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# RELATIONSHIP BETWEEN CAPTURE OF PINK AND SPINY BOLLWORMS MALE MOTHS IN RELATION TO CERTAIN ENVIRONMENTAL FACTORS AND ACCUMULATE HEAT UNITS

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## ABSTRACT

Ecological studies on the pink bollworm, *Pectinophora gossypiella* (Saund.) and spiny bollworm, *Earias insulana* (Boisd.) were carried out at Abo-Hammad district, Sharkia Governorate, Egypt during two consecutive cotton growing seasons of 2007 and 2008. The obtained results indicated that the pink bollworm male moths catch recorded five peaks during 2007 and 2008 seasons.

The accumulated heat units from peak to peak in the first season 2007 were 412.50, 345.06, 460.97 and 465.40 degree-days, respectively. While in the second season 2008. The accumulated heat units from peak to peak were 318.21, 459.14, 463.79 and 459.76, respectively.On the other hand the spiny bollworm catch recorded four peaks during the same seasons, the accumulated heat units from peak to peak in the first season 2007 were 557.26, 737.01 and 610.37 degree-days of the four peaks, respectively , while in the second season 2008 the accumulated heat units from peak to peak were 698.78, 738.37 and 609.79 degree-days, respectively.

Effects of maximum, minimum, mean temperatures and mean of RH % on catch of pink bollworm male moths in pheromone traps were very low in season 2007 (6.44%) and low in season 2008 (28.86%) . Results concerning , relative humidity showed insignificant effect in the 1$^{st}$ season 2007 comparison to effect significant in the second season 2008. On the other hand the effects of max., min. and mean temp. on spiny bollworm catch were significant in season (2007) and insignificant in the 2$^{nd}$ season, respectively. Results also showed that the mean RH % had insignificant effect on spiny bollworm catch in the two seasons. Finally effects of all weather factors together were 41.93 and 28.37% in the two seasons, respectively.

## INTRODUCTION

Cotton plants are liable to infestation with many pests during the different stages of their growth. Among the most important of wish are the pink bollworm, *Pectinophora gossypiella* (Saund.) and the spiny bollworm, *Earias insulana* (Boisd.). The cotton bollworms have been recently considered among the most serious pests in Egypt. It caused severe damage to different crops especially cotton. Numerous studies have been carried out on the population activity of these pests, but relatively little work on the simultaneous effect of weather factors on their incidence is available in the literature. Examples of such studies are those of (Hosny and Khattab, 1960; Nasr *et al*., 1982; Al-Shannaf, 1994; El-Sayed, 2001; Al-Shannaf, 2002; Amer, 2004 and Hegab, 2008). More information about the behavior and abundance of the bollworms in relation to the changes in the environmental weather factors are required to facilitate the prediction of their population density, which may help to reduce the amount of the used insecticides for their control.

The present study was designed to add to the knowledge on the abundance of the above mentioned pests by studying the effect of temperature and relative humidity together with their simultaneous effect on the occurrence of these pests during the two successive cotton growing seasons 2007 and 2008.

## MATERIALS AND METHODS

Field experiments were carried out at Abo-Hamad, district Sharkia Governorate, Egypt during cotton growing seasons of 2007 and 2008 to study the seasonal fluctuation. The experimental area were cultivated with the Egyptian cotton Giza 86 variety, *Gossypium barbadence* which was sown after clover on 20 $^{th}$ and 27 $^{th}$ March during the two seasons, respectively in order to study certain ecological and control agents on both pink bollworm, *P. gossypiella* and spiny bollworm, *E. insulana* attacking cotton plants. The cotton areas were subjected to normal agricultural practices allover study periods where the following studies were conducted:

The seasonal fluctuation of pink and spiny bollworms were studied using pheromone traps baited with specific sex pheromone of the three bollworms (Pink bollwom, pheromone: 1:1 mixture of (ZZ, ZE) 7, 11-hexadecadienyl acetate) and (Spiny bollwom, pheromone: (Z) 10, (E) 12-hexadecadienal, (Z) 11-hexadecanal. Capsules containing 2 mg/lure were obtained from Plant Protection Research Institute, Agric, Res., Center (ARC), Dokki, Giza, Egypt.

Two isolated areas of four feddans each, far from each of other by a distance of about 250 meter were chosen at the site of experiment. Delta sticky traps baited with pheromone capsules of pink bollworm placed in cotton fields . In addition yellow funnel plastic traps baited with pheromone capsule of spiny bollworm were hanged on a wooden stand of 2 m height, placed 30 cm about 10-15 cm above the canopy in cotton plants allover the two seasons**.** Three traps were allocated randomly in each area one trap each 2.00 feddans. The traps baited with the specific pheromone of each insect. The traps were installed from April 31$^{st}$ to the 1$^{st}$ week of October 2007 and 2008 seasons. Weekly examination of traps was done and the captured male moths were recorded. The pheromone capsules were replaced other new ones every 15 days. The traps position was adjusted according to the plant high. The weather factors, maximum, minimum temperature and relative humidity were obtained from weather Meteorology Station, Cairo, Egypt. Capture male moths were correlated with weather factors. Either alone or combined with each other (Explained Variance E. V.) .

Temperature threshold of *P. gossypiella* and *E. insulana* were determined by Hashem, *et al*. (1997), Gergis, *et al.* (1990) and Amin and Gergis (2006) 12.68 and 11.60, respectively. On the basis of previous thresholds, full model of partial regression and multiple correlation. The analysis of variance was computed using Costat Software Computer program (2005).

## RESULTS AND DISCUSSION

Seasonal population fluctuation of pink and spiny bollworms male moths population where monitored using sex pheromone traps.

**1. The pink bollworm, *Pectinophora gossypiella*:**

Data given in Tables (1 and 2) and illustrated in Figres. (1 and 2) revealed that the population density of pink bollworm male moths varied from one season to other. The activity period of the pests attracted at flowering and fruiting stages. The first catches were obtained on 6th and 24th of May 2007 and 2008 seasons, respectively with averages of 38.00 and 25.00 males/trap/week for both seasons , respectively. Five peaks were recorded in 2007 season on May 20th, June 17th ,July 8th , August 5th and September 2nd with mean numbers of 129.00, 73.33, 138.33, 67.66 and 87.00 males/trap/ week with mean temperature of 24.58 - 33.64 ºC and 55.71 - 67.43 RH % in the second season of 2008, five peaks were occurred at May 31st (38.00 males/trap/week), June 21st (54.66 males/trap/week), July 19th (75.66 males/trap/week), August 16th (68.66 males/trap/week) and September 13th (81.00 males/trap/week). The peaks were existed under the condition of 28.30 - 31.70 ºC of mean temperature and 56.43 - 69.00 RH %

Generally, the weekly mean number of males caught varied significantly from season to other. As results showed that the mean number of trapped males were (61.87 and 43.28 males/trap /week) during 2007 and 2008 seasons, respectively.

The results are agreement with the findings of Hegab, 2002 who mentioned that after the insect initial incidence, it fluctuated in numbers to show different numbers of population activity peaks ranging from 9 to 15 peaks/year and Amer, 2004 & Hegab, 2008 they stated that the first appearance of male moths of the pink bollworm in the specific sex pheromone traps occurred in relatively low numbers at the beginning of March and afterwards the insect population fluctuation in numbers recording about four peaks of activity through cotton growing season and having the highest maximum level of abundance during October progressively declined in November.

**1.1. Relationship between accumulated heat units and catch of pink bollworm:**

Results in Tables (1 & 2) indicated that five peaks were recorded in 2007 season appeared after the accumulation of 822.77, 1235.27, 1580.33, 2041.30 and 2506.70, while the accumulated heat units from peak to peak were 412.50, 345.06, 460.97 and 465.40 degree-days. In the second season of 2008, five peaks were appeared after the accumulation of 858.80, 1177.01, 1636.15, 2099.94 and 2559.70, while the accumulated heat units from peak to peak were 318.21, 459.14, 463.79 and 459.76 degree-days were required for the development of these five generations.

Accumulated heat units and expected number of generation of both pink and spiny bollworms were counted according to accumulate heat units for one generation.

**Table (1): Weekly mean numbers of captured pink bollworm, *Pectinophora gossypiella* and spiny bollworm, *Earias insulana* male moths using sex pheromone trap in cotton fields at Abou-Hamad district and accumulated heat unit counts, Sharkia Governorate during 2007 season.**

| Date | | *P. gossypiella* | | | *E. insulana* | | | Weather factors | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean No./ moths/trap | A H P | A* | Mean No./ moths/trap | A H S | A** | Temperature | | | % R H |
| | | | | | | | | Max. | Min. | Mean | |
| 6 | May | 38.00 | 609.81 | | 18.49 | 708.39 | | 30.44 | 19.94 | 23.16 | 54.71 |
| 13 | | 20.33 | 716.68 | | 13.66 | 822.82 | | 30.14 | 17.97 | 24.74 | 55.40 |
| 20 | | 129.00 | 822.77 | | 12.66 | 936.47 | | 30.17 | 16.0 | 24.58 | 55.71 |
| 27 | | 69.66 | 928.15 | | 26.33 | 1049.41 | | 30.14 | 20.94 | 28.32 | 53.87 |
| 3 | June | 55.33 | 1027.68 | | 5.66 | 1156.50 | | 34.02 | 22.46 | 28.32 | 54.79 |
| 10 | | 26.66 | 1129.45 | | 1.33 | 1256.83 | | 34.71 | 22.66 | 28.97 | 61.71 |
| 17 | | 73.33 | 1235.27 | 412.50 | 3.00 | 1379.21 | | 28.89 | 24.2 | 33.64 | 62.29 |
| 24 | | 65.66 | 1349.01 | | 3.00 | 1500.51 | | 34.81 | 27.57 | 25.90 | 57.29 |
| 1 | July | 45.00 | 1465.61 | | 10.33 | 1624.67 | 557.26 | 36.81 | 26.39 | 31.26 | 63.71 |
| 8 | | 138.33 | 1580.33 | 345.06 | 1.00 | 1746.95 | | 35.66 | 27.24 | 31.89 | 65.29 |
| 15 | | 30.00 | 1694.47 | | 1.66 | 1868.65 | | 35.13 | 25.57 | 31.33 | 66.14 |
| 22 | | 27.66 | 1809.45 | | 0.66 | 1991.19 | | 33.43 | 26.36 | 29.93 | 67.00 |
| 29 | | 46.66 | 1928.70 | | 7.33 | 2118.00 | | 34.50 | 25.03 | 30.33 | 67.71 |
| 5 | Aug. | 67.66 | 2041.30 | 460.97 | 12.00 | 2238.16 | | 35.33 | 25.31 | 26.93 | 67.43 |
| 12 | | 48.33 | 2157.26 | | 14.00 | 2361.68 | 737.01 | 34.44 | 26.16 | 30.31 | 66.14 |
| 19 | | 49.66 | 2273.29 | | 7.33 | 2485.27 | | 35.02 | 25.00 | 30.32 | 66.14 |
| 26 | | 59.00 | 2389.05 | | 7.66 | 2608.59 | | 35.91 | 26.03 | 31.0 | 66.29 |
| 2 | Sept. | 87.00 | 2506.70 | 465.40 | 14.00 | 2733.80 | | 33.81 | 24.96 | 23.39 | 63.71 |
| 9 | | 71.66 | 2622.14 | | 15.00 | 2856.80 | | 33.74 | 23.89 | 28.84 | 62.43 |
| 16 | | 73.66 | 2729.83 | | 22.33 | 2972.05 | 610.37 | 33.00 | 24.70 | 28.96 | 65.43 |
| 23 | | 74.33 | 2839.07 | | 15.66 | 3088.85 | | 32.08 | 27.57 | 28.71 | 64.71 |
| 30 | | 59.66 | 2939.69 | | 12.00 | 3197.03 | | 30.50 | 23.33 | 27.83 | 64.17 |
| 7 | Oct. | 66.33 | 3047.50 | | 11.66 | 3312.40 | | 31.29 | 24.10 | 28.27 | 64.16 |
| Total | | 1422.91 | 236.75 | | 236.75 | | | | | | |
| Mean | | 61.87 | 10.29 | | 10.29 | | | | | | |

**A H P = Accumulated heat units, pink bollworm**
**A*=Account Heat units from peak to peak, pink bollworm**
**A H S =Accumulated heat units, spiny bollworm**
**A** =Account heat units from peak to peak, spiny bollworm**

The present results are in accordance with the findings of Amin *et al.* (1999) who studied the population size of the spiny bollworm, *E. insulana* using delta pheromone traps and they found 7-8 field generations per year. Generations occurred at an average of 436.8 DD's above threshold of 11.6 °C. have seven generations a year. Generations occurred at average of 374 ± 22.75 DD's, respectively. The lower thresholds were 11.60 ºC. Ismail *et al.* (2005) reported that the lower thresholds of development of spiny bollworm under different temperatures were 10.58, 7.40, 12.50, 9.38 and 9.90 °C for egg, larvae, pupae, pre-oviposition period and generation, respectively. The average thermal units required to complete the development was 55.79, 273.60, 137.50, 40.94 and 449.57 DD's for egg, larvae, pupae, pre-oviposition period and generation, respectively. The present results showed 3-4 generations for the spiny bollworm under field conditions which is relatively lower than that recorded by Moawad *et al*. (1994) and Husein,

Nagwa, *et al.* (2002). The changes in the number of annual generation could be regarded to variation the amount of heat unit accumulated from season to another.

**Table (2): Weekly mean numbers of captured pink bollworm, *Pectinophora gossypiella* and spiny bollworm, *Earias insulana* male moths using sex pheromone trap in cotton fields at Abou-Hamad district and accumulated heat unit counts, Sharkia Governorate during 2008 season.**

| Date | | *P. gossypiella* | | | *E. insulana* | | | Weather factors | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean No./ moths/ trap | A H P | A* | Mean No./ moths/ trap | A H S | A** | Temperature | | | % R H |
| | | | | | | | | Max. | Min. | Mean | |
| 17 | May | 0.00 | 653.47 | | 0.00 | 763.69 | | 32.11 | 20.16 | 26.17 | 55.57 |
| 24 | | 25.00 | 753.51 | | 32.00 | 871.29 | | 34.82 | 22.06 | 28.53 | 56.43 |
| 31 | | 38.00 | 858.80 | | 16.00 | 984.14 | | 36.34 | 23.24 | 28.30 | 58.57 |
| 7 | Jun. | 24.00 | 959.32 | | 10.66 | 1092.22 | | 34.00 | 22.18 | 28.09 | 59.57 |
| 14 | | 42.33 | 1066.32 | | 6.00 | 1206.77 | | 35.84 | 24.09 | 29.97 | 57.71 |
| 21 | | 54.66 | 1177.01 | 318.21 | 10.00 | 1325.02 | | 36.14 | 25.26 | 30.75 | 60.00 |
| 28 | | 20.00 | 1292.12 | | 14.00 | 1447.69 | | 39.49 | 27.37 | 32.99 | 57.43 |
| 5 | July | 25.33 | 1406.93 | | 20.00 | 1570.07 | 698.78 | 35.26 | 26.91 | 31.30 | 63.57 |
| 12 | | 36.66 | 1522.12 | | 10.00 | 1692.82 | | 31.20 | 26.69 | 31.54 | 64.57 |
| 19 | | 75.66 | 1636.15 | 459.14 | 9.00 | 1814.41 | | 35.97 | 26.27 | 31.03 | 65.14 |
| 26 | | 35.66 | 1753.27 | | 8.00 | 1939.09 | | 38.19 | 27.79 | 32.99 | 66.00 |
| 2 | Aug. | 29.66 | 1867.54 | | 15.00 | 2060.92 | | 37.46 | 27.19 | 32.86 | 67.64 |
| 9 | | 52.00 | 1983.43 | | 24.00 | 2184.37 | | 35.54 | 27.14 | 31.33 | 67.71 |
| 16 | | 68.66 | 2099.94 | 463.79 | 33.00 | 2308.44 | 738.37 | 36.46 | 27.24 | 31.70 | 69.00 |
| 23 | | 34.33 | 2215.16 | | 14.66 | 2431.22 | | 36.43 | 26.71 | 32.89 | 67.00 |
| 30 | | 61.33 | 2333.12 | | 10.66 | 2556.75 | | 37.41 | 27.78 | 32.59 | 64.86 |
| 6 | Sept. | 72.66 | 2450.20 | | 12.33 | 2681.38 | | 35.64 | 27.69 | 31.99 | 66.71 |
| 13 | | 81.00 | 2559.70 | 459.76 | 15.66 | 2798.44 | | 34.90 | 25.03 | 29.97 | 64.14 |
| 20 | | 60.66 | 2668.93 | | 26.33 | 2915.32 | 609.79 | 34.33 | 24.84 | 29.70 | 64.57 |
| 27 | | 55.66 | 2774.80 | | 22.66 | 3028.66 | | 33.77 | 24.21 | 29.01 | 64.93 |
| 4 | Oct. | 45.66 | 2908.82 | | 16.00 | 3170.24 | | 34.5 | 24.32 | 29.80 | 65.82 |
| Total | | 908.92 | 203.30 | | 325.96 | | | | | | |
| Mean | | 43.28 | 9.68 | | 15.52 | | | | | | |

**A H P = Accumulated heat units, pink bollworm**
**A*=Account Heat units from peak to peak, pink bollworm**
**A H S =Accumulated heat units, spiny bollworm**
**A** =Account heat units from peak to peak, spiny bollworm**

### 1.2. Effect of certain weather factors on the population activity of caught males:

The relationships between weather factors and the population of pink bollworm caught males during the two successive seasons 2007 and 2008 could be illustrated as follows:

**A. Effect of maximum temperature:**

Results given in Table (3) show a positive and insignificant correlation and a positive insignificant correlation (r = 0.0718) in 2007, while negative

and insignificant correlation(r = - 0.1961) between weekly mean max. temp. and mean caught males during 2007 and 2008 seasons, while for simple regression indicating low effect of this factors tested during the two seasons.

**B. Effect of minimum temperature:**

The statistically analysis given in Table (3) revealed negative and insignificant relationship (r = - 0.0880) between minimum temp. and mean number of captured males of pink bollworm during first season 2007, while positive insignificant correlation (r = 0.3566) recorded in 2008 season, while simple regression values recorded insignificant regression (0.79 and 12.81%) during the two seasons, respectively.

**C. Effect of mean temperature:**

Data in Table (3) indicated that a positive and insignificant relationship (r = 0.0464 and 0.2923) between mean temp. and mean number of capture males of *P. gossypiella* during the cotton seasons 2007 and 2008. while for simple regression indicating low effect of this factor tested during the two seasons.

**D. Effect of daily mean relative humidity:**

The relationship between the mean relative humidity and the changes in the population density of *P. gossypiella* was negative and insignificant during 2007, positive and significant in 2008. Generally, it can be mentioned that relative humidity had a pronounce effect on the population activity of the pink bollworm. It caused insignificant effect (1.91) in 2007 and significant effect (26.84) in the second season (Table, 3).

**Table (3): Simple correlation coefficient (r) and multiple regression for the number of captured male moths of the pink bollworm, *Pectinophora gossypiella* (Saund.) by using sex pheromone traps under weekly means of temperature and relative humidity during 2007 and 2008 seasons.**

| Weather factors | 2007 season | | | | |
|---|---|---|---|---|---|
| | Simple correlation | SE | P | Regression | |
| | | | | Simple | EV% |
| Max. temp. | 0.0718 | 0.2177 | NS | 1.36 NS | 6.44 |
| Min. temp. | -0.0880 | 0.2174 | NS | 0.79 NS | |
| Mean temp. | 0.0464 | -0.2179 | NS | 0.74 NS | |
| Mean RH % | -0.0930 | 0.2173 | NS | 1.91 NS | |
| Mean | | | | 1.45 | |
| **2008 season** | | | | | |
| Max. temp. | -0.1961 | 0.2249 | NS | 5.35 NS | 28.86 |
| Min. temp. | 0.3566 | 0.2143 | NS | 12.81 NS | |
| Mean temp. | 0.2923 | 0.2194 | NS | 9.32 NS | |
| Mean RH % | 0.5163 | 0.1965 | * | 26.84* | |
| Mean | | | | 13.58 | |

**P =Probability *= Significant NS= non significant SE = Standard error**

The results are in according with the findings of El-Sayed, 2001, Hegab, 2002 who stated that the effect of some weather factors could be arranged descendingly as follows: temperature, light period and relative humidity. Amer, 2004 and Hegab, 2008 reported that the relationship

between maximum & minimum temperature were negative and insignificant and relative humidity showed pronounced effect on moth catches; simple correlation & regression coefficient values were positive & insignificant.

**E. Combined effect of the weather factors:**

Data in Table (3) show that the simple regression values of the weather factors averaged 1.45 and 13.58 during the two seasons of study. Also, results revealed that the all weather factors were lowest effect on appearance of insect in 2007 season, while in season 2008 it was relatively affected male moths capture (6.44 and 28.86%), respectively.

**2. The spiny bollworm, *Earias insulana:***

The results in Tables (1 and 2) and illustrated in Figures (1 and 2) clear that the spiny bollworm remained active throughout allover the season with population fluctuation in numbers recording about four peaks of activity occurred during 2007 and 2008 seasons in cotton fields. In the first season, the peaks were recorded at May 27$^{th}$ ,July1$^{st}$ , Aug. 12$^{th}$ and September 16$^{th}$ with mean number (26.33, 10.33, 14.00 and 22.33 males/trap/week) at 28.32 - 31.26 ºC of mean temp. and 53.87- 66.14 R.H %.

In the second season the pest occurred four peaks at May 24$^{th}$, July 5$^{th}$ , Aug. 16$^{th}$ and September 20$^{th}$ with mean number (32.00, 20.00, 33.00 and 26.33 males/trap/week) at 28.53 - 31.70 ºC of mean temp. and 56.43 - 69.00 RH%. The relatively high mean male numbers were recorded at 27$^{th}$ of May in 2007 season and the end of September and 16$^{th}$ Aug. during 2008 season, while the relatively low seasonal mean number of 10.29 and 9.68 males/trap/week recorded during the two seasons of study, respectively.

The present result are in agreement with the findings of Amin *et al.* (1999) studied the population size of spiny bollworm using delta pheromone traps and they found 7 -8 field generation/year. Hegab, 2002 found that after the insect initial incidence, it fluctuated in numbers to show different numbers of population activity peaks ranging from 11 to 13 for spiny bollworm according to the investigating year. Amer, 2004 who found that the spiny bollworm captured moths had 6 generations a year. The fourth generation is the highest one with relatively percentages (43.41 & 46.45 %) of the total captures in 2000 and 2001 seasons, respectively. Hegab, 2008 stated that the spiny bollworm moths catch recorded three peaks in 17$^{th}$ July, 27$^{th}$ August and 11$^{th}$ September with mean numbers of 2.50, 8.25 and 9.25 males/trap/week during 2005,06 and 07 seasons on cotton, respectively.

**2.1. Relationship between accumulated heat units and catch of spiny bollworm:**

Results in Table (1 & 2) indicated that four peaks were recorded in 2007 season at appeared after the accumulation of 1049.41, 1624.67, 2361.68 and 2972.05, while the accumulated heat units from peak to peak were 557.26, 737.01 and 610.37 degree-days. In the second season of 2008, four peaks were appeared after the accumulation of 871.29, 1570.07, 2308.44 and 2915.32, while the accumulated heat units from peak to peak were 698.78, 738.37 and 606.79 degree-days were required for the development of these four generations.

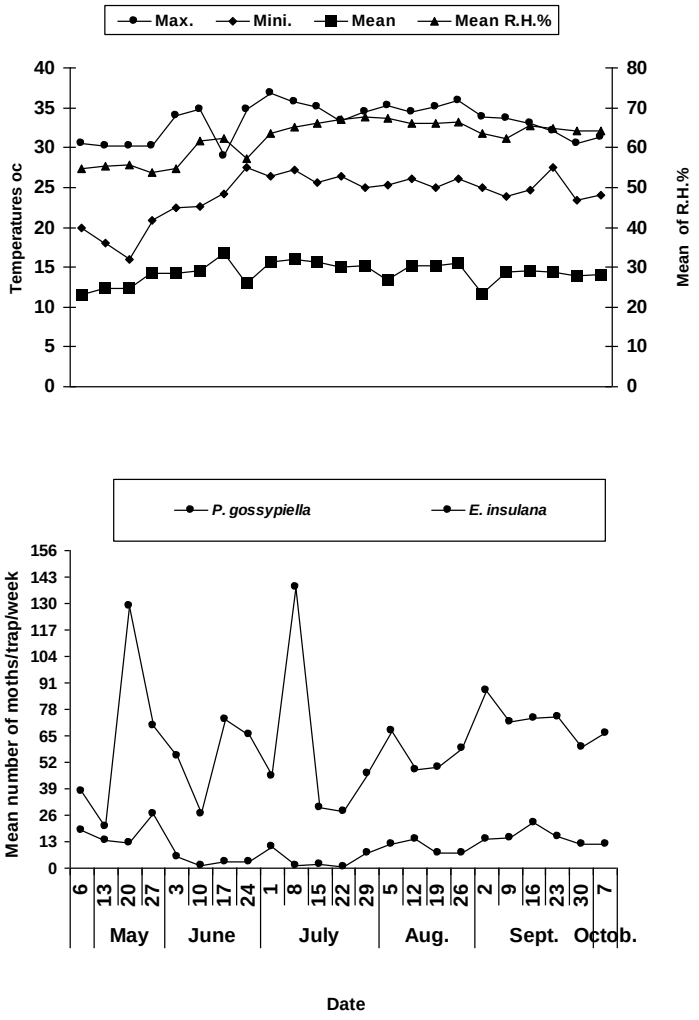


**Fig. (1): Seasonal fluctuation of captured male moths of pink bollworm, *P. gossypiella* and spiny bollworm, *E. insulana* using sex pheromone traps at Abo-Hamad district Sharkia Governorate during 2007 season**

Accumulated heat units and expected number of generation of spiny bollworm were count according to accumulate heat units for one generation.

The present results are in accordance with the findings of Amin *et al.* (1999) studied the population size of the spiny bollworm, *E. insulana* using delta pheromone traps and they found 7-8 field generations per year. Generations occurred at an average of 436.8 DD's above threshold of 11.60

°C. have seven generations a year. Generations occurred at average of 374 ± 22.75 DD's, respectively. The lower thresholds were 11.6 ºC. Temperature threshold of *P. gossypiella* and *E. insulana* were determined by Gergis, *et al.* (1990) and Amin and Gergis (2006) 12.68, 11.60, respectively on the basis of previous threshold Ismail *et al.* (2005) they reported that the lower thresholds of development of spiny bollworm under different temperatures were 10.58, 7.40, 12.50, 9.38 and 9.90 °C for egg, larvae, pupae, pre-oviposition period and generation, respectively. The average thermal units required to complete the development was 55.79, 273.60, 137.50, 40.94 and 449.57 DD's for egg, larvae, pupae, pre-oviposition period and generation, respectively. The present results showed 3-4 generations for the spiny bollworm under field conditions which is relatively lower than that recorded by Moawad *et al*. (1994) and Husein, Nagwa, *et al.* (2002).

The changes in the number of annual generation could be regarded to variation the amount of heat unit accumulated from season to another.

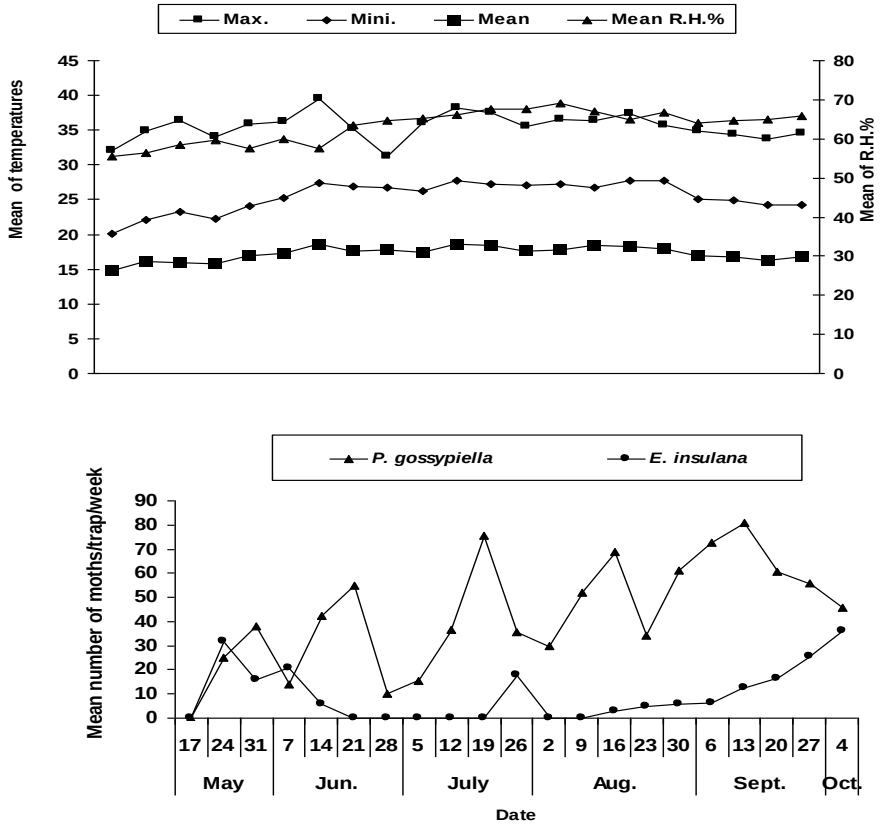


**Fig. (2): Seasonal fluctuation of captured male moths of pink bollworm, *P. gossypiella* and spiny bollworm, *E. insulana* using sex pheromone traps at Abo-Hamad district Sharkia Governorate during 2008 season.**

**2.2. Effect of certain weather factors on the population activity of spiny bollworm caught males:**

The response of this trial is to illustrated the relationship and effect of mean daily (max. temp., min. temp., mean temp. and daily relative humidity %) with the population fluctuation of *E. insulana* male moths caught in pheromone traps during 2007 and 2008 seasons. Table (4)**.**

**A. Effect of maximum temperature:**

Results given in Table (4) show the simple correlation and regression coefficient values of the relationship between the changes of the daily max. temp. and the changes in the population size of spiny bollworm males during 2007 season were negative and significant, but it was negative and insignificant during 2008 season. Analysis results revealed that the population of males were significant during 1$^{st}$ season and insignificant in the 2$^{nd}$ season, while simple regression indicating relatively effect in the two seasons, respectively.

**B. Effect of minimum temperature:**

Data in Table (4) show the simple correlation and regression coefficient values of the relationship between the changes of the min. temp. and the changes in the population size of spiny bollworm males during 2007 season were negative and highly significant, but it was negative and insignificant during 2008 season. These results reveal that an increase of min. temp. caused decrease in the number of capture males in pheromone traps, while simple regression indicating moderately effect in 2007 and 2008 seasons (45.23 and 30.97%, respectively).

**C. Effect of mean temperature:**

Data in Table (4) indicated that a negative and highly significant relationship (r = - 0.5575) in 2007 and negative & insignificant( r = -0.4109) in 2008 season between mean temp. and mean number of capture males of *E. insulana*, while for simple regression indicating moderately influence of this factor tested during the two seasons (31.09 and 36.62 %, respectively).

**D. Effect of daily mean relative humidity:**

The relationship between the mean relative humidity and the changes in the population fluctuation of *E. insulana* was negative and insignificant during the two seasons. Relative humidity had the lowest factor effect on the population activity of the spiny bollworm. (Table, 4).

The results are in according with the findings of El-Sayed, 2001 & Hegab, 2002 reported that spiny bollworm, the order was different and varied from one year to another showing the following arrangement: night period, temperature and relative humidity in 1997 and 1998 years, whereas in 1999 a switch in position between the first and second factors was taken place. Amer, 2004 and Hegab, 2008 who reported that the relationship between maximum & minimum temperature were negative and insignificant and relative humidity showed pronounced effect on moth catches; simple correlation & regression coefficient values were positive & insignificant.

**E. Combined effect of the weather factors:**

Data in Table (4) show that the simple regression values of the weather factors, averaged 30.73 and 23.57 during the two seasons of study. Also,

results revealed that the all weather factors were moderately effect on appearance of insect in 2007, while in 2008 it was relatively effect on male moths in traps (41.93 and 28.37%), respectively.

**Table (4): Simple correlation coefficient (r) and multiple regressions for the number of captured male moths of the spiny bollworm, *Earias insulana (*Boisd.*)* by using sex pheromone traps under weekly means of temperature and relative humidity during 2007 and 2008 seasons.**

| Weather factors | 2007 season | | | | |
|---|---|---|---|---|---|
| | Simple correlation ( r) | S.E. | P. | Regression | |
| | | | | Simple | Multiple E.V.% |
| Max. temp. | -0.5003 | 0.1889 | * | 28.93* | 41.93 |
| Mini. temp. | -0.6037 | 0.1739 | ** | 45.23** | |
| Mean temp. | -0.5575 | 0.1846 | ** | 31.09** | |
| Mean RH% | -0.2832 | 0.2093 | NS | 17.68NS | |
| Mean | | | | 30.73 | |
| **2008 season** | | | | | |
| Max. temp. | -0.3673 | 0.2133 | NS | 21.65 NS | 28.37 |
| Mini temp. | -0.3444 | 0.2154 | NS | 30.97* | |
| Mean temp. | -0.4109 | 0.2092 | NS | 36.62* | |
| Mean RH% | -0.1264 | 0.2276 | NS | 5.05 NS | |
| Mean | | | | 23.57 | |

**P. =Probability** ***= Significant** ****= Highly significant**
**NS= non significant** **S.E.=Standard error**

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# العلاقة بين بعض العوامل البيئية واصطياد فراشات ديدان اللوز القرنفلية، الشوكية فى المصائد الفيرمونية

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**معهد بحوث وقاية النباتات -مركز البحوث الزراعية- دقى- جيزة- مصر**

أجريت دراسات حقلية بمنطقة ابوحماد – محافظة الشرقية أثناء موسمين متتاليين ٢٠٠٧ و٢٠٠٨ . وتم زراعة المناطق التجريبية بقطن صنف جيزه ٨٦ لإجراء بعض الدراسات الايكولوجية لديدان اللوز (القرنفلية والشوكية) التي تصيب نباتات القطن.

أشارت النتائج إلي أن المصائد الفيرمونية سجلت خمس قمم لفراشات دودة اللوز القرنفلية خلال موسمى الدراسه على التوالى، كذلك التغير في درجات الحرارة المتجمعة من قمة إلي قمة والتي كانت ٤١٢.٥٠، ٤٣٥.٠٦، ٤٦٠.٩٧ و ٤٦٥.٤٠ فى موسم ٢٠٠٧. وفى الموسم الثانى ٢٠٠٨ كانت٣١٨.٢١ ، ٤٥٩.١٤، ٤٦٣.٧٩ و٤٥٩.٧٦ على التوالي.

أما بالنسبة لدودة اللوز الشوكية فقد سجلت المصائد اربع قمم في موسمي الدراسه. كذلك للتغير في درجات الحرارة المتجمعة من قمة إلي قمة والتي كانت ٥٥٧.٢٦ ، ٧٣٧.٠١ و٦١٠.٣٧ فى موسم ٢٠٠٧. وفى الموسم الثانى ٢٠٠٨ كانت ٦٩٨.٧٨ ، ٧٣٨.٣٧ و٦٠٩.٧٩ على التوالي. وترجع الاختلافات في عدد الاجيال لديدان اللوز القرنفلية والشوكية إلى التغير فى درجات الحرارة والرطوبه النسبيه.

أشارت النتائج إلي أن تأثير عامل الحرارة العظمي والصغرى ومتوسط درجات الحراره والرطوبه على تعداد فراشات دودة اللوز القرنفلية كان منخفضا جداً في الموسم الأول (٦.٤٤٪) ومنخفضا فى الموسم الثانى (٢٨.٨٦٪) وكان للرطوبة النسبية تأثيراً غير معنوياً فى الموسم الاول ومعنوياً فى الموسم الثانى. أما بالنسبة لدودة اللوز الشوكية فقد أشارت النتائج إلى أن تأثير عامل درجة الحرارة العظمى، والصغرى ومتوسط درجات الحراره كان معنوياً فى الموسم الأول وغير معنوياً فى الموسم الثانى، أما تاثير عامل الرطوبه النسبيه فكان غير معنوياً فى موسمى الدراسة على التوالى.

ومما سبق نستخلص ان تعداد فراشات ديدان اللوز تاثر بالتغير فى درجات الحرارة فى الموسم الثانى والتى اثرت بنسبه( ٢٨.٨٦٪) بالنسبة لدودة اللوز القرنفلية ، اما فى حالة فراشات دودة اللوز الشوكيه فنجد من تلك الدراسه ان العوامل البيئية اثرت على اصطياد الفراشات بنسبه (٤١.٩٣ ٪) فى الموسم الأول اما فى الموسم الثانى فكان تأثير تلك العوامل البيئية معتدلا (٢٨.٣٧٪).

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