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Population Fluctuation of *Tuta absoluta* on Tomato Plant and Effect of Some Insecticides Against it

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Abstract: Tomato leaf miner, *Tuta absoluta* (Meyrick) is a serious pest especially, for tomato plants. It infects the leaves as well as the fruit and causes more damage to them. In this study, the experiments were carried out at open field planted with tomato (Ilesa cultivar) at summer season. This study concerned mainly with determination the density of *T. absoluta* inside the fruit on this cultivar and management of it with new pesticides. The results indicated that, there were two peaks of *T. absoluta* in the fruit of tomato during the summer season of the two years 2021 and 2022. The tested insecticides were Tomagard 5% SG (Emamectin benzoate), Molterace (Metaflumizone) 22% SC and Fast 5% EC (Esfenvalerate). Molterace was the effective one when applied on the fruit during the two years.

Key words: Tomato plants · *T. absoluta* · Insecticides

INTRODUCTION

Tomato cultivar (*Lycopersicon* spp.) is economically one of the important vegetables [1, 2]. Tomato plants are grown both under plastic-covered greenhouses and in the open field. The annual production is estimated at about 107 million metric tons which represent 72 % of the total production [3, 4].

Tomato leaf miner, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) is a pest of high economic importance in many countries such as the Mediterranean basin and Latin America. Although potatoes, physalis, common beans and various wild solanaceous plants are suitable hosts of it, the primary host is tomato [5].

Chemical control is the primary method to manage pests using synthetic insecticides, but it has serious drawbacks due to high insecticide costs and the destruction of natural enemy populations [6, 7]. Also, the chemical insecticides make residues on tomato fruits and pollution in the environment [8, 9].

This study aims to evaluate the population fluctuation of *T. absoluta* in tomato cultivars during the summer season in 2021/ 2022 and the management of it with chemical insecticides.

MATERIALS AND METHODS

Field Population Density: The experiments were accomplished on the farm of the Agriculture Research Center at Baramoon village, Dakahlia Governorate during two summer seasons of 2021/ 2022. This field is free of any pesticide treatment. The area was about six Kirat, divided into two kirates for population fluctuation and the other for application of three insecticides compared with control.

Every week after the appearance of tomato fruits, the population fluctuation of *T. absoluta* inside the fruits was examined and counted.

The Used Insecticides and Field Experiment: Three chemical insecticides were used and mentioned in Table (1). They were applied in the two seasons on the fruits of tomatoes. Each insecticide was applied in kirate, which was divided into four replicates and a kirate was used for control. 100 fruits were checked in each treatment, live larvae were counted before spraying and 5, 7 and 10 days after spraying.

Statistical Analysis: Data in reduction experiment were analyzed by Hendrson and Tilton [10] as follows:

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Table 1: Names and doses of the used insecticides

Active ingredients	Trade name	Dose
Emamectin benzoate	Tomagard 5% SG	40 gm/ 100 L water
Metaflumizone	Molterace 22% SC	100 cm/ 100 L water
Esfenvalerate	Fast 5% EC	40 cm^3/ 100 L water

$$\text{Reduction mortality \%} = [1-(\frac{C_b}{C_b} \times \frac{T_a}{T_b})-1] \times 100$$

whether:

C_b = Number of alive pest individuals in control before treatment.
C_a = Number of alive pest individuals in control after treatment.
T_a = Number of alive pest individuals after treatment.
T_b = Number of alive pest individuals before treatment.

RESULTS

Population Density: Data in Fig. (1) illustrated that there were two peaks of population density of *T. absoluta* inside the tomato fruits, one peak was on 20 May which recorded 18 in 2021 and 20 in 2022. However, the other peak was detected on 17 June which recorded 22 in 2021 and 26 in 2022. Awadalla *et al.* [11] detected the population density of *T. absoluta* on tomato planting and found that the highest population of male moths was in June when using the trap.

Field Experiment

During 2021: Data in Table (2) showed that, after 5 days of treatment, the total reduction was 60.56, 60.25 & 25.83% for Tomagard, Molterace and Fast, respectively.

Table 2: Reduction of *T. absoluta* due to insecticide treatment during 2021

	1st replicate			2nd replicate			3rd replicate			4th replicate			Treatment efficiency		
	Pest number			Pest number			Pest number			Pest number			Pest number		
Treatment	Before	After	Red. %	Before	After	Red. %	Before	After	Red. %	Before	After	Red. %	Before	After	Total Red. %
							After 5 days								
Tomagard	2	1	50	2	1	40	3	2	11.1	3	2	33.3	2.5	1.25	60.56
Molterace	3	1	66.67	4	1	70	3	1	55.6	4	2	50	3.5	1.25	60.25
Fast	4	2	50	3	2	20	4	3	0	3	2	33.3	3.5	2.25	25.83
Control	4	4		6	5		4	3		4	4		4.5	4	
							After 7 days								
Tomagard	2	0	100	2	0	100	3	0	100	3	1	66.7	2.5	0.25	91.67
Molterace	3	0	100	4	0	100	3	0	100	4	1	75	3.5	0.25	93.75
Fast	4	1	75	3	0	100	4	0	100	3	0	100	3.5	0.25	93.75
Control	4	4		6	5		4	3		4	4		4.5	4	
							After 10 days								
Tomagard	2	0	100	2	0	100	3	0	100	3	0	100	2.5	0	100
Molterace	3	0	100	4	0	100	3	0	100	4	0	100	3.5	0	100
Fast	4	0	100	3	0	100	4	0	100	3	0	100	3.5	0	100
Control	4	5		6	6		4	4		4	5		4.5	5	

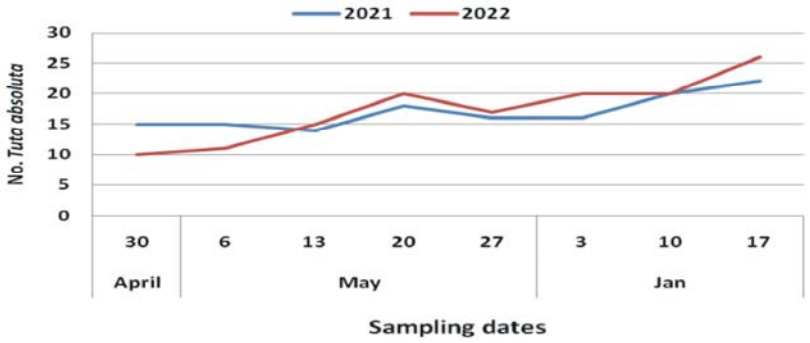

Fig. 1: Population density of *Tuta absoluta* on tomato fruits during 2021

Table 3: Reduction of *T. absoluta* due to insecticide treatment during 2022

	1st replicate			2nd replicate			3rd replicate			4th replicate			Treatment efficiency		
	Pest number			Pest number			Pest number			Pest number			Pest number		
Treatments	Before	After	Red. %	Before	After	Red. %	Before	After	Red. %	Before	After	Red. %	Before	After	Total Red. %
							After 5 days								
Tomagard	3	3	0	3	2	20	3	1	66.67	3	2	33.33	3	2	30
Molterace	2	0	100	3	2	20	3	2	33.33	2	1	50	2.5	1.25	50.8
Fast	1	0	100	3	2	20	2	2	0	4	2	50	2.5	1.5	42.5
Control	4	4		6	5		4	4		4	4				
							After 7 days								
Tomagard	3	0	100	3	2	33.33	3	2	46.67	3	1	66.7	3	1.25	61.68
Molterace	1	0	100	3	2	33.33	3	2	46.7	3	0	100	2.5	1	70.1
Fast	1	1	20	3	0	100	2	2	20	4	3	25	2.5	1.5	41.25
Control	4	5		6	6		4	5		4	4				
							After 10 days								
Tomagard	3	0	100	3	0	100	3	0	100	3	0	100	3	0	100
Molterace	1	0	100	3	0	100	3	0	100	3	0	100	2.5	0	100
Fast	1	0	100	3	0	100	2	0	100	4	0	100	2.5	0	100
Control	4	6		6	8		4	6		4	6				

Table 4: Mean of the total reduction of larvae during 2021/ 2022

Year	Treatments	Mean of 1st reduction after 5 days	Mean of 1st reduction after 7 days	Mean of 1st reduction after 10 days	Mean of total reduction
2021	Tomagard	33.61	91.67	100	75.09
	Molterace	60.56	93.75	100	84.77
	Fast	25.83	93.75	100	73.19
2022	Tomagard	30	61.68	100	63.9
	Molterace	50.8	70.1	100	73.6
	Fast	42.5	41.25	100	61.25

However, after 7 days of treatment, the reduction was 91.67, 93.75 & 93.75% for the three insecticides, respectively. After 10 days of treatment, the reduction was 100% for the three insecticides. Jansson, *et al.* [12] and Torres, *et al.* [13] illustrated that Emamectin benzoate (Tomagard) has a high potency against lepidopterous pests with an efficacy of about 1, 500-fold.

During 2022: Data in Table (3) showed that, after 5 days of treatment, the total reduction was 30, 50.8 & 42.5% for Tomagard, Molterace and Fast, respectively. However, after 7 days of treatment, the reduction was 61.68, 70.1 & 41.25% for the three insecticides, respectively. After 10 days of treatment, the reduction was 100% for the three insecticides. Brévault *et al.* [14] recorded a good efficacy of the insecticide, Indoxacarb as a larval insecticide of *H. armigera*.

Total Reduction During the Two Years 2021/ 2022: Data in Table (4) detected that Molterace had the highest reduction reported at 84.77 & 73.6% in 2021 & 2022, respectively. Then Tomagard recorded 75.09 & 63.9% in 2021& 2022, respectively. Then, fast recorded 73.19 & 61.25% in 2021 and 2022, respectively. Méndez *et al.* [15] and Ghosh *et al.* [16] proved that Metaflumizone is very effective against *Helicoverpa armigera*.

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