



Evaluation of toxicity of carbosulfan to eggs, larvae and adults of green lacewing, *Chrysoperla carnea* (Stephens) (Neuroptera: Chrysopidae)

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ABSTRACT: The toxicity of carbosulfan was tested against eggs, larvae and adults of *Chrysoperla carnea* (Stephens) under laboratory conditions. Lesser ovicidal action was observed at 500 ppm (equivalent to effective field dose of 250g a. i. ha⁻¹). All the concentrations caused significant grub mortality when grubs were subjected to the chemical by oral feeding and thin film methods. Carbosulfan was harmful to *Chrysoperla* adults when assessed through contamination method.

KEY WORDS: Carbosulfan, *Chrysoperla carnea*, toxicity

The common green lacewing, *Chrysoperla carnea* (Stephens) is a cosmopolitan generalist predator in a wide range of natural, agricultural and forestry habitats. The effect of pesticides on many species of chrysopids has been studied in detail (Mizell and Schiffhauer, 1990; Hassan *et al.*, 1991). Carbosulfan is a systemic carbamate insecticide commonly used for the management of sucking pests of cotton. With a view to generate information on safety to natural enemies, present investigation was conducted to test the toxicity of carbosulfan to *C. carnea*.

Effect of carbosulfan on the egg hatchability of *C. carnea*

Laboratory studies were conducted to assess

the effect of carbosulfan on the eggs of *C. carnea*, as per the method described by Krishnamoorthy (1985). The eggs along with stalk collected on brown paper strips were sprayed with different concentrations viz., 500, 1000 and 2000 ppm using an atomizer. Each treatment was replicated five times with 200 eggs per concentration. Untreated check was maintained by spraying distilled water. Methyl-oxy-demeton (500ppm) was used as comparative standard since it has been recommended by Tamil Nadu Agricultural University and followed widely among the farmers for controlling sucking pests of cotton. The number of grubs hatched from each treatment was recorded and per cent hatchability was worked out.

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Effect of carbosulfan on the mortality of *C. carnea* grubs

Oral feeding method

Eggs of *Corcyra cephalonica* (Stainton) were exposed to UV radiation of 15W capacity for 15 minutes to kill the embryos and then sprayed with different concentrations of carbosulfan viz., 500, 1000 and 2000 ppm with an atomizer. Methyl-oxy-demeton (500ppm) was maintained as standard. The treated eggs were shade-dried for 15 minutes and then transferred to test tubes (1cc/ test tube) of size 15x2cm. For untreated check, the eggs were sprayed with distilled water. Second instar grubs of *C. carnea* were transferred to these test tubes (@ 10 per test tube). After complete feeding of the treated eggs, the grubs were provided with untreated *Corcyra* eggs until pupation. Observations were made on the grub mortality 12, 24 and 48 hours after treatment.

Thin film exposure method

The bioassay method described by Mc Kitchen and Plop (1988) was adopted with modifications. The different concentrations of insecticides, 0.2, 0.4, and 0.8 per cent of carbosulfan 25EC and 0.2 per cent of methyl-oxy-demeton 25 EC were prepared in analytical grade acetone.

Glass scintillation vials of 20ml capacity with 1mm thickness were evenly coated with 1ml of acetone solution containing insecticide formulation and dried by rolling for few seconds. Second instars lacewing grubs were released into the vial at 10 per vial, covered with muslin, and secured with a rubber band. Observations were taken on the mortality at 12, 24 and 48 hours after treatment. After 12 hours exposure of the grubs, 1cc of *C. cephalonica* eggs were given as feed to the surviving grubs and per cent mortality was computed.

Effect of carbosulfan on the longevity and fecundity of *C. carnea* adults

Diet contamination technique

The adults were fed with 10 per cent sucrose solution containing different concentrations viz.,

500, 1000 and 2000ppm of carbosulfan and 500ppm of the comparative standard methyl-o-demeton. Five pairs of freshly emerged *C. carnea* adults were allowed in separate plastic containers per concentration. Each concentration was replicated five times. In the untreated check, the adults were fed with 10 per cent sucrose solution alone. The eggs laid in each treatment were collected daily by keeping a brown paper sheet (21x 6cm) along the inner side of the plastic container. Observations were made on the longevity of both sexes and fecundity of females.

Effect of carbosulfan on egg hatchability

The results on the ovicidal action on *C. carnea* indicated that carbosulfan at 2000ppm caused maximum egg mortality of 44.38 per cent at 48 hours after treatment (HAT) followed by carbosulfan 1000ppm. The lowest concentration of carbosulfan, 500ppm inflicted less mortality and recorded maximum egg hatching of 80.42 and 86.86 per cent and ranked next to untreated check, which recorded 86.10 and 91.10 per cent at 24 and 48 HAT, respectively. The result indicates that carbosulfan at 500ppm is relatively harmless to *C. carnea* eggs compare to higher concentrations (Table 1). The results are in agreement with the findings of Vogt and Vinuela (2001) who have conducted similar studies on *C. carnea*. According to them, only slight reduction in hatching percentages ranging from 0 to 14 after spraying of *C. carnea* eggs with 13 pesticides belonging to different chemical groups (organophosphates, juvenoids, chitin synthesis inhibitors, avermectins, fungicides and herbicides) was observed.

Effect of carbosulfan on grub mortality

The effect of carbosulfan 25EC on the grubs of *C. carnea* studied by larval feeding method revealed that the test chemical at all the concentrations tested caused significant grub mortality. The highest grub mortality was obtained in carbosulfan 25 EC 2000ppm (99.99%) followed by 1000ppm (99.50%) and 500ppm (81.90%) at 48 HAT, whereas the grub mortality in untreated check was 21.46 per cent only (Table 1). In thin film

exposure method, the results revealed that cent per cent grub mortality was recorded at carbosulfan at 1000 and 2000ppm, followed by the lowest dose (500ppm) of carbosulfan 25 EC (95.40%) and methyl-oxy-demeton 25 EC (94.50%) at 48 HAT, while it was 27.60 per cent in untreated check. This shows that carbosulfan is harmful to grubs of *C. carnea* (Table 1).

Srinivasan and Sundara Babu (2000) reported highest grub mortality of 83.33 per cent in carbaryl (0.1%) followed by quinalphos (76.66%).

Effect on adult longevity and fecundity

With regard to the effect of carbosulfan 25EC on adult longevity and fecundity of *C. carnea*, the results indicated that carbosulfan at all the concentrations significantly affected the longevity and fecundity (Table 2). The adult longevity in carbosulfan at 500,1000 and 2000ppm was 7.04, 2.64 and 1.44 days, respectively. Maximum adult longevity of 15.90 days was recorded in untreated check followed by methyl-o-demeton 500ppm

Table 1. Toxicity of carbosulfan to eggs and grubs of *C. carnea*

Sl. no.	Treatment	Mortality (%)		
		Eggs (48 HAT)	Grubs (48 HAT)	
			Oral feeding	Thin film
1	Carbosulfan 25EC @ 500ppm	13.14 ^b (19.82)	81.90 ^b (64.83)	95.40 ^b (77.64)
2	Carbosulfan 25EC @ 1000ppm	21.88 ^c (24.49)	99.50 ^c (86.97)	100.00 ^c (89.88)
3	Carbosulfan 25EC @ 2000ppm	44.38 ^d (29.66)	100.00 ^d (89.88)	100.00 ^d (89.88)
4	Methyl- oxy- demeton 25EC @ 500ppm	19.70 ^c (22.46)	80.30 ^b (63.70)	94.50 ^b (76.61)
5	Untreated check	8.90 ^a (15.31)	21.46 ^a (27.58)	17.60 ^a (24.77)

HAT – Hours after treatment

In a column means followed by a common letter are not significantly different by DMRT (P = 0.05).

Values in the parentheses are arcsine transformed values.

Table 2. Effect of carbosulfan on the *C. carnea* adults

Sl. no.	Treatment/Concentration	Adult longevity (days)	No. of eggs laid per 5 female
1	Carbosulfan 25EC @ 500ppm	7.04 ^b (2.74)	97.94 ^c (9.92)
2	Carbosulfan 25EC @ 1000ppm	2.64 ^d (1.77)	37.66 ^d (6.17)
3	Carbosulfan 25EC @ 2000ppm	1.44 ^e (1.37)	19.06 ^e (4.41)
4	Methyl-oxy- demeton 25EC @ 500ppm	8.50 ^c (2.99)	115.04 ^b (10.74)
5	Untreated check	15.90 ^a (4.05)	422.42 ^a (20.56)

In a column means followed by a common letter are not significantly different by DMRT (P = 0.05).

Values in parentheses are $\sqrt{x + 0.5}$ transformed values.

(8.5 days). Higher number of eggs were laid in untreated check (422.42) compared to 97.94, 37.66 and 19.06 in carbosulfan at 500, 1000 and 2000 ppm, respectively. The standard check of methyl-ox-demeton ranked next to untreated check by recording 115.04 eggs.

The reduction on egg laying observed in the experiment could be attributed to the administration of carbosulfan contaminated diet. Similar findings on adult longevity and fecundity were reported by Medina *et al.* (2001). They observed that among the insecticides tested, tebufenozide, spinosad and azadirachtin, spinosad at 500 mg l⁻¹ exerted a sub-lethal effect on longevity and fecundity of adults.

Based on the results obtained in the present studies on safety, it is inferred that carbosulfan 25 EC at the recommended field concentration has lesser ovicidal action against *C. carnea*. However, it is harmful to grubs and adults. Accordingly spraying of carbosulfan on crops can be decided based on the population of particular life stage of *C. carnea*. Similarly the releases can also be planned to avoid contact action to grubs.

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