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Population fluctuation of Pink, Spiny Bollworms and Cotton Leafworm Male Moths in Cotton Fields

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ABSTRACTS

The present study was carried out in Zagazig district, Sharkia Governorate, Egypt in cotton fields (*Gossypium barbadens*) Giza 86 during 2014 and 2015 seasons to study investigate the population fluctuation of pink bollworm, (PBW) *Pectinophora gossypiella* (Saund.), spiny bollworm, (SBW) *Earias insulana* (Boisd.), and cotton leafworm, (CLW) *Spodoptera littoralis* (Boisd.). Results indicated that the population of the (PBW) male moths had five peaks in the two investigated seasons. The highest peak of male moths was recorded during the 4th week of September through the aforementioned seasons with 180 and 176 male moths/trap/week in both seasons, respectively. In case of (SBW) male moths had four and three peaks in the two seasons. The highest peak of moths was recorded during the 2nd week of September during two seasons. The population occurred with 48 and 51 male moths/trap/week in both seasons, respectively. Cotton leaf worm male moths had four peaks in the two seasons. The highest peak of moths was recorded at the 1st and 2nd week of May during two seasons, respectively, with 420 and 630 male moths/trap/week in both seasons, respectively. Statistical analysis showed that the relationship insignificant during the two seasons of study, between weekly mean numbers of PBW and SBW male moths caught in pheromone traps and maximum, minimum temperature and mean RH (%). In case of CLW, the relationship between weekly mean numbers and maximum temperature and mean RH (%) was insignificant in the two seasons of study, but it was significant between male moths and minimum temperature in the season of 2014.We conclude from the foregoing that it can use three types of traps sexual attraction for each of the pink, spiny bollworms and cotton leafworm in forcast census male moths for use in Integrated Pest Management program.

Keywords: Pectinophora gossypiella, Earias insulana and Spodoptera littoralis, pheromone, traps ,weather factors and peaks .

INTRODUCTION

Cotton is one of the major economic crops in Egypt. Most of the losses in yield and quality are caused by insect pests, the most serious pests are pink bollworm, *Pectinophora gossypiella* (Saund.) and the spiny bollworm, *Earias insulana* (Boisd.) and *Spodoptera littoralis* (Biosd.) which are considered destructive pests infesting cotton plants and causing usually severe damage resulting in high loss in both quantity and quality of the obtained yield (Amer 2004 and Hegab, 2008 and Abdel-Salam and Negm, 2009). The delta pheromone trap was more efficient in capturing *P. gossypiella* in cotton field Al- Beltagy, (1999), Dahi, (2003) and Elmo *et al.* (2012). Increase in relative humidity at one site was associated with a decrease in the number of *S. littoralis* male's recorded Campion *et al*. (1974). The effect of maximum, minimum and mean temperatures and R.H. % on the catch of *S. littoralis* in pheromone traps was significant and insignificant Al-shannaf and Hegab (2010a). The peak field incidence of pink bollworm on locule damage and larval incidence was recorded after three weeks of first peak pheromone trap catch Sandhya *et al.*, 2010. The population density of spiny bollworm has highly significant & positively correlation with maximum temperature, while with minimum temperature positive and insignificant in the two seasons El-Sayed (2005). In Egypt the pink bollworm moths catch recorded three and four peaks during 2003 and 2004 cotton seasons, but RH % recorded positive & insignificant during 2003 season and positive & highly significant in 2004 season, while spiny bollworm recorded three peaks during the two seasons of study. The simple correlation values between the maximum temperature, and the population of *E. insulana* was negative and insignificant in 2003, while in 2004 season it was positive and significant. The effect of R.H. % was negative and insignificant during the two seasons Hegab, (2008). The pink bollworm had four generations on cotton plants during the period from May1st to September 30th when the moths emerged during May from diapauses larvae. The predicted peaks were detected earlier or later 3-4 days than the observed peaks Yones *et al.* (2012). A significant and positive correlation was recorded between population fluctuations of *S. litura* and weather parameters including rainfall, maximum temperature and wind speed (Fand *et al.*, 2015).

Because of what is happening in the changing ecosystem components, from rise in temperature, humidity and change of cultivated plants etc .. must re-examine the spread of insects and fluctuating seasonal and annual according to the data in the environment.

Thus, aim of this work: study the population fluctuation of *P. gossypiella, E. insulana* and *S. littoralis* male moths captured by pheromone traps and the effect of some weather factors.

MATERIALS AND METHODS

Field studied were carried out during two cotton seasons of 2014 and 2015 at Zagazig district Sharkia Governorate, Egypt to study the population fluctuation of *P. gossypiella*, (PBW), *E. insulana* (SBW) and *Spodoptera lttoralis* (CLW), respectively. The experimental area was cultivated with the Egyptian cotton, *Gossypium barbadence* Giza 86 that sown at 18th and 25th March during the two seasons, respectively. Cotton plants were subjected to normal agricultural practices as recommended by the Ministry of Agriculture in the experiment areas in respect of the control program all over the two seasons of study. 15 feddans were divided into three plots each, five feddans.

The seasonal fluctuation of PBW, SBW and CLW were studied by using pheromone traps. Three species of traps used were put in each tested plot. Delta pheromone traps, funnel traps and Pan yellow trap baited with pheromone capsules of PBW, SBW and CLW. The traps were placed above the canopy by about 20-30 cm according to the plant hight. The pheromone capsule for each insect was changed biweekly. The traps were installed from 31th May until 15th November and 24th of April until 2nd October in 2014 and 2015 seasons of PBW, respectively and from 7th of Jun. until 27th September and from 15th Jun. until 28th Sept. in 2014 and 2015 seasons for SBW, while in case of CLW it were installed from 31th April until 8th October and from 24th April until 2nd October in 2014 and 2015 seasons. The traps were examined weekly and male moths caught were counted. The values of weather factors, maximum, minimum temperature and relative humidity, were obtained from Central Laboratory for Agricultural Climate Egypt. Each tested factor alone and the combined effect (Explained Variance E.V. %) were used. The analysis of variance was computed by using Costat Software Computer program (1990).

RESULTS AND DISCUSSION

Data given in Figures (1 and 2) revealed that the population size of BPW moths varied from season to another. Five peaks were recorded in cotton 2014 season at the 14th Jun, 12th July, 6th and 27th of Sept. and 8th November with means numbers of male moths caught in pheromone traps were 38.33, 30.33, 87.33, 180 and 118.33 males /trap/week. In the second season, five peaks were occurred at second week of May, 19th June, 10th Jul., 14th Aug. and 25th September with the mean numbers of 138, 80, 51, 168 and 176 males /trap/week. In case of SBW in the first season. Four peaks were recorded in cotton 2014 season at the 28th Jun, 19th July, 23th Aug. and 13th Sept. with means numbers of 26, 23, 35 and 48 males /trap/week. While in the second season three peaks were recorded in cotton 2015 season at the 29th Jun, 27th July, 14th Sept. with means numbers of 20.33, 20.33, and 51 males /trap/week Fig. (3 and 4). In case of CLW. Four peaks were recorded in cotton 2014 season at the 7th May, 25th Jun., 23nd Jul. and 3rd Sept. with means numbers of 420,132, 56 and 396 males /trap/week. While in the second season four peaks were recorded at the 15nd May, 26th Jun., 24th July and 4th Sept. with means numbers of 630,555,189 and 283 males /trap/week Figs. (5 and 6).

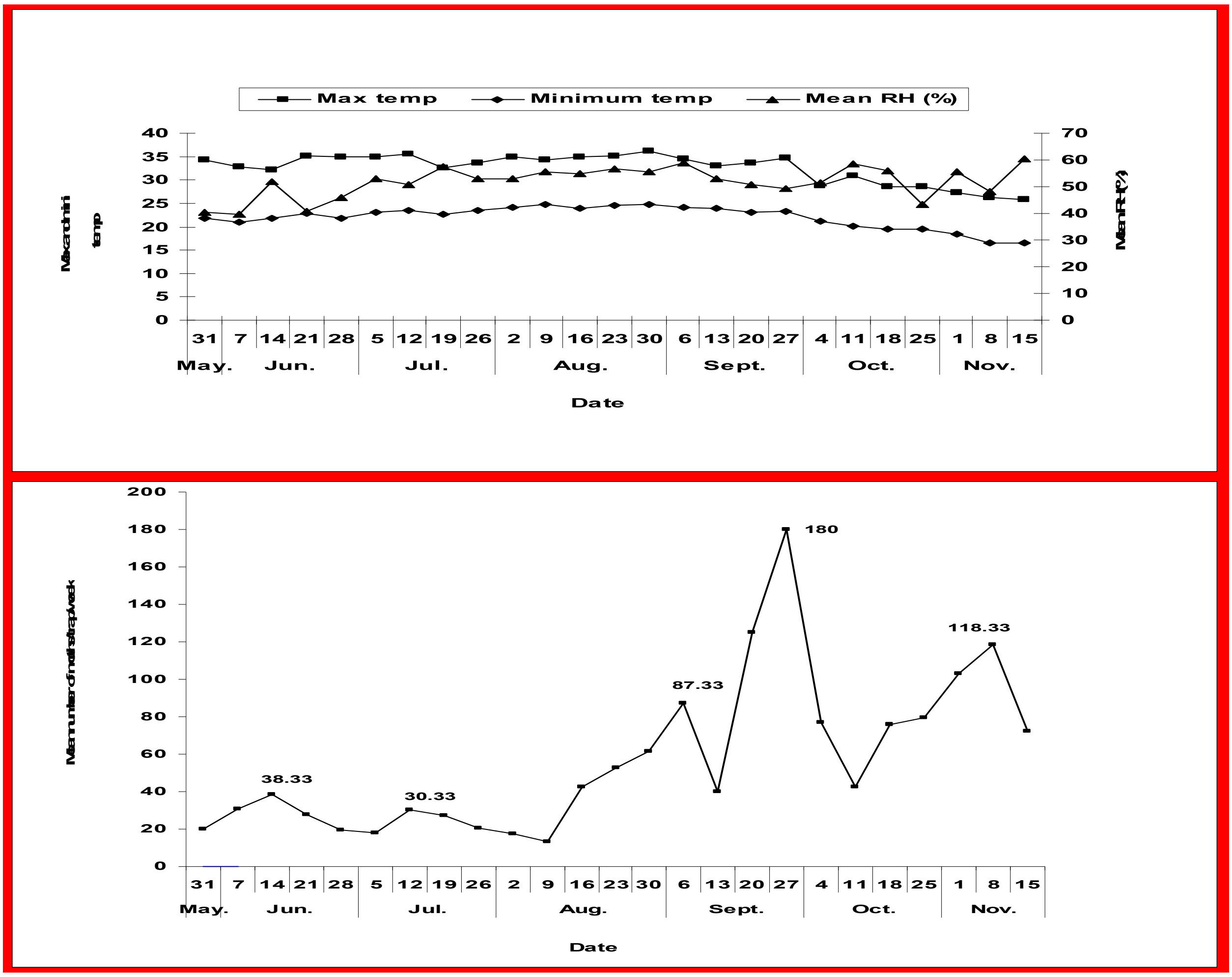

Fig. 1. Seasonal population fluctuations of *P. gossypiella* on cotton plants by using sex pheromone traps during 2014season

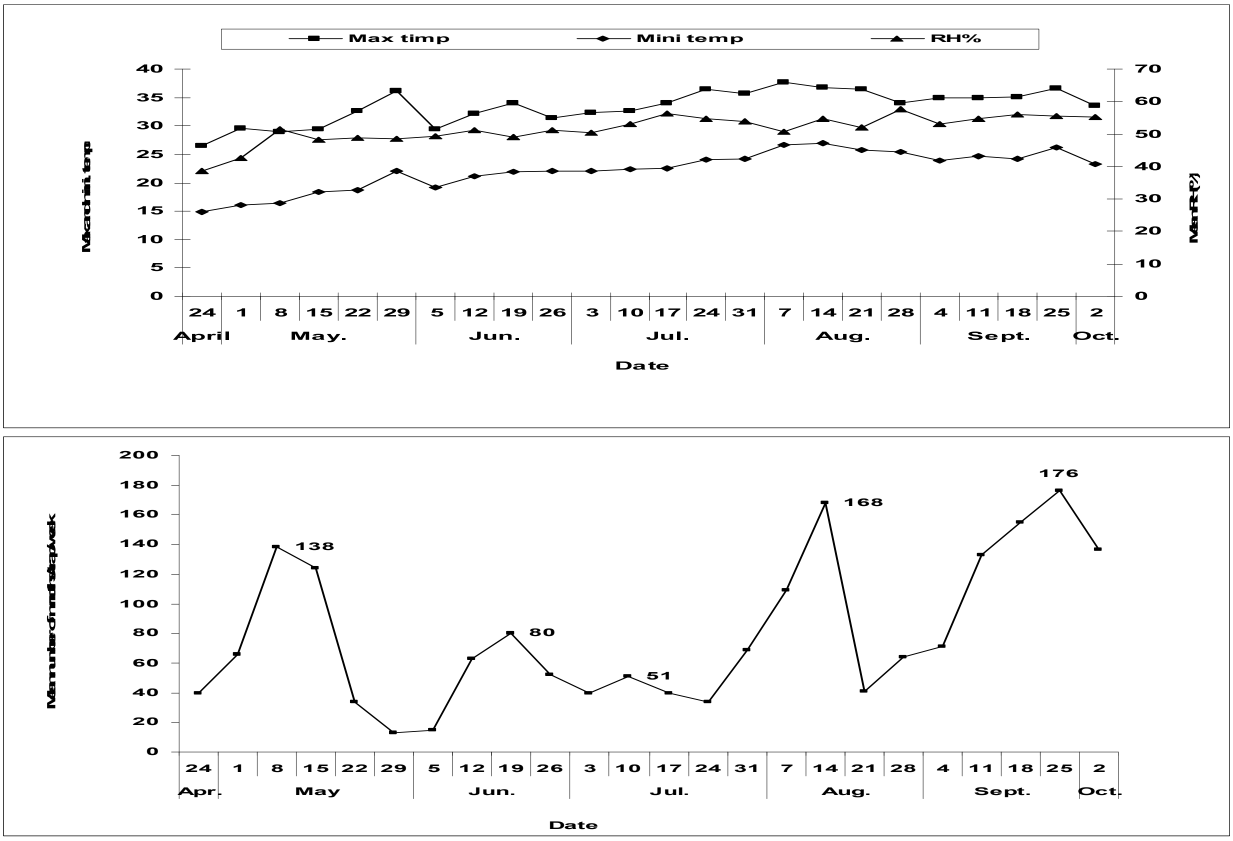

Fig. 2. Seasonal population fluctuations of *P. gossypiella* on cotton plants by using sex pheromone traps during 2015 season

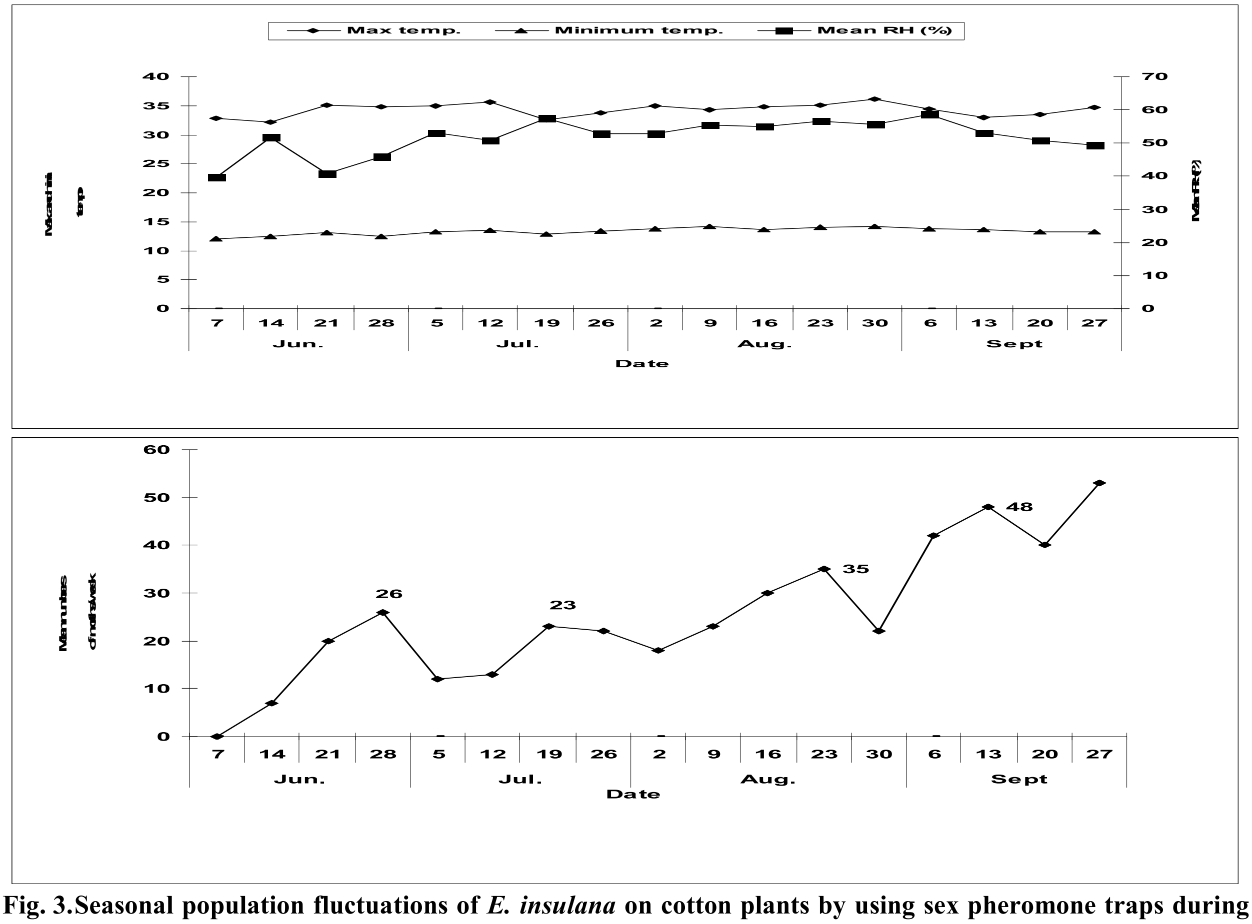

Fig. 3.Seasonal population fluctuations of *E. insulana* on cotton plants by using sex pheromone traps during 2014 season

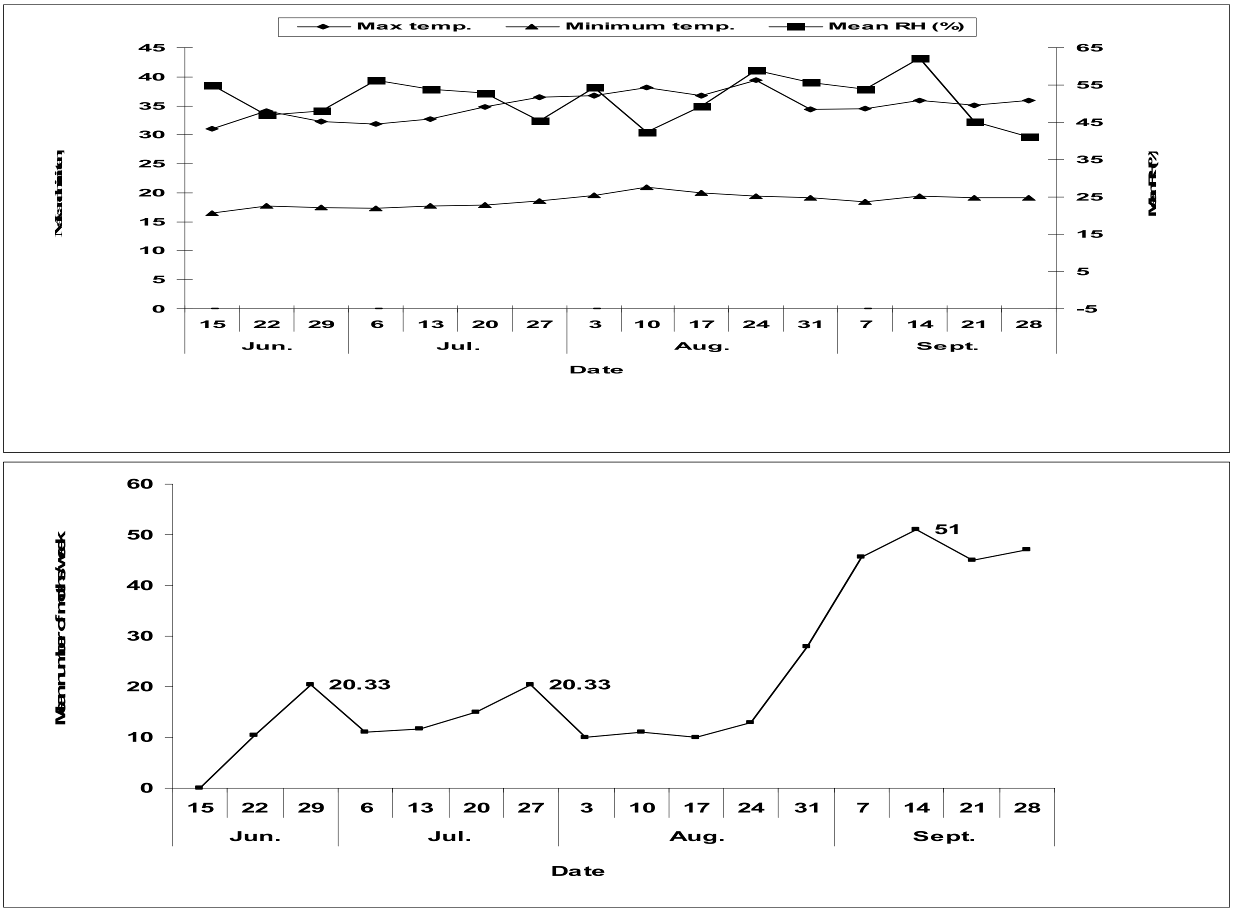

Fig. 4.Seasonal population fluctuations of *E. insulana* on cotton plants by using sex phermone traps during 2015 season

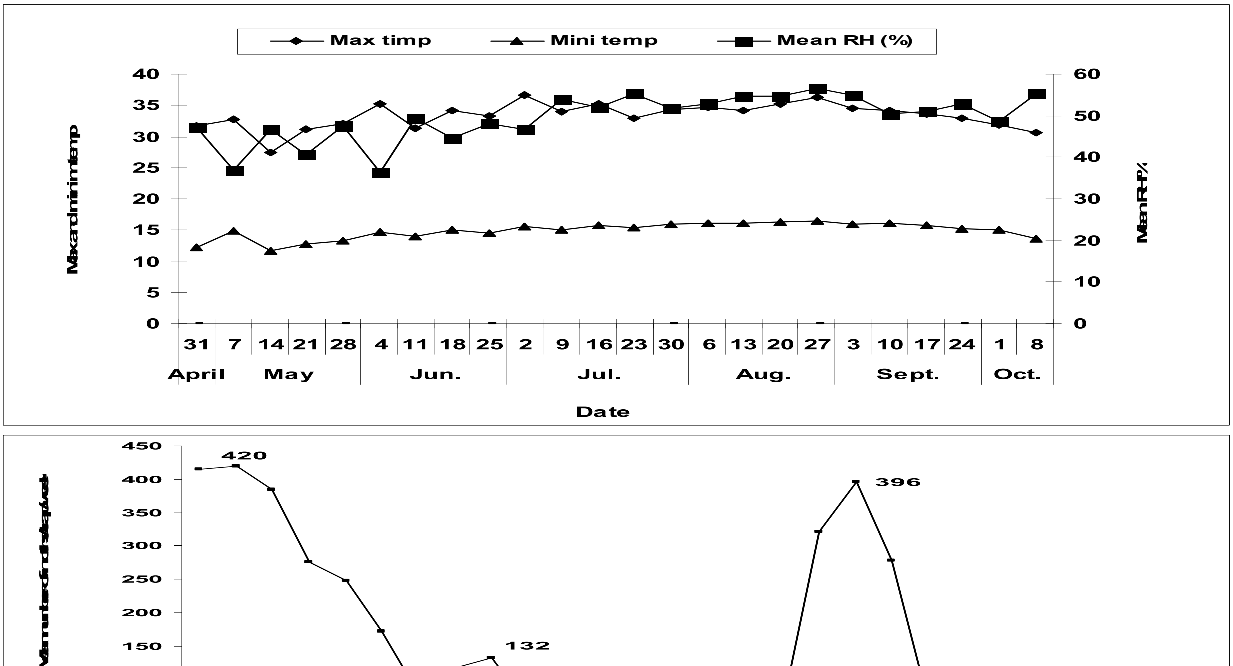

Fig. 5. Seasonal population fluctuations of *S. littoralis* on cotton plants by using sex pheromone traps during 2014season

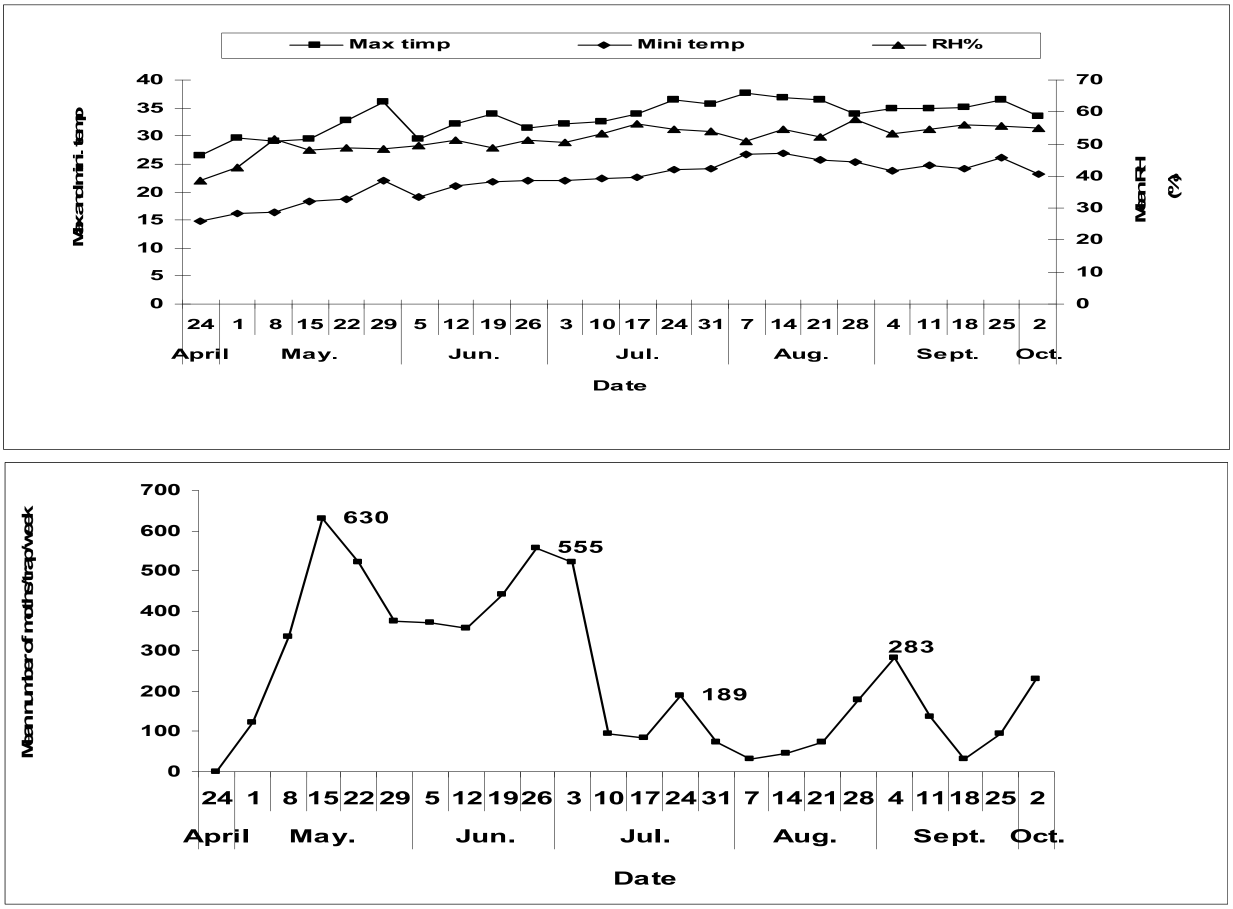

Fig. 6. Seasonal population fluctuations of *S. littoralis* on cotton plants by using sex pheromone traps during 2015 season

Relationships between capture of male moths in Delta sticky pheromone traps in cotton fields and some weather factors, Statistical analysis of data presented in Tables (1 and 2) shown that the correlation between weekly mean numbers of pink bollworm male moths in traps and each of maximum, minimum temperature and mean RH (%) was negative and positive insignificant in the seasons of 2014 and 2015.

The same trend was found in both cases of spiny bollworm, except in of minimum temperature the correlation was negative and significant of CLW. The total effect of the tested factors during 2014 and 2015 seasons for pink bollworm was 15.84 and 14.96 %, for spiny bollworm was 25.28 and 9.11 %, and for cotton leaf worm was 22.94 and 16.08 %, respectively.

Table1.Simple correlation (r) and explained variance (E.V.) between the means Max., Mini. temperature and relative humidity and the mean male moths of pink, spiny bollworms and cotton leafworm caught by using sex pheromone traps during 2014 season

Insects	Weather factors	Simple correlation	SE	E.V. %
	Max. temperature	-0.3871^{NS}	0.1922	
Pink bollworm	Mini. temperature	-0.3211^{NS}	0.1974	15.84
	Mean RH %	0.0802^{NS}	0.2078	
	Max. temperature	-0.1000^{NS}	0.2569	
Spiny bollworm	Mini. temperature	0.4595^{NS}	0.2293	25.28
	Mean RH %	0.3580^{NS}	0.2410	
	Max. temperature	-0.2754^{NS}	0.2049	
Cotton leafworm	Mini. temperature	-0.4430*	0.1940	22.94
	Mean RH %	-0.3964^{NS}	0.1957	

SE= Standard Error *= significant NS= non significant

Table2.Simple correlation (r) and explained variance (E.V.) between the means Max., Mini. temperature and relative humidity and the mean male moths of pink, spiny bollworms and cotton leafworm caught by using sex pheromone traps during 2015 season

Insects	Weather factors	Simple correlation	SE	E.V. %
	Max. temperature	0.2301^{NS}	0.2074	
Pink bollworm	Mini. temperature	0.3151^{NS}	0.2023	14.96
	Mean RH %	0.3683^{NS}	0.1982	
	Max. temperature	0.1424^{NS}	0.2645	
Spiny bollworm	Mini. temperature	0.2557^{NS}	0.2583	9.11
	Mean RH %	0.0555^{NS}	0.2668	
	Max. temperature	0.3632^{NS}	0.1986	
Cotton leafworm	Mini. temperature	0.3726^{NS}	0.1978	16.08
	Mean RH %	0.1986^{NS}	0.2089	

SE= Standard Error NS= non significant

Qureshi and Ahmed (1991) maximum of 12 moths per trap per night in the month of October were captured in case of spiny bollworm. The effect of relative humidity on *E. insulana* male moths was negative and insignificantly correlated during in the first season, 2000 and positively correlated during the second season (2001) Amer (2004). The population density of *E. insulana* has highly significant & positively Correlation with maximum temperature, while with minimum temperature positive and insignificant in the two seasons El-Sayed (2005). In Egypt the pink bollworm moths catch recorded three and four peaks during 2003 and 2004 cotton seasons, but RH % recorded positive & insignificant during 2003 season and positive & highly significant in 2004 season, while spiny bollworm recorded three peaks during the two seasons of study. The simple correlation values between the maximum temperature, and the population of *E. insulana* was negative and insignificant in 2003, while in 2004 season it was positive and significant. The effect of R.H. % was negative and insignificant during the two seasons Hegab, (2008). The effect of maximum, minimum and mean temperatures and R.H. % on the catch of *S. littoralis* in pheromone traps was significant and insignificant Al-shannaf and Hegab (2010a). The peak field incidence of pink bollworm on locule damage and larval incidence was recorded after three weeks of first peak pheromone trap catch Sandhya *et al*. (2010). Nocturnal activity peaks were found to be related with the time of year. A significant and positive correlation was recorded between population fluctuations of *Spodoptera litura* (Fab.) and weather parameters including rainfall, maximum temperature and wind speed (Fand *et al*., 2015). The peak activity of *Helicoverpa armigera* (Hub.) adults was observed from September to November, while it was from November to January for pink bollworm in different seasons. The tobacco caterpillar, *S. litura* showed wide variations regarding the peak incidence. Minimum temperature and rainfall were found to exert highly significant negative influence on pheromone trap catch of *H. armigera* while, all the weather parameters except morning relative humidity had highly significant negative influence on the pheromone trap catch of pink bollworm and tobacco caterpillar (Prasad *et al*., 2008). Male moths *S. litura* were active from July to October and attained four peaks with three oviposition peaks during both years on groundnut. First to third peaks of male moth catches coincided with first to third peaks of oviposition while very meager oviposition was observed during fourth peak of male moth catches. Oviposition on groundnut foliage showed significantly positive correlation with male moth catches in pheromone trap (Gedia *et al*., 2009). The pink moths catch recorded six and five peaks during two seasons, respectively. On the other hand the spiny bollworm catch recorded four peaks during first and second, seasons, respectively at different weather factors. The effect of maximum and minimum temperature on catch of pink moths in pheromone traps was low during the two seasons. Also, relative humidity showed lowest effect in the two seasons. The effect of maximum and mean temperature were moderately in the two seasons. The effect of R.H. % was lowest in 1st season and very lowest in the 2nd season during the two seasons, respectively. Relationships between trap catch of moths was positive and negatively & significant and insignificant at the two seasons for the all weather factors, but it was negatively and insignificant of RH % in the 2nd season. The peak captured *E. insulana* adult males in the sampling period was on 18 November Al-Shannaf and Hegab and (2010b). The pink bollworm had four generations on cotton plants during the period from May1st to September 30th when the moths emerged during May from diapauses larvae. The predicted peaks were detected earlier or later 3-4 days than the observed peaks Yones *et al.* (2012). Investigation of monthly changes in captures in relation to temperature in Iran. Analysis of the variance of results showed significant differences between time and trap number in the trapping values of *E. insulana*. Moth populations were observed in the second week of September. The peak captured *E. insulana* adult males in the sampling period was on 18 November. These results enable forecasting of seasonal *E. insulana* population peaks, providing additional information vital for the development of a successful, integrated pest-management programme for spiny bollworm (Hajatm and *et al*., 2015). Field experiments revealed that *P. gossypiella*, male moths captures remained at low levels during summer, increased late in August, peaked at mid of September and declined toward the end of the season. Trap captures increased sharply by the end of June for *P. gossypiella* (Milonas *et al*. 2016). Simple correlation and regression coefficients were also computed to know the relationship between weather factors and moth catches. The highest peaks of pink bollworm appeared during April, November and December during the two seasons. Out of weather factors, maximum temperature and rainfall showed positive response while minimum temperature, average temperature and relative humidity had a negative impact on the population fluctuation of pink bollworm. Regression coefficient showed 8.92% impact of weather factors in population fluctuation (Ali *et al*., 2016).

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تذبذب تعداد ذكور فراشات دودة اللوز القرنفلية والشوكية و دودة ورق القطن في حقول القطن

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أجريت هذه الدراسة في الزقازيق محافظة الشرقية، مصر في حقول القطن صنف جيزة ٨٦ (جوسيبيم باربادينس) تحت الظروف البيئية خلال موسمى ٢٠١٤ و ٢٠١٥ على التوالى لدراسة تذبذب تعداد دودة اللوز القرنفلية والشوكية ودودة ورق القطن . وأشارت النتائج إلى أن تعداد ذكور فراشات دودة اللوز القرنفلية (بيكتينوفورا جوسيبيلا) المصاده سجلت خمس قمم في الموسمين.سجل أعلى قمة للفراشات خلال الأسبوع الرابع من سبتمبر خلال موسمى الدراسة. حيث سجل ١٨٠ و ١٧٦ فراشة / مصيدة / الأسبوع في كلا الموسمين على التوالي . في حالة فراشات دودة اللوز الشوكية (ايرياس انسيولانا) سجلت المصائد أربع قمم للنشاط في الموسمين وكانت أعلى قمة للنشاط خلال الأسبوع الثانى من شهر سبتمبر في كلا الموسمين . سجل اعلى قمة ٤٨ و٥١ ذكر/فراشة / مصيدة / الأسبوع في كلا الموسمين على التوالي. كما أظهرت النتائج ان ذكور فراشات دودة ورق القطن سجلت أربع قمم خلال موسمى الدراسة وسجل أعلى متوسط لتعداد الفراشات خلال الأسبوع الاول والثانى من مايو وكان ٤٢٠ و ٦٣٠ فراشة / مصيدة / الأسبوع خلال موسمى الدراسة على التوالي . أظهرت نتائج التحليل الاحصائى وجود علاقة غير معنوية خلال موسمى الدراسة بين المتوسط الأسبوعى لذكور فراشات دودتى اللوز القرنفلية والشوكية ودرجة الحرارة العظمى والصغرى والرطوبة النسبية ،كانت تلك العلاقة بين متوسط تعداد ذكور فراشات دودة ورق القطن ودرجة الحرارة العظمى والرطوبة النسبية غير معنوية في عام ٢٠١٤ و٢٠١٥، بينما كانت تلك العلاقة معنوية بين متوسط تعداد ذكور فراشات دودة ورق القطن ودرجة الحرارة الصغرى فى موسم ٢٠١٤. نستخلص مما سبق انه يمكن استخدام الثلاثة انواع من المصائد الفيرمونية الجاذبة الجنسيه لكل من دودة اللوز القرنفلية والشوكية ودودة ورق القطن فى التنبؤ بتعداد ذكور الفراشات لاستخدامها فى برنامج المكافحة المتكاملة