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Evaluation of insecticidal rotation against cotton whitefly *Bemisia tabaci* on the Nili tomato crop.

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ABSTRACT

A field trial was conducted on a viral-infection tolerant tomato variety (Rover E.446 F_1 hybrid), at Etay El-Baroud, Agricultural Research Station (Zarzoura), Behera Governorate, Egypt. Three treatments with different biorational and conventional insecticides in a rotational program had been applied for controlling the cotton whitefly *Bemisia tabaci*.

The present results showed that the best treatment was a sequence of fenpropathrin, pymetrozine and lambda-cyhalothrin. It gave good result for controlling the different stages of *B. tabaci* and minimized visible virual symptoms. Also, the highest yield of tomatoes was obtained after three sprays during the season .

INTRODUCTION

Tomato, *Lycopersicon esculentum* Miller is one of the most important vegetable crops in Egypt, for fresh consumption, processing and exportation. Viruliferow whiteflies are able to infect tomato plants with Tomato Yellow Leaf Curl Virus (TYLCV) within 4 hours of inoculative feeding insecticides with a quick killing effect on adults are needed for preventing the spread of this virual disease. There are four regular periods of tomato plantation in Egypt: Early summer, Summer, Nili plantation and Winter plantation. *Bemisia tabaci* is a common pest on all these plantations

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but Nili plantation is the most severely affected. Complete yield loss in the autumn plantation (Nili) is common.

Organo Phosphate compounds (OPs), carbamates and pyrethroids are usually used in Egypt to suppress the whitefly populations. However, most of them does not give satisfactory results, probably because of development of resistance (Ayoub 1994, Cahill *et. al.*, 1995; and Ayad *et al.*, 1997 & 1999). The present study aimed to evaluate and affirm the effect of certain alternation or insecticidal rotation schemes on whitefly infestation, virual transmission and average yield of harvested tomatoes.

MATERIALS AND METHODS

A field trial was conducted on tomato variety Rover (E-446)F_1 hybrid at Etay El-Baroud Agricultural Research Station (Zarzoura), Behera Governorate, Egypt. Seedlings of tomato 22 days old, were transplanted in open field plots on August 16, 1998, after melon crop. The experimental design was strips of three treatments and an untreated check. Plot size was 250 m^2, with 4 replicates. Normal agricultural practices were followed with the application of the recommended rates of the biorational and conventional insecticides in a rotational program as illustrated in (Table 1). A single nozzle Knapsack sprayer was used.

Table (1): Treatments, spraying dates and rates of application.

	Date	31/8/1998	7/9/1998	14/9/1998	21/9/1998	28/9/1998
	Treatments	1St.Spray	2nd.Spray	3rd.Spray	4th.Spray	5th.Spray
Rover (E-446)	1	Pirimiphos-methyl (Actellic EC 50%) 375 ml / 100L.	*Beauveria bassiana* (Biofly IU $3 \cdot 10^7$ 100 ml / 100L.	Minerral oil (KZ-oil EC 95%) 1.5 l / 100L	Chlorpyrifos-methyl (Reldane EC50%) 250 ml / 100L	Potassium salts of fatty acids (M-Pede 49%) 1.5 l / 100L
	2	Fenpropathrin (Dathrin EC 20%) 750 ml / fed.		Pymetrozine (Chess SP 25%) 480 gm / fed.	Lambda-Cyhalothrin (Karate EC 5%) 94 ml / fed.	
	3	*Beauveria bassiana* (Biofly)	Imidacloprid (Confidor SC 35%) 75 ml / 100L.	Minerral oil (KZ-oil)	Thiocyclam hydrogen oxalate (Evisect SP 50%) 250ml / 100L	Potassium salts of fatty acids (M-Pede)

The efficacy of the products used against the adult stages was determined by counting insects on the lower surface of 20 compound leaves at the center of each replicate (80/treatment). Counts were made in the early morning when flight activity is minimal according to Butler *et al.* (1988). Pre-treatment counts were made in the early morning just before application and post-treatment counts were made on day 1, 3, 5 and 7 after treatment. The spray program was set depending on the average adult count approximately three on the compound leaf (Mehta *et al.*, 1994).

The efficacy against immature stages (eggs and nymphs) was tested by collecting 20 compound leaves/replicate (80/treatment) on day 2, 5 and 7 after each application, leaves were carried to the laboratory and whitefly immature stages were counted using a binocular microscope. Percent reduction was calculated according to Henderson and Tilton equation (1955).

The TYLCV symptoms were evaluated on 25 randomized plants in each replicate (100/treatment) 34, 48, 62 and 76 days after transplanting. Symptoms were evaluated morphologically. The number of plants exhibiting virual symptoms was recorded, and the percent virual symptoms severity was visually estimated. Determination of disease percentage and severity was estimated according to infection degrees (ID) as follows: no visible symptoms (1); slight stunting and no apparent other symptoms (3); moderate stunting and other mild symptoms (5); moderate to severe stunting and striking other symptoms (7) and severe symptoms (9) (Polston *et al.*, 1994; Abney and Ploper, 1994):

$$\text{Diseases Severity} = \frac{\Sigma[\text{infection degrees} \times \text{number of samples}]}{\max \text{of ID} \times \text{Total number of samples}} \times 100$$

RESULTS AND DISCUSSION

Data in (Table 2) showed the efficacy of the chemicals used on eggs. Treatment 2 showed the highest efficacy followed by treatment 1 and 3.

The efficacy of the chemical used on larvae (Table 3) showed that treatment 2 was still the best followed by treatment 3 then 1, respectively.

Table (2): Efficacy of certain treatments against whitefly eggs on tomato Nili plantation, presented as percent reduction of infestation at different time intervals.

Date	3/8/98			7/9/98			14/9/98			21/9/98			28/9/98		
Treatment	D2(1)	D5(1)	D7(1)	D2(2)	D5(2)	D7(2)	D2(3)	D5(3)	D7(3)	D2(4)	D5(4)	D7(4)	D2(5)	D5(5)	D7(5)
1	83	81	24	60	–	88	66	86	94	82	86	89	21	84	51
2	91	96	97	96	96	96	96	89	99	95	94	81	86	100	88
3	51	89	73	87	86	43	0	71	86	57	62	39	44	22	51

Table (3): Efficacy of certain treatments against whitefly larvae on tomato Nili plantation, presented as percent reduction of infestation at different time intervals.

Date	31/8/98			7/9/98			14/9/98			21/9/98			28/9/98		
Treatment	D2(1)	D5(1)	D7(1)	D2(2)	D5(2)	D7(2)	D2(3)	D5(3)	D7(3)	D2(4)	D5(4)	D7(4)	D2(5)	D5(5)	D7(5)
1	93	77	0	0	4	0	0	61	63	38	54	40	60	50	0
2	99	99	93	87	70	36	63	60	71	79	93	82	96	70	96
3	60	22	20	66	7	0	50	85	64	48	93	71	90	68	71

Table (4): Efficacy of certain treatments against whitefly as immature stages (eggs & larvae) on tomato Nili plantation, presented as percent reduction of infestation at different time intervals from treatment.

Date	3/8/98			7/9/98			14/9/98			21/9/98			28/9/98		
Treatment	D2(1)	D5(1)	D7(1)	D2(2)	D5(2)	D7(2)	D2(3)	D5(3)	D7(3)	D2(4)	D5(4)	D7(4)	D2(5)	D5(5)	D7(5)
1	87	79	14	46	-	47	25	76	88	66	74	72	43	68	21
2	95	97	96	94	90	86	83	80	94	88	94	81	92	83	93
3	57	74	60	83	63	41	22	80	83	54	78	56	74	50	63

Table (5): Efficacy of certain treatments against whitefly adults on tomato Nili plantation, presented as percent reduction of infestation at different time intervals from treatment.

Date	31/8/98				7/9/98				14/9/98				21/9/98				28/9/98		
Treatment	D1	D3	D5	D7	D8 (1)	D10 (3)	D12 (5)	D14 (7)	D15 (1)	D17 (3)	D19 (5)	D21 (7)	D22 (1)	D24 (3)	D26 (5)	D28 (7)	D29 (1)	D31 (3)	D33 (5)	D35 (7)
1	79	71	43	24	0	33	0	6	82	37	39	47	0	0	0	0	14	61	61	69
2	98	99	98	95	91	86	75	69	92	68	61	70	99	98	93	90	83	78	92	99
3	60	28	20	22	87	72	28	18	71	17	34	0	97	11	0	0	31	23	57	66

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From the results of (Tables 2 and 3) it can be noted that eggs of *B. tabaci* appeared to be more susceptible than larvae to the tested chemicals. These findings disagreeded with those obtained by El-Sayed and Abou El-Ghar (1992) However, when the results of both stages were combined as immature stage (egg+nymphs), treatment 2 was the best followed by 3 then 1, respectively. (Table 4).

Regarding the efficacy on adults (Table 5), treatment 2 gave the highest effect with the least number of adults on the leaves followed by treatment 3 then 1. Treatment 2 gave the best results for all stages, however, it was sprayed only three times, the first with fenpropathrin, then pymetrozine and Lambda-cyhalothrin. These results fully agreeded with both Korkor *et al.*, (1995) of who reported that synthetic pyrethroids were the most effective insecticides against *B. tabaci.*, also with those previously obtained by Ayad *et al.*, (1999 & 2002).

Also Among pyrethroids, it was found that cyhalothrin and fenpropathrin controlled *B.tabaci* and suppressed leaf crumple virus transmission. Moreover, in another study, pymetrozine was reported to be an effective insecticide on the different stages of whitefly (Fluckiger *et al.*, 1992). Also it was mentioned by Elbert *et al.*, (1990) that imidacloprid was highly effective insecticide for controlling whitefly resistant strain.

Table (6): Per-cent of Plants infected with virus from 34-76 days after transplanting

Date	19/9	3/10	17/10	31/10
	Infection %			
Treatment	D34	D48	D62	D76
Check	19	66	100	100
1	14	50	81	84
2	8	36	57	61
3	18	61	89	90

The average percentages of virual infected plants (Table 6) showed that treatment 2 was still the best with the minimal severity of infection (Table 7). Verma *et al.*, (1989) reported that the incidence of tomato leaf curl virus was directly related to the population density.

Table (7): Per-cent Severity with visible virus symptoms.

Date	19/9	3/10	17/10	31/10
	Severity %			
Treatment	D34	D48	D62	D76
Check	7	8	9	9
1	6	6	7	8
2	3	4	4	4
3	5	6	7	7

The average yield of harvested tomatoes is presented in (Table 8). Treatment 2 produced the highest yield followed by 3 then 1. It is quite clear that there was a relation between the population density of *B. tabaci* and tomato yield losses.

Table (8): Average yield of harvested tomatoes

Treatment	Check	1	2	3
Yield in kg	304	483	1437	744

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تقييم المبيدات الحشرية فى برامج دورية على الذبابة البيضاء فى محصول الطماطم النيلى

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تم تقييم ثلاثة معاملات بالمبيدات التقليدية وغير التقليدية على صنف الطماطم Rover (E-466) F ١ hybrid لمكافحة لذبابة البيضاء فى محصول الطماطم النيلى كانت مساحة القطعة التجريبية ٢٥٠ م٢ شرائح قسمت إلى أربع مكررات.

أوضحت النتائج ان المعاملة بالفينبروباثرين (داثرين ٢٠%) بيمترازين (تشيس ٢٥%) ثم لنداسيهالوثرين (كرات ٥%) فى تتابع قد أعطت أفضل نتيجة بالنسبة لمكافحة البيض، اليرقات، الحشرات الكاملة كذلك أعطت أفضل محصول وأقل نسبة إصابة فيروسية مع انخفاض فى شدة الإصابة.