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INFLUENCE OF CERTAIN AGRICULTURAL PRACTICES ON POPULATION DYNAMICS OF *Helicoverpa (heliothis) Armigera* AND *Chrysodeixis Chalcites.*

Salama, R.[1]; E. A. El-Shazly[1]; I.S. Abdel-Wahab[2] and S.S. Ibrahim[2]

[1] Department of Economic Entomology and Pesticides, Faculty of Agric., Cairo Univ. Giza, Egypt.

[2] Plant Protection Research Institute, Agricultural Research Center. Dokki, Giza, Egypt.

ABSTRACT

The present investigation was carried out to study the efficiencies of agricultural practices i.e. planting dates and tomato varieties on the population dynamics of tomato fruit worm, *Helicoverpa armigera* and tomato semilooper worm, *Chrysodeixis chalcites* at Kaha Research Station, El-Kalyoubia governorate during two successive seasons 2005 and 2006 where the results clearly showed a few number of eggs and larvae of *H. armigera* and *C. chalcites* in all tomatoes plantations. The abundance of *H. armigera* was relatively higher in the second season (2005/2006) than in the first season (2004/2005). The 3rd planting date (15 September) had the lowest incidence of *H. armigera* and gave the greatest yields in both studing seasons.

TH 348 variety showed the lowest population of both worms *H. armigera* and *C. chalcites* and gave the greatest yields.

Keywords: *Helicoverpa armigera* ;*Chrysodeixis chalcites* ; population dynamics; agricultural practices.

INTRODUCTION

Tomato, *Lycopersican esculentum* Mill is considered one of the most important vegetable crops for fresh consumption and processing. Tomato Fruits contain some important nutritional compounds for human feeding such as proteins, fats and carbohydrates, in addition to some miners and vitamins, specially vitamins C and A. In Egypt the cultivated area of tomato has increased considerably from 454988 fed. during season 2002 to 464491 fed. during season 2006, yielding 7640818 tons (with an average of 16.45 tons / fed.,) (Anonymous 2005 & 2007).

The tomato fruit worm "American bollworm" *H. armigera* (Hubner), commonly Known as a pod borer, is considered as major pest recorded to feed nearly > 200 host plants (Matthews 1999 and Sharma 2001).

Tomato looper, *C. chalcties*., has a wide spread distribution, its later instars eat the entire leaf, at most leaving the midrib it also reported to feed on flowers and fruits. (Mau & Martin 1991 and Steven,1995). Recently, increase attention has focused on tomato worm *H. armigera* and tomato looper *C. chalcites* caused damage of feeding on tomato leaves, stems, buds, flowers and fruits.

To avoid high infestations of the noctuid *H. armigera* and *C. chalcties* on field-cultivated tomatoes agronomic methods of defense may also be used, such as weeding to kill the pupae, deep plugging of adjacent uncultivated areas during the period of oviposition, and elimination of weeds on which the females ovipositor.

Therefore, the current investigation was planned to study the effect of certain agricultural practices such as planting date and tomato varieties on the population dynamics of *Helicoverpa armigera* and *Chrysodeixis chalcites* , as well as certain biochemical compounds identified as a promising source of tomato plant resistance.

MATERIALS AND METHODES

1-Field studies:

The field studies were conducted throughout two successive growing seasons, 2004/2005 and 2005/2006 on tomato variety *lycopersicon esculentum* Mill at Kaha Research Station, EL Kalyoubia Governorate. The experimental area was about ½ Fadden which was divided into 36 plots. Each plot size was about 42 m^2 (6 x 7m).Two different treatments (planting dates and tomato varieties) were carried out to study the influence of them on the population density of *Helicoverpa armigera* and *Chrysodiexis chalcites* as well as survey of the natural enemies associated them. The experiments were designed in Randomized Complete Block Design.

1.1-Sampling methods:-

1.1.1- Survey of certain caterpillars attacking tomato plant.

Ten plants were taken weekly as a random sample per plot at each of the three replicates. Eggs, larvae and pupae of all *H.armigera* and *C. chalcites* were observed, recorded, collected and reared for identification. The eggs, larvae and pupal distribution of *H.armirera* and *C. chalcites* among the different tomato plants structure were examined by destructive sampling of plants from experimental trials. Plants were examined weekly in each plot in separate rows of each experimental block starting 15 days from plant transportation.

Leaves were observed without moving stems to reveal the upper and lower surface of leaves, all flowers were checked and finally the fruits were examined according to the crop phonology of plant, destructive sampling used to obtain preliminary estimates of the relationship between eggs and larvae populations and fruit damage in field trials.

Three leaves from the sprout terminal were selected for examination searching the preferred oviposition site by *H.armigera* females on tomato, ten leaves per plot were carefully examined for eggs presence.

1.1.3- Survey of available natural enemies associated with *Helicoverpa* (*Heliothis*) *armigera* (Hubner) and *Chrysodeixis chalcites* (Esper) as predators and parasitoids.

For parasitoids, survey and collected samples of eggs and larvae of tomato fruit worm (T.F.W.) *H.armiga* and tomato looper *C. chalcites* were held in tubes containing a fresh food and kept under laboratory conditions (at 26 ± 1ºC and 60±5%R.H.) until emergence of adults parasitoids. The adults were daily collected for identification.

The samples were identified by the identification department and biological control research at the Plant Protection Research Institute (PPRI)., Agricultural Research Center, Ministry of Agriculture, Egypt. For

identification, parasitoids species were kept in glass tubes and preserved in 70% ethyl alcohol with few drops of glycerin.

1.2- Effects of certain agricultural practices on the population density of *Helicoverpa (Heliothis) armigera* and *Chrysodeixis chalcites.*

1.2.1.- Planting date.

Three sowing dates, 5 June, 5 July and 5 August were done by using tomato Castle Rock variety in the nursery cultivated in Horticultures Research Institute at EL- Kalyoubia Governorate. After 40 days, tomato seedlings were transplanted with a ball of peat at the 3 to 5 true leaves stage on 15 July, 15August and 15 September, soil for trials was prepared according to usual cropping practices in the studied herbicide (Herbzed 2.5 L/fed. and Stomp EC 500 (1.7 L/200 L water / fed). Plants were cultivats in the presence of water at 50-cm intervals in double rows and plant distance was 40cm.

After planting, tomato seedlings were treated with 75cm Admiral /100 L water as an insecticide against whitefly, 3 gm Rizolix thrum /L water + 3gm Remodel /L water as a fungicide against root rots. Ten plants were randomly chosen and examined weekly starting 2 weeks from transplantation in each plot by checking the upper and lower surface of leaves as well as the flowers and fruit according to the crop phonology of plant during the two seasons.

1.2.2-Tomato varieties

This experiment was carried out by using three tomato varieties such as Castle Rock, Hybrid Nsxty 9535 F1 and Hybrid TH 348. The 1st tomato variety , Castle Rock was planted in 40 cm between plants while the 2nd and 3rd tomato varieties the plant distance was 50 cm .

Three tomato varieties were sown on 5 July in the nursery and were transplanted on 15 August in open field, the seedlings were received all previous insecticides and fungicides in both the nursery and open field .

1.2.3- Damage assessment and yield losses due to *Helicoverpa* (*Heliothis*) *armiger* infestation:-

At harvesting time and when the 80% of tomato fruits reach red fruit stage, all tomato fruits were manually collected and placed in labeled plastic bags, fruits were classified, weighted and scored as healthy (undamaged) and damaged fruits (feeding larval holes by *H.armigera*) .

Fruit quality was estimated in two ways, as the percentage total damaged fruits and/or as the percentage undamaged fruits. The number and weight of undamaged and damaged red fruits were calculated for each plot and yield loss % was then determined for each fruit quality as follows:

$$\text{Yield loss \%} = \frac{\text{Total weight red fruits} - \text{weight of undamaged red fruits}}{\text{Total weight red fruits}} \times 100$$

1.2.4.-Effect of weather factors on the population density of *H. armigera*:-

Three weather factors, (maximum & minimum) ºC temperatures and relative humidity R.H.% were obtained from the Central Laboratory for Agricultural Climate, Dokki, Cairo during two season (2004/2005 and 2005/2006) were used in this study.

RESULTS AND DISCUSSION

1-Effect of planting dates:-

1.1.Tomato fruit worm, *Helicoverpa* (*Heliothis*) *armigera:-*

Effect of planting dates on population dynamic of tomato fruit worm, *H. armigera* through 2004/2005 and 2005/2006 seasons was shown in Table (1). At the 1st season (2004/2005), the highest mean number of eggs (0.25 eggs /30 plants) was recorded in the 1st plantation followed by the 3rd and the 2nd plantations which recorded 0.10 and 0.05 eggs /30 plants, respectively. While the highest mean larval number was recorded in the 3rd plantation with 0.80 larvae /30 plants followed by the 2nd and 1st plantations with 0. 65 and 0.15 larval /30 plants, respectively. At the harvesting time, the tomato yield percentage reduction recorded 36.11 , 28.25 and 9.32 % in the 1st , 2nd and 3rd planting dates, respectively.

At the 2nd seasons (2005/2006), the highest mean number of eggs (3.80 eggs / 30 plants) was found in the 1st plantation followed by the 2nd and 3rd plantation which recorded 0.30 and 0.15 eggs / 30 plants, respectively. The highest mean number of larvae (0.55 larva / 30 plants) was recorded in the 3rd plantation followed by 0.15 and 0.05 larva / 30 plants in the 1st and 2nd plantations, respectively. The percentage yield reduction which recorded in the three tomato plantations was 31.62, 16.66 and 14.46 % in the 1st , 2nd and 3rd plantations, respectively.

1.2.Tomato semi-looper worm, *Chrysodeixis chalcites* :-

As shown in Table (2), data indicated that the highest mean number of eggs was 2.25 eggs / 30 plants in the 2nd plantation followed by 1.55 and 0.40 eggs/ 30 plants in the 1st and 3rd plantation , respectively at the 1st season (2004/2005) .The highest mean larval number was 0.45 larvae / 30 plants in the 1st plantation followed by 0.4 and 0.15 larvae / 30 plants in the 3rd and 2nd plantations, respectively. In the second season (2005/2006) , the 3rd plantation had the highest mean number of eggs and larvae (0.2 and 0.25 / 30 plants, respectively . Pinto *et .al.,* 1995 and EL-Gendi *et .al.,* 1997 found that the lowest number was 2 larvae / 500 tomato fruits in June plantation, while the highest number was 27 larvae / 500 tomato fruits in August plantation

.In India, Dincer 1984 and Borah 1995 reported that tomato planted on October 25 had the lowest incidence of *Heliothis armigera* and gave the greatest yields.

2. Effect of tomato varieties : -

From the data presented in the Table (3 and 4) it is obvious that population of both insect pests *H.armigera* and *C. chalcites* were found with few number of eggs and larvae in all tomatoes plantations. The abundance of *H.armigera* was relatively high in the second season (2005/2006) as compared with the first season (2004/2005).

T1

T2

3050

T3

T4

2.1.Tomato fruits worm:-

In the 1st season ,the highest mean number of eggs and larvae was 0.05 eggs/30 plants and 0.65 larvae / 30 plants , respectively occurred in Castle Rock variety, while the Nsxty 9535 F1 and TH 348 varieties had no eggs during the 2nd planting date (15 August). The lowest mean number of larvae was 0.15 larvae / 30 plants in TH 348 variety, while Nsxty 9535 F1 variety had the moderate means number of larvae with 0.2 larvae / 30 plants (Table, 3) .In the 2nd season, the highest mean number of eggs and larvae (0.35 eggs and 0.15 larvae / 30 plants, respectively) was occurred in the TH 348 variety followed by Castle Rock variety which recorded 0.3 eggs and 0.05 larvae / 30 plants.

While the Nsxty 9535 F1 variety had 0.3 and 0.0 eggs and larvae / 30 plants, respectively. At harvest time , the highest tomato yield reduction occurred in Castle Rock variety in both season with 27.79 % and 16.67 % , respectively followed by Nsxty 9535 F1 variety with 8.8 % and 9.6%, respectively while the TH 348 variety had the lowest yield reduction in both season 6.5 % and 8.4 % , respectively.

2.2. Tomato semi looper worm:

The data recorded in **Table (4)** indicated that Castle Rock variety at the 1st season received the highest mean number of eggs (2.25 eggs / 30 plants) followed by Nsxty 9535 F1 variety which received 1.15 eggs / 30 plants. While The lowest mean number of eggs was 1.1 eggs / 30 plants was recorded with TH 348 variety. In the same season the Castle Rock variety received 0.15 larvae / 30 plants, while the two other varieties had no larvae .

.During the 2nd season 2005/2006, the three tested varieties didn't receive any egg of *C. chalcites* while the Castle Rock and Nsxty 9535 F1 varieties received only 0.05 larvae / 30 plants throughout the season .

When different varieties of the same crop are grown side by side, differences in infestation level may be very marked. Resistance plants have a lower pest population density, or fewer damage symptoms than the other plants which are termed susceptible. Conversely, there will be some plants that appear to be preferred by the pests and this especially susceptible plant will bear very high pest populations . Reducing sugars in fruits were positively correlated with the degree of infestation, while the zinc and iron content of foliage and ascorbic acid contents of fruits were negatively correlated . The resistant to the tomato fruit worm , *H.armigera* refer to the phenols content in leaves of tomato varieties (Banerjee & Kallo 1989 and Rath & Nath 2001).Ya *et.al.*2006 reported that phenolic-rich aqueous extract of tomato foliage inhibit early larval growth of the fruit worm, *Heliothis zea* (Sharma *et.al.*2003 and Simmons *et.al.*2004).

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تأثير بعض المعاملات الزراعية علي ديناميكية تعداد دودة ثمار الطماطم و دودة الطماطم النصف قياسية.

رمضان سلامة[1] ؛ عز الشاذلي[1] ؛ إدريس عبد الوهاب[2] و سماح سيد[2]

[1] قسم الحشرات الاقتصادية و المبيدات- كلية الزراعة – جامعة القاهرة

[2] معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقي – جيزة

أجري هذا البحث لدراسة تأثير بعض المعاملات(الممارسات) الزراعية مثل ميعاد الزراعة و بعض أصناف الطماطم علي ديناميكية تعداد دودة ثمار الطماطم و دودة الطماطم النصف قياسية و ذلك في محطة بحوث قها بمحافظة القليوبية خلال موسمي ٢٠٠٥ ؛٢٠٠٦ و قد أوضحت النتائج أن كمية وضع البيض و اليرقات لكلا الحشرتين كان منخفضا بصفة عامة و رغم ذلك فإن تعداد حشرة دودة ثمار الطماطم في موسمي ٢٠٠٥ ؛ ٢٠٠٦ كان أعلي نسبيا من التعداد في موسمي ٢٠٠٤ /٢٠٠٥ ؛ كما أوضح ميعاد الزراعة (١٥ /٩) أنه أنسب المواعيد الثلاث نظرا لقلة تعداد الآفة و أعلي كمية محصول ناتج. كما أظهر الصنف TH 348 أقل معدل إصابة و أعلي محصول ناتج .

Table (1) : Effect of planting dates on mean number of *Helicoverpa armigera* eggs, larvae and percentage of infested tomatoes/30 plants and yield reduction of Castle Rock variety at El-Qalyoubia Governorate during 2004/2005 and 2005/2006 seasons

Plantations	Season (2004-2005)									Season (2005-2006)								
	Mean number/30 plants			Weather factors			Yield			Mean number/30 plants			Weather factors			Yield		
	H. armigera		Natural enemies *C.carnea*	Temp. ºC		R.H. %				*H. armigera*		Natural enemies *C.carnea*	Temp. ºC		R.H. %			
	Eggs	Larvae	Eggs	Max.	Min.	Mean	Healthy fruits(Kg.)	Infested fruits(Kg.)	Reduction %	Eggs	Larvae	Eggs	Max.	Min.	Mean	Healthy fruits(Kg.)	Infested fruits(Kg.)	Reduction %
1st plantation (15Juli)	0.25	0.15	19	32.40	20.56	57.24	11.79	6.67	36.11	3.80	0.15	6	30.38	18.70	58.33	5.08	2.35	31.62
2nd plantation Recommended (15 August)	0.05	0.65	17	28.07	16.70	57.79	25.75	10.00	28.25	0.30	0.05	5	26.37	15.11	59.44	10.00	2.00	16.66
3rd plantation (15 September)	0. 1	0.80	2	26.95	15.57	58.95	41.36	4.25	9.32	0.15	0.55	2	25.47	14.30	60.37	50.29	8.50	14.46

Table (2): Effect of planting dates on mean number of *Chrysodeixis chalcites* eggs, larvae, percentage of infested tomatoes/30 plants of Castle Rock variety at El-Qalyoubia Governorate during 2004/2005 and 2005/2006 seasons.

Plantations	Season (2004-2005)						Season (2005-2006)					
	Mean number /30 plants		Natural enemies *C.carnea*	Weather factors			Mean number /30 plants		Natural enemies *C. carnea*	Weather factors		
				Temp .ºC		R.H.%				Temp .ºC		R.H. %
	Eggs	Larvae	Eggs	Max.	Min.	Mean	Eggs	Larvae	Eggs	Max.	Min.	Mean
1st plantation	1.55	0.45	19	32.40	20.56	57.24	0.05	0.00	6	30.38	18.70	58.33
2nd Plantation (Recommended)	2.25	0.15	17	28.07	16.70	57.79	0.00	0.05	5	26.37	15.11	59.44
3rd plantation	0.40	0.40	2	26.57	15.57	58.95	0.20	0.25	2	25.47	14.30	60.37

Table (3): Effect of tomato varieties on mean number of *Helicoverpa armigera* eggs, larvae and mean percentage of infested tomatoes/30 plants at El-Qalyoubia Governorate during 2004/2005 and 2005/2006 seasons.

Varieties	Season (2004-2005)									Season (2005-2006)								
	Mean number/30 plants						Yield			Mean number/30 plants						Yield		
	H. armigera		Natural enemies *C.carnea*	Weather factors						*H. armigera*		Natural enemies *C.carnea*	Weather factors					
				Temp. °C		R.H. %							Temp. °C		R.H. %			
	Eggs	Larvae	Eggs	Max.	Min.	Mean	Healthy fruits(Kg.)	Infested fruits (Kg.)	Reduction %	Eggs	Larvae	Eggs	Max.	Min.	Mean	Healthy fruits(Kg.)	Infested fruits (Kg.)	Reduction %
Castle Rock (recommended)	0.05	0.65	17	28.07	16.70	57.79	10.00	25.65	27.79	0.30	0.05	5	26.37	15.11	59.4	2.00	9	16.67
Nsxty9535F1	0	0. 2	12				2.75	28.28	8.80	0.30	0.00	8				2.00	18.63	9.60
TH 348	0	0.15	10				4.25	60.25	6.50	0.35	0.15	14				1.50	16.25	8.40

Table (4): Effect of tomato varieties on mean number of *Chrysodeixis chalcites* eggs, larvae and mean percentage of infested tomatoes/30 plants at El-Qalyoubia Governorate during 2004/2005 and 2005/2006 seasons.

varieties	Season (2004-2005)						Season (2005-2006)					
	Mean number /30 plants		Natural enemies *C.carnea*	Weather factors			Mean number /30 plants		Natural enemies *C. carnea*	Weather factors		
				Temp.ºC		R.H. %				Temp.ºC		R.H.%
	Eggs	Larvae	Eggs	Max.	Min.	Mean	Eggs	Larvae	Eggs	Max.	Min.	Mean
Castle Rock (recommended)	2.25	0.15	17	28.07	16.70	57.79	0.00	0.05	5	26.37	15.11	59.44
Nsxty9535F1	1.15	0.00	12				0.00	0.05	8			
TH 348	1.10	0.00	10				0.00	0.00	14			