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Population Fluctuations of Tomato Leaf Miner *Tuta absoluta* Meyrick and its Associated Predators in Tomato Plants and Effect of Insecticides ,Biocides and Sex Pheromone Traps on the Insect Population.

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ABSTRACT

A field study was carried out at the experimental farm of the faculty of Agriculture, Kafr EL-Sheikh region during two successive seasons 2014 and 2015, to study the population fluctuation of *Tuta absoluta* larvae and associated predators on tomato plants and determine the effect of some insecticides and biocides on *T. absoluta* larvae and chlorophyll content in tomato leaves., Also, Relationship between numbers of insect males caught in pheromone traps and its larvae. Results showed that in the first season 2014, *T. absoluta* larvae appeared in relatively low numbers and increased gradually to exhibit the two peaks (187 and 168 larvae /10 plants on June 24th and July 15th, respectively. The same trend was recorded in the second season 2015. As for predators, *Nesidiocoris ternuis* constituted the greatest in number followed by true spiders. *coccinella undicimpunctata* (L.) came in the third rank, while *Scymnus* spp. was recorded in few numbers. Results indicated that Excellent insecticide was the most potent compound in reducing the population density of *T. absoluta* larvae with reduction of 90.97, 95.67, 96.26% after application at 5, 7 and 10 days, respectively. with all average 94.2±1.6 of reduction While the least average of percentage of reduction for insect larvae caused by Biotect 48, 41, 86.43 and 85.40% at 5, 7 and 10 days after application, respectively with the least average 71.7±11.7. In the second season 2015, in contrast, Voliam flexi was the most potent compound in reducing the population density of insect larvae with reduction percent of 100.0, 98.1 and 100.0% at 5,7 and 10 days after application respectively, with all average 99.2±0.8 .While Agree compound caused the least average of reduction for insect larvae with 81.5, 78.88 and 84.5% at 5, 7 and 10 days after application respectively with all average 81.6±1.6. Statistical analysis showed significant differences among treatments to reduction of *T. absoluta* larvae in the first and second seasons. Chlorophyll content grand average increased by Biotect treatment while it was least with Voliam flexi in 2014 and 2015 season. Populations of *T. absoluta* males appeared in sex pheromone traps had three and four peaks in 2014 and 2015 seasons, respectively, while larvae of this insect had two peaks and one peak in the first and second season, respectively.

INTRODUCTION

Tomato (*Lycopersicon esculentum* L.) is important vegetable crops grown in Egypt. Egypt is considered one of the important tomato producer in the world (WPTC, 2011). Tomato leaf miner, *Tuta absoluta* (Meyrick) (Lepidoptera : Gelechiidae), is considered to be one of the most devastating pests affecting tomato crops, where crop losses range from 60 to 100% if no control measures were applied. Currently, *T. absoluta* management in most countries is mainly based on chemical treatments. Nonetheless, special emphasis is being placed on implementing environmentally safe strategies (lietli *et al*., 2005, Desneux *et al*., 2010 and Derbalah *et al*., 2012).

Biological control has been developed and widely applied in different countries several natural enemies, especially predators attack pests on tomato plants, where they play an important role in suppressing the pest population such as several south American states, Bio-insecticide, *Bacillus thuringiensis* var. Kurstaki exhibited a medium to low efficiency on all instars of *T. absoluta* (Molla *et al*., 2011). Khidr *et al.,* (2013) showed that *B. thuringiensis* had potential effect when integrated with Neem that increased the reduction in infestation rates with *T. absoluta* larvae. Also, Fredon– Corse (2009) Which revealed *B. thuringiensis* var. Kurstaki used for larval control, natural solutions of BtK applied to crops once per week at the end of the day and registered for use against *T. absoluta* larvae on tomatoes in the united states by (Sixmith, 2009).

Tomato crops is treated with pesticides in order to control pest infestation. Residues after pesticide application on vegetable crops need to be determined and the waiting period between application and harvest accordingly be recommended to ensure that the product is free from residues before it reaches market (Shalaby *et al.,* 2012).

Mahmoud *et al.,* (2014) showed that tomato fruits previously treated with Coragen and Aljambo insecticides should be left at least 3 weeks to ensure that the fruits contain residue level below Maximum Residue Limits (MRL). Sex pheromone traps must be investigated to monitor *T. absoluta* populations for determination the correct timing for control. Therefore, present study was undertaken with the objective:-

1- To study the population fluctuation of *T. absoluta* larvae and associated predators on tomato plants.
2- Determine the effect of some low toxicity insecticides and biocides against tomato leaf miner, *T. absoluta*.
3- To study the effect of some insecticides and biocides in chlorophyll content in tomato leaves.
4- Relationship between the numbers of *T. absoluta* males cought in pheromone traps and numbers of its larvae in tomato plants.

MATERIALS AND METHODS

In order to achieve the goal the current study, two different experiments were carried out to measure the seasonal abundance of *Tuta absoluta* on tomato plants, and to evaluate the effect of different chemicals insecticides and biopestisides on *T. absoluta* at Kafr El-Sheikh region.

1- Seasonal abundance of *Tuta absoluta*:

The field experiment was carried out at The experimental farm of the faculty of Agriculture , Kafr El-Sheikh University, Egypt. Experimental area (approximately – 400m^2) was planted with tomato plants *Lycopersicon esculentum* Mill. Variety Elisa, after seeded in a greenhouse on April 5th ,then transferred to the filed during summer cultivation on May, 5th of 2014 and 2015 seasons under normal filed and agricultural practices. The experiment block design was randomized with each treatment replicated four times. Samples were taken randomly after fifteen days from transplanted. Each sample

weekly consisted of 10 plants / replicate The total number of larvae of *T. absoluta* and associated predators were counted and the average number per 10 plants was calculated.

2- Effect of insecticide and Biocides against *T. absoluta*:

An area of half fedan was chosen at Kafr El-sheikh region, Egypt. The area was cultivated in late summer plantation with tomato variety Elisa on May 5th 2014 and 2015 seasons. The experimental area was divided into 24 plots (6 treatments x 4 replicates). The normal agricultural practices were done as recommended. Six treatments were used in the two tested seasons (three chemical insecticides and two bioinsecticides) in addition to control treatment, Table (1) Spraying treatments was applied on May30th and June 4th for 2014 and 2015 seasons, respectively using CP_3 Knapsack.

Samples were taken randomly consisted of 10 plants / replicate in order to determine reduction percentage of infestation for each compound. Surviving larvae were counted before and after 5, 7 and 10 days of treatment.

Data were statistically analyzed using Henderson and Tilton formula (1955) as follows:

$$\text{Reduction\%} = 1 - \left\{\frac{\text{Treatment after x Control before}}{\text{Treatment before x Control after}}\right\} \times 100$$

Table 1. Tested compounds sprayed to control *T. absoluta* in experimental field with various rates /100 Liters.

Serial No.	Trade Name	Active ingredient	Dose /100 Liters
1	Excellent 1-9% EC	Emamectin Benzoate	300cm3 /100L
2	Voliam Flexi 40% WG	Thiamethoxam-Chlorantraniliprole	80gm /Feddan
3	Dimeuron 10% EC	Hexaflumuron	200cm3/Feddan
4	Agree 50% WG	*Bacillus thuringiensis*	500gm /Feddan
5	Biotect 9.4% WP	*Bacillus thuringiensis*	400gm /Feddan
6	Control (untreated)	Water	100%

3- Chlorophyll content of tomato leaves:

Chlorophyll content of tomato leaves was measured in SPAD, after 10 days of the spray for tested compounds, a portable leaf chlorophyll meter (Minolta) (Marquard and Timpton, 1987) on the recently fully expanded leaf.

4. Statistical analysis:

Data were subjected to ANOVA, and variable means were compared using Duncan's Multiple Range Test (1955) at 5% level

RESULTS AND DISCUSSION

1. The population fluctuations of the tomato leaf miner *Tuta absoluta* during 2014 and 2015 seasons:

The population fluctuations of *T. absoluta* larvae on tomato plants was illustrated by Fig. (1). In the first season 2014, tomato leaf miner larvae appeared in relatively low numbers during the third week of May 2014 and increased gradually to exhibit the first peak (187 larvae /10 plants) on June 24th, followed by a second peak (168 larvae /10 plants) on July15th. In the second season 2015, the same trend was recorded. Two peaks also was recorded, the first peak was (157 larvae /10 plants) on June 24th, followed by high second peak (174 larvae /10 plants) on July 21th, after wards, the population density of tomato leaf miner, *T. absoluta* decreased to the end of the two seasons 2014 and 2015.

Our results in agree with those of Ibrahim (2012), who indicated that highest peak of larvae of *T. absoluta* was (69 larvae /90 leaflets) on June15th 2010. While in the second season 2011 the peak of larvae was (70 larvae /90 leaflets) on June 15th .

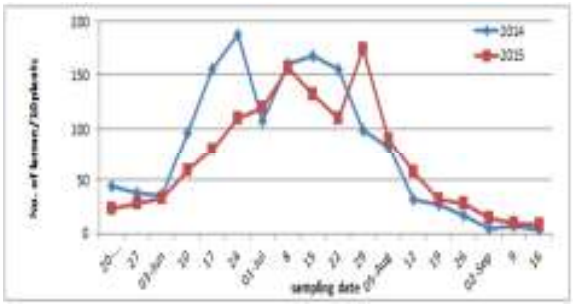

Fig. 1. population fluctuations of the tomato leaf miner *Tuta absoluta* during 2014 and 2015 seasons

Monthly average number of *Tuta absoluta* larvae on tomato plants during 2014 and 2015 seasons

Data in Table (2) showed that the highest monthly average number of larvae rearing on tomato plants during the first season 2014 was recorded in June 2014 and represented by 143 larvae/10 plants. While in the second season 2015, the highest monthly average number of larvae was recorded in July 2015 and represented by 138.5 larvae/10 plants.

Data in Table (2) revealed that the highest average number of *T. absoluta* larvae was recorded in the first season 2014 with an average 73.35 larvae/10 plants followed by the second season 2015 and represented by 59.4 larvae/10 plants.

Table 2. Monthly average number of *Tuta absoluta* larvae on tomato plants during 2014 and 2015 seasons

Seasons	Average No. of *T. absoluta* larvae on tomato plants						
	May	June	July	Aug	Sep.	Total	All Average
2014	41	143	138	39.75	5	366.75	73.35
2015	25.5	70.5	138.5	52	11	297	59.4

As for predators Table(3) , *Nesidiocoris tenuis* (Reuter) constituted the greatest predators as represented in number of individuals-the total number of this predator per 10 plants was 599 individuals forming about (37.9%) of the total recorded numbers of predators during the two seasons of study .the next common species on tomato

plants was true spiders .The total number of this predators was 575 individuals /10 plants during the two seasons 2014 and 2015 and represented by (36.4%) of the total predators . *coccinella undicimpunctata* (L.) was the third rank and the total number of this predators /10plants was 253 individuals forming about (16.01%) of the total predators during the two seasons .the remaining three predators *Chrysoperla carnea* (Steph), *Orius* sp. and *scymnus* spp .were represented by moderate and few numbers and recording 4.6%,2.9% and 2.2% respectively of total predators .

Our results are confirmed by Sadek (2015) who found that *N.tenuis* constituted the greatest group as represented in number of individuals. the total number of this arthropods per five plants was 412 individuals forming about (43.9%) of the total recorded numbers of beneficial arthropods during the two seasons of study. *Macrolophus caliginosus* came the second rank with total number 320 individuals and represented by(34.1%) of total predators. *Scymnus interruptus* was the third rank and recording (6.8%) of total predators. the remaining 5 species were represented by (15.2%) of total predators Samy *et al.*,(2016) showed that *Scymnus.spp.* constituted the greatest in number with forming about 34.08 and 41.59% per 10 plants at Kafr el-sheikh and Al-Gharbiya, respectively. The next common species on potato plant was *C.undecimpunctata* which represented by 28.70 and 35.34% respectively. *C.carnea* and spiders occupied the third rank while *P.alfierii* was the last one .

Table 3. Numbers of predators occurring on tomato plants during 2014 and 2015 seasons at Kafr El-Sheikh region:

Predators	Season		Total	% Occurence
	2014	2015		
1. *scymnus* spp	21	13	34	2.2
2.*coccinella undicimpunctata* (L.)	130	123	253	16.01
3. *Orius* sp.	26	20	46	2.9
4.*Chrysoperla carnea* (Steph)	44	29	73	4.6
5.*Nesidiocoris tenuis* (Reuter)	284	315	599	37.9
6. Spiders	312	263	575	36.4

2. Efficacy of tested compounds in reducing *Tuta absoluta* larvae on tomato plants:

Data presented in Table (4) showed that the percent reduction in infestation of tomato leaf miner, *T. absoluta* larvae at Kafr El-Sheikh region during 2014 and 2015 summer seasons. In the first season 2014 in Table (4) revealed that excellent insecticide was the most potent compound in reducing the population density of *T. absoluta* larvae with reduction of 90.97 , 96.67 and 96.26% after application at 5, 7 and 10 days with all average 94.2±1.6 of reduction followed by Voliam flexi with reduction of *T. absoluta* larvae infestation by 83.65, 96.11 and 94.93% at 5, 7 and 10 days after application, respectively. While Dimeuron insecticide was the least average percentage for reduction of *T. absoluta* larvae with 77.74, 90.75 and 90.75% at 5, 7 and 10 days after application respectively.

In case of biocides, Agree caused 65.05, 77.45 and 89.3% reduction of *T. absoluta* infestation at 5, 7 and 10 days after application, followed by Biotect caused 48.41, 86.43 and 85.40% reduction at 5, 7 and 10 days after application respectively with the least all average 71.7± 11.7. Statistical analysis showed significant differences among treatments to reduction of *T. absoluta* larvae in the first season

In the second season, 2015. Results is table (5) showed that Voliam flexi was most potent compound in reducing the population density of *T. absoluta* larvae with reduction of 100.0, 98.1 and 100.0% at 5, 7 and 10 days after application, with all average 99.2 ±0.8 followed by Excellent with reduction of 97.29, 100.0 and 96.75% at 5, 7 and 10 days after application, respectively. Dimeuron came the third rank and caused 88.73, 92.8 and 97.39% at 5, 7 and 10 days after application respectively. As biocides, in contrast biotect caused 87.5, 85.78 and 87.80% reduction in *T. absoluta* infestation at 5, 7 and 10 days after application while Agree came the last one with 81.5, 78.88 and 84.5% reduction at 5, 7 and 10 days after application ,respectively. with all average 81.6+1.6. Statistical analysis showed significant differences among treatments to reduction of *T. absoluta larvae* in the second season

Table 4. Efficiency of insecticide and biocides in reducing *Tuta absoluta* larvae on tomato plants at 2014 season

Compound	% Reduction in the number of larvae / 10plants after			
	5 days	7 days	10 days	All average
Insecticide 1.Excellent 1.9% EC	90.97 ± 3.1	96.67 ±3.9	96.26 ± 3.9	94.2 ± 1.6a
2.Voliam Flexi 40% WG	83.65 ± 3.7	96.11 ± 2.4	94.93 ± 5.0	90.8 ± 3.6a
3.Dimeuron 10% EC	77.74 ± 4.6	90.75 ± 9.5	90.75 ± 9.5	87.0 ± 4.6a
Biocides 4. Agree 50% WG	65.05 ± 4.3	77.45 ± 13.0	89.3 ± 1.4	79.7 ± 7.4b
5. Biotect 9.4% WP	48.41 ± 8.00	86.43 ± 4.52	85.4 ± 1.6	71.7 ± 11.7b

Means followed by the same letter are not significantly different at 0.05 level of probability (Dancun,s Multiple Range Test 1955).

Table 5. Efficiency of insecticide and biocides in reducing *Tuta absoluta* larvae on tomato plants at 2015 season

Compound	% Reduction in the number of larvae / 10plants after			
	5 days	7 days	10 days	All average
Insecticide 1.Excellent 1.9% EC	97.27 ± 2.2	100 ± 0.0	96.75 ± 1.8	97.9 ± 1.2 ab
2.Voliam Flexi 40% WG	100 ± 0.0	98.1 ± 1.8	100 ± 0.0	99.2 ±0.8 a
3.Dimeuron 10% EC	88.73 ± 1.1	92.8 ± 4.1	97.39 ± 1.7	94.4 ± 1.9 b
Biocides 4. Agree 50% WG	81.5 ± 2.7	78.88 ± 5.5	84.5 ± 1.7	81.6 ± 1.6 d
5. Biotect 9.4% WP	87.5 ± 2.7	85.78 ± 5.2	87.8 ± 2.7	87.3 ± 0.8 c

Means followed by the same letter are not significantly different at 0.05 level of probability (Dancun,s Multiple Range Test 1955).

Our results are confirmed. by Hendawy and Fakharany (2012). They found that Primo and Actellic were the most effective followed by Capl 2 oil and K2 oil that induced the lowest reduction for *T. absoluta* and then, it is clear that orange oil that induced a slight reduction in *T. absoluta* population on tomato plants. Desneux *et al*., (2010) found that the products most commonly used by growers for *T. absoluta* management were Spinosad, Azadirachtin and Abamectin, but Indoxacarb and *Bacillus thuringiensis* based insecticides were also applied in tomato plants.

3. Effect of tested compounds in chlorophyll content (SPAD) on tomato leaves at Kafr El-Sheikh region.

Data presented in Table (6) showed that chlorophyll content nonsignificant differences due to compound application in 2014 and 2015 season. The chlorophyll content grand average increased by Biotect treatment followed by Dimeuron and control treatments. While it was least with Voliam flexi treatment, the other tested compounds had moderate effects in 2014 season. In the second season 2015, the same trend was recorded. Chlorophyll content in SPAD had the highest value with Biotect and Dimeuron followed by control treatment. While it was the least with Voliam flexi. The other treatments had moderately effects. Our results similar to Samy *et al*., (2016). They showed that the chlorophyll content grand average increased significantly by Dipel2x treatment at Kafr El-Sheikh. In Al-Gharbiya, chlorophyll content (SPAD) recorded the highest level with Protect and Match treatment, while it was the least with Proclaim treatment in potato leaves.

4. Relationship between the numbers of *T. absoluta* males caught in pheromone traps and numbers of its larvae in tomato plants during 2014 and 2015 seasons.

Population fluctuation of adult male stage of *T. absoluta* in tomato field (Alisa variety) were studied by using pheromone traps baited with sex pheromone of *T. absoluta* under the conventional Agriculture conditions at Kafr El-Sheikh region during 2014 and 2015 seasons in Table(7)

In 2014 season, the male moths of *T. absoluta* began to appear in baited traps with high mean number (163.5 male /trap /week) on June 10th, then the population increased to 176.25 male representing the first peak for this insect on June 17th. Throughout the period extended from late June to the end of season on September 16th two peaks of 193 and 255.25 male /trap /week were recorded on July 22nd and August 26th, respectively, which represented second and third peaks for this insect pest Table (7) and Fig.(2). In 2015 season, population of *T. absoluta* males appeared in sex pheromone traps with high mean numbers (239.5 males /traps /week) on June 10th. Then the mean numbers of caught males increased gradually to 258.75 males /trap /week which represented the first peak of insect on June 17th Table (7) and Fig (3). Along the whole period from June 17th to September 16th, the insect had three peaks of 311.5, 356 and 400 males /trap /week on July 15th, August 12th and 26th, respectively, which represented second, third and fourth peaks. as for larvae , in the first season had two peaks 57.5 and 111.5 larvae /10 plants on july 1st and August 19th respectively. While in the second season larvae had one peaks 119.75 larvae /10 plans on August 19th.

Table 6. Effect of tested compounds in chlorophyll content (SPAD) on tomato leaves at Kafr El-Sheikh region.

Compounds	Average chlorophyll content			
	R_1	R_2	R_3	Average
	Season 2014			
1.Excellent 1.9% EC	61.8	59.7	65.8	62.63±1.7a
2.Voliam Flexi 40% WG	62.1	57.6	62.6	60.77±1.5 a
3.Dimeuron 10% EC	65.9	71.1	56.8	64.6±4.1 a
4. Agree 50% WG	62.7	63.7	62.9	63.1±0.3 a
5. Biotect 9.4% WP	66.1	72.5	57.5	65.2±4.3a
6. Conrol (untreated)	61.1	64.6	66.6	64.1±1.6 a
Season 2015				
1.Excellent 1.9% EC	62.7	60.0	64.3	62.33±1.2 a
2.Voliam Flexi 40% WG	62.9	55.3	60.4	58.67±2.2 a
3.Dimeuron 10% EC	66.0	74.0	58.1	66.03±4.5 a
4. Agree 50% WG	63.2	64.0	60.8	62.67±0.9 a
5. Biotect 9.4% WP	70.0	71.5	61.3	67.6±3.1 a
6. Conrol (untreated)	62.1	63.9	68.0	64.67±1.7 a

Means followed by the same letter are not significantly different at 0.05 level of probability (Dancun,s Multiple Range Test 1955).

Table 7. Relationship between the numbers of *T. absoluta* males caught in pheromone traps and numbers of its larvae in tomato plants during 2014 and 2015 seasons.

Inspection date	Mean No. of male/ trap		Mean No. of larvae/ 10 plants	
	2014	2015	2014	2015
Jun. 10	163.5	239.5	23	13.5
17	176.25	258.75	32.5	20
24	143	190.5	50	29.25
Jul. 1	130.5	225.25	57.5	40.25
8	150.25	280	48	49.5
15	185.5	311.5	63.5	61
22	193	291.5	70	63.5
29	160.5	322.5	72.5	75.5
Aug. 5	188.25	343.25	76.5	81.75
12	200	356	103.5	98.5
19	221.5	335.5	111.5	119.75
26	255.25	400	91.5	116.5
Sep. 2	240.5	342	27.5	32.5
9	222	301	25	11.5
16	110	163	9.5	8.25
Seasonal mean +SE	182.67± 10.62	290.68 ± 16.85	57.47± 7.95	54.75± 9.66

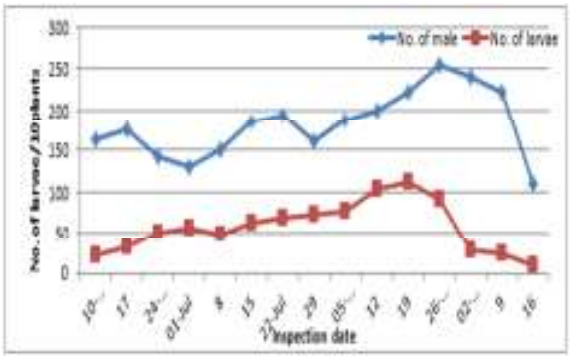

Fig .2. Relationship between the numbers of *T. absoluta* males caught in pheromone traps and numbers of its larvae in tomato plants during 2014 season

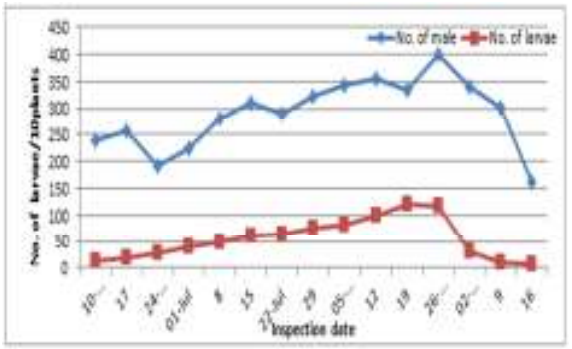

Fig .3. Relationship between the numbers of *T. absoluta* males caught in pheromone traps and numbers of its larvae in tomato plants during 2015 season

Santos *et al.* (2008) who found that the greater capture of adults *T. absoluta* occurred at the end of March. There was a great capture of adults /trap in the conventional area than in the integrated area. However, at the end of the cropping season, there were more adults /trap in the integrated area than in the conventional area. Bavaresca *et al* (2005) found that the seasonal fluctuation of tomato leaf worm adult varied in quantity of male captured in delta traps and in the period of occurrence and among areas evaluated. Pest management system adopted by growers affected the standard of the population fluctuation in the studied areas. The monitoring process using sexual pheromone in delta traps was adequate to identify the time of tomato leaf worm population increments and has potential to be used to define thresholds for pest control. Gursel Cetin *et al* (2014) found that male adult population density of *Tuta absoluta* from April to August was fewer than 150 individuals per trap, this density from at the end of August to at the end of December was found above the 150 individuals per trap in both years 2011 and 2012. Adults were captured to trap from the end of April or the beginning of May to the end of December in both years

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التذبذبات العدديه لصانعه انفاق اوراق الطماطم *Tuta absoluta* و المفترسات المصاحبه لها علي نباتات الطماطم و تاثير المبيدات الحشريه و الحيويه و المصايد الفرمونيه علي تعداد الحشره

أمل بهجت أبو القاسم

محطه البحوث الزراعية بسخا – معهد بحوث وقاية النباتات – كفرالشيخ – مركز البحوث الزراعية – مصر.

اجرى البحث فى المزرعة البحثية لكلية الزراعة كفرالشيخ خلال موسمين متتاليين ٢٠١٤، ٢٠١٥ لدراسة التذبذبات العددية ليرقات صانعة أنفاق أوراق الطماطم على نباتات الطماطم و المفترسات المصاحبه لها و تأثير بعض المبيدات الحشرية والحيوية على يرقات صانعة أنفاق أوراق الطماطم ومحتوى الكلورفيل في أوراق الطماطم و ايضاً العلاقة بين اعداد ذكور الحشرة التى تم اصطيادها في مصائد فرمونية ويرقات الحشرة. أوضحت النتائج في الموسم الاول ٢٠١٤ أن يرقات صانعة انفاق اوراق الطماطم تتزايد تدريجياً مكونة قيمتان (١٨٧، ١٦٨ يرقه /١٠ نباتات) في ٢٤ يونيو، ١٥ يوليو على التوالى في الموسم الثاني ٢٠١٥ كان نفس الاتجاة السابق و بالنسبه للمفترسات : كان المفترس *Nesidiocoris ternuis* (Reuter) الاكثر عددا يليه العناكب الحقيقيه المفترسه و ابو العيد ١١ نقطه جاء في المرتبه الثالثه بينما الاسكمينس كان الاقل عددا. كما اوضحت النتائج أن مبيد أكسلانت كان الاكثر سمية في خفض الكثافة العددية ليرقات حشرة صانعة أنفاق أوراق الطماطم حيث بلغت نسبة الخفض بعد المعاملة ٩٠.٩٧، ٩٥.٦٧ و ٩٦.٢٦% بعد ٥، ٧، ١٠ ايام على التوالى. بينما كان اقل نسبة خفض ليرقات الحشرة بواسطة بيوتكت حيث بلغت نسبة الخفض٤٨ ، ٤١، ٤٣.٨١، ٨٥.٤٠ بعد ٥، ٧، ١٠ ايام من المعاملة على التوالي فى موسم ٢٠١٤ على العكس في الموسم الثاني ٢٠١٥ كان المبيد فوليام فليكسي اكثر المركبات سمية في خفض الكثافة العددية ليرقات هذه الحشرة حيث بلغت نسبة الخفض ١٠٠.٠، ٩٧.٦٠، ١٠٠.٠% عند ٥، ٧، ١٠ يوم بعد المعاملة على التوالي بينما مركب أجرى تسبب في أقل نسبة خفض ليرقات الحشرة وكانت النسب ٨١.٥٠، ٧٨.٨٨، ٨٤.٥% عند ٥، ٧، ١٠ ايام بعد المعاملة على التوالي. اظهر التحليل الاحصائي وجود فروق معنويه بين المعاملات ونسب الخفض للاصابه بصانعه انفاق اوراق الطماطم خلال الموسمين ٢٠١٤-٢٠١٥ أوضحت النتائج أن رش المركبات المختبره ادي الي زياده محتوي الكلوروفيل في حاله بيوتكت وكان فوليام فليكس اقل المبيدات المختبره علي محتوي الكلوروفيل في كلا الموسمين ٢٠١٤/٢٠١٥. كما أوضحت النتائج أن تعداد الذكور التى تم اصطيادها بالمصائد الفرمونية كان لها ثلاث قمم وأربعة قمم في موسمي الدراسة ٢٠١٤، ٢٠١٥ على التوالي بينما يرقات الحشره كان لها قمتان في الموسم الاول و قمه واحده في الموسم الثاني.