Parasitism Efficiency of *Trichogramma embryophagum* (Hymenoptera: Trichogrammatidae)on the Eggs of Brinjal Shoot and Fruit borer, *Leucinodes orbonalis* (Lepidoptera: Crambidae)

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Abstract
The parasitism efficiency of the egg parasitoid, *Trichogramma embryophagum* on one- two- and three- day old eggs of *Leucinodes orbonalis* was studied under laboratory condition during three different seasons. The emergence rate of *T. embryophagum* from parasitized different aged eggs of *L. orbonalis* and the parasitizing ability of *T. embryophagum* through parthenogenesis reproduction in three different seasons were also analyzed at laboratory conditions. The results indicated that the activity of *T. embryophagum* was enhanced by the seasons *Kharif* and *Rabi* in study area. Besides, the egg parasitoid proved its efficacy against *L. orbonalis*. The parasitism and emergence rate of *T. embryophagum* was 88.67 and 91.73 per cent, respectively, during *Kharif*, 2013 at 30.6±1.3^{0}C and 90.67 and 90.42 per cent, respectively during *Rabi*, 2013 at 29.7±0.8^{0}C compared to 67.33 and 79.34 per cent, respectively, at 36.2±1.3^{0}C during summer season on one-day old eggs. The findings clearly described the slight susceptibility of *T. embryophagum* to weather conditions in summer season. It was also noted that the parasitoid, *T. embryophagum* preferred one-day-old eggs of *L. orbonalis* for parasitism during all seasons compared to 2- or 3-days old eggs. The ability of *T. embryophagum* in parasitizing the eggs of *L. orbonalis* by parthenogenesis reproduction was 10.7 eggs per single parasitoid. The results indicated the usefulness of *T. embryophagum*in parasitizing eggs of *L. orbonalis*.

Keywords:Emergence rate, *Leucinodes orbonalis*, Parasitism, Parthenogenesis,*Trichogramma embryophagum*
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Introduction

Brinjal (*Solanum melongena* L.) is native to Indian Subcontinent and is grown extensively in tropical and subtropical countries. Although it is an important crop, the production is threatened by several factors. The major one among these is brinjal shoot and fruit borer, *Leucinodes orbonalis*. The management of this pest is difficult as the larvae live inside the fruit or shoot however, if spraying of insecticides is undertaken at the time of neonate larvae hatching from the eggs or before the neonate larvae bore inside shoots or fruits, successful results could be obtained. In order to achieve this, frequent application of insecticides is essential as the neonate larvae can enter fruits or shoots within a few hours of hatching from eggs (Alam *et al.*, 2003). However, the frequent application of insecticides after the flowering stage of brinjal plant is not advisable as the brinjal fruits are picked at frequent intervals. By considering these the trend is moving towards the bio-rational pest management. As such the present study was conducted to find the parasitism efficiency of egg parasitoid, *Trichogramma embryophagum* against *L. orbonalis* at the Bio-control laboratory of Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore, India to incorporate it as one of the management strategies in Bio-Intensive Pest Management (BIPM) of *L. orbonalis*.

Materials and Methods

Parasitism efficiency and emergence rate of T. embryophagum

Three pieces of cloths each containing thirty numbers of one- two- and three- day old eggs (cohorts) of *L. orbonalis* were obtained from laboratory culture. Each piece of cloth was kept in a cleaned test tube of 2 cm diameter and *T. embryophagum* was introduced into these tubes at the rate of 6:1 (host : parasitoid) and tightly covered by cloth. A control experiment was also set by keeping a piece of cloth with thirty one-day old eggs of *L. orbonalis* in a cleaned test tube (diameter 2cm) without egg parasitoid. Each treatment was replicated five times in a Completely Randomized Design (CRD) and conducted during three different seasons *viz.*, *Kharif*, 2013 (30.6±1.3^{0}C) *Rabi*, 2013 (29.7±0.8^{0}C) and summer, 2014 (36.2±1.3^{0}C).The parasitized eggs of *L. orbonalis*, which turned black, were counted and transferred to another cleaned test tube and covered tightly. The emergence rate was worked

out by counting the number of adult *T. embryophagum* emerged out of parasitized eggs of *L. orbonalis*. The data were analyzed using two-way ANOVA with replications.

Parasitic ability of T. embryophagum by parthenogenesis

A single parasitized egg from parasitized one, two and three day old eggs of *L. orbonalis* was cautiously cut with the small piece of cloth and kept in a cleaned test tube and covered by a cloth rigidly. After the emergence of parasitoid, a small piece of cloth consisting 35 one-day old eggs of *L. orbonalis* were provided to test tube containing a single parasitoid to find the parasitism ability of *T. embryophagum* by parthenogenesis which emerged from parasitized different age groups of eggs of *L. orbonalis*. An untreated control was arranged by keeping a piece of cloth consisting 35 one-day old eggs of *L. orbonalis* in a test tube without introduction of *T. embryophagum*. Each treatment was replicated five times and arranged in CRD and repeated in three different seasons as mentioned above. The data were analyzed by two-way ANOVA.

Results and Discussion

Parasitism efficiency and emergence rate of T. embryophagum

The results displayed in the Table 1 show that the parasitism efficiency and emergence rate of *T. embryophagum* was enhanced by the weather parameters prevailed in Kharif and Rabi seasons. Besides, the findings revealed that *T. embryophagum* preferred one-day old eggs of *L. orbonalis* for parasitism in all tested seasons compared to 2 or 3-day old eggs.

On the other hand, within the season the emergence rate of *T. embryophagum* from parasitized different aged group of eggs of *L. orbonalis* was comparatively similar which showed aging of the eggs of *L. orbonalis* was not the factor in influencing the emergence rate of *T. embryophagum*. From these finding it can be concluded that the parasitism efficiency and emergence rate of *T. embryophagum* was advanced by the weather conditions existed in *Kharif* and *Rabi* seasons at Coimbatore, Tamil Nadu, India.

Parasitic ability of T. pretiosum by parthenogenesis

The Table 1 also shows the number of eggs of *L. orbonalis* parasitized by parthenogenesis of *T. embryophagum*, which was emerged from parasitized one-day, two-day and three-day old eggs of *L. orbonalis*.The statistical analysis revealed that within the seasons the adult *T. embryophagum* emerged from parasitized different aged egg of *L. orbonalis* had equivalent capacity in parasitizing the eggs of *L. orbonalis* by parthenogenesis.Besides, the seasons, Kharif, 2013 and Rabi, 2013 advanced the parthenogenesis reproduction of *T. embryophagum* in the absence of male insects compared to summer, 2014. An average of 10.7 eggs of *L. orbonalis* was parasitized by *T.*

Table 1: Parasitism efficiency and emergence rate *Trichogramma embryophagum* from *L. orbonalis* (eggs)

Seasons	Age of eggs of *L. orbonalis* (days)	Parasitism (%)	Emergence rate of *T. embryophagum*	Number of *L. orbonalis* eggs parasitized by parthenogenesis
***Kharif*, 2013**	One	88.7 ^{a}	91.7 ^{a}	10.8 ^{ab}
	Two	67.3 ^{b}	88.2 ^{ab}	11.6 ^{a}
	Three	31.3 ^{d}	87.0 ^{b}	10.6 ^{ab}
	Untreated control (One-day old)	0.00 ^{f}	0.00 ^{d}	0.00 ^{e}
***Rabi*, 2013**	One	90.7 ^{a}	90.4 ^{ab}	11.2 ^{a}
	Two	70.7 ^{b}	87.8 ^{ab}	9.20 ^{bc}
	Three	34.7 ^{d}	88.6 ^{ab}	10.8 ^{ab}
	Untreated control (One-day old)	0.00 ^{f}	0.00 ^{d}	0.00 ^{e}
Summer, 2014	One	67.3 ^{b}	79.3 ^{c}	8.60 ^{cd}
	Two	44.7 ^{c}	77.6 ^{c}	7.40 ^{d}
	Three	22.7 ^{e}	77.3 ^{c}	7.40 ^{d}
	Untreated control (One-day old)	0.00 ^{f}	0.00 ^{d}	0.00 ^{e}
CV (%)		6.18	5.60	18.2
CD (0.05)				
Seasons		1.66	2.02	0.87
Age of eggs of *L. orbonalis*		1.92	2.33	1.00
Seasons X Age of eggs of *L. orbonalis*		3.33	4.04	1.73

In each column, means with similar alphabets are not significant at P<0.05 by DMRT

embryophagum during the seasons, *Kharif* and *Rabi*and it was 7.8 in summer season. The findings stated that the weather conditions existed in summer slightly declined the reproduction ability of *T. embryophagum*.

This is the first attempt made to study some important biological features including parthenogensis of the egg parasitoid, (*T. embryophagum*in), of brinjal shoot and fruit borer, *L. orbonalis*.

Conclusions

The egg parasitoid, *Trichogramma embryophagum* had the potential in functioning as a bio-control agent of Brinjal shoot and fruit borer, *Leucinodes orbonalis*. It was slightly susceptible to the weather conditions during summer.

References

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