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Influence of leucilure in parasitization behaviors of *Trichogramma chilonis* Ishii in Brinjal

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Abstract
The poormans crop, brinjal is the most widely cultivated vegetable crop in south east Asian countries. Though affected by several pests, brinjal is most seriously infested by the pest, shoot and fruit borer, *Leucinodes orbonalis*. In the present investigation, the parasitisation behavior of *Trichogramma chilonis* was tested with and without *L. orbonalis* sex pheromone, against *Corcyra* eggs under *in-vitro* condition and against *Leucinodes orbonalis* eggs in *in-vivo* condition. The results proved that under laboratory condition, the maximum parasitization was seen in *Corcyra* card + pheromone lure (88.33 eggs/ card) than in host eggs alone (60.40 eggs/ card). Under field condition, the maximum parasitization was observed in brinjal cropped plot installed with sex pheromone trap with 34.12 eggs/ card compared to brinjal sole cropped plot with 24.00 eggs/ card.

Keywords: *Trichogramma chilonis*, *Leucinodes orbonalis*, *Corcyra*

Introduction
Brinjal, *Solanum melongena* Linnaeus (Family: Solanaceae) has been cultivated in our country since age and is the native of India. Brinjal is one of the most popular and economically important vegetables among small scale farmers and low income consumers of the entire universe. Such economically important commercial crop is reported to be infected by 142 species of insects, four species of mites and three species of nematodes [10]. Among them, the internationally known as eggplant fruit and shoot borer (EFSB) is considered to be the most serious insect pest of brinjal in all parts of India [2]. The average pesticide consumption in India is around 0.381 kg a.i./ha occupying 14 per cent of pesticides in the country against vegetables, predominantly on chilli (5.13%) followed by brinjal (4.6%) as compared to world average of 0.5 kg a.i./ha. The frequently used insecticides like synthetic pyrethroids lead to resurgence on the sucking insect's viz., aphid, whitefly and leafhopper. Though *T. chilonis* is recommended against *L. orbonalis*, the parasitisation levels with pheromone and without pheromone were yet to study. Definitely the inclusion of these components can be a viable tool in IPM option and can be used to replace the sole use of chemical insecticides in brinjal crop. Therefore, the present investigation was concentrated on assessing the compatibility of behavior approach using pheromone.

Materials and Methods
Laboratory condition
The experiment was carried out at Biocontrol laboratory, Department of Plant Protection, Anbil Dharmalingam Agricultural College and Research Institute, Tiruchirappalli. The investigation was assessed through no choice test by using influence of synthetic EFSB pheromone on the parasitization behavior of *T. chilonis* by placing the sterilized unparasitized *Corcyra* egg card @ 0.5 cc in a ziplock cover having nucleus card of Tricho with (0.02 cc) and without pheromone lure. About 12 replications were maintained for each treatment so, totally 24 covers were kept under observation. These bags were placed in ventilated dark place, after three days, the extend of parasitization (blackening of eggs) and parasitoid emergence was observed under laboratory condition. The experiment was replicated twice for conformation.

Field condition
The field experiment was conducted at farmer's field at Podhavur village, Thiruchirapalli, with brinjal variety, Manaparai local in an area of one acre which was divided into four equal quarters in which pheromone traps were installed in diagonals opposite quarters.

Remaining two diagonal quarters were taken as control without pheromone traps for comparison. The influence of pheromone trapping system on parasitization behavior of *T. chilonis* egg parasitoid was studied by augmentative release of *T. chilonis* at fortnight interval. The egg parasitoid,
T. chilonis was released @ 2cc/acre. The egg parasitoid, *T. chilonis* was released at the rate of 2 cc / acre. In every 0.25 acre treatment plot, 0.5cc Trichocard was cut in 20 pieces and it was distributed at uniform distance across the entire plot. The interaction effect of pheromone trapping system on parasitization behavior of *T. chilonis* was assessed by bait card technique (sentinel egg card technique) using laboratory host *Corcyra cephalonica* eggs. Therefore, a total of 80 unparasitized *Corcyra* egg card pieces having approximately 0.025 cc were also distributed for comparison. The data on the mean number of parasitized eggs were transformed to square root transformed value and analyzed using agres-agdata software.

Results

The results on the influence of pheromone on parasitization behavior of *T. chilonis* on brinjal crops under laboratory condition indicated higher mean number of parasitization (88.33 eggs/card) in *Corcyra* card + pheromone lure while it was lower than in parasitized egg (83.66 eggs/card) observed in host egg placed alone (Table1). In second confirmatory experiment, result also showed that the maximum parasitization of *Corcyra* eggs (82.46 eggs/card) was recorded in *Corcyra* card + pheromone lure and minimum parasitisation recorded in (60.4 eggs/card) host eggs alone without pheromone

The result on the influence of pheromone on parasitization behavior of *T. chilonis* on brinjal crops under field condition registered maximum parasitization in brinjal crop plot imposed with *Leucinodes* sex pheromone trap (36.62 eggs/card) compared to low level of 30.12 parasitization noticed in the plot with brinjal alone (Table 2). In the second experiment, the parasitization per card was 30.25 egg/card in brinjal sole cropped plot and 38.63 eggs in brinjal crop imposed with sex pheromone trap. In third experiment, maximum mean number of parasitization was recorded in brinjal crop with *Leucinodes* sex pheromone trap (30.37eggs/card) and lower level of parasitization was observed in brinjal sole cropped plot with 21.75 eggs/card. In the fourth experiment, the maximum number of parasitization observed was in sex pheromone with brinjal crops 30.87 eggs/card mean number of parasitization whereas only 13.87 eggs/card in brinjal sole cropped plot.

Discussion

Strain of the *T. chilonis* being having a broad spectrum of host, *L. orbonalis* can be effectively in the presence of Leucilure. Eggplant shoot and fruit borer, *L. orbonalis* control widely used biocontrol agents like egg parasitoids of *T. chilonis* the fact that a reaction of the wasp was elicited only by female moths during calling activity and concurrent with male moth responses strongly suggests that the parasitoids were indeed responding to the sex pheromone of the moth. The reaction of *T. pretiosum* to its host's sex pheromone may be illustrative of a more general phenomenon among egg parasitoids of noctuids as similar effects have also been found for *T. evanescens* parasitoids of *M. brassicae* [6]. The sex pheromone of *H. zea* serves as a kairomones for *T. pretiosum*. However, the results do not provide much information about the mechanism causing higher parsitization rates in the field, as found by Lewis *et al*. [3]. Odour of *H. zea* moths in addition to the sex pheromone apparently influence the searching behavior of *T. pretiosum*, as indicated by the however in the field these is a gap in time between the release of sex pheromone by the host moths and searching activity of *Trichogramma* wasps. Calling activity by *H. zea* occurs during the night [9] and although *Trichogramma* spp. will parasitise host eggs in darkness. Evidence from the studies of wall [12] and wall *et al*. [11] suggests that adsorption of pheromone to vegetation might be the factor that makes this material available as a kairomone for diurnal parasitoids. Orientation behavior of *Trichogramma* egg parasitoids *T. evanescens* and *T. pretiosum* in response to the sex pheromone of their notcuid host *M. brassicae* and *H. zea* was investigated in the wind. Compared to clean air, residence times, walking times and path lengths on a platform higher in pheromone loaded air than in clean air. The host's sex pheromone caused wasps to land shortly after takeoff. The result showed higher rates of parasitism of moth's eggs in pheromone treated plots in earlier field experiments. This may be due to the effect of lure. If the lure is frequently changed at proper intervals, the parasitisation level will be more. Sex pheromone of hosts appears to function as kairomones in the detection of host aggregations by these wasps [5]. Lewis *et al*. [3] found an increase in the rate of parasitisation of eggs of *H.zea* on cotton by *T. spp*. When plots were treated with synthetic sex pheromone of *H. zea*. However, alternatively behavior responses leading to arrestment by host sex pheromone and enhancement of local searching activity might be the mechanism causing higher rates of parasitisation in the field. *T. pretiosum* responded positively to the odour of *H.zea* calling moths.

T. evanescens respond positively to the odour of *M. brassicae* [6]. Several authors have speculated about the possible application of semiochemicals to enhance the efficacy of parasitoids in biological control programmes [4, 1, 7]. Therefore, the use of sex pheromone can be a compatible one with augmentative release of biocontrol agents like *T. chilonis* with higher parasitisation in the management of BSFB in an ecofriendly manner without chemical pesticides.

Table 1: Influence of *L. orbonalis* pheromone on parasitization behaviour of *T. chilonis* (laboratory studies)

Experiment	Mean number of parasitized eggs/ card	
	Laboratory host egg with Pheromone	Laboratory host egg without Pheromone
1	88.33 (9.30)	83.66 (9.10)
2	82.46 (8.97)	60.40 (7.67)
SEm	0.027	0.011
CD	0.132	0.054

Figures in the parentheses are based on square root transformation.

Table 2: Influence of *L. orbonalis* pheromone on parasitization behaviour of *T. chilonis* under field condition (Off -station)

Treatment	Mean number of parasitized eggs/ card				
	Expt.1	**Expt. 2**	**Expt. 3**	**Expt. 4**	**Mean**
Plot with Brinjal alone	30.125 (5.53)	30.25 (5.54)	21.75 (4.71)	13.87 (3.79)	24.00 (4.94)
Plot with Brinjal + Pheromone trap	36.62 (6.09)	38.63 (6.25)	30.37 (5.55)	30.87 (5.60)	34.12 (5.88)
SEm	0.081	0.020	0.041	0.037	
CD (0.05)	0.672	0.165	0.344	0.310	

Figures in the parentheses are based on square root transformation.

Conclusion

It can be concluded from the present study, the behavioural approach of use of sex pheromone is found compatible with augmentative biocontrol *Trichogramma chilonis* Ishii suggested for *L. orbonalis* management

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