a	-	5.00 (6.64) ^a	-	5.00

Mean of four observations * n - No of insects treated ES – Existing source

Figures in parentheses are arcsine transformed

Per cent mortality in a column followed by the same superscripts are not significantly different according to DMRT at P=0.05.

Table 5: Effect of chlorpyrifos 20 EC on eggs of *Chrysoperla zastrowi*

Treatment	Dose (ml.ha ⁻¹)	After three days (n = 25)		Corrected mortality (%)
		Egg hatchability * (%)	Mortality (%)	
Chlorpyrifos 20 EC	250	60.00 (50.77) ^{bc}	40.00 (39.23) ^{bc}	37.71
Chlorpyrifos 20 EC	500	54.67 (47.68) ^{bc}	45.33 (42.32) ^{bc}	43.25
Chlorpyrifos 20 EC	750	44.00 (41.55) ^{de}	56.00 (48.45) ^{de}	54.32
Chlorpyrifos 20 EC	1000	38.67 (38.44) ^e	61.33 (51.56) ^e	59.86
Dursban 20 EC (standard check - ES)	500	52.00 (46.16) ^{cd}	48.00 (43.84) ^{cd}	46.02
Dimethoate 30 EC	500	62.67 (52.34) ^b	37.33 (37.66) ^b	34.94
Untreated check	-	96.33 (79.47) ^a	3.67 (11.02) ^a	-

Mean of three observations * n - No of insects treated ES – Existing source

Figures in parentheses are arcsine transformed

Means in a column followed by the same superscripts are not significantly different according to DMRT at P=0.05.

Table 6: Effect of chlorpyrifos 20 EC on grubs of *Chrysoperla zastrowi*

Treatment	Dose (ml.ha ⁻¹)	After 6h*		After 12 h*		After 24 h*		After 48 h*		Mean mortality (%)
		Mortality (%) (n = 10)	Corrected mortality (%)	Mortality (%)	Corrected mortality (%)	Mortality (%)	Corrected mortality (%)	Mortality (%)	Corrected mortality (%)	
Chlorpyrifos 20 EC	250	6.67 (8.86) ^b	6.67	16.67 (23.86) ^b	16.67	33.33 (35.22) ^b	28.57	44.00 (41.51) ^b	40.00	25.17
Chlorpyrifos 20 EC	500	6.67 (12.29) ^b	6.67	30.00 (33.21) ^{cd}	30.00	40.00 (39.23) ^b	35.71	60.00 (50.85) ^{bcd}	57.14	34.17
Chlorpyrifos 20 EC	750	10.00 (18.43) ^b	10.00	33.33 (35.22) ^d	33.33	46.67 (43.08) ^b	42.86	66.67 (54.99) ^{cd}	64.29	39.17
Chlorpyrifos 20 EC	1000	16.67 (23.86) ^{bc}	16.67	36.67 (37.22) ^d	36.67	50.00 (45.00) ^b	46.43	70.00 (57.00) ^b	67.86	43.34
Dursban 20 EC (standard check - ES)	500	6.67 (12.29) ^b	6.67	30.00 (33.21) ^{cd}	30.00	43.33 (41.15) ^b	39.28	63.33 (52.78) ^{bcd}	60.71	35.83
Dimethoate 30 EC	500	3.33 (6.14) ^b	3.33	23.33 (28.78) ^{bc}	23.33	36.67 (37.22) ^b	32.14	46.67 (42.99) ^{bc}	42.86	27.50
Untreated check	-	0.00 (0.28) ^a	-	0.00 (0.28) ^a	-	6.67 (12.29) ^a	-	6.67 (12.29) ^a	-	3.34

Mean of three observations * n - No of insects treated ES – Existing source

Figures in parentheses are arcsine transformed

Per cent mortality in a column followed by the same superscripts are not significantly different according to DMRT at P=0.05.

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