

## THE FLIGHT ACTIVITY AND SUSCEPTIBILITY OF THE PINK BOLLWORM *PECTINOPHORA GOSSYPIELLA* TO INSECTICIDES AS AFFECTED BY COTTON VARIETY

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### ABSTRACT

On fields planted with Giza 89 and Giza 86 cotton varieties, the population fluctuation of the pink bollworm, *Pectinophora gossypiella* (Saund.), was studied using sex pheromone traps at Kafr El-Sheikh Governorate during 2002 and 2003 seasons. Also, the effect of prevailing weather factors (maximum temperature, minimum temperature, relative humidity and wind speed) on the flight activity of the insect and susceptibility of the larvae to insecticides were determined on Giza 89 and Giza 86 cotton fields.

Results indicated that the pink bollworm had three to four generations during two successive cotton seasons. Giza 89 cotton variety was more susceptible to infestation by *P. gossypiella* than Giza 86 variety. The population fluctuation of pink bollworm was affected significantly by the changes in weather factors on Giza 89 cotton variety, meanwhile, the effect was insignificant on the insect population on Giza 86 fields. The effect of wind speed was negative, whereas the effect of the other weather factors (relative humidity and temperature) was positive. Also, on Giza 86 cotton fields, the pink bollworm larvae were more susceptible to insecticide treatments.

### INTRODUCTION

The pink bollworm *Pectinophora gossypiella* (Saund.) is considered one of the most destructive pests that attacking cotton plants during flowering and maturing stages. Such pest may cause severe loss of cotton yield quantity and quality. Different methods are available to control the pink bollworm and to maintain its population at level below that causing economic injury, among of which the integration of cultural, biological and chemical control methods.

The principal cultural practices employed against cotton bollworms were investigated such as, planting less susceptible cotton varieties (Abul-Nasr, 1960; Lukefahr *et al.*, 1965; Lukefahr and Martin, 1966; Hassanein *et al.*, 1969; Nasr and Azab, 1969; Badawy, 1974, Abdel-Rahim *et al.*, 1976; Al-Biltagy, 1990; Wilson *et al.*, 1992 and Abo-Shofoa *et al.*, 1995). Hassanein *et al.*, 1969 and Al-Biltagy, 1990 reported that a tendency in the early blooming cotton varieties was observed to represent the least susceptible among those tested. This important characteristic may be due to their ability in producing early blooms, and therefore it could escape from the heavy attack at the end of the season.

The sex pheromone traps were used as an important tool in monitoring the fluctuations in the population activity of this insect (Ahmed, 1979; Gupta and Agrawal, 1985; Hossein, 1990 and Abdel-Hamid *et al.*, 1999). Also, the susceptibility of cotton varieties to infestation by pink bollworm was studied using sex pheromone traps (Chu *et al.*, 1991). The effect of the prevailing weather factors on the seasonal abundance of pink bollworm play an important role in predicting the infestation in cotton fields (Guirguis *et al.*, 1991 and El-Sadaany *et al.*, 1999).

Accordingly, the present study aimed to investigate the following points on two Egyptian cotton varieties (Giza 89 and Giza 86) during 2002 and 2003 seasons:

1. The flight activity of the pink bollworm.
2. The correlations between the numbers of pink bollworm male moths and prevailing weather factors.
3. The changes in susceptibility of the pink bollworm larvae to insecticides.

## MATERIALS AND METHODS

Set of experiments was carried out during 2002 and 2003 cotton growing seasons at the farm of the Horticulture Services Unit, Sakha, Kafr El-Sheikh Governorate to study the flight activity, effect of the prevailing weather factors and susceptibility of the pink bollworm, *Pectinophora gossypiella* to insecticides in Giza 89 and Giza 86 cotton fields.

1. **The flight activity and effect of the prevailing weather factors:**

An experiment was carried out during 2002 cotton season in two isolated fields of 2 feddan cultivated with Giza 89 cotton

variety and 1.5 feddan with Giza 86 variety. During 2003, the area was 2.5 and 1.5 feddan for Giza 89 and Giza 86 cotton fields, respectively. Giza 89 cotton fields were chosen far away by 3 km from the Giza 86 fields. Planting occurred on dates of March 18<sup>th</sup>, 2002 and March, 26<sup>th</sup>, 2003. The normal agricultural practices were followed and no chemical control was tried. Hand picking of the cotton leafworm egg-masses was conducted to avoid the application of insecticides. Pheromone -baited Delta stick traps with capsules each loading 2 mg a.i. gossypure were used. Two pheromone traps was positioned in each area from the end of May till the end of September, 2002 and 2003. The sticky plates were replaced by new ones every three days and the captured male moths were counted every six days. Capsules were replaced by new ones every two weeks (Flint *et al.*, 1986). The effect of the prevailing weather factors (maximum temperature, minimum temperature, relative humidity and wind speed) on the flight activity of the pink bollworm moths was studied. The records of the four factors were supplied by the agro-meteorological station at Sakha, Kafr El-Sheikh (Table 1).

**Table (1):** Average of prevailing maximum temperature (Max. T.), minimum temperature (Min. T.), relative humidity (R.H.) and wind speed (W.S.) during 2002 and 2003 cotton seasons.

Dates	2002 season				2003 season			
	Max. T. °C	Min. T. °C	R.H. %	W.S. m/s	Max. T. °C	Min. T. °C	R.H. %	W.S. m/s
May	30.2	13.6	55.3	2.3	32.2	15.0	69.5	2.5
June	32.3	18.4	63.3	1.9	33.5	18.7	64.9	2.4
July	34.4	21.0	67.7	1.7	32.6	19.7	68.5	1.8
Aug.	33.6	20.3	65.3	1.2	33.7	19.9	73.2	1.4
Sept.	34.0	19.8	61.4	1.1	33.0	18.0	68.6	1.3

- 2. The susceptibility of the pink bollworm to insecticides:** -
- The cultivated cotton varieties Giza 89 and Giza 86 were planted during March 18<sup>th</sup> to March 24<sup>th</sup>, 2002 and during March 25<sup>th</sup> to April 3<sup>rd</sup>, 2003. The experimental fields were 225 and 109 feddans for Giza 89 and Giza 86 during 2002 cotton season, where they were 259 and 183 feddans during 2003, respectively. The cotton plants received the normal agricultural practices and all the fields of Giza 89 and Giza 86 varieties were treated with

conventional insecticides in sequence applications regime during 2002 and 2003 as shown in Table (2) to reduce the pink bollworm infestation. The insecticide applications regime established by Ministry of Agriculture, Egypt. The experimental locations were treated with insecticides at recommended rates followed and recommended by the official authorities of Ministry of Agriculture. Cotton aerielly sprayed 5 successive times by using a helicopter aircraft.

**Table (2):** Conventional insecticide applications for the control of *P. gossypiella* during 2002 and 2003 cotton seasons.

Date of spray	Insecticides		Formulation	Rate of application/fed.
	Trade name	Common name		
<b>2002 cotton season</b>				
June 24	Atabron	Chlorfluazuron	EC 5%	400 ml
July 15	Dursban	Chlorpyrifos	EC 48%	1 liter
July 30	Sumigold	(ISO) Esfenvalerate	EC 20%	150 ml
August 16	Curacron	Profenophos	EC 72%	750 ml
August 31	Sevin	Carbaryl	WP 85%	1.5 kg
<b>2003 cotton season</b>				
June 29	Atabron	Chlorfluazuron	EC 5%	400 ml
July 18	Curacron	Profenophos	EC 72%	750 ml
July 31	Sumialpha	Esfenvalerate	EC 5%	600 ml
August 18	Dursban	Chlorpyrifos	EC 48%	1 liter
Sept. 1	Sevin	Carbaryl	WP 85%	1.5 kg

Samples of 400 green bolls were collected at random from both diagonals of the inner square of each restricted area every six days. Sampling started on July 9<sup>th</sup>, 2002 and July 15<sup>th</sup>, 2003 and continued till September 13<sup>th</sup>, 2002 and September 19<sup>th</sup>, 2003. The cotton bolls were examined internally and the larval contents of pink bollworm in each treatment were counted.

Data concerning the flight activity of the pink bollworm male moths in relation to the prevailing weather factors was subjected to statistical analysis. A computer program (MREG2) was used for estimating the simple correlation coefficients between the weather factors and the population of the pest.

## RESULTS AND DISCUSSION

### 1. Flight activity of male moths:

Data presented in Table 3 show the mean number of trapped male moths of pink bollworm as estimated by sex pheromone traps

during two cotton growing seasons (2002 and 2003) on two cotton varieties (Giza 89 and Giza 86). It is observed that the flight activity of the moths started in the last week of May and extended till the last week of September during the two seasons of the study.

**Table (3):** Average catch of *P. gossypiella* male moths during 2002 and 2003 cotton seasons using gossypure sticky traps on two cotton varieties.

Mean number of male moths/trap/6 days					
2002 season			2003 season		
Dates	Giza 89	Giza 86	Dates	Giza 89	Giza 86
May 31 -June 5	5.5	7.0	May 28 -June 2	39.0	32.0
June 6-11	7.0	9.5	June 3-8	52.5	39.5
12-17	7.5	12.0	9-14	70.0	49.5
18-23	8.5	19.0	15-20	61.0	47.5
24-29	11.0	12.5	21-26	54.0	41.5
June 30-July 5	15.0	10.5	June 27-July 2	58.5	38.0
July 6-11	20.5	17.5	July 3-8	83.5	67.0
12-17	30.0	32.0	9-14	112.0	80.5
18-23	82.0	29.0	15-20	180.5	82.0
24-29	53.5	24.5	21-26	169.0	89.5
July 30-Aug. 4	39.5	35.0	July 27-Aug. 1	161.5	86.0
Aug. 5-10	77.5	61.5	Aug. 2-7	158.0	79.5
11-16	96.5	83.0	8-13	140.0	73.5
17-22	81.0	69.0	14-19	193.0	138.0
23-28	68.0	53.0	20-25	245.5	157.5
Aug. 29-Sept. 3	79.5	42.5	26-31	199.5	183.0
Sept. 4-9	63.0	4.0	Sept. 1-6	184	161.5
10-15	60.5	61.5	7-12	200.5	153.5
16-21	73.0	50.5	13-18	263.0	147.5
22-27	66.5	42.5	19-24	190.0	146.0
Total	945.5	712.0	Total	2815	1893
Mean	47.3	35.6	Mean	140.8	94.7

It is clear that the pink bollworm has four generations in Giza 89 and Giza 86 cotton fields during the first season (2002). The peaks of the four generations in Giza 89 cotton fields were recorded during the 3<sup>rd</sup> week of July, 2<sup>nd</sup> week of August, 1<sup>st</sup> week of September and 3<sup>rd</sup> week of September. The corresponding mean numbers of caught moths were 82, 96.5, 79.5 and 73 male moths/trap/6 days for the four peaks, respectively. In Giza 86 cotton

fields, the four peaks were recorded during the 3<sup>rd</sup> week of June (19 male moths), 2<sup>nd</sup> week of July (32 male moths), 2<sup>nd</sup> week of August (83 male moths) and 2<sup>nd</sup> week of September (61.5 male moths/trap/6 days).

In the second season (2003), four generations of pink bollworm were recorded in Giza 89 fields. The peaks were 70, 180.5, 245.5 and 263 male moths/trap/6 days, at the 2<sup>nd</sup> week of June, 3<sup>rd</sup> week of July, 3<sup>rd</sup> week of August and mid of September, respectively. In Giza 86 fields, three generations were recorded. the peak of the 1<sup>st</sup> generation at the 2<sup>nd</sup> week of June (49.5 male moths), the 2<sup>nd</sup> peak at 4<sup>th</sup> week of July (89.5 male moths) and the 3<sup>rd</sup> peak at the last week of august (183 male moths/trap/6days). The results of Nasr and Azab (1969) show that the number of generations of pink bollworm vary on different cotton varieties and also from one season to another in the same region.

During the two seasons of the study, 2002 and 2003, the average mean number of the pink bollworm male moths/trap/6 days was 47.3 and 140.8 in Giza 89 cotton variety, while it was 35.6 and 94.7 male moths in Giza 86 variety during 2002 and 2003, respectively. The data revealed that Giza 89 cotton variety was more susceptible to infestation by pink bollworm than Giza 86. This result agree with that obtained by Abo-Sholola *et al.* (1995). They stated that Giza 86 cotton variety was lowest susceptible to infestation by *P. gossypiella*. Meanwhile, Wilson *et al.*, 1992, concluded that differences in the thickness of carpel walls had little effect on the ability of pink bollworm to penetrate bolls.

## 2. Effect of certain weather factors on the flight activity of male moths:

The averages of male moths catch of the pink bollworm were correlated with the averages of prevailing temperature, relative humidity and wind speed. The calculated simple correlation coefficients during the two seasons of study are given in Table 4.

Concerning the effect of the four weather factors on pink bollworm moths population during 2002 season, it is clear that the correlation coefficients recorded highly significant values in Giza 89 cotton fields. In 2003 season, the simple correlation coefficient between the insect population and wind speed was significant, while it was insignificant for temperature and relative humidity.

**Table (4):** Simple correlation coefficients between the average catch of *P. gossypiella* male moths and four weather factors in Giza 89 and Giza 86 cotton fields during 2002 and 2003 seasons.

Cotton variety	Simple correlation coefficients (r)							
	Maximum temp.		Minimum temp.		Relative humidity		Wind speed	
	2002	2003	2002	2003	2002	2003	2002	2003
Giza 89	0.851**	0.140	0.720**	0.233	0.688**	0.187	-0.811**	-0.534*
Giza 86	0.537*	0.084	0.240	0.158	0.329	0.126	-0.529*	-0.317

\* = Significant at 0.05 level

\*\* = Significant at 0.01 level

In Giza 86 cotton fields, the simple correlation coefficients were insignificant in all cases during the two seasons except that for maximum temperature and wind speed it was significant during 2002.

It is to be mentioned that, the correlations during the two seasons in both Giza 89 and Giza 86 cotton fields were negative only in case of wind speed, meanwhile they were positive for the other weather factors. It could be generally concluded that the four weather factors were affecting the insect population significantly in Giza 89 cotton fields, meanwhile their effects were insignificant in Giza 86 fields. El-Saadany *et al.* (1999) concluded that the amount of changes in the maximum day temperature, minimum night temperature and relative humidity required to alter the catch of bollworms when the tested factors remain constant around their averages.

### 3. Susceptibility of the pink bollworm to tested insecticides:

The present investigation was directed to study the efficiency of insecticide treatments against the pink bollworm during the two seasons of 2002 and 2003 in Giza 89 and Giza 86 cotton varieties. The results obtained are given in Table 5.

It is obvious that the percent of infestation by *P. gossypiella* larvae in Giza 89 treated fields ranged between 1.0 and 5.75% with an average of 3.33% during 2002 season, whereas it ranged between 0.5 and 5.0% with an average of 2.69% in Giza 86 cotton fields. In 2003, the boll infestation ranged between 0.75 and 6.0% with an average of 3.90% in Giza 89 fields, meanwhile it ranged

between 0.5 and 7.0% with an average of 3.58% in Giza 86 variety. The results in Table 5 stated that the pink bollworm was more susceptible to insecticides in Giza 86 treated fields than that in Giza 89 fields.

**Table (5):** Effect of insecticide treatments on boll infestation by *P. gossypiella* larvae in Giza 89 and Giza 86 cotton fields during 2002 and 2003 seasons.

Average percent of infestation					
2002 season			2003 season		
Dates	Giza 89	Giza 86	Dates	Giza 89	Giza 86
July 9	1.00	0.50	July 15	0.75	0.50
July 15	1.75	0.50	July 21	1.00	0.75
July 21	2.00	1.00	July 27	2.25	2.75
July 27	3.00	1.25	Aug. 2	3.00	3.00
Aug. 2	2.75	2.00	Aug. 8	3.50	3.25
Aug. 8	3.75	3.75	Aug. 14	4.75	3.50
Aug. 14	3.25	2.75	Aug. 20	4.25	3.25
Aug. 20	3.75	3.25	Aug. 26	4.75	4.00
Aug. 26	4.00	3.75	Sept. 1	5.50	4.25
Sept. 1	4.25	4.00	Sept. 7	5.25	4.75
Sept. 7	4.75	4.50	Sept. 13	5.75	6.00
Sept. 13	5.75	5.00	Sept. 19	6.00	7.00
Total	40.00	32.25	Total	46.75	43.00
Mean	3.33	2.69	Mean	3.90	3.58

By comparison between Giza 89 and Giza 86 cotton varieties, it could be stated generally that Giza 86 was lowest susceptible to infestation by pink bollworm. Also, in Giza 86 fields, the fluctuation in pink bollworm population did not affected greatly by the changes in weather factors and the pink bollworm larvae were more susceptible to insecticides.

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تأثير بعض أصناف القطن على نشاط الطيران وحساسية اليرقات للمبيدات  
في دودة اللوز القرنفلية

محمد عبد الفتاح ناصف - صفوت عبد السلام عارف  
معهد بحوث وقاية النباتات مركز للبحوث الزراعية الدقى جيزة

أجريت هذه الدراسة في مجموعتين من حقول القطن احدهما مزروعة بصنف القطن جيزة ٨٩ والاخرى بالصنف جيزة ٨٦ بمحافظة كفر الشيخ لمعرفة تأثير الاختلاف في صنف القطن على تعداد ونشاط الطيران لفرشات دودة اللوز القرنفلية باستخدام المصائد الجاذبة الجنسية وتأثير الظروف الجوية السائدة على هذا النشاط. كذلك تم دراسة مستوى حساسية يرقات دودة اللوز القرنفلية للمبيدات في حقول صنف القطن جيزة ٨٩ ، جيزة ٨٦ عند المعاملة بنفس برنامج الرش خلال موسمي ٢٠٠٢ ، ٢٠٠٣ .

ولقد اوضحت النتائج ما يلي:

- ١- يوجد لدودة اللوز القرنفلية ٣-٤ اجيال خلال موسم القطن وان اجيال الحشرة قد تختلف في عددها وتوقيتها باختلاف صنف القطن ومن موسم الى آخر في نفس المنطقة.
- ٢- الصنف جيزة ٨٩ كان أكثر حساسية للاصابة بدودة اللوز القرنفلية من الصنف جيزة ٨٦.
- ٣- كان تأثير العوامل الجوية السائدة على نشاط الحشرة اكثر وضوحا في حقول القطن صنف جيزة ٨٩ عن حقول الصنف جيزة ٨٦ وان تأثير سرعة الرياح على نشاط وتعداد الفرشات كان سلبيا بينما كان التأثير موجبا في حالة درجات الحرارة والرطوبة النسبية.
- ٤- كانت يرقات دودة اللوز القرنفلية اكثر حساسية للمبيدات في حقول القطن صنف جيزة ٨٦ عنه في حقول الصنف جيزة ٨٩.