EFFECT OF RADIANT INSECTICIDE ON THE BIOLOGY AND EGG'S HATCHABILITY OF *CHRYSOPERLA CARNEA* (STEPHENS) (NEUROPTERA: CHRYSOPIDAE)

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Abstract

Effect of Radiant (insecticide) on developmental stages and reproduction of *Chrysoperla carnea* (Stephens) resulted from treated eggs were estimated. The LC_{25}, LC_{50} and LC_{95} values for radiant-treated 1-2 days old eggs were 0.625, 1.875 and 27.323 ppm, respectively. The results indicated that the percentage of hatchability, larvae formed cocoons and adult emergence were differently and high affected by different concentrations, when reared on two preys, *Pectinophora gossypiella* (Saund.) eggs and *Aphis craccivora* nymphs. The obtained results showed a prolongation in (larval+cocoon) period resulted from eggs treated with LC_{50} and reared on *P. gossypiella* or *A. craccivora* compared to control, this period was estimated by 19.5 and 17.8 days, respectively, compared to 16.9 and 15.9 days for the controls. The larval feeding capacity of *C. carnea* highly differed significantly between larvae resulted from treated egg and fed on *P. gossypiella* eggs or *A. craccivora* nymphs compared to control. The results indicated also high shortening in longevity of females and males and high reduction in total eggs laid and percentage of hatchability.

Key words: Radiant 12%, predator *C. carnea*, preys *P. gossypiella* and *Aphis craccivora*

INTRODUCTION

The common green lacewing, *Chrysoperla carnea* (Stephens) is one of the most common arthropod predators (Tauber *et al.,* 2000). This predator has been observed associated with a wide prey range including aphid, eggs and neonate larvae of Lepidopteran insects such as, *Pectinophora gossypiella, Earias insulana* (Boisd.) and *Spodoptera littoralis* (Boisd.), scale insects, whiteflies, mites and other soft bodied insects.

The insecticide spinosad has been shown to be an effective pest control agent (Brickle *et al.*, 2001), particularly for control of lepidopteran insect pests (Wanner *et al,* 2000). Many authors studied the effect of spinosad on *C. carnea* .Of these Medina *et al.* (2001) demonstrated that spinosad had little effect on *C. carnea* adult longevity and fecundity with no impact on eggs. While in 2003, Medina *et al.* reported that azadirachtin and diflubenzuran were highly toxic to *C. carnea* third instar larvae. In 2003, Medina *et al.* observed that spinosad shortened the life span of *C. carnea* and Yoo and Kim (2000) indicated a reduction in fecundity of predatory mites.

The present investigation were cared out to study the effect of spinetoram (Radiant) compound on the egg hatching and development of immature stages as well as adult longevity and fecundity of the *Chrysoperla carnea* adults. Eggs and adults of predator were collected from cotton field in Qalubia Governorate.

MATERIALS AND METHODS

The adults of *C. carnea* were collected from cotton fields and confined in chimney glass, covered with a piece of black muslin as a site for ovipostion, Eggs laid were collected and kept until hatching. The neonate larvae were divided into two groups, the first was reared on eggs and larvae of the pink bollworm (PBW), *P. gossypiella* and the second was reared on the aphid, *Aphis craccivora* for two generation.

Insects used as prey:

***P. gossypiella*:**

The newly hatched larvae of PBW used in these experiments were reared in the laboratory on semi-artificial diet inside glass vials (2x7 cm) according to Rashad and Ammer (1985).

***Aphis craccivora* (Koch)**

The broad been (*Vicia faba* L.) was planted in laboratory under room conditions and the seedling were infested by the aphid, *Aphis craccivora*.

Insecticides used:

Common name: Radiant SC12% (spinetoram), it is a new product from spinosyns group with the same mode of action, it is a trademark of Dow Agro Science Co. The recommended rate was 35 ml add to 200 L water/feddan.

Procedure:

To study the ovicidal activity of Radiant against eggs of *C. carnea*, serial concentrations, in water, were prepared. Six concentration (12, 6, 3, 1.5, 0.75, and 0.375 ppm) for Radiant were freshly prepared for the stock solution of 0.5 ml/1 liter water.

Treatment of *C. carnea* eggs:

The strips of muslin cloths with attached eggs of *C. carnea* (one-two days old) were dipped into the afore-mentioned selected concentrations of Radiant .The control eggs were dipped into water only. The strips were left for 1-2 hrs until drying, kept at the rearing condition and examined daily until hatched. LC_{25}, LC_{50} and LC_{90} were determined and recorded.

Newly hatched larvae of *C. carnea* resulted from eggs treated with the dose of LC_{50} of Radiant were kept, individually, in glass vials stoppered with cotton-wool. One group was fed on eggs of PBW and another group was fed on *Aphis craccivora* nymphs. The vials were examined daily until the cocoons were formed to estimate the total consumption of prey and larval and cocoon durations for each group. The pre-ovipostion, ovipostion and post-ovipostion periods as well as number of deposited eggs and percentage of hatching were also estimated. All studies were carried out at 26±1 °C and 70-80% R. H.

Statistical analysis:

One way analysis of variance (ANOVA) and Duncan's multiple range test of means were used (Duncan's, (1955).

RESULTS AND DISCUSSION

Ovicidal effect of Radiant:

The LC_{25}, LC_{50} and LC_{95} values for *C. carnea* eggs (1-2 days old) treated with radiant 12 % were 0.625, 1.875 and 27.323 ppm, respectively, (Table 1).

The hatchability percentages of eggs increased as the concentrations of Radiant decreased. They ranged between 0.0 and 83.3% compared to 98% for untreated eggs.

Percentages of larvae formed cocoons:

Data in Table (1) show the percentages of hatched larvae developed and formed cocoons when reared on *P. gossypiella* or *A. craccivora.* Such percentages increased with the decrease of radiant concentrations and ranged from (0.0 to 68.0%) and (0.0 to 80.0%) at concentrations ranged from 12 to 0.375ppm compared to 93% and 95% in the control fed on PBW and *A. craccivora*, respectively.

Adult emergence:

Also, data in Table (1) show the percentages of adult emergence from the cocoons resulted from treated eggs and reared on PBW or aphid increased by the decrease of radiant concentrations. These ranged from 0.0 to 87.0% and from 0.0 to 78.0% compared to 93.0% and 98.0% from control, respectively.

Durations of immature stages of *C. carnea* resulted from eggs treated with the dose of LC_{50}:

Larval stage:

Table (2) demonstrates that the average larval duration resulted from eggs treated with LC_{50} varied from 1st instar to 3rd instar larvae when fed on *P. gossypiella* eggs or *A. craccivora* nymphs.

First instar larvae:

The duration of 1st instar larvae increased significantly in treated compared to untreated eggs, Table (2). The duration of larval instar averaged 3.89 and 3.9 days when larvae resulted from treated eggs reared on *P. gossypiella* or aphid, respectively, compared to 2.5 and 2.9 days for control larvae.

Second instar larvae:

In contrast, this duration decreased in 2nd instar larvae to 2.6 and 3.3 days compared to 3.6 and 3.4 days when reared on PBW or aphid, respectively.

Third instar larvae:

The duration were 4.7 and 2.1 days, for treated eggs compared to 3.6 and 3.2 days for the control .These data indicate that the eggs treated with the dose of LC_{50} prolonged in the duration of 1st and 3rd larval instar but shortened the duration of 2nd instar Table (2).

Cocoon:

The duration of cocoon increased significantly Table (2). It lasted 8.6 and 8.8 days for treated eggs and 7.3 and 6.9 days for untreated eggs with larvae fed on PBW or aphid, respectively.

The total durations, from 1st instar larvae until emergence of adults were 19.5 and 17.8 days when eggs were treated and the hatched larvae fed on PBW eggs and aphid nymphs, respectively. The respective durations for the control were 16.9 and 15.9 days.

Larval food consumption:

The mean numbers of the two prey species consumed showed significant differences between 1st instar larvae hatched from treated eggs and control larvae. The mean numbers of prey individuals consumed by 1st instar larvae of *Chrysoperla* resulted from eggs treated with LC_{50} dose were 27.6 eggs of PBW and 18.9 aphid nymphs. The respective consumed prey in the control larvae were 38.5 and 31.3 Table (3). This fact indicates 27 and 42 % reduction in larval consumption of eggs and nymphs, respectively.

In 2nd instar larvae the differences in consumption were highly significant. The consumptions were 39.3 eggs and 23.5 nymphs in larvae resulted from treated eggs whereas the respective consumptions were 77.3 and 65.6 in the control larvae .The same results were found in the 3rd larval instar.

Mandour (2009) recorded similar result and stated that development of *C. carnea* was spinosad concentration-dependent, the larval, pupal and total larval plus pupal periods lasted 3, 1 and 4 days longer compared to control with reduction in cocoons resulted. Vinuela *et al.* (2001) found that 13 different pesticides induced only slight reduction in percent of egg-hatch in *C. carnea*. Medina *et al.* (2003) observed that spinosad shortened the life span of *C. carnea*, and Yoo and Kim (2000) observed a reduction in fecundity of predatory mites. In contrast, several parasitoid wasps showed some sensitivity to spinosad (Williams *et al.* 2003). Schneider *et al.* (2004) reported a decrease in adult emergence and longevity of the endoparasitoid, *Hyposoter didymator* (Thunberg) treated with spinosad, 14 out of 15 studies reported some sort of sublethl effects on parasitoids following treatment with spinosad (Williams *et al.* 2003). Dutton *et al.* (2003) also found that developmental period of *C. carnea* lasted longer when larvae were fed upon Bt-contaminated *Spodoptera littoralis* larvae.

Ovipositonal period:

Table (3) showed that the ovipostion period and longevity of *C. carnea* females and males resulted from eggs treated with LC_{50} dose were slightly shorter than those resulted from untreated eggs. The predator female and male longevities were slightly longer when immature stages resulted from treated or untreated eggs were fed on aphid nymphs than on PBW eggs.

The pre ovipostion, ovipostion, post ovipostion periods and longevity were 3.7, 8.6, 0.3 and 12.5 days, respectively for female resulted from treated eggs compared to 2.6, 12.0, 2.3 and 16.9 days/ for females resulted from untreated eggs when immature stages were reared on PBW eggs. The respective values in females when immature stages were reared on aphid were 2.1, 10.3, 1.6 and 14.1 days/ (treated eggs) compared to 1.6, 14.7, 2.3 and 18.6 days (untreated eggs).

Female fecundity:

The average number of eggs laid/ female and percentage of hatchability decreased when the predator resulted from treated eggs compared to untreated one. On the other hand the number of deposited eggs and % hatchability increased when *C. carnea was* reared on PBW eggs compared to aphid. The mean numbers of deposited eggs were 69.0 and 58.0 eggs/ female resulted from treated eggs and reared on PBW eggs and aphid, respectively, compared to 158.0 and 117.0 eggs/ female resulted from untreated eggs and reared on PBW and aphid, respectively, Table (4). Galvan *et al.* (2005) reported that when treated females of *Harmonia oxyridis* with indoxcarb and spinosad reduced survival, fecundity and fertility.

Table 1. Effect of different concentrations of Radiant on hatchability, larval and adult stages of *C. carnea* reared on *Pectinophora gossypiella* eggs and *Aphid craccivora* nymphs.

Conc. ppm	*P. gossypiella*				*Aphis craccivora*		
	No. of eggs observed	% egg hatched	% larval reached to cocoon	% adult emergence	No. of eggs observed	% larval reached to cocoon	% adult emergence
12	60	0.0	0.0	0.0	60	0.0	0.0
6	60	18.3	5.0	0.0	60	23.17	7.0
3	60	53.6	40.6	53.0	60	60.6	56.3
1.5	60	58.0	63.6	57.5	60	65.3	61.54
0.75	60	68.3	60.0	69.3	60	71.6	65.0
0.375	60	83.3	68.0	87.0	60	80.0	78.0
Control	30	98.0	93.0	95.0	30	95.0	98.0

Table 2. Durations of immature stages of *C. carnea* resulted from eggs treated with LC_{50} dose (1.875 ppm.) and untreated eggs.

Instars	Duration (days± S.E.)							
	P. gossypiella				Aphid			
	Treated	Untreated	LSD	P	Treated	Untreated	LSD	P
1st instar	3.89±0.2a (3-4)	2.5±0.1b (2-3)	0.48	**	3.9±0.3a (3-5)	2.9±0.1b (2-3)	0.45	**
2nd instar	2.6±0.17b (2-4)	3.6±0.16a (3-4)	0.55	**	3.3±0.1a (3-4)	3.4±0.3a (3-4)	0.35	**
3rd instar	4.7±0.1a (3-5)	3.6±0.21b (3-4)	0.43	*	2.1±0.2b (2-3)	3.2±0.1a (3-4)	0.22	***
Cocoon	8.3±0.4a (7-9)	7.3±0.36b (6-8)	0.76	*	8.5±0.5a (7-9)	6.4±0.4b (6-7)	0.58	***
Total	19.5±1.4 (16-21)	16.9±0.6 (14-18)	0.58	***	17.8±2.3a (15-19)	15.9±1.3b (14-17)	1.61	*

Table 3. Average number of *P. gossypiella eggs* and aphids consumed by different instars of *C. carnea* resulted from eggs treated with LC_{50} dose of Radiant and untreated eggs.

Instars	Consumption							
	P. gossypiella				Aphid			
	Treated	Untreated	LSD	P	Treated	Untreated	LSD	P
1st instar	27.6±0.1b	38.5±1.17a	3.58	**	18.9±0.6b	31.3±0.6a	2.26	***
2nd instar	39.3±0.4b	77.3±0.3a	0.57	***	23.5±0.4b	65.6±0.58a	1.76	***
3rd instar	88.67±0.3b	120.3±0.5a	0.98	***	107.0±1.6b	183.33±a	9.16	***
Total immature stage	151.57±0.5b	232.3±2.4a	2.41	***	159.3±0.7b	280.0±2.07a	5.21	***

Table 4. Ovipostional period, fecundity, longevity of *C. carnea* adult resulted from eggs treated with Radiant (LC_{50} dose).

prey		Pre-ovi (Days)	Ovipostion (Days)	Post-ovi (Days)	Total eggs laid	% hatchability	longevity (Days)	
							♀	♂
PBW	Treated	3.7±0.2a	8.6±0.5b	0.3±0.1b	69.0±3.1b	61	12.3a	7.5
	Untreated	2.6±0.2b	12.0±0.3a	2.3±0.1a	158.0±2.6a	93	16.8b	11.3
	LSD	0.45	0.53	0.57	6.60		0.55	NS
	P	**	***	***	***		**	
		Pre-ovi	ovipostion	Post-ovi	Total eggs laid	% hatchability	Longevity ♀	♂
Aphid	Treated	2.1±0.1	10.3±0.3b	1.6±0.2b	58.0±0.36a	43.0	14.0±0.2b	10.6±0.4b
	Untreated	1.6±0.13	14.7±0.61a	2.3±a	117.0±b	87.0	18.6±0.5a	12.5±0.2
	LSD	NS	0.97	0.68	12.20		0.97	0.57
	P		***	***	***		***	**

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تأثيرمبيد الرادينت علي فقس البيض وبعض الخصائص البيولوجية لاسد المن

هشام صالح شعلان ، ميرفت عبد السميع قنديل

معهد بحوث وقاية النباتات - مركز البحوث الزراعية الدقي - الجيزة

تم دراسة تأثير مبيد الرادينت علي نسبة الفقس لبيض المفترس الحشري اسد المن وكذلك متابعة بعض الخصائص البيولوجية تحت الظروف المعملية من درجة الحرارة ٢٦ ±١ م° ورطوبة نسبية ٧٥-٨٠%. اوضحت النتائج ان نسبة الفقس للبيض تختلف باختلاف التركيز المستخدم فهناك علاقة عكسية بين نسبة الفقس للبيض و التركيز المستخدم فعند زيادة التركيز تقل نسبة الفقس للبيض. كما تم دراسة تاثير استخدام التركيز النصف مميت LC_{50} لمبيد الرادينت علي الفقس الناتج من البيض المعامل ووجد أنه قد سبب اطالة معنوية في مدة الطور اليرقي وكذلك العذراء عن الكنترول وكذلك خفض في نسبة خروج الحشرة الكاملة من الشرانق كما انخفضت ايضا فترة وضع البيض والنسبة المئوية لفقس البيض للافراد الناتجة من البيض المعامل عن الكنترول كذلك المرباة علي بيض دودة اللوز القرنفلية مقارنة بالمرباة على من البقوليات.