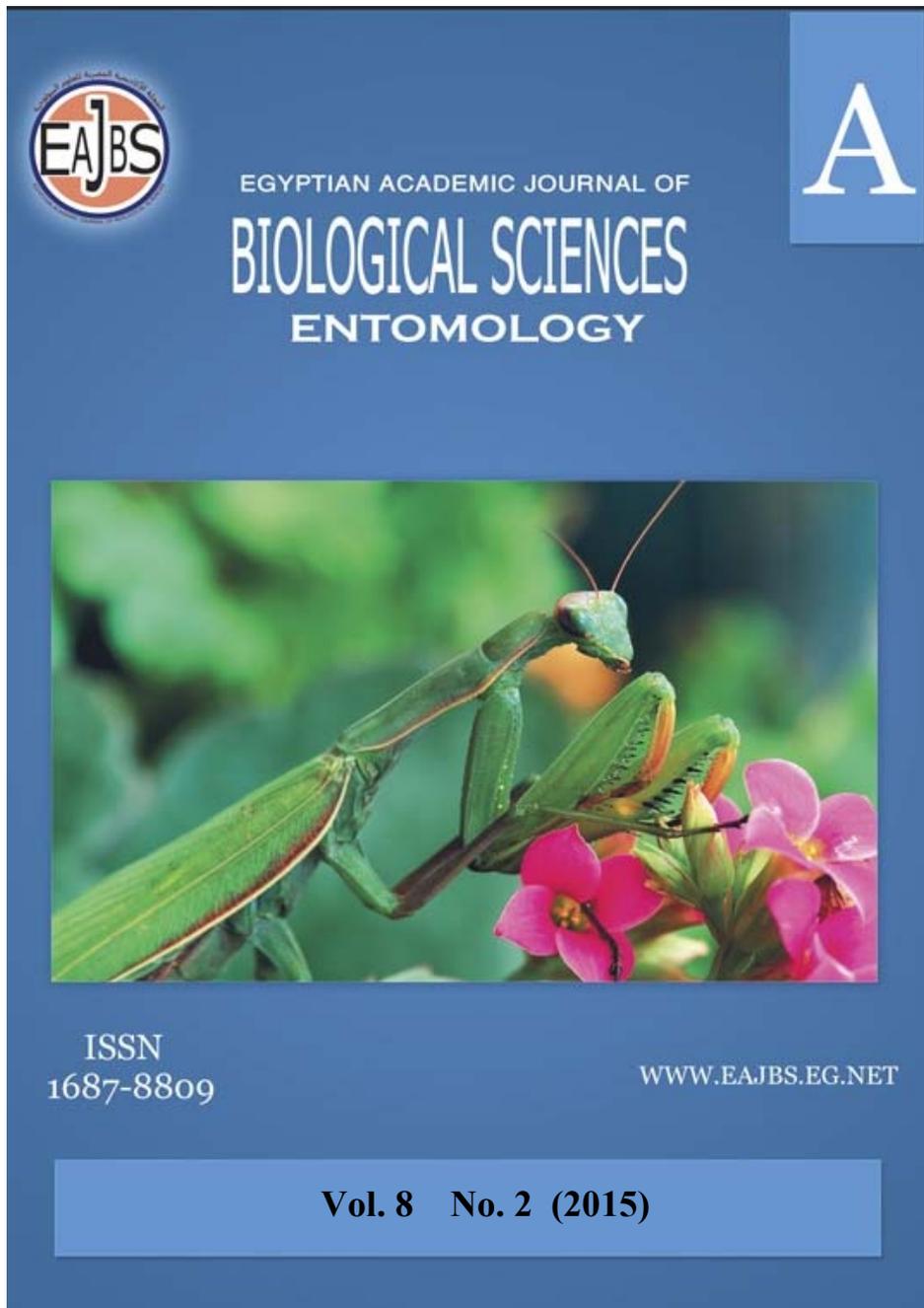


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Effect Of Two Control Tactics in The Integrated Pest Management On The Population Of *Tuta absoluta* (Meyrick) (Lepidoptera : Gelechiidae) In Tomato Fields.

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ABSTRACT

Seven field trials were cultivated with tomato plants, *Lycopersicon esculentum* (Var. Alisa), carried out in summer plantation, 2014 in Ismailia and Sharkia governorates. The work was conducted to study the impact of residential and out residential block, number of sex pheromone traps per feddan, height of sex pheromone trap and some insecticides on the population of tomato borer *Tuta absoluta* (Meyrick). The obtained data showed that population of tomato borer recorded two peaks on April, 12 and May, 17 in the two governorates. Residential block recorded higher number than out residential block in the two governorates. The first peak presented 482 and 452 males/trap/ week and the second one amounted 520 and 198 males/trap/ week in residential and out residential block, respectively in Ismailia governorate. In Sharkia governorate the first peak represented by 479 and 421 males/trap/week and the second one recorded 511 and 178 males/trap/week in residential and out residential block, respectively. Also percentage of infested tomato fruits were higher in residential block than in out residential block presented 32.6 and 27.4 % in residential and 21.75 and 18.7 % in out residential block in Ismailia and Sharkia governorates respectively. Ismailia governorate recorded higher population of tomato borer and percentage of infested tomato fruits than Sharkia governorate and statistical analysis showed significant differences between the two governorates. Regarding height of traps, statistical analysis showed significant differences between 80, 50 and 30 cm height. 80 cm. height of trap upon plant shoot tip recorded the highest numbers, while 30 cm. recorded the least one in the two governorate. Six pheromone traps/feddan recorded the highest number of captured males and the lowest infested tomato fruits while two pheromone traps per feddan recorded the least numbers of males and the highest of percentage of infested tomato fruits. Methomyl proved to be the most effective insecticide against tomato borer giving mean corrected mortality percentage 88.88 % and 87.53 % after three days (initial) and residual effect, respectively. Acetamiprid gave the least initial effect amounted 58.33 and deltamethrin gave the least residual effect presented 29.46 %. Methomyl gave the least percentage of infested tomato fruits followed by Spinosad and abamectin while deltamethrin gave the highest percent of infested fruits. Statistical analysis showed significant differences between tested insecticides and between percentage of infested tomato fruits.

The obtained data concluded to cultivate tomato out residential block, used traps at a rate of 6 traps / feddan on 80 cm height upon shoot tip and spray methomyl and spinosad insecticides six application.

INTRODUCTION

The tomato borer, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae), is a major insect pest of processed and fresh tomatoes, both in greenhouses and open field crops (Desneux, 2010). This pest has spread rapidly since its introduction to Europe in

2006, and within just a few years its global status has changed completely, from a South American tomato pest into a major threat to world tomato production (Roditakis, 2010 and Desneux *et al.*, 2011). Presently, the pest threatens other cultivated solanaceous plants such as eggplant and potato (Desneux, 2010; Unlu, 2012 and Caparros Megido *et al.*, 2013). Since its introduction in many countries, chemical sprays have been the main method of control used against *T. absoluta* (Galarza and Larroque, 1984). However, the efficiency of chemical control of tomato borer infestations has been poor because of the endophytic habit of its larvae, which are protected in the leaf mesophyll or inside fruits (Cocco *et al.*, 2013), and insect pest resistance against a number of applied insecticides (Siqueira *et al.*, 2000a; Siqueira *et al.*, 2000b; Siqueira *et al.*, 2001; Lietti *et al.*, 2005; Silva, 2011 and Reyes, 2012). In order to reduce the excessive use of insecticides in tomato fields, environmentally sound control strategies have been developed, including cultural control measures (*e.g.* crop rotation, selective removal, traps and destruction of infested plant material) (Korycinska and Moran, 2009), the use of natural enemies (Desneux, 2010 and Urbaneja, 2012) and resistant varieties of tomato (Oliveira *et al.*, 2012). Additional alternative control methods, based on the use of the insect's sex pheromones, have also been developed to control *T. absoluta*. The high biological activity of the synthetic pheromone suggests that it could be useful for pest monitoring and in mating disruption (Fernando *et al.*, 2001 and Rudy *et al.*, 2013). The best trap, baited with 100 µg of the synthetic sex pheromone caught on average 1200 males per trap per night, while those baited with virgin females caught only 201 males. The male response to this pheromone is restricted to the same early-morning time window during which females exhibit calling behaviour. Trap colour effect on efficacy of sex pheromone (Taha *et al.*, 2012) the results demonstrate that the red colour can be used to enhance the effectiveness of sex pheromone traps for capturing male *T. absoluta* moths.

The present study aimed to study impact of surrounding the residential and out residential block, number of pheromone traps per feddan, Effect of height of pheromone traps upon plant shoot tip and efficacy of some insecticides on population of *T. absoluta* and estimate percentage of infested tomato fruits compared with insecticides application in tomato fields.

MATERIALS AND METHODS

Sex pheromones was used from production Trifolu-M-Germany, export Adeco company Egypt at 0.6 mg. concentration. The pheromone compound (E3, Z8, Z11)-tetradecatrien-1-yl acetate.

Experimental design and site:

The experimental area were 6 feddan for each in El-Tal elkabier district, Ismailia Governorate and Fakous district, Sharkia Governorate in early summer plantation, 2014. Each experimental fields planted with Tomato plants, *Lycopersicon escolentum* (Var. Alisa, Hybrid) in a private farm. Thirty five day-old of planting seeds in the nursery then plants transferred to the arable land, on February 22, 2014, agriculture practices were applied, used red plastic basin water traps (35 cm. diameter, 15 cm. depth), addition water containing detergent (3 g. detergent powder to reduce surface tension), were chosen according to (Taha *et al.*, 2013) were baited with capsule loaded with a synthetic sex pheromone. The experiments were conducted in Ismailia and Sharkia governorates as follow :

1-Effect of surrounded residential and out residential block to tomato fields on the captured males of *T. absoluta* in pheromone traps.

Experimental area was one feddan, divided into two fields, each field was half feddan, the first field was surrounded by residential block, the second one was chosen far from residential block about one kilometer, three pheromone traps were placed per field in the two Governorates. The pheromone traps were placed after 15 days from cultivation till harvest time above 50 cm from the shoot tip of plants. Traps were investigated weekly to remove moths and replenished water and detergent but pheromone was renew every 45 days . The male adults were counted and recorded.

2-Impact of sex pheromone traps number per feddan on suppression of population of captured male of *T. absoluta*.

Experimental area were four feddan divided into four fields, each field was one feddan, the first field contained two pheromone traps, the second field 4 pheromone traps and six pheromone traps in the third field and control without pheromone trap. The traps were examined weekly .

3-Effect of Height of pheromone traps upon plant shoot tip on *T. absoluta* population.

Experimental area was feddan per Governorate, planted with tomato plants (Var. Alisa, Hybrid) on December 10, 2013, the pheromone traps placed on the level 30,50 and 80 cm upon shoot tip of tomato plants, three pheromone traps per highness were putted, the captured insect males were counted and recorded weekly and remove moths and replenish water and detergent .

4-Estimation of infested tomato fruits with *T. absoluta*.

The infested tomato fruits with insect larvae of *T. absoluta* were assessed after three weeks from starting contract and composition of tomato fruits . In each field 30 plants were selected randomly in cross diagonals were inspected carefully, the number of healthy and infested fruits were recorded to calculate the percentage of infested fruits. Data from treatments were subjected to analyzed and the difference between means was tested for significant at 0.05% level by F. test according to Fisher (1944)

5-Impact of some insecticides application on mean number of tomato borer larvae after six applications in Sharkia governorate:

Area of half feddan was cultivated with tomato plants in Sharkia governorate, 400 meter far from residential block. Five insecticides Table (1) were applied and control (sprayed with water) each were sprayed six times during two months at ten days intervals.

Table 1: Common name, Trade name, formulations, concentrations and rate of application of tested insecticides.

Trade name	Common name	Formulations	Concentration of A.I.	Rate of appl. /100 LW
Tracer	Spinosad	SC	24%	20 ml/100 LW
Kafrothrin	Deltamethrin	EC	25%	375ml/100LW
Lannate	Methomyl	SP	90%	300 g/feddan
Abamectin	Abamectin	EC	1.8%	40ml/100 LW
Mospilan	Acetamiprid	SL	20%	25 g/100 LW

Experimental area divided into 18 plots , each treatment repeated three times, treatments were randomly distributed in complete block design, ten leaves were collected from ten plants randomly per plot before spray and 3,5,7 and 10 days after spray, put in pepper bag and examined in laboratory. Corrected mortality percentage was calculated according to the equation adapted by Henderson and Tilton (1955). Data was subjected to test and analysis of variance (ANOVA) and means were separated by Duncan's (Duncan,1955) multiple range tests.

RESULTS AND DISCUSSION

1 - Effect of surrounded residential and out residential block to tomato fields on the captured males of *T. absoluta* in pheromone traps.

a- Ismailia governorate:

Fig. (1) appeared the impact of residential and out residential block on population density of captured males in pheromone traps in El-Talelkabier district, Ismailia governorate. The population of tomato borer *T. absoluta* began to appear in low number in early March. Then the population increased gradually reaching the first peak in mid April which presented 482 and 454 males/ trap/ week in residential and out residential block, respectively. After that the population declined on April,19 represented by 300 and 60 males / trap / week in residential and out residential block, respectively. The population increased gradually reached the second peak on May ,17 which amounted 520 and 198 males/trap/week in residential and out residential block, respectively. The population was increased in residential block compared to out residential block. These results was in agreement with Soliman *et al.* (2014) and El-Aassar *et al.* (2015).

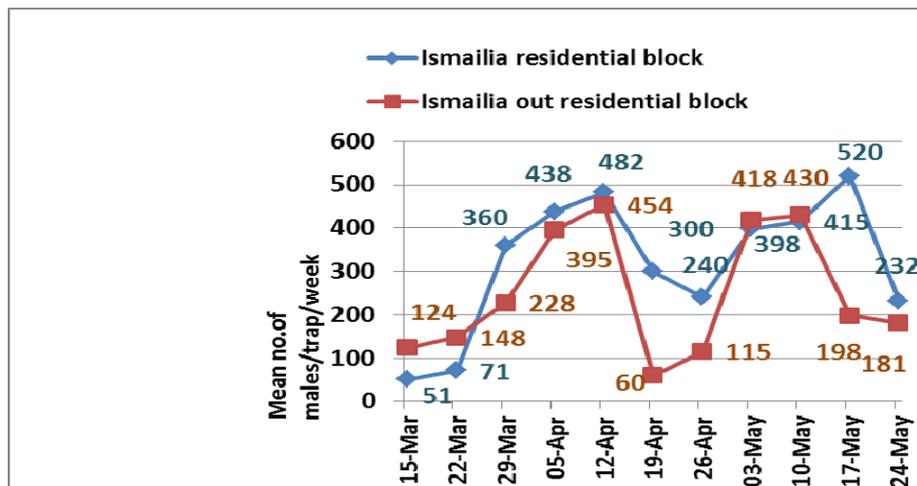


Fig.1. Effect of residential and out residential block on captured males of *Tuta absolutain* pheromone trap in El-Talelkbier district, Ismailia governorate.

b-Sharkia governorate:

As shown in Fig. (2) the population of captured males of tomato borer in pheromone traps in residential and out residential block in Fakous district , Sharkia governorate. The same trend was noticed in Ismailia and Sharkia governorate and the population recorded two peaks and was higher in residential block than out residential block. The population began to appear in mid March and increased gradually reached the first peak on April, 12 represented by 479 and 421 males/trap/week in residential and out residential block, respectively. After that the population declined and increased gradually reached the second peak on May, 17 presented 511 and 178 males/trap/week in residential and out residential block, respectively.

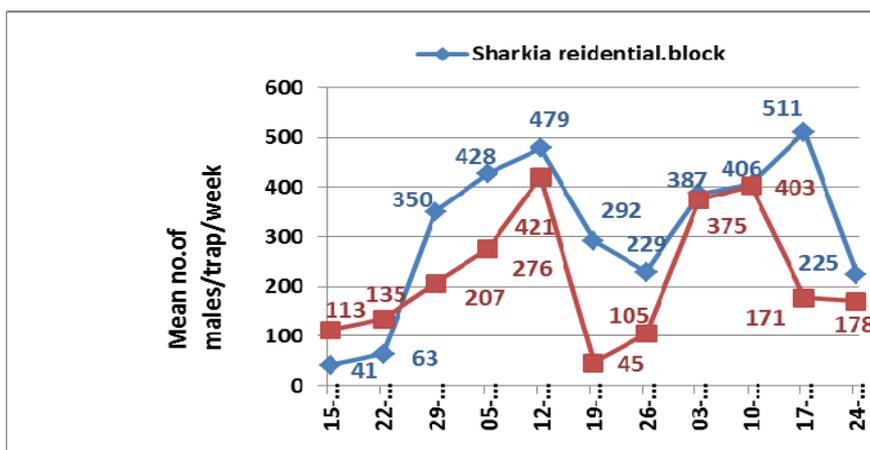


Fig. 2: Effect of residential and out residential block in pheromone traps on capture males of *Tuta absoluta*, Fakous district, Sharkia governorate.

The previous data appeared that pheromone traps captured higher numbers in Ismailia governorate than Sharkia governorate, may be Spread the cultivation of solanaceous vegetables through the year, especially tomatoes and geographical location (Kolar and Lodge 2001), These results was in agreement with Mohamed (2015).

Statistical analysis showed significant differences between the two governorates in residential and out residential block as represented in Fig. (3).

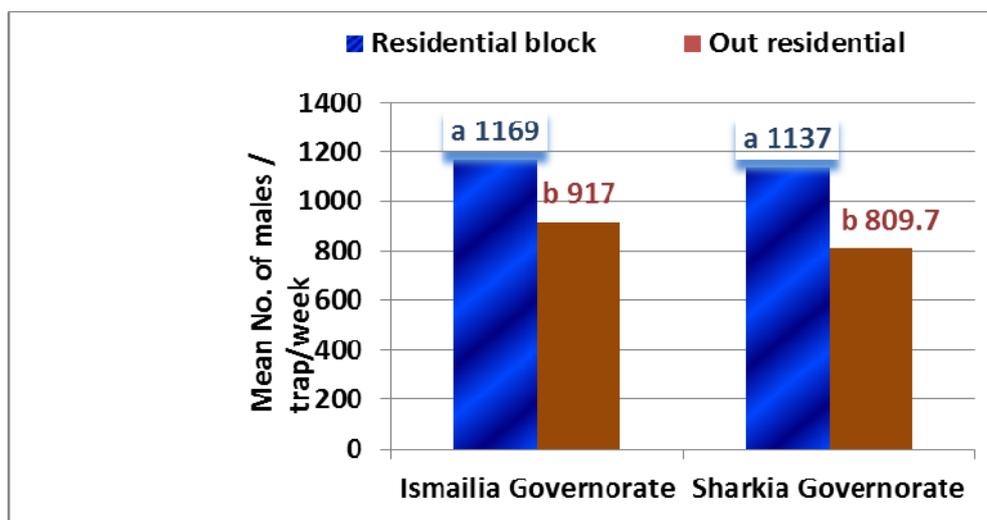


Fig. 3: Effect of residential and out residential block on mean number of *T. absoluta* population density males per trap.

C- Percentage of infested tomato fruits in Ismailia and Sharkia governorates:

Data in Fig.(4) appeared that percentage of infested fruits in residential block were higher than in out residential block, represented by 32.6 and 27.4 % in residential and 21.75 and 18.7% in out residential block in Ismailia and Sharkia governorate, respectively. Also Ismailia governorate recorded higher number of infested fruits than Sharkia governorate.

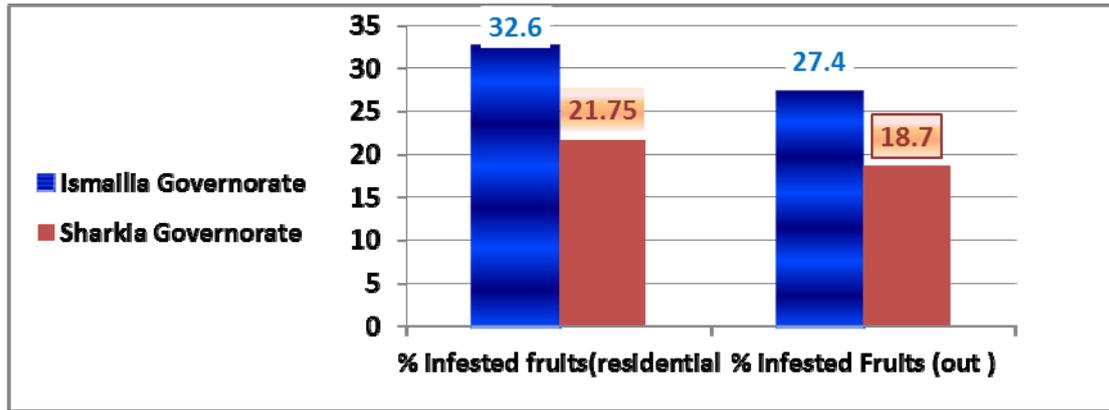


Fig. 4: Infestation % with *T. absoluta* in tomato fruits in residential and out residential block in Ismailia and Sharkia governorates.

2-Impact of sex pheromone traps number per feddan on suppression of population of captured male of *T. absoluta*.

Data in Fig. (5) showed number of trap/feddan in Ismailia and Sharkia governorate in summer 2014 plantation. Increasing the numbers of traps/feddan increased the numbers of male captured moths of *T. absoluta*. Six pheromone traps/feddan captured the higher numbers of tomato leaf borer presented by 19278 and 14647 males during plantation in Ismailia and Sharkia governorates, respectively. On the other hand, two sex pheromone traps/feddan recorded the least numbers of male captured moths amounted 6925 and 6320 males during the plantation in Ismailia and Sharkia governorates respectively.. Statistical analysis showed significant differences between number of pheromone traps during the two governorates as represented in Fig. (5), where six pheromone trap came the first category followed by four and two pheromone traps (L.S.D. 0.05 at Ismailia and Sharkia were 11.42 and 5.73, Respectively).

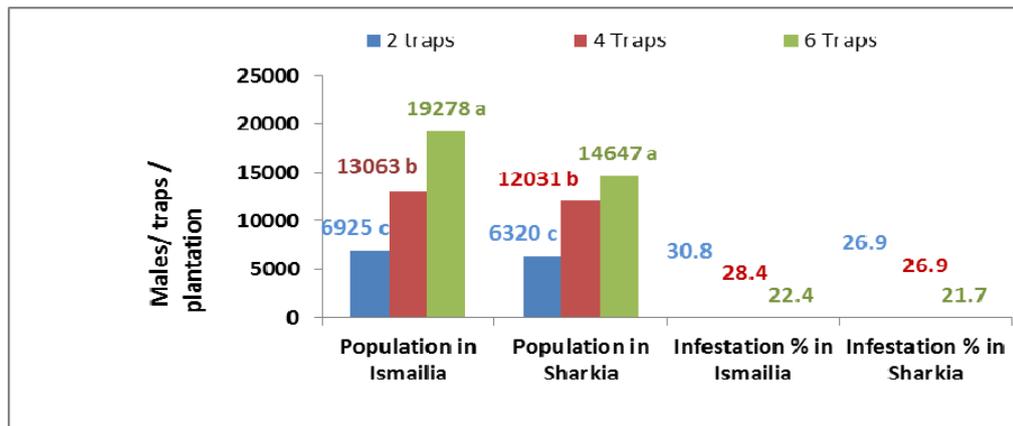


Fig. 5: Impact of pheromone traps number per feddan on the insect population density and infestation % of fruits in Ismailia and Sharkia Governorates.

Regarding the percentage of infested fruits data appeared that increasing numbers of traps/feddan decreased percentage of infested fruits in the two governorates. Percentage of infested fruits was 22.4% and 21.7 % in feddan harbored six pheromone traps/ feddan in Ismailia and Sharkia governorates respectively. On the contrary, the highest numbers of percentage of infested fruits was 30.8 % and 26.9 % in treatments of two sex pheromone traps/ feddan in Ismailia and Sharkia governorates, respectively. These results was in agreement with Bayram, (2014).

3- Effect of Height of pheromone traps upon plant shoot tip on *T. absoluta* population.

Data in Table (2) showed the effect of height of pheromone traps at 30, 50 and 80 cm upon shoot tip of tomato plants on population of captured males. Increasing the height of pheromone trap increased the captured number of tomato borer males. The number of captured males was 1321, 1072 and 808 male/trap/ plantation at 80, 50, 30 cm. height in Ismailia governorate respectively. The corresponding values in Sharkia governorate were 1097, 852 and 588 males/trap/plantation. Statistical analysis showed significant differences between three height in Ismailia and Sharkia governorate. The three heights divided into three groups, the first group was at 80 cm. height, the second group was 50 cm. height and the third group was 30 cm. height.

The same trend was noticed in infested fruits. The infested fruits was 20.3, 26.6, 31.0 and 55.7 at 80 cm., 50 cm. and 30 cm. height and control in Ismailia governorate, respectively. The corresponding data of infested fruits were 19.7, 24.5, 28.0 % and 43.2 in Sharkia governorate. There are significant differences between the percentage of infested fruits in Ismailia and Sharkia governorate. The infested fruits divided to three group at the three heights in the two governorates. These results are in agreement with Lazgeen *et al.* (2013).

Table 2: Effect of height pheromone traps upon tip on tomato plant on capture of *T. Absoluta* males and infested percent in Ismailia and Sharkia governorate.

Governorate	Populations of males at indicated height			Infested fruits % at indicated height		* Infested fruits in control	LSD _{0.05}
	50 cm	80 cm	30 cm	50 cm	80 cm		
Ismailia	1072b	1321a	31b	26.6c	20.3d	55.7a	2.31
Sharkia	852b	1097a	28b	24.5b	19.7c	43.2a	3.88

*The control without pheromone traps

4- Efficacy of some insecticides on *T. absoluta* larvae after six sprays in Sharkia governorate:

As shown in Table (3) the efficacy of the tested pesticides in controlling *T. absoluta* larvae differed significantly. Methomyl proved to be the most effective pesticide giving mean corrected mortality percentage 88.88% and 87.53 % after three days (initial) and residual effect, respectively. Acetamiprid gave the least initial effect amounted 58.33% and deltamethrin gave the least residual effect presented 29.64%.

The pesticides divided into four group in their initial effect after three days. The first group was methomyl and deltamethrin, Spinosad occupied the second group. The third group was abamectin and the fourth group was acetamiprid. The pesticides divided to two groups in their residual effect, the first group was methomyl, Spinosad, abamectin and acetamiprid. Deltamethrin occupied the second group. These results in agreement with Soliman *et al.* (2014) and El-Assar *et al.* (2015).

Concerning the percentage of infested fruits as shown in Table (3) the same trend was noticed as residual effect. Methomyl gave the least percentage of infested fruits accounted for 12.75% followed by Spinosad by Spinosad by 16.6 % and abamectin presented by 17.96% and deltamethrin gave the highest infested fruits by 47.63%

Table 3: Effect of some insecticides on *T. absoluta* larvae population during summer plantation of 2014 season in Sharkia governorate.

Treatments	Before treatments	Mean number of larvae after / ten leaves								Mean residual effect	Infested fruit %
		Initial		Residual effect							
		3 days		5 days		7 days		10 days			
		No.	C.M %	No.	C.M %	No.	C.M %	No.	C.M %		
Spinosad	17.5	5.0	80.95 b	4.5	81.63	5.0	82.14	2.5	91.07	84.94a	16.6
Deltamethrin	5.0	1.0	86.66a	3.0	57.14	6.5	18.75	7.0	12.5	29.46b	47.63
Acetamiprid	20.0	12.5	58.33d	11.5	58.93	12.5	60.93	5.0	84.37	68.19a	32.78
Methomyl	30.0	5.0	88.88a	4.5	89.28	5.0	89.58	7.8	83.75	87.53a	12.75
Abamectin	22.5	7.5	77.77c	8.0	74.60	5.0	86.11	2.6	92.77	84.49a	17.96
Control	25.0	37.5		35		40		40			51.2
LSD _{0.05}			2.73							24.59	

C.M % = corrected mortality percentage

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ARABIC SUMMERY

تأثير طريقتي مكافحة من المكافحة المتكاملة على تعداد حافرة الطماطم توتا ابسوليوتا في حقول الطماطم

محمد حسن عبد الرحمن سليمان

معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي - جيزة - مصر

اختير سبعة حقول تجريبية مزروعة بنباتات الطماطم (صنف اليبسا) في العروة الصيفية لسنة 2014 في محافظة الإسماعيلية ، ومحافظة الشرقية. تهدف الدراسة إلى دراسة تأثير الكتلة السكنية وخارج الكتلة السكنية ، عدد المصايد الفرمنية / فدان ، ارتفاع المصيدة وبعض المبيدات الحشرية على تعداد حافرة الطماطم توتا ابسوليوتا وعدد ثمار الطماطم المصابة . أظهرت نتائج الدراسة أن تعداد حافرة الطماطم سجلت ذروتين في يوم 12 ابريل، 17 ابريل في محافظتي الإسماعيلية والشرقية. سجلت الذروة الأولى 482، 452 ذكر/مصيدة/الأسبوع ، الذروة الثانية سجلت 520، 198 ذكر/مصيدة/الأسبوع في الزراعات داخل الكتلة السكنية وخارج الكتلة السكنية على التوالي في محافظة الإسماعيلية. وفي محافظة الشرقية بينت الذروة الأولى وجود 479 ، 421 ذكر/مصيدة/الأسبوع ، الذروة الثانية سجلت 511 ، 178 ذكر /مصيدة/الأسبوع في الكتلة السكنية وخارج الكتلة السكنية على التوالي. أيضا النسبة المئوية للثمار المصابة كانت مرتفعة في الكتلة السكنية بالمقارنة بخارج الكتلة السكنية حيث سجلت 32.6 ، 27.4 % في الكتلة السكنية ، 21.75 ، 18.7 % في خارج الكتلة السكنية في محافظتي الإسماعيلية والشرقية على التوالي . في محافظة الإسماعيلية سجلت النتائج أعلى تعداد بحافرة الطماطم والنسبة المئوية للثمار المصابة عن محافظة الشرقية كما أوضح التحليل الاحصائي وجود فروق معنوية بين المحافظتين . وبخصوص ارتفاع المصايد ، بينت نتائج التحليل الاحصائي وجود فروق معنوية بين الارتفاعات الثلاثة 30، 50 ، 80 سم ، حيث أن ارتفاع المصيدة فوق قمة النبات بمسافة 80 سم سجلت أعلى تعداد بينما ارتفاع المصيدة فوق القمة النامية للنبات بمسافة 30 سم سجلت اقل تعداد في المحافظتين . وفي حالة عدد المصايد للفدان ، 6 مصايد سجلت تعداد عالي للذكور مع اقل نسبة مئوية للثمار المصابة وفي حالة وجود مصيدتين للفدان سجلت النتائج اقل عدد للذكور مع نسبة إصابة عالية لثمار الطماطم. مبيد الميثوميل كان أكثر المبيدات المختبرة فعالية ضد حافرة الطماطم حيث سجل نسبة خفض في الإصابة 88.88 % ، 87.53 % بعد 3 أيام من الرش (إبادة فورية) والتأثير المتأخر على التوالي . في حين ان الاسبيناميريد سجل اقل تأثير فوري حيث سجل نسبة خفض مقدارها 58.33 % ، الدلتامثرين أعطى اقل تأثير متأخر مسجلا 29.46 % . معاملة الميثوميل سجلت اقل نسبة مئوية للثمار المصابة بحافرة الطماطم يليه الاسبينوساد ، اليامكتين بينما الدلتامثرين اعطى اعلى نسبة ثمار مصابة. نتائج التحليل الاحصائي بينت وجود فروق معنوية بين المبيدات المختبرة وبين النسبة المئوية للثمار المصابة.

يوصى البحث بزراعة الطماطم خارج الكتلة السكنية ، واستخدام المصايد بمعدل 6 مصايد/ فدان وان تكون المصايد على ارتفاع 80 سم فوق القمة النامية لنبات الطماطم ، واستخدام مبيد الميثوميل والاسبينوساد رشا على الطماطم بمعدل 6 رشات .