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Field longevity studies of pheromone lure of brinjal shoot and fruit borer (*Leucinodes orbonalis* Guenee) in relation to weather parameters

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Abstract
An experiment was conducted at farmers field of simikeri, bagalkot district during 6th February to 6th april, 2013 to assess the field longevity of pheromone lures in relation with weather parameters. It revealed that after 2 months of exposure of lure in the field, the left over pheromone quantity observed was 1.55mg. The maxi mum and minimum temperature showed non-signifcant negative relationship with male moth catches. Morning and afternoon relative humidity had negative relationships with brinjal shoot & fruit borer moth catches and rainfall had non significant positive relationship with male moth catches, whereas, wind speed showed negative relationship with brinjal shoot and fruit borer.

Keywords: *Leucinodes orbonalis*, pheromone lure, simikeri

Introduction
Brinjal or eggplant or aubergine (*Solanum melongena* L.) is an horticultural important, highly cosmopolitan and popular vegetable grown as poor man's crop in India. It is the second largest producer of brinjal after China and in Karnataka, brinjal is cultivated over an area of 16.1 thousand ha with a production of 421.4 thousand tonnes (Anon., 2019) [3].

Unfortunately, the sustainability of production of brinjal is under threat from shoot and fruit borer (BSFB), *Leucinodes orbonalis*, guenee (Lepidoptera, crambidae) which causes up to 70 to 90 per cent yield loss. (Ali. *et al.,* 1980; Kallo, 1988; Anon., 1995; Dhandapani *et al.,* 2003) [1, 2, 6]. It is considered as nearly monophagous although potato has been recorded as an alternate host (Nandihalli *et al.,* 1996) [13].

This pest is attacking to the brinjal throughout the crop period starting from seedling to harvesting stage. Wilting of young shoots is the main symptom on the shoots and a significant portion of yield is lost due to fruit damage, often leading to abandonment of the entire crop by the farmers (Bhanu *et al.,* 2007) [4]. The farmers resort to indiscriminate use of insecticides to keep the pest under check. Since brinjal crop is harvested at regular and short intervals as a vegetable for consumption, the use of toxic pesticides is not advisable due to the frequent pickings, the use of chemicals for management of this pest started proving to be detrimental to the health of consumers vowing to the toxic residues of the chemicals in the produce. Frequent and indiscriminate use of insecticides has also posed other problems like resistance development and resurgence of pests, environmental pollution, disruption of natural enemies and health hazards (Mehrotra, 1990) [12]. Even though one cannot do away with chemical pesticides completely, a paradigm shift in the approach is warranted in tackling the pest species. Integration of ecologically viable and cost effective methods with other available methods of pest management is the need of the hour.

To develop ecologically safe and viable IPM programme for *Leucinodes orbonalis*, usage of ecofriendly insecticides *viz.,* chitin synthesis inhibitors, juvenile hormone mimics, ecdysone antagonists, avermectins, neem, bacillus thuringiensis Berliner etc., are of vital importance. This approach will also provide safety to the natural enemies and result in insecticide free quality produce. In addition to eco- friendly insecticides, in the recent years, use of pheromones started gaining importance as an effective tool in pest monitoring and mass trapping.

After identification of sex pheromone components (E-11-16: Ac & E11-16: OH) from Indian population of BSFB by Cork *et al.* (2001) [5], number of studies were carried out in different parts of the country to manage BSFB using sex pheromone. But, most of these studies were concentrated on standardisation of basic aspects such as pheromone blend ratio,

effective dose of pheromone, basic designs of traps and lures and also application of the pheromone for pest monitoring whereas detailed information on longevity of pheromone lure in relation to weather parameters was the focus of this study.

Material and methods

The field experiment was conducted at Simikeri, Bagalkot District to assess the field longevity of pheromone lures. Water trap with plastic vial as a single dispenser was used during the experimentation. Totally, 30 lures loaded with 4 mg of pheromone in each lure were used in 30 traps and installed in brinjal crop at half feet above the crop canopy. The pheromone lures (plastic vials) used during present investigations were obtained from Bio-control Research laboratories, Bangalore, containing 4 mg of sex pheromone of brinjal shoot and fruit borer having components of (E)-11-hexadecenyl acetate and (E)-11-hexadecen-10-0l in 100:1 blend, respectively**.**

At weekly interval, five lures from the installed traps were taken out and sent to Bio-Control Research Laboratories, Bangalore, for analysis of left over pheromone in the lure. Similar procedure was followed up to two months. Simultaneously, observations were also made at weekly interval on male moth catches in the pheromone traps. Weather parameters such as maximum and minimum day temperature, relative humidity and rainfall were also obtained from Agro meteorological Department, Regional Horticultural Research and Extension Centre, UHS, Bagalkot. Weather parameters and trap catches were correlated to know the possible relationship between them.

Results and discussion

Pheromone release rate is one of the important factors which influences the male moth catches. In the view of this, field study was conducted to know the release rate pattern of pheromone lure over a period of two months. It was observed that the efficiency of tested lures was optimum in catching male moths of brinjal shoot and fruit borer up to two months under field conditions. As the lure exposure period increased under field condition, the mean quantity of pheromone and number of the male moth catches were decreased. The results revealed that the mean quantity of pheromone left over in the lures was 3.04 mg and 1.55 mg at 15 and 60 days of exposure period, respectively. The moth catches were 3.80 and 1.40 per trap per day at 15 and 60 days of exposure periods, respectively (Table 1).

At the same time correlation between left over pheromone, trap catches and weather parameters was worked out during study period to find out the interaction between the number of male moth catches, and left over pheromone with major weather factors like maximum and minimum temperature, morning and evening relative humidity, rainfall and wind speed. The results indicated that there was non-significant positive relationship between trap catches (r=0.416) and left over pheromone (Table 2). The recorded data indicated that there was non-significant negative correlation between maximum temperature (r=-0.107) and minimum temperature (r=-0.414) with *L. orbonalis* male moth catches. Similarly, the morning and evening relative humidity had negative correlation with number of male moth catches of *L. orbonalis* which was statistically non-significant. The rainfall had positive correlation with male moth catches, while wind speed had negative correlation. Both were statistically non-significant.

Lure longevity study revealed that after 2 months of exposure of lure in the field, the left over pheromone quantity observed was 1.55 mg (Fig. 1). These results are in conformity with Bhanu *et al.* (2007) [4] who reported that lures were be viable under field conditions for over 2 months which was confirmed by release rate studies carried out under laboratory conditions. Even though commercial companies claim lures work for two months but last 15 days lures were not efficient in catching male moths. However, further studies are needed to confirm these results.

Maximum and minimum temperature showed non-significant negative relationship with male moth catches. Similar findings were also observed in the case of *H. armigera* (Nesbitt *et al*., 1979; Korat and Lingappa, 1995; Kulkarni *et al*., 2004) [14, 7, 9]. However, Krishna Kumar *et al.* (2009) reported that the significant negative correlation between minimum temperature and brinjal shoot and fruit borer moth catches. Morning and afternoon relative humidity had negative relationships with brinjal shoot and fruit borer moth catches, which is broadly in line with findings of Kumar and Babu (1996), Kumar *et al.* (2004) and Patnaik, (2000) [15]. Rainfall had non significant positive relationship with male moth catches of brinjal shoot and fruit borer. These results differed from those of Kumar *et al.* (2009) [11], who recorded significant negative correlation between rainfall and BSFB trap catches. Wind speed showed negative relationship with BSFB, which was also recorded in the case of *H. armigera* (Nesbitt *et al*., 1979; Korat and Lingappa, 1995) [14, 7].

Table 1: Influence of exposure period on release rate of pheromone from the lure under field conditions

Batch number	Lure exposure period (Days)	*Mean quantity of left over pheromone in the lure (mg)	Mean male moth catches/trap/day Mean ± SD
1	15	3.04	3.80±0.53
2	30	2.30	3.04±0.32
3	38	2.56	0.85±0.20
4	45	2.39	1.20±0.26
5	52	1.88	2.40±0.20
6	60	1.55	1.40±0.52

*Mean of five lures

Table 2: Simple correlation among left over pheromone, weather parameters and mean male moth catches of *Leucinodes orbonalis*

Weather parameters	Correlation coefficient 'r'
Average mean male moth catches	0.416
Maximum temperature (ºC)	-0.107
Minimum temperature (ºC)	-0.414
RH I (%)	-0.537
RH II (%)	-0.698

Rain fall (mm)	0.262
Wind speed (km/h)	-0.124

RH I= Morning Relative Humidity
RH II=Evening Relative Humidity

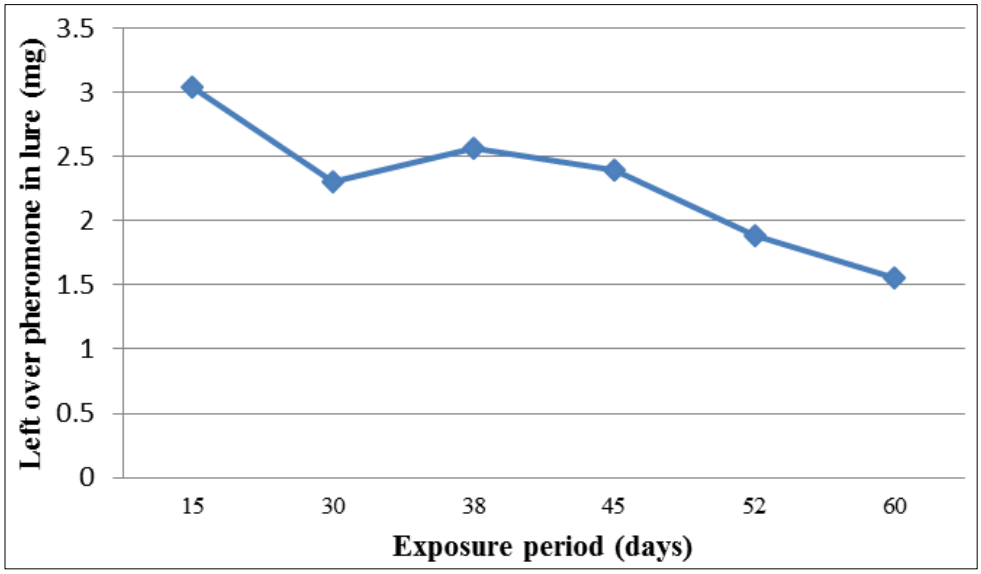

Fig 1: Release pattern of sex pheromone of *Leucinodes orbonalis* from the lures over the period of exposure under field conditions at Bagalkot.

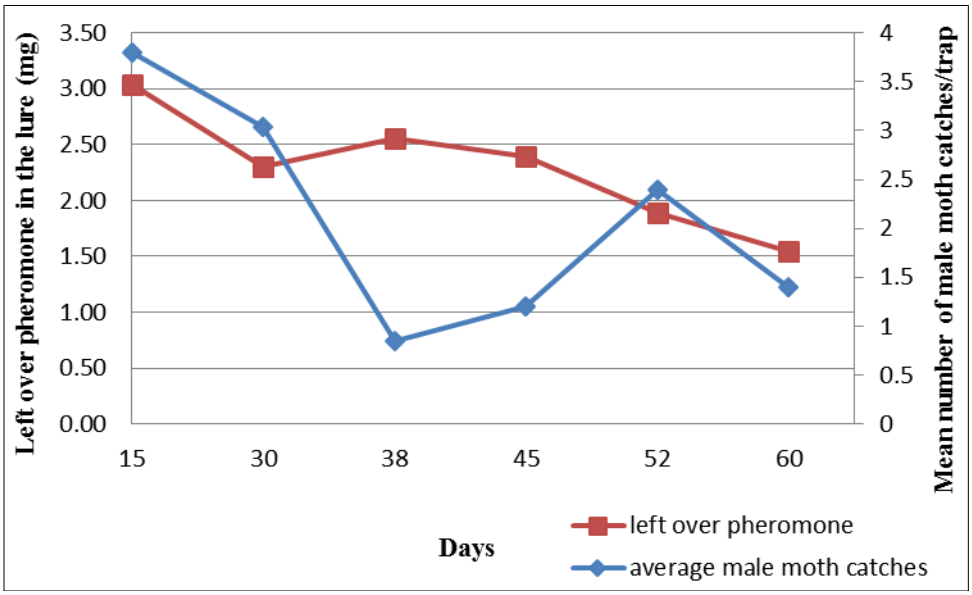

Fig 2: Comparison of male number of male moth catches to left over pheromone in the lure

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