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Effect of host egg density on parasitism and adult emergence in *Trichogramma chilonis* Ishii (Hymenoptera: Trichogrammatidae) in two systems

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ABSTRACT: **Effect of egg density of *Corcyra cephalonica* (Stainton) on parasitism and adult emergence in *Trichogramma chilonis* Ishii was investigated under two systems of rearing in the laboratory. In nucleus culture maintenance system, 150 eggs / two females and under mass production system, 500 adults to 1 cc of eggs (about 15,000 eggs) were found most optimum for efficient utilization of eggs and females. The highly significant regression coefficients obtained for relation between egg density and number of egg parasitised, and per cent parasitisation and number of adults indicated the usefulness of prediction model.**

KEY WORDS: *Corcyra cephalonica*, egg density, parasitism, systems, *Trichogramma chilonis*

A large number of species of trichogrammatids are distributed throughout India, out of which *Trichogramma chilonis* Ishii, *T. japonicum* Ashmead and *T. achaeae* Nagarkatti and Nagaraja are most widely distributed. Thousands of trichogramma wasps must be released per hectare of crop to reduce the pest population (Li, 1994; Singh, 1994). Super parasitism is of common occurrence in *Trichogramma* in the laboratory, especially when lesser eggs are offered for parasitisation. Narayanan and Chacko (1957) reported that though one to three adult parasitoids may emerge from a single egg of *Corcyra cephalonica* (Stainton), these are often defective, have malformed wings and are inactive. However, very limited superparasitism occurs if sufficient numbers of host are available. Singh and Jalali (1994) reported that superparasitism can be avoided if a ratio of 1 female: 35 host eggs is maintained during rearing of trichogrammatids.

It was, therefore, felt necessary to work out parasitoid: host egg ratio for two systems of rearing, namely, nucleus culture maintenance for laboratory rearing and mass production for field utilization. Such information is necessary for optimum utilization of host eggs in the laboratory.

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MATERIALS AND METHODS

The experiment was conducted in the laboratory at 26±1.5°C and 65 ± 5 per cent relative humidity. *Trichogramma chilonis* BioH-1 strain adapted for tomato ecosystem from laboratory culture was used for the experiment.

Laboratory nucleus culture

For the experiment, UV irradiated *Corcyra cephalonica* eggs were taken in densities of 50, 100, 150, 200, 250 and 300 eggs and each treatment was replicated five times. The eggs at different densities were first sprinkled on the cards (4 x 2 cm) and then placed in test tubes (15 x 2.5 cm). Honey solution (50%) was provided as streaks in test tubes for adult feeding. Two females were released for 24 hours and the tubes were secured with cotton swab. After 24 hours the adults of *T. chilonis* were removed from the tubes. After 5th day of exposure the card bits were observed for parasitisation and absolute counting was done for parasitised eggs on that day. From the 9th day after the exposure, emerging adults from parasitised eggs of *C. cephalonica* were counted from each replication in each treatment.

Mass production

In this experiment, parasitised "Tricho cards" were taken and 275, 550, 825 and 1100 parasitised eggs were counted and bits were cut and used and from these 250, 500, 750 and 1000 adult parasitoids were obtained. Each treatment was replicated five times. These parasitised bits were placed in polythene bags (32x 20cm). Fine streaks of honey solution (50%) were provided inside bags for emerging adults to feed. Card measuring 10 x 12cm was taken and fine layer of gum was applied and 1 cc of eggs (about 15000 eggs) were sprinkled uniformly and placed inside polythene bags. Each treatment (dosage) was replicated 5 times. In each replication parasitoids were allowed to parasitise eggs till they died. After the 5th day of exposure, observation was taken for parasitisation in different treatments. On the 8th day, random sampling was done by cutting 10 bits from each parasitised card and parasitised eggs were counted and absolute counting for parasitised eggs was worked out by multiplying total area of surface by parasitised surface. On the 9th day of exposure, the adults emerged were counted per 100 parasitised eggs in each treatment from five replications. The data were subjected to analysis of variance (ANOVA one way) and the means separated by LSD values (P=0.01). Percentage data were subjected to arcsine transformation before analysis.

RESULTS AND DISCUSSION

The results indicated that number of parasitised eggs increased with egg density. Number of parasitised eggs increased from 47.4 to 134.2 when density increased from 50 to 250 eggs and declined thereafter (Table 1). It varied significantly between 50 and 250 egg density (P=0.01). Studies also indicated that at the lowest density (50 eggs) per cent parasitism was maximum (95.9) followed by 100 egg density (75.5% parasitism). The lowest per cent parasitism was found at 300 egg density (42.4%) and it varied significantly (P=0.01) at various densities. The decrease in parasitism with increase in density for *Trichogramma* species has earlier been reported by Juan *et al.* (1994). The adult recovery increased with increase in egg density and was maximum (120.2) at 250-egg density (Table1). Juan *et al.* (1994) reported similar observation for various *Trichogramma* species.

Regression curves were fitted between host egg density and number of eggs parasitised; and per cent parasitisation and number of adults emerged, to predict these functions based on egg density. The regression equation and R^2 obtained for number of eggs parasitised is ($y = 38.8 + 0.33x$, $R^2 = 0.92$), per cent parasitism ($y = 77.3 - 0.13x$, $R^2 = 0.84$) and adults emerged ($y = 45.8 + 0.27x$, $R^2 = 0.85$), respectively. With highly significant regression coefficients ($t = 6.9$, 4.6 and 4.9, respectively, P=0.01) indicating that it is possible to predict these functions based on egg density.

Table 1. Effect of egg density on parasitisation and adult emergence of *T. chilonis* under nucleus culture system

Egg density	No. of eggs parasitised	Per cent parasitisation	No. of adults emerged
50	47.4d	95.9 (78.3)a	46.6d
100	77.0c	75.5 (60.3)b	79.4c
150	90.0c	60.1 (50.8)c	99.6a
200	108.8b	54.4 (47.5)d	95.6b
250	134.2a	53.9 (47.2)d	120.2a
300	126.2a	42.0 (40.4)e	117.6a
SEM ±	3.6	1.6	5.4
LSD (P≤0.01)	14.3	6.4	21.7

Figures in parentheses are arcsine-transformed values.
Values followed by the same letter in the same column are not significantly different (P ≤ 0.01).

In mass production system, results showed that maximum parasitisation (97.3%) was obtained when 500 parasitoids / card were released. In dosages of 250, 750 and 1000 parasitoids, parasitism obtained was 29.9, 83.8 and 81.3 per cent, respectively.

Studies also showed that the number of eggs that remained unparasitised was minimum in 500 parasitoid density (2.7%) and maximum in 250 parasitoid density (70.1%). Per cent super parasitised eggs were significantly more at 750 (12.1) and 1000 (14.9) parasitoid density comparing other densities (Table 2). The finding is in conformity with Narayanan and Chacko (1957) who also reported super parasitism of eggs if available in less numbers.

Table 2. Effect of egg density on parasitism and adult emergence of *T. chilonis* under mass production culture system

Parasitoid density / cc eggs	Per cent parasitisation	Adults emerged / 100 eggs	Per cent super parasitised eggs	Per cent unparasitised eggs
250	29.9 (33.2)	109.6	0.0	70.1 (57.2)
500	97.3 (80.5)	92.6	0.0	2.7 (9.5)
750	83.8 (66.2)	26.0	12.1	4.0 (11.5)
1000	81.3 (64.3)	74.6	14.9	3.8 (11.1)
SEM ±	1.5	2.7	0.8	1.6
LSD (P≤0.01)	6.5	11.6	3.5	7.1

Figures in parentheses are arcsine-transformed values.
Values followed by the same letter in the same column are not significantly different (P ≤ 0.01).

Thus the studies suggest that for nucleus culture 150 eggs / two females is the optimum level in terms of egg utilisation and parasitism, while for mass production 500 parasitoids / cc eggs of *C. cephalonica* is optimum and economical. Thus from one fully parasitised "Tricho card" (1 cc parasitised eggs), about 30 parasitised "Tricho card" can be obtained in the next generation.

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