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THE EFFECT OF WEATHER FACTORS ON THE POPULATION FLUCTUATION AND FLIGHT ACTIVITY OF *Earis insulana* (BIOS.) MALES ON COTTON GIZA 86 VARIETY

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ABSTRACT

The effect of certain weather factors (daily maximum and minimum temperature, relative humidity and wind velocity) on the seasonal abundance of *Earis insulana* (Boisd.) adult males during 2002, 2003, and 2004 cotton growing seasons was studied. The obtained data showed that *E. insulana* males exhibited 3-4 peaks of flight activity in response to sex pheromone traps. The highest occurence was observed July - August.

E. insulana males showed positive response to the increase of temperature and relative humidity. The amount of variability attributed to combined effect of weather factors on *E. insulana* male populations was different from year to year. Maximum temperature and relative humidity were the most effective factors on *E. insulana* populations.

INTRODUCTION

Cotton is the most important economic crop in Egypt, for both local consumption and for export. Cotton plants are liable to be attacked by several insect pests beginning from seed germination up to maturity. The spiny bollworm, *Earis insulana* (Boisd.) is one of the most serious insect pests which causes great reduction in quality and quantity of the field.

Insect pest management strategy includes several tactics to mange insect pests which reflects population reduction of the pest, as well as maximizes the crop yield. Insect monitoring tactic is important for decision-makers to apply control measures at the proper time. Pheromone traps is highly efficient tool for monitoring insect pest population fluctuation because of specifity of pheromones for attracting insects. In such concern, many investigators used pheromone traps as an efficient detector for pest population and dispersal during cotton season (Hosny *et al* 1978, Flint *et al* 1990, El-Zanan & El-Hawary 1998 and El-Mezayyen *et al* 1997).

The present investigation was carried out to study the relationship between flight activity of *E. insulana* adult males and some weather conditions.

MATERIALS AND METHODS

The present investigation was conducted at Sakha Agricultural Research Station, Kafr El-Sheikh Governorate during 2002, 2003, and 2004 cotton growing seasons to study the flight activity and seasonal abundance of *E. insulana* (Boisd.) males in response to prevailing temperature, relative humidity, and wind velocity.

Cotton (Giza 86 variety) was sown on 19 March 2002, 18 March 2003, and 24 March 2004. The cultivated area was four feddans. The traps

were replicated four times each at a rate of one trap/feddan and plants received normal agronomic practices. No pesticides were applied during the experimental period with the exception of herbicides.

Pheromone traps were placed in the cotton fields beginning from 13 May till the end of September. Each trap was baited with the specific pheromone capsules containing 2 mg synthetic sex pheromone (E, E) 10, 12 – hexadecadinal with renewal of the pheromone capsule every three days. The trapped moths were counted every six days.

The daily maximum and minimum temperatures, relative humidity and wind velocity were obtained from Meteorological Department at Sakha, Agricultural Research Station, Kafr El-Sheikh.

Data were statistically analyzed where the multiple correlation (R) determination coefficient values were calculated (Steel and Torrie, 1960) and determination coefficient (R^2) between the weather factors and population of *E. insulana*.

RESULTS AND DISCUSSION

1-Population fluctuation of *E. insulana* male moths:

Data presented in Table (1) and illustrated in Fig. (1) show the weekly changes in the population of *E. insulana* male moths captured by sex pheromone traps during three cotton growing seasons; 2002, 2003, and 2004.

In 2002 season, three peaks of flight activity were recorded. The first peak occurred on the 2nd week of June with 10.25 male moths / trap / 6 day, and the second is the highest occurred on the 4th week of July (51.25 moths) while the third one (47.0 moths) was detected on the fourth week of August.

In 2003 cotton growing season, four active periods of the male moths of *E. insulana* with four peaks were recorded in the 4th week of May, the 5th end of June, the 4th week of July and 4th week of August by the mean of 28, 33, 34.5 and 67.25 male moths / trap / 6 day respectively.

Also, in 2004 season, four peaks were recorded, on the 1st week of June, the 4th week of June, the 4th week of July, and the 4th week of August, by the mean of 19.25, 39.75, 43.0, and 43.0 male moths / trap / 6 days respectively.

Generally, the results of this study showed that the high population density of *E. insulana* was detected by mid-July towards the end of season. These results confirm those obtained by El-Mazayyen *et al* (1997) who indicated that peaks of *E. insulana* adults occurred during May, August and October at Kafr El-Sheikh Governorate.

El-Basyouni (2003) detected 4 – 5 generations of *E. insulana* on Giza 89 and Giza 86 cotton varieties.

2- Effect of some weather factors on the flight activity of E. insulana males:

The effect of the four weather factors, maximum and minimum temperature, relative humidity, and wind velocity on the population fluctuation of *E. insulana* is shown in Table (2). Multiple correlation (R) and determination coefficient values (R^2) were calculated.

Table (1): The mean catch of *E. insulana* male moths during 2002, 2003, and 2004 cotton growing seasons using pheromone baited sticky traps on cotton (Giza 86) variety.

Trapping duration		Mean number of male moths / trap / 6 days		
		2002 season	2003 season	2004 season
May	14 – 19	2.25	21.50	5.25
	20 – 25	2.00	23.75	8.75
	26 – 31	3.25	28.00	15.25
June	1 – 6	7.00	20.75	19.25
	7 – 12	10.25	17.75	15.75
	13 – 18	8.75	25.75	20.50
	19 – 24	7.25	29.25	27.50
	25 – 30	6.75	33.00	39.75
July	1 – 6	3.75	13.75	35.75
	7 – 12	5.25	31.25	22.25
	13 – 18	14.00	12.00	24.25
	19 – 24	28.75	18.00	38.25
	25 – 30	51.25	34.50	43.00
	31-5 August	8.75	13.50	41.50
August	6 – 11	7.00	8.50	31.50
	12 – 17	24.50	18.00	32.75
	18 – 23	28.75	45.75	43.00
	24 – 29	47.00	67.25	28.50
	30 – 4 Sep.	34.75	19.00	43.50
Sep.	5 – 10	14.00	7.25	18.5

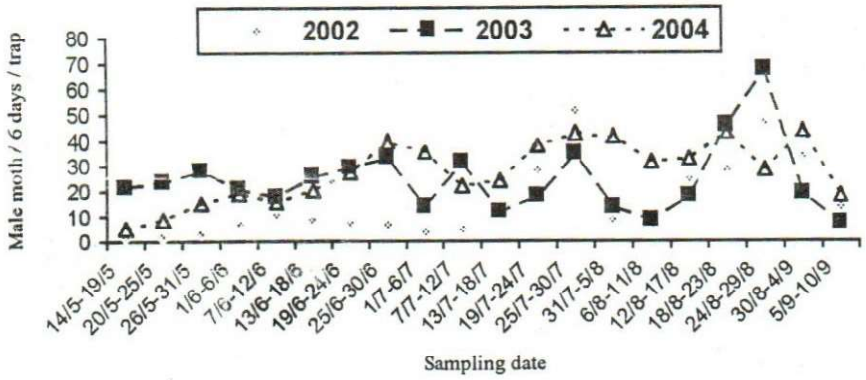

Fig. (1): Population fluctuation of the *E. insulana* male moths during three cotton growing seasons at Kafr El-Sheikh governorate.

In the first season (2002), *E. insulana* males were recorded at the 3rd week of May (at 20.95°C and 58.60%R.H.) and increased gradually to reach the first peak in the 2nd week of June (10.25 males/trap) when the mean temperature and relative humidity were 26.20°C and 60.70% R.H. The second peak had been recorded in the 4th week of July (51.25 males/trap) when the mean temperature and relative humidity were 29.25°C and 72.80%

respectively. While, the third peak (47.0 males/trap) was recorded in the 4th week of August (at 26.95°C and 68.90% R.H.).

Correlation and regression analysis between *E. insulana* male population and abiotic factors (temperature, relative humidity and wind velocity) were done during season 2002 (Table, 2)

Table (2): Effect of temperature (maximum, minimum and mean), relative humidity and wind velocity on *E. insulana* male population during 2002.

Factor	Correlation and simple regression				Multi-regression analysis		
	r	b	P	R^2	b.reg	P	E.V.%
Max.T	0.484*	3.30	0.031	23.4	-20.22	0.572	28.8
Mini.T	0.367	1.95	0.112	13.4	-23.50	0.513	
Mean T	0.459*	3.02	0.042	21.1	45.11	0.526	
R.H.	0.414	1.36	0.070	17.1	1.25	0.380	
Wind	-0.275	-0.22	0.241	7.5	-0.10	0.663	

From the statistical point of view, there were significantly positive correlations between male population and both of maximum and mean temperature (r = 0.484 and 0.459), while there were insignificantly positive correlations between male population and both of minimum temperature (r = 0.367) and relative humidity (r = 0.414). The correlation between *E. insulana* male population and wind velocity was negatively insignificant as "r" value was -0.275 (Table,2).

The simple regression analysis for the effect of maximum and mean temperature on *E. insulana* male population revealed to significantly positive effect (b = 3.30 and 3.02). While, the daily minimum temperature, relative humidity or wind velocity showed insignificant effect on male population (b = 1.95, 1.36 and -0.22, respectively).

The amount of variability attributed to combined effect of the weather factors on the *E. insulana* male population was 28.8% of the total factors affecting on the male population changes during the first season and the maximum temperature was the most effective factor as R^2 value was 23.4% (Table,2).

The relationship between *E. insulana* male population (MP) and weather factors during the first season could be represented by the following equation:

$$MP = -120.4 - 20.2\ T_{Max} - 23.5\ T_{Min} + 45.1\ T_{Mean} + 1.25\ R.H. - 0.10\ W.V.$$

During the second season (2003), *E. insulana* male population increased gradually by the time from the 3rd week of May (at 25.40°C and 80.20% R.H.) to reach its first peak (28 males/trap) in the 4th week of May at 24.30°C and 66.40% R.H., while the 2nd peak was observed in the 4th week of June (33.0 males/trap) at 27.10°C and 68.30% R.H. The 3rd peak (34.50 males/trap) had been recorded in the 4th week of July when the mean temperature and relative humidity were 27.30°C and 64.70%; while the 4th peak was recorded on the 4th week of August (67.25 males/trap) when the mean temperature and relative humidity were 28.53°C and 78.20%.

Statistical analysis showed that, there were positively insignificant correlations between male population and each of maximum, minimum, mean temperature and relative humidity as "r" values were 0.209, 0.211, 0.238 and 0.218, respectively. While, there were negatively insignificant correlation between male population and wind velocity as "r" value was - 0.099 (Table, 3).

Table (3): Effect of temperature (maximum, minimum and mean), relative humidity and wind velocity on *E. insulana* male population during 2003.

Factor	Correlation and simple regression				Multi-regression analysis		
	r	b	P	R^2	b.reg	P	E.V.%
Max. T	0.209	2.55	0.376	4.4	-1973	0.108	23.5
Mini. T	0.211	1.32	0.372	4.5	-1972	0.108	
Mean T	0.238	2.22	0.312	5.7	3946	0.108	
R.H.	0.218	0.55	0.355	4.8	0.21	0.783	
Wind	-0.099	-0.10	0.677	1.0	0.16	0.586	

The simple regression analysis for the effect of maximum, minimum, mean temperature and relative humidity on *E. insulana* male population revealed to positively insignificant effect (b = 2.55,1.32,2.22 and 0.55, respectively). While, the wind velocity showed negatively insignificant effect on male population (b = -0.10).

The amount of variability attributed to combined effect of the weather factors on *E. insulana* male population was 23.5% of the total factors affecting on the male population changes during the second season and the mean temperature was the most effective as R^2 value was 5.7% (Table, 3).

The relationship between *E. insulana* male population and weather factors during the second season could be represented by the following equation:

$$MP = -21.9 - 1973\ T_{Max} - 1972\ T_{Min} + 3946\ T_{Mean} + 0.21\ R.H. + 0.16\ W.V.$$

In the third season (2004), *E. insulana* males appeared at the 3rd week of May (at 21.55°C and 59.00% R.H.) and increased gradually to reach the first peak in the 1st week of June (19.25 males/trap) when the mean temperature and relative humidity were 23.20°C and 64.70% R.H. and the second peak had been recorded in the 4th week of June (39.75 males/trap) when the mean temperature and relative humidity were 26.35°C and 69.20%. While, the 3rd peak (43.00 males/trap) was recorded in the 4th week of July (at 26.65°C and 69.50% R.H.) and the 4th peak had been recorded in the 3rd week of August (43.00 males/trap) when the mean temperature and relative humidity were 27.70°C and 69.30% R.H.

Correlation and regression analysis showed that, there were positively high significant correlations between male population and each of maximum, minimum, mean temperature and relative humidity as "r" values were 0.584, 0.675, 0.710 and 0.680, respectively. While, there were negatively insignificant correlation between male population and wind velocity as "r" value was –0.382 (Table,4).

Table (4): Effect of temperature (maximum, minimum and mean), relative humidity and wind velocity on *E. insulana* male population during 2004.

Factor	Correlation and simple regression				Multi-regression analysis		
	r	b	P	R^2	b.reg	P	E.V.%
Max. T	0.584*	4.24	0.007	34.1	-45.1	0.676	52.2
Mini. T	0.675*	2.98	0.001	45.6	-45.6	0.676	
Mean T	0.710*	4.32	0.00	50.4	93.7	0.666	
R.H.	0.680*	2.16	0.001	45.2	0.79	0.556	
Wind	-0.382	-0.26	0.097	14.6	-0.05	0.803	

The simple regression analysis for the effect of maximum, minimum, mean temperature and relative humidity on *E. insulana* male population revealed to positively high significant effect (b = 4.24, 2.98, 4.32 and 2.16, respectively). While, the wind velocity showed negatively insignificant effect on male population (b = -0.26).

The amount of variability attributed to combined effect of the weather factors on the *E. insulana* male population was 52.2% of the total factors affecting on the male poulation changes during the third season and the mean temperature was the most effective factor as R^2 value was 50.4% (Table,4).

The relationship between *E. insulana* male population and weather factors during the third season could be represented by the following equation:

$$MP = -100.8 - 45.1\ T_{Max} - 45.6\ T_{Min} + 93.7\ T_{Mean} + 0.79\ R.H. - 0.05\ W.V.$$

According to El-Saadany et al. (1999), the amount of daily changes in minimum, maximum, mean temoerature and relative humidity might alter the catch of spiny bollworm when the weather factors remain constant around their ranges. In the present study, the weather factors influence the male flight activity of *E. insulana* moth during the period of investigation. However, *E. insulana* males showed positive response to the increase of both temperature and relative humidity, especially in the third season. Similar results were obtained by Karaman et al. (1982); El-Mezayyen et al. (1997) and Taman (1990).

On the contrary, *E. insulana* males showed different response to the change of temperature and relative humidity (Hamid et al. 1994 and Taman 1990). El-Basyouni (2003) demonstrated that the response of *E. insulana* male was different according to the host plant of cotton variety.

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تأثير العوامل الجوية على التذبذب فى تعداد فراشات دودة اللوز الشوكية ونشاط طيران الحشرة على صنف القطن جيزة ٨٦

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أجرى هذا البحث فى مزرعة محطة البحوث الزراعية بسخا – كفر الشيخ على صنف القطن جيزة ٨٦ لدراسة تأثير درجات الحرارة العظمى والصغرى و درجات الرطوبة النسبية وكذلك سرعة الرياح خلال الأعوام ٢٠٠٢ ، ٢٠٠٣ ، ٢٠٠٤ على تذبذبات التعداد لذكورحشرة ديدان اللوز الشوكية البالغة وكذلك على نشاط طيرانها. وقد أوضحت النتائج ظهور ٣-٤ قمم بالنسبة لنشاط طيران حشرة ديدان اللوز الشوكية بالنسبة لاستجابتها للمصايد الفرمونية و كان اعلي فترة نشاط خلال شهرى يوليو و اغسطس.

اما بالنسبة لتأثير العوامل الجوية علي نشاط و تعداد الحشرة فقد لوحظ وجود استجابة موجبة لزيادة درجات الحرارة و الرطوبة النسبية و قد اختلف مقدار هذا التغير من سنة الي أخري حيث كانت درجة الحرارة العظمى و الرطوبة النسبية من اكثر العوامل تأثيرا علي تعداد الإفة.