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# Parasitisation of brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenée by *Trathala flavoorbitalis* Cameron

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**ABSTRACT:** For the eco-friendly management of any pest, biological control agents are promising element. Studies were undertaken to find the natural parasitisation efficiency and population dynamics of *Trathala flavoorbitalis* Cameron a nonspecific parasitoid of brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenée. *T. flavoorbitalis* was found to be an abundant parasitoid in brinjal ecosystem. The maximum natural infestation of *T. flavoorbitalis* in field was 40.00 per cent. The parasitoid infestation was significantly positively correlated with increase in fruit damage. Sex ratio studies in the parasitoids revealed that the males outnumbered females during the initial period of emergence, whereas at later period the females were more in number.

**Keywords:** Brinjal, fruit borer, *Trathala flavoorbitalis*, *Leucinodes orbonalis*, parasitoids, correlation and sex ratio

## INTRODUCTION

The shoot and fruit borer, *Leucinodes orbonalis* Guenée is a serious and regular pest of brinjal (Ranjith *et al*., 2019). For an eco-friendly approach of pest management, maintenance of population natural enemies like predators and parasitoids are necessary. Among the 21 parasitoids reported so far from brinjal shoot and fruit borer, one of the major parasitoids is *Trathala flavoorbitalis* Cameron (Sandanayake and Edirisinghe, 1992), with a maximum parasitisation of 61.7 per cent in natural condition (Srinivasan, 2008). *T. flavoorbitalis* is a wide spread nonspecific parasitoid of *Leucinodes orbonalis*. The parasitoid attacks all the instars of *L. orbonalis*, laying up to five eggs in a larva, but only one parasitoid grub develops beyond first instar. *T. flavoorbitalis* seems to be a potential parasitoid in biological control for brinjal shoot and fruit borer (Talekar, 2005; Srinivasan, 2008; Kumar and Raghuraman, 2014). To understand facts about the efficacy and population dynamics of *T. flavoorbitalis* in field, a study was under taken at Tamil Nadu Agricultural University, Coimbatore, India.

## MATERIALS AND METHODS

### Natural occurrence of parasitoids of *Leucinodes orbonalis*

Infested fruits were collected and the larvae were reared on brinjal fruits under laboratory condition (25±2°C temperature and 65±5% relative humidity) to record the parasitoids of *L. orbonalis*. Observation on number of parasitoids emerged from field collected *L. orbonalis* larvae were counted from August 2017 to June 2018 and preserved in 70 per cent alcohol for identification. The relative abundance and Berger-Parker index of dominance of these parasitoids were calculated as follows:

### Relative abundance (Pi)

Relative abundance (Pi) is the measure of the proportion of individuals over abundance (N) of all species.

$$Pi=N_i/N$$

Where N represents the sum of total number of all individuals in the sample and $N_i$ represents the number of individuals in $i^{th}$ species.

### Berger-Parker index of Dominance (d)

The Berger-Parker index of Dominance (d) expresses proportional importance of most abundant species and is defined as;

$$d=N_{max}/N$$

**Table 1. Relative abundance of parasitoids of *Leucinodes orbonalis* at Coimbatore**

| Species of parasitoid | Relative abundance (Pi) | Berger-Parker index of dominance (d) |
|---|---|---|
| *Trathala flavoorbitalis* Cameron | 0.794 | 1.00 |
| *Bracon* sp. | 0.112 | 7.08 |
| *Bracon brevicornis* (Wesmael) | 0.019 | 42.50 |
| *Phaneratoma* sp. | 0.056 | 14.17 |
| *Brachymeria* sp. | 0.009 | 85.00 |
| *Stenobracon nicevillei* (Bingham) | 0.009 | 85.00 |

**Table 2. Extent of parasitisation by *Trathala flavoorbitalis* on *Leucinodes orbonalis***

| Harvest | Field I | | Field II | |
|---|---|---|---|---|
| | Per cent parasitism | Sex ratio (M:F) | Per cent parasitism | Sex ratio (M:F) |
| I | 10.58 | 1:0.83 | 15.52 | 1:0.29 |
| II | 15.45 | 1:0.54 | 12.18 | 1:0.74 |
| III | 17.35 | 1:1.00 | 40.00 | 1:1.93 |
| IV | 30.59 | 1:1.26 | 19.97 | 1:1.81 |
| V | 21.21 | 1:3.00 | 21.62 | 1:1.56 |
| VI | 19.77 | 1:0.89 | 35.78 | 1:1.55 |

**Table 3. Correlation between parasitisation by *Trathala flavoorbitalis* with fruit infestation caused by *Leucinodes orbonalis* and meteorological variables**

| Parameter | Parasitism by *T. flavoorbitalis* |
|---|---|
| Per cent fruit infestation | 0.714* |
| Temperature (Maximum) | -0.093 |
| Temperature (Minimum) | 0.111 |
| Relative Humidity (Morning) | 0.286 |
| Relative Humidity (Evening) | 0.247 |
| Rainfall | -0.039 |
| Sunshine Hours | -0.500 |
| Evaporation | -0.364 |
| Wind speed | -0.294 |
| $R^2$ | 0.941 |

N= 11; *significant at 5% (p=0.05)

$Y=1265.744+0.927X_1+14.570X_2-29.884X_3-15.822X_4+6.511X_5-0.515X_6-10.666X_7+24.936X_8-15.610X_9$

Where $N_{max}$ is the number of individuals in the most abundant species and N is the total number of individuals in the sample species.

**Parasitisation rate of *Trathala flavoorbitalis* on *Leucinodes orbonalis***

An experiment was conducted during March to June 2018 at a farmer's field in Coimbatore district of Tamil Nadu, India with and without pheromone trapping for *L. orbonalis*. Infested fruits of brinjal were collected at each harvest from field. The collected fruits were kept in plastic trays and observed for parasitisation in larvae. The larvae after pupation were separated and kept in plastic containers for parasitoid emergence. After emergence, sexes were separated based on the presence of ovipositor of parasitoid. The parasitisation by *Trathala flavoorbitalis* at each harvest was analysed statistically. The extent of parasitisation was also subjected to correlation analysis with weather factors such as maximum and minimum temperatures, morning and evening relative humidity, rainfall, sunshine hours, evaporation and wind speed.

## RESULTS

**Relative abundance of parasitoids of *Leucinodes orbonalis***

The parasitoid diversity in Coimbatore is presented in Table 1. A total of six species of parasitoids *viz*., *T. flavoorbitalis*, *Bracon brevicornis* (Wesmael), *Bracon* sp., *Phanerotoma* sp., *Brachymeria* sp. and *Stenobracon nicevillei* (Bingham) were recorded from larvae and pupae of *L. orbonalis*. The individual parasitoid dominance expressed in Berger Parker index (d) revealed that, the most abundant parasitoid was *T. flavoorbitalis* (79.4%) followed by *Bracon* sp. (11.2%) and *Phanerotoma* sp. (5.6%). All the other three parasitoids were least abundant.

**Extent parasitisation by *Trathala flavoorbitalis* in brinjal field**

The study to find out the extent of parasitisation by *T. flavoorbitalis* in brinjal field with pheromone trapping (60 traps per ha) for *L. orbonalis* and without pheromone trapping revealed that, the parasitisation had been influenced by host sex pheromone. The field with pheromone attracted more *T. flavoorbitalis* than field without pheromone. During third and sixth harvest, the highest *T. flavoorbitalis* parasitisation of 40.00 and 35.78 per cent was observed respectively in the field with pheromone trapping for *L. orbonalis* whereas in field without pheromone trapping, during fourth and fifth harvest, a maximum parasitisation of 30.59 and 21.21 per cent was observed respectively. The parasitisation in field without pheromone trapping ranged between 10.58 and 30.59 per cent but in pheromone treated field, the parasitisation rate ranged between 12.18 and 40.00 per cent. Except during second and fourth harvest the field with pheromone trapping for *L. orbonalis* showed superiority in parasitisation (Table 3). The sex ratio analysis revealed that initially males outnumbered females and upon increase in the infestation rate, more females were emerged. The sex ratio observed in first harvest was 1:0.29 in field with pheromone trapping and in second harvest 1:0.54 in field without pheromone trapping.

The correlation matrix of per cent parasitisation with the environmental parameters and per cent fruit infestation indicated that, the parasitisation by *T. flavoorbitalis* was significantly positively correlated with fruit infestation by *L. orbonalis* (r= 0.714) and was not correlated with minimum temperature (r= 0.111), morning relative humidity (r= 0.286) and evening relative humidity (r= 0.247), maximum temperature (-r= -0.093), rainfall (r= -0.039), sunshine hours (r= -0.500), evaporation (r= -0.364) and wind speed (r= -0.294). The linear regression analysis revealed that the weather factors and fruit infestation had an impact of 94.1 per cent on parasitisation by *T. flavoorbitalis* (Table 3).

## DISCUSSION

For an eco-friendly approach of pest management, maintenance of population of natural enemies like predators and parasitoids are necessary. Trichogrammatids are one of the most important groups of bio control agents with renowned interest for the suppression of lepidopterous pests all over in India (Naik *et al*., 2015) but these are utilized through inundative release of the parasitoids. Natural occurrence and large scale control relatively less in case of trichogrammatids. So naturally occurring indigenous parasitoids can play a key role in bio-intensive pest management. Brinjal shoot and fruit borer hosts several indigenous parasitoids. The abundance study on parasitoids revealed that, a larval-pupal parasitoid, *T. flavoorbitalis* was the most abundant species than to all other parasitoids, which were encountered less than 10 times during the study period. Similar observation on the abundance of *T. flavoorbitalis* was also reported by Talekar (2005), Srinivasan (2008) and Kumar and Raghuraman (2014).

Parasitoids forage for herbivorous hosts seeks infochemicals as a cue to identify and locate the host insects. Pheromones and plant volatiles are the major cues utilized by parasitoids fauna while searching the

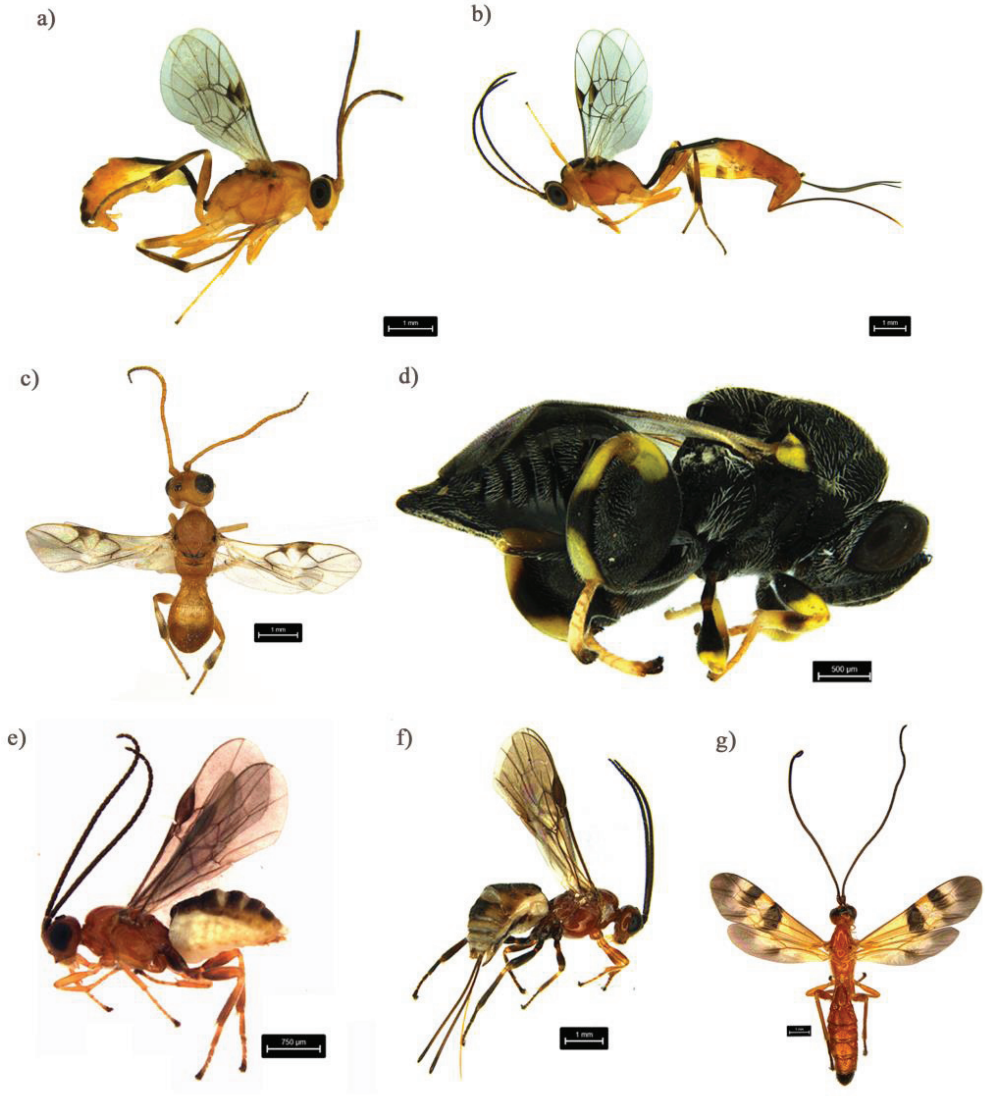


**Fig. 1. Parasitoids of *Leucinodes orbonalis*, a) Male *Trathala flavoorbitalis*; b) Female *T. flavoorbitalis* c) *Phaneratoma* sp. d) *Brachymeria* sp. e) Male *Bracon* sp. f) Female *Bracon* sp. g) *Stenobracon nicevillei***

specified host insect. Synthetic pheromones also serve as kairomone in search of host by parasitoids. This increases parasitism by the parasitoids. The parasitisation by *T. flavoorbitalis* was significantly high in field which had pheromone traps. The study revealed a higher parasitism of 40.00 per cent on larvae of *L. orbonalis*, which was less as compared to the report of Srinivasan (2008) who recorded a maximum parasitism of 61.7 per cent in natural condition. Sandanayake and Edirisinghe (1992) also reported a higher level of parasitism by *T. flavorobitalis* in Sri Lanka. This indicates that the parasitoid had potential role in reducing the population of *L. orbonalis* (Talekar, 2005; Srinivasan, 2008; Kumar and Raghuraman, 2014). The results of correlation indicated that the parasitisation is positively associated with fruit damage. This clearly depicts that the parasitoid population is highly related to the pest population density rather than the weather parameters prevailed in that condition. Being a natural parasitoid, which were not amenable to mass production in laboratory the *T. flavorobitalis* can manage the population of *L. orbonalis* in field. Possibility of mass production of this shy ichneumonid parasitoid can be investigated for a better management of the key pest of brinjal, the shoot and fruit borer.

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