EFFECT OF CERTAIN ENVIRONMENTAL FACTORS ON *SPODOPTERA LITTORALIS* (BOISD.) AND *HELICOVERPA ARMIGERA* (HÜB.) CAPTURE MALE MOTHS IN RELATIONSHIP TO ACCUMULATED HEAT UNITS

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Abstract

Ecological studies on the cotton leafworm (CLW), *Spodoptera littoralis* (Boisd.) and American bollworm (ABW), *Helicoverpa armigera* (Hüb.) were carried out at Abo-Hammad district, Sharkia governorate, Egypt during two consecutive cotton growing seasons of 2007 and 2008. Results indicated that CLW male moths catch occurred at three peaks during 2007 and 2008 seasons. The accumulated heat units from peak to peak were 619.13 and 648.63 degree-days in the first season, while in 2008 season it was 783.51and 667.91 degree-days. The accumulated heat units from peak to peak of ABW were 469.85 and 739.52 degree-days in the first season, but in 2008 it was 588.03 and 616.40 degree days were required for the development of these three generations.

The effect of maximum, minimum and mean temperatures and R.H. % on the catch of cotton leafworm in pheromone traps was significant during 2007 and insignificant in 2008 season (44.20 and 22.81%). Also, the relative humidity showed insignificant effect in the 1st season and significant in the second one. While, the effect of max., mini. and mean temp. showed insignificant effect in the 1st and 2nd seasons except, the maximum temperature caused significant effect in the 2nd season, respectively. While the mean % RH showed significant effect in the 1st season and insignificant effect in the 2nd season. The effect of all weather factors on catch of American bollworm male moths were positive and insignificant at the two seasons, except mean of % R.H. was negative in the 1st season. On the other hand, the all weather factors showed lowest influence on American bollworm in 2007 season. Whereas, at the second season it caused moderately influence (7.89 and 25.71%, respectively.

From the previous results it could concluded that the population density of both CLW and ABW male moths were affected with changes in weather factors (temperature and % relative humidity) and can be used to forecasting the population of both these pests.

INTRODUCTION

Cotton leaf worm (CLW), *S. littoralis* (Boisd.) and the american bollworm (ABW), *H. armigera* (Hüb.) (Lepidoptera: Noctuidae) are the major insect pests destructive cotton fields in Egypt. It occurrence covers all cultivated areas. (Dahi,

1997) indicated that CLW moths recorded three overlapping generations in the cotton fields and stated that the lower threshold of development (t_0) of to complete their generation was 10.14 °C. The american bollworm has been recently considered as one of the serious insect pests in Egypt. It caused severe damage to different crops especially cotton, sweet pepper, tomato and other vegetable plantations. The fluctuations in the acuteness of its attack and in its population density depend on ecological and physiological factors, which, up to the present, are not precisely determined. The ABW is a polyphagous pest causing extensive damage on many crops such as cotton, okra and tomato (Sharma, 2001). Amer 2004 stated that ABW had three generations in the cotton fields, while the effect of max. and mini. temp. in the fluctuations in trap moths was positive and highly significant effect ,but the effect of percentage R.H. was insignificant, and the explained variance was positive and highly significant. Amer *et al.* 2009 indicated that the lower thermal threshold for generation of ABW was 11.54 °C and the thermal constant was 494.39 DD's. The obtained results are essential information for predicting the field population.

El-Sayed, *et al.* 2009 recorded three peaks of ABW on the okra and cotton plants in the fields. Numerous studies have been carried out on the population activity of these insect 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 (Amer 2004).

The present study aimed to throw light on the relative abundance of the studied insect pests and clarify the role of temperature and relative humidity as well as their simultaneous effects on the occurrence of these pests during the two successive cotton growing seasons 2007 and 2008.

MATERIALS AND METHODS

Field trials were carried out during two cotton growing seasons of 2007 and 2008 at Abo-Hammad, district Sharkia governorate, Egypt to study the seasonal ecological effects on CLW and ABW. The experimental area was cultivated with the Egyptian cotton, *Gossypium barbadence* Giza 86 variety that sown at 20th and 27th March during the two seasons, respectively. The cotton areas were subjected to normal agricultural practices allover the two seasons of study.

The seasonal fluctuation of the cotton leafworm and american bollworm were

studied by using pheromone traps. Two isolated areas of five feddans each, far from each other by a distance of about 250 meter were chosen at the site of experiment. Yellow water traps baited with pheromone capsules of the cotton leafworm and american bollworm were placed in cotton fields and were hanged on a wooden stand of 2 m height, placed 30 cm above the ground and about 10-15 cm above the canopy in cotton plants allover seasons. Three traps were allocated randomly in each area, one trap /1.50 feddan. The traps were installed from 29th March until 4th October in 2007 and 2008 seasons of CLW and from end April until 7th October in 2007 season, while it was installed from10th May until 4th October in 2008 season of ABW. Weekly examination of traps were done and the captured male moths were recorded. The pheromone capsules were changed every 15 days. The traps position was adjusted according to the plant high. The values of weather factors, maximum, minimum, mean temperature and relative humidity, were obtained from Weather Meteorology Station, Cairo, Egypt. Capture male moths were correlated with weather factors. Each factor alone and the combined effect (Explained Variance E.V. %) were used. The degree days were calculated according to Seaver *et al.* 1990. The lower and upper temperature thresholds of ABW were 11.54 and 30 °C according to Amer *et al.* 2009. The accumulated heat units were calculated from 1st January in both seasons. Full model of partial regression and multiple correlations were established. The analysis of variance was computed by using Costat Software Computer program (1990).

RESULTS AND DISCUSSION

Seasonal population fluctuation of the cotton leafworm and american bollworm male moths by using sex pheromone traps

1-The cotton leafworm, *S. littoralis*

Data given in Tables (1 and 2) revealed that the population size of CLW moths varied from season to another. The activity period of male moths started at 5th April in 2007 and 2008 seasons, respectively with averages of 2.67 and 3.00 males/trap/week, respectively. Three peaks were recorded in cotton 2007 season at the 31st May, 5th July and 9th August with means numbers of 290.00, 45.00 and 55.33 males /trap/week at 29.00, 31.36 and 30.24 °C mean temperature and 54.00, 64.68 and 67.29 % R.H. In the second season of 2008, three peaks were occurred at 7th June (253.67 males/trap/week), 19th July (182.00 males/trap/week) and 23rd August

(113.00 males/trap/week). The peaks were existed under the condition of 28.09, 31.12 and 31.57 °C of mean temperature and 59.57, 65.14 and 67.00 % R.H.

1.1.Relationship between accumulated heat units and catch of the cotton leafworm moths

Results in Tables (1 and 2) indicated that three peaks were recorded in 2007 season and appeared after the accumulation of 1220.32, 1839.45 and 2488.08 heat units, while the accumulated heat units from peak to peak were 619.13 and 648.63units. In the second season of 2008, three peaks were appeared after the accumulation of 1415.89, 2199.40 and 2734.31 units, while the accumulated heat units from peak to peak were 783.51and 667.91units were required for the development of these three generations.

Generally, the weekly mean number of male caught was varied significantly from season to another, where the seasonal mean numbers of trapped males were (44.85 and69.42 males/trap /week) during 2007 and 2008 seasons, respectively.

The results are in agreement with those obtained by many authors (Dahi, 1997) who indicated that CLW moths were recorded three overlapping generations in the cotton fields and stated that the lower threshold of development t_0 of to complete their generations were 10.14 °C . Dahi, 2005 stated that, the average of accumulated heat units required for the generation of CLW was 523.27 DD's.

Table 1. Seasonal population fluctuation of *S. littoralis* male moths and accumulated heat units counts at Abou-Hammad region Sharkia governorate during 2007 season.

Date		Mean No.	A H P	A*	Temperature			% R H
					Max.	Mini.	Mean	
5	April	2.67	468.91		32.6	19.1	25.85	56.90
12		3.00	542.02		31.27	17.70	24.17	56.14
19		1.33	629.66		30.23	16.26	23.24	58.14
26		2.33	712.51		28.19	15.16	21.89	59.71
3	May	5.33	804.70		29.6	17.19	23.39	55.29
10		106.67	903.20		31.56	18.07	24.86	54.86
17		138.00	994.41		29.57	16.86	23.00	55.86
24		165.00	1099.45		33.86	18.43	26.16	54.86
31		290.00	1220.32		35.43	22.57	29.00	54.00
7	June	116.00	1345.40		36.91	24.29	30.6	62.57
14		56.67	1451.05		29.89	21.43	25.66	62.57
21		12.00	1575.02		33.56	25	29.28	58.43
28		16.67	1707.17		35.58	26.93	31.26	60.71
5	July	45.00	1839.45	**619.13**	36.24	26.44	31.36	64.86
12		12.00	1970.90		35.53	26.29	30.91	65.00
19		5.67	2101.56		33.51	26.43	29.97	67.71
26		7.00	2229.75		34.10	25.34	29.72	67.00
2	Aug.	25.33	2358.04		35.23	25.11	30.17	67.43
9		55.33	2488.08	**648.63**	34.63	25.86	30.24	67.29
16		33.33	2616.56		34.14	25.43	29.79	65.86
23		25.00	2747.57		35.86	26	30.93	66.86
30		17.67	2876.25		35.03	25.29	30.16	66.29
6	Sept.	13.00	2998.51		32.47	24.06	28.26	62.86
13		13.33	3124.65		34.84	24.50	29.67	63.86
20		12.33	3248.76		33.10	24.31	28.71	64.86
27		10.17	3371.77		32.93	24.14	28.54	64.14
4	Oct.	10.00	3485.62		30.23	20.44	25.34	61.71
Total		**1210.83**						
Mean		**44.85**						

A. H P.= Accumulated heat units, cotton leafworm

A.*=Account Heat units from peak to peak of cotton leafworm

Table 2. Seasonal population fluctuation of S. littoralis male moths and accumulated heat units counts at Abou-Hammad region Sharkia governorate during 2008 season.

Date		*Spodoptera littoralis*			Weather factors			
		Mean No.	A H P	A*	Temperature			% R H
					Max.	Mini.	Mean	
5	April	3.00	480.82		29.70	13.00	21.35	59.20
12		3.00	558.38		29.57	14.29	21.93	59.00
19		4.00	642.90		28.14	15.50	21.82	57.43
26		2.67	731.32		28.86	12.86	20.86	56.57
3	May	5.33	834.04		31.07	15.46	23.26	54.00
10		10.67	948.93		35.63	20.86	28.16	53.86
17		71.76	1056.70		32.11	20.36	26.24	55.57
24		138.33	1174.52		34.97	22.06	28.51	56.43
31		217.67	1297.59		36.23	23.24	29.74	58.57
7	June	253.67	1415.89		34.00	22.19	28.09	59.57
14		150.33	1540.66		35.84	24.09	29.96	57.71
21		61.33	1669.14		36.14	25.26	30.70	60.00
28		40.00	1802.03		39.49	26.44	32.96	57.43
5	July	72.33	1934.62		35.30	26.91	30.11	64.29
12		108.00	2067.57		36.29	26.69	31.49	64.57
19		182.00	**2199.40**	**783.51**	35.97	26.27	31.12	65.14
26		101.67	2334.30		38.19	27.35	32.77	66.00
2	Aug.	75.33	2466.35		37.46	26.76	32.11	67.57
9		25.67	2600.02		35.54	27.10	31.32	67.71
16		55.67	2734.31		36.46	27.24	31.85	69.00
23		113.00	**2867.31**	**667.91**	36.43	26.71	31.57	67.00
30		72.00	3003.91		37.41	27.79	32.6	64.86
6	Sept.	60.67	31.37.91		35.64	27.69	31.66	68.71
13		21.33	3265.19		34.80	25.03	29.91	64.14
20		10.00	36392.20		34.46	24.84	29.65	64.57
27		8.00	3515.85		33.20	24.14	28.67	64.93
4	Oct.	7.00	3640.30		31.10	22.80	27.00	61.40
Total		**1874.45**						
Mean		**69.42**						

A. H P.= Accumulated heat units, cotton leafworm

A.*=Account Heat units from peak to peak of cotton leafworm

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

1.2.1. Effect of maximum temperature

Results given in Table (3) revealed that negative and insignificant relationship in 2007, while positive and significant correlation in 2008 (r=-0.0737 and 0.4430) between max. temp. and mean number of captured males of moths, while simple regression values recording insignificant and significant regression (3.35 and 24.86 %) in the first and second seasons, respectively.

1.2.2. Effect of minimum temperature

The statistical analysis given in Table (3) revealed that negative and insignificant relationship in 2007, while positive and insignificant correlation in 2008 (r=-0.1511 and 0.3591) between minimum temp. and mean number of captured males of moths, while simple regression values recording insignificant (12.93 and 21.46 %) in the two seasons of study.

1.2.3. Effect of mean temperature

Data in Table (3) indicated positive and insignificant relationship (r=0.2010) in 2007, but in 2008 it was positive and significant (r=0.4045) between mean temp. and mean caught males, while for simple regression values were insignificant in the two seasons of study (4.56and 21.74%), respectively.

1.2.4. Effect of daily mean relative humidity

The relationship between the mean relative humidity and the changes in the population density of *S. littoralis* was negative and significant during 2007, while positive and insignificant in 2008. Accordingly, the relative humidity had pronounce effect on the population activity of this pest in the first season, but in 2008 it caused insignificant effect. (Table,3). Simple regression values were highly significant in 2007 and insignificant in 2008 (39.21 and 4.43%), respectively.

1.2.5. Combined effect of the weather factors

Data in Table (3) showed that the simple regression values of the four weather factors were highly significant influence during 2007 season (44.20 %) and insignificant influence in the second season (22.81%), respectively.

Also, results indicated that, the average number of the all weather factors were 15.01 and 18.12 in the two seasons, respectively.

Gergis *et al.* (1994) in Egypt, investigated the relationship between temperature and developmental rate of *S. littoralis* life sequenced on cotton under field conditions. They found high accurate relationship between temperature and rate of development.

Table 3. Simple correlation (r) and multiple regression for the number of captured male moths of the, *S. littoralis* during 2007 and 2008 seasons.

Weather factors	2007 season				
	Simple correlation	SE	P	Regression	
				Simple %	Multiple E.V.%
Max. temp.	-0.0737	0.199	Ns	3.35 ns	44.20**
Mini temp.	-0.1511	0.1977	Ns	12.93 ns	
Mean temp.	0.2010	0.1999	Ns	4.56 ns	
Mean RH%	-0.4685	0.1767	*	39.21**	
Average				15.01	
	2008 season				
Max. temp.	0.4430	0.1793	*	24.86*	22.81ns
Mini temp.	0.3591	0.1867	Ns	21.46 ns	
Mean temp.	0.4045	0.1829	*	21.74 ns	
Mean RH%	0.0621	0.1996	ns	4.43 ns	
Average				18.12	

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

2-The american bollworm, *H. armigera*

The results in Tables (4 and 5) clearly indicated that the ABW numbers was very low and recorded three peaks of activity during 2007 and 2008 seasons.

In 2007 season, the first peak was occurred at 3rd of June with (18.66 moth/trap/week) at 28.32 °C mean temp. and 54.79 % R.H., the second peak recorded (6.66 moths/trap/week) at 31.26 °C mean temp and 63.71 % R.H. at the first of July in 2007 season and (5.66 moths/trap/week) in the 12th August recorded at 30.31 °C mean temp. and 66.14 % R.H. In 2008 season the 1st peak recorded (6.66 moth/trap/ week) at (28.30 °C mean temp. and 58.57 % R.H. on 31st May, while the second peak recorded (10.00 moths/trap/week) at 31.30 °C mean temp and 63.57 % R. H. on 5th July. The third peek recorded (5.66 moths/trap/week) in the 9th August at 31.33 °C mean temp and 67.71 % R.H. While the relatively low seasonal mean number of 1.69 and 1.78 males /trap /week recorded during the two seasons of study, respectively.

2.1. Relationship between accumulated heat units and catch of the American bollworm moths

Results in Table (4 and 5) indicated that three peaks were recorded in 2007 season that appeared after the accumulation of 1163.88, 1633.73 and 2373.25 heat units, while the accumulated heat units from peak to peak were 469.85 and 739.52 units. In the second season of 2008, also, population recorded three peaks that

appeared after the accumulation of 991.33, 1579.36 and 2195.76 heat units, while the accumulated heat units from peak to peak were 588.03 and 616.40 units which required for the development of these three generations of american bollworm.

These results agree with the obtained by (Bekheit, 1992) who stated that the highest peak of *H. armigera* moths was during June and July. Bhadairia and Bhadairia, 1998 found five peaks of *H. armigera*, Srivastava and Srivastava, 1989 recorded three periods of *H. armigera* moths activity during the period of study 1987-1988. Amer, 2004 found that male moths of *H. armigera* started to attract by sex pheromone traps on the 3rd week of April with about 0.8 male moths/trap/week and the 1st week of April with about 0.6 male moths/trap/week during 2000 and 2001 seasons, respectively. After wards, the insect population fluctuated during the two seasons. The highest peak occurred at the 1st week of August in both season.

Table 4. Seasonal population fluctuation of *H. armigera* male moths and accumulated heat units counts at Abou-Hammad district Sharkia governorate during 2007 season.

Date		Mean No.	A H P	A*	Temperature			% R H
					Max.	Mini.	Mean	
6	May	0.66	714.09		30.44	19.94	23.16	54.71
13		0.00	828.94		30.14	17.97	24.74	55.40
20		0.00	943.01		30.17	16.0	24.58	55.71
27		0.66	1056.37		30.14	20.94	28.32	53.87
3	June	18.66	1163.88		34.02	22.46	28.32	54.79
10		0.00	1273.62		34.71	22.66	28.97	61.71
17		0.00	1387.42		28.89	24.2	33.64	62.29
24		0.00	1509.15		34.81	27.57	25.90	57.29
1	July	6.66	**1633.73**	469.85	36.81	26.39	31.26	63.71
8		3.00	1756.43		35.66	27.24	31.89	65.29
15		0.00	1878.55		35.13	25.57	31.33	66.14
22		0.00	2001.51		33.43	26.36	29.93	67.00
29		1.00	2128.74		34.50	25.03	30.33	67.71
5	Aug.	2.66	2249.32		35.33	25.31	26.93	67.43
12		5.66	**2373.25**	739.52	34.44	26.16	30.31	66.14
19		0.00	2497.27		35.02	25.00	30.32	66.14
26		0.00	2621.00		35.91	26.03	31.0	66.29
2	Sept.	0.00	2746.64		33.81	24.96	23.39	63.71
9		0.00	2870.05		33.74	23.89	28.84	62.43
16		0.00	2985.72		33.0	24.70	28.96	65.43
23		0.00	3102.94		32.08	27.57	28.71	64.71
30		0.00	3211.55		30.5	23.33	27.83	64.17
7	Oct.	0.00	3327.34		31.29	24.10	28.27	64.16
Total		**38.96**						
Mean		**1.69**						

A. H P.= Accumulated heat units, *Helicoverpa armigera*

A.*=Account Heat units from peak to peak of *Helicoverpa armigera*

Table 5. Seasonal population fluctuation of H. armigera male moths and accumulated heat units counts at Abou-Hammad district Sharkia governorate during 2008 season.

Date		Mean No.	A H P	A*	Temperature			% R H
					Max.	Mini.	Mean	
17	May	0.00	770.04		32.11	20.16	26.17	55.57
24		0.00	878.06		34.82	22.06	28.53	56.43
31		6.66	**991.33**		36.34	23.24	28.30	58.57
7	June	0.00	1099.83		34.00	22.18	28.09	59.57
14		0.00	1214.80		35.84	24.09	29.97	57.71
21		0.00	1333.47		36.14	25.26	30.75	60.00
28		1.66	1456.56		39.49	27.37	32.99	57.43
5	July	10.00	**1579.36**	**588.03**	35.26	26.91	31.30	63.57
12		2.00	1702.53		31.20	26.69	31.54	64.57
19		0.00	1824.54		35.97	26.27	31.03	65.14
26		0.00	1949.64		38.19	27.79	32.99	66.00
2	Aug.	5.00	2071.89		37.46	27.19	32.86	67.64
9		5.66	**2195.76**	**616.40**	35.54	27.14	31.33	67.71
16		2.33	2320.25		36.46	27.24	31.70	69.00
23		0.00	2443.45		36.43	26.71	32.89	67.00
30		0.00	2569.40		37.41	27.78	32.59	64.86
6	Sept.	0.00	2694.45		35.64	27.69	31.99	66.71
13		0.00	2811.93		34.90	25.03	29.97	64.14
20		0.00	2929.14		34.33	24.84	29.70	64.57
27		0.00	30.42.99		33.77	24.21	29.01	64.93
Total		**35.64**						
Mean		**1.78**						

A. H P.= Accumulated heat units, *Helicoverpa armigera*
*=Account Heat units from peak to peak of *Helicoverpa armigera*

2.1. Effect of certain weather factors on the population activity of the american bollworm caught males

Data in Table (6) indicated that, simple correlation (r) and multiple regression for the number of captured male moths of *H. armigera* by sex pheromone traps under weekly mean of temp. (max., mini. and mean) and R.H. percentage during 2007 and 2008 seasons were insignificant.

Combined effect of the weather factors, Data in Table (6) showed that the simple regression values of the four weather factors averaged 10.71 and 16.83 % during the two seasons of study. Also, results revealed that the all weather factors showed slight effect on the appearance of insect in 2007, while in 2008 it showed relative effect on male moths in traps (7.89 and 25.71%), respectively.

These results partially agree with the findings of Khan *et al.* 2003 who found positive correlation between infestation of ABW and weather factors (temperature and relative humidity). Amer, 2004 found that the effect of max. and mini temp. on the fluctuations in the number of trapped moths was positive and highly significant in 2000 and 2001 seasons. While the effect of mean daily relative humidity showed and insignificant correlation during the two seasons of study. On the other hand, explained variance by the effect of combined three weather factors was positive and highly significant in 2000 and 2001 seasons. Nada *et al.* 2004 found that the population of *H. armigera* at Dakahlia in Egypt had three and four peaks and the days from peak to peak ranged between 30-33 days, also, heat units between 440-486 units. Parajulee, *et al.* (2004) showed a significant positive relationship between moth abundance and average weekly temperatures, whereas a significant negative relationship was observed between moth abundance and average weekly wind velocity of both species *H. zea and H. virescencs* Also, showed a positive correlation between moth abundance and cumulative degree- days 1 January. Average weekly abundances were positively correlated between adjacent months during most of the active fruiting season (June-September).

Table 6. Simple correlation (r) and multiple regression for the number of captured male moths of the, *H. armigera* during 2007 and 2008 seasons.

Weather factors	2007 season				
	Simple correlation	SE	P	Regression	
				Simple	Multiple E.V.%
Max. temp.	0.1734	0.2149	NS	6.13 NS	7.89
Mini temp.	0.2271	0.2125	NS	22.63 NS	
Mean temp.	0.2275	0.2126	NS	8.63 NS	
Mean RH%	-0.0455	0.2177	NS	5.53 NS	
Average				10.71	
	2008 season				
Max. temp.	0.0796	0.2287	NS	13.30 NS	25.71
Mini temp.	0.3043	0.2185	NS	14.67 NS	
Mean temp.	0.3686	0.2133	NS	22.37 NS	
Mean RH%	0.3331	0.2163	NS	16.96 NS	
Average				16.83	

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

REFERENCES

1. Amer, A. E. A. 2004. Ecological and physiological Studies on bollworms. Ph. D. Thesis, Fac. of Agric., Moshtohor Branch, Zagazig Univ., Egypt. 213 pp.
2. Amer, A.E.A., A.A.A. El-Sayed and M.A. Nada. 2009. Development of american bollworm, *Helicoverpa Armigera* (Hübner) (Lepidoptera: Noctuidae) In Relation To Heat Unit Requirement. Egypt. J. Agric. Res.,87 (3):667-674.
3. Bekheit, H. K. M. 1992. Toxicological studies on bollworms. Ph.D. Thesis, Fac. Agric. Zagazig Univ.
4. Bhadairia, N. K. S. and N. S. Bhadairia. 1998. Seasonal population of grain borer, Heliothis armigera (Hüb.).Advances in Plant. Sci.,11 (2),283-285.
5. Costat, S. 1990. Microcomputer program analysis, version4-20 CoHort Software, Berkly CA, USA.
6. Dahi, H. F. 1997. New approaches for management the population of cotton leaf worm, *Spodoptera littoralis* and pink bollworm, Pectinophera gossypiella. In Egypt. M. Sc. Thesis, Fac. of Agric., Cairo University, Egypt.
7. Dahi H. F. 2005. Egyptian cotton leafworm *Spodoptera littoralis* development on artificial diet in relation to heat units requirements. Egypt. J. Agric. Res.,83 (1):199-209.

8. El-Sayed, A.A.A., Merfat A. Kandil and A.E. Amer. 2009. Seasonal fluctuation of *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) on cotton and okra and heat units related. Egypt. J. Agric. Res., 87(4):909-921.
9. Gergis, M. F., M. A. Rizk, M. A. Makadey and A. Hussein. 1994. Relationship between temperature and rate of development of cotton leaf worm, *Spodoptera littoralis*. Miniaj. Agric. Res. & Dev., 14 (2):235-243
10. Khan, B.S., M. Afzal and M.A. Murtaza. 2003. Effect of abiotic factors against the infestation of American bollworm *Helicoverpa armigera* (Hubner) on different varieties of cotton under unsprayed conditions. Journal of biological Sciences, 3(1):82-85.
11. Nada, M. A., M. G. Ragab and E. S. Mansour. 2004. Seasonal abundance and prediction possibility of American bollworm, *Helicoverpa armigera* (Hub.) in relation to pheromone trap catches and heat unit accumulated. Egypt. J. Appl. Sci, 19 (11): 294-409.
12. Parajulee, M. N., D. R. Rummel, M. D. Arnold and S. C. Carroll. 2004. Long –term seasonal abundance patterns of *Helicoverpa zea* and *Heliothis virescens* (Lepidoptera: Noctuidae) in the Texas High Plains. J. Entomol., 97 (2):668-77.
13. Seaver, D., J. Strand and A. J. Strawn. 1990. DDU degree-day utility users guide version 2.0, Univ. of California Division of Agriculture and Natural Resources UCIPM Publication 9, Integrated Pest Management Program, Univ. of California, Davis.
14. Sharma, H. C. 2001. Cotton bollworm/ legume pod borer, *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) biology and management. International Institute for Semi-Arid Tropics, India.
15. Srivastava, C. P. and R. P. Srivastava. 1989. Comparison of *Heliothis armigera* (Hubner) male moth catches in light and pheromone traps at Udaipur, Rajasthan, India. Insect Sci., Applic., 10 (5): 565-568.

تأثير بعض العوامل البيئية على اصطياد ذكور فراشات دودة ورق القطن ودودة اللوز الأمريكية وعلاقتها بالوحدات الحرارية المتجمعة

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أجريت دراسات حقلية في قرية عمريط بمنطقة ابوحماد –محافظة الشرقية أثناء موسمي ٢٠٠٧و٢٠٠٨ . وتم زراعة المناطق التجريبية بقطن مصرى صنف جيزه ٨٦ لإجراء بعض الدراسات الايكولوجية لدودة ورق القطن ودودة اللوز الامريكية التي تصيب نباتات القطن.

أشارت النتائج إلي أن المصائد الفيرمونية سجلت ثلاث قمم لفراشات دودة ورق القطن وكانت تلك القمم كالتالى (٢٩٠,٠٠ ، ٤٥,٠٠ و٥٥,٣٣ فراشة/ مصيده/اسبوع) فى اخر مايو ،٥ يوليو و٩ اغسطس ٢٠٠٧ ، بسبب التغير في الوحدات الحرارية المتجمعة من قمة إلي قمة (٦١٩,١٣ و٦٤٨,٦٣) . بينما في موسم ٢٠٠٨ كانت تلك القمم كالتالى (٢٥٣,٦٧ ، ١٨٢,٠٠ و١١٣,٠٠فراشة/ مصيده/ اسبوع) فى اول يونيو ،١٩ يوليو و٢٣ اغسطس و كان التغير في الوحدات الحرارية المتجمعة من قمة إلي قمة علي النحو التالي (٧٨٣,٥١ و٦٦٧,٩١) .سجلت المصائد ثلاث قمم لدودة اللوز الامريكية خلال موسمى الدراسه وكانت تلك القمم كالتالى (١٨,٦٦ ، ٦,٦٦ و٥,٦٦ فراشة/مصيد/ اسبوع) عند ٣ يونيو ،اول يوليو و١٢ اغسطس) . وكان التغير في الوحدات الحرارية المتجمعة من قمة إلي قمة (٤٦٩,٨٥ و٧٣٩,٥٢) .قد ترجع الاختلافات في عدد اجيال دودة ورق القطن الى التغير فى درجات الحرارة والرطوبه النسبيه.

أشارت النتائج إلي أن تأثير عامل الحرارة العظمي على اصطياد فراشات دوة ورق القطن كان منخفضا فى الموسم الاول ومرتفعا فى الموسم الثانى ،بينما تاثير عامل الحرارة الصغرى كان منخفضا فى كلا الموسمين على التوالى ،كما اوضحت النتائج ان تاثير متوسط درجات الحرارة كان منخفضا فى الموسم الاول ومرتفعا فى الموسم الثانى ،وعلى الجانب الاخر اوضحت النتائج ان تاثير الرطوبة النسبية كان منخفضا فى كلا الموسمين على التوالى. اما التاثير الكلى لعوامل الطقس المدروسة كان مرتفعا فى الموسم الاول ومنخفضا فى الموسم الثانى (٤٤,٢٠ و٢٢,٨١ %) على التوالى

أشارت النتائج الى ان تأثير عامل درجة الحرارة والرطوبه النسبيه على اصطياد فراشات دودة اللوز الامريكية كان غير معنوياً فى موسمي الدراسة . بالنسبه للتاثير الكلى للعوامل البيئية على اصطياد الفراشات كان ضعيفاً جدا خلال الموسم الاول (٧,٨٩ %) ومعتدلا فى الموسم الثانى (٢٥,٧١ %).

مما سبق نستخلص أن تعداد كل من فراشات دودة ورق القطن ودودة اللوز الأمريكية قد تأثرا بالتغير فى درجات الحرارة فى موسمى الدراسة، كما نستخلص كذلك إمكانية التنبؤ بتعداد كل من دودة ورق القطن ودودة اللوز الامريكية فى حقول القطن للسيطرة عليهما .