

## **ESTIMATING THE RELATIONSHIP BETWEEN THE OPULATION DENSITY OF PINK BOLLWORM, *Pectinophora gossypiella* (SAUNDERS) AND THE INFESTATION LEVELS IN THE COTTON GREEN BOLLS**

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### **ABSTRACT**

Field trials were carried out in many different villages, distributed in 10 districts at Kafr El-Sheikh Governorate during three successive seasons (1997, 1998 and 1999) to determine the changes in the population density of the PBW and to evaluate the relationship between the population density of *P. gossypiella* male moths, captured in sex pheromone traps (from May 30 till September 20<sup>th</sup>) and the infestation percentages in green bolls (from July 16 to September 8<sup>th</sup>) in the treated and untreated cotton fields. The number of male moths, captured in sex pheromone traps was higher in untreated area than that of treated one during the whole period of investigation. On the other hand, the fluctuations in the population size of moths changed from one time to another forming four clearly intervals periods of activity (four peaks) from late of May to half of September of the three cotton seasons. The percentage of infestation by *P.gossypiella* in cotton green bolls in untreated area was also higher than that of treated one. The percentages of infestation during 1997 season were generally harboured the highest number, following by that of 1998 and 1999 seasons, respectively, in the treated and untreated areas in the different districts of Kafr El-Sheikh Governorate. The results indicated that there were a strong relationship between the population of *P. gossypiella* male moths and the percentage of infestation in cotton green bolls in untreated areas of the 10 districts during the whole periods of study, while insignificant relationship between them was resulted in the treated cotton fields during 1997, 1998 and 1999 cotton seasons.

### **INTRODUCTION**

The pink bollworm, *Pectinophora gossypiella* (Saunders) was first reported as a cotton pest in Africa in 1904 (Nobel,1969). In Egypt, it was first recorded in 1910 near Alexandria. The population increased gradually and in a few years it invaded the cultivated cotton fields throughout the country.

The larvae occur on the cotton plants at the beginning of the fruiting stages (squares and flowers) and, later on, attack the green bolls causing serious damages to fiber and seeds and accordingly a great reduction in cotton yield (Adkisson *et al.*1963; Davidson and Sanots,1966; El-Shaarawy *et al.*1975; Abul-Naga and Ghanem1979; Cai *et al.*1985; Sidhu and Dhawan,1986; Dhawan *et al.*1990; Kabissa,1990; Romeilah,1991; and Kostandy,1992).

Because of the economic importance of cotton on the one hand, and its high quality on the other, many authors studied the population activity and seasonal abundance of this insect pest, using sex pheromone traps as an important agent in attracting and monitoring the male moths (Ahmed,1979 ; Jayaswal and Saini,1982; Giannetti *et al.*1983; Taneja and Jayaswal,1986;

Yuan and Wu,1987; Dhawan and Sidhu,1987; Singh and Lather,1989; Dhaliwal *et al.*1993; Beasley and Adms,1994; Nada *et al.*1998 and Abdel-Hamid *et al.*1997).

The present work was carried out aiming mainly for estimating the relationship between the population density of *P. gossypiella* and infestation level in cotton green bolls.

## **MATERIAL AND METHODS**

The field trials of the present study were conducted in many different villages distributed in 10 districts, namely Desouq (38 villages); Seedy Salem (37 villages); Kafr El-Sheikh (29 villages); Kelleen (27 villages); El-Reyad (24 villages); Beyala (23 villages); El-Hamool (16 villages); Fewa (13 villages); Metobus (11 villages) and Balteem (7villages) following to Kafr El-Sheikh Governorate during the cotton growing seasons of 1997, 1998 and 1999. Every village was represented by one feddan treated with insecticides (chosen in the middle of a large area), cultivated with cotton variety Giza 86 for three successive seasons. In each district, one feddan was selected as a control area (untreated cotton field) during the three years of study. The changes in the population density of the PBW were studied during the whole period of investigation, using for sampling the moths delta sex pheromone traps, baited with the pheromone capsules. Each capsule contained 1 mg. of the active ingreadient (Cis-7, Cis-11- hexadecadinyl acetate). The traps were suspended on wooden stands at 100 – 125 cms. above the ground level. The capsules were renewed every 20 – 25 days. The number of captured male moths were recorded weekly, from May 30 till September 20<sup>th</sup> all over the three seasons round.

Random weekly samples of 100 cotton green bolls were collected from the three plant levels in each selected area (treated and untreated fields), examined carefully and the percentages of infestation were estimated during the three cotton seasons ( from July16 till September 8<sup>th</sup>). The inspections of green bolls were conducted on the same day of trap catch collection.

### **Treatments:**

Treated areas were sprayed four times into two weeks intervals, starting from July 17, 23 and 31<sup>th</sup>, during 1997, 1998 and 1999 cotton seasons respectively, using the recommended rate of the proper insecticides per feddan diluted with 300 litres water. Insecticides used in each spray and their rates are shown in Table (1). In the three years of study;

the first and second sprays were carried out by a hand pressure spray model (CP3), while the third and fourth one were conducted by air spray, using a helicopter, prepared for this purpose.

**Table 1: Insecticides used and the rate of application during 1997, 1998 and 1999 seasons.**

Number of spray	Insecticides		Rate /feddan
	Trade name	Common name	
1997			
1 <sup>st</sup> spray	Curacron	Profinfos	750 gm /feddan
2 <sup>nd</sup> spray	Dilphos	Dichlorophos + XRD	1 Liter /feddan
3 <sup>rd</sup> spray	Sumi alfa	Dithiocarb	600 cm /feddan
4 <sup>th</sup> spray	Larvin	Dithiocarb	500 gm /feddan
1998			
1 <sup>st</sup> spray	Curacron	Profinfos	750 gm /Feddan
2 <sup>nd</sup> spray	Dilphos	Dichlorophos + XRD	1 Litre /feddan
3 <sup>rd</sup> spray	Kendo	Cyhalothrin	375 cm /feddan
4 <sup>th</sup> spray	Larvin	Dithiocarb	500 gm /feddan
1999			
1 <sup>st</sup> spray	Curacron	Profinfos	750 gm /feddan
2 <sup>nd</sup> spray	Dilphos	Dichlorophos + XRD	1 Liter /feddan
3 <sup>rd</sup> spray	Sumi alfa	Dithiocarb	600 cm /feddan
4 <sup>th</sup> spray	Larvin	Dithiocarb	500 gm /feddan

#### **Statistical analysis:**

The weekly averages of male moths, captured in sex pheromone traps and the corresponding weekly averages of infestation percentages in green bolls formed the bases of the statistical analysis.

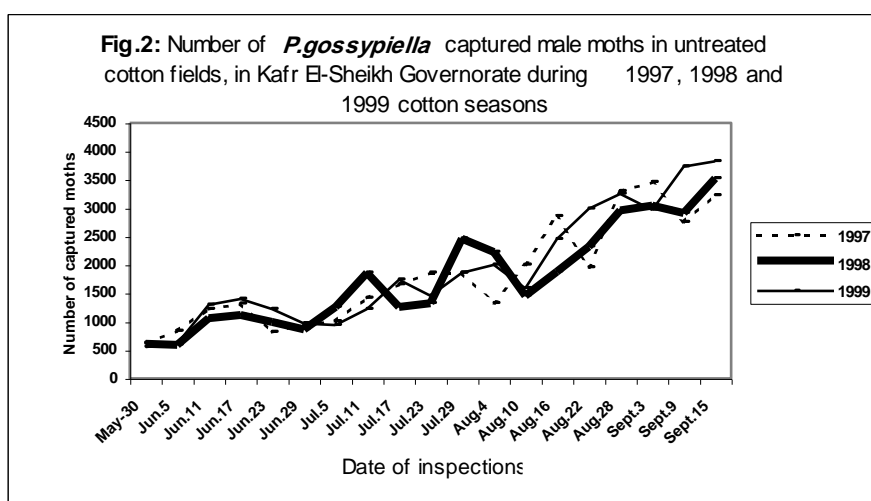
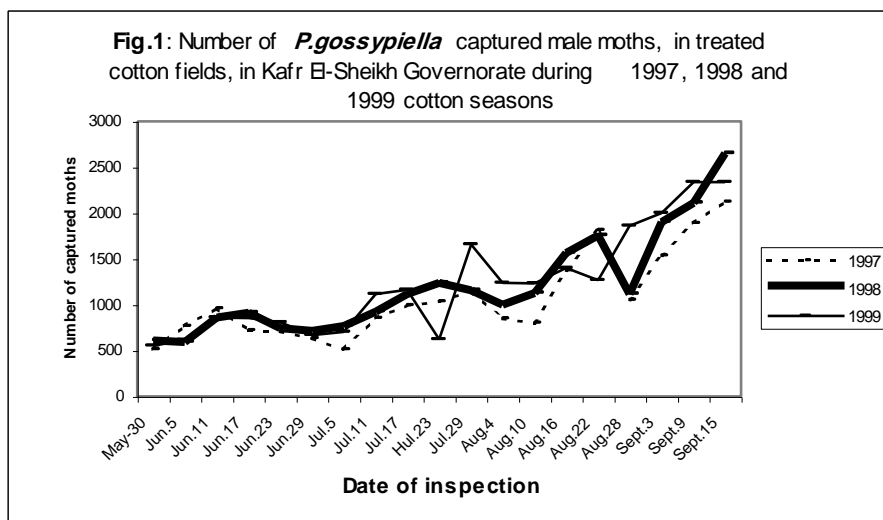
It was thought of interest to evaluate the relationship between the population size of *P. gossypiella* captured male moths in sex pheromone traps (from May 30 till September 20<sup>th</sup>) and the percentages of infestation in cotton green bolls (from July 16 to September 8<sup>th</sup>) "in treated and untreated areas", and accordingly the correlation coefficient "r" values were worked out along with the corresponding levels of significant for the three cotton seasons of 1997, 1998 and 1999.

According to Fisher (1944-1950), the correlation coefficient test was carried out, during only 1997 cotton season, in the treated cotton fields of whole the villages (225 villages), cultivated by cotton crop in 10 districts at Kafr El-Sheikh Governorate. The "r" values which represented the relationship between the average number of captured male moths and the percentages of infestation of every district were also estimated.

## **RESULTS AND DISCUSSION**

Figs.(1 & 2), show the numbers of captured male moths in sex pheromone traps in the different localities during the period from May 30 to September 7<sup>th</sup> for the three cotton seasons of 1997, 1998 and 1999.

*P. gossypiella* moths could be captured in sex pheromone traps all over the three cotton seasons round were occurred in a few numbers in early season, at the late of May, and increased gradually reaching its maximum during September of the three years in both treated and untreated areas.



The illustrated data in Figs. (1 & 2) cleared that the number of captured male moths was higher in untreated area than that of treated one during the whole period of investigation. On the other hand, the fluctuations in the population size of moths changed from one time to another forming four clearly intervals periods of activity (four peaks) from late May to half September of the three cotton seasons under study in treated and untreated fields. The shape and time appearance of these peaks differed according to the moths occurrence, resulting from the larval diapause of the previous season. The four peaks were represented by the number of moths, caught in sex pheromone traps in treated and untreated cotton fields.

#### **Treated cotton fields:**

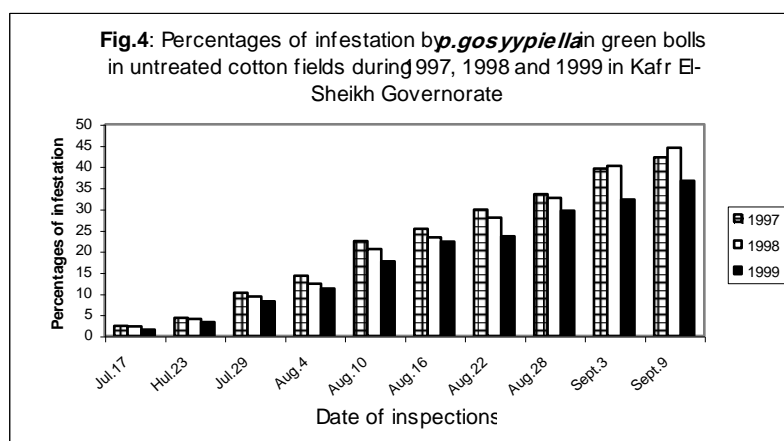
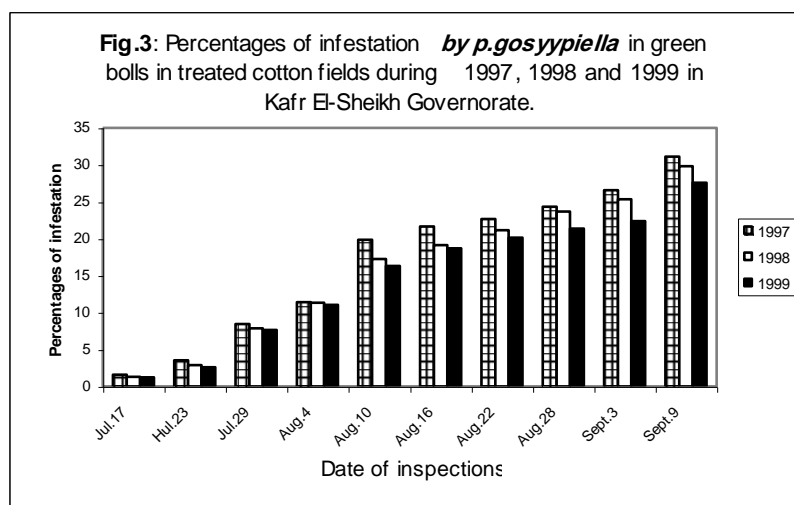
In 1997, the first peak was found in the 2<sup>nd</sup> week of June While the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> were conducted during the 4<sup>th</sup> week of July, 3<sup>rd</sup> week of August and half of September, respectively. For 1998 cotton season, these four peaks were occurred during the 3<sup>rd</sup> week of June, 3<sup>rd</sup> week of July, 3<sup>rd</sup> week of August and 2<sup>nd</sup> week of September, respectively. In 1999 cotton growing season, the four peaks took place in 3<sup>rd</sup> week of June, late of July, 3<sup>rd</sup> week of August and 2<sup>nd</sup> week of September, respectively (Fig.1).

#### **Untreated cotton fields:**

In untreated fields, during 1997, the first period of activity was represented by a peak, found during the 3<sup>rd</sup> week of June while the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> peaks were appeared during the late of July, half of August and the 2<sup>nd</sup> week of September, respectively. In 1998 cotton season, the four peaks were distributed on the 2<sup>nd</sup> week of June, 2<sup>nd</sup> week of July, 4<sup>th</sup> week of August and 3<sup>rd</sup> week of September, respectively. For 1999 cotton growing season, the previous four mentioned peaks were conducted in the 3<sup>rd</sup> week of June, 3<sup>rd</sup> week of July, 4<sup>th</sup> week of August and 2<sup>nd</sup> week of September respectively, (Fig.2),

Previous four mentioned peaks were conducted in the 3<sup>rd</sup> week of June, 3<sup>rd</sup> week of July, 4<sup>th</sup> week of August and 2<sup>nd</sup> week of September respectively, (Fig.2),

The percentages of infestation by *P.gossypiella* in cotton green bolls in untreated area were higher than those of treated one (Figs.3 & 4). The infestation percentage during 1997 season harboured the highest number, following by that of 1998 and 1999 seasons, respectively, in the treated and untreated cotton fields of the different localities of Kafr El-Sheikh Governorate.



**The relationship between the number of captured male moths and infestation percentage in cotton green bolls:**

The correlation coefficient test was carried out to demonstrate the relationship between the number of male moths, captured in sex pheromone traps and the percentages of infestation in green bolls, during only 1997 cotton season, in the treated cotton fields of the whole 225 villages (Table 2), cultivated by cotton crop in 10 districts at Kafr El-Sheikh Governorate.

The obtained data in Table (2) demonstrated that a significant positive relationship between the number of captured male moths and percentages of infestation were calculated, only in 35 villages from the total number of them (225 villages) of the 10 districts of Kafr El-Sheikh Governorate, distributed on Desouq, Seedy Salem, Kafr El-Sheikh, Kelleen, El-Reyad, Byala, Fewa and Balteem, and represented by 10, 9, 4, 9, 1, 3, 1 and 2 villages, respectively, while this relationship was insignificant in the treated areas of the other villages under investigation during 1997 cotton season.

**Table 2: The correlation coefficient values between the average number of *P.gossypiella* captured male moths and the infestation percentages in cotton green bolls in whole villages; cultivated by cotton in Kafr El-Sheikh Governorate during 1997 cotton growing season.**

Number	Desouq 38 villages	Seedy Salem 37 villages	Kafr El-Sheikh 29 villages	Kelleen 27 villages	El-Reyad 24 villages	Byala 23 villages	El-Hamool 16 villages	Fewa 13 villages	Metobus 11 villages	Balteem 7 villages
	"r" Values	"r" Values	"r" Values	"r" Values	"r" Values	"r" Values	"r" Values	"r" Values	"r" Values	"r" Values
1	- 0.0393	- 0.7592	- 0.1896	0.3832	0.4827	0.3592	- 0.6199	0.1436	- 0.2153	0.9700
2	- 0.3921	- 0.2083	0.3576	0.6304	- 0.4740	0.4776	- 0.4444	- 0.5055	- 0.5956	0.0462
3	- 0.0403	0.5907	0.2593	0.9310	0.4442	0.3184	0.1743	0.3601	- 0.1422	0.4228
4	- 0.4457	- 0.6038	0.5613	- 0.3897	0.1708	0.0187	- 0.5011	0.0027	- 0.6701	0.3145
5	0.4807	0.5240	- 0.5026	0.6699	0.3591	0.0524	- 0.6750	- 0.1783	- 0.6714	0.7636
6	0.8988	- 0.1698	- 0.5160	0.3420	0.4403	0.3189	- 0.3581	- 0.5879	- 0.1522	0.1634
7	0.8975	- 0.3830	- 0.3355	0.3018	0.5599	- 0.0717	- 0.6315	- 0.3017	- 0.0068	0.3888
8	0.6100	0.4749	0.4101	0.6095	0.2818	- 0.0718	0.2829	0.5669	- 0.4343	
9	0.2868	0.6853	0.1520	- 0.1749	0.4220	0.5160	- 0.4344	0.1794	- 0.4262	
10	0.2193	0.0510	0.4823	0.1536	- 0.0455	0.6807	- 0.3068	0.3139	- 0.3103	
11	0.7643	- 0.2911	- 0.6380	0.1747	- 0.3632	- 0.3307	- 0.2520	- 0.0472	- 0.1539	
12	0.2063	0.1645	0.4263	0.8377	0.2133	- 0.6776	- 0.3300	- 0.3431		
13	- 0.4522	- 0.7338	0.8297	0.1321	- 0.2370	0.3129	- 0.3059	- 0.5094		
14	0.3600	- 0.3908	0.4517	0.6114	0.1216	0.4961	0.0396			
15	0.2507	- 0.6309	0.5024	0.4769	- 0.6339	0.3845	0.1917			
16	- 0.2460	0.1258	0.3259	- 0.3940	0.3139	0.7641	- 0.1461			
17	0.7041	- 0.5978	- 0.0375	0.0876	0.2624	0.2804				
18	0.4242	- 0.4354	0.0983	- 0.1897	- 0.2245	0.2350				
19	0.6320	- 0.0213	0.2746	0.3982	0.0207	0.4858				
20	0.1846	- 0.7603	- 0.0568	0.7456	0.3606	0.3092				
21	0.2177	0.0435	0.7059	- 0.7664	0.2866	0.3850				
22	0.4224	0.4319	- 0.0370	- 0.2667	0.3484	0.4479				
23	- 0.0862	- 0.5783	- 0.570	- 0.1699	- 0.2464	- 0.4304				
24	0.3334	- 0.3312	- 0.5031	0.8054	0.4543					
25	- 0.4558	- 0.1803	0.1496	0.5745						
26	0.3380	0.0790	0.0564	0.5481						
27	- 0.1004	0.0277	0.0608	0.4459						
28	0.4907	- 0.1234	- 0.4146							
29	- 0.0197	- 0.5885	- 0.0252							
30	0.4875	0.2483								
31	0.3127	- 0.4896								
32	0.8079	- 0.5233								
33	0.7543	- 0.3415								
34	- 0.0397	- 0.1870								
35	0.8588	0.3372								
36	- 0.7698	0.1024								
37	- 0.4179	- 0.5056								
38	0.3576									

The correlation coefficient test was estimated , also, to indicate the relationship between the average number of captured male moths of every district (collected), and the corresponding averages of infestation percentages in green bolls in both the treated and untreated fields during the three seasons under study (Table 3).

#### Treated cotton fields:

As shown in Table (3) the “r” values, obtained during 1997, 1998 and 1999 cotton seasons reflexed the insignificant relationship between the average numbers of male moths, captured in sex pheromone traps and the averages of infestation percentage in green bolls (expressed as “r” values”) in the different districts of Kafr El-Sheikh Governorate during all the three seasons round.

#### Untreated cotton fields.

Data in Table (3) indicated that, in untreated cotton fields, the “r” values between the average numbers of male moths, captured in sex pheromone traps and the averages of infestation percentage in green bolls, represented clearly the highly significant positive relationship between them during the whole period of investigation (from 1997 to 1999 seasons) .

In 1997 cotton season, the “r” values of Desouq, Seedy Salem, Kafr El-Sheikh, Kelleen, El-Reyad, Beyala, El-Hamool, Fewa, Metobus and Balteem were 0.9769 (the highest value), 0.8877, 0.7851, 0.9356, 0.9424, 0.7798, 0.8546, 0.8816, 0.7192 and 0.8252 respectively. During 1998, these values were 0.7758, 0.8955, 0.8192, 0.8973, 0.9115, 0.7625, 0.7548, 0.7542, 0.8812 and 0.9124 (highest value), respectively. During 1999 cotton season, the “r” values were 0.8821, 0.7981, 0.9214, 0.8571, 0.8972, 0.8817, 0.8945, 0.9521 (highest value), 0.7458 and 0.7987 respectively.

From the previous results, it appears logic to mention out here, that there is a strong relationship between the population size of *P. gossypiella* male moths and the infestation percentage in cotton green bolls in untreated area.during the whole period of study.

**Table 3: The correlation coefficient values between the average number of *P.gossypiella* captured male moths and the infestation percentages in cotton green bolls in 10 districts of Kafr El-Sheikh**

Year	Treatment	Desouq	Seedy Salem	Kafr El-Sheikh	Kelleen	El-Reyad	Byala	El-Hamool	Fewa	Metobus	Balteem
		“r” Values	“r” Values	“r” Values	“r” Values	“r” Values	“r” Values	“r” Values	“r” Values	“r” Values	“r” Values
1997	Treated	0.3716	0.2761	0.3622	0.3874	0.2628	0.3082	0.3257	0.3121	0.4822	0.2360
	Untreated	0.9769	0.8877	0.7851	0.9356	0.9424	0.7798	0.8546	0.8816	0.7192	0.8252
1998	Treated	0.4351	0.3677	0.3111	0.2225	0.3269	0.2235	0.3331	0.2956	0.3258	0.2687
	Untreated	0.7758	0.8955	0.8192	0.8973	0.9115	0.7625	0.7548	0.7542	0.8812	0.9124
1999	Treated	0.3227	0.3332	0.2325	0.3351	0.2965	0.3256	0.3369	0.3117	0.3253	0.3653
	Untreated	0.8821	0.7981	0.9214	0.8571	0.8972	0.8817	0.8945	0.9521	0.7458	0.7987



According to the obtained results in this work, it is clear that the population activity and size of *P. gossypiella* moths and the infestation percentage in cotton green bolls influenced by the chemical insecticides, sprayed cotton fields during the cotton growing season.

Finally, some authors in various parts of the world agreed with the results obtained in the present study; Davidson and Sanots, 1966; Jayaswal and Saini, 1982; Gupta and Agrawal, 1985; Dhawan and Sidhu, 1987; Dhawan *et al.* 1990; Romeilah, 1991; Abdel-Hamid *et al.* 1997; Nada *et al.* 1998, otherwise, our findings contradicted the findings of Giannetti *et al.* 1983; Yuan and Wu 1987; Kabissa, 1990 in the number and duration of the cotton bollworm generations in addition to the time of moths appearance.

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## **تقدير العلاقة بين حجم ونشاط مجموع فراشات دودة اللوز القرنفلية ونسبة الإصابة في اللوز الأخضر.**

**سندس عبد التواب محمد - سمير محمد توفيق - محمد عبد الحميد روميله  
معهد بحوث وقاية النباتات - مركز البحوث الزراعية - وزارة الزراعة - الدقى - الجيزة.**

أجريت هذه التجربة فى عدة قرى تابعة لعشرة مراكز بمحافظة كفر الشيخ خلال مواسم 1997 و 1998 و 1999 لتوضيح التغيرات التى تحدث فى حركة نشاط وكثافة مجاميع فراشات دودة اللوز القرنفلية - وكذلك لتقدير العلاقة بين حجم مجموع ذكور الفراشات المصادة فى المصائد الجاذبة الجنسية فى الفترة من 30 مايو حتى 20 سبتمبر ونسبة الإصابة فى اللوز الأخضر فى الفترة من 16 يوليو الى 8 سبتمبر فى الحقول المعاملة والغير معاملة بالمبيدات . وقد بينت النتائج أن تعداد فراشات دودة اللوز القرنفلية كانت أعلى فى الحقول الغير معاملة عنها فى الحقول التى عوملت بالمبيدات . من ناحية أخرى أوضحت النتائج أن التذبذبات التى تحدث فى حجم مجموع ا لفراشات تتغير من وقت لآخر مكونة أربع فترات نشاط واضحة (4 زروات) من نهاية مايو الى نصف سبتمبر خلال الثلاثة مواسم . كما أظهرت النتائج أيضا أن نسبة الإصابة بديدان اللوز القرنفلية فى اللوز الأخضر كانت أعلى فى الحقول الغير معاملة عنها فى المساحات المعاملة - وكانت نسبة الإصابة فى موسم 1997 أعلى منها فى موسمي 1998 و 1999 فى كل من الحقول المعاملة والغير معاملة وأيضا فى كل مراكز محافظة كفر الشيخ . وقد بينت نتائج التحليل أن هناك علاقة قوية (عالية المعنوية موجبة) بين تعداد ذكور الفراشات التى تم جمعها بالمصائد الجاذبة الجنسية ونسبة الإصابة فى اللوز الأخضر فى الحقول الغير معاملة بالمبيدات خلال الثلاثة مواسم بينما كانت هذه العلاقة ضعيفة وغير معنوية فى الحقول المعاملة .