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Research Note

# Performance of *Cotesia flavipes* Cameron (Hymenoptera: Braconidae) parasitizing *Chilo partellus* (Swinhoe) (Lepidoptera: Crambidae) as affected by size of ovipositional chambers

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**ABSTRACT**: Investigations on larval parasitization of *Chilo partellus* (Swinhoe) by *Cotesia flavipes* Cameron in ovipositional chambers of different sizes were carried out under laboratory conditions at 27±2°C and 75±5 per cent relative humidity. Maximum parasitization (89.56 per cent) and maximum number of cocoons (37.53) was recorded in test tube when only one larva was provided in ovipositional chambers. The larval parasitization and cocoon formation were reduced with the increase in larval density from 2 to 5 larvae per chamber. The sex ratio recorded in test tube was statistically superior to pearl pet jar of 1000 and 2000 g but was on par with pearl pet jar of 500 g. The data showed that the provision of one larva to the one pair of adult of *C. flavipes* in test ovipositional chamber resulted in more female biased sex ratio, (80.0 per cent) in test tube followed by 78, 72 and 53 per cent sex ratio in pearl pet jar of 500, 1000 and 2000 g respectively.

**KEY WORDS**: *Cotesia flavipes,* larval endoparasitoid, *Chilo partellus,* maize stem borer, ovipositional chambers

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*Cotesia flavipes* Cameron (Hymenoptera: Braconidae) is an important gregarious larval endoparasitoid of graminaceous stem borers. It is found in nature during *kharif* season throughout the country and proven as a dominant larval parasitoid of *Chilo partellus* (Swinhoe) by reducing the population up to 32-55 per cent (Divyal *et al.,* 2009; Padmaja and Prabhakar, 2004). It has now become the major mortality factor of stem borers and therefore, efforts are being made for the development of multiplication technology. The short life span and over lapping generations help *C. flavipes* to be more successful in the maize crop. Due to its important role in the management of *C. partellus*, efforts have been made to augment the parasitoid in the maize ecosystem also (Jalali and Singh, 2003). The multiplication of larval parasitoid in the laboratory was being achieved in ovipositional chambers of different size. The effect of space on parasitization was taken care during the provision of number of host larvae to avoid overcrowding. It is also essential to isolate the parasitized larvae to avoid the super parasitization and destruction of egg laying potential of parasitoid. So far no systematic information is available on the effect of ovipositional chambers on the parasitization of *C. flavipes*. Therefore, it was planned to investigate the optimum space required by *C. flavipes* for the optimum parasitization of *C. partellus*.

For the present investigation, the nucleus culture of *C. flavipes* was collected from the parasitized larvae of *C. partellus* from maize fields. These larvae were reared on split maize stem till the formation of cocoon of *C. flavipes* (Overholt *et al*., 1994). The cocoons thus collected were kept in test tube for adult emergence. The culture was maintained in controlled conditions at 27±2°C temperature and 75±5 per cent relative humidity.

The experiment was conducted by using ovipositional chambers of different sizes. Test tubes of 12 × 2.5 cm size and pearl pet plastic jars of different storage capacity *viz*., 500g (11 × 8 $cm^2$), 1000g (16 × 10 $cm^2$) and 2000g (23 × 12 $cm^2$) were used. Variable numbers of host larvae (1, 2, 3, 4 and 5) were exposed for 24 hours to one mated female of *C. flavipes* and collected back for rearing on maize stem piece. Each set of experiment was replicated 5 times. Per cent larval parasitization, number of cocoons formed per larva and per cent females emerged was recorded and data were analyzed through ANOVA.

## Parasitization

Parasitization of maize stem borer larvae by *C. flavipes* decreased with increase in size of ovipositional chamber (Table 1). The test tube recorded higher parasitization but, was at par with pearl pet jar of 500 g and different from jars of 1000 and 2000 g capacity. The provision of a single larva to one pair of adult *C. flavipes* in test ovipositional chamber resulted in the maximum parasitization (89.56 per cent) in test tube followed by (88.05, 76.53 and 66.79 per cent) in pearl pet jars of 500, 1000 and 2000 g capacity, respectively. Increase in larval density from one to five in ovipositional chambers resulted in decreased parasitization (89.56 to 54.56 percent in test tube). Similar results were observed when size of ovipositional chambers was increased from 500 to 2000g plastic jars and provision of larvae from 2 to 5. This clearly showed the importance of close association between host and parasitoid.

### Cocoon formation

The numbers of cocoons formed in different test chambers with varied larval density (Table 2) showed that increase in the size of ovipositional chambers and larval density reduced the number of cocoons formed. It was also evident from the data that the number of cocoons formed in test tube was higher than other test chambers but, at par with pearl pet jar of 500 and 1000 g and different from the jar of 2000 g. The provision of a single larva to one pair of adults of *C. flavipes* in test ovipositional chambers resulted in the formation of minimum number (35.20) of cocoon in pearl pet jar of 2000 g while, maximum (37.53) was recorded in test tube followed by 37.13 and 36.28 cocoon formation in pearl pet jar of 500 and 1000 g, respectively. The provision of two to five larvae in test tube resulted in 19.21 to 7.03 cocoons only as compared to 37.53 with one larva. The increase in larval density from 2 to 5 larvae to single pair of adult parasitoid in different ovipositional chambers showed the distribution of eggs laid which resulted in decreased number of cocoons formed per larva. The data also showed no significant difference of test chambers on number of cocoons formed.

### Sex ratio

Sex ratio of parasitoid is affected by forced proximity of female parasitoids to their hosts. The provision of one larva to one pair of adults of *C. flavipes* in test ovipositional chamber resulted in more female biased sex ratio, 80.0 per cent, in test tube followed by 78, 72 and 53 sex ratio in pearl pet jar of 500, 1000 and 2000 g respectively. It is also apparent from the data that the sex ratio recorded in test tube was superior to pearl pet jar of 1000 and 2000 g but was at par with pearl pet jar of 500 g. The provision of increased number of larvae (from 2 to 5) to adult parasitoids showed that test tube and pearl pet jar of 500 g found suitable for maintaining proper sex ratio and were at par. On contrary increase in pearl pet jar size of 1000 and 2000 g, reduced the sex ratio. The sex ratio in pearl pet jar of 2000 g was not female biased, hence, categorized least suitable.

**Table 1. Effect of different ovipositional chambers and larval density on parasitization of *Chilo partellus* by *Cotesia flavipes***

| Specification of ovipositional chambers | | | Mean larval parasitization (%) by *C. flavipes* | | | | |
|---|---|---|---|---|---|---|---|
| Name | Size | Capacity | Larval density of *C. partellus* in ovipositional chamber | | | | |
| | | | One larva | Two larvae | Three larvae | Four larvae | Five larvae |
| Test tube | 12 × 2.5 cm$^2$ | – | 89.56 (71.22) | 82.98 (65.67) | 75.45 (60.30) | 68.02 (55.56) | 54.55 (47.61) |
| Pearl pet jar | 11 × 8 cm$^2$ | 500 g | 88.05 (69.80) | 77.89 (61.97) | 71.78 (57.92) | 66.09 (54.39) | 57.44 (49.28) |
| Pearl pet jar | 16 x 10 cm$^2$ | 1000 g | 76.53 (61.02) | 70.97 (57.40) | 63.56 (52.87) | 60.56 (51.00) | 56.27 (48.61) |
| Pearl pet jar | 23 x 12 cm$^2$ | 2000 g | 66.79 (54.81) | 64.04 (53.16) | 53.02 (46.73) | 49.98 (44.99) | 42.24 (40.54) |
| SEm± | | | 0.81 | 0.90 | 0.71 | 0.54 | 0.92 |
| CD ($P$ = 0.05) | | | 1.72 | 1.90 | 1.51 | 1.14 | 1.96 |
| CV % | | | 1.99 | 2.38 | 2.07 | 1.66 | 3.14 |

Values in parentheses represent angular retransformed values.

**Table 3. Effect of different ovipositional chambers and larval density of *Chilo partellus* on sex ratio of *Cotesia flavipes***

| Specification of ovipositional chambers | | | Female parasitoids emerged (%) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Larval density in ovipositional chamber | | | | | | | | | |
| | | | One larva | | Two larvae | | Three larvae | | Four larvae | | Five larvae | |
| Name | Size | Capacity | Female emerged (%) | Sex ratio (F:M) | Female emerged (%) | Sex ratio (F:M) | Female emerged (%) | Sex ratio (F:M) | Female emerged (%) | Sex ratio (F:M) | Female emerged (%) | Sex ratio (F:M) |
| Test tube | 12 × 2.5 $cm^2$ | – | 80.00 (63.60) | 0.80 0.80 | 82.00 (64.77) | 0.82 0.82 | 83.00 (65.99) | 0.83 0.83 | 82.00 (64.77) | 0.82 0.82 | 80.00 (63.60) | 0.80 0.80 |
| Pearlpet jar | 11 × 8 $cm^2$ | 500 g | 78.00 (62.19) | 0.78 0.78 | 80.00 (63.60) | 0.80 0.80 | 78.00 (62.19) | 0.78 0.78 | 80.00 (63.60) | 0.80 0.80 | 80.00 (63.60) | 0.80 0.80 |
| Pearlpet jar | 16 x 10 $cm^2$ | 1000 g | 72.00 (58.06) | 0.72 0.72 | 74.00 (59.49) | 0.74 0.74 | 75.00 (60.04) | 0.75 0.75 | 71.00 (57.42) | 0.71 0.71 | 69.00 (55.93) | 0.69 0.69 |
| Pearlpet jar | 23 x 12 $cm^2$ | 2000 g | 53.00 (46.84) | 0.53 0.53 | 70.00 (56.93) | 0.70 0.70 | 65.00 (53.74) | 0.65 0.65 | 68.00 (55.55) | 0.68 0.68 | 62.00 (52.06) | 0.62 0.62 |
| SEm± | | | 1.16 | | 1.03 | | 1.28 | | 0.92 | | 1.12 | |
| CD ($P$ = 0.05) | | | 2.45 | | 2.19 | | 2.70 | | 1.95 | | 2.37 | |
| CV % | | | 3.17 | | 2.67 | | 3.34 | | 2.41 | | 3.01 | |

Values in parentheses arc sine retransformed values.

**Table 2. Effect of different ovipositional chambers and larval density on number of cocoons of *Cotesia flavipes* per larva of *Chilo partellus***

| Specification of ovipositional chambers | | | Mean larval parasitization (%) by *C. flavipes* | | | | |
|---|---|---|---|---|---|---|---|
| Name | Size | Capacity | Larval density of *C. partellus* in ovipositional chamber | | | | |
| | | | One larva | Two larvae | Three larvae | Four larvae | Five larvae |
| Test tube | 12 × 2.5 cm² | – | 37.53 (6.13) | 19.21 (4.38) | 12.29 (3.51) | 09.05 (3.01) | 07.03 (2.65) |
| Pearl pet jar | 11 × 8 cm² | 500 g | 37.13 (6.09) | 18.58 (4.31) | 12.53 (3.54) | 08.91 (2.98) | 07.61 (2.75) |
| Pearl pet jar | 16 × 10 cm² | 1000 g | 36.28 (6.02) | 18.48 (4.29) | 11.81 (3.43) | 09.81 (3.13) | 07.11 (2.66) |
| Pearl pet jar | 23 × 12 cm² | 2000 g | 35.20 (5.93) | 18.71 (4.32) | 12.45 (3.53) | 08.78 (2.96) | 06.65 (2.58) |
| SEm± | | | 0.08 | 0.12 | 0.07 | 0.06 | 0.10 |
| CD ($P$ = 0.05) | | | 0.17 | 0.26 | 0.14 | 0.12 | 0.21 |
| CV % | | | 2.09 | 4.46 | 3.05 | 3.08 | 5.81 |

Values in parentheses represent angular retransformed values.

The results of present investigation are in agreement with research of various workers. Srikanth *et al.* (2000) reported that parasitization rates of *C. flavipes* on the borers of sugarcane and sorghum was negatively correlated with the number of larvae per female parasitoid. Tillman (2001) studied biological factors hypothesized to affect parasitization by *Cotesia marginiventris* on *Spodoptera exigua* as well as its sex ratio. He observed highest parasitization of one day old host with close association of adult female parasitoids and host: female parasitoid ratio was 10:1 and 30:1.

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