EUROPEAN ACADEMIC RESEARCH
Vol. II, Issue 6/ September 2014

Impact Factor: 3.1 (UIF)
DRJI Value: 5.9 (B+)

ISSN 2286-4822
www.euacademic.org

Use of sex pheromone traps and insecticides for the management of *Earias spp.* and *Helicoverpa armigera* in okra crop

MUHAMMAD SHAHZAD MALIK
Department of Entomology
Sindh Agriculture University, Tandojam, Sindh
Pakistan
GHULAM HUSSAIN ABRO
Department of Entomology
Sindh Agriculture University, Tandojam, Sindh
Pakistan
School of Biological Sciences
University of Queensland, Brisbane, St. Lucia
Australia
RAB DINO KHUHRO
Department of Entomology
Sindh Agriculture University, Tandojam, Sindh
Pakistan
KHALID HUSSAIN DHILOO[1]
Department of Entomology
Sindh Agriculture University, Tandojam, Sindh
Pakistan
State Key Laboratory for Biology of Plant Diseases and Insect Pests
Institute of Plant Protection
Chinese Academy of Agricultural Sciences, Beijing
P.R. China
AFTAB RAZA JARWAR
Department of Entomology
Sindh Agriculture University, Tandojam, Sindh
Pakistan

Abstract:

The experiment on management of Helicoverpa armigera and Earias vittella through sex pheromone traps in okra was carried out at on an area of 1 acre at Latif Farm, Sindh Agriculture University, Tandojam, Pakistan from 1st June to 18th August, 2012. Four varieties

of okra i.e. Kiran, Noori-786, Durga and Rama Krishna were grown in a Randomized Complete Block Design (RCBD). Objective of this study was to compare population management of H. armigera and E. vittella in IPM and Non-IPM plot treatments. The results proved that IPM plot recorded maximum overall larval mean populations of H. armigera (0.61 ± 0.22) on Kiran variety, followed by Durga (0.52 ± 0.21), Noori-786 (0.50 ± 0.20) and, Rama Krishna (0.50 ± 0.20). The overall maximum mean larval population of E. vittella (0.41 ± 0.18) was recorded on Rama Krishna in IPM plot followed by Durga (0.39 ± 0.18), Kiran (0.37 ± 0.17) and Noori-786 (0.33 ± 0.16). The results further showed that sex pheromone traps installed at IPM plot captured maximum adult population of E. vittella and H. armigera. The data showed that maximum overall mean adult catches of E.vittella were (7.92 ± 0.81) recorded on Kiran variety, followed by Noori-786 (4.83 ± 0.63), Durga (4.75 ± 0.63) and Rama Krishna (3.42 ± 0.53). However, maximum overall mean adult catches of H.armigera were (4.08 ± 0.58) recorded on Noori-786 followed by, Durga (3.92 ± 0.57), Rama Krishna (3.67 ± 0.55) and Kiran (3.42 ± 0.53) respectively. The statistical result showed that there was no significant difference in effectiveness between neem oil and neem powder at (P<0.05) level.

Key words: Sex pheromone traps, insecticides, *Earias spp*, *Helicoverpa armigera*, okra, IPM and Non-IPM

Introduction

This study investigates the management and comparison of IPM and non IPM techniques against spotted and American bollworms on okra crop at Tandojam and its surroundings. Here we present use of sex pheromone traps as Integrated Pest Management tool from the perspective and choices available to resource poor farmers.

Among the vegetable crops grown in the world, okra (*Abelmoschus esculentus* L. Moench), also known as lady's

[1] Corresponding author: khdhiloo@yahoo.com

finger or bhendi, belongs to family Malvaceae and is an important crop grown throughout the year. Okra is thought to be native to an area extending from Ethiopia (Jacquelyn, 1999). Okra is widely grown all over Pakistan and is one of the cash crops of Sindh-Pakistan (Javed *et al*, 2009; Khoso, 1992). Besides Pakistan, it is grown in many countries of the world like Africa, southern Europe and America (Ariyo, 1993; Oyelade *et al*., 2003). The world's total annual okra production was about 4.8 million tonnes; and the share of Pakistan was 0.116 M tones during year 2009 (FAOSTAT, 2009). Okra has moderate levels of vitamins A and C and of calcium, phosphorus, and potassium, and is higher than many vegetables in thiamin, riboflavin and niacin. Okra is a popular health food due to its high fiber, vitamin C, and folate content. Okra is also known for being high in antioxidants. Okra is also a good source of calcium and potassium (Duvauchelle, 2011). It is popular in Pakistani cuisine, where chopped pieces are stir-fried with spices, pickled, salted or added to gravy-based preparations such as bhindi ghosht and sambar.

The okra crop is ravaged by many insect pests right from germination to harvest (Sharma *et al.,* 1997; Jagtab *et al*., 2007). Among sucking insect pests i.e. whitefly, aphid, jassid and thrip are the major pests of okra. Sucking pests in the early stage and the fruit borers, *E. vittella* Fabricius, *E. insulana* Boisduval and *H. armigera* (Hübner) in the later stage cause extensive damage to fruits and result in 69 per cent yield loss (Atwal and Singh, 1990; Mani *et al.,* 2005). The magnitude of infestation and the nature and extent of injury vary from variety to variety, seasons and localities (Greathead, 1986). The bollworms, *E. insulana*, *E vittella* and *H. armigera* (Lepidoptera: Noctuidae) are serious polyphagous insect pests on many economic crops including okra and are widely distributed in North Africa, India, Pakistan and other countries of the world (CWIE, 1968). Due to high reproductive and

damage potential and internal feeding habits of bollworms, their management on okra has become quite difficult for the growers.

Use of insecticides has been found to provide acceptable solution to tackle insect pest problems (Pawar *et al.,* 1988; Verma, 1989). Despite these advantages, the use of chemical pesticides had been ecologically unsafe and harmful to natural enemies in the environment. Vegetables are mostly consumed fresh therefore use of chemical insecticides for the protection of vegetable crops cause human health hazards. Therefore, an alternative to insecticides and to minimize their use, farmers can easily rely on IPM strategies like use of bio-pesticides and the installation of insect traps like sticky traps, light traps and sex pheromone traps (Priya and Misra, 2007).

Use of neem bio-pesticides as IPM tool, are simple in use; low-cost and easily available in the market since quite long time and their effectiveness against chewing, sucking pests and borers on many vegetables and grain crops have been demonstrated with variable success (Akbar *et al*., 1993, 1996, 1999; Dash *et al*., 1997; Bhatnagar and Sharma, 1997; Kumar and Bhatt, 1999; Ganguli and Ganguli, 1998; Bhanukiran and Panwar, 2000; Ahmed *et al*., 2002).

The pheromone traps are used to capture or directly reduce male moths. The use of sex pheromones include identification of pheromones, development of dispensers and traps, assessment of pheromone traps as a monitoring device, and the use of pheromones for mating disruption (Kehat, 1993). The sex pheromone trap mechanism or bait can vary widely (Weinzier et al. 1991).

Therefore, the present study was carried out to characterize sex pheromones trap response against different adult males of *E. insulana, E vittella* and *H. armigera* along with comparative effects of neem pesticide with synthetic pesticide against their larval infestation in okra for the benefit of farmer and consumer communities.

Materials and Methods

Pheromone traps, survey methods, data collection and analytical methods

The neem oil, Novastar 56 EC and Pheromone traps were purchased from the local market of District Tando Allahyar, Sindh-Pakistan.

Pheromone trap and Dose management for pesticide and bio-pesticides along with survey time selection

(i) ***Experimental field*:** The experiment was carried out under normal field conditions at Latif Farm, Sindh Agriculture University, Tandojam, Pakistan from May to August, 2012 (sowing till harvesting).

(ii) **Survey, plot size management and treatment management methods:**

The commonly grown four okra varieties such as Kiran, Durga, Noori–786 and Rama Krishna were grown on one acre on 10th of May, 2012, equally divided into two sub-plots i.e., Integrated Pest Management (IPM) and Farmer practices/ Non-IPM plots with Randomized Complete Block Design (RCBD) method. The distance between IPM and Non-IPM plots was 2 meters along with row to row (45 cm) and plant to plant (15 cm). The pesticide spinetoram "Radiant120% SC" was used against okra fruit borers in Non-IPM plot at 80 ml per acre. The IPM plot was sprayed with neem bio-pesticide at 800 ml per acre. Three applications of insecticides were made at interval of 21 days. Whereas, in IPM plot eight pheromone traps, four sex pheromone traps were randomly installed at 4-feet above ground level for capturing of *Helicoverpa armigera* and four for spotted (*Earias vittella* and *Earias insulana*) bollworms. The wicks were replaced at fortnight intervals.

Data collection

The observations for adults captured per trap were recorded at weekly intervals. For larval population of *Helicoverpa* and spotted bollworms, observations were recorded at weekly intervals. Larval population was recorded per 25 plants (top, mid and bottom) selected at random from IPM and Non-IPM fields. All other necessary agronomical practices were also carried out as per crop requirement. No or negligible rainfall was recorded during the entire study. Meteorological data was obtained by the Meteorological Station, Agriculture Research Institute, Tandojam-Sindh.

Analytical methods

Raw data management

All the data were processed into mean reduction percent with overall reduction percent by Microsoft Office Excel 2007, Microsoft Office Word 2007. Finally all the data were statistically analyzed and LSD at 0.05% was also tested by using Statix-8.1 computer software program.

Results

The data in Table-1 comparatively show that maximum mean larval population of *H. armigera* and *E. vittella* was (0.95 and 0.55) recorded on Kiran variety in IPM as compared to Non-IPM plot (0.65 and 0.50), respectively. Whereas, on Noori-786 variety (0.85 and 0.75) in IPM as compared to Non-IPM plot (0.70 and 0.35), respectively. For Durga variety maximum mean larval population of *H. armigera* and *E. vittella* (1.00 and 0.56) was recorded in IPM as compared to Non-IPM plot (0.60 and 0.55), respectively. Whereas, maximum larval mean population of *H. armigera* and *E. vittella* was (0.65 and 0.70) recorded on Rama Krishna variety in IPM as compared to Non-IPM plot (0.50 and 0.45), respectively. The data in Table-1 further depicted that maximum overall larval mean population

of *H. armigera* was (0.61 ± 0.22) recorded on Kiran variety in IPM plot, followed by Durga (0.52 ± 0.21), Noori-786 (0.50 ± 0.20), Rama Krishna (0.50 ± 0.20), respectively. Whereas, maximum overall larval mean population of *E. vittella* (0.41 ± 0.18) was recorded on Rama Krishna in IPM plot followed by Durga (0.39 ± 0.18), Kiran (0.37 ± 0.17) and Noori-786 (0.33 ± 0.16), respectively.

Table-2 shows data of adults of *E. vittella* and *H. armigera* captured through sex pheromone traps installed in IPM plot. The data showed that maximum overall mean adult catches of *E. vittella* were (7.92 ± 0.81) recorded on Kiran variety, followed by Noori-786 (4.83 ± 0.63), Durga (4.75 ± 0.63) and Rama Krishna (3.42 ± 0.53), respectively. However, maximum overall mean adult catches of *H. armigera* were (4.08 ± 0.58) recorded on Noori-786 followed by, Durga (3.92 ± 0.57), Rama Krishna (3.67 ± 0.55) and Kiran (3.42 ± 0.53) respectively.

The ANOVA results of adult population *H. armigera* trapped at all four varieties through sex pheromone trap in IPM plot showed that treatments were statistically significant at ($P < 0.05$) level indicating variance among treatments. Whereas, the ANOVA results of adult population *E. vittella* trapped at all four varieties through sex pheromone trap in IPM plot showed that treatments were also statistically significant at ($P < 0.05$) level indicating variance among treatments. The LSD further confirmed that 4 separate groups "a, b, bc and c" were formed indicating variance among treatments.

Discussion

The larval field population of *E. vittella* and *H. armigera* was recorded maximum in IPM plot as compared to Non-IPM plot during the study period. The present study further revealed that adult population of *E. vittella* captured maximum in Kiran

variety followed by Noori-786, Durga and Rama Krishna. However, maximum overall mean catches of *H. armigera* were recorded in Noori-786 followed by, Durga, Rama Krishna and Kiran. The study further revealed that *E. insulana* specie of spotted bollworm was not recorded during the study. The results of present study agree with those of Malik *et al.* (2003), who reported that the pheromone traps used against *H. armigera* and *E. vittella* were installed at 1.5 m from the ground in okra. First moth in the field appeared during 7th and 6th weeks of trap installation each year 1995 and 1996, respectively. Maximum mean numbers of moths (11th and 7th) were captured during 9th and 7th weeks of installation, when the average temperatures were 28.38 and 25.78°C each year, respectively. A total mean number of 24 and 17 months were captured during the two years of study respectively. The adult pest remained in the field till 11th and 4th August 1995 and 1996, respectively. The study strongly recommended the use of pheromone over pesticides against the pests in okra. The results of present study partially agree with those of Askari *et al.* (2008) who reported that, using sex pheromone traps was known as an effective method for monitoring and capturing *E. vittella* and *H. armigera*, the important pests of okra. On the basis of efficiency, solidity, ease of installation in each region, synthetic sex pheromone traps could be recommended as the best trap for capturing of *E. vittella* and *H .armigera.* The results of present study partially agree with those of Jeyakumar *et al.* (2008) who evaluated the interaction of pheromone traps in catching the adult moths of two bollworms (American bollworm-*H. armigera* and spotted bollworm- *Earias spp*.) during okra season 2002 and 2004. In general, pheromone traps at times of high population pressure (2002) of American and spotted bollworm. However, at times of low abundance of both American and spotted bollworm, i.e. during 2004, it was found that the pheromone traps (3.76 and 5.82 adults/trap/3 nights respectively) were significantly more effective in

trapping adults. However, no adverse effect was noticed in case of pheromone trap catches of spotted bollworm.

Conclusion

It is concluded from the present study that maximum larval field population of *H. armigera* and *E. vittella* appeared in IPM plot as compared to Non-IPM plot. Maximum overall mean catches of *E. vittella* were recorded in Kiran while minimum in Rama Krishna variety of okra. Maximum overall mean catches of *H. armigera* were recorded in Noori-786 while minimum in Kiran variety of okra.

Acknowledgements
This study was supported by project of Higher Education Commission, Islamabad, Pakistan (HEC PROJECT GRANT NO. 20-1404/ R & D / 09). We extend our thanks to the management team of Latif Farm, Sindh Agriculture University Tandojam for their cooperation to conduct this experiment.

Conflict of interest declaration: The authors have declared that no conflicts of interests exist.

REFERENCES

Ahmed, S., M.A. Saleem and I. Rauf, 2002. Field Efficacy of Some Bioinsecticides against Maize and Jowar Stem Borer, *Chilo Partellus* (Pyralidae: Lepidoptera). Intern. J. Agric. Biol., 3: 332-334.

Akbar, S, S. Ahmed, M. Iqbal and A. Ishtiaq, 1993. Comparative efficacy of synthetic insecticides and neem extract against insect pests of Brinjal. Pakistan Entomol., 15: 99-102.

Akbar, S, S. Ahmed and M Hassan, 1996. Efficacy of neem products and insecticides against white backed planthopper, *Sogatella furcifera* (Horv.). Pakistan J. Zool., 28: 5-7.

Akbar, S., S. Mushtaq and R. Akbar, 1999. Relative toxicity of neem products and insecticides against maize stem borer and maize aphid. Pakistan J. Zool., 31: 237-40.

Ariyo, O.J. 1993. Genetic diversity in West African okra (Abelmoschus caillei): Stevels multivariate analysis of morphological and agronomic characteristics. Genetic Resour. Crop Evol. 40:25-32.

Askari, Hassan (Barimani, Hassan); Al Mansur, Hassan; Zargaran, Mohamad Reza; Vatan Dust, Amin; Hanifeh, Siyamak; Mansur Qazi, Mostafa; Ghobari, Hamed; Tabriziyan, Mehrdad; Babaei, Mohammad Reza; A`liAkbari, Qasem; A`jamHassani, and Maryam. 2008. Study on possibility of *Tortrix viridana* control by its Iranian pheromone. Research Institute of Forest and Rangeland, Karaj (Iran).71 p.

Atwal, A. S. and B. Singh. 1990. Pest population and assessment of crop losses, Publication, Indian Agriculture Research Institute, New Delhi, Pp36.

Bhanukiran, Y. and V.P.S. Panwar, 2000. In vitro, efficacies of neem products on the larvae of maize stalk borer *Chilo partellus* (Swin.). Ann. Pl. Protect. Sci., 8: 240-2.

Bhatnagar, A. and V.K. Sharma, 1997. Effects of neem leaf and custard apple seed extracts on maize stem borer, *Chilo partellus* (Swin.). Plant Protect. Bull. Faridabad, 49: 33-40.

Common Wealth Institute of Entomology, 1968. Distribution Maps of Pests, *Earias vittella* F. London, UK., pp: 91.

Dash, A.N., B. Senapati, P.R. Mishra and S.K. Mukherjee, 1997. Efficacy of neem derivatives alone and in combination with synthetic insecticides against rice leaffolder. Pest Managem. Ecol. Zool., 5: 17-20.

Duvauchelle, Joshua. 2011. "Okra Nutrition Information". LiveStrong.com. Retrieved 24 June 2012.

FAOSTAT. 2009. Food and Agriculture Organization of the United Nations. Available online with updates at http://faostat.fao.org./site/339/default.aspx.

Ganguli, R.N. and J. Ganguli, 1998. Residual toxicity of insecticides and neem based formulations against *Chilo partellus* (Swin.) infesting maize. Indian J. Agric. Res., 32: 227- 32.

Greathead DJ (1986). Parasitoids in classical biological control. In: Insect Parasitoids. Waage, J. and D. Greathead (Eds), pp. 289-318. 13th Symposium of Royal Entomological Society of London, 18-19. Sept. 1985. Academic Press, London.

Jacquelyn, W., 1999. Agriculture Business Communities Families Home and Garden Kids Ar Us Natural. University of Arkansas Cooperative Extension Program, University of Arkansas at Pine Bluff, United States Department of Agriculture and County Goverments Cooperating, Arkansas, USA., pp: 1-3.

Jagtab, C. R., S.S. Shetgar and P.K. Nalwandikar. 2007. Fluctuation in population of lepidopterous pest infesting okra in relation to weather parameters during Kharif. Indian Journal of Entomology, 69 (3) : 218-220.

Javed, H; Aziz, M.A, and Leghari, R.A.K. 2009. Resistance in different okra (Abelmoschus esculentus L.) cultivars against American bollworm (Helicoverpa armigera Hub.). J.sgric. Res., 47: 433-438.

Jeyakumar P., Jat M.C., Singh Amar, and Monga D. 2008. Role of Pheromone Traps in the Management of Bollworms in Cotton Ecosystem. Indian Journal of Entomology, vol: 71, 1. 65-67.

Kehat M, D Ezra. Sex pheromones: Achievements in monitoring and mating disruption of cotton pests in Israel. Arch Insect Biochem Physiol. 1993; 22 (3-4): 425-431.

Khoso, A.W.1992. Growing vegetable in Sindh 1sted. Department of Agronomy. S.A.U, Tando Jam (115-118).

Kumar, S. and R.I. Bhatt, 1999. Field evaluation of plant leaf extracts oil and neem products against mango hopper (*Amritodus atkinsoni* Leth.) and thrips (*Scirtothrips mangiferae* Hood). Allelopathy J., 6: 271-6.

Malik, M.F., D. Rahman and L. Ali. 2003. Pheromone technology for the control of *Helicoverpa armigera* in okra. Asian Journal of Plant Sciences, 2 (5): 409-411.

Mani. M., A. Krishnamoorthy and C. Gopalakrishnan. 2005. Biological control of lepidopterous pests of Horticultural crops in India. A Review of Agricultural Research, 26(1): 39-49.

Oyelade, O.J., B.I.O. Ade-Omowaye and V.F. Adeomi. 2003. Influence of variety on protein, fat contents and some physical characteristics of okra seeds. J. Food Eng. 57:111-114.

Pawar, A. D., J. Prasad and R. Singh. 1988. Field evaluation of traps and sex pheromones of *Heliothis armigera* Hub. (Noctuidae: Lepidoptera) and effect of release of parasites on male moth catches in pheromone traps.Plant Protection Bulletin, 36: 29-30.

Priya, B. S. and H. P. Misra. 2007. Biopesticides for the management of okra fruit borer, *Earias vittella* (Fabricius). Pest Management in Horticultural Ecosystems, 13(2): 176-179.

Sharma, M. L., H. S. Raj and M.L. Verma. 1997. Biopesticides for management of *Helicoverpa armigera* (Hubner) in Chickpea. International Chickpea, Pigeon Pea Newsletter, 4 : 26-27.

Verma, S. 1989. Efficacy and persistence of some insecticides against jassid infesting okra (*Abelmoschus esculentus*).Plant Protection Bullettin, 41 (1/2) : 42-45.

Weinzier, R., T. Henn, P. G. Koehler and C. L. Tucker. 1991. Insect Attractants and Traps. University of Florida IFAS Extension, PP. 1-3.

Table-1 Mean larval population of *H. armigera* and *E. vittella* on four okra varieties from IPM and Non-IPM plots during, 2012

Date of Obser:	Varieties																Temp: °C	R.H%
	Kiran				Noori-786				Durga				Rama Krishna					
	IPM		Non-IPM		IPM		Non-IPM		IPM		Non-IPM		IPM		Non-IPM			
	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2		
01/6/2012	0.50	0.45	0.30	0.50	0.45	0.20	0.35	0.30	0.35	0.25	0.35	0.30	0.35	0.10	0.20	0.10	34.87	49.5
09/6/2012	0.40	0.15	0.25	0.25	0.40	0.20	0.25	0.15	0.40	0.35	0.45	0.30	0.35	0.30	0.15	0.20	32.75	57.5
18/6/2012	0.30	0.30	0.55	0.35	0.50	0.25	0.50	0.35	0.45	0.40	0.35	0.35	0.40	0.25	0.30	0.35	33.62	55.5
25/6/2012	0.35	0.25	0.45	0.30	0.40	0.30	0.55	0.30	0.45	0.25	0.55	0.35	0.40	0.60	0.25	0.35	34.12	54.5
03/7/2012	0.60	0.35	0.40	0.25	0.40	0.20	0.40	0.35	0.60	0.56	0.41	0.25	0.60	0.30	0.40	0.30	31.87	60.5
10/7/2012	0.75	0.35	0.65	0.30	0.50	0.20	0.70	0.30	0.50	0.40	0.60	0.35	0.65	0.30	0.50	0.45	32.37	55
16/7/2012	0.95	0.45	0.55	0.45	0.85	0.35	0.30	0.20	1.00	0.40	0.60	0.40	0.55	0.35	0.30	0.45	32.50	59.5
23/7/2012	0.80	0.45	0.30	0.45	0.50	0.35	0.15	0.15	0.50	0.45	0.45	0.40	0.65	0.5	0.25	0.25	32.62	59.5
30/7/2012	0.65	0.50	0.30	0.25	0.65	0.50	0.30	0.25	0.45	0.40	0.40	0.30	0.35	0.70	0.35	0.15	31.75	60
07/8/2012	0.90	0.55	0.50	0.30	0.40	0.75	0.50	0.25	0.52	0.40	0.55	0.55	0.65	0.55	0.35	0.25	30.50	62
13/8/2012	0.65	0.35	0.40	0.20	0.55	0.40	0.35	0.30	0.50	0.45	0.55	0.40	0.55	0.50	0.30	0.30	31.37	61.5
18/8/2012	0.45	0.30	0.30	0.20	0.45	0.30	0.25	0.20	0.55	0.40	0.45	0.35	0.45	0.45	0.20	0.05	31.75	60.5
Mean ± S.E	**0.61 ± 0.22**	**0.37 ± 0.17**	**0.41 ± 0.18**	**0.32 ± 0.16**	**0.50 ± 0.20**	**0.33 ± 0.16**	**0.38 ± 0.17**	**0.26 ± 0.14**	**0.52 ± 0.21**	**0.39 ± 0.18**	**0.48 ± 0.19**	**0.36 ± 0.17**	**0.50 ± 0.20**	**0.41± 0.18**	**0.30 ± 0.15**	**0.27 ± 0.14**	**32.51±1.64**	**57.96 ± 2.19**

T1= *H.armigera*/T2= *E.vittella*

Table-2 Average number of adults of *H. armigera* and *E. vittella* trapped per trap on four okra varieties in IPM plot.

Date of Obser:	Varieties							
	Kiran		Noori-786		Durga		Rama Krishna	
	H. armigera	*E. vittella*	*H. armigera*	*E. vittella*	*H. armigera*	*E. vittella*	*H. armigera*	*E. vittella*
01/6/2012	4	8	5	8	7	6	3	5
09/6/2012	6	9	5	7	5	6	8	5
18/6/2012	4	7	8	5	5	7	5	7
25/6/2012	6	9	7	6	5	5	6	4
03/7/2012	6	8	7	8	5	6	7	4
10/7/2012	6	8	3	7	6	5	6	8
16/7/2012	6	8	7	3	5	2	2	1
23/7/2012	2	8	6	6	8	7	7	5
30/7/2012	0	8	0	3	0	4	0	0
07/8/2012	0	9	0	1	0	0	0	0
13/8/2012	0	6	0	4	1	7	0	2
18/8/2012	1	7	1	0	0	2	0	0
Mean ± S.E	**3.42 ± 0.53 a**	**7.92 ± 0.81 a**	**4.08 ± 0.58 a**	**4.83 ± 0.63 b**	**3.92 ± 0.57 a**	**4.75 ± 0.63 bc**	**3.67 ± 0.55 a**	**3.42 ± 0.53 c**

Fig.1- Photographs showing Management of *E.vittella* and *H.armigera* through sex pheromone traps