J. Agric. Sci. Mansoura Univ., 28 (3): 2327 - 2334, 2003

SEX PHEROMONE TRAPS: A TOOL FOR INFESTATION PREDICTION BY THE SPINY BOLLWORM *Earias insulana* (BOISD) ON TWO COTTON VARIETIES WITH RESPECT TO SOME WEATHER FACTORS

El-Basyouni, Suzan A.

Sakha Agriculture Research Station, Plant Protection Research Institute A.R.C.

ABSTRACT

Field trials were carried out at Meet El-Deeb, Kafr El-Sheikh Governorate during cotton growing seasons 2001 and 2002 to predict the infestation level by the spiny bollworms *Earias insulana* on two cotton varieties using sex pheromone traps. Protective treatments using aircraft according to the national programme on bollworm were conducted coincided. The possible correlation between the recorded caught males and both of cotton variety and some weather factors were statistically analyzed, four generations were recorded on Giza 89 and Giza 86 during 2001 season. On the other hand, the same number of generations was recorded with Giza 86 in the second season while five generations were recorded with Giza 89 variety.

Statistical analysis of the mean number of male moths and percentage of boll infestation by larvae showed highly significant correlation in 2001 season with the two tested varieties, where it was positively insignificant with Giza 89 and negatively insignificant with Giza 86 during 2002.

The relationship between the maximum, minimum temperature and relative humidity on the fluctuation of the spiny bollworm male moths was found to be negative with Giza 89 while it was positive with Giza 86.

INTRODUCTION

Profitable cotton production in Egypt must depend on successful and efficient insect management programme (IPM) which reduces the risk disastrous crop losses by pests.

One of the IPM's items is the use of sex pheromone traps to predict and survey the level of infestation. So chemical insecticides could be used in the proper time to reduce costs and problems as a result of miss application of insecticides.

During the years following the isolation of the sex attractant of the silkworm moth *Bonbyx mori* (L.) by Butendandt *et al.* (1959) over 670 pheromones have been identified, (Kalssen *et al.*, 1982). Pheromone trapping of cotton bollworms was proved as a tool to indicate the periods when infestation may occur whenever scouting must be intensified so that economic thresholds can be utilized in making pest control decision.

Pheromone trapping was initiated in Egypt on 1979, to monitor the seasonal occurrence and distribution of *Pectinophora gossypilla* (Sound) (Flint *et al.*, 1985; Nassef, 1989, El-Zanan and El-Hawary, 1995 and Watson *et al.*, 1995). However, little is known about the application of this technique with the spiny bollworm *Earias insulana* (Boisd) which is considered one of the most destructive pest of cotton plants during flowering and maturing stages. The fruiting stage of cotton plants provide the moths with suitable

oviposition sites and ensure the availability of food sources for their larvae. This continuous availability of oviposition and feeding sites through a long period help the cotton bollworms in building up a considerable large sized populations and consequently caused tremendous damage. It has been argued that in the absence of a conventional insecticide in the pheromone treated areas there could be in upsurge of the spiny bollworm *E. insulana* late in season on Compion (1984).

So, the present study was conduced to assay the probability of using sex pheromone with the spiny bollworms *Earias insulana* on two cotton varieties. The relation between the male caught and both of the actual infestation by the larvae of this insects. Moreover the relation between the caught male and some weather factors were studied.

MATERIALS AND METHODS

An experiment was carried out during two successive cotton growing seasons, 2001 and 2002 at Meet El-Deeb Kafr El-Sheikh Governorate. The experimental areas were cultivated with Giza 89 (109 and 195 feddan) in 2001 and 2002 season, and Giza 86 (233 and 262 feddan) in 2001 and 2002, respectively. Planting occurred on 20-24 March for Giza 86 and 18-20 March for Giza 89 in 2001, wherever, it was 25 March to 1 April for Giza 86 and 1-4 April for Giza 89 in 2002. Cotton plants received normal agriculture practices, pheromone traps were placed in each field from the 31st of May till the end of September in both seasons, traps were fixed and distributed at rate of 1 trap/10 feddan manually. The baited sex pheromone (Delta) were fixed on metal bars just above cotton plants. The traps were baited with specific pheromone capsules replaced every 2 weeks by fresh ones, the adhesive sheets were also changed every three days and the numbers of trapped males were counted. The sex pheromone traps were baited with the synthetic pheromone formulation in polyethylene vials. Every vial contains 2 mg of the active ingredient of the synthetic pheromone. The pheromone consists of E10, E12, hexactecadinal. Trapping was continued till the end of September in the two seasons.

According to the national spray program applied on cotton bollworm in Egypt, the experimental areas in the two seasons were sprayed aerially as a protective sprayer by using a helicopter aircraft. Five applications was conducted in the current study using the recommended insecticides (Table 1).

Samples of 400 green boll were collected at random from both diagonals of the inner square of each variety every six day in order to study the relation between the actual infestation and the caught males. The cotton bolls were examined internally and larvae in each treatment was counted. Sampling started on June 24 (2001) and June 29 (2002) and continued till August 31 (2001) and the 1st of September (2002). The daily maximum, minimum temperatures and R.H.% were obtained from the Meterological Department at Sakha Agricultural Research Station Kafr El-Sheikh. Data were statistically analyzed and the simple correlation values were calculated according to Steel and Torie 1960).

Table (1) Insecticides used as protectant against the bollworm during 2001 and 2002 growing seasons and their rate of application.

Date	Common name	Trade name	Rate of application/ fed.
	2001 season		
24.6	Chlorfluzron 5% EC	Attabron	400 cm
15.7	Chloropryifos 48% EC	Dursban	1 L
30.7	Esfenvalerate (ISO) 20% EC	Sumi gold	150 cm
16.8	Pronofos 72% EC	Curacron	750 cm
31.8	Carbaryl 85% W.P	Sivin	1.5 kg
	2002 season		
29.6	Chlorfluzron 5% EC	Attabron	400 cm
18.7	Pronofos 72% EC	Curacron	750 cm
131.7	Esfenvalerate 5% EC	Sumialpha	600 cm
18.8	Chloropyrifos 48% EC	Durspan	1 L
1.9	Carbaryl 85% W.P.	Sivin	1.5 kg

RESULTS AND DISCUSSION

Generations of the spiny bollworm:

Data presented in Table (2) and Figure (1,2) show the fluctuation of the male moths of spiny bollworms during the period extended from the first of June till the end of September in 2001 and 2002 seasons.

As for 2001 (Figure 1), there were four generations with four sharp peaks in Giza 89 and Giza 86. Those peaks were found to be in the fourth week of June, July, August and the third week of September in the case of Giza 89. The corresponding number of caught males were 15.72, 6.27, 11.26 and 14.09 (males/trap/6 days), at the same periods. On the other hand, on G. 86 those peaks occurred in the second week of June, July, August and the first week of September with a mean number of 4.88, 4.67, 3.5 and 15.75 males, respectively.

Regarding 2000 growing seasons, Figure (2), five generations were observed on G 89, during a period extended from first of June till 28th September, reaching their peaks during the 3rd week of June (14.05), the 4th week of July (16,85), the 3rd week of August (15), 4th week of September (12.62) and the 4th week of the same month (20.79 male/traps/6 days). On G. 86 four peaks were recorded during the third week of June (10.47), the 3rd week of July (22.48), the 2nd week of August (18.59) and the 4th week of September (13.86).

The obtained data reflected that, population peaks of *E. insulana* was occurred during June, July, August and September. During the two seasons maximum number of moth caught were recorded during June 2001 and September 2001, for G 89, while they were recorded during September (15.79, 2001) and July (22.48, 2002) in the case of G. 86. The obtained results are parallel with those obtained by many authors. Hossain (1990) reported five generations for *E. insulana*. El-Zanan and El-Hawary (1995) indicated that the maximum numbers of *E. insulana* adult moths were recorded during September and October in 1989 and 1990. El-Mezayen *et al.* (1997) recorded that population peaks of *E. insulana* were occurred during May, August and October in 1995 and during August and September in 1996.

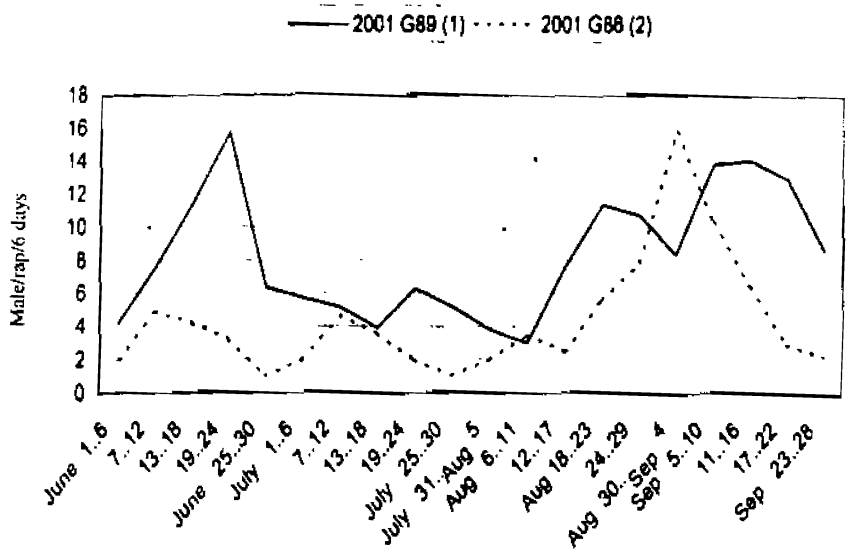

Fig. (1): Average catch of *E. insulana* moths using pheromone sticky traps in cotton fields in year 2001.

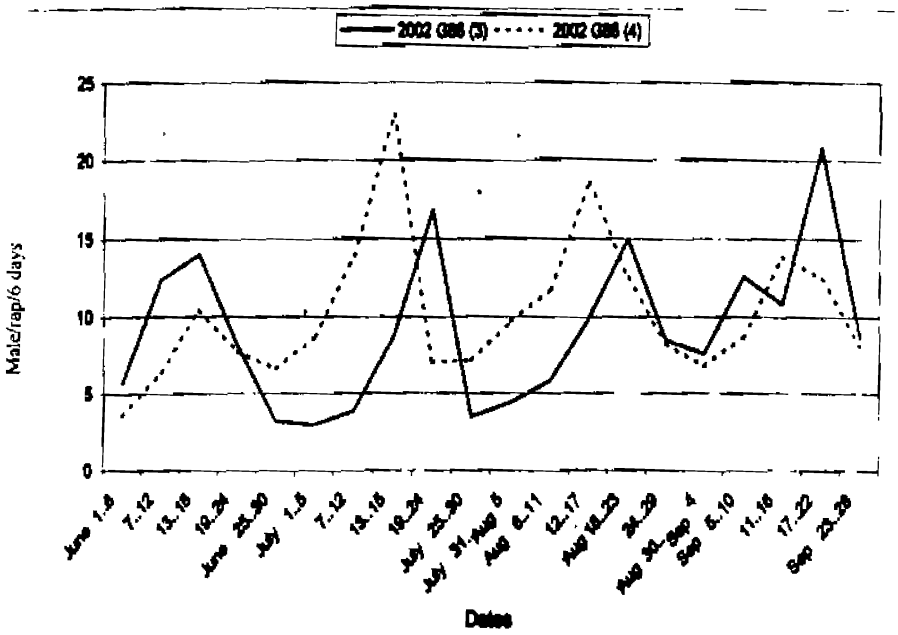

Fig. (2): Average catch of *E. insulana* moths using pheromone sticky traps in cotton fields in year 2002.

Table (2): Number of *E. insulana* adult moths caught using pheromone traps on two varieties of cotton at Meet El-Deeb Kafr El-Sheikh during 2001 and 2002 seasons.

Cotton variety		2001 season		2002 season	
		Mean no. of male moths/ trap/6 days		Mean no. of male moths/ trap/6 days	
Date		G. 89(1)	G. 86 (2)	G. 89 (3)	G. 86 (4)
Jun.	1-6	4.19	2.00	5.70	3.59
	7-12	7.55	4.88	12.40	6.41
	13-18	11.37	4.21	14.05	10.47
	19-24	15.72	3.25	8.15	7.70
	25-30	6.36	1.00	3.20	6.60
Jul.	1-6	5.73	1.96	2.95	8.71
	7-12	5.48	4.67	3.85	13.93
	13-18	3.92	3.55	8.65	22.48
	19-24	6.27	1.96	16.85	7.03
	25-30	5.19	1.04	3.50	7.15
Jul. 31-Aug.	5	3.82	2.00	4.40	9.74
Aug.	6-11	3.00	3.50	5.80	11.74
	12-17	7.64	2.50	9.90	18.59
	18-23	11.36	5.58	15.0	12.52
	24-29	10.73	7.87	8.45	8.19
Aug. 4-Sept.	30	8.36	15.79	7.60	6.78
	5-10	13.82	10.37	12.62	8.70
	11-16	14.09	6.42	10.85	13.85
	17-22	12.91	2.96	20.79	12.48
	23-28	8.63	2.21	8.65	8.11

(1) Mean number of 11 traps (2) Mean number of 24 traps
(3) Mean number of 20 traps (4) Mean number of 27 traps.

Boll infestation by spiny bollworm larvae:

To evaluate the correlation between the number of caught males and the actual infestation with the spiny bollworm larvae, bolls were examined periodically for larval infestation and the percentage of infestation were calculated.

Results presented in Table 3 revealed that the percentage of infestation ranged between (0.25 and 3%, G. 89) and (0 and 1.75 in the case of G. 86) in 2001 (Table 3). The corresponding values ranged between (0 and 2.25) and (0.5 and 3.25) for G. 89 and G. 86, respectively in 2002 growing seasons.

Based on the simple correlation values, Table 4, highly significant correlation could be detected between the number of caught males and the corresponding percentage of infestation for the two varieties in 2001 ($r = 0.735$ and 0.903 for G. 89 and G. 86 at 1% probability). As regard with 2002 seasons, the influence of number of caught males was positively insignificant (0.070) for G. 89 from the one hand, while on the other hand, r values was negatively insignificant for G. 86 (-0.238).

Table (3): Percentage of infestation of green cotton boll with *E. insulana* on two cotton varieties during 2001 and 2002 seasons.

Sampling dates		2001 season		Sampling dates		2002 seasons	
		G. 89	G. 86			G. 89	G. 86
July	9	0.75	0	July	15	0.0	0.75
	15	0.25	0.75		21	0.25	1.0
	21	0.50	0.25		27	0.75	0.75
	27	0.5	0.0	Aug.	2	1.25	0.5
Aug.	2	0.75	0.0		8	2.0	1.25
	8	1.0	0.25		14	1.25	1.75
	14	1.75	0.25		20	1.75	2.0
	20	2.0	0.50		26	1.25	2.75
	26	2.50	1.25	Sep.	1	1.75	3.0
Sep.	1	3.0	1.50		7	2.0	3.25
	7	3.0	1.75		13	2.25	3.25

Table (4): The simple correlation values of spiny bollworm male moths *and percentage of infestation* on two cotton varieties during 2001 and 2002 seasons at Kafr El-Sheikh.

Varieties	Average No. of male/ trap/6 days	
	2001	2002
G. 89	0.735**	0.070
G. 86	0.903**	-0.238

*** Significant at 0.01 probability level.***

***Effect of weather factors* on the number of caught males:**

To interpret the obtained data which reflect fluctuations in the caught *male numbers* and peaks during the two growing seasons 2001 and 2002. The maximum and minimum temperature as well as the relative humidity were recorded during those seasons. Correlation between those values and the number of caught males was determined by calculating the simple correlation coefficient (Table 5). Data reflected a negative significant correlation between the recorded weather factors (maximum, minimum temperature and relative humidity) and the caught males from field cultivated with Giza 89 variety either at 2001 or 2002 seasons. *The highly significant* correlation was found with the percentage of humidity at 2002 growing season. On contrary to this relation a positive one was observed with Giza 86 variety at the two seasons and the highest effect was recorded with the minimum temperature.

In this respect, Karaman *et al.* (1982) reported that daily minimum temperature *and daily relative humidity* seemed to influence significantly the activity of the bollworm *P. gossypiella* and *E. insulana* in middle Egypt. Moreover, *El-Saadany et al.* (1999) concluded that the amount of changes in maximum day temperatures, minimum night temperatures and relative *humidity might* alter the catch of either pink or spiny bollworms when the tested factors remain constant around their ranged.

Table (5): The simple correlation values of spiny bollworms male moths and the three weather factors (max., min. temp. and R.H.%) on two cotton varieties (G. 89 and G. 86) during 2001 and 2002 seasons at Kafr El-Sheikh.

Character	Cotton variety	Seasons	Max. temp.	Min. temp.	R.H%
Male/trap/ 6 days	G. 89	2001	-0.158	-0.462*	-0.31
		2002	-0.384	-0.264	-0.573**
	G. 86	2001	0.288	0.094	0.195
		2002	0.302	0.646**	0.281

* Significant at 0.05 probability level
** Significant at 0.01 probability level

Based on the results obtained in the present investigation, it could be concluded that using pheromone traps in cotton fields are of great deal for detecting and monitoring insect population. On the other hand, the precise knowledge of the appropriate dates of moth generations plays a major role in the decision making process in the integrated pest management for reducing the infestation level. Also it cold stated that Giza 89 was more tolerant to the infestation by the spiny bollworm.

ACKNOWLEDGMENT

I am grateful to Dr. W.M. Watson, Professor of Plant Protection, A.R.C. Plant Protection Institute Egypt. for his critical and valuable advice.

REFERENCES

Butenandt, A.R.; R. Bechmann; D. Stam and E. Heekery (1959). Ber den sexuallocksloff des seidenspinners *Bombyx mori* Reindarstelung und Konestituton. Z. Naturforsch 146: 238-284.

Compion, D.G. (1984). Survey of pheromone uses in pest control. In: Techniques in pheromones Research. Hummel H.E. and Miller T.A. (eds.). Springer-Verlag, Chap. 14, pp. 405-449.

El-Mezayen, G.A.; M.K.A. Abo-Sholoa and M.M. Abou-Kahla (1997). The effect of three weather factors on population fluctuations of *Spodoptera littoralis* (Boisd), *Pectinophora gossypiella* (Saunders) and *Earias insulana* (Biosd). J. Agric. Sci. Mansoura Univ., 22(10): 3307-3314.

El-Zanan, A. and A.S. El-Hawary (1995). Pheromones baited and light trapped adult populations of certain cotton pests; (cotton leafworm and bollworms) in relation to filed infestations. J. Agric. Res. Tanta Univ. 21(1): 1651-1631.

El-Saadany, G.B.; A.M. Hossain; S.M. El-Fateh Ramadan and M.A. Romeilah (1999). The simultaneous effect of physical environmental factors covering the population activity of cotton bollworms moths. Egypt. J. Agric. Res. 77(2): 591-609.

Flint, H.M.; J.R. Merkle and A. Yamamoto (1985). Pink bollworm (Lepidoptera: Gelechiide), field testing a new polyethylene tube dispenser for gossyplure. J. Econ. Entomol. 78(6): 1431-1436.

Hossain, A.M. (1990)., Ecological studies on bollworms in relation to the cropping system and host plants in Fayoum region, Ph.D. Thesis Fac. of Agric. Ain Shams Univ. Egypt.

Kalssen, W.; R.L. Ridgway and M. Inscoe (1982). Chemical attractants in the integrated pest management programs. In: Insect suppression with controlled release pheromone systems. Kydonineus A.F., M. Beroza (eds.). CRC press, Boca Raton, Florida Vol. 1, Chap. 2. pp. 13-130.

Karaman, G.A.; A.A. Abdel-Naby and M.A. Makady (1982). Simultaneous effect of certain whether factors on the population dynamics of the pink and spiny bollworms in middle Egypt. 1st Sci. Meet., Arab Soc. Plant Protect., 22-25 Nov., Abstract: 88.

Nassef, M.A. (1989). Integrated control of pink bollworms *Pectinophora gossypiella*. M.Sc. Thesis, Fac. of Agric. Zagazig University.

Steel, R.G.D. and J.H. Torrie (1960). Principles and procedures statistics with special reference to Biological Science. McGraw Hill Book Co. N.Y. USA, p. 481.

Watson, W.M.; K.A. Gouhar; A.A. El-Feshawi; Fayza H. Sharaf and M.A. Nassef (1995). Efficiency and performance of sex pheromone and conventional insecticides on pink bollworm infestation cotton field. J. Agric. Sci. Mansoura Univ., 20(12): 5170-5188.

المصائد الفرمونية: كأداة للتنبؤ بالاصابة بدودة اللوز الشوكية على صنفيـــن مـــن القطن وعلاقتها ببعض العوامل الجوية

د. سوزان احمد البسيونى
معهد بحوث وقاية النباتات ــ مركز البحوث الزراعية

أجريت دراسات حقلية فى مزرعة ميت الديب بسخا محافظة كفرالشيخ خلال موسمى قطن ٢٠٠١ ، ٢٠٠٢ للتنبؤ بمستوى اصابة صنفين من القطن بالاصابة بدودة اللوز الشوكية بواسطة اســـتخدام المصـــائد الفرمونية. واستخدام ايضا رش وقائى للمبيدات تبعا للبرنامج الوقائى الخاص بديدان اللوز والموازنة مع نسبة الاصابة الفعلية فى المصائد ايضا درست العلاقة بين كلا الصنفين وبعض العوامل الجوية. واوضحت النتائج وجود اربعة اجيال لدودة اللوز الشوكية فى الصنفين فى موسم ٢٠٠١ بينما سجل جيزة ٨٩ خمسة اجيال فـــى موسم ٢٠٠٢ واعطى جيزة ٨٦ نفس العدد السابق.

التحليل الاحصائى لمتوسطات اعداد الفراشات مع نسبة اصاب اللوز. أوضحت ان الارتباط كـــان موجبا مع جيزة ٨٩ فى حين كان سالبا مع جيزة ٨٦ فى كلا الموسمين.

اوضحت العلاقة بين العوامل الجوية الرئيسية (الحرارة العظمى والصغرى والرطوبـــة النســـبية وتذبذبات فراشات ودودة اللوز الشوكية عن وجود ارتباط سالب مع جيزة ٨٩ فى حين انه كان موجبـــا مـــع جيزة ٨٦.