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THE EFFECT OF SOME PESTICIDES ON THE BIOLOGICAL ASPECTS OF THE PREDATORY MITE AMBLYSEIUS GOSSIPI EL-BADRY

BY

E.M.Zanaty* , M.S.Tadros** , and A.E.El-Sherbeni**

* Dept. of Biology, Faculty of Education, Kafr El-Sheikh

** Dept. of Plant Protection, Faculty of Agriculture, University of Tanta

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ABSTRACT

The effects of 5 pesticides on both A. gossipi El-Badry and Tetranychus cucurbitacearum (Sayed) were investigated. The LC_{50} values of the selected pesticides on both predator and prey were evaluated.

Results indicated that Neoron was the most toxic compound to T.cucubitacearum,(LC_{50}=19 mg/kg) and was the least toxic to predatory mite, A. gossipi, (LC_{50} =250 mg/kg). The other insecticides applied were different in their toxicity. They were always more toxic to the predator. All pesticide application affected A. gossipi adults. A decrease of egg laying capacity, hatchability and food consumption was clear. On the other hand, an increase happened in both egg incubation period, larval and nymphal stages. The measure of biological parameters indicated most toxicity to Baythroid and least to Sumicidin, Lannate and Dursban came in between.

INTRODUCTION

Amblyseius gossipi El-Badry is considered as one of the most effective predacious mites controlling many

Tetranychid mites [1,2]. The widespread applications of pesticides upset the natural balance of organisms in nature. Therefore, it was essential to investigate the effect of some pesticides on both predatory and phytophagous mites. The direct effect of pesticides was extensively studied by many authors [3,4]. Scanty knowledge is recorded about the effect of pesticides on the biological aspects of predator after application.

The present work aimed to study the direct effect of some pesticides on both predacious and phytophagous mites. It was also our purpose to find out the indirect effect of the applied toxic compounds on the biological aspects of the predacious mite, A.gossipi. Recommendations for the best and most practical control of the phytophagous mite, Tetranychus cucurbitacearum would be pointed out.

MATERIALS AND METHODS

a- Culture:

Individuals of Tetranychus cucurbitacearum (Sayed) were collected from a field cultivated with cotton and were cultured in the laboratory on leaves of sweet-potatoes. On the same sampling date, and from the same field, females of the predatory mite, Amblyseius gossipi El-Badry were also collected and reared artificially on castor pollens as described by Zanaty [5] and were used in this study.

b- Pesticides used:

Five pesticides were selected for the present investigation : Four insecticides (Sumicidin, Bythroid, Lannate and Dursban), and only one acaricide (Neoron).

Bromopropylate : 1-methylethyl 4-bromo-α-(4-bromophenyl)-α-hydroxybenzeneacetate, (Neoron 50%, EC, 0.5 1/fed).

Chlorpyrifos : 0,0-diethyl-0-(3,5,6-trichloro-2-pyridyl) phosphorothioate, (Dursban 48%, EC, 1.0 1/fed).

Cyfloxilate : Cyano (4-fluoro-3-phenoxyphenyl) methyl 3-(2,2-dichloroethenyl)-2,2-dimethyl-cyclopropanecarboxylate, (Bythroid 5%, EC, 0.75 1/fed).

Fenvalerate : Cyano(3-phenoxyphenyl) methyl 4-chloro alpha (1-methylethyl) benzeneacetate, (Sumicidin 20%, EC, 0.6 1/fed).

Methomyl : 1-(methylthio) acetaldehyde 0-methylcarbamoyloxime, (Lannate, 22.5%, WSC, 1.25 1/fed).

c- Pesticide application methods:

A glasss atomizer was used for spraying the different concentrations of each selected pesticide on sweet-

-potato leaf discs.The latters were circled with tangle foot (natural canada balsam, castor and citronella oils) to avoid prey or predator escape. Individuals of prey or predator were introduced to each concentration (5 concentrations by 4 replicates for each). The discs were put separately in Petri dishes provided with cotton saturated with water and covered with a filter paper. Control dishes were sprayed with water only. The treated samples were kept in an incubator under average temperature of 28 $\pm$ 1°C and 60% R.H. Counts were made after 24 hours of application to find out the mortality percentage. Corrections were made by using Abbott's formula [6] and the LC_{50} and slope values for each toxicant were calculated.

To study both contact and stomach effect of the pesticides on some biological aspects of the predatory mite, the following methods were used :

i- Contact effect:

A group of 20 predatory adult female mites that survived after 24 hours of application with the LC_{50} concentration were isolated. Every mite was put separately over a disc of ~~sweet potato~~ plant as described previously. Ten adults of non-treated preys of spider mites were introduced daily to each separate female predator for a period of 7 days.

ii- Stomach effect :

The LC_{50} concentration of each toxicant was applied to the prey, T. cucurbitacearum. Ten of the survivals were introduced daily to each non-treated female predator (20 replicates) for a period of 7 days. This test was done using an incubator set on (28 ± 1°C and 60-70% R.H.).Observations concerning egg laying, incubation period, egg viability, duration of food consumption were recorded. Toxicity to the immature stages were recorded by transferring each hatched larvae to a new Petri dish where the mortality recordes were taken.

RESULTS

a- Pesticide toxicity to predator and prey :

From the obtained results (Table 1), it may be concluded that Neoron was the most toxic compound to the prey, T.cucurbitacearum (LC_{50} = 19 mg/kg) and the least toxic to the predatory mite, A.gossipi (LC_{50} = 250 mg/kg) whereas the other applied pesticides varied in toxicity and were always more toxic to the predator than the prey. Lannate was found to be the most toxic insecticide against the predator (LC_{50} = 5 mg/kg), it was ineffective against the prey (LC_{50} = 125000 mg/kg). With regard to, the slope values, they were comparatively lower for Neoron and Dursban (0.88 and 0.99, respectively) for the prey population, while the predator population showed high slope

values to Neoron and Dursban (2.20 and 2.38).

b- Effect of LC_{50} on the biological aspects of the predator:
i- The contact and stomach effects of the LC_{50} concentration for each applied pesticide on egg laying capacity, incubation period and hatchability of eggs are shown in Table (2).

Results indicated that egg laying capacity decreased from 1.58 egg/female/day, for control, to 0.7 and 0.05 egg/female/day for contact and stomach applications of Baythroid and Lannate respectively, whereas other pesticides varied in their effect. Statistical analysis proved significant differences among the high and low effective pesticides. The incubation period of eggs increased in all cases and reached its maximum length in Neoron (contact) and Bythroid, respectively. The percentage of hatched eggs decreased from 96.38% (control) to its maximum in Baythroid (70%) and Dursban (70.83) for contact and stomach applications, respectively.
ii- The duration and mortality of both larval and nymphal stages produced from hatched eggs are shown in Table (3).

Results showed that, the duration of larvae increased from 1.10 days, for control, to a maximum of 1.66 days for Lannate and 1.63 days for Bythroid for contact and

stomach applications, respectively. The same trend was observed in the nymphal stage. The nymphal period reached its maximum in Baythroid and Sumicidin for contact and stomach treatments, respectively. The lethal effect of the applied toxicants was continuous and affected the larval stage. The Sumicidin and Lannate were the most toxic materials against the larval stage (35.70 and 40.00% for Sumicidin and Lannate respectively). On the other hand, nymphs survived the effect of all the five applied compounds.

iii- Effect of pesticides on predation capacity.

It was clear from Table (1) that predation capacity decreased from 6.32 prey/female/day for control to 1.32 for Bythroid and 2.14 for Neoron in contact and stomach applications, respectively, and these two compounds were considered as the most toxic chemicals. On the other hand, Neoron (4.11 prey/female/day) and Lannate (4.21 prey/female/day) were considered as the most safe materials for contact and stomach applications, respectively. The statistical analysis indicated significant differences between high and low toxic compounds and control.

The results also showed that Dursban and Neoron had strong contact effect on the adult female of predators during the first week after treatment. Results also indicated that Dursban was the most toxic compound in case of

stomach application (Table 4).

DISCUSSION AND CONCLUSION

In the course of the present investigation Neoron was the most toxic compound to T.cucurbitacearum (Sayed) and at the same time was the least toxic chemical to the predatory mite,A.gossipi El-Badry. The other four insecticides applied varied in their toxicity and were always more toxic to the predator than the prey, specially Lannate which was very harmful to the predator and has negligeble effect on the prey. Similar conclusions were reported by Zohdy et al.[4]. They mentioned that the insecticide Lannate was the most toxic material to the predatory mite, A.gossipi, whereas the acaricides Acar and Kalthane were the least toxic compounds. Thus, Neoron can be used safely for the control of the phytophagous mite without any harm to the predator. Regarding the slope values, the comparatively lower values obtained with Neoron and Dursban indicate a heterogenecity of the population of T.cucurbitacearum in response to the two chemicals with possibly resistance built up with the continuous use of these compounds. The population of the predatory mite, A.gossipi showed less heterogenecity in response to Neoron and Dursban with high slope values (2.20 and 2.38).

Contact or stomach application of the LC_{50} of the app-

lied pesticidess caused a reasonable harmful effect on the biology and population density of the predatory mite. The predacious efficiency of the predator was negatively affected by using the pesticides . Similar results were obtained by some investigators [7,8 and 9]. These authors used various pesticides against Amblysieus exertus, A.brazilli and A.gossipi.

From the results obtained in the course of the present investigation, it could be concluded that when using a specific acaricide against phytophagous mites, it is recommended to apply the toxic compounds at a time when the population of the predatory mite is very low, to avoid direct suppression in population and harmful effects on the biology of the survived individuals.

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Table (1): Direct toxicity of five compounds on the predatory mite, Amblyseius gossipi and its prey Tetranychus cucurbitaceerum.

Insecticide	LC_{50} (mg/kg)		C.F.*		Slope	
	Predator	Prey	Predator	Prey	Predator	Prey
Sumicidin	12	1300	6.67-21.60	778.4-2171	1.22	0.99
Lannate	5	125000	2.80-9.10	54347.8-287500	1.66	1.19
Baythroid	10	1300	5.88-17.00	828 - 2041	1.35	1.13
Neoron	250	19	219.3-286.1	9.05 - 39.9	2.22	0.99
Dursban	26	14	18.57-36.80	7.78 - 13.5	2.38	0.88

* Confidence limits.

Table (2): Contact and stomach effect of five pesticides on fecundity, incubation period and hatchability of Amblyseius gossipi.

Pesticide	Total number of eggs/20 females/week		Mean number of eggs laid/ female/day		Mean number of incubation period(day)		Number of hatched larvae/20 females		Percentage of hatchability	
	Contact	Stomach	Contact	Stomach	Contact	Stomach	Contact	Stomach	Contact	Stomach
Sumicidin	18	11	0.13	0.08	1.93	1.85	14	9	77.70	81.81
Dursban	25	24	0.18	0.17	1.43	1.65	19	17	76.00	70.83
Baythroid	10	15	0.07	0.11	2.07	1.94	8	12	70.00	80.00
Lannate	22	7	0.16	0.05	1.38	1.77	17	5	77.27	71.24
Neoron	31	18	0.22	0.13	2.13	1.84	25	13	80.64	72.22
Control	221	221	1.58	1.58	1.24	1.24	213	213	96.38	96.38
L.S.D. 0.05	12.60	50.40	0.09	0.36	0.23	0.15	6.18	7.40	-	-
0.01	9.80	36.40	0.07	0.26	0.17	0.11	8.55	10.24	-	-

Table (3): Contact and stomach effect of some pesticides on duration and mortality of larvae and nymphs of *Amblysieus gossipi*.

Pesticide		Average of duration in days				Mortality			
		Larvae		Nymphs		Larvae		Nymphs	
		Contact	Stomach	Contact	Stomach	Contact	Stomach	Contact	Stomach
Sumicidin		1.58	1.46	4.26	4.56	35.70	33.30	0.0	0.0
Dursban		1.28	1.34	3.92	3.71	21.10	23.20	0.0	0.0
Baythroid		1.50	1.63	4.44	4.26	25.00	16.60	0.0	0.0
Lannate		1.66	1.42	4.12	4.02	23.50	40.00	0.0	0.0
Neoron		1.34	1.53	3.78	4.47	16.00	30.70	0.0	0.0
Control		1.10	1.10	3.12	3.12	0.40	0.40	0.0	0.0
L.S.D.	0.05	0.10	0.05	0.11	0.05	-	-	-	-
	0.01	0.14	0.07	0.16	0.06	-	-	-	-

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Teble (4): Contact and stomach effect of some pesticides on predation capacity of Amblyseius gossipi.

Pesticide	Mean number of consumed preys/ female/week		Mean number of consumed preys/ female/day		Mortality predators during week			
					Number		Percentage	
	Contact	Stomach	Contact	Stomach	Contact	Stomach	Contact	Stomach
Sumicidin	23.50	16.81	3.36	2.32	6	4	30.0	20.0
Dursban	12.25	19.00	1.75	2.72	8	9	40.0	45.0
Baythroid	9.25	21.25	1.32	3.04	5	7	25.0	35.0
Lannate	19.25	29.46	2.75	4.21	5	8	25.0	40.0
Neoron	28.75	15.00	4.11	2.14	8	2	40.0	30.0
Control	44.25	44.25	6.32	6.32	2	2	10.0	10.0
L.S.D. 0.05	4.10	3.18	0.58	0.45	-	-	-	-
0.01	5.67	4.40	0.81	0.62	-	-	-	-

تأثير بعض مبيدات الآفات على المجالات البيولوجيه للحلم المفترس *A. gossipi*

ا٠د٠ اعتماد نناتى ، ا٠د٠ محسن شكرى ، د٠ عبدالحكيم الشربينى
كلية التربية ـ جامعة طنطا (كفر الشيخ)
كلية الزراعة ـ جامعة طنطا (كفر الشيخ)

عنيت هذه الدراسة اساسا بالتأثير الذى تحدثه خمسة مبيدات على الحلم المفترس *A. gossipi* وعلى العنكبوت الأحمر ، أيضا قيم الـ LC_{50} لجميع المبيدات المختبره بالنسبه لكل من المفترس والفريسه قد تم تقديرها ـ والنتائج المتحصل عليها يمكن تلخيصها فى الآتى :ـ

١ـ لوحظ أن مبيد النيورون كان أشد المبيدات سميه للعنكبوت الأحمر (LC_{50} = 19 mg/kg) بينما أعطى نفس المبيد تأثيرا ساما أقل بالنسبة للمفترس (LC_{50} = 250 mg/kg)

٢ـ باقى المبيدات اختلفت وتباينت فى درجه سميتها ـ ولكنها وبصفه عامه كانت أكثر ضررا بالمفترس٠

٣ـ كل المبيدات المختبره أضرت بالأطوار الكامله وغير الكامله للمفترس ـ حيث تسببت فى انخفاض كفاءه وضع البيض ، وفى انخفاض نسبه الفقس وايضا فى معدل استهلاك المفترس للفريسه٠

٤ـ أشارت نتائج القياسات الحيوية المستخدمه فى هذا البحث الى أن مبيد البايثروويد كان أعظم المبيدات ضررا فى حين أن مبيد السوميسيدين كان أقلهم خطرا على المفترس٠ هذا وقد أحدث مبيدى اللانيت و الدورسبان تأثيرا يتوسط فى قوته (مقدار الضرر) التأثير الضار للمبيدين السابقيين٠