

INTEGRATED MANAGEMENT PROGRAM OF TUTA ABSOLUTA (MEYRICK) (LEPIDOPTERA: GELECHIIDAE) INFESTING TOMATO PLANTS UNDER FIELD CONDITIONS

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ABSTRACT

Tomato, *Lycopersicon esculentum* Miller is one of the economically important vegetables in Egypt as well as in the world. Egypt is occupied the Fifth rank in tomato production in the world (FAW 2012). Many pests attacking tomato plants causing serious damage by sucking the sap. One of the most serious pests is the tomato borer, *Tuta absoluta*, it is well known that, the leaf miner insects are very difficult to control. The infestation occurs in any stages of the plant growth causing considerable economic damage to yield from one degree to another. Therefore, this experiment was conducted in Ashmon region, Menoufia Governorate, Egypt in private farm to apply the suggested IPM program. Two areas (each one about 0.2 Hectare i.e .half Fadden) were cultivated by tomato plants to evaluate the program. In the first area, the traditional agricultural applications were applied, while the second one was exposed to the suggested IPM program. The results detected that the highest mean numbers of eggs was 16.3 eggs/10 leaves in control farm, whereas the highest recorded mean numbers in IPM program was 2.0 eggs /10 leaves. In the IPM program the highest mean numbers of recorded larvae was so low (1.0 larvae /10 leaves), the highest mean numbers of mines was 2mines / 10 leaves and the percentages of damage in fruits in IPM program was 1.6%. The suggested IPM program recorded successful results to control *Tuta absoluta* in tomato farms in Menoufia Governorate, during summer season of 2014.

Key words: *Tuta absoluta* (Meyrick), Tomato plant, IPM program (*Bacillus*,*Buvaria*,*Trichogramma sp.*,Sex pheromone),Egypt.

INTRODUCTION

The tomato borer *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) is originally came from South America, where it is considered one of the most devastating pests of tomato crops (Barrientos et al. 1998; Estay 2000; EPPO 2006). This pest is present throughout the crop growing cycle. Larvae can infest leaves, flowers stems and fruits, causing important losses in tomatoes (Lo'pez 1991; Apablaza 1992). Since *T. absoluta* was detected in the Mediterranean Basin, the most common control practice has been based on the use of chemical insecticides (Bielza2010). However, these treatments may disrupt the existing integrated pest management programs in tomato crops, The *T. absoluta* management tactic consisted of foliar chemical sprays and sex pheromone basin water traps in IPM applications used for *T. absoluta* control was more effective than used in the farmer field applications during summer season 2013(Hassan 2015).

MATERIAL AND METHODS

To apply this program, tomato plants (Super strain B cultivar) were planted in Ashmon region Menoufia Governorate, Egypt, during mid-February, 2014. In the same time equal areas of land (0.2 Hectare=half Fadden) received all agricultural practices and sprayed according to the Agriculture Ministry program rules. The IPM program was applied as present in table (1):

Table (1): Materials used to control *Tuta absoluta* in IPM program.

Treatment date	Trade name	Active ingredient	Rate of application
20/01/2014	Tuta 100 N	(E,Z,Z) -3,8,11-Tetradecatrienyl acetate	3 mg/ dispenser
30/02/2014	Actra	Thiamethoxam25% WG	20 gram 100 liters
15/03/2014	Challenger	Chlorfenapyr36% SC	50 cm100 liters
02/04/2014	Coragen	Chlorantraniliprole 20% SC	15 cm100 liters
17/04/2014	Vertimic 1.8%EC	Abamectin 1.8%EC	40cm/100litres
25/04/2014	Trisser	Spinosad 24% SC	50 cm/Fadden
10/05/2014	Biovar	<i>Beauveria Bassiana</i>	10% (32 · 106) conidia/g 200
25/05/2014	Dipel 2X	<i>Bacillus Thuringiensis</i>	6.4% (32,000) lu/mg 200
10/03/2014	<i>Trichogramma achaeae</i>	<i>Trichogramma achaeae</i>	30 cards / Fadden

SC= Suspension concentrate (= flow able concentrate)

WG= Wet table dispersible granules

Sample was applied as 10 tomato leaves or tomato fruits during all the dates of inspection, transferred to the insect laboratory of the Department of Economic Entomology and Agricultural Zoology in the Faculty of Agriculture, Minuofia University, Shebin El-Kom, Egypt, examined ,counted the insect and tabulated .The statistical analyses of the present data were carried out using SAS program computer including t-test, and simple correlation and regression (SAS Institute, 2003).

RESULTS AND DISCUSSION

The obtained results presented in (Table 2) revealed that the mean numbers of different stages of *Tuta absoluta* in IPM program and the traditional applications. Data obtained were discussed as follows:

The egg stage:

As shown in (Table2) the results of mean numbers of eggs in IPM program started with 2.0 eggs /10 leaves during 8, March 2014 and decreased to record 0.1 egg /10 leaves from the second and the third week of March. In the remain period extended from last week of March till the end of the experiment the mean numbers ranged between 0.0 – 0.5 eggs / 10 leaves.

On the other hand, the mean numbers of eggs in the control farm started with 1.4 eggs / 10 leaves in the first week of March and increased gradually to recorded 16.3 eggs / 10 leaves on April .12,

2014, then decreased in April, 19 (7.5 eggs /10 leaves). During the period started from April, 26 until last week of May varied 0.3 – 4.0 eggs/ 10 leaves. The results detected that the highest mean numbers of eggs was 16.3 eggs in control farm , whereas recorded the highest mean numbers in IPM program 2.0 eggs /10 leaves , it mean that the population of egg decreased to reach 1/8 of control mean numbers. Our useful obtained results here is referring to the releasing of the parasitoid *Trichogramma achaeae* .

The larval stage:

In the IPM program the mean numbers of larvae , generally during the period of study ranged between 0.0 – 1.0 larvae / 10 leaves while the mean numbers of larvae began with 2.5 larvae during the first week of March and increased gradually to reach 30.0 larvae / 10 leaves on April ,12,for the control application . After that the mean numbers decreased sharply and ranged between 1.6 – 15.0 larvae / 10 leaves during April, 19till May,24 increased again recording 9.0 larvae / 10 leaves . The obtained results showed a good effects of the IPM program, since the highest mean numbers record so low mean numbers of larval stage (1.0 larvae).(Table 2).

The moth stage:

Data as presented in (Table1: 2) showed that the trapped numbers of moths ranged between 30 – 321 moth / trap in control application farm , whereas in IPM program the mean numbers of adults stage varied between 89 – 1200 adults / trap .

The mean numbers of mines:

Tuta absoluta dug mines in large number in the control farm reached 61.0 mines / leaves and 87.0 mines / 10 leaves during the first and last week of April respectively. However,in the IPM program the highest mean numbers of mines was 2 mines / 10 leaves, these results confirm that the mean numbers of larval stage, such reliable results in significant gain to reduce the damage of *Tuta absolutae*. The present data in Table (2) showed that there were significant differences between all sampling in eggs, larval and moths stages and mines.

Table (2): Comparison of *T. absoluta* stages in control and IPM field application.

Inspection date	Mean numbers of population density and mines							
	Mean no. of eggs/ 10 leaves		Mean no. of larvae / 10 leaves		Mean no. of moths/ trap		Mean no. of mines/ 10 leaves	
	Control field	IPM field	Control field	IPM field	Control field	IPM field	Control field	IPM field
08/03/2014	1.4	2.0	2.5	1.03	30	322	6.0	1.0
15/03/2014	1.7	0.1	5.0	0.5	31	98	7.5	1.5
22/03/2014	4.0	1.0	15.0	0.2	161	155	22.6	2.0
29/03/2014	8.0	0.3	17.5	0.1	237	500	26.6	0.7
05/04/2014	10.0	0.2	24.5	0.3	281	380	61.0	1.6
12/04/2014	16.3	0.5	30.0	0.1	321	450	56.0	0.8

19/04/2014	7.5	0.2	15.0	0.0	304	350	45.0	0.1
26/04/2014	4.0	0.4	7.0	0.0	108	89	87.0	0.2
03/05/2014	2.0	0.2	3.5	0.1	250	1100	76.0	1.0
10/05/2014	0.6	0.1	3.6	0.1	210	1125	67.0	0.3
17/05/2014	0.3	0.2	1.6	0.6	100	1200	37.0	2.0
24/05/2014	4.0	0.0	9.0	0.3	175	900	24.0	0.1
31/05/2014	1.0	0.3	3.0	0.2	60	1450	16.0	0.0
Mean ±SE	4.68 ±1.29	0.42 ±0.15	10.55 ±2.54	0.27 ±0.08	174.46 ±28.29	624.54 ±129.4	40.90 ±7.36	0.87 ±0.20
t value	3.27**		4.05**		3.39**		5.43**	
Prob. > t	0.0032		0.0005		0.0024		0.0001	

Analysis according to t-test procedure by SAS program (2003)

** High significant at 0.05 level

Data in table (3) represented the damaged fruit numbers of tomato plants. The damaged fruit numbers in IPM program ranged between 0 -3 fruits from the total numbers were examined (10 fruits), while in normal program of control the damaged numbers ranged between 3 – 10 tomato fruits. The highest value of damaged fruits reached 30 %for the IPM program, whereas reached to close 100 % damage in control farm. The suggested IPM program recorded successful results to control *Tuta absoluta* in tomato farms in Menoufia Governorate. Results showed that the damaged fruits caused by *T. absoluta* larvae were significantly low, with an average of 1.63 damaged fruits per 10 fruits in IPM program (Table3). However, the damaged fruits were very high (Table3), with an average of 6.38 damaged fruits/ 10 fruits in case of control field applications, showing a significant difference between IPM program and control fields (F' value= 4.60, Prob. > F' = 0.0004). These results were in harmony with those obtained Miranda et al. (2005), Huber and Drobny (2010) and Hassan (2015).

Table (3): Comparison of damaged fruits in control and IPM field.

Inspection date	Mean number of damaged fruits/ 10 fruits		% Fruit damages	
	Control field	IPM field	Control field	IPM field
12/04/2014	8	0	80	0
19/04/2014	10	1	100	10
26/04/2014	8	2	80	20
03/05/2014	3	2	30	20
10/05/2014	3	2	30	20
17/05/2014	6	3	60	30
24/05/2014	9	1	90	10

31/05/2014	4	2	40	20
Mean ±SE	6.38 ±0.98	1.63 ±0.32		
t value	4.60 **			
Prob. > t	0.0004			

Analysis according to t-test procedure by SAS program (2003)

** High significant at 0.05 level.

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- برنامج للمكافحة المتكاملة لحشرة حافرة الطماطم التي تصيب نباتات الطماطم تحت الظروف الحقلية
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Arabic Summary الملخص العربي

الطماطم واحدة من اهم محاصيل الخضر الاقتصادية في مصر والعالم حيث تحتل مصر المرتبة الخامسة من حيث كميته الانتاج على مستوى العالم (منظمة الاغذية والزراعة 2012). وتصاب الطماطم بالعديد من الافات التي تسبب اضرار بالغه خصوصا حافرة الطماطم وتعد هذه الحشرة من صانعات الانفاق والتي يصعب مكافحتها نظرا لانها تصيب النبات في مراحل نموه المختلفه مسببه ضرارا بالغاً للمحصول وقد اجريت هذه التجربه في مركز اشمون - محافظة المنوفية - مصر في احدى المزارع الخاصه لتطبيق برنامج للمكافحة المتكامله لهذه الافه لذلك تم زراعة منطقتين كل منهما بمساحة نصف فدان احدهما لبرنامج المكافحة المتكامله والاخرى لمعاملة الكنترول واوضحت النتائج ما يلي :

وجد ان اعلى متوسط لاعداد البيض 16,3 بيضه لكل 10 ورقات للكنترول بينما اعلى قيمه في برنامج المكافحة المتكامله 2 بيضه لكل 10 ورقات , بلغت اعلى قيمه لليرقات 30 يرقة لكل 10 ورقات للكنترول بينما في IPM كانت اعلى قيمه 1 يرقة للعشر ورقات , اعلى قيمه للانفاق في الكنترول 87 نفق للعشر ورقات بينما IPM كانت 2 نفق للعشر ورقات , اعلى قيمه للفراشات في الكنترول 321 فراشه / مصيده بينما IPM بلغ 1200 فراشه / مصيده, وقد لوحظ ان برنامج المكافحة المتكامله المقترح حقق نجاحا كبيرا في مكافحة هذه الحشره مقارنة بالاسلوب الاعتيادي المتبع في مكافحتها حيث بلغت اعلى نسبه مؤويه في الاصابه 30% IPM بينما في الكنترول بلغت %100.