

EFFECT OF SOME BIOLOGICAL AND CHEMICAL PESTICIDES IN CONTROLLING *TUTA ABSOLUTA* OF TOMATO

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ABSTRACT

This study was conducted at the open fields of the Agricultural Research Station in Dohuk Governorate during the year 2019 on the tomato crop, a local variety. In this study, the effect of chemical pesticides (*Imidamex*, *Matrixine plus*) and biological pesticides (*Antario KAB*, *Biocure*) were tested on the percentage of leaf infection, number of larvae, the percentage of fruit infestation and the rate of productivity of one plant. The results revealed that the lowest percentage of leaf infection and the lowest number of larvae appeared with plants treated with *Biocure*, with an average of 22.7% and 0.36 larva/leaf, respectively. Whereas, the lowest infection rate for fruits and the highest productivity of plants appeared of plants treated with *Antariocap*, as the rates were 2 fruits/plant and 7.32 kg/plant, respectively. The results showed the superiority of the *Antariocap* pesticide in controlling this insect, as it had the highest reduction rate in the infested tomato fruits, at a rate of 90.4%.

Key words: Oxymatrin , Imidacloprid

الجلال وآخرون

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مقارنة تأثير بعض المبيدات الحيوية والكيميائية في مكافحة حفار الطماطم

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باحث

باحث

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المستخلص

أجريت هذه الدراسة في الحقول المكشوفة لمحطة الابحاث الزراعية في محافظة دهوك لسنة 2019 على محصول الطماطم صنف محلي, إذ أختبر تأثير اربعة مبيدات كيميائية هي (*Biocure* و *Matrixine plus*, *Imidamex*, *Antario KAB*) في نسبة اصابة الاوراق وعدد اليرقات ونسبة اصابة الثمار ومعدل انتاجية النبات الواحد, وتبين من خلال الدراسة ان اقل نسبة اصابة للاوراق, وادنى عدد يرقات ظهرت عند معاملة النباتات بمبيد بيوكيور بمتوسط بلغ 22.7%, 0,36 يرقة / ورقة بالتتابع. في حين كانت اقل نسبة اصابة للثمار واعلى انتاجية للنباتات عند معاملةها بمبيد انتاريوكاب اذ بلغت المعدلات 2 ثمرة / نبات, 7.32 كغم / نبات بالتتابع. وبينت النتائج تفوق مبيد انتاريوكاب في مكافحة الحشرة إذ عطى اعلى نسبة خفض في ثمار الطماطة المصابة بمعدل بلغ 90.4%.

الكلمات المفتاحية: ناخرة اوراق الطماطة, اوكسيماترين, اميدوكلوپرايد

INTRODUCTION

Tomato *Lycopersicum Solanum* belongs to the *Solanaceae* family, and is considered one of the important vegetables grown in various countries. Its fruits are used for fresh consumption and manufacture of paste, and it is considered the third crop in terms of cultivated area in the world. In this respect, it is grown in tropical and subtropical regions, and the global production is estimated at 130 million tons, 85 million tons used for daily human consumption, and 42 million tons for industrialization (11). Tomatoes, considered one of the economic agricultural crops in Iraq, are grown in large areas in various regions of Iraq, especially the central and southern regions, and the cultivated area is estimated at about 24,000 acres (2). Tomatoes are infected by many agricultural pests that kill them and reduce their production. Tomato leaf insect, *Tuta Absoluta* (Meyrick), is one of the main pests in the countries of the Mediterranean basin; it causes great losses that may reach 100% in terms of quantity and quality (4,8,9). Moreover, it attacks leaves, branches, growing apices and fruits (10). Tomato plant is the main host for this insect, but it attacks many plants of the *Solanaceae* family, such as eggplant, tobacco and potatoes, in addition to many herbs (12). This insect infects both open tomatoes and the ones in the greenhouses (14, 21). The original or native source of this insect is in South America (17, 18). It was recorded for the first time in Spain in 2006 (13) and is currently widespread in Europe (31), the Middle East (6,22) and in Africa (14,16). Each insect lays about 260 eggs on leaves, stems and fruits and has about 12 generations per year (30). To control this insect, several methods must be combined and used in combating it, including agricultural, biological, natural and chemical ones (19). Most of the studies and researches conducted in various countries of the world confirmed the emergence of resistance in insects, due to the use of chemical pesticides, as well as, the

negative effect of these manufactured chemical pesticides on vital enemies and beneficial vertebrates (5,7,15,29). Given the danger of this insect on tomatoes and its resistance to some chemical pesticides, researchers recommend using an integrated control program to control this insect by using chemical pesticides with microbial pesticides (21, 25). In this respect, the use of biological pesticides, especially bacterial pesticides, have an important role in controlling this insect, as they have little impact on the environment and the insect's vital enemies (28,32). Also, the insect pathogenic fungi are among the modern resistance methods to control this insect and are currently used (23). Therefore, the aim of the present study was to compare the effect of some biological pesticides (Antario KAB, Biocure) and chemical pesticides (Imidamex, Matrixin plus) in controlling tomato leaf and fruits diggers, *Tuta absoluta*, in open fields.

MATERIALS AND METHODS

This research was conducted at the Agricultural Research Station of the Agricultural Research Directorate in Dohuk, where the seeds of the Hanin Tomato variety (hybrid variety) were planted in midday in the month of March, and after the land was prepared, the seedlings were transplanted to it on 5/5/2019. All the crop management such as dripping with irrigation, fertilizing and manual bush controlling, are implemented. The land was divided into fifteen lines (streaks), with three lines for each treatment, in addition to the comparison treatment. The lines were distributed randomly and marks were placed for this purpose, each line contains twenty tomato seedlings (experimental unit). The spraying of pesticides with recommended concentration was applied through (table 1) the use of the back sprinkler, taking into account the work of a barrier between one line and another, in order to avoid the occurrence of interference with the pesticide spray. Each three lines were sprayed with the pesticide concerned with the first spray on 7-22-2019.

Table 1 . Types of pesticides tested in an experiment to measure their effectiveness on tomato leafminer *Tuta absoluta*

Name of commercial pesticide	Active ingredient	Usage ratios/ 1 liters water
Antario Kab(Biological)	Abamectin 1% g , <i>B thuringiensis</i> 1,4 % g	0.5-1 g
Imidamex	Imidacloprid 70%	0.2-0.3 g
Matrixin plus	Abamectin 5% و Oxymatrin 2.4%	0.5 g
Biocure(Biological)	<i>Bacillus thuringiensis</i> var <i>kurstaki</i> 32000 Iu	0.75-1 g

The reading was taken ten days after the date of the treatment and it was as follows:

1- Calculating the Percentage of Leaves Infection and the Number of Larvae on the Leaves. 50 leaves are taken from each treatment randomly and the following is calculated: the number of infected leaves, the number of healthy leaves, the number of larvae in the infested leaves, the number of eggs in the infested leaves.

Leaves infection percentage = the number of infected papers in the sample / the total number of leaves in the sample * 100%

2- Calculating the Percentage of Fruits Infection

five plants are randomly selected from each treatment and the following are calculated: the number of infected fruits, the number of healthy fruits, and the weight of the total yield of the plants in each treatment. 20 days after the first spray, the second spray is repeated on the treatments with the same pesticides, and the aforementioned readings will be taken 10 days after the spraying process. 20 days after the second spray, the spraying process is repeated, similar to the first and second spray. The results were analyzed statistically using the RCBD, and the difference between the averages was tested using the Duncan test at a probability level of 5% using the SAS system.

RESULTS AND DISCUSSION

The results of using *Antario KAB*, *Imidamex*, *Matrixine plus* and *Biocure* pesticides in combating *Tuta Absoluta* showed a difference between the treatments in the percentage of leaf infection, the number of larvae per leaf, the number of eggs, the percentage of fruit infection; in addition to, the number of total healthy fruits, and the rate of plant productivity.

1- Effect of pesticide on the percentage of infecting tomato leaves

Pesticides varied in reducing the percentage of leaf infection, as the rates ranged between (22.7 - 54)%, while the percentage of leaf infection in the comparison treatment was 70.7%. *Biocure* pesticide was superior in reducing the infection rate to the rest of the other pesticides and had the lowest percentage of infection to leaves, with a rate of 22.7%, followed by *Matrixine plus* pesticide at a rate of 28.7% (Table. 1). The percentage of leaf infection reduction for both pesticides was (67.9, 59.4) %, respectively. The results showed that there were significant differences between the treatments at a probability level of 0.05. The *Biocure* pesticide recorded the lowest rate of infection for leaves when it was treated on 8/20/2019, reaching 16%, while the highest rate of infection was for the leaves of plants treated with *Antario KAB* on 9/9/2019, at a rate of 64%.

Table 2 . Effect of the some biological pesticides (Antario KAB, Biocure) and chemical pesticides (Imidamex, Matrixine plus) on leaves infection rate of tomato leafminer *Tuta absoluta*

Pesticides	Leaves Infection Rate%			Means	Percentage of Infection Reduction%
	3 August	20 August	9 September		
Antario KAB	58.0 D	40 H	64 C	54 B	23.6
Imidamex	52.7 F	22 M	46 G	40.2 C	43.1
Matrixin plus	32.0 J	26 L	28 k	28.7 D	59.4
Bio cure	18 N	34 I	16 O	22.7 E	76.9
Cont.	80 A	54 E	78 B	70.7 A	
Means	48.1 A	35.2 C	46.4 B		

The different letters indicate the presence of significant differences between the factors at a probability level of 0.05

2- Effect of treatment with pesticides on the number of larvae on tomato leaves

Number of larvae varied in their presence on tomato leaves and differed according to the types of pesticides used. The rates ranged between (0.36 - 0.76) larvae / leaf, while the average number of larvae in the comparison treatment was 0.83 larvae / leaf. The treatment

of plants with *Biocure* pesticide was superior in reducing the number of larvae on leaves, with a reduction rate of 56.6%. It was followed by the pesticide *Imidamex*, at a rate of reduction of 32.5%. The average number of larvae in the two treatments was 0.36 and 0.56 larvae / leaf, respectively, (Table. 2). The results showed that there were significant

differences among the treatments at a probability level of 0.05. *Biocure* recorded the lowest rate of larvae when treated on 3/8/2019, at 0.2 larvae / leaf; whereas, the highest average number of larvae was recorded when plants were treated with the pesticide *Matrixine plus* on 08/20/2019, as the rate was

1.23 larvae / leaf. The results are in agreement with what Sandeep et al. (27) reported that the activity of the toxic protein of *Bacillus Thuringiensis* was high against the second, third and fourth age larvae of tomato leaf pest, with the LC50, 0.12, 0.27, and 0.42 µg / ml larvae, respectively.

Table 3. Effect of treatment with some pesticides on the average number of tomato leafminer larvae *Tuta absoluta*

Pesticides	Leaves Infection Rate%			Means	Percentage of Infection Reduction%
	3 August	20 August	9 September		
Antario KAB	0.75 D	0.45 H	0.93 C	0.71 B	18.4
Imidamex	0.37 I	0.54 FE	0.78 D	0.56 C	32.5
Matrixin plus	0.56 E	1.23 A	0.50 G	0.76 D	8.4
Bio cure	0.20 J	0.52 FG	0.37 I	0.36 E	56.6
Cont.	0.45 H	1.04 B	1.02 B	0.83 A	
Means	0.46 C	0.75 A	0.72 B		

The different letters indicate the presence of significant differences between the factors at a probability level of 0.05

3- Effect of the pesticide on preparing tomato leaf pest eggs

The pesticides differed among themselves in reducing the number of tomato leaf pest eggs, and the statistical analysis showed that there were significant differences among the treatments at a probability level of 0.05 (Table. 3). The rates of egg numbers ranged between (0.85 - 1.45) eggs / leaf, while the rate in the comparison treatment was 1.57 eggs / leaf.

Antario KAB excelled in reducing the number of eggs, with a reduction rate of 45%, followed by *Biocure* 28%, while *Imidamex* recorded the lowest rate of reduction in the number of eggs at 7.6%. The lowest number of eggs was recorded when plants were treated with *Antario KAB* on 3/8/2019, at a rate of 0.34 eggs / leaf, while the highest number of eggs was recorded with the pesticide *Imidamex*, which was 1.9 eggs / leaf.

Table 3. effect of treatment with some pesticides on the average number of eggs of tomato leafminer *Tuta absoluta*

Pesticides	Leaves Infection Rate%			Means	Percentage of Infection Reduction%
	3 August	20 August	9 September		
Antario KAB	0.34 G	1.80 C	0.37 N	0.85 E	45.9
Imidamex	1.31 L	1.90 A	1.34 G	1.45 B	7.6
Matrixin plus	1.25 J	1.13 I	1.35 F	1.30 C	17.2
Bio cure	1.20 k	0.70 M	1.50 E	1.13 E	28.0
Cont.	1.32 H	1.88 B	1.53 D	1.57 A	
Means	1.24 B	1.51 A	1.21 C		

The different letters indicate the presence of significant differences between the factors at a probability level of 0.05

4- The Effect of the pesticide on the percentage of infecting fruits

The results of the experiment, given in Table (4), showed a variation in the effect of pesticides in reducing the percentage of infestation of tomato fruits, as the rates ranged between (2 - 3.57) fruits/plant, while the rate for the comparison treatment was 20.9

fruits/plant. *Antario KAB* pesticide surpassed the rest of the pesticides in reducing the incidence of infecting tomato fruits, with a reduction rate of 90.4%, followed by *Imidamex*, *Matrixine plus*, and *Biocure* at rates of 85.6, 82.9 and 81.8%, respectively (Table. 4).

Table 4 . Effect of treatment with some pesticides on the percentage of fruit infestation on tomato plants

Pesticides	Fruit Infection Rate% Fruits/plant			Means Fruits/plant	Percentage of Infection Reduction%
	3 August	20 August	9 September		
Antario KAB	0.00	0.86 E	5.13 DCE	2.00 C	90.4
Imidamex	0.00	0.00 E	9.00 DC	3.00 C	85.6
Matrixin plus	0.00	1.11 E	9.60 DC	3.57 C	82.9
Bio cure	0.00	2.53 DE	9.00 DC	3.8 C	81.8
Cont.	0.00	12.12 C	50.8 A	20.9 A	
Means	0.00	3.32 B	16.7 A		

The different letters indicate the presence of significant differences between the factors at a probability level of 0.05

In the study produced by Sandeep (26), in India, were used *Chlorantraniliprole*, *Spinosad*, *Indoxacarb*, *Bt var. Kurstaki*, and *Dipel* against tomato leaf pest. *Chlorantraniliprole* was observed to be the best pesticide with a decrease of 81.48%. In comparison, a reduction of 80.58 and 79.10% was observed with *Bt Kurstaki* and *Spinosad*, respectively. Also, the results of one of the studies carried out by Marzieh (20) indicated that there was a synergy in affecting the larvae of tomato leaf pest between the bacteria *Bt* and the pesticide *Abamectin*.

5- Effect of pesticides on tomato plant productivity and its fruit number

The results of the experiment showed that the number of tomatoes at the end of the season varied according to the type of pesticide used, but there were no significant differences

among them. All of them significantly outperformed the comparison treatment, and reached the productivity rates of the three pesticides *Antario KAB*, *Matrixine plus*, *Imidamex*, *Biocure*; in addition to, the comparison treatment 20, 18, 17.6, 16.6, 12 fruits/plant, respectively (Table. 5). This variation in the number of fruits resulting from the use of pesticides was reflected in the amount of production per plant per kilogram, where the productivity of plants in the pesticide treatments ranged between (5.2 - 7.3) kg / plant, while the productivity in the comparison treatment was 3 kg / plant (Table. 6). Plants treated with *Antario KAB* had the highest productivity, with an average of 7.3 kg / plant, and differed from the comparison with clear significant differences at a probability level of 0.05.

Table 5 . Average number of total healthy fruits of tomato plants treated with some pesticides

Pesticides	Average number of Fruits Fruits/plant			Means Fruits/plant
	3 August	20 August	9 September	
Antario KAB	22.4 AB	26.6 A	11.2 BC	20.0 A
Imidamex	12.6 BC	26.6 A	13.8 BC	17.6 AB
Matrixin plus	12.8 BC	26.8 A	14.6 BC	18.0 AB
Bio cure	12.2 BC	25 A	12.8 BC	16.6 AB
Cont.	13.2 BC	13.8 BC	9.20 C	12.0 BC
Means	14.6 B	23.8 A	11.3 B	

The different letters indicate the presence of significant differences between the factors at a probability level of 0.05

Table 6 . Effect of the pesticide type on the percentage of infestation of tomato plants with *Tuta absoluta* and the quantity of production

pesticides	Leaves	Number	of	Number	of	Fruits	Number	of	Production
	Infection Rate%	Larva Larva/leaf		Eggs Egg/leaf		Infection Rate%	total Fruits Fruits/plant		Kg/plant
Antario KAB	54 B	0.71 B		1.17 D		2.00 C	20.0 A		7.32 A
Imidamex	40.2 C	0.56 C		1.45 B		3.00 C	17.6 AB		6.94 A
Matrixin plus	28.7 D	0.76 D		1.30 C		3.57 C	18.0 AB		5.10 AB
Bio cure	22.7 E	0.36 E		1.13 E		3.8 C	16.6 AB		5.2 AB
Cont.	70.7 A	0.83 A		1.57 A		20.9 A	12.0 BC		3.00 B

The different letters indicate the presence of significant differences between the factors at a probability level of 0.05

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