J. Plant Prot. and Path., Mansoura Univ., Vol.6 (10): 1415 - 1425 ,2015

SEASONAL FLUCTUATION OF THE SPINY BOLLWORM, *Earias insulana* (BOISD.) ON SOME HOST PLANTS

Amer, A. E. A.; A.A.A. EL-Sayed and M.S. Hashem
Plant Protection Research Institute, Agriculture Research Center, Dokki, Egypt

ABSTRACT

The seasonal fluctuation of the spiny bollworm (SBW), *Earias insulana* (Boisd.), (moths and larvae) was detected on cotton*, Gossypium barbadens*e L., okra, *Hibiscus esculentus* L. and maize, *Zea maize* L. at Minia Elkamah district, Sharkia Governorate during 2013 and 2014 seasons. Results revealed that the population of SBW male moths recorded four peaks on cotton and okra each season , the fourth peak appeared the highest numbers on the 2nd & 3rd and 3rd & 4th weeks of October with 39 & 57 and 45 & 65 moths/trap/week in the two cotton and okra seasons, respectively. While, on maize, the population of moths recorded two peaks with 7&11 and 10&13 moths /trap/ week in first sowing date and one peak with 30 and 40 moths /trap/ week in second sowing date during the two seasons, respectively. The infestation percentage by the SBW larvae was recorded two peaks in cotton at 4th week and 3rd week of August and 2nd and 3rd weeks of October and three peaks in okra at 4th and 2nd week of June, 2nd week of September and 3rd week of November; the second peak in cotton (26.0 and 19.0 %) and third peak in okra (33.0 and 37.0 %) were the highest than other during the two seasons, respectively. While, the highest infestation percentage by the SBW larvae which attack maize was recorded in 3rd week of August with 3.0 and 4.0% and 3rd week of November with 5.0% in the first and second sowing date during the two seasons, respectively. The infestation by the SBW larvae and the population of SBW male moths captured in sex pheromone traps were highest on okra followed by cotton and maize. The population of SBW moth catches was negatively correlated with mean of temperature and positively correlated with mean of relative humidity in 2013 and 2014 seasons. This study play an important role in determine timing to control of the SBW.

Keywords: seasonal fluctuation*, Earias insulana* and host plants

INTRODUCTION

The spiny bollworm*, Earias insulana* (Boisd.) is a major pest of cotton, okra and maize in Egypt Abul-Nasr, *et al.* (1972) and Khidr *et al.* (1990). Okra was preferred the cotton towards the end of season when the cotton bolls surface was hard. *E. insulana* eggs were found to be laid on any part of the husk and the larvae, which make their way through the husk, feed on kernels and their placenta causing an infestation which reach 36% of the crop (Mettwally and Mabrouk, 1959). Nada *et al.* (2009) revealed that the population of *E. insulana* male moths showed five and four peaks on cotton during the two seasons, 2007 and 2008, respectively. Al-Shannaf and Hegab (2010) found that the spiny bollworm male moths recorded five peaks during 2007 and 2008 seasons. Nada *et al.* (2010) recorded that the spiny bollworm larval infestation had three peaks in cotton. Occurrence period of larval infestation on cotton terminal shoots and fruit structures extended from

mid May to the end of September. In the maize the spiny bollworm larval infestation period extended from end July to end of September with one peak, while, in okra it appeared from first week of August till 4th week of October with two peaks. Dhawan and Sidhu (1984) the maximum damage of *Earias spp* was 67.7 and 52.4% for fruits and buds, respectively in end October. The maximum damage to shoots was 1.7% and 1.5% for flowers occurred in mid August. The population of *Earias spp.* increased slowly until to mid-September and rapidly there after. Qureshi and Ahmed (1991) the larval population in the fruiting bodies of cotton and the moth counts in pheromone traps increased with the developmental stages of the crop. The peak of moth and larval infestation of spotted and spiny bollworms was observed in August and October, respectively. Dhawan and Simwat (1996) revealed that in India, a negative and significant correlation was observed with weather parameters (Temp.°C, RH % and wind) except for maximum temperature where it was positive. Dhaka and Pareek (2008) the minimum temperature and relative humidity (RH) had negative significant effect on all the three bollworms, during 2001 only. Patel (2015) cleared that the maximum temperature and evening relative humidity had significant negative and significant positive influence on *E. vittella* population.

The aim of this work was to study the seasonal fluctuation of *E. insulana* on some host plants by using the pheromone traps and infestation percentages.

MATERIALS AND METHODS

The present study was carried out at Minia Elkamah district, Sharkia Governorate, within an assemblies of cotton, about five feddan, cultivated at first week of April, okra two feddan cultivated at fourth week of March and the maize was cultivated on tow dates in the year (about five and two feddan in the first and second sowing date), the first at 4th week of May and the second at 1st week of September during 2013 and 2014 seasons, respectively. The experimental area was subjected to normal agricultural practices at critical growth stages.

Three pheromone traps (funnel traps) were fixed in cotton, maize and okra fields throughout a period extended from first week of June to the fourth week of October in cotton field and the fourth week of November in maize and second week of November in okra fields during 2013 and 2014 seasons. The pheromone capsule was changed every two weeks. The numbers of *E. insulana* male moths caught was recorded weekly.

Plant samples:

One hundred cotton buds were collected weekly from first week of June tell the second week of July after that one hundred cotton bolls were collected weekly until third week of October. The buds and bolls were investigated and the number of the spiny bollworm was recorded. One hundred pods of okra were collected weekly from first week of June tell second week of November. The okra pods were investigated and the spiny bollworm was recorded. One hundred ears of maize were investigated visually during fourth week of July

until fourth week of August at first sowing date and from fourth week of October till the fourth week of November at second sowing date and the number of the spiny bollworm were recorded.

Statistical analysis

Daily mean temperatures and RH during 2013 and 2014 were obtained from Agricultural Research Center (ARC), Meteorological Central Laboratory. The multiple regression and simple correlation between daily mean temperatures & RH and the spiny bollworm pheromone trap catches were calculated as described by Little and Hills (1975).

RESULTS AND DISCUSSION

Pheromone traps:

1- On cotton

Data in Table (1) and Fig. (1) showed that the numbers of the spiny bollworm male moths captured by the sex pheromone traps throughout the period from June, 7th to the October, 25th on cotton. The spiny bollworm moths had four peaks during 2013 and 2014 seasons. The first capture was recorded at the second and first week of June during the two seasons, respectively. The number of the spiny bollworm male moths increased slightly until reaching the first peak on 3rd week of June with 5 and 7 male moths/trap/week. The second peak recorded on 4th week of July with 13 and 15 male moths/trap/week, respectively. The third peak recorded on 4th week of August with 19 and 20 male moths /trap/ week, respectively. The fourth peak was the highest numbers during the two seasons recorded 39 and 57 male moths/trap/week during 2nd and 3rd week of October, respectively.

On maize:

Data in Table (1& 2) and Fig. (1& 2) cleared that the numbers of the spiny bollworm male moths captured in the sex pheromone traps throughout the period from June, 7th to the November, 29th on maize (during the first and second date). The spiny bollworm moths had three peaks during of 2013 and 2014 seasons, two peaks during the first sowing date and one peak during the second sowing date each season. The last peak was the highest one during the two seasons. The spiny bollworm male capture was low before ears maize appearance and increased to record the first beak during 4th week of July with 7 and 11 male moths/trap/week during the two seasons, respectively. While, the second peak recorded on 4th and 3rd weeks of August with 10 and 13 male moths/trap/week during the two seasons, respectively The captured was decreased during the period between first and second sowing date and return to increased gradually after the second sowing date till recorded the highest peak during 3rd and 4th weeks of October with 30 and 40 male moths/trap/week during the two seasons.

On okra plants:

Data in Table (1) and Fig. (1) indecated the numbers of the spiny bollworm male moths captured in the sex pheromone on okra. The spiny bollworm moths had four peaks during of 2013 and 2014 seasons the fourth peak was the highest one during the two seasons. The number of the spiny

bollworm male moths increased slightly until recorded the first peak on 3rd week of June with 4 and 8 male moths/trap/week, respectively. The second peak of capture was recorded on 4th week of July with 9 and 18 male moths/trap/week, respectively. The third peak was recorded 18 and 25male moths/trap/week during 4th week of August, respectively. The fourth peak was recorded 45 and 65male moths/trap/week during 2nd and 3rd week of October, respectively.

Table (1): Number of *E. insulana* male moths caught by sex pheromone traps on different host plants and the infestation percentage during 2013.

Dates	Mean number of male moths/trap/week			Infestation percentage		
	Cotton	Maize	Okra	Cotton	Maize	Okra
07/06/	0	1	0	0		0
14/06/	1	0	1	0		1
21/06/	5	0	4	0		3
28/06/	3	1	2	0		1
05/07/	2	0	3	0		1
12/07/	2	0	4	1		0
19/07/	4	3	9	0		0
26/07/	13	7	5	0	1	1
02/08/	8	4	6	1	2	1
09/08/	5	2	7	0	1	1
16/08/	4	2	8	1	3	2
23/08/	19	10	18	4	1	4
30/08/	14	6	15	7	0	4
06/09/	12	5	11	5		5
13/09/	15	4	17	5		7
20/09/	17	2	19	7		4
27/09/	22	3	29	10		5
04/10/	28	6	40	14		12
11/10/	39	22	45	26		14
18/10/	37	30	44	21		21
25/10/	35	27	33	15	2	22
01/11/		21	24		3	26
08/11/		9	16		1	31
15/11/		10	10		5	33
22/11/		10			1	
29/11/		14			0	
Total	285	199	370	117	20	199
Total	854					
% form total	33.37	23.30	43.32	5.57	1.66	8.29

Generally, the population of the spiny bollworm was high on okra during the two season recorded flowed by cotton and maize. The male moths captured on okra was recorded 43.32 and 44.43% from the total pheromone

trap captured during first and second seasons respectively. Nada *et al.* (2009) revealed that the population of *E. insulana* male moths showed five and four peaks on cotton during two seasons, 2007 and 2008, respectively. Al-Shannaf and Hegab (2010) found that the spiny bollworm male moths recorded five peaks during 2007 and 2008 seasons. The moths moved between the three host plants according to available the food or used the control program on cotton plants.

Table (2): Number of *E. insulana* male moths caught by sex pheromone traps on different host plants and the infestation percentage during 2014.

Dates	Mean number of male moths/trap/week			Infestation percentage		
	Cotton	Maize	Okra	Cotton	Maize	Okra
07/06	3	1	2	1		2
14/06/	5	0	3	1		4
21/06/	7	0	8	0		2
28/06/	5	1	6	0		0
05/07/	4	0	7	0		0
12//07/	7	4	10	1		1
19/07/	10	5	13	0		2
26/07/	15	11	18	0	1	3
02/08/	11	6	15	1	1	3
09/08/	7	4	13	2	2	2
16/08/	5	10	17	5	4	2
23/08/	20	13	25	2	1	2
30/08/	16	7	17	3	0	3
06/09/	13	5	12	4		5
13/09/	15	4	16	6		9
20/09/	14	2	23	7		6
27/09/	23	3	37	9		7
04/10/	34	4	50	12		14
11/10/	55	11	51	14		17
18/10/	57	32	65	19		22
25/10/	50	40	35	11	2	23
01/11/		23	25		4	26
08/11/		18	14		3	28
15/11/		13	13		5	37
22/11/		11			1	
29/11/		15			0	
Total	376	243	495	98	24	220
Total	1114					
% form total	33.75	21.81	44.43	4.67	2.00	9.17

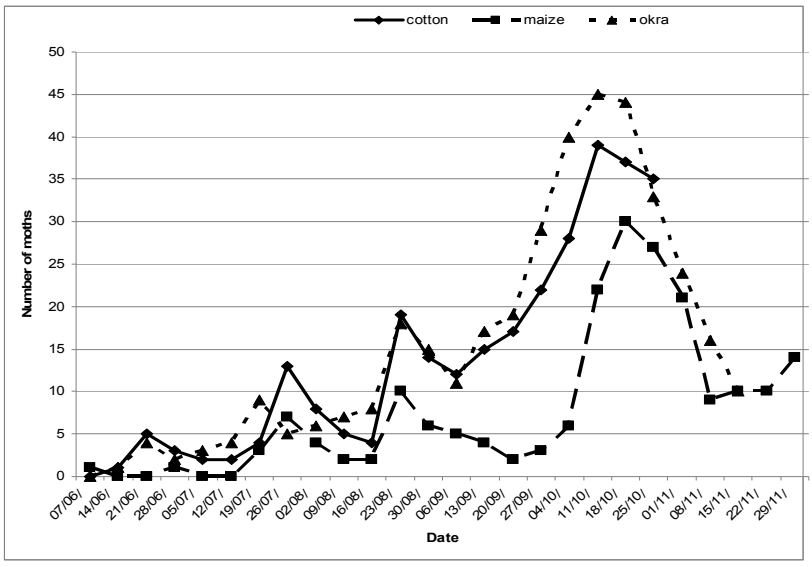

Fig. (1): Number of *E. insulana* male moths caught by sex pheromone traps on different host plants during 2013.

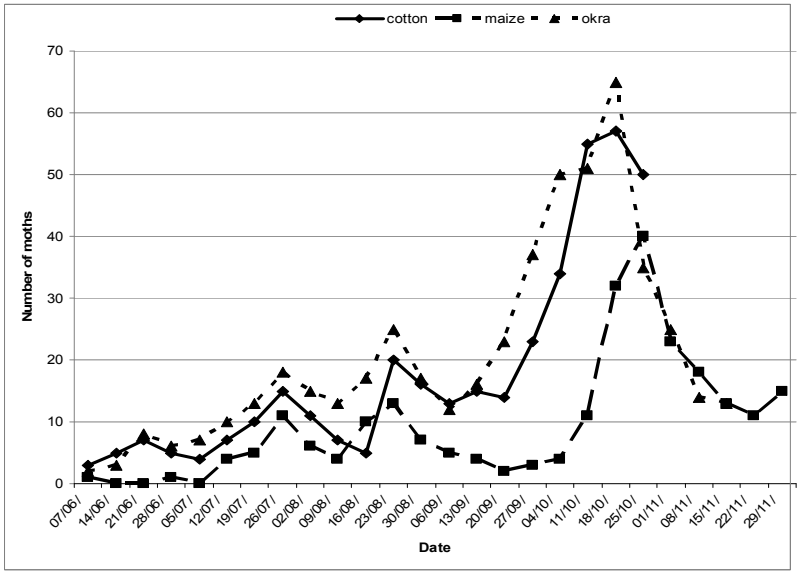

Fig. (2): Number of *E. insulana* male moths caught by sex pheromone traps on different host plants during 2014.

Plant infestations:

Cotton plant:

Data presented in Table (1&2) showed that the cotton infestation percentage with the spiny bollworm larvae was low during June, July and increased gradually until recorded the first peak of infestation during 4th week and 3rd week of August with 7.0 and 5.0 % during the two seasons, respectively. The second peak was recorded on 2nd and 3rd week of October with 26.0 and 19.0 % during the two

Maize plant

The infestation of maize ears with the spiny bollworm larvae was low during the two seasons. First infestation was appeared on 3rd week of July in first sowing data and 4th week of October in second sowing date during two seasons. The highest infestation by spiny bollworm larvae attacking maize that recorded in 3rd week of August with 3.0 and 4.0 % and 3rd week of November with 5.0 % in first and second sowing date during two seasons, respectively. The infestation in second sowing date was the highest than first sowing date.

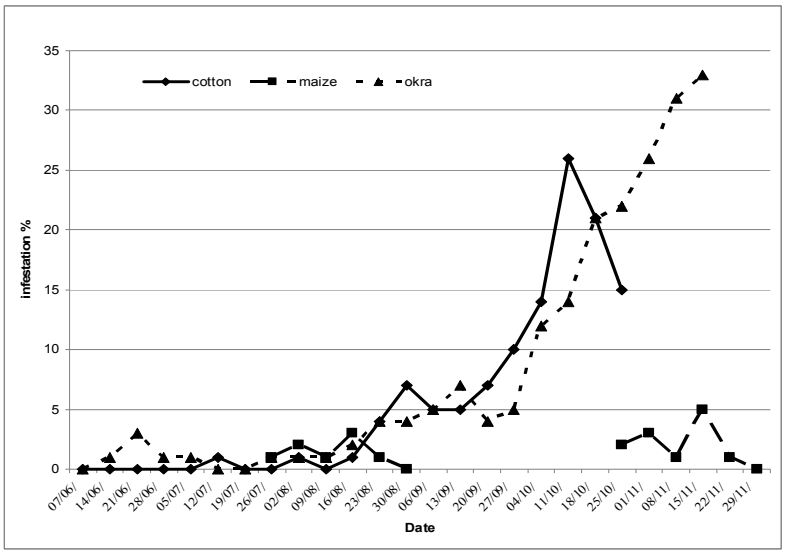

Fig. (3): Infestation percentage of *E. insulana* on different host plants during 2013.

Okra plants

The obtained results in Table (1&2) indicated that the overall mean percentages of infested okra by the spiny bollworm larvae during the whole season were 8.29 and 9.17 % during 2013 and 2014 cotton season, respectively. Three peaks of infestation on the okra pods were recorded each season. The first peak recorded on 4th and 2nd weeks of June with 3.0 and 4.0 %, while, the second peak recorded on 2nd week of September with 7.0 and 9.0 % after that the infestation percentages were increased gradually until the

end of season to recorded the third peak on 3rd week of November with the highest infestation (33.0 and 37.0 %) during the two seasons, respectively.

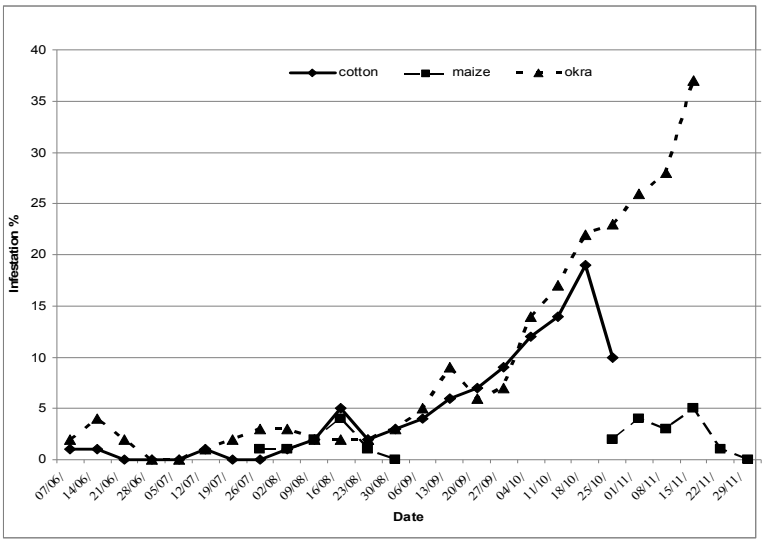

Fig. (4): Infestation percentage of *E. insulana* on different host plants during 2014.

Generally, okra plant recorded the highest infestation with the spiny bollworm larvae followed by cotton and maize. Okra was preferred for spiny bollworm over cotton towards the end of the season when the cotton boll surface was hard Khidr *et al.* (1990). The larvae of spiny bollworm causing an infestation which may reach 36.0% of the maize crop (Mettwally and Mabrouk, 1959). Nada *et al.* (2010) found that *E. insulana* occurrence period of larval infestation in the cotton terminal shoots and fruits (buds & bolls) extended from mid May to the end of September and recorded three peaks. In the maize larval infestation was extended from late July to late September with one peak, while in okra it occurrence from first week of August and extended to 4th week of October with two peaks. Nada *et al.* (2009) recorded that *E. insulana* larval infestation recorded three and one peak on cotton and maize, respectively. Hajatmand *et al.* (2014) in Iran the peak of cotton boll infestation percentage with the spiny bollworm was in 18th of November. The spiny bollworm is active almost throughout the year on its different host plants (Abul-Nasr *et al.* 1972; Arif and Attique 1990). The attack on the cotton bolls is generally higher than buds. Highest infestation was recorded during August and September (Qureshi & Ahmed, 1991).

Relationship between number of spiny bollworm male moths and mean temperature and RH

Data presented in Table (3) showed that the correlation coefficient between spiny bollworm male moths trap catches in relation to mean temperature and RH. . Correlation coefficient (r) for weekly number of spiny

bollworm male moths catches versus to mean weekly temperatures were (- 0.56, - 0.39 and - 0.42) and (- 0.45, - 0.41 and - 0.27) for Cotton, Maize, Okra during 2013 and 2014, respectively. While for RH Correlation coefficient (r) were (0.49, 0.43 and 0.46) and (0.23, 0.34 and 0.23) for three host plants during 2013 and 2014, respectively. Explained variance values were 37.02, 23.61 and 26.64 % for 2013 while 2014 were 42.67, 30.72 and 16.48 %, respectively. The population of spiny bollworm moth catches was negatively correlated with mean the temperature and positively correlated with mean relative humidity in three host plants during 2013 and 2014.

Dhaka and Pareek (2008) the minimum temperature and RH have negative significant effect on all the three bollworms during 2001 only. Padwal and Sharma (2015) stated that the *E. vittella* population was positively correlated with the maximum temperature and negatively correlated with relative humidity.

Table (3): Simple correlation and multiple regressions between mean temperature and R.H and the number of *E. insulana* male moths caught by pheromone traps during 2013 and 2014 seasons .

Host plant	Weather factors	2013				2014			
		Simple correlation		Multiple regression	E.V %	Simple correlation		Multiple regression	E.V %
		r	p	R^2		r	p	R^2	
Cotton	Mean temperature	-0.56	0.008**	0.3702	37.02	-0.45	0.04*	0.4267	42.67
	Mean RH	0.49	0.023*			0.23	NS		
Maize	Mean temperature	-0.39	0.043*	0.2361	23.61	-0.41	0.033*	0.3072	30.72
	Mean RH	0.43	0.027*			0.34	NS		
Okra	Mean temperature	-0.42	0.04*	0.2664	26.64	-0.27	NS	0.1648	16.48
	Mean RH	0.46	0.02*			0.23	NS		

E.V% = Explained variance

REFERENCES

Abul-Nasr, S.M.; M.M. Megahed and A.A. Mabrouk (1972): A study on the host plants of the spiny bollworm, *Earias insulana* (Boisd.) other than cotton and maize. Bull. Soc. Entomol. Egypt, 56, 151-161.

Al-Shannaf, H.M.H. and M.E.M. Hegab (2010): Capture of pink and spiny bollworms male moths in relation to certain environmental factors and accumulate heat units. J. Plant Protection and Pathology, Mansoura University,1 (5):251-263.

Arif, M.I. and M.R. Attique (1990): Alternative hosts in carryover of *Earias insulana* (Boisd.) and *Earias vittella* (F.) in Punjab, Pakistan. Pak. Cottons, 34:91–96.

Dhaka, S.R. and B.L. Pareek (2008): Weather factors influencing population dynamics of major insect pests of cotton under semi arid agro-ecosystem. Indian Journal of Entomology, 70 (2): 157-163.

Dhawan, A.K. and A.S. Sidhu (1984): Incidence and relative abundance of different species of spotted bollworms on okra at Ludhiana, Punjab. Journal of Research, Punjab Agricultural University, 21 (4): 533-542.

Dhawan, A.K. and G.S. Simwat (1996): Monitoring the seasonal abundance of cotton bollworms with pheromone traps. Indian Journal of Ecology, 23 (2): 123-129.

Hajatmand, F.; H. Abbasipour; G. Amin; A. Askarianzade, and J. Karimi (2014): Evaluation of infestation percentage of cotton fields to the spiny bollworm, *Earias insulana* (Boisd.) (Lep.: Noctuidae), and its relationship with pheromone traps. Archives of Phytopathology and Plant Protection, 47 (12): 1523–1529.

Khidr, A.A.; S.N. Kostandy; M.G. Abbas; M.W. El-Kordy; O.A. El-Gougary (1990): Host plants, other than cotton, for the pink boll worm, *Pectinophora gossypiella* and the spiny bollworm, *Earias insulana.* Agricultural Research Review, 68 (1):135-139.

Little, T.M. and F.J. Hills (1975): Statistical methods in agricultural research. Available from U.C.D. Book Store, University of California, Davis: 241 pp

Mettwally, A.G. and A. Mabrouk (1959): A short note on infestation of corn by the spiny bollworm, *Earias insulana* (Boisd.) in Egypt. Agric Res. Rev. Cairo, 37: 315-320.

Nada, M.A.; M.G. Ragab and A.E.A. Amer (2009): Effectiveness of accumulated heat units on population fluctuation of spiny bollworm and associated predators in cotton and maize fields. Egypt. J. Agric. Res., 87(4):1009-1024.

Nada, M.A.; M.G. Ragab and Karima A. El-Lebody (2010): Occurrence and movement of the spiny bollworm, *Earias insulana* (Boisd.) within some its host plants. J. Plant Protection and Pathology, Mansoura University, 1(8):635-646.

Padwal, K.G. and S.K. Sharma (2015): Population dynamics of *Earias vittella* of okra. Annals of Plant Protection Sciences, 23 (2): 398-399.

Patel, S.D.; H.V. Pandya; J.A. Dahatonde; S.R. Patel and K.C. Bambhaniya (2015): Population dynamics of *Earias vittella* through pheromone trap and correlation co-efficient between moth catches with weather parameters. International Journal of Plant Protection, 7 (1): 240-242.

Qureshi, Z.A. and N. Ahmed (1991): Monitoring seasonal population fluctuation of spotted and spiny bollworms by synthetic sex pheromones and its relationships to boll infestation in cotton. Journal of Applied Entomology, 112: 171-175.

التقلبات الموسمية لدودة اللوز الشوكية على بعض العوائل النباتية

عادل السيد على عامر ، على أحمد أحمد السيد و مصطفى سعيد هاشم
معهد بحوث وقاية النباتات، مركز البحوث الزراعية، الدقى- جيزة

تم تتبع التقلبات الموسمية لدودة اللوز الشوكية فى حقول القطن والباميا والذرة بمركز منيا القمح محافظة الشرقية خلال الموسمين ٢٠١٣ و ٢٠١٤. وقد أوضحت النتائج أن تعداد ذكور فراشات دودة اللوز االشوكية سجلت أربعة قمم فى حقلى القطن والباميا خلال الموسم وقد سجلت القمة الرابعة أعلى تعداد (٣٩ و٥٧ ذكر / مصيدة /أسبوع) و (٤٥ و ٦٥ ذكر / مصيدة /أسبوع) فى الأسبوع الثانى و الثالث و الأسبوع الثالث و الرابع من أكتوبر خلال موسمي القطن والباميا على التوالى . بينما سجل تعداد الفراشات فى حقل الذرة قمتين (٧ و ١١ ذكر / مصيدة / أسبوع) و (١٠ و ١٣ ذكر / مصيدة /أسبوع) فى ميعاد الزراعة الأول و سجل قمة واحدة (٣٠ و ٤٠ ذكر / مصيدة /أسبوع) فى ميعاد الزراعة الثانى خلال موسمي الدراسة على التوالى. على الجانب الأخر سجلت نسب الإصابة بيرقات دودة اللوز الشوكية قمتين فى حقل القطن فى الأسبوع الرابع و الثالث من أغسطس و الأسبوع الثانى و الثالث من أكتوبر وثلاث قمم فى حقل الباميا فى الأسبوع الرابع و الثانى من يونية و الأسبوع الثانى من سبتمبر و الأسبوع الثالث من نوفمبر والقمة الثانية فى القطن (٢٦.٠ و ١٩.٠ %) والثالثة فى الباميا (٣٣.٠ و ٣٧.٠ %) كانت أعلى من القمم الأخرى خلال موسمي الدراسة على التوالى. كما سجلت أعلى نسب إصابة بيرقات دودة اللوز الشوكية فى الذرة فى الأسبوع الثالث من أغسطس (٣.٠ و ٤.٠ %) فى ميعاد الزراعة الأول والأسبوع الثالث من نوفمبر فى ميعاد الزراعة الثانى (٥.٠ و ٥.٠ %) خلال الموسمين. نسب الإصابة بيرقات دودة اللوز الشوكية وتعداد ذكور فراشاتها فى المصائد الفرمونية كانت عالية فى الباميا يليها القطن ثم الذرة.كما وجد ارتباط سالب بين تعداد الذكور فى المصائد ومتوسط درجة الحرارة وارتباط موجب مع متوسط الرطوبة النسبية. وهذة الدراسة تلعب دوراً هاماً فى تحديد توقيت مكافحة دودة اللوز الشوكية.