Side Effects of Some insecticides on the Parasitoid *Encarsia formosa* Gahan. (Hymenoptera: Aphelinidae)

Ahmed Ali BALOCH, Ali Muhammad KALROO
Cotton Research İnstitute, Sakrand-67210,
District Nawabshah, Sindh-PAKİSTAN

Halit ÇAM
Gaziosmanpaşa University, Faculty of Agriculture,
Department of Plant Protection, Tokat-TURKEY

Received:

ABSTRACT

Three pesticides of different groups were tested in the laboratory for the evaluation of side-effects of the pesticides on the parasitoid *Encarsia formosa,* in Germany in 1996. The adult mortality as well as the rate of parasitization was assessed. Maximum mortality i.e. 36.76 % was caused by Karate in 3 days old adults and followed by Nuvacron where the same was 33.33 % in 2 days old adults. 100% mortality occurred in Nuvacron, Roxion, Karate and Control at 5 th, 7th, 4 th and 11th day old *E.formosa* respectively. Maximum reduction in parasitization i.e. 85.33% was caused by Karate and followed by Nuvacron (77.33% reduction) as compared to control.

Key Words : *Encarsia formosa*, Aphelinidae, Hymenoptera, Insecticides.

Parazitoit *Encarsia formosa* Gahan (Hymenoptera: Aphelinidae)'ya Bazı İnsektisitlerin Yan Etkileri

ÖZET

Laboratuvarda, parazitoit *Encarsia formosa'* ya pestisitlerin yan etkilerinin değerlendirilmesi için farklı gruplardan üç pestisit 1996 yılında Almanya'da test edildi. Ergin ölüm ve parazitleme oranları belirlendi. En fazla ölüm oranına, üç günlük erginlerde % 36.76 ile Karate ve iki günlük erginlerde % 33.33 ile Nuvacron neden oldu. Nuvacron, Roxion ve Karate İnsektisitleri kullanıldığında sırasıyla 5, 7 ve 4 günlük

E.formosa' larda % 100 ölüm ortaya çıkarken bunlar kullanılmadığında parazitoit 11 gün yaşadı. Kontrol ile karşılaştırıldığında en yüksek parazitlenme % 85,33 oranında Karate ile elde edildi, bunu % 77,33 ile Nuvacron takip etti.

Anahtar Kelimeler: *Encarsia formosa,* Aphelinidae, Hymenoptera, İnsektisitler.

INTRODUCTION

White fly *Bemisia tabaci* (Genn.) is a very important and epidemic pest of cotton and some important vegetables e.g tomato, brinjal, potato etc. in Pakistan. It also causes considerable damage to greenhouse crops and ornamentals (1).

In Pakistan, whitefly is a great threat to cotton crop. It not only damage the crop but affect the quality of the lint. Because of this damage, cotton export of the country is going to decline. This alarming situation forced the policy makers and scientist of the country to develop a plant protection strategy of cotton crop against this pest on warm footings.

Traditionally, pesticides are considered as only the parameter to control the pests. But actually it may not be true. One can not omit or afford to ignore the side effects of the pesticides. Bio-control agents play a vital role in plant protection strategy, but in a heavy infested crops, these natural enemies are often not able to control the pests satisfactorily (2).

There are many natural enemies of *B. tabaci. Encarsia formosa* is one of the most effective natural antagonist for the control of this pest (3). Therefore selective pesticides are required to support the effect of the beneficials.

The aphidicide Pirimicarb and acaricides like Avermectin and Flucy cloxuron are known to reduce some pest species but to spare the beneficial ones at a dilution of 1/10 of the recommended field concentration (4). In Pakistan up to now only a few pesticides are available to give better control of this pest but their side effects on beneficials are still not known. So in this work some pesticides were tested in the laboratory to evaluate their possible side-effects on *E.formosa.*

MATERIALS AND METHODS

This research was carried out in Hannover Technical University, Germany, in 1996. The mass rearing of *E. formosa* was done on whitefly infested cotton plants under greenhouse conditions, where temperatures were 27-32 ± 1 °C with a 50 to 75 % R.H. and 16 hour light. Leaves with parasitized whitefly larvae were collected and kept in a closed plastic box of 30 X 18 X 10 cm. for 24 hours in the greenhouse compartment where *E. formosa* was mass reared. For the test, adult females of *E.formosa* were collected with an exhaustor. The missing numbers (if any) of one day adults of wasps were completed by adding the new ones not older than three days.

The experiment was conducted as per the guidelines of Ooman (5) and the testing units were constructed as per his description-consisting of two glass plates (12 X 12 cm.). One with a hole (5 cm.), a metal ring with gauge covered ventilation holes and a file of cellulose paper backed by a card board-sheet, kept together with two bolts and elastic bands. A tube on the metal ring served as connection of the cage to a ventilation system.

The glass plates as well as the metal ring were sprayed in a Potter Tower (Burkhard Manufacturing 12 tbs./sq. Inch; distance of 1.5 cm. between spray table and tube) resulting in 1 mg. deposit per cm^2 and left to dry for one hour.

Pesticides were tested at the recommended field concentration or doze. For the experiment pesticides quantity was calculated as mg/litre of spray volume, which was 40 litres/acre. Deionized water was used for the control group.

Fully developed primary leaves of cotton with about 2 day old larvae/nymphs of *B.tabaci* were exposed on the 1 to 5 days after the application for six hours to females of *E.formosa* for parasitization. The bean leaves were then placed on detached leaf cultures with bottom side up on a pad of moist cotton wool and left to develop for about 14 days (at 20 ± 1 °C with 55 to 70% R.H. and 16 hour light). The experiment was replicated for four times.

RESULTS AND DISCUSSION

Rate of Mortality

The mortality rate of the adult females was assessed on the 1st to 11th day of the observations. The mortality rates were corrected according to Abbott (6).

The results presented in Table 1, indicated that the maximum mortality i.e. 33.33, 26.67, 36.67 and 20.00 % was caused by Nuvacron, Roxion, Karate and control in 2, 3 and 4 days old adults respectively, whereas 100% mortality occurred in Nuvacron, Roxion, Karate and control at 5th, 7th, 4th and 11th day old *E.formosa* respectively.

The 100% mortality in the 11 day old wasps of *E.formosa* in the untreated control may be due to the natural mortality at this age.

Level of Parasitization

Observations presented in Table 2, reveals that the percentage of parasitization increased as the age of *E.formosa* increased and vice versa. Maximum percentage of reduction in parasitization i.e. 85.33% was caused by Karate and followed by Nuvacron, where the same was 77.33% as compared to control.

Table 1. Rate of mortality of *Encarsia formosa* caused by different pesticides.

Age of E.formosa (Days)	No.of adults	No.of adults died in treatments i.e.				% age of mortality caused by			
		Nuvacron	Roxion	Karate	Control	Nuvacron	Roxion	Karate	Control
1	30	6	3	7	0	20.00	10.00	23.33	0
2	30	10	5	10	1	33.33	16.67	33.33	3.33
3	30	9	8	11	2	30.00	26.67	36.67	6.67
4	30	3	6	2	6	10.00	20.00	16.67	20.00
5	30	2	4		6	6.67	13.33		20.00
6	30		3		4		10.00		13.33
7	30		1		4		3.33		13.33
8	30				3				10.33
9	30				2				6.67
10	30				1				3.33
11	30				1				3.33
Total percentage of mortality						100	100	100	99.99

Table 2. Level of parasitization of whitefly caused by *Encarsia formosa.*

(Figures in Bracket indicate the percentage of reduction of parasitization as compared to the control).

Age of E.formosa (Days)	No.of Females	Average percentage of Parasitization/Female in the Treatment			
		Nuvacron	Roxion	Karate	Control
1	20	18(45.00)	12(30.00)	19(47.50)	40.00
2	20	31(51.67)	23(38.33)	33(55.00)	60.00
3	20	45(61.64)	37(50.68)	50(68.49)	73.00
4	20	56(70.00)	46(57.50)	62(77.50)	80.00
5	20	58(77.33)	46(61.33)	64(85.33)	75.00

The total number of parasitized whitefly was counted and divided by the number of females of *E.formosa* present at the start of the test. The reduction of parasitization ranged between 30 to 47.5 (1 day old) and 61.33 to 85.333% (5 days old) *E.formosa* females, so Roxion can be classified as less harmful to *E.formosa* as compared to Karate and Nuvacron.

Similarly according to Ooman's (5) sequential testing scheme which was adopted by the IOBC working group and EPPO, a pesticide causing reduction of parasitization of less than 50% should be classified as "harmful". Therefore in present study no further testing after 5 days were conducted with the pesticides on the immatures of whitefly. After Ooman (5) the threshold for harmless was changed by the IOBC working group to 30% reduction of parasitization (7). According to this new scheme of classification Roxion is moderately harmful for *E.formosa.*

If we look at International literature, the Pyrethroids generally showed a harmful effect on beneficial species. Cypermethrin and Fenpropathrin caused 100% reduction in parasitization of *Encarsia sp.* (8). Deltamethrin had to be classified as harmful (IOBC class "4") when it was tested against *Encarsia sp.* in the laboratory and in semifield tests i.e. 97% reduction of parasitization (9). Where as Codina *et al.* (8) reported that the Carbamate methomyl proved to be "moderately harmful" with 73% reduction in parasitization after the semifield test, while pyrethroids and Methomyl are less suitable

i.e. 97% reduction of parasitization (9). Where as Codina *et al.* (8) reported that the Carbamate methomyl proved to be "moderately harmful" with 73% reduction in parasitization after the semifield test, while pyrethroids and Methomyl are less suitable to enhance *E.formosa* in the control of the whitefly. The systemic insect growth regulator Cyromazin was safe to adults of *E.formosa,* but had some effect on the larvae (40%) reduction of fecundity.

ACKNOWLEDGEMENT

The senior author is highly thankful to Alexander Von Humboldt Foundation of Germany for granting the fellowship during 1996, which make enable him to carry out these studies in Germany.

REFERENCES

1. Baloch, A.A., Population Dynamics and Bionomics Studies of White fly (*Bemicia tabaci* Genn.) on Cotton Crop and Biological means to develop optimum Pest Management Practices in Sindh. Final Research Report - Project No. PK-ARS - 228, Submitted to USDA Under Pl. 480 Programme, 174 pp., 1990.

2. Baloch, A.A., and Kalroo, A.M., Integrated Pest Management in Cotton in Sindh, Pakistan. I. Natural Enemies of Insect Pests, 18 pp. In Proceedings of the BOSTID-PARC Research Programme-Towards Solutions for Stressed Lands. A Publication of U.S.National Academy of Science,Washington D.C, August,1994.

3. Henter, H.J., Luttikuizen, P.C., Visser, J.W. and Lenteren Van, J.C., Variation in host use in *Encarsia formosa.* Bull.IOBC. 16 (2): 67-70,1993.

4. Stalz, M., Unter Suchung Zur Wirkung Subletaler Konzentratonen Ausgewahlter Phlanzen Schutzmittel: auf *Tetranychus urticae* K. (Acarina: Tetranychidae) und *Phytoseiulus persimilis* A.H. (Acarina: Phytoseiidae) in labour und in Halbfreiland. Ph.D. Thesis, Univ. Wien, 1992.

5. Ooman, P.A., Guidelines for the evaluation of side effects of pesticides: *Encarsia formosa.* Bull. OEPP/EPPO Bull. 15: 257-265,1985.

6. Abbott, W.S., A method of Computing the effectiveness of an insecticides. J. Econ.Ent. 18: 265-267, 1925.

7. Hassan, S.A., Meeting of the working group "Pesticides and Beneficial Organisms". University of Southampton, U.K., September 1991. Bull.IOBC/WPRS, 15: 1-3,1992.

8. Codina, J., Avilla, J. and Albajes, R., Toxicity of various agrochemicals to *Encarsia tricolor* (Hymenoptera: Aphelinidae) a parasitoid of *Trialeurodes vaporariorum* (Homoptera: Aleyrodidae). Proceedings of the CEC / IOBC Expert Meeting Cabrils: 27-29 May 1987. "Integrated Pest Management in Protected Vegetable Crop", 167- 174,1990,

9. Habtu, F.F. and Samsoe-Petersen, L., Semi-field method for testing side effects of pesticides on adults of the parasitic wasp *Encarsia formosa* (Gahan) (Hymenoptera: Aphelinidae). J.Appl.Ent., 104 (5): 473-479, 1987.