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Predection of the pink bollworm infestation in cotton fields by means of sex pheromone traps and some weather condition in Kafr El-Sheikh and Dakahlia Governorates

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ABSTRACT

The present investigation was directed to study the occurrence and seasonal abundance of the pink bollworm *Pectinophora gossypilla* (Saunders) (PBW) in cotton fields during 2003 and 2004. The effect of prevailing climatic factors on flight activity of male moths was also studied. Flight activity studies using pheromone traps during two successive cotton seasons indicated that *P. gossypiella* had three generations with three sharp peaks on cotton during the period started early in May and extended till the last week of September. The combined effect of the prevailing temperature and relative humidity were responsible for 8.3 % and 36.7 % at Kafr El-Sheikh Governorate of the changes in male moths population during 2003 and 2004, mean while, Dakahlia Governorate responsible for 11.1 and 40.5% of the changes of the population male moths respectively. Larval population and boll infestation started during early July and increased progressively till the end of the season.

INTRODUCTION

In Egypt and worldwide as well, there is a growing public concern about environmental pollution which is induced by excessive use of insecticides. Cotton is subjected to pests attacks which required excessive use of insecticides to protect the crop. In order to wise use pesticides, timing the insecticidal application based on field population levels will minimize farmer's risk, reduce cost and save the environment.

Sex pheromones are utilized in monitoring and estimating insect population and relating such level to field infestation and damage. This technique has many advantages: (1) to reduce insecticide treatment, by

eliminating unnecessary application (Toscano *et al.*,1994), (2) to conserve populations of beneficial arthropods in pheromone treated areas than those treated with broad spectrum insecticides(El-Adl *et al.*, 1988) and (3) to provide and early warning of pest incidence particularly of pest occurs sporadically from year to year or where long-range migration is sucspected (El-Zanan and El-Hawary 1999).

The objectives of the present investigation are to relate field population of the male pink bollworm, *P. gossypiella* with their field infestation percentages, and evaluating the effect of three prevailing weather factors (average maximum temperature, minimum temperature and relative humidity) on the seasonal abundance of pink bollworm.

MATERIALS AND METHODS

The present study was based on determining the number of pink bollworm, *P. gossypiella* (PBW) male moths caught nightly by Pheromone traps are fixed in Biala and Fowa districts, Kafr El-Sheikh Governorate, and El-Senballawen and Aga districts, Dakahlia Governorate during the two successive years 2003 and 2004 of cotton plantation.

Planting cotton occurred on late March and first half of April in both Governorates in the two seasons. Cotton plants received normal agricultural practices. Pheromone traps were placed in each field from the 31st of May till the end of September in both seasons. Traps were fixed and distributed at rate of 1 trap/30 feddans manually. The baited sex pheromones (Delta) were fixed on metal bars just above cotton plants. The traps were baited with specific pheromone capsules and replaced every 2 weeks by fresh ones. The adhesive sheets were also changed every three days and the numbers of trapped males were counted. The sex pheromone traps were baited with synthetic pheromone formulation in polyethylene vials. Every vial contains 2 mg of active ingredient of the synthetic pheromone. The pheromone consists of a 1:1 mixture of (Z, Z) and (Z, E) – isomers of 7, 11 – hexadecadienyl acetate, obtained from Plant Protection Institute, Dokki Giza, Egypt.

According to the national sprays program applied on cotton bollworm in Egypt, the experimental areas in the two seasons were sprayed by motor and four applications were conducted in the current study using the recommended insecticides (Table 1).

Table (1): Insecticides used against the bollworms during 2003and 2004 growing seasons and their rates of application

Date of application	2003 season		
	Common name	Trade name	Rate of Application/fed
11th July	Chlorfluzuron5%EC	Atabron	400 cm^3
27th July	Cefenralerate5EC	Sumialpha	600 cm^3
16th Aug.	Chloeopyrifos48%EC	Pestba	1.0 liter
4th Sept.	Carbaryl 85 % WP	Calical	1.5 kg
	2004 season		
6th July	Chlorfluzuron5% EC	Atabron	1.0 liter
20th July	Cefenralerate5% EC	Sumialpha	600 cm^3
5th Aug.	Profenfos72%EC	Percal	750 cm^3
28th Aug.	Carbaryl 85 % WP	Calical	1.5 kg

Samples of 100 green bolls were collected at random from diagonals of the inner square of each trap every six days in order to study the actual infestation. The cotton bolls were dissected and larvae in each boll were counted. Sampling started on July and continued till half September.

The averages of maximum, minimum temperatures and R.H % were obtained from the Meterological Department at both Governorates. Data

were statistical analyzed and the simple correlation values were calculated according to Steel and Torrie (1960).

RESULTS AND DISCUSSION

1. Abundance of the pink bollworm in Kafr El-Sheikh Governorate:

Data presented in Table (2) and Figures (1, 2) show the fluctuation of the male moths of pink bollworm during the period extended from the first week of June till the end of September (2003 and 2004 seasons) in Biala and Fowa districts.

During the season of 2003, three generations with three sharp peaks occurred in Biala and Fowa districts (Fig. 1). These peaks were found in the third week of June, fourth week of July and (second week of August and first week of September) in both Biala and Fowa districts. The corresponding numbers of caught males were 5.4, 5.5 and 5.15 (males/trap/6 days) in Biala and 6.0, 4.4 and 8.4 (male/trap/6 days) in Fowa.

Regarding 2004 growing season, four generations were found in Biala and Fowa districts, during a period extended from first week of June till the end of September (Fig. 2). The peaks of generations are found on the 2nd week of June (4.77), the 2nd week of July (4.67) and the last week of August (7.80) and 11.77 (male/trap/6 days) in the 2nd week of September in Biala. However, in Fowa, peaks of generations were found on the fourth week of June (12.05), July (6.28) and September (11.37) as well as in the last week of August (10.73).

The obtained data demonstrate that peaks of *P. gossypiella* males occurred during June, July, August and September during the two seasons. During the two seasons, maximum numbers of moths caught were recorded during July and August 2003 in Biala and Fowa. While peaks were recorded during September 2004 in both districts. The obtained results are parallel with those obtained by many authors. Metwally *et al.* (1996) reported that

Table (2): Average numbers of trapped male moths of the PBW in Biala and Fowa districts during cotton season of 2003 and 2004

Period of inspection		2003 season		2004 season	
		Mean No. Of male moths/trap/6 days		Mean No. Of male moths/trap/6 days	
		Biala*	Fowa**	Biala***	Fowa****
June	3 – 8	3.70	4.25	2.95	5.10
	9 – 14	3.30	5.05	4.77	7.35
	15 – 20	5.40	6.00	4.21	11.33
	21 – 26	1.75	3.85	3.35	12.05
	27 – 2	2.75	3.25	1.65	6.33
July	3 – 8	2.30	2.75	1.96	5.65
	9 – 14	2.30	3.05	4.67	5.40
	15 – 20	3.55	3.85	3.45	3.92
	21 – 26	5.50	4.40	1.97	6.28
	27 – 1	4.85	4.35	1.09	4.57
August	2 – 7	4.35	4.10	2.12	3.75
	8 – 13	5.15	4.25	3.50	2.94
	14 – 19	4.80	3.45	2.65	6.65
	20 – 25	2.95	4.55	5.58	10.41
	26 – 31	2.90	5.40	7.80	10.73
September	1 – 6	2.60	6.35	11.45	10.73
	7 – 12	2.65	6.35	11.77	8.24
	13 – 18	0.65	3.85	6.44	10.66
	19 – 24	0.20	2.85	3.50	11.37
	25 – 30	0.00	1.35	2.00	7.11

* Mean number of 300 traps.
** Mean number of 170 traps.
*** Mean number of 411 traps.
**** Mean number of 215 traps.

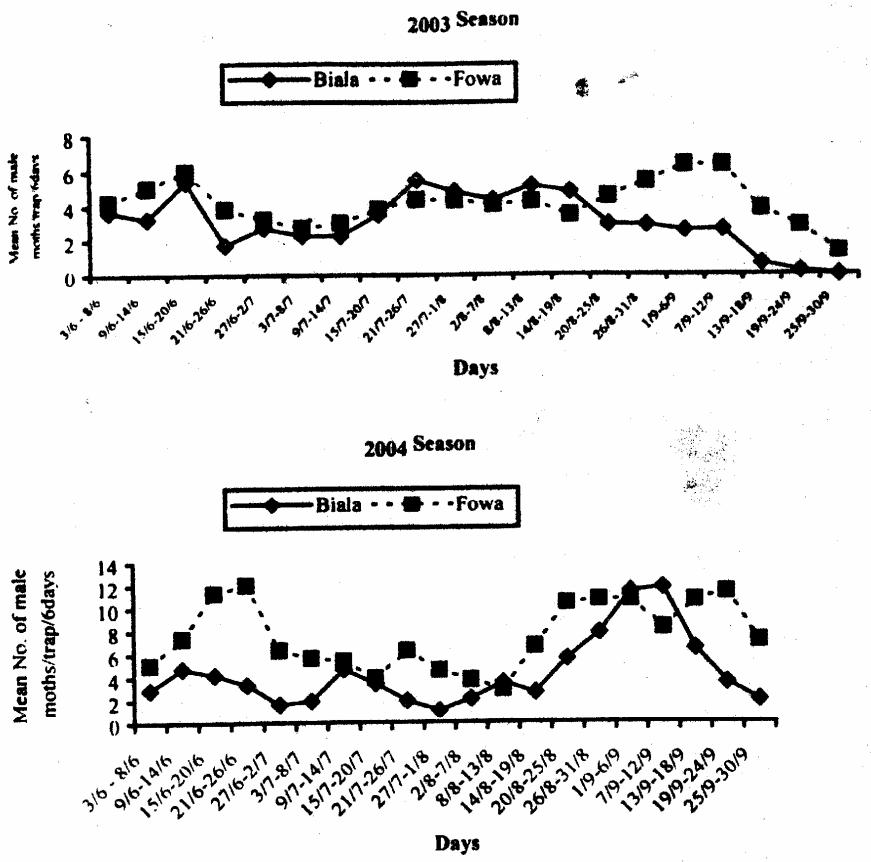

Fig. (1 & 2): Average number of *Pectinophora gossypiella* adult male moth caught using pheromone traps in the two districts Biala & Fowa, Kafr El-Sheik Governorate during 2003 & 2004 seasons.

the population dynamic of pink bollworm recorded three generations Shrkia Governorate. Guirguis *et al* (1991) studied the occurrence a seasonal abundance of the pink bollworm in cotton fields and found thr generations with three sharp peaks of this insect.

2. Abundance of the pink bollworm in Dakahlia Governorate:

Data presented in Table (3) and Figures (3, 4) show the fluctuation the male moths of PBW during the period extended from the 1st week June till the end of September in 2003 and 2004 seasons on two districts Dakahlia governorate.

During the season of 2003 as shown in Fig.(3), there were thre generations with three sharp peaks in El- Senballawen and Aga districts i both seasons. These peaks occurred on the 3rd week of June, last week July and last week of August in 2003 season. The corresponding numbers caught males were 3.63, 6.19 and 6.98 in case of El-Senballawen and 1.6 3.71 and 4.25 in case of Aga at the same season, respectively.

Regarding 2004 growing season (Fig. 4), three generations were foun in Aga district, with their peaks during 2nd week of June, 4th week of Jul and 2nd week of September in El- Senballawen and Aga . The trapped mal moths recorded 20.2, 13.9 and 11.4 male/trap/6 days in El- Senballawen an 8.95, 7.26 and 6.75 male/trap/6 days in Aga district .

3. Infestation rates by PBW larvae:

To evaluate the correlation between the number of caught males and the actual infestation with the PBW larvae, bolls were examined periodically fo infestation and the percentage of infestation were calculated. As matter o fact the rate of infestation levels of PBW larvae were recorded from cotton plantation treated with insecticides for controlling cotton bollworms.

Table (3): Average number of PBW adult male moths caught by pheromone traps in the two districts (El-Senbellwan & AGA), of Dakahlia Governorate during 2003 & 2004 seasons.

Period of inspection		2003 season		2004 season	
		Mean No. of male moths/trap/6 days		Mean No. of male moths/trap/6 days	
		El-Senbellawen*	Aga**	El-Senbellawen ***	Aga ****
June	2 – 7	1.35	0.97	17.0	8.95
	8 – 13	2.55	1.20	20.2	7.72
	14– 19	3.63	1.65	16.2	6.38
	20– 25	2.75	1.32	10.4	4.38
	26 – 1	1.54	1.23	7.8	2.72
July	2 – 7	2.04	1.47	6.0	2.38
	8 – 13	3.48	2.30	9.0	6.33
	14– 19	4.69	3.05	11.2	4.45
	20– 25	5.24	3.71	13.9	7.26
	26– 31	6.19	3.45	12.4	7.10
August	1 – 6	4.25	3.15	9.0	5.85
	7 – 12	5.25	2.87	8.0	5.58
	13– 18	5.78	307	7.8	5.77
	19– 24	6.78	3.77	7.1	6.07
	25– 30	6.98	4.25	6.4	3.73
September	31 – 5	5.45	4.05	10.0	6.70
	6 – 11	5.02	3.48	11.4	6.75
	12– 17	4.59	3.20	8.7	5.43
	18– 23	3.99	3.86	4.2	4.70
	24– 29	1.90	2.30	2.5	2.20

* Average no. of 90 traps.
** Average no. of 71 traps.
*** Average no. of 95 traps.
**** Average no. of 79 traps.

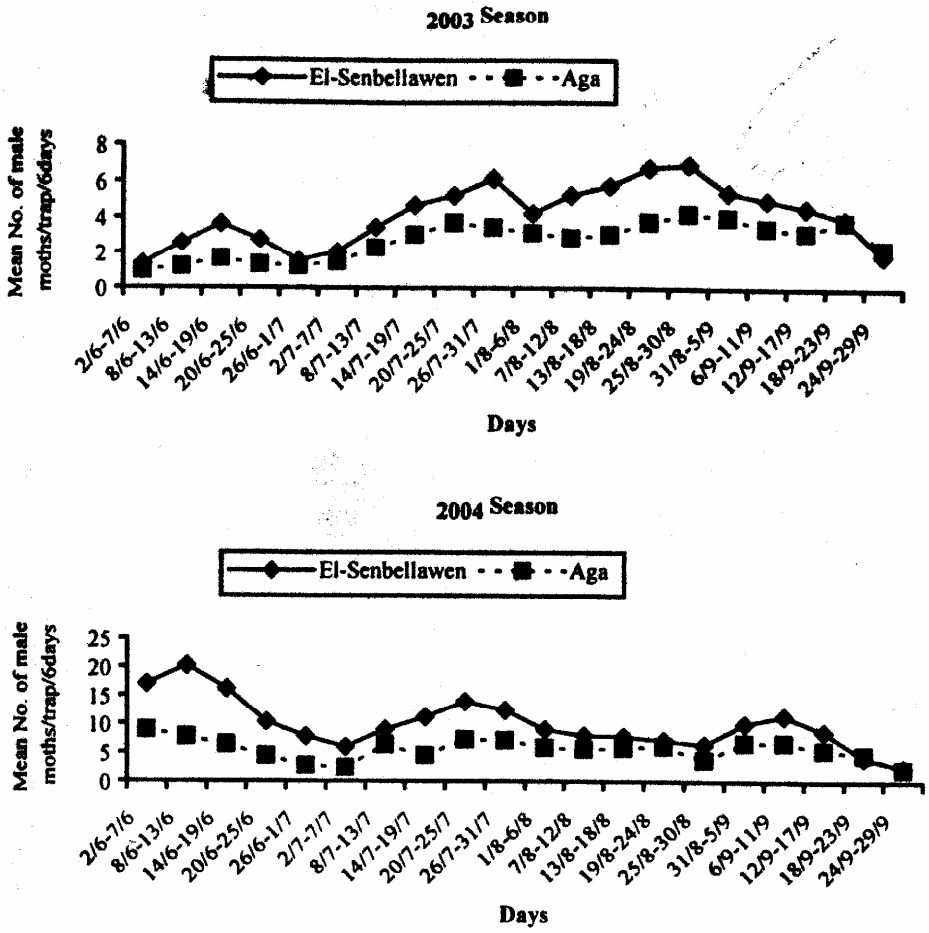

Fig. (3 & 4): Average number of *Pectinophora gossypiella* adult male moths caught using pheromone traps in the two districts El-Senbellwan & AGA, Dakahlia Governarate during 2003 & 2004 seasons.

Table (4): Percentages of infestation recorded from cotton fields treated with insecticides in two Governorates during 2003 and 2004 seasons.

Sampling dates		2003 season		Sampling dates		2003 season	
		Biala	Fowa			El-Senbellawen	Aga
July	6 – 11	1.27	0.75	July	7 –12	1.40	0.55
	12 –17	1.19	0.89		13–18	0.88	0.57
	18 – 3	0.85	0.45		19–24	1.49	1.57
	24 –29	0.89	0.96		25–30	1.35	1.85
Aug.	30– 4	1.22	1.50	Aug.	31– 5	1.56	2.27
	5– 10	1.91	1.89		6 –11	1.78	1.84
	11– 6	1.99	1.36		12-17	1.79	1.85
	17– 22	0.65	1.34		18–23	2.44	1.66
	23– 28	0.68	1.00		24–29	2.16	1.78
Sept.	29– 3	0.78	1.33		30– 4	2.00	1.78
	4– 9	1.92	2.25	Sept.	5–10	1.77	2.21
	10– 15	1.70	2.12		11–16	2.23	2.05
	16 –21	1.00	1.2		17–22	1.85	1.97
2004 season				2004 season			
July	7 – 12	0.58	0.75	July	9 – 14	1.93	0.70
	13 –18	0.72	0.60		15–20	1.09	0.33
	19 –24	1.24	0.98		21–26	1.15	1.00
	25 –30	1.17	1.25		27 – 1	1.89	2.45
Aug.	31 – 5	1.16	1.27	Aug.	2 – 7	1.83	2.94
	6 –11	1.34	1.85		8 – 13	2.28	3.10
	12– 17	1.17	2.15		14 – 9	3.21	2.65
	18 – 3	1.16	1.75		20 – 5	2.70	1.98
	24 –29	0.95	0.90		26–31	2.85	2.44
Sept.	30 – 4	0.88	0.70	Sept.	1 – 6	2.55	2.20
	5 – 10	1.01	1.10		7– 12	2.15	1.80
	11 –6	0.92	1.40		13–18	1.66	1.40

Results presented in Table (4) revealed that the percentage of infestation ranged between (0.65 and 1.99) and (0.58 and 1.34) in Biala district during 2003 and 2004 cotton seasons, respectively. The corresponding values ranged between (0.45 and 2.25) and (0.60 and 2.15) for Fowa district in the same seasons.

ranged between (0.45 and 2.25) and (0.60 and 2.15) for Fowa district in the same seasons.

Data obtained during 2003 cotton season, the percentage of infestation, ranged between (90.88 and 2.23) and (0.55 and 2.27) in El- Senballawen and Aga districts, and ranged between (1.09 and 3.21) and (0.33 and 2.94) during 2004 season, respectively.

4. Effect of three weather factors on *P. gossypiella*

Results in Tables (5&6) indicated that the multiple regression values for maximum temperature were positive and significant (B = 0.560, 0.399, 0.741 and 0.695 at Dakahlia Governorate while B= 0.192, 0.020, 1.561 and 0.664 at Kafr El- Senballawen Governorate during 2003 and 2004, respectively. The minimum temperature was affected positive and negative significant (B= 0.140, 0.137, - 0.508 and – 0.182) at Dakahlia Governorate while, in Kafr El-Sheikh (B= - 0.185, 0.310, - 1.630 and – 0.887) during 2003 and 2004, in respect to relative humidity, multiple regression indicated a positive and negative relationship between relative humidity and number of moths in both 2003 and 2004 seasons (B= 0.070, 0.015, - 0.308 and – 0.039 at Dakahlia Governorate) whereas it (B= 0.019, - 0.122, 0.260 and 0.131 at Kafr El-Sheikh. It means that the relative humidity may low effect on population density during 2003 and 2004.

R^2 values for the three weather factors were 0.405, 0.380, 0.137 and 0.111 at Dakahlia Governorate while they were 0.083, 0.232 and 0.100 in 2003 and 2004, respectively, at Kafr El-Sheikh Governorate (Tables 5&6). It revealed that the three weather factors were responsible for obvious ratio of variability in the population of moths. This means that there are unknown or a biotic unconsidered factors that may be responsible of variability in population density.

Karaman *et al.* (1982) reported that the daily minimum, daily mean relative humidity seemed to influence significantly *P. gossypiella* population fluctuation in middle Egypt. Hossain (1990) indicated that the three main weather factors maximum, minimum temperature and relative humidity were significantly effective on the changes in population of *P. gossypiella* moths captured by pheromone baited traps in Fayom Governorate. Metwally *et al.* (1996) found that there were positive

Table (5): Effect of temperatures (maximum and minimum) and relative humidity on *P. gossypiella* male population during 2003 and 2004 cotton seasons in Kafr El-Sheikh Governorate.

Season & district	Weather factor	Mean value of weather Factor	Mea No. Of Male /trap	*B*	S. E	R^2	E.V (%)	F
2003 Biala	Max.Temp. °C Min.Temp. °C R. H %	30.71 18.81 63.71	3.05	0.192 -0.185 0.019	0.213 0.225 0.085	0.083	8.3 %	0.452
2003 Fowa	Max.Temp. °C Min.Temp. °C R. H %	30.71 18.81 63.71	4.14	0.020 0.310 - 0.122	0.196 0.207 0.087	0.232	23.2%	1.513**
2004 Biala	Max.Temp. °C Min.Temp. °C R. H %	33.87 19.54 71.00	4.69	1.561 - 1.630 0.260	0.850 0.656 0.105	0.367	36.79%	3.091**
2004 Fowa	Max.Temp. °C Min.Temp. °C R. H %	33.87 19.54 71.00	6.25	0.664 - 0.887 0.131	0.989 0.763 0.122	0.100	10.00%	0.594

Table (6): Effect of temperatures (maximum and minimum) and relative humidity on *P. gossypiella* male population during 2003 and 2004 cotton seasons in Dakahlia Governorate

Season & district	Weather factor	Mean value of weather factor	Mean No. of male/trap	*B*	S. E	R^2	E. V (%)	F
2003 El-Senbellawen	Max.Temp. °C Min.Temp. °C R. H %	34.19 21.46 75.21	4.37	0.560 0.140 0.070	0.346 0.331 0.069	0.405	40.5%	3.634**
2003 AGA	Max.Temp. °C Min.Temp. °C R. H %	34.19 21.46 75.21	2.72	0.399 0.137 0.015	0.291 0.211 0.044	0.380	38.0%	3.275**
2004 El-Senbellawen	Max.Temp. °C Min.Temp. °C R. H %	34.37 21.75 70.43	9.96	0.741 - 0.508 - 0.308	1.177 0.877 0.278	0.137	13.7%	0.845*
2004 AGA	Max.Temp. °C Min.Temp. °C R. H %	34.37 21.75 70.43	5.52	0.695 - 0.182 - 0.039	0.493 0.367 0.116	0.111	11.17 %	0.665*

correlations between the number of pink bollworm moths and the thermal heat units expressed as daily degree till July during 1989 to 1991. El-Zanan *et al.* (1998) reported that the combined effect of the three weather factors on changes of the pink bollworm population was responsible for 71, 30, 66 and 56 % during 1994, 1995, 1996 and 1997. Nassef and Aref (2004) reported that the population fluctuation of pink bollworm was affected significantly by the changes in weather factors during 2002 and 2003 cotton season at Kafr El-Sheikh Governorate.

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التنبؤ بالإصابة بدودة اللوز القرنفلية بواسطة المصائد الفرمونية والعوامل الجوية فى محافظتى كفر الشيخ والدقهلية.

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مركز البحوث الزراعية – معهد بحوث وقاية النباتات

أجريت هذه التجربة لدراسة تذبذب تعداد دودة اللوز القرنفلية فى حقول القطن خلال موسمى 2003 ، 2004 كذلك تمت دراسة تأثير العوامل الجوية على نشاط طيران ذكور فراشاتها.

تمت دراسة نشاط الذكور باستخدام المصائد الفرمونية خلال الموسمين السابقين وأوضحت النتائج أن دودة اللوز القرنفلية لها 3 – 4 أجيال مع وجود ثلاث قمم واضحة على القطن بداية من أوائل مايو حتى نهاية الأسبوع الأخير من سبتمبر.

كان التأثير المشترك للعاملين الجويين (الحرارة – الرطوبة) على الفراشات كانت بنسبة 8.3% – 36.7% فى محافظة كفر الشيخ خلال موسمى 2003 ، 2004 وكان تأثير العاملين الجويين فى محافظة الدقهلية 11.1 % – 40.5 % فى تغير تعداد ذكور الفراشات خلال نفس الموسمين على التوالى أما تعداد اليرقات وإصابة اللوز فقد كان ثابتين خلال بداية يوليو وازداد تدريجيا حتى نهاية الموسم