

**POPULATION DENSITY AND FLUCTUATION OF COTTON
BOLLWORM, *PECTINOPHORA GOSSYPIELLA*
AFFECTED BY VARIOUS FACTORS
AT TWO EGYPTIAN GOVERNORATES**

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Abstract

This experiment was carried out on two governorates, Behira and Beni-Sueif through two successive cotton seasons 2004 & 2005 using two varieties Giza 70 and Giza 88 at Behira governorate and Giza 80 at Beni-Sueif governorate. Data revealed that the larval population density increased during August on both check and treated plants through 2004 and 2005 seasons in the two governorates. Larval population density was higher in check plants than on treated ones. Also data clearly showed that the adult's fluctuations differed from time to time during the experimental period, which extended from June till September. Generally, the moth population density was higher in the pheromone traps than in the light traps, spite of the moths was males only. The highest adult population density was recorded in Giza 80 at Beni-Sueif governorate at 30.6°C & 50.2% R.H. in 2004 season and 33.2°C & 51.8% R.H. in 2005 season. Statistically analysis revealed significant differences among the cotton varieties, where the lowest larval population density was recorded on Giza 70 followed by Giza 88 in Behira governorate at an average of 29.3°C & 63% R.H. in 2005 season. Data of this research indicated that the most recommended cotton variety was Giza 88.

INTRODUCTION

In Egypt, cotton plants like other field crops are attacked by a lot of lepidopterous pests. The pink bollworm *Pectinophora gossypiella* (Saund.) causes a threat to cotton and is considered as mid-late season pest (El-Shaarawy *et al.* 1975). *P. gossypiella* emerges from the diapousing larvae in spring and continue into late July and early August. Some early moths emergence before cotton fruiting forms are available (Slosser and Waston, 1975). Sex pheromone and light traps were used for monitoring this pest (Nassef and Watson 2002).

The attraction of pink bollworm male moths to sex attractant for males was firstly demonstrated by Ouye and Bult (1962).

Dhawan and Sidhu (1987) recorded that pheromone traps could be used to monitor, the seasonal occurrence and distribution of the gelechiid *P. gossypiella* in cotton fields in Punjab India. Emergence of adults from diapaused larvae began during the first 2 weeks of March.

The present study aims to investigate the population density and fluctuation of larvae of the pink bollworms, *P. gossypiella* at Beni-Suef and Behira governorates on three cotton varieties besides the population density of its moths by sex and light traps.

MATERIALS AND METHODS

Field experiments were carried out at Beni-Suef (middle Egypt) and Behira (North-west of Delta) Governorates in cotton field. At Beni-Suef Governorate, Giza 80 cultivar was cultivated in mid-March for two successive seasons (2004 & 2005) in $\frac{1}{2}$ feddan. At Behira governorate, Giza 70 and Giza 88 varieties each were cultivated also in mid-March for the same two successive seasons in $\frac{1}{2}$ feddan. Hundred cotton bolls from each two governorates were taken weekly in random from two plots. one was treated by the recommended pesticides, Pest pan, Tilton and Sumi-gold and the other was untreated. These samples were transferred to the laboratory in order to investigate the larval infestation rate of *P. gossypiella* was calculated on the three tested cultivars throughout two seasons, 2004 & 2005.

1. Stekam sex pheromone and light traps:

The stekam sex pheromone traps containing pheromone [E(10) E(12) hexadeca dienal or E (10) (7) hexadeca dienalacerate] were used. Traps were situated 30 cm above the crop canopy height and they were distributed in cotton field 250 m apart. Pheromone capsules were replaced with fresh ones every 15 days. The captured moths were weekly counted and removed from the traps. One an ultraviolet light traps (250 watt) was utilized per experimental area from the June till September (Robinson and Robinson 1950). It was set on the roof of a village house at about 4 meters above the ground level. The collected traps catches at weekly intervals were counted to determine the population density of the pink bollworm moths.

2. Certain weather factors:

The weather factors considered in the present search were temperature and relative humidity, which were provided by the metrological. Department at Agricultural Research Center (ARC) during the experiment al seasons 2004 & 2005 to study the effect of them on the population fluctuations of the *P. gossypiella*.

Data were analyzed by the simple correlation and regression coefficient and the mean values were subjected to the least significant differences (LSD). Also, data were subjected to analysis of variance (ANOVA).

RESULTS AND DISCUSSION

Data revealed that during the two studying seasons (2004 & 2005), the larval population density of *P. gossypiella*, generally, was higher in 2004 season than 2005.

In addition, the mean number of moths captured by sex pheromone trap was higher than those captured by the light trap during the two successive seasons, (Table 1 and Fig. 1) although the trapped moths were only males.

In 2004, the least mean larval population density of check plants was recorded in June (17.3 larvae) at 26.7°C & 56% R.H., while, the highest mean number was recorded in September (41.4 larvae). The same trend was obtained from the samples of the treated plants where 11.7 & 29.3 larvae were recorded in June and August, respectively.

In 2005, the decrease and the increase in population density of *P. gossypiella* was similar to those occurred in 2004 season, in which the least mean number was recorded in June (12.7 and 8.0 larvae) and the highest was obtained in August (32.6 and 19.2 larvae) for check and treated plots, respectively (Table 1 and Fig. 1).

In 2004 season, the highest mean number of moths, which were caught by sex pheromone and light traps, occurred in July and August (74.0 and 42.8 moths, respectively) at 28.6 and 29.3°C & 59.3 and 63% R.H., while the lowest mean number of moths were 34 and 3.6 recorded in June, respectively at 26.7°C & 56% R.H.)

In 2005 season, the highest mean number of moths, caught by sex pheromone and light traps, occurred in August (95 and 47.4 moths, respectively) at 29.6 & 53.4% R.H., while the lowest mean number of moths were 42.3 and 4.8 which obtained during June, respectively at 23.1°C & 64% R.H.

Table 1. Mean population density of *pectinophora gossypiella* larvae and moths collected from cotton bolls and (pheromone & light) traps at Behira Governorate throughout 2004 & 2005 on Giza 70 cotton variety.

Sampling Date		Mean of 2004 Year						Mean of 2005 year					
		Population density		Traps		Weather factors		Population density		Traps		Weather factors	
		Check	Treated	Sex pheromone	Light	Temp.	R.H.	Check	Treated	Sex pheromone	Light	Temp.	RH.
June	Total	52	35	102	11	-	-	75	48	127	28.9	-	-
	X̄	17.3 ^c	11.7 ^c	34 ^b	3.6 ^c	26.7	56	12.7 ^c	8.0 ^d	42.3 ^b	4.8 ^c	23.1	64.0
July	Total	156	105	445	153	-	-	122	58	454	101		
	X̄	24.3 ^b	17.5 ^b	74 ^a	25.5 ^b	28.6	59.3	24.4 ^b	11.6 ^c	90.8 ^a	20.2 ^b	29.0	50.2
August	Total	236	176	460	257	-	-	122	58443	475			
	X̄	39.5 ^a	29.3 ^a	71.8 ^a	42.8 ^a	29.3	63	32.6 ^a	19.2 ^a	95 ^a	47.4 ^a	29.6	53.4
Sept.	Total	207	131	285	185	-	-	99	68	338	166		
	X̄	41.4 ^a	26.2 ^a	57 ^b	37 ^a	26.44	56.6	24.8 ^b	17.0 ^b	84.5 ^a	41.5 ^a	27.5	57.3
F		16.3***	24.2***	0.05 ^{ns}	10.2**	-	-	28.5***	55.4***	6.6*	90.2***	-	-
LSD		7.8	4.6	19.6	12.5	-	-	5.1	2.4	15.2	7.7	-	-

Means followed by the same letter in each column are not significantly different.

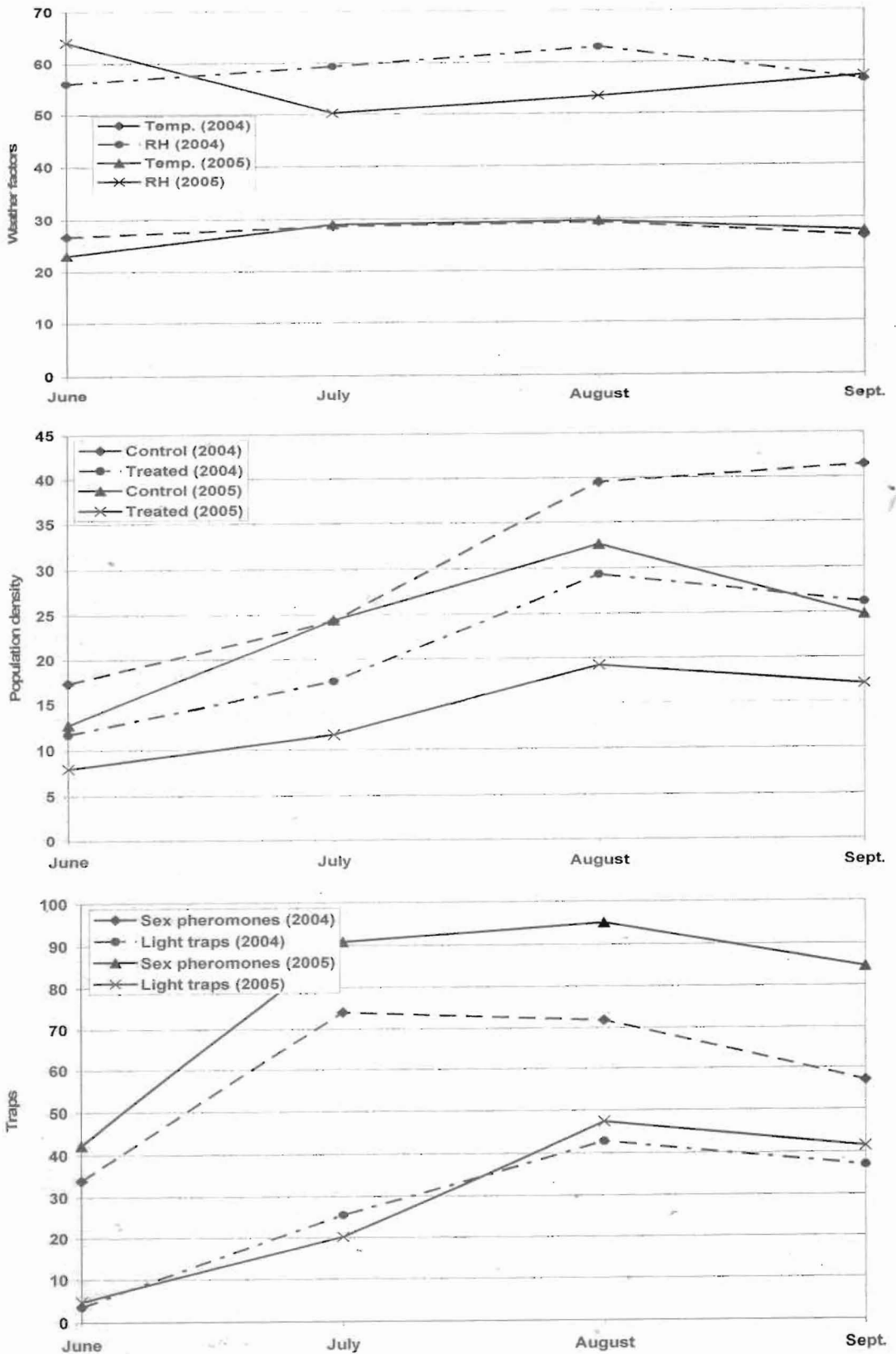


Fig. 1. Mean population density of *pectinophora gossypiella* larvae and moths collected from cotton bolls and (pheromone & light) traps at Behira, Governorate throughout 2004 & 2005 on Giza 70 cotton variety.

In both studying seasons, although pheromone traps caught only male moths, but the mean population density of these males were higher than the mean population density of male and female moths caught by the light traps.

Statistical analysis during 2004 season, showed high significant differences between the larval population density in check and treated plots at all sampling dates (F values = 16.3 and 24.2 and LSD = 7.8 and 4.6, respectively), while there were no significant differences between the population of moths caught by sex pheromone traps. On the other hand, there were significant differences between the populations of moths caught by light traps in various sampling dates (Table, 1).

Statistical analysis during 2005 season, indicated high significant differences between the larval population density in check and treated plots at all sampling dates (F values = 28.5 and 55.4 and LSD = 5.1 and 2.4), respectively. The differences among the population of moths caught by sex pheromone traps were significant and they were highly significant among the populations of moths caught by light traps at all sampling dates (F values = 6.6 and 90.2 and LSD = 15.2 and 7.7, respectively).

The least mean number of population density (Table 2 and Fig. 2), on Giza 80 cotton variety recorded in 2004 and 2005 seasons, was 9 & 6 and 10.8 & 8.0 larvae in June on check and treated plants, respectively. In 2004, the highest mean larval population density was obtained in August on both check and treated plants (27.3 & 15.2 larvae). The highest larval population density in 2005 on treated plots was 13.8 larvae recorded in September. On the contrary, on check plants 30.8 larvae were recorded as the highest population density in August (Table, 2 & Fig. 2).

Table 2. Mean population density of *pectinophore gossypiella* larvae and moths collected from cotton bolls and (pheromone & light) traps at Behira Governorate throughout 2004 & 2005 on Giza 88 cotton variety.

Sampling Date		Mean of 2004 Year						Mean of 2005 year					
		Population density		Traps		Weather factors		Population density		Traps		Weather factors	
		Check	Treated	Sex pheromone	Light	Temp.	R.H.	Check	Treated	Sex pheromone	Light	Temp.	RH.
June	Total	27	18	94	11	-	-	67	36	318	28.9	-	-
	X	9.0 ^c	6.0 ^c	31.3 ^c	3.6 ^d	26.7	56	10.8 ^c	8.0 ^d	53 ^c	4.8 ^c	23.1	64.0
July	Total	120	85	438	153	-	-	112	47	443	101	-	-
	X	20 ^b	14.2 ^a	73 ^a	25.5 ^c	28.6	59.3	22.4 ^b	9.4 ^c	88.6 ^a	20.2 ^b	29.0	50.2
August	Total	164	91	431	257	-	-	144	59	454	237	-	-
	X	27.3 ^a	15.2 ^a	71.8 ^a	42.8 ^a	29.3	63	30.8 ^a	11.8 ^b	90.8 ^a	47.4 ^a	29.6	53.4
Sept.	Total	99	55	275	185	-	-	84	55	323	166	-	-
	X	19.8 ^b	11.0 ^b	55 ^b	37 ^b	28.44	56.6	21.0 ^b	13.8 ^a	80.7 ^b	41.5 ^a	28.7	57.3
F		9.1**	33.3**	16.5***	1.6***	-	-	20.8***	17.6***	6.6*	90.2***	-	-
LSD		5.4	3.4	16.7	10.3	-	-	5.5	2.5	15.2	7.7	-	-

Means followed by the same letter in each column are not significantly different.

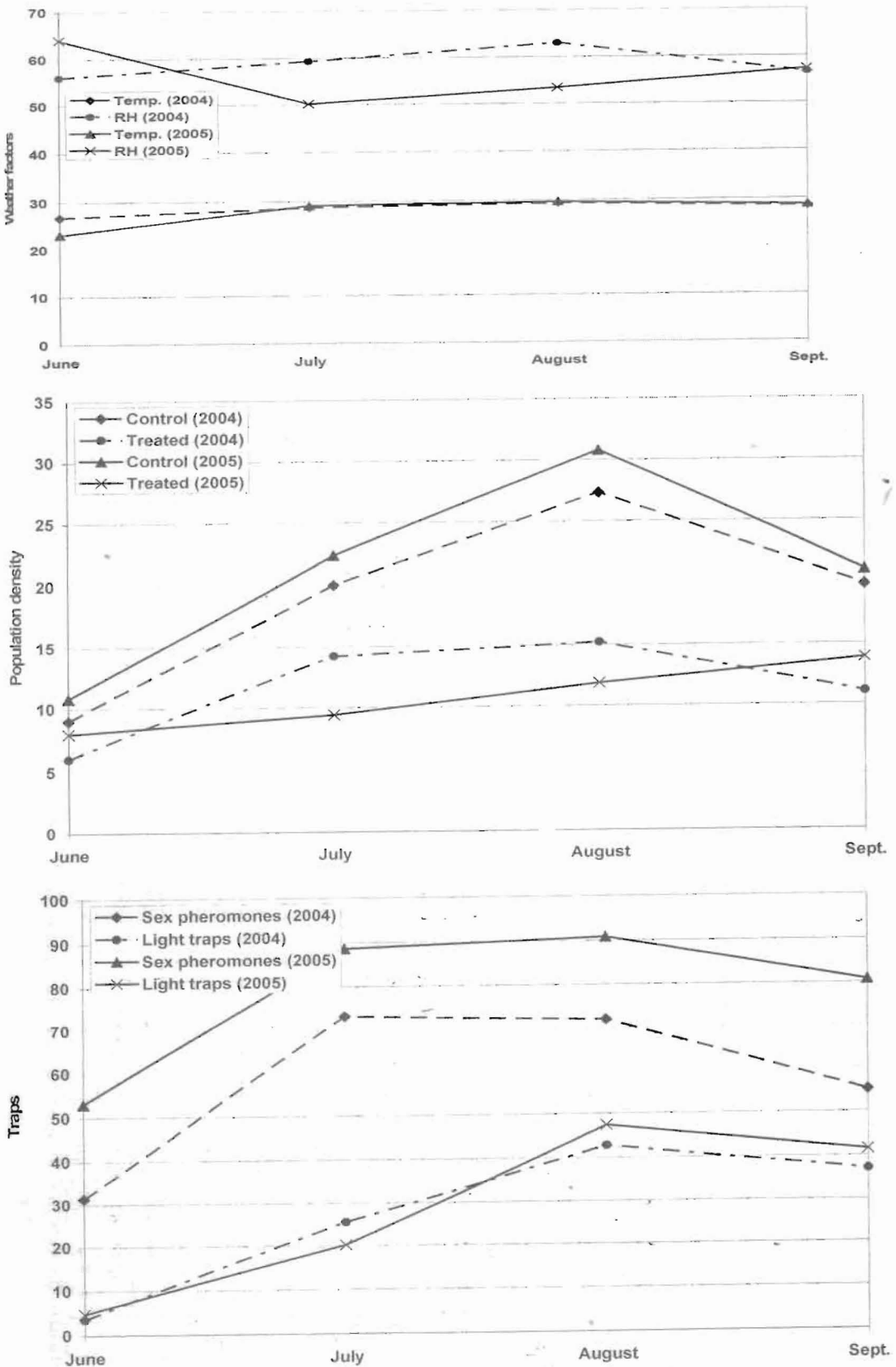


Fig. 2. Mean population density of *pectinophora gossypiella* larvae and moths collected from cotton bolls and (pheromone & light) traps at Behira. Governorate throughout 2004 & 2005 on Giza 88 cotton variety.

The lowest densities of moths obtained from sex pheromone and light traps were 31.3&3.6 in 2004 season and 53&4.8 in 2005 season at 23.1°C & 64% R.H. during June.

In 2004, season 73 moths were recorded as the highest population density in July for sex pheromone traps, while, it was 42.8 moths in August for light traps.

Statistical analysis during 2004 season, showed significant differences between the larval population density in check and treated plots on various sampling dates (F values = 9.1 and 33.3 and LSD = 5.4 and 3.4, respectively). Oppositely, highly significant differences were recorded between the population of moths caught by sex pheromone traps and light traps at all sampling dates (F values = 16.5 and 1.6 and LSD = 16.7 and 10.3, respectively).

Statistical analysis during 2005 season, indicated high significant differences between the larval population density in check and treated plots at various sampling dates (F values = 20.85 and 17.6 and LSD = 5.5 and 2.5), respectively. For traps, significant differences between the population of moths caught by sex pheromone traps were reported but highly significant differences between the population of moths caught by light traps were calculated at various sampling dates (F values = 6.6 and 90.2 and LSD = 15.2 and 7.7, respectively).

The lowest larval mean population density, at Beni-Sueif governorate on Giza 80 cotton variety in 2004 and 2005 seasons, was recorded in June (13 & 18.2 and 15.7 and 9.7 larvae) on check and treated plants, respectively at 31.0°C & 46.6% R.H. during 2004 season and 28.3°C & 47.5% R.H. during 2005 season (Table 3 and Fig. 3).

Table 3. Mean population density and the number of *pectinophora gossypiella* moths collected from pheromone and light traps at Beni-Sueif Governorate throughout 2004 & 2005 seasons on Giza 80 cotton variety.

Sampling Date		Mean of 2004 Year						Mean of 2005 year					
		Population density		Traps		Weather factors		Population density		Traps		Weather factors	
		Check	Treated	Sex pheromone	Light	Temp.	R.H.	Check	Treated	Sex pheromone	Light	Temp.	RH.
June	Total	65	41	327	21	-	-	94	58	365	81	-	-
	\bar{X}	13 ^c	8.2 ^d	45.4 ^b	4.2 ^c	31.0	46.6	15.7 ^c	9.7 ^c	60.8 ^c	14 ^d	28.3	47.5
July	Total	110	67	387	142	-	-	128	77	491	123	-	-
	\bar{X}	22 ^b	13.4 ^c	77.4 ^a	28.4 ^b	30.4	49.8	25.6 ^b	15.4 ^b	98.2 ^b	24.6 ^c	30.4	54.2
August	Total	170	80	438	233	-	-	191	114	513	195	-	-
	\bar{X}	34 ^a	16 ^b	87.6 ^a	46.6 ^a	30.6	50.2	38.2 ^a	22.8 ^a	102.6 ^a	39 ^a	30.2	51.8
Sept.	Total	139	108	318	220	-	-	123	81	349	122	-	-
	\bar{X}	27.8 ^b	20.6 ^a	63.6 ^a	44 ^a	31	47.4	30.8 ^a	20.3 ^a	69.8 ^c	30.5 ^b	28.1	49.2
F		12.1**	22.8***	2.0ns	27.9***	-	-	52.1***	48.0***	44.2**	70.4***	-	-
LSD		8.0	3.2	20.7	11.5	-	-	4.7	3.0	19.5	8.9	-	-

Means followed by the same letter in each column are not significantly different.

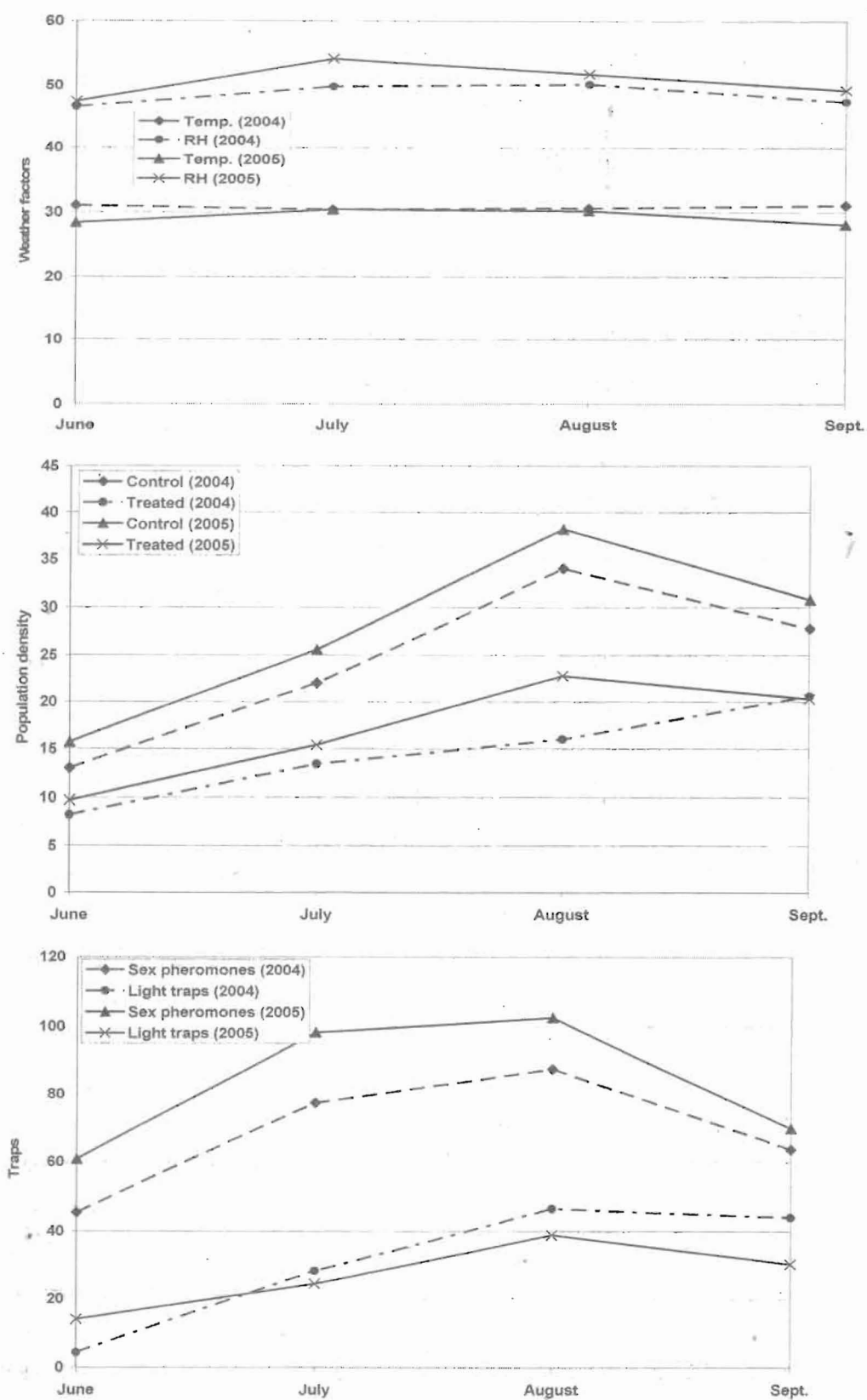


Fig. 3. Mean of population density and the number of, *pectinophora gossypiella* moths collected from pheromone and light traps at Beni-Sueif Governorate throughout 2004 and 2005 seasons on Giza 80 cotton variety.

In 2004, 73 moths were recorded as the highest population density in July for sex pheromone traps, while, it was 42.8 moths in August for light traps.

The obtained results were as the same as the one obtained from sex pheromone and light traps being 45.4 & 4.2 in 2004 season and 60.8 & 14 in 2005 season for sex pheromone and light traps, respectively, at 28.3°C & 47.5% R.H.

The highest mean larval population density was obtained in August (34 larvae) on check plots, while on treated plots in was 20.6 larvae in September in 2004.

The highest mean of larval population density was cited in August and it was 38.2 and 22.8 larvae on check and treated plants, respectively in 2005 season.

For the two types of traps, the lowest and the highest population densities were recorded in June and August, respectively (Table, 3).

In 2004 season, the differences between the larval population density in check plots were significant and in treated plots were highly significant at various sampling dates (F values = 12.1 and 22.8 and LSD = 8.0 and 3.2, respectively). Non significant differences between the population of moths caught by sex pheromone traps were recorded, while, highly significant differences between the population of moths captured by light traps were reported at various sampling dates (F values = 2.0 and 27.9 and LSD = 20.7 and 11.5, respectively).

In 2005 season, the differences were highly significant between the larval population density in check and in treated plots at various sampling dates. The differences were significant between the population moths caught by sex pheromone traps and highly significant between the populations of moths caught by light tarps on various sampling dates.

In general, the used cotton varieties can be ranked in relation to the sensitivity to pink bollworm infestation as follows: Giza 70, Giza 80 and Giza 88. So, Giza 88 in the most recommended cotton variety.

The previous results are considered in harmony with those obtained by Mansour *et al.* (2004) who investigated the susceptibility of eight Egyptian cotton cultivars (Giza 45, Giza 70, Giza 75, Giza 76, Giza 77, Giza 80, Giza 81 and Dandara) to cotton bollworm, *Pectinophora gossypiella* in a field experiment conducted in Qalubya governorate. They found that the eight Egyptian cotton cultivars were susceptible to *P. gossypiella* infestation but there are no significant differences in the susceptibility among the eight cotton cultivars.

Thangaraju and Uthamasamy (1990) found that rainfall, sunshine hours and relative humidity in the morning affected pheromone trap recorded that high population of *Pectinophora gossypiella* moths occurred in July, August, September,

October and November at Sharkia governorate during cotton growing seasons in 1989 and 1990 and the maximum number of captured males was recorded in mid-August. Data of our research are, to some extent, similar to those of El-Deeb *et al.* (1995) and the differences may be due to the prevailing temperature and relative humidity.

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الكثافة العددية والتذبذب في أعداد حشرة دودة اللوز القرنفلية في محافظتين مصريتين نتيجة عوامل مختلفة

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تم إجراء هذه التجربة في محافظتي بني سويف والبحيرة موسمي فطن ٢٠٠٤، ٢٠٠٥ لدراسة الكثافة العددية والتذبذبات في أعداد يرقات دودة اللوز القرنفلية علي نباتات القطن المعاملة بالمبيدات الموصي بها والنباتات غير المعاملة للمقارنة. وذلك علي صنفى جيزة ٧٠، جيزة ٨٨ بمحافظة البحيرة وصنف جيزة ٨٠ بمحافظة بني سويف. كما تم حصر تعداد الفراشات من خلال المصادد الضوئية والفرمونية وقد أوضحت النتائج زيادة أعداد اليرقات خلال شهر أغسطس علي كل من النباتات المقارنة والمعاملة علي حد سواء خلال موسم ٢٠٠٤ ، ٢٠٠٥ بكلتا المحافظتين. كانت الكثافة العددية لليرقات أعلى في الحقول غير المعاملة عن المعاملة.

سجل أقل تعداد اليرقات علي الصنف جيزة ٧٠ يليه جيزة ٨٨ بمحافظة البحيرة حيث كان متوسط الحرارة والرطوبة ٢٩,٣°م، ٦٣% رطوبة نسبية خلال موسم ٢٠٠٤ و ٢٩,٦°م ، ٥٣,٩% موسم ٢٠٠٥ تعداد لليرقات علي الصنف جيزة ٧٠ يليه جيزة ٨٨ بمحافظة البحيرة حيث كان متوسط الحرارة والرطوبة ٢٩,٣°م، ٦٣% رطوبة نسبية خلال موسم ٢٠٠٤ و ٢٩,٦°م ، ٥٣,٩% موسم ٢٠٠٥ .

كما أوضحت النتائج أن هناك تذبذباً في أعداد الفراشات يتغير من وقت لآخر خلال فترة التجربة (من شهر يونيو وحتى سبتمبر). كان تعداد الفراشات أعلى في المصادد الفرمنية عنه في المصادد الضوئية برغم من أنها ذكور فقط وأعلى تعداد للفراشات سجل علي الصنف جيزة ٨٠ بمحافظة بني سويف حيث كان متوسط درجات الحرارة والرطوبة ٣٠,٦°م ، ٥٠,٢% موسم ٢٠٠٤ و ٣٣,٢°م ، ٥١,٨% موسم ٢٠٠٥ .

أوضح التحليل الإحصائي أن هناك فروقاً معنوية بين درجة إصابة أصناف القطن المستخدمة بدودة اللوز القرنفلية وأفضلها هو صنف القطن جيزة ٨٨.