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FIELD EVALUATION OF CERTAIN INSECTICIDES AGAINST WHITEFLY, *Bemisia tabaci.* (HOMOPTERA: ALEYRODIDAE), IN AL-HASA, SAUDI ARABIA.

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ABSTRACT

Four insecticides were evaluated in the open field for their efficacy against whitefly *Bemisia tabaci* on tomato plants. Two of insecticides (pirimiphos-methyl and chlorpyriphos-ethyl) were from organophosphorus compounds, and the other two (cypermethrin and fenvalerate) from pyrethroids. Two sprays were applied for these insecticides at the recommended rates. Reduction percentages of whitefly population at different intervals (an hour, 1, 3, 7 and 15 days) were estimated. Data of first spray showed that the means of whitefly were high after an hour of spray then reduced in all insecticide treatments afterwards except on third day of pirimiphos-methyl treatment. The maximum percent of reduction reached 65.64% in pirimiphos-methyl treatment along 15 days when compared with control. After the second spray, the percent of reduction were 70.42, 62.90, 57.82 and 49.98 in chlorpyrifos-ethyl, pirimiphos-methyl, fenvalerate and cypermethrin, respectively along 15 days compared with control. None of insecticide treatments gave complete reduction of whitefly at any time of insecticide treatment.

INTRODUCTION

Whitefly, *Bemisia tabaci*, is an important pest of vegetable crops, causes economic damage to crops by sucking plant sap. This pest contaminates crop products with honeydew, which forms substrate for the development of sooty molds, and transmit plant viruses such as Geminiviruses (Johnson *et al.*, 1992; Omer *et al.*, 1992; Liu *et al.*, 1993). To prevent economic losses is required to develop of an integrated pest management program that necessitate accurate assessments of economic thresholds and detailed knowledge of the most effective mean of control (Bi *et al.*, 2002).

Insecticides are still important components in integrated pest management system designed to suppress whitefly populations on various crops (Liu *et al.*, 1993; Toscano *et al.*, 1998). Intensive research has been carried out in recent years for evaluating insecticides with novel modes of action against whitefly (Fuog *et al.*, 1998; Ishaaya and Horowitz 1998; Palumbo *et al.*, 2001; Bi *et al.*, 2002).

The wide array of modes of action presents an exciting opportunity for the effective integration of many of these chemicals into targeted insect pests (Ishaaya and Horwitz 1998). The availability of such chemical diversity should enable the development of management strategy, which minimizes the threat of insecticide resistance (Denholm *et al.*, 1998).

The present study was carried out to test the efficacy of four insecticides against whiteflies on tomato under field conditions of Al-Hasa, Eastern Province, Saudi Arabia.

MATERIALS AND METHODS

Chemicals

The tested insecticides were purchased locally and used for the field trails at the recommended rates, Actellic (pirimiphos-methyl, 50% EC, Dursban (chlorpyrifos-ethyl) 48% EC, at a rate of 2.0 ml/liter, Cypermethrin 10% EC at a rate of 0.5 ml/l and Sumicidin (fenvalerate) 20% EC at a rate of 0.75 ml/l.

Field trials

The efficacy of pirimiphos-methyl, chlorpyriphos-ethyl, cypermethin and fenvalerate were evaluated against whitefly on tomato (cv. Trecora) that cultivated in open fields under Al-Hasa conditions. The trail was carried out at King Faisal University, Agricultural and Veterinary Training and Research Station. The experiment was designed in Randomized Complete Block Design (RCBD) with three replicates (plots), each of three rows (five meter long/each) and spaced at 30 cm apart. Cultural practices were applied as recommended for commercial production of tomatoes; the insecticides were applied at the recommended rates. Two sprays were applied at 15 days interval. A hand operated Knapsack sprayer was used to apply the insecticides. Treatments were evaluated by counting the adult of whitefly on 10 leaves, taken at random from each plot. Insect counts were taken just before and after treatment at an hour, 1, 3, 7 and 15 days. The reduction percentage in whitefly population was estimated using Henderson and Teleton equation (1955).

Statistical analysis

Collected data were statistically analyzed according to the technique of analysis of variance (ANOVA) according to the method stated by Gomez and Gomez (1984). To compare treatment means, least significant difference (LSD) test was done by Costat program (1986).

RESULTS AND DISCUSSION

Effect of insecticide treatments on whitefly population

1- First spray

The effect of insecticide treatments on whiteflies was evaluated by counting the number of *B. tabaci* per tomato leaf throughout 15 days after first spray with recommended rates of insecticides (Table 1). Data showed that control treatment had the high number of whiteflies per leaf that reached a mean of 14.76 adult/leaf along 15 days; meanwhile, the mean of whiteflies severely reduced in pirimiphos-methyl and chlorpyrifos-ethyl treatments, where reached 4.24 and 4.72 adult/leaf, respectively. In the same manner, the mean of whiteflies were 5.24 and 5.60 adult/leaf after the treatment of cypermethrin and fenvalerate, respectively. Data also revealed that pirimiphos-methyl and chlorpyrifos-ethyl reduced the number of whiteflies slightly more than cypermethrin and fenvalerate. The statistical analysis revealed no significant differences between all insecticide treatments over 15 days of treatment. While there was a significant differences between control and all insecticide treatments. Reduction percentage of whiteflies at the different intervals after the first spray compared with the control was calculated using Henderson and Teleton equation (1955). The reduction percentage in the number of whiteflies was high after an hour then reduced in all insecticides treatments except on third day of pirimiphos-methyl (Table 2). While the mean of reduction was 65.64 % for pirimiphos-methyl treatment.

Table (1): Mean number of *Bemisia tabaci* per tomato leaf throughout fifteen days after 1st spray of insecticide treatments.

Treatment	No of whitefly/leaf					
	an hour	1 day	3 days	7 days	15 days	Mean
Pirimiphos-methyl	5.2	4.6	3.2	5.0	3.2	4.24
Chlorpyrifos-ethyl	3.4	2.6	5.6	7.8	4.2	4.72
Cypermethrin	3.4	4.2	7.4	9.4	3.6	5.60
Fenvalerate	4.2	5.8	6.4	5.6	4.2	5.24
Control	17.2	10.0	23.0	17.6	6.0	14.76
$LSD_{0.05}$ = 2.4						

Table (2): Reduction percentage of *Bemisia tabaci* at different intervals after 1st spray of insecticide treatments.

Treatment	Reduction at different intervals (%)					
	An hour	1 day	3 days	7 days	15 days	Mean
Pirimiphos-methyl	69.8	54.0	86.1	71.6	46.7	65.64
Chlorpyrifos-ethyl	80.2	74.0	75.7	55.7	30.0	63.12
Cypermethrin	82.2	58.0	67.8	46.6	60.0	62.92
Fenvalerate	75.6	42.0	72.2	68.2	30.0	57.60
Control	00.0	00.0	00.0	00.0	00.0	00.00

2- Second spray

The effect of insecticide treatments on whiteflies was evaluated by counting the number of *B. tabaci* per tomato leaf throughout 15 days after a second spray by the recommended rates of insecticides (Table 3). Data showed that control treatment had the highest number of whiteflies per leaf, where reached a mean of 16.6 adult/leaf along 15 days. The means of whiteflies reduced in insecticide treatments where reached 7.62 and 6.26 adult/leaf in pirimiphos-methyl and chlorpyrifos-ethyl treatments, respectively; meanwhile, the means of whiteflies were 10.68 and 8.50 adult /leaf in cypermethrin and fenvalerate treatments, respectively. Data also revealed that organophosphorus insecticide treatments had reduced the number of whiteflies slightly more than pyrethroid insecticides. The statistical analysis revealed significant differences between the control and all tested insecticides. Reduction percentage of whitefly at the different intervals after the second spray compared with the control (Table 4) was also calculated using Henderson and Teleton equation (1955). The reduction percentage in whiteflies was high after an hour then reduced in most insecticide treatments after 15 days of treatments. The reduction percentages were 70.42, 62.90, 57.82 and 49.98 % for chlorpyrifos-ethyl, pirimiphos-methyl, fenvalerate and cypermethrin, respectively along 15 days.

In conclusion, the insecticide treatments reduced the number of whiteflies on tomato when compared with the control. The percent of reduction reached maximum values (80-85%) in some insecticide treatments after an hour. The mean reduction percentage does not exceed 70 %, while the low reduction percentage was around 50% after 15 days of treatments. The data showed that no treatment of any insecticide gave a complete reduction either after first or second spray. The decreased activity of insecticides with the passing time from insecticides application might due to the effect of environmental conditions on the degradation of insecticides and/or the migration and immigration of tolerant and resistant individuals of whiteflies from non-treated to treated plots.

Table (3): Mean number of *Bemisia tabaci* per tomato leaf throughout fifteen days after 2nd spray of insecticide treatments.

Treatment	No of whitefly/leaf					
	an hour	1 day	3 days	7 days	15 days	Mean
Pirimiphos-methyl	9.0	6.2	8.3	5.8	8.8	7.62
Chlorpyrifos-ethyl	9.2	7.4	4.3	4.8	5.6	6.26
Cypermethrin	17.2	4.4	4.0	14.0	13.8	10.68
Fenvalerate	6.3	9.8	6.3	4.6	15.5	8.5·
Control	11.6	16.1	18.5	19.6	17.2	16.60
$LSD_{0.05}$ = 3.2						

Table (4): Reduction percentage of *Bemisia tabaci* at different intervals after 2nd spray of insecticide treatments.

Treatment	Reduction at different intervals (%)					
	an hour	1 day	3 days	7 days	15 days	Mean
Pirimiphos-methyl	78.8	61.4	55.1	70.4	48.8	62.90
Chlorpyrifos-ethyl	78.4	54.0	76.8	75.5	67.4	70.42
Cypermethrin	59.5	72.7	65.9	32.0	19.8	49.98
Fenvalerate	85.2	39.1	78.4	76.5	9.9	57.82
Control	00.0	00.0	00.0	00.0	00.0	00.00

Several factors may contribute to the lower efficacies of these tested insecticides under field conditions either the migrants' whiteflies to the treated plots in the field or the sever environmental conditions under Saudi climate in Al-Hasa, which may affect the persistence of insecticides.

Chemical control is still an important component of integrated pest management strategy. As indicated in this study, the tested insecticides did not suppress the whitefly population completely. In such case, chemical control is not powerful tools for managing whitefly in tomato fields. There is a possibility that whitefly develop a resistance to conventional insecticides in this region. Introducing and altering chemical treatment on tomato in a defined way could be strategic to combat the potential risk of whitefly resistance to insecticides.

The results of Tkachuk *et al.* (1983) pointed that fenvalerate at 0.1-0.2% reduced the whitefly population in greenhouse by 89-99.6%, while pirimiphos-methyl reduced the population by only 40.6%. Horowitz *et al.*

(1988) reported that the highest mortality of *B. tabaci* was (99.2%) obtained with single application of a mixture of cypermethrin and DEF. While DEF alone gave 77.3-81.1% Mortality. In the meantime, cypermethrin with sodium chlorate gave the lowest mortality recorded (20.4-54.4%). Ishaaya *et al.* (1987) reported that cypermethrin toxicity to whitefly under the field condition is strongly synergized by adding an equal weight of monocrotophos or acephate. The reduction of whitefly infestation is verified by determining the remaining residues of two of the tested insecticides pirimiphos-mehtyl and cypermethrin.

The present investigation suggests that the control of whitefly should not depend mainly on insecticides alone since inadequate control was achieved after applications of different insecticides. The integration of many methods or disciplines under the umbrella of IPM may be useful to control this serious pest in the near future. The strategy should be fulfilled to manage or delay resistance in whitefly.

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التقييم الحقلي لبعض المبيدات الحشرية ضد ذبابة الطماطم البيضاء في محافظة الإحساء بالمملكة العربية السعودية.

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تم تقييم أربع مبيدات حشرية تحت ظروف الحقل المفتوح لدراسة كفاءتها في مكافحة الذباب الأبيض على محصول الطماطم. اثنان من المبيدات ينتميان إلى مجموعة المركبات الفوسفورية العضوية وهما البيريميفوس ميثايل والكلوربيريفوس ايثايل. بينما الآخران ينتميان إلى مجموعة البيروثرويدات وهما السيبرمثرين والفنفاليريت. تم تطبيق رشتين من المبيدات السابقة بالمعدلات الموصى بها حقليا وتم تقدير نسبة الخفض في عشيرة الذباب الأبيض خلال ١٥ يوم من المعاملة. أوضحت النتائج زيادة أعداد الذباب الأبيض بعد الرش مباشرة (ساعة) ثم انخفض العدد في جميع المعاملات ما عدا بعد ثلاث أيام في معاملة البيريميفوس ميثايل وكانت أعلى نسبة خفض في عشيرة الحشرة هي ٦٥,٦٤% في معاملة البيريميفوس ميثايل خلال ١٥ يوم من الرشة الأولى. بعد الرشة الثانية وصلت نسبة الخفض ٧٠,٤٢ ، ٦٢,٩٠ ، ٥٧,٨٢ و ٤٩,٩٨% في معاملات الكلوربيريفوس إيثايل، البيريميفوس ميثايل والفنفاليريت والسيبرمثرين على التوالي مقارنة بالكونترول خلال ١٥ يوم من الرشة الثانية. من ناحية أخرى لم تظهر أي من المعاملات خفض كلي في عشيرة الحشرة عند أي وقت من المعاملة.

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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

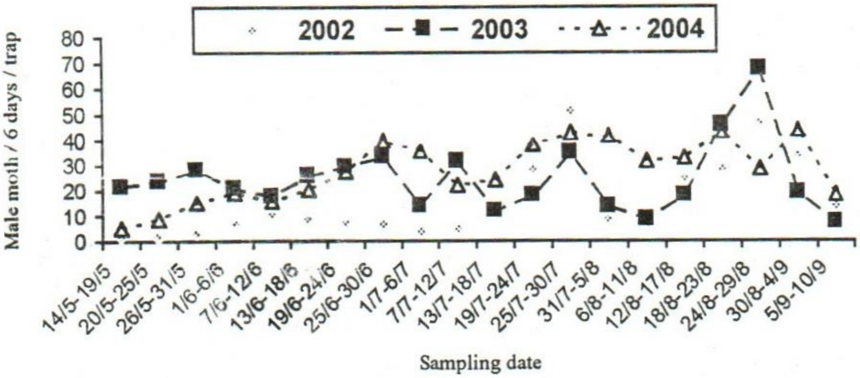

Fig. (1): Population fluctuation of the *E. insulana* male moths during three cotton growing seasons at Kafr El-Sheikh governorate.

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 الافة.