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# PARASITOIDS ASSOCIATED WITH DIFFERENT STAGES OF *CRICULA TRIFENESTRATA* HELFER (SATURNIIDAE: LEPIDOPTERA)*

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## Abstract

**One egg parasitoid, *Telenomus* sp., and two pupal parasitoid, *Brachymeria criculae* (Khol.) and *Pediobius* sp. were found to parasitize *Cricula trifenestrata* at the Institute of Postgraduate Studies in Agriculture, Salna, Gazipur and its surrounding locations. The *pediobius* sp. was recorded for the first time in Bangladesh. Natural egg parasitization was ranged from 0-88% with a mean of 41.1% and those for pupae were 25.0-92.8% with a mean of 66.4%. Larval parasitoids were not found. Higher pupal parasitization was caused by *B. criculae* compared to *Pediobius* sp. The mean number of parasitoids developed per pupa was 5.7 and 12.7 for *B. criculae* and *Pediobius* sp., respectively when attacked singly and 4.3 and 11.6 when attacked combinedly.**

*Key words:* Mango, *Cricula trifenestrata*, Parasitoids.

## Introduction

Among the insect pests of mango (*Mangifera indica* L.) affecting its production, leaf eating caterpillar, *Cricula trifenestrata* Helfer, commonly known as mango defoliator is most important one. It is sporadic but a serious pest of mango and its larvae destroy 13 to 51 percent of leaves of the infested trees (Alam and Hazarika, 1953). Karim (1989) rated *C. trifenestrata* as an occasional pest of mango which occurs suddenly in a year as severe pest infesting some localized areas and disappears. In some years, it draws a special attention to farmers because of its appearance in large numbers causing serious defoliation of mango trees. It is presumed that high natural mortality due to parasitization and predation of different developmental stages might be one of the reasons of wild population fluctuations between years.

The investigation on effectiveness of parasitoids for suppressing this pest received very little attention. Alam and Hazarika (1953) reported two pupal parasitoids and one unidentified predaceous mite of *C. trifenestrata* in Bangladesh. Karim (1989) added a new

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unidentified species of Ichneumonid wasp as pupal parasitoid including *Brachymeria criculae* (Khol.). Whereas Ali and Karim (1991) reported three pupal parasitoids, *B. criculae, Mesocomys orientalis* and *Sarcophaga* sp. and an egg parasitoid, *Telenomus* sp.

Before developing a suitable control measure for this pest, detailed information about the status of natural enemies is necessary. This is also important in decision making for initiating any control action against the pest. However, the systematic study on the natural enemies of this pest has drawn a very little attention. The present study was, therefore, undertaken with an aim to identify the parasitoids attacking different developmental stages of *C. trifenestrata* and to evaluate their role as biocontrol agents. Therefore, a research work was undertaken using *C. trifenestrata* infested mango tress at the Institute of Postgraduate Studies in Agriculture (IPSA) and its surrounding locations for the purpose.

## Materials and Methods

### *Sampling*

Mango trees at IPSA (centre) and its surrounding localities, about 5 km away from IPSA toward east, west, north and south were surveyed extensively to identify the egg, larval and pupal parasitoids of *C. trifenestrata* and to evaluate their effectiveness in suppressing its populations. Survey locations were Gazipura and Vanua village in the east, Majlishpur in the west, Masterbari and Nanduail in the north, and Kalnipara in the south. The survey area at each location was consisted of 3 unit spots of about 0.10 $km^2$. Cocoons of *C. trifenestrata* with pupae for three subsequent generations (IV in 1991 and I & II in 1992) and eggs as well as larvae for two generations (I & II in 1992) were randomly collected from selected mango trees. Egg, larvae of different instars with the infested twigs and pupal cocoons with leaf whorls were collected. These were placed in net cages (25 cm × 25 cm × 35 cm) and carried to the laboratory for investigation.

### *Egg parasitization*

Collected eggs, larvae and pupae were reared under constant laboratory conditions maintained at 27 ± 1.5°C temperature and 45 ± 3.5% relative humidity (RH). Egg masses were initially examined under the microscope to examine the apparent egg parasitization. For further observation the petiole of leaf bearing egg mass(s) was inserted into vial containing water and plugged with cotton and parafilm to prevent drying. The vials were then kept in petridish (180 mm dia.) until hatching. Each emerged mass was observed under a stereoscopic microscope attached with TV monitor to check the exit holes and number of parasitoids emerged or failed to emerge.

### *Larval parasitization*

At the time of collection larvae were separated gently by soft camel hair brush from the infested leaf. To observe the larval parasitization, live larvae were reared in rearing cage (64 mesh/$cm^2$) with regular supply of fresh leaves. Larvae those hatched from the collected eggs were also reared until third instar. The field collected second instars were reared until fifth instar. Larvae collected at third, fourth or fifth instars were reared upto pupation. Larvae those died or failed to pupate within 4 weeks were dissected under a microscope to examine the presence of parasitoid(s).

### *Pupal parasitization*

Field collected pupae kept individually in transparent plastic container (15 cm × 12 cm) covered by fine markin cloth. Pupae of different age were observed to investigate the stage and time of parasitization. Parasitization by large and small sized pupal parasitoid were

determined by the presence of large and small exit holes through pupal cuticle. The relative abundance of parasitoid species was determined based on pooled data. The extent of parasitization by the pupal parasitoid was determined on the basis of number of a particular parasitoid attacking per pupa singly or combinedly with others. This was recorded from 50 known parasitized pupae samples collected randomly from 5 locations at high parasitoid population density of generation II. Collected species of parasitoids were identified locally and also sent to the Entomological Laboratory, Faculty of Agriculture Kyushu University, Fakuoka 812, Japan for confirmation.

**Results and Discussion**

*Egg parasitoids*

Laboratory rearing of egg masses collected from 5 locations in generation I and II showed an overall 41.1% egg parasitization with a range of 0-88% due to *Telenomus* sp. (Scelionidae) (Table 1). In generation I, egg masses collected from IPSA and south of IPSA showed 0% parasitization but in generation II, had 84.2 and 82.8% egg parasitization, respectively. *Telenomus* sp. which appeared to be the lone egg parasitoid of *C. trifenestrata* had high potential of parasitization. The egg parasitoid, *Telenomus* sp. also reported by Ali and Karim (1991) and recorded 100% parasitization in one generation in Joydebpur, Gazipur.

*Larval parasitoids*

In generation I and II the visual and microscopic examination of total 280 larvae of different stages collected from 5 locations revealed that there was no larval parasitoids associated with any stage. Hitherto, no report was available on the occurrence of any identified larval parasitoid. Only Alam (1967) listed one species of unidentified tachinid fly as larval parasitoid.

**Table 1.** Egg parasitization of *Criculae trifenestrata* by *Telenomus* sp. collected from IPSA, Salna, Gazipur and its surrounding locations (1992).

| Locations | Generation | Sampling dates | Egg collected (no.) | Parasitoid emerged (no.) | Parasitization (%) |
|---|---|---|---|---|---|
| East of IPSA | I | Feb. 27 | 160 | 30 | 18.7 |
| | II | May 30 | 125 | 110 | 88.0 |
| West of IPSA | I | March 3 | 190 | 70 | 36.8 |
| | II | June 1 | 85 | 30 | 35.3 |
| IPSA | I | March 5 | 128 | 0 | 0.0 |
| | II | May 31 | 95 | 80 | 84.2 |
| North of IPSA | I | March 7 | 130 | 42 | 32.3 |
| | II | June 3 | 170 | 90 | 52.9 |
| South of IPSA | I | Feb. 28 | 101 | 0 | 0.0 |
| | II | May 29 | 82 | 68 | 82.9 |
| Total/ Mean | | | 1266 | 520 | 41.1 * |

* Weighted mean.

*Pupal parasitoid*

Rearing and microscopic examination of young and mature stage pupae showed that egg laying by pupal parasitoid took place at two stages of pupal development. Prasitoid eggs were laid either on prepupal stage when host larval hairs already shredded at the alter part of the last moult or on newly formed cocoons. Newly hatched parasitoid larvae bore through the cocoon to enter into the pupa for feeding. The egg laying on cocoon was also observed by Alam and Hazarika (1953). However, the egg laying behaviour of pupal parasitoids on prepupae observed in the present study was not reported earlier. The pupae of 3 generations, collected from 5 locations and reared in the laboratory, yielded *Brachymeria (Chalcis) criculae* (khol) (Chalcididae) and *Pediobius* sp. (Eulophidae) as pupal parasitoids. *Brachymeria criculae* (khol) recorded in this study was also reported earlier by Alam and Hazarika (1953), Alam (1967) and Ali and Karim (1991). Two Ichnemonid parasitoids, *Theronia zebra* Voll (Rohwer, 1918) and *Xanthopimla pedator* F. (Thompson, 1945) of this pest were reported from Java and India, respectively. Alam (1967) included three other pyralid species, *Mussidia* sp., *Tirathaba* sp. and *Phycita dentilinella* W. as pupal parasitoid from Bangladesh. Ali and Karim (1991) reported two other pupal parasitoid, *Mesocomys orientalis* Ferr (Chalcididae) and *Sarcophaga* sp. (Sarcopha-

**Table 2.** Pupal parasitization of *Cricula trifenestrata* collected from IPSA, Salna, Gazipur and its surrounding locations in three generations (1991-92).

| Location | Generations* | Sampling dates | | Pupae Collected (no.) | Pupae parasitized by (no.) | | | Parasiti - zation (%) |
|---|---|---|---|---|---|---|---|---|
| | | | | | *Brachymeria criculae* alone(a) | *Pediobius* sp. alone(b) | Both species (a & b) together | |
| East of IPSA | IV | Jan. | 18,20 | 315 | 99 | 21 | 125 | 77.8 |
| | I | Apr. | 20, 21 | 72 | 8 | 0 | 10 | 25.0 |
| | II | July | 24, 25 | 195 | 71 | 9 | 14 | 48.2 |
| West of IPSA | IV | Jan. | 22, 25 | 222 | 70 | 34 | 102 | 92.8 |
| | I | April | 18 | 92 | 12 | 4 | 21 | 40.2 |
| | II | July | 20 | 102 | 42 | 8 | 41 | 89.2 |
| IPSA | IV | Jan. | 23 | 35 | 18 | 0 | 2 | 57.1 |
| | I | April | 22 | 50 | 17 | 0 | 7 | 48.0 |
| | II | July | 19 | 40 | 22 | 5 | 4 | 77.5 |
| North of IPSA | IV | Jan. | 22, 23 | 472 | 117 | 71 | 121 | 65.5 |
| | I | April | 20, 21 | 125 | 29 | 0 | 22 | 40.8 |
| | II | July | 27 | 182 | 38 | 0 | 35 | 40.1 |
| South of IPSA | IV | Jan. | 18,20 | 564 | 207 | 27 | 209 | 78.5 |
| | I | April | 20, 21 | 132 | 31 | 12 | 47 | 68.2 |
| | II | July | 24,25 | 80 | 23 | 8 | 15 | 57.6 |
| Total | | | | 2678 | 804 | 199 | 775 | |
| Total % parasitization | | | | | 30.0 | 7.4 | 28.9 | 66.4** |

* Generation IV for 1991 and I, II for 1992.

**Weighted mean.

gidae). In the present study the recorded pupal parasitoid, *Pediobius* sp. of *C. trifenestrata* was reported first time in Bangladesh.

The accumulated pupal parasitization for three generations was 66.4% with a range of 25.0-92.8% (Table 2). Comparatively higher parasitization was caused by *B. criculae* (n= 2678). The occurrence of parasitization was not consistent among the locations in any generation. This variation in percent parasitization was not unusual. Alam and Hazarika (1953) reported about (90% parasitization caused by *B. criculae* and *P. dentilinella* whereas Ali and Karim (1991) recorded 79.7% parasitization caused by *B. criculae*, 20.1% by *M. Orientalis* and 0.2% by *Sarcophaga* sp.

*Extent of parasitization*

The mean number of *B. criculae* and *Pediobius* sp. developed per pupa was 5.7 and 12.7, respectively when attacking singly. Whereas these parasitoids when attacked combinedly, the mean number of *B. criculae* developed per pupa was dropped to 4.3 and *Pediobius* sp. to 11. 6 (Table 3). Without indicating the name of parasitoid(s) Alam and Hazarika (1953) reported 2 to 8 parasitoids developed per host pupa. Though the egg parasitization by *Telenomus* sp. was only 41.1%, it might be important biological control agent for suppressing *C. trifenestrata*. Because this parasitoid has a good reproductive potentiality and phoresy as indicated Orr (1988) as well as Bin and Johnson (1982).

It was observed that the greater number of pupal parasitization in a location of a particular generation resulted very low host population with poor parasitization in the next generation (Table 1 and 2). Hence, it may be concluded that high level of egg and pupal parasitization might govern the seasonal fluctuation of this pest. Therefore, the judicious use of insecticides against mango pest in this region of Bangladesh is necessary for augmentation of parasitoids.

**Table 3.** The intensity of *Brachymeria criculae* and *Pediobius* sp. attacking *Cricula trifenestrata* pupa* alone or in combination at IPSA and its surrounding locations (1992).

| Locations | Numbers of pupae observed | Mean number of parasitoid per pupa | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | *Brachymeria Criculae* alone (a) | Range | *Pediobius* sp. alone (b) | Range | Both sp. (a &b) together | | Both sp. (a &b) range | |
| | | | | | | a | b | a | b |
| East of IPSA | 50 | 7.1 | 3 -10 | 11.8 | 9-14 | 5.2 | 12.4 | 3-7 | 8 -14 |
| West of IPSA | 50 | 2.4 | 2 - 4 | 5.5 | 4 -7 | 3.0 | 11.8 | 2-5 | 7 -12 |
| IPSA | 50 | 5.7 | 2 -9 | 14.8 | 12-16 | 7.2 | 8.8 | 5-9 | 3 -11 |
| North of IPSA | 50 | 9.2 | 4-11 | 14.2 | 9-17 | 2.5 | 15.7 | 1-4 | 9 -19 |
| South of IPSA | 50 | 3.9 | 1-5 | 17.2 | 12-22 | 3.4 | 9.2 | 3-5 | 7 12 |
| Total/ Mean | 250 | 5.7 | 1-11 | 12.7 | 4-22 | 4.3 | 11.6 | 1-9 | 3-19 |

*on the basis of parasitized pupae collected in generation II.

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