Pest Management in Horticultural Ecosystems,
Vol. 15, No. 2 pp 114-120 (2009)

SEX PHEROMONE BASED IPM TECHNOLOGY FOR BRINJAL SHOOT AND FRUIT BORER, *Leucinodes orbonalis* Guenee (LEPIDOPTERA : PYRALIDAE)

D.B. PAWAR, M.N. BHALEKAR, A.G. CHANDELE, B.M. ILHE and H.N. SHINDE

All India Co-ordinated Vegetable Improvement Project, M.P.K.V., Rahuri 413 722, India
E-mail : pawardattji@yahoo.co.in

ABSTRACT : An IPM technology involving non chemical and eco-friendly components i.e. sex pheromone traps, integrated with other practices were tested for three years (2006 to 2008) against brinjal shoot and fruit borer (BSFB) at All India Coordinated Vegetable Improvement Project, M.P.K.V, Rahuri, India. The study revealed that mass trapping of *Leucinodes orbonalis* moths with the help of plastic funnel traps @ 1 per 100 sq.m. baited with leucilure sex pheromone, clipping of infested shoots at weekly interval starting at 20 days after transplanting (DAT), spraying with NSKE 4% four times at an interval of 15 days starting at flowering and destruction of infested fruits after harvest had reduced the shoot infestation to the extent of 80.44% over untreated and 61.64% over without mass trapping. The increase in yield was 44.75% over untreated and 11.76% over without mass trapping.

Key Words : Brinjal, IPM technology, *Leucinodes orbonalis,* sex pheromone

INTRODUCTION

Brinjal or egg plant (*Solanum melongena* L.) is an important vegetable crop which gains good returns to the farmers. Therefore, it is widely cultivated throughout Maharashtra state and also in India. The brinjal shoot and fruit borer (BSFB) (*Leucinodes orbonalis* Guenee) is the devastating pest of brinjal which causes loss to the extent of 48.03% (Mall *et al.,* 1992 and Singh *et al.,* 2000). To combat this pest, farmers depend mainly on chemical pesticides. The indiscriminate use of pesticides poses a number of problems. To reduce these hazards, different IPM techniques have to be employed under field conditions. Now a days sex pheromones have been gaining importance throughout world for mass trapping of BSFB (Cork *et al.,* 2005; Jhala *et al.,* 2005; Krishna Kumar *et al.,* 2005; Mandal *et al;* 2005; Rath & Dash, 2005 and Bhanu *et al.,* 2007). The present investigation was undertaken to assess the pheromone trap as a component of IPM module for management of brinjal shoot and fruit borer.

MATERIALS AND METHODS

A field experiment was conducted during *kharif* season of 2006, 2007 and 2008 at All India

Coordinated Vegetable Improvement Project, M.P.K.V. Rahuri. It was laid out in two isolated blocks of 900m^2 at 200 m distance with four treatments and five replications. In one block, sex pheromone traps @ 1 per 100 sq.m. were installed for mass trapping of moths. The other block was without pheromone traps. Except this both blocks were given similar other treatments *viz.*, shoot clipping + NSKE (4%) spray, only shoot clipping, only NSKE sprays and untreated. Destruction of infested fruits at harvest was the common treatment.

In mass trapping, the sex pheromone traps contained plastic funnel trap with a rubber septa were selected (leucilure) and were erected in the field at 20 days after transplanting (DAT). The septa were changed at 60 days interval for three times. The shoot clipping was started at 20 DAT at weekly interval up to the incidence of the shoot borer damage and sprays of NSKE 4% were started at flowering and were given four times at 15 days interval. To take care of sucking pests, *viz.*, leafhopper, aphids and white fly the roots of seedlings were dipped in a solution of imidadoprid @ 1 ml/l water for 3 hr before transplanting.

RESULTS AND DISCUSSION

The data presented in Table 1 revealed that the shoot infestation was the lowest in the treatment which consisted mass trapping with funnel traps, followed by shoot clipping at weekly interval, followed by four sprays of NSKE (4%) than untreated. The per cent reduction in shoot damage over untreated plot was 80.44 in mass trapping with shoot clipping and sprays of NSKE 4 % while per cent reduction was 61.64 over untreated plot without mass trapping.

Table 1. Effect of mass trapping on brinjal shoot damage due to *L. orbonalis*

S. No.	Treatments	Per cent shoot infestation		Per cent reduction in damage over untreated		Per cent reduction in damage over WMT
		Mass Trapping	Without Mass Trapping	Mass Trapping	Without Mass Trapping	
1.	Shoot clipping + NSKE 4%	2.29* (8.64)	5.97* (14.14)	80.44	57.33	61.64
2.	Shoot clipping	2.55 (9.15)	6.11 (14.31)	78.22	52.56	58.26
3.	NSKE 4%	3.41 (10.52)	6.30 (14.41)	70.87	48.91	46.82
4.	Untreated control	11.71 (19.95)	12.88 (20.97)	0.00	0.00	13.27
	S.E. ±	**0.86**	**0.92**			
	C.D. (P = 0.05)	**2.97**	**3.20**			

Figures in parentheses indicate arc sin values
WMT = Without mass trapping

*Average of three years

Table 2. Effect of different IPM components on the incidence of *L. orbonalis*

S. No.	Treatments	Per cent fruit infestation (No. basis)		Per cent reduction in damage over untreated		Per cent reduction in damage over WMT
		Mass Trapping	Without Mass Trapping	Mass Trapping	Without Mass Trapping	
1.	Shoot clipping + NSKE 4%	19.77* (26.35)	27.90* (31.86)	51.88	38.11	29.13
2.	Shoot clipping	28.29 (31.97)	35.18 (36.37)	31.15	21.96	19.58
3.	NSKE 4%	23.35 (28.85)	29.50 (32.88)	43.17	34.56	20.84
4.	Untreated control	41.09 (39.83)	45.08 (41.86)	0.00	0.00	8.85
	S.E. ±	**0.44**	**0.35**			
	C.D. (P = 0.05)	**1.28**	**1.00**			

Figures in parentheses indicate arc sin values *Average of three years
WMT = Without mass trapping

Table 3. Effect of mass trapping and other treatments on the yield of brinjal

S. No.	Treatments	Yield of marketable fruits q/ha		Per cent increase in yield over untreated		Per cent increase over WMT
		Mass Trapping	Without Mass Trapping	Mass Trapping	Without Mass Trapping	
1.	Shoot clipping + NSKE 4%	284.22*	256.60*	44.75	45.54	11.76
2.	Shoot clipping	259.15	233.36	31.98	32.36	11.05
3.	NSKE 4%	275.62	250.65	40.37	42.17	9.96
4.	Untreated control	196.35 (39.83)	176.30 (41.86)	-	-	-
	S.E. ±	**2.71**	**1.98**			
	C.D. (P = 0.05)	**7.80**	**5.70**			

*Average of three years WMT = Without mass trapping

The fruit infestation ranged from 19.77 to 41.09 % (Table 2). It was lowest (19.77 %) in pheromone erected block integrated with clipping of infested shoots at weekly interval starting at 20 DAT, spraying with NSKE (4%) for four times and destruction of infested fruits after harvest. The per cent reduction in fruit damage over untreated was 51.88% in mass trapping, while the per cent reduction in fruit damage over without mass trapping was 29.13%. It was highest than other treatments (i.e) only shoot clipping, only NSKE 4% sprays and untreated.

The yield of marketable fruits (Table 4) was the highest in the treatment combination of mass trapping of *L. orbonalis* moths, clipping of infested shoots at weekly interval, spraying with NSKE 4% for four times and destruction of infested fruits after harvest (284.22 q/ha). The per cent increase in yield over untreated was the highest in the same treatment (44.75 %) and over without mass trapping was (11.76 %) also highest. The additional profit realized over without mass trapping was Rs 18096/- (Table 5). The highest monetary benefit due to adoption of IPM practice was reported by Natrajan *et al.*, (2005) and Swami Shashankanandaji, (2005).

The data on number of moths caught weekly during the study (Table 5) revealed that maximum number of moths were caught in the month of August to October in all the three years, which indicated the peak period of the pest. Similarly, the data on natural enemies observed in the experiment is presented in Table 7. It is seen from the table that the population of *Crossopalpus* sp., a dipteran predator of leafhopper and whitefly, was 2.8-3.4 adults/plant while population of *Chrysoperla carnea*, a neuropteran predator of sucking pests was 1.4 to 3.0 eggs/plant. *Crossopalpus* sp. adult was observed feeding on sucking pests viz. leafhopper adults and whitefly adults and was identified by Pawar *et. al.*, (2001). The population of a parasitoid of BSFB i.e. *Trathala flavor-orbitalis* emerged from the infested fruits was 1-3 adults/20 fruits. *Trathala flavor-orbitalis* has been reported to parasitize *L. orbonalis* larvae (Tiwari and Moorthy, 1984;

Table 4. Economics of IPM technologies evaluated for managing *L. orbonalis*

S. No.	Treatments	Gross income @ Rs. 8/kg		Expenditure (cost of cultivation /ha) (Rs.)		Additional income (Rs.)		Additional profit
		MT	WMT	MT	WMT	MT	WMT	WMT
1.	Shoot clipping + NSKE 4%	2,27,376	2,05,280	55,600	51,600	1,71,776	1,53,680	18,096
2.	Shoot clipping	2,07,320	1,86,688	53,600	49,600	1,53,720	1,37,090	16,630
3.	NSKE 4%	2,20,496	2,00,520	53,600	49,600	1,66,896	1,50,920	15,976
4.	Untreated control	1,57,080	1,41,040	47,600	43,600	1,09,480	97,440	12,040

MT : Mass Trapping WMT : Without Mass Trapping

Table 5. Number of moths of *L. orbonalis* trapped in sex pheromone trap

Date of observation	No. of moths/trap/week	Date of observation	No. of moths/trap/week	Date of observation	No. of moths/ Trap/week
2006-07		**2007-08**		**2008-09**	
4.7.06	48	–	–	–	–
11.7.06	56	–	–	–	–
18.7.06	40	–	–	–	–
25.7.06	32	25.7.07	96	–	–
1.8.06	52	1.8.07	80	2.8.08	65
8.8.06	42	8.8.07	87	9.8.08	56
15.8.06	55	15.8.07	107	16.8.08	45
22.8.06	50	22.8.07	120	23.8.08	20
29.8.06	68	29.8.07	67	30.8.08	97
5.9.06	72	5.9.07	36	6.9.08	49
12.9.06	84	12.9.07	33	13.9.08	47
19.9.06	78	19.9.07	15	20.9.08	8
26.9.06	65	26.9.07	18	27.9.08	17
3.10.06	87	3.10.97	16	4.10.08	42
10.10.06	98	10.10.07	16	11.10.08	5
17.10.06	90	17.10.07	91	18.10.08	14
24.10.06	89	24.10.07	106	25.10.08	84
31.10.06	60	31.10.07	57	1.11.08	88
7.11.06	52	7.11.07	36	8.11.08	65
14.11.06	30	14.11.07	43	15.11.08	50
21.11.06	14	21.11.07	14	22.11.08	24
28.11.06	10	28.11.07	15	29.11.08	15
5.12.06	10	5.12.07	10	6.12.08	10
12.12.06	8	12.12.07	11	13.12.08	8
19.12.06	10	19.12.07	8	20.12.08	10
26.12.06	8	26.12.07	7	27.12.08	7
3.1.07	6	3.1.08	6	3.1.09	8
–	–	–	–	10.1.09	5

Table 6. Effect of IPM treatments on natural enemies

S. No.	Treatments	*Crossopalpus sp.* / plant	*Chrysoperla carnea* eggs /plant	*Trathala flavor-orbitalis* /20 fruits
1	Shoot clipping + NSKE 4%	2.8	1.6	2.0
2.	Shoot clipping	3.0	2.0	2.0
3.	NSKE 4%	2.8	1.4	1.0
4.	Untreated control	3.4	3.0	3.0

Sandanayake and Edirisinghe, 1992; Pawar *et al.*, 2001 and Yasodha and Natarajan, 2005).

ACKNOWLEDGEMENTS

We thank the Head, Department of Horticulture for providing necessary facilities. Thanks are due to M/s Agriland Biotech Ltd, Baroda, Gujarat for supplying pheromone traps and lures for this study.

REFERENCES

Bhanu, K.R.M., Prabhakara, M.S. and Jayanth, K.P. 2007. Field evaluation of indigenously developed sex pheromone lures for mass trapping brinjal shoot and fruit borer *Leucinodes orbonalis* Guenee (Lepidoptera: Pyralidae). *Pest Management in Horticultural Ecosystems,* **13** : 115-121.

Cork, A., Alam, S.N., Srinivasan, K., Das, C.S., Ghosh, G.C. and Talekar, N.S. 2005. Development of pheromone trap system for eggplant borer, *Leucinodes orbonalis* in South Asia. National Symposium on Recent Advances in Integrated Management of Brinjal Shoot and Fruit Borer, 3-4 Oct.2005, *Extended summary,* pp 25-28.

Jhala, R.C., Patel, J.R., Patel, RH., Bharpoda, T.M., Patel, N.C., Patel, M.G., Chavda, A.J., Patel, Y.C. and Talekar, N.S. 2005. Evaluation of ecofriendly integrated pest management components to combat eggplant shoot and fruit borer *(Leucinodes orbonalis* Guenee) in Gujarat. National Symposium on Recent Advances in Integrated Management of Brinjal Shoot and Fruit Borer, 3-4 Oct. 2005, pp. 39-43.

Krishna Kumar, N.K., Krishna Kumari, B., Singh, H.S., Ranganath, H.R., Shivkumara, B. and Kalleshwaraswamy, C.M. 2005. Field evaluation of trap design, pheromone loading and dispenser for trapping eggplant shoot and fruit borer, *Leucinodes orbonalis* using synthetic pheromone lure. National Symposium on Recent Advances in Integrated Management of Brinjal Shoot and Fruit Borer, 3-4 Oct.2005, pp. 21-24.

Mall, M.P., Pandey, R.S., Singh, S.V. and Singh, S.K. 1992. Seasonal incidence of insect pests and estimation of losses caused by shoot and fruit borer on brinjal. *Indian Journal of Entomology,* **54** : 241-247.

Mandal, D., Baral, K., Chattterjee, H. and Mandal, P. 2005. Integrated pest management of eggplant shoot and fruit borer, *Leucinodes orbonalis* Guenee. National Symposium on Recent Advances in Integrated Management of Brinjal Shoot and Fruit Borer, 3-4 Oct. 2005. Pp. 58-62.

Natarajan, N., Cork, Alan, Velavan, S.S., Dhakshinamoorthy, G. and Pandi, R. 2005. Economics of IPM for management of

eggplant shoot and fruit borer under sustainable farming condition in Tamil Nadu. National Symposium on Recent Advances in Integrated Management of Brinjal Shoot and Fruit Borer, 3-4, Oct. 2005, pp. 171-178.

Pawar, D.B., Warade, S.D. and Patil, S.K. 2001. Record of some natural enemies of vegetable pests. *Insect Environment,* **6 :** 168-169.

Rath, L.K. and Dash, Bijayeeny. 2005. Study on efficacy of a non chemical IPM module for the management of brinjal shoot and fruit borer. National Symposium on Recent Advances in Integrated Management of Brinjal Shoot and Fruit Borer, 3-4 Oct. 2005, pp. 63-66.

Sandanayake, M. and Edirisinghe, J.P. (1992). *Trathala flavoorbitalis* : parasitisation and development in relation to host stage attacked, *Insect Science and Application,* **3 :** 287-292.

Shashankanandaji, Swami, 2005. Implementation of an integrated pest management strategy for the control of eggplant shoot and fruit borer in Ranchi District of Jharkhand. National Symposium on Recent Advances in Integrated Management of Brinjal Shoot and Fruit Borer, 3-4 Oct. 2005, 181-182.

Singh, S.V., Singh, K.S. and Malik, Y.P. 2000. Seasonal abundance and economic losses of shoot and fruit borer, *Leucinodes orbonalis* on brinjal. *Indian Journal of Entomology,* **62 :** 247-252.

Tiwari, G.C. and Moorthy, D.N.K. (1984). New records of two parasites of brinjal shoot and fruit borer, *Leucinodes orbonalis* Guen. *Entomon,* **9:** 63-64.

Yasodha, P. and Natarajan, N. 2005. Biodiversity of natural enemies of *Leucinodes orbonalis* (Guen.) National Symposium on Recent Advances in Integrated Management of Brinjal Shoot and Fruit Borer, 3-4 Oct. 2005. Pp. 85-89.