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STUDY THE EFFECT OF RADIANT COMPOUND ON SOME BIOLOGICAL ASPECTS OF *Cunaxa setirastirs* (HERMANN) (ACARINA: ACTINEDIDA: CUNAXIDAE)

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ABSTRACT

Laboratory experiments were carried out during the period from July 2009 to May 2010, to study the efficicency of three concentrations (2.816, 1.77 and 0.79 ppm) of Radiant compound 12% against adult stages of the predatory mite *Cunaxa setirastirs* (Hermann) and the sequence effect of the three concentrations against the eggs resulted from treated females by LC_{50} under laboratory conditions 25±1°C and 75±5%R H. Results indicated that the three concentrations caused high effect on duration of preoviposition, oviposition and postoviposition, where by lasted 7.2, 21.7 & 2.9 days, 5.3, 26.5 &4.6 days and 4.3, 29.0 & 5.5 days at 2.816, 1.77 and 0.79 ppm, respectively, at 2.816 , 1.77 and 0.79 ppm and 4.3, 29.0 & 5.5 days at 0.79 ppm, respectively,compared with 3.4, 40.0 and 3.9 days in control. Also, the female and male longevity were high affected by the three concentrations. The high decreased in longevity period occurred at 2.816 ppm which was estimated by 32.7days for female and 19.3 days for male compared with 45.7 and 34.46 days for female and male, respectively, in control. On the other hand, the three concentrations caused high reduction in the average number of deposited eggs per female, it was 54.6, 73.3 and 84.3 eggs/female treated by 2.816, 1.77 & 0.79ppm, respectively, compared with 124 eggs in control. When eggs treated with Radiant, the LC_{50} , LC_{25} and LC_{10} were 1.6,0.618 and 0.43 ppm, respectively and prolonged the duration larvae, protonymph, dutonymph and tritonymph stages in both female and male.

INTRODUCTION

The phytophagous mite *Tetranychus urticae* Koch, infest over 150 agricultural crops, including major food crops, fiber crops and ornamentals (Dekeyser and Downer, 1994 and Bolland *et al.*, 1998). *T urticae* has a worldwide distribution. Recently it has described as a cause of occupational allergic disease, (Delgado *et al.,* 1997). The predacious Cunaxid mites were reported to feed on harmful insect and mites. The member of this family complete the important role has been clearly observed in soil or on plants. The studies on the ecological or biological aspects of Cunaxid are few, Nassar (1976), El-Khateeb (1998) and Khalil (2000) .The extensive use of chemical pesticides in pest control resulted in some problems such as pollution, increasing the pest resistance and destroying predators. Many trials allover the world have been succeeded by the use of bio-pesticides in controlling mite pests in different fruit, orchards and field crops, Abo-EL-Ghar (1986), Ibrahim *et al.* (1994), EL- Ghobashi *et al.* (2002), Sato *et al.* (2002), Aucejio *et al.* (2003) and Kim *et al.* (1999). Also, biotic compounds played an important role in pest control. Among these compounds, Spinosad, or Radiant, gets its name from the microbe that produces it, a soil-dwelling bacterium called *Saccharopolyspora spinosa*, spinosad possess less risk

than most insecticides to mammals, birds, it is already approved for used on more than 100 crops. Therefore the aim of this research was to examine the effect of Radiant 12% compound on some biological aspects of the predatory mite *Cunaxa setirastirs* (Hermann) and understand its role, as a natural enemy of pests in fields.

MATERIALS AND METHODS

The present investigations were carried out to study the effect of three concentrations of Radiant 12% against the predator mite adults of *Cunaxa setirastirs* and studied its effect on ovipositional period, fecundity, fertility and longevity and feeding capacity of adult male and female.

Rearing of *Tetranychus urticae* as prey:

For establishing a colony of the two spotted spider mite*, T. urticae* in the laboratory, the technique of Azouz (1999) was employed. The original samples of the mite were collected from potato leaves infested with the mite. The colony was reared in the laboratory of Plant Protection Research Institute, under constant conditions of 25±1°C and 75±5%R H. A pure culture of *T. urticae* was propaged on sweet potato cutting placed in glass jars filled with water, which in turn were placed in a water pan and protected by an arch covered with muslin. The colony was kept at room temperature under 24 hours illumination. The females spotted spider mite *Teranychus urticae* KOEH used as a prey

Rearing the predator

Cunaxa setirastirs was collected from leaves of cucumber in Qaliubaia and Giza Governorates and samples were transfer to laboratory for direct examination by stereomicroscope. Adults of mite were clearing in Nesbits solution and than slide mounted in Hoyer's medium for identification. Adult females were allowed to oviposit eggs obtained eggs were used to establish main culture of this mite.

Radiant: Spinetoram (Radiant 12 %sc.) it is a new product from spinosyns group.

Prepared the solution:

The stock solution prepared by dissolving 0.1 ml from radiant to 1 L water. Three concentrations were used from Radiant for treated the newly emergence adult females and males of *C. setirastirs*.

Toxicity effect of Radiant on adult predator.

To determine the parameters of LC_{50}, LC_{25} and LC_{10} values of Radiant 12% against adult of *C. setirastirs,* aqueous dilutions were freshly prepared and checked in pilot experiment. The adults females and males were sprayed by the prepared concentrations (6, 3, 1.5, 0.75, 0.375 and 0.187 ppm), then held in open air for 2-3 hours to allow drying. The percentages of mortality/ concentration were estimated after 24 h., LC_{50}, LC_{25} and LC_{10} value were calculated using Proban software.

Latent effect of LC_{50}, LC_{25} and LC_{10} of Radiant 12% on predator mite adults of *Cunaxa setirastirs*.

Newly emerged adult *C. setirastirs* were used to evaluate the Twenty pars of adult (20♂X 20♀) were transferred to the upper surface of cucumber *Cucmis sativus* L. (3 inch in diameter) using fine brush. Four discs were used as three replicates for each concentration. Discs were placed up side on moist cotton wool in Petri dishes. The disc surface carrying the females and males was directly sprayed with the three concentrations of Radiant using a glass atomizer. Control treatment was sprayed with water.

Also, the adult treatment were kept in an incubator under constant conditions 25±1°Cand 65±5%R H. These treatments were examined daily to study some of biological aspects such as pre-oviposition, oviposition and post- oviposition and number of eggs laid (fecundity), percentage of hatchability and female and male longevity.

Sequence treated eggs resulted from females of *Cunaxa setirastirs* treated by LC_{50}, of Radiant 12%.

To determine the LC_{50}, LC_{25} and LC_{10} of Radiant 12% on eggs resulted from females treated by LC_{50} of Radiant and the subsequent progeny of *Cunaxa setirastirs,* aqueous dilutions were freshly prepared and checked in pilot experiment. The egg were sprayed by the prepared concentrations (6, 3, 1.5, 0.75, 0.375 and 0.187 ppm), then held in open air for 1-2 hours to allow drying. Three replicates were tested concentration, each replicate contains 30 eggs. On the other hand, 30 eggs resulted from adult treated by LC_{50} radiant used as control and 30 eggs resulted from untreated adults were sprayed by water and used as control. The treated and the untreated eggs were kept at the same controlled conditions of rearing. The percentage hatchability/ concentration were estimated, and the calculated LC_{10}, LC_{25} & LC_{50} were calculated using Proban.

Rearing the predator mites resulted from eggs treated by LC_{50}, LC_{25} and LC_{10} of Radiant 12%:

Sixty individuals of mite predator resulted to maturity on *Tetranychus urticae* as a prey. 60 newly emerged mite were placed individually transferred by a fine brush on surfaces of potato leaves. The leaf was placed in Petri dish lined with water saturated cotton wool. Sufficient numbers of the two spotted spider mite, *T. urticae* were offered daily until the end of larvae, protonymph, deutonymph and tritonymph instar mite. At the same time, the incubation period of eggs, larval, protonymph, dutonymph and tritonymph stages duration were estimated.

RESULTS AND DISCUSSION

Toxicity effect on adult:

Data presented in Table (1) showed the toxicity of radiant compound on adult stages of *Cunaxa setirastirs* adults. It revealed that LC_{50}, LC_{25} and LC_{10} values were 2.816, 1.77 and 0.79 ppm for adult after one day, respectively.

Table (1): Toxicity of Radiant 12% against adults of the predatory mite, *Cunaxa setirostris* after one day.

Stage treated	LC_{10}		LC_{25}		LC_{50}	
Adult (one day old)	2.816		1.77		0.79	
	Limits					
	upper	Lower	Upper	Lower	Upper	Lower
Radiant 12%	3.368	2.384	2.066	1.271	1.703	0.863

Pre-ovipostion period:

Data presented in Table (2) showed means of time required for maturation of females *Cunaxa setirastirs* ovaries treated by three concentrations of Radiant. The pre-ovipostion was 7.2, 3.5 and 4.3 days at 2.816, 1.77 and 0.79 ppm of Radiant, respectively compared with 3.4 days for control.

Table (2): Effect of three concentrations of Radiant 12% on Ovipositional periods and Fecundity of females *Cunaxa setirostris* R. G. H. when fed on *Teteanychus urticae* at 25± 1 ◦C and 75± 5 %

Compound used	Conc. (ppm)	Ovipositional periods Mean ±SE			Fecundity mean ±SE		Incubation period
		Pre-ovipostion	ovipostion	Post-ovipostion	Total eggs \ ♀	% hatchability	
Radiant 12 %	2.816	7.2 ±6.1c	21.7± 1.5c	2.9±o.5	54.6±2.9	35..6%	8.3±0.5
	1.77	3.5±0.5ab	26.5±0.6b	4.6±0.2	73.3±4.5	43.3%	8.1±0.5
	0.79	4.3±0.2b	29.0±0.5b	5.5±0.2	84.3±3.1	64.6	6.8±0.4
Control	-	3.4±0.03a	40.0±1.1a	3.9±0.2a	124±7.9	89.96	5.5±0.2
LSD		.763	6.531	0.986	8.365	7.281	0.562
P		**	**	**	***	**	*

Ovipostion period:

Concerning, statistical analysis of obtained data, Table (2) showed that time taken for eggs deposition.The mean ovipostion periods were 21.7, 26.5 and 29.0 days for the female treated by three concentration 2.816, 1.77 and 0.79 respectively, compared with 40 days for untreated females. Also, these data indicated that the high concentration 2.816ppm caused reduction in the ovipostion period to half time than control. while, no significant differences were recoded between the females treated by LC_{25} (1.77ppm) and LC_{10} (0.79ppm).

Post- oviposition:

Data in Table (2) also,indicated that the post ovipostion period of *C. setirastirs* mites females treated with the three concentrations 2.816, 1.77 and 0.79 ppm had high significant effect compared with control , these period were 2.9, 4.6 and 5.5 days at three concentrations, respectively, compared with 3.9 days for control. Besides, it can be show that, the two concentrations 1.77 & 0.79 ppm caused prolonged post-ovipostion period while, the high concentration 2.816ppm caused high decrease in this period.

Female fecundity:

The number of deposited eggs by female *Cunaxa setiriostris* was high significantly decreased when it treated by the three concentrations

2.816, 1.77 and 0.79 ppm of Radiant compared with untreated control. Table (2) recorded the mean number of deposited eggs by one female was reduced when treated by the three concentrations. It was 54.6, 73.3 and 84.3 eggs/ female treated by 2.816, 1.77 and 0.79 ppm, respectively, compared with 124 eggs/ intreated female untreated. These results indicated that the high concentration caused high reduction in total eggs and less reduction in total eggs was recorded with low concentration. Bostanian *et al.*, (2010) noticed that Imidacloprid and Thiamethoxam were moderately toxic to adults of the predacous mite, Neoseiulus fallacies and had significant adverse effects on fecundity.

Percentage of hatchability:

Data in Table (2) show that the three concentrations of Radiant caused significant reduction in the viability of eggs deposited by treated female. Also, data revealed that the highest hatchability percentage was 64.96% recordedat low concentration (0.79 ppm), while the lowest percentage hatchability was recroded 35% at high concentration (2.816ppm) compared with 89.96% in control.

Incubation period:

Data presented in Table (2) showed high significant effect between the incubation period of eggs resulted from treated and untreated females. The mean incubation period of *C. setirostris* eggs prolonged to 8.3, 8.1 and 6.8 days for eggs laid from females treated by 2.816, 1.77 and 0.79 ppm of radiant, respectively, compared with 5.5 days for eggs laid by untreated females.

Adult longevity:

Data in table (3) indicated that the three concentrations had significant effect on *C. setirostris* treated females compared with untreated ones, the three concentration caused reduced in longevity estimated by 32.7, 36.8 and 39.1 days/ females treated by 2.816, 1.77 &0.79 ppm, respectively, compared with 45.7 days/ female in control. Obtained data revealed that the males *C. setirostris* longevity treated by the three concentrations had high significant effect. This period decreased to 19.3, 25.8 and 25.2 days /male treated by 2.816, 1.77 and 0.79 ppm, respectively, compared with 34.46 days for untreated males (Table 3).

Table (3): Effect of different concentrations of Radiant 12% on longevity and food consumption of both sexes, of *Cunaxa setirostris* when fed on Teteanychus *urticae* at 25± 1◦C and 75± 5 %

Compound used	Conc. (ppm)	Longevity days ±SE		Consumption	
		♀	♂	♀	♂
Radiant 12%	2.816	32.7±2.9 (36-37)	19.3±0.2 (17-20)	190±10.3 (170-230)	135.3±9.6 (90-160)
	1.77	36.8±1.3 (33-38)	25.8±2.6 (22-30)	289±6.5 (190-320)	223±7.9 (120-270)
	0.79	39.1±0.5 (37-47)	25.2±0.3 (23-27)	353± 4.8 (170-380)	241± 10.5 (135-276)
	Control	45.7±4.4 (41-56)	34.0±2.6 (28-39)	380± 9.7 (310-411)	290± 8.9 (170-230)

Feeding capacity of treated and untreated adults:

Feeding capacity of treated adults *C. setirostris* showed highly difference in number consumption when fed on *T. urticae* compared with untreated ones, Table (4). The average consumption of treated adult female predator were 190, 289 & 253 preys/♀ compared with 380 preys/♀ of untreated females. On the other hand, the treated males showed decreased in consumption to 135.3, 223 & 241 preys/♂ compared to 290 preys in control. These data indicated that the food consumption increased when the concentration of Radiant decrease**.**

Table (4): Toxicity of Radiant 12% against eggs of predatory mites Cunaxa setirostris produced from treated adult females by LC50.

Stage / treated	LC_{10}		LC_{25}		LC_{50}	
Eggs (2days)	0.43		0.618		1.6	
	Limits					
	upper	Lower	Upper	Lower	Upper	Lower
Radiant 12%	0.629	0.203	2.066	0.490	2.11	1.416

Sequence treated eggs resulted from females of *Cunaxa setirastirs* by LC_{50} of Radiant 12%:

Toxicity on eggs:

Data in Table (4) show that the *C. setirastis* eggs resulted from females treated by LC_{50} were more susceptible to Radiant. It recorded 1.6, 0.618 and 0.43 ppm,for LC_{50}, LC_{25} and LC_{10}, respectively.

Incubation period:

Data presented in Table (5) revealed that the incubation period of *Cunaxa setirastirs* mite eggs, highly affected when eggs resulted from female treated by LC_{50} treated by the three concentration (LC_{50}, LC_{25} and LC_{10}), where it recorded 8.9, 8.1 & 7.3 days for female eggs, respectively, compared with 8.3 days /eggs resulted from treated adults by LC_{50} and 5.6 days in control (untreated females).

Developmental time of spiderling stage:

The observed results documented that the duration of all developmental stages of the predatory mite, *C. setirostris* resulted from female treated by LC_{50} was affected by the three concentration (LC_{50}, LC_{25} and LC_{10}), it prolonged the duration of predator compared to control (Table 5).

Larval stage

As shown in Table (5) the three treated had very high difference effects on larval stage. This duration prolonged to 4.7, 4.32 and 4.13 days/ female and high shorted to 1.84, 4.0 and 4.0 days / female resulted from eggs treated by three concentrations, respectively, compared to 2.33 and 2.1/ female and 1.12 and1.1 days/female resulted from treated adults by LC_{50} and untreated.

Table (5): Development of immature stages of *Cunaxa setirostris* produced from treated eggs by three concentrations of Radiant 12% at 25±1°C and 75-70 % R.H.

Stages		Duration (in days) ± S.E.			Control[1]	Control[2]
		LC_{50}	LC_{25}	LC_{10}		
Female	Incubation period	8.9± 1.1	8.1± 0.76	7.3±1.1	8.3±0.5	5.6±0.1
	Larvae	1.84±0.02	1.4 ±0.1 0.	1.4±0.1	1.2± 0.01	1.2± 0.01
	Protonymph	3.66±0.02	3.35±0.123	3.3±0.1	2.3±0.1	2.1±0.1
	Deutonymph	4.36±0.04	3.78±0.23	3.43±0.3	3.28±0.12	3.1±0.1
	Tritonymph	3.4±0.2	3.3±0.12	3.18±0.1	2.8±0.03	2.1±0.01
	Total immatures	13.26±0.13	11.83±0.8	11.01±0.76	9.48±0.76	8.5±0.54
Male	Incubation period	6.03± 0.2	4.5± 0.1	4.13±0.1	3.5±0.12	3.1±0.1
	Larvae	4.7±0.14	4.32±0.23	4.13±0.3	2.33±0.12	2.1±0.1
	Protonymph	1.84±0.02	1.4 ±0.1 0.	1.12±0.1	1.2± 0.01	1.1±0.1
	Deutonymph	3.27±0.32	3.2±0.22	3.12±0.1	2.47±0.03	2.1±0.01
	Total immature stage	9.81±0.8	8.92±0.28	8.56±0.6	6.00±0.6	5.33±0.36
	Life cycle/♂	17.27±1.3	17.9±0.82	15.12±067	13.17±1.03	10.63±0.51

Control[1] = eggs resulted from adult treated by LC_{50}
Control[2]= eggs used without any insecticide (untreated)

Protonymph:

The obtained data in Table (5) recorded that the duration of females and males protonymphal stage prolonged to 3.66, 3.35 and 3.3 days/female and, decreased to 1.84, 1.4 and 1.12 days/ male at three concentration (LC_{50}, LC_{25} and LC_{10}), respectively, compared with 2.33 and 2.1days/ females and 1.2 and 1.12 days/male, resulted from treated adults by LC_{50} and control, respectively.

Deutonymphal stage:

Results in Table(5) recorded that the deutonymphal stage resulted from treated eggs were 4.36, 3.78& 3.43 days/ females and 3.27, 3.2 & 3.12 days/male, while it lasted to 3.28 and 3.1 days/female and 2.47 &2.1 days/ males in control, respectively.

Tritonymphal stage:

It was observed that the average duration of the female tritonymph stage resulted from eggs treated lasted for 3.4, 3.3 &3.18 days, while when resulted from treated adults by LC_{50} it lasted 2.8 days /female and 2.1days in control (untreated female (Table (5).

Total immature stage:

Data presented in Table (5) show that the average duration of female and male immature stages resulted from treated females with three concentrations were 13.26, 11.83 and 11.01 days/ female and 9.81, 8.92 and 8.56 days/male, respectively compared with 9.48 and 8.50 days /female and 6.0 and 5.33 days/male, respectively.

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دراسة تاثير مركب الرادينت علي بعض المظاهر البيولوجية للمفترس الأكاروسي *Cunaxa setirostris* (ACARINA: ACTINEDIDA: CUNAXIDAE)

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أولا : أجريت دراسة معملية لتقييم ثلاثة تركيزات مختلفة للمركب الحيوى الرادينت 12 % التي تسبب اماتة ل 50 و 25 و 10 % موت للآفراد الكاملة للمفترس الاكاروسي ***Cunaxa setirostris*** وتاثير هذة التركيزات علي بعض المظاهر البيولوجية لدورة الحياة للأطوار الكاملة و الكفاءة التناسلية وكذلك الكفاءة الأفتراسية للمفترس الأكاروسي ***Cunaxa setirostris*** تحت الظروف المعملية من درجة حرارة 25±1 °م ورطوبة نسبية 75 ± 5 % و قد اوضحت النتائج اطالة فترة ما قبل وضع البيض وفترة ما بعد وضع البيض و لكن علي العكس قصرت فترة وضع البيض الي 21.7 و 26.5 و29 يوم علي لتوالي للأناث المعاملة بالتركيزات 2.816 ، 1.77 ، 0.79 وعلي التوالي. كما اوضحت النتائج ايضا ان هناك علاقة عكسية بين مدة حياة الأنثي و الذكر و التركيز المستخدم فكلما زاد التركيز قلت مدة حياة الأفراد الكاملة.

ثانياً: تم اخذ البيض الناتج من الأناث المعاملة بالتركيز المسبب ل 50 % موت (2.816 جزء في المليون) وتم معاملة هذا البيض بثلاث تركيزات (1.6 ، 0.618 و 0.43 جزء في المليون) الذي سبب عدم فقس البيض بنسبة 50 ، 25 و 10 %. ثم متابعة الفقس الناتج و تأثير هذة التركيزات علي مدة حياة الأطوار الغير كاملة.

وقد اوضحت النتائج اطالة في جميع الأطوار الغير كاملة عند معاملة البيض بتر كيزات 1.6 ، 0.618 و 0.43 جزء في المليون. كانت مدة حياة الأطوار الغير كاملة للأنثي 13.26 ، 11.83 و 11.01 يوم علي التوالي مقارنةً ب 9.48 يوم للاطوار الغير كاملة الناتجة من الأناث المعاملة بالجرعة التي تسبب 50 % موت ، 8.5 يوم في الكنترول.

اما في حالة الذكر فقد كانت هذة المدة 9.81 ، 8.92 و 8.56 يوم عند معاملة البيض بالتركيزات 1.6 ، 0.618 و 0.43 جزء في المليون مقارنةً ب 9.17 يوم في الذكور الناتجة من الأناث المعاملة ب 2.168 جزء في المليون مقارنة ب 8.43 يوم في الغير معامل.

قام بتحكيم البحث

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