Menoufia J. Plant Prot., Vol. 2 August (2017): 263 - 268

EFFICIENCY OF THREE CHEMICAL AND TWO BIOLOGICAL INSECTICIDES ON *TUTA ABSOLUTA* LARVAE IN THE FIELD OF TOMATO AT EL BEHEIRA GOVERNORATE

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Received : May 23 , 2017 **Accepted: May 27 , 2017**

ABSTRACT: *Chemical insecticides: Coragen (chlorantraniliprole), Voliam- Flexi (thimethoxam 20% + chlorantraniliprole) and Proclaim (emamectin benzoate), and the two bio-insecticides Vertimec (abamectin) and Dipel 2X (Bacillus thuringiensis), were evaluated in the present study in Bader district during tomato spring plantation 2016, for their efficacy in the control of Tuta absoluta (Meyrick) (Lepidoptera: Gelechiidae) infesting tomato plants. The grand mean effect of the two tested applications showed that Vertimec. was the superior in the control of the insect pest causing 72.7% reduction in larval stages , followed by 69.7% for both of Voliam- Flexi and Coragen, while Dipel 2X recorded (65.3%) and Proclaim (64.16%).*

Key words: *Tomato, Avermectin, Abamectin, Neonicotinoid, Bacillus thuringiensis, Biocontrol.*

INTRODUCTION

Tomato, *Lycopersicon esculentum* (Mill) belonging to family Solanaceae which is important and remunerative vegetable crop grown around the world for fresh market and processing (Salunkh *et al*., 1987). Annual production accounts estimated by about 107 million metric tons a fresh market tomato representing 72% of the total vegetables production (FAO, 2002).

The tomato leaf miner , *Tuta absoluta* (Meyrick) (Lepidoptera: Gelchiidae) is a serious pest of both outdoor and greenhouses tomatoes (CFIA, 2010). *Tuta absoluta* larvae feed on the leaves of several species of solanaceous plants. This insect pest was recorded on many solanaceous species, including pepper, eggplant and potato plants.

The insect deposits eggs usually on the leaves, stems and lesser extend on fruits. After hatching young larvae penetrate into tomato fruits, leaves on which they feed and develop creating mines and galleries on leaves, larvae feed only on mesophyll leaving the epidermis intact (OEPP, 2005). Tomato plants can be attacked at any developmental stage, from seedling to mature stage.

Up to 100% losses have been reported in tomato crops and even where chemicals control are implemented, losses can still exceed 5% (Korycinska and Moran, 2009).

The present experimental trail was implemented to evaluate the effect of three chemical and two bioinsecticides on the larval instars of that serious pest on tomato plants along two successive sprays.

MATERIAL AND METHODS

The present study was conducted at Badr district, El Beheira Governorate, to evaluate the efficacy of three insecticides, and two bio insecticides in the following table.

To evaluate their efficiency in controlling *Tuta absoluta* larvae, one feddan was planted by tomato seedling, variety (Heinz). The normal agricultural practices were carried out. The field was divided into 18 plots (6 treatments* 3 replicates). A total plots were considered for each tested insecticides. Two sprays were applied, 10 days between them, the first was after 30 days from transplanting, and the second application was sprayed after 10 days from spraying the first application. Sampling started before the first application directly, samples of 15 leaflets/ replicate were picked up randomly from the medium vertical plants level after 3, 5 and 10 days from spraying (45 leaflet/ treatment) were put in a paper bags and transferred to the laboratory for examining and counting the alive larvae. The reduction percentages of *Tuta absoluta* larvae was determined according to the equation adopted by Handerson and Tilton (1955).

Obtained data were submitted to analysis of variance (ANOVA) and recording the mean number of alive larvae at probability level 0.05.

RESULT AND DISCUSSION

The obtained results in Tables (1), (2) and (3) indicated that the tested insecticides showed almost close effects in reducing the larvae of *Tuta absoluta* insect pest infesting tomato plants under field conditions.

After the first spray with tested pesticides, the initial effect after 3 days from spraying the tested treatments recorded reduction % as 67%, 69%, 58%, 61 and 95% in the larval population with Voliam- Flexi, Coragen, Proclaim, Dipel 2X and Vertimec, respectively. In the 5^{th} day after spray the reduction percentages was highly increased recording 84%, 83%, 80%, 83% and 79%. Ten days after pesticides application, the reduction percentages was continued in increase recording 90%, 89%, 82%, 75% and 82% for the above mentioned insecticides, respectively.

The grand mean reduction percentages in *Tuta absoluta* larvae by the first spray was 80.33% with Voliam- Flexi and Coragen followed by 73.33%, 73% and 72.33% for Proclaim, Dipel 2X and Vertimec, respectively.

Statistical analysis proved the significant variation between the mean numbers of larvae / sample after 3, 5 and 10 days after spraying and the grand mean with F. values and L.S.D. presented in Table (1).

Almost similar results in reducing the tomato leaf miner *T. absoluta* larval infestation were obtained by the second spray application after ten days from the first spray Table (2) where the reduction percentages in larvae were 49%, 46%, 44%, 39% and 57% after 3 days from spraying, 56%, 60%, 58%, 54% and 75% after 5 days from spraying and 73%, 71%, 63%, 80% and 81% population reduction after 10 days from spraying for Voliam- Flexi, Coragen, Proclaim, Dipel 2X and Vertimec, respectively.

Table of tested pesticides

Trade name formulation	Active Ingredient	Recomm-ended dose/100 L water	Class/group	Pre harvest interval PHI(Day)
Voliam Flexi40%WG	Thiamethoxam 20%+ Chiorantraniliprole	20 g	Neonicotinoid + Diamide	10
Coragen20% SC	Chloantraniliprole	15 cm	Diamide	7
Proclaim5% SG	Emamectin benzoate	30 g	Avermectin	5
Vertimec1.8% EC	Abamectin	40 cm	Abamectin	14
Dipel 2X 6.4% DF	*Bacillus thuringiensis*	100 g	Bio	N/A
control	Water			

SC=Suspension concentrate. EC= Emulsifiable concentrate
WG= Wettable dispersible granules. N/A= Not applicable
SG= Soluble granules. DF= Dry flowable

Table (1): Effect of five treatments on *Tuta absoluta* larvae infesting tomato plants in El Beheira Governorate (first spray) during spring plantation of 2016 season

Treatment	Rate/ 100 L. water	Mean number of larvae/ 15 leaflets and reduction %							Grand mean	Grand mean Red%
		before spray	after 3 days		after 5 days		after 10 days			
Voliam- Flexi	20 g	25	11.0 ab	67%	7.0 b	84%	5.7 d	90%	12.2 bc	80.3%
Coragen	15 cm	20	8.3 ab	69%	6.0 b	83%	4.3 d	89%	9.7 c	80.3%
Proclaim	30 g	20.7	11.7 ab	58%	7.3 b	80%	9.0 c	82%	12.2 ab	73.3%
Dipel 2X	100 g	22.3	11.7 ab	61%	6.7 b	83%	14.7 a	75%	13.8 ab	73.0%
Vertimec	40 cm	25.3	14.0 a	59%	10.3a	79%	11 b	82%	15.2 a	72.3%
Control	-	28.3	38.3	-	49.3	-	71.0	-	52.9	-
F. value	-	-	2.06		3.83		86.22		4.6	-
L.S.D.5%	-	-	4.456		2.69		1.409		2.7	-

Means in each column followed by the same letter are not significantly different at 5% level.

Table (2): Effect of five treatments on *Tuta absoluta* larvae infesting tomato plants in El Beheira Governorate (second spray) during spring plantation of 2016 season.

Treatment	Rate/ 100 L. water	Mean number of larvae/ 15 leaflets and % reduction							Grand mean	Grand mean Red%
		before spray	after 3 days		after 5 days		after 10 days			
Voliam- Flexi	20 g	5.7	3.0 c	49%	2.7 b	56%	1.7 ab	73%	3.3 c	59%
Coragen	15 cm	4.3	3.0 c	46%	2.3 b	60%	1.7 ab	71%	2.8 c	59%
Proclaim	30 g	9.0	5.3 b	44%	4.0 b	58%	3.7 a	63%	5.5 b	55%
Dipel 2X	100 g	14.7	8.7 a	39%	6.7 a	54%	3.0 ab	80%	8.3 a	57.6%
Vertimec	40 cm	11	5 b	57%	3 b	75%	2.0 ab	81%	5.3 b	71%
Control	-	71	74.6	-	76.3	-	79	-	76.6	-
F. value	-	-	22.05		9.23		2.4		22.7	-
L.S.D.5%	-	-	1.557		1.819		1.819		1.3	-

Means in each column followed by the same letter are not significantly different at 5% level.

It is worth to say that the effect of the tested treatments was less comparing with the results of the first spray that may due to the quick adaptation of this insect, which is a famous character for it , in addition to the very smallest population of the pest before the second spray showed that the control of this pest is difficult because manifestation of resistance to great part of applied insecticides.

Statistical analysis of the obtained data presented in Table (2) proved the significance of the differences between the effects of the tested treatments, F values and L.S.D. at 0.05 level.

The grand mean effect of the two tested applications in Table (3) showed the same observation and results in Table (1) and (2) indicating that Vertimec in the rate of 40 cm. was the superior for controlling the insect pest causing 72.66% reduction followed by 69.66% for Voliam- Flexi and Coragen, Dipel 2X (65.3%) and Proclaim (64.16%).

Table (3): The grand mean number and reduction % by the two sprays of 5 insecticdes on *Tuta absoluta* larvae infesting tomato plants at El Beheira Governorate

Treatment	Rate / 100 L. water	Grand mean of larvae/ 15 leaflets	Grand reduction %
Voliam- Flexi	20 g	7.7 cd	69.7%
Coragen	15cm	6.3 d	69.7%
Proclaim	30 g	8.8 cb	64.2%
Dipel 2X	100 g	11.04 a	65.3%
Vertimec	40 cm	10.2 ab	72.7%
F. value	-	8.16	-
L.S.D. 5%	-	1.9	-

Means in each column followed by the same letter are not significantly different at 5% level.

Similar results have been reached by Astor and Scals (2009), in Spain reported the efficacy of [chlorantraniliprole] with another pesticides in integrated control programmers for the tomato insect pest, Gonzalez-Cabrera *et al.* (2009) and (2011), in Spain found that B.t compounds could be a good agent in controlling *T. absoluta*, Linden and Staaij (2011), showed that abamectin (vertimec) and emamectin benzoate (proclaim) were effective against *T. absoluta*, Bassi *et al.* (2012), in Brazil referred to Chlorantraniliprole is a novel diamide insecticide with outstanding performance on *Tuta absoluta,* Biondi *et al.* (2012), showed that Integrated Pest Management (IPM) programs may include pesticide applications for controlling *T. absoluta* The tested chemicals were abamectin, *Bacillus thuringiensis* and emamectin benzoate, Valchev *et al.* (2013), found that the control of this pest is difficult because of the latent way of life of the larvae in the mines, high reproductive potential, polyvoltine development and manifestation of resistance to great part of applied insecticides. For control *T. absoluta* it is still that the application of chemical insecticides is very good with biological activity towards the larvae was Coragen 20 SC causing 79.18% reduction 14 th day after treatment. Birgucu *et al.* (2014), in Turkey found that insecticides used against *Tuta absoluta* Chlorantraniliprole + abamectin, emamectin benzoate, all individuals treated larvae were died at the 7 DAA. Ingegno *et al.* (2014), evaluated *Bacillus thuringiensis* and emamectin benzoate against *T. absoluta,* Soliman *et al.* (2014), in Egypt reported that the percent reduction in infestation was 79.73 using Emamectin benzoate, Ayalew (2015), in Ethiopia showed that plots treated with diamide insecticides (chlorantraniliprole) fruit infestation was significantly lower with 2-6% fruit damage, Bratu *et al.* (2015), showed that emamectin-benzoate used once at a rate of 14.25 g a.i./ha had high efficacy (99.0%) and finally Osman (2015), in Egypt recorded that Proclaim and Coragen achieved highest accumulated mortalities in *Tuta absoluta* larvae (100%) 5 days post treatment.

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كفاءة ثلاثة مبيدات حشرية كيميائية و اثنان من المبيدات الحشرية البيولوجية ضد يرقات صانعة انفاق الطماطم بمحافظة البحيرة

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الملخص العربى

تعتبر حشرة صانعة أنفاق الطماطم أوحافرة الطماطم من أهم الآفات المدمرة لمحصول الطماطم بل تعتبر في الآونة الأخيرة أهم آفة علي الإطلاق لاسيما إصابتها لنباتات العائلة الباذنجانية عموما وأمام الانتشار الواسع والخسائر الفادحة التي تسببها الآفة وكذلك الأهمية الإقتصادية لمحصول الطماطم فقد لجأ المزارعون الي الإستخدام المكثف للمبيدات مما أدى الي ظهور صفة المقاومة وبالتالى ضعف نتائج المكافحة.

تم بمركز بدر محافظة البحيرة في ربيع عام 2016 إجراء إختبار تقييم لثلاثة مبيدات كيميائية (فوليام فليكسى، كوراجين، بروكليم) وإثنان حيويان (دايبل، فيرتيميك) ، لمكافحة يرقات صانعة انفاق الطماطم التى تصيب نباتات الطماطم تحت الظروف الحقلية ، من خلال إجراء رشتين بينهما 10 ايام وتم فحص عينات من الأوراق وتم عد اليرقات الحية كل 3، 5 ، 10 أيام ، وقد أظهرت نتائج الرشة الأولي ان نسبة خفض تعداد اليرقات كانت (80.3٪) لكل من فوليام فليكسى– كوراجين، يليه المبيدات بروكليم، دايبل، فيرتيميك بنسب خفض (73,3٪ ، 73٪ ، 72.3٪) علي التوالي. بينما أظهرت نتائج الرشة الثانية تفوق المبيد الحيوي الفيرتيميك حيث سجل نسبة خفض 71٪ يليه الفوليام فليكسي والكوراجين مسجلين 59 ٪ ثم الدايبل 57.6٪ وأخيرا البروكليم بنسبة خفض 55٪. كما أظهرت نتائج المتوسط العام لنسب الخفض في تعداد اليرقات لكلا الرشتين حيث جاء الفيرتيمك في المركز الأول بنسبة 72,7٪ يلية الفوليام فليكسي والكوراجين بنسبة خفض 69.7٪ ثم الدايبل بنسبة 65.3٪ وجاء البروكليم فى المركزالأخير بنسبة خفض64.2٪.