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Short communication

Effect of pheromone lure-distance and direction in trapping brinjal fruit and shoot borer (*Leucinodes orbonalis* Guen.) male moths

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ABSTRACT

An experiment was conducted at Bhubaneshwar, Orissa, to study the presence of male Brinjal Shoot and Fruit Borer (BSFB) outside cropping area and the effect of wind direction on male BSFB trap catches. Water traps with 4 mg of synthetic BSFB pheromone lure in rubber septa were placed at 0, 50, 100, 150 and 350 m away from a brinjal field in all four directions i.e., North, South, East and West. Water level in the traps was maintained constant and lures were changed at 20 days interval. Count of BSFB trapped males and record of wind direction was made every 24 h for 61 days. Results indicated that the number of male BSFB moths in distantly located traps (350 m from the brinjal field) was at par with the numbers observed in traps placed in the main brinjal field. Traps located at 50 and 100 m from brinjal field attracted less male BSFB moths than those at 0, 150 and 350 m indicating the feasibility of trapping male BSFB moths even in non-brinjal area. Trap direction did not significantly influence trap catch. Nearly 60% of BSFB male moths were observed in traps placed against direction of the wind.

Key words: *Leucinodes orbonalis*, pheromone, trap distance, wind direction

Eggplant (*Solanum melongena* L.) or brinjal is among the most important vegetables in many parts of the world. The shoot and fruit borer (*Leucinodes orbonalis* Guen. Lepidoptera: Pyralidae), is a major pest on brinjal and can destroy entire crop (Atwal, 1976). Several insecticides were reported to be effective (Kuppuswamy and Balasubramanian, 1980; Singh, 1983; Tewari and Krishna Moorthy, 1983) against *L. orbonalis*. Recently it has been observed that chemical control measures are less effective (Krishna Kumar *et al*, 2006) possibly because of development of insecticide resistance. No viable resistance is observed within cultivated *S. melongena* (Dhankar, 1988). Natural parasitism is low (Srinivasan, 1994) and other alternative control measures such as barrier cropping, use of botanicals (Ansari and Nair, 1972; Ansari and Thomos, 1974; Peter and Govindarajalu, 1994) and bio-agents (Bustamantae *et al*, 1994) were not always economically effective.

After identifying the major component of female sex pheromone of brinjal shoot and fruit borer (BSFB) (Zhu *et al*, 1987; Attygalle *et al*, 1988), pheromone lure was integrated as a component in the IPM of BSFB (Cork *et al*, 2001). Results indicated that more trap catches of male BSFB moths were observed when the traps were placed at the crop canopy level (Talekar, 2002). The use of pheromone technology for management of BSFB IPM was evaluated on a large scale in South-East Asia (Alam *et al*, 2003). Despite its effectiveness in attracting a number of male moths, no significant reduction in fruit borer damage was observed (Krishna Kumar *et al*, 2004). The extent of male trapping is influenced by a number of factors. Krishna Kumar *et al* (2004) indicated that the orientation of moths to the pheromone lure greatly depended on prevailing weather conditions and is affected by pesticides such as cypermethrin.

Thus, there is a need to find ways for need-based application of chemical pesticides for management of insect pests without affecting the efficacy of BSFB pheromone. Placement of pheromone traps away from the brinjal field is one such method, as, this will also facilitate a community approach to BSFB management. Experiments were therefore initiated to study the effect of pheromone lure-distance and direction on trapping male BSFB.

An experiment was laid out at the Central

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Table 1. Vegetation in trapping grid

Direction	Distance (m) of traps (from brinjal crop) and flora in trapping grid					Distance from nearest brinjal field outside the grid (m)
	0	50	100	150	300	
East	Brinjal	Fruit crop nursery plants, guava and weeds	Lime and weeds	Aonla and weeds	Bitter gourd and weeds	500
West	Brinjal	Banana, Sapota and weeds	Sapota and weeds	Litchi and weeds	Cashew and weeds	1000
North	Brinjal	Mango and weeds	Mango and weeds	Mango and weeds	Forest plants and weeds	800
South	Brinjal	Fallow, weeds and forest plants	Guava and weeds	Guava and weeds	Forest plants and weeds	900

Horticultural Experiment Station, Bhubaneswar, a regional station of the Indian Institute of Horticultural Research, Bangalore. A local cultivar, *Long green* was raised in the field nursery in September and planted in October, 2004 in 1500 m^2 area. All the recommended cultural practices were followed except application of the insecticide. Water traps (Pest Control India Ltd.) containing 4 mg of BSFB lure in rubber septa were placed in all four directions of the field at a distance of 0, 50, 100, 150 and 350 m from the crop zone. Traps were adjusted periodically to the height of the crop. Composition of the vegetation as recorded in the trapping grid is presented in Table 1. Inside the trapping grid, no brinjal crop was raised except in the experimental plot. Outside the grid, there was no brinjal crop up to a distance of 1000 m.

Water traps with BSFB pheromone lures [synthesized indigenously at the Indian Institute of Chemical Technology (IICT), Hyderabad] were placed in December, 2004. The pheromone vials were changed every 20 days. Water level in the traps was regularly maintained and the number of male moths trapped was recorded at every 24 h for 61 days. Similarly, direction of the wind was recorded daily at 5 p.m. Data on total number of moths trapped were sub-grouped into two categories: *wind-positive* (those trapped in the direction of wind on any particular day) and *wind-negative* (male moths flying towards the trap against direction of the wind). Trap catch data were subjected to Analysis of Variance (ANOVA) (Little and Jackson, 1977) after square root transformation.

Vegetation recorded inside the trapping grid comprised of fruit plants (banana, sapota, mango, cashew, litchi, lime and aonla), bitter gourd and weeds. None of these plants is a host for BSFB (Table 2). The synthetic sex pheromone was effective in trapping male BSFB moths. However, number of moths trapped varied form trap to trap and within a trap over time. Interestingly, males were seen to be trapped not only within the cropped area but also 350 m away. Data indicated that the mean number of moths trapped in traps located at 150m and 350 m from the experimental field (non-host area) was *at par* with the number trapped within the field (P=0.05), which indicates the possibility of trapping BSFB male moths in non-host area. A possible reason for moths trapped in the non-host area might be influx of males into the trapping grid or their outflux from the brinjal field. Either way, this gives an indication that presence or absence of a brinjal crop is of less significance for the orientation of BSFB male moths towards the pheromone lure. This information can be utilized to successfully trap BSFB male moths to implement a community based, area-wide pheromone technology. Our results indicating the attraction of male moths to the chemical lure, irrespective of the presence or absence of host plant, provides a window of opportunity to lure the pest, all through the year. Furthermore, trapping a significant number of male BSFB moths, especially during the lean season, limits the biotic potential of the pest significantly.

Table 2. BSFB trap catch in relation to distance from brinjal field and wind direction

Direction	Distance(m)					Direction effect
	0	50	100	150	350	
North	0.5376(0.6589)	0.0612(0.2019)	0.0952(0.1781)	0.1925(0.4324)	0.6426(0.7819)	0.3050 (0.4506)
South	0.6081(0.7444)	0.2027(0.3674)	0.1920(0.3577)	0.2817(0.4871)	0.2159(0.3776)	0.3061 (0.4669)
East	0.3798(0.5926)	0.0729(0.2554)	0.1167(0.2628)	0.4039(0.5071)	0.4991(0.6956)	0.2945 (0.4627)
West	0.1995(0.4348)	0.0504(0.1829)	0.1419(0.3513)	0.3638(0.5596)	0.1841(0.4136)	0.1878 (0.3884)
Distance effect	0.4310(0.6077)	0.0968(0.2519)	0.1364(0.2875)	0.3164(0.4965)	0.3854(0.5672)	

	Direction effect	Distance effect	Interaction
S Em (±)	0.0574	0.0642	0.1285
CD (*p=0.05*)	NS	0.1840	NS

·Figures in parentheses are square root transformed values

Table 3. Effect of wind direction on orientation of male BSFB moths and trap catch

Number of days the wind blew in a specific direction			Mean wind positive population	Mean wind negative population	% trapped as wind negative
Direction of wind (location of trap)	Wind blow days Negative	Positive			
S → N (South)	26	9	0.08	0.23	74.19
N → S (North)	9	26	0.11	0.20	64.52
E → W (East)	16	10	0.10	0.19	65.52
W → E (West)	10	16	0.06	0.12	66.67
Mean					67.72

The number of male BSFB moths trapped at 50 m and 100 m from the experimental brinjal field was significantly less (p=0.05) compared to traps placed at 0 m, 150 m and 350 m. The possibly large influx of BSFB males from far and wide may be a reason for increased catches in traps placed at 150 m and 350 m, also indicating that the BSFB males are good fliers. Similarly, traps placed at 0 m recorded significantly more moths, possibly as a direct result of fruit infestation, continuously breeding and emerging adult population within the brinjal field.

Results indicated that male trapping can be done without presence of the host plant, which, in turn, points to the fact that sex stimulus, is the primary factor (though environmental influences can not be ignored). By this, immigrant males could be trapped in the non-host area itself (before these could reach the host area). By placing traps near/ around the brinjal field for targeting the moths, interference from cypermethrin could be avoided. However, results show that trapping of males is required in both brinjal and non-brinjal areas if area-wide management is to be successful.

Data on trap catches in the four directions are presented in Table 3. Wind direction for 26 days was from South to North, 10 days from West to East, 16 days from East to West and 9 days from North to South. Proportion of the wind negative trap catches (male moths flying towards the trap against the direction of wind) was more than 64 %. This indicate that placement of pheromone traps against wind direction enhanced BSFB trap catches.

REFERENCES

Alam, S. N, Rashid, M. A., Rouf , F. M. A., Jhala, R. C., Patel, J. R., Satpathy, S., Shivalingaswamy, T. M., Rai , S., Wahundeniya , I., Cork , A., Ammaranan, C., Talekar, N. S. 2003. IPM Strategy for Eggplant Fruit and Shoot Borer-Final Technical Report of a DFID-funded Project R7465 (C): Development of an Integrated Pest Management strategy for the control of eggplant fruit and shoot borer (*Leucinodes orbonalis*) in South Asia, Asian Vegetable Research Centre, Taiwan. pp 1-66

Ansari, P. A. R. and Thomos, M. J. 1974. On the use of lemon grass leaf infusion for the control of brinjal aphid. *Agril. Res. J. Kerala*, **12**: 77

Ansari, P. A. R. and Nair, M. R. G. K. 1972. On the control of brinjal pests using deterrents. *Agril. Res. J. Kerala*, **10**: 133-135

Attygalle, A. B., Schwaraz, J. and Gunawardena, N. E. 1988. Sex pheromone of brinjal fruit and shoot borer *Leucinodes orbonalis* Guenee (Lepidoptera: Pyralidae). *Zeitschrift fur Naturforschung*, **43**: 790-792

Atwal, A. S. 1976. Agricultural pests of India and South East Asia. Kalyani Publishers, New Delhi, p. 527

Bustamantae, R. C, Luzaran, P.B., Gruber, L.T. and Villanueva, E., 1994. Field evaluation of different control measures against eggplant shoot and fruit borer. *The Philippines J. Pl. Industry*, **59**: 119-125

Cork, A., Alam, S. N., Das, A., Das, C. S., Ghosh, G. C., Farman, D .I., Hall, D. R., Maslen, N. R., Vedham, K., Phythian, S. J., Roue, F. M. A. and Srinivasan, K. 2001. Female sex pheromone of brinjal shoot and fruit borer, *Leucinodes orbonalis* (Lepidoptera : Pyralidae), blend optimization. *J. Chem. Ecol.*, **27**: 1867-1877.

Dhankar, B. S. 1988. Progress in resistance studies in the eggplant (*Solanum melongena* L.) against shoot and fruit borer (*Leucinodes orbonalis* Guen.) infestation. *Tropical Pest Management*, **34**: 343-345

Krishna Kumar, N. K., Venugopalan, R., Krishna Moorthy, P. N., Shiva Kumara, B. and Ranganath, H. R. 2004. Influence of weather factors on the attraction of male eggplant shoot and fruit borer, *Leucinodes orbonalis* Guenee to synthetic sex pheromone in South India. *Pest Mgt. Hortl. Ecosys.*, **10**: 161-167

Krishna Kumar, N. K., Krishna Kumari, B., Singh, H. S., Ranganath, H. R., Shiva kumara, B. and Kalleshwarswamy, C. M. 2006. Pheromone trapping protocols for brinjal fruit and shoot borer, *Leucinodes* *orbonalis* Guenee (Lepidoptera: Pyralidae): evaluation of trap design, quantity and dispenser. *J. Hort. Sci.*, **1**: 39-42

Kuppuswamy, S and Balasubramanian, M. 1980. Efficacy of synthetic pyrethroids against brinjal fruit borer, *Leucinodes orbonalis* Guen. *South Ind. Hort*., 28: 91-93

Little, T. M. and Jackson, H. F. 1977. Agricultural Experimentation Design and Analysis: ANOVA, John Wiley and Sons, Inc. Canada, pp-44

Peter, C. and Govindarajalu, V. 1994. Efficacy and persistence toxicity of certain new insecticides against brinjal pest complex. *Pestology*, **18**: 27-30

Singh, D. 1983. Control of brinjal fruit borer, *Leucinodes orbonalis,* with synthetic pyrethroids. *Pesticide*, **17**: 14-15

Srinivasan, K. 1994. Recent trends in insect pest management in vegetable crops. In: G. S. Dhaliwal and Arora (eds.) Trends in Agricultural Insect Pest Management. Commonwealth publishers, New Delhi, pp-345-372.

Talekar, N. S. 2002. Controlling eggplant fruit and shoot borer. International co-operators guide. AVRDC Publication No. 02:534, Taiwan.

Tewari, G. C. and Krishna Moorthy, P. N. 1983. Effectiveness of synthetic pyrethroids against the pest complex of brinjal. *Entomon*, **8**: 365-368.

Zhu. P., Kong. F, Yu, N. S., Hu, X. and Xu, J. 1987. Identification of the sex pheromone of egg plant borer, *Leucinodes orbonalis* Guenee (Lepidoptera: Pyralidae). *Zeitschrift fur Naturforschung*, **42**:1347-1348.

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