

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; 10(4): 647-650
www.biochemjournal.com
Received: 20-01-2026
Accepted: 23-02-2026

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Influence of different *Trichocard* colours on the biological parameters and parasitization efficiency of *Trichogramma chilonis*

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DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i4i.8257>

Abstract

The present investigation entitled “Influence of Different Trichocard Colours on the Biological Parameters and Parasitization Efficiency of *Trichogramma chilonis*” was carried out at Bio- Control Laboratory of Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut during 2024-2025. The aim was to assess the response on biological parameters of *Trichogramma chilonis* to different colours of trichocards. Highest development period, parasitized, fecundity and adult emergence was recorded in yellow colour trichocard with 8 days, 87 per cent, 71.3 per cent and 76 per cent respectively. Lowest is recorded in red colour trichocard with 5 days, 72.33 per cent, 43 per cent and 45.33 per cent respectively.

Keywords: Fecundity, parasitization, *Trichogramma chilonis* and trichocard

Introduction

The egg parasitoids, *Trichogramma chilonis* (Ishii) is a tiny wasp from a group of insects which belongs to family Trichogrammatidae and order Hymenoptera. The genus *Trichogramma* spp. parasitoids egg stage of the pest. Almost many different species viz., *Trichogramma chilonis*,

T. minutum, *T. achaeae*, *T. japonicum*, *T. pretiosum* etc. are being mass reared for control the pests of sugarcane, rice, maize, chickpea, vegetables etc. In India, approximately 26 species of Trichogrammatids have been documented, among which *Trichogramma chilonis* (Ishii), *Trichogramma japonicum* (Ashmead) and *Trichogramma achaeae* are considered particularly significant (Kumar and Kumar, 2015)^[4].

A sizable family of tiny parasitic wasps is known as the Trichogrammatidae. Their length ranges from 0.40-0.70 mm, while their width across the head varies from 0.15-0.25 mm. The three segmented tarsi, large forewing, pubescence in rows or lines, and a single curve formed by the marginal and stigmal veins are characteristics that distinguish this group. The parasitic efficacy of *Trichogramma* would be influenced by the physical and or nutritional quality of *C. cephalonica* when fed the different diets that carried out in the present experiment. To optimize current technique of mass production of *C. cephalonica* and to improve parasitoids production (Lavanya *et al.*, 2021)^[5].

The *Trichogramma chilonis* Ishii is one of the most widely utilized egg parasitoids in biological control programmes against lepidopteran pests in India and worldwide. Being a minute wasp of the family Trichogrammatidae, it parasitizes the eggs of numerous crop pests and there by prevents damage at the most vulnerable stage of the host life cycle. In recent years, several studies have confirmed the remarkable efficiency of *T. chilonis* in different agro-ecosystems. For instance, in guava, four augmentative releases of *T. chilonis* (2,000 parasitized eggs per tree) resulted in a

73.6per cent reduction in fruit and shoot borer damage, along with an increase of 1.70 MT yield and a net gain of about USD 258 per acre during the rainy season, while winter releases also led to significant yield and income advantages (Singh *et al.*, 2023)^[9].

Although *Trichogramma* is possibly the most extensively researched natural enemy genus, little is known about their visual detection and influence of colours on their biology. Colours

can be used for short-range foraging (Lobdell *et al.*, 2005) [6]. Plant colour has been shown to Influence the orientation and feeding responses of a variety of Insects. Phytophagous insects may favour a particular colour or intensity and hue of colour in their preferred plants. *Trichogramma spp.* may use visual cues such as plant colour in their selection process, as has been observed for several hymenopteran parasitoids from families such as Braconidae and Aphelinidae. Like most other hymenopteran species studied, *Trichogramma* can detect differences in light intensity and wavelength. The colour of trichocards influences the parasitism efficiency of *T. chilonis* (Singh *et al.*, 2001) [8]. The present experiment has been conducted to learn about the egg-laying responses of *Trichogramma chilonis* to different coloured cards with the primary objective that a proper egg card colour may encourage the parasitoid to lay more eggs on the egg cards that contain its host and thereby increasing the level of parasitisation in the process. The field success is dependent on their performance, which can be altered by laboratory mass raising procedures. (Cherif *et al.*, 2021) [3].

Experimental Site

The research was conducted at the Biological Control Laboratory, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.). The centre is located on the western side of the Delhi-Dehradun National Highway (NH-58), approximately 10 km north of Meerut city. It lies at 29.074902°N latitude and 77.708568°E longitude.

Methods and Materials

Preferences of female *Trichogramma ostrinae* on egg cards of different colors, considering the effects of inoculation time, generations and learning experiences on wasp parasitism were recorded. The preferences of female *T. ostrinae* for oviposition were also assessed across egg cards of different colors. Subsequent experiments identified the egg card background color most preferred by *T. ostrinae* and examined the influence of inoculation time, generations, and learning experiences on parasitism rates (Wang *et al.*, 2025) [10]. The coloured egg card were prepared by gluing 100 number of freshly laid UV irradiated *C. cephalonica* eggs on respective coloured cards with the help of 10per cent *Acacia* gum. These cards were kept equidistantly on the bottom of a petri dish. At the centre of the petri dish, a small already parasitized egg card containing 20 numbers of parasitized eggs (likely to emerge) were placed and a very fine streak of 50per cent honey were kept on the card as adult diet. Then the petri dish was covered and sealed with para film in order to prevent the possible escape of adult parasitoids. The wasps were allowed to parasitize the eggs for 24 hr. Then, the parasitized eggs card was removed and kept in BOD at 27±2°C and 65±5per cent R.H. for further development of wasp. After 4 days of incubation, parasitized egg turns black and fluffy. The per cent parasitisation were recorded on 4th, 6th and 8th days by observing the egg hole and adult emergence were recorded on 8th, 10th and 12th days after parasitization. The experiment was repeated 3 times by changing the position of eggs and card strips in Petri dish.

Per cent parasitization

Black colour eggs were considered as the parasitized eggs,

on the basis of which, per cent parasitization was determined.

The per cent parasitisation is calculated by the formula:

$$\text{per cent parasitism} = \frac{\text{Number of black eggs with emergence hole}}{\text{Number of host eggs provided for parasitism}} \times 100$$

Per cent adult emergence

Out of total parasitized eggs, the number of parasitoids emerged on the basis of holes on parasitized eggs, were counted and per cent adult emergence were determined.

The per cent adult emergence is calculated by formula:

$$\text{IE (\%)} = 100 - (T \times 100/C)$$

Where, T = emergence in treated batches C = emergence in the control.

Developmental period for the parasitoid from first day of parasitization to adult emergence were recorded in days to determine developmental time for the egg parasitoid under study.

Fecundity

Number of host eggs parasitized by the individual gravid female emerged from parasitized eggs on different colour card were counted and fecundity was determined.

The fecundity is calculated by the formula:

$$F = N/I$$

Where, N = total number of eggs produced by female insects I = is the number of individual females studied

Different colour of trichocard used

Treatments No.	Treatments cards
T ₁	Yellow
T ₂	Green
T ₃	Pink
T ₄	Blue
T ₅	White
T ₆	Red
T ₇	Purple

Results and Discussion Per cent parasitization

The data on per cent parasitization, presented in Table 3 and depicted in Fig. 1 revealed significant differences among the different colour cards. Significantly maximum parasitization of 87 per cent was recorded when the host eggs were glued on yellow colour cards which was significantly superior over rest of the colour cards. The next effective colour card was pink with 83.33per cent parasitization which were followed by green, white, purple, blue and red 80.66, 78.66, 74.33, 73.66 and 72.33 per cent parasitization, respectively and all these treatments were at par with each other.

Adult emergence

The data on effect of different colour cards on per cent adult emergence under experiment is presented in Table 1 and depicted in Fig. 2. Significantly maximum adult emergence of 76 per cent was recorded when the host eggs were glued on yellow colour cards and followed by pink colour card with 65 per cent adult emergence and the least adult

emergence was recorded in red with 45.33 per cent followed by blue with 55.66 per cent emergence.

4.3.3 Fecundity of *Trichogramma chilonis*

Based on the progeny of *T. chilonis* emerged from parasitized host eggs, influenced by different colour trichocards, the fecundity of *Trichogramma* female was assessed. The data presented in Table 1 and depicted in Fig 3. revealed that maximum lifetime fecundity was recorded from the female developed on yellow colour cards with 71.33 eggs per female which was significantly superior over all other colour cards tested under study. Next in order was a pink colour card recording 66 eggs per female. Significantly least effective was red colour recording 43 eggs per female followed by purple colour card recording 49.33 eggs.

4.3.4 Effect of different colour cards on development period

The mean development period as influenced by various colour cards ranged from 5 to 8 days. The data is presented in Table 1 and depicted in Fig. 4. Development period was significantly more on yellow colour card followed by pink colour cards, with recording 8 and 7.33 days, respectively. Least female longevity was recorded in red colour card with 5 days followed by purple colour card with 5.33 days.

Table 1: Response on biological parameters of *Trichogramma chilonis* to different colours of trichocards.

S. No.	Treatments	Development period(days)	Parasitized (per cent)	Fecundity (per cent)	Adult emergence (per cent)
T ₁		8.00	87.00	71.33	76.00
	Yellow	(0.90)	(68.90)	(57.63)	(60.67)
T ₂		6.33	80.66	56.66	58.33
	Green	(0.80)	(64.21)	(48.83)	(49.79)
T ₃		7.33	83.33	66.00	65.00
	Pink	(0.86)	(65.94)	(54.33)	(53.74)
T ₄		5.66	73.66	51.66	55.66
	Blue	(0.75)	(59.13)	(45.59)	(48.26)
T ₅		6.66	78.66	58.66	60.66
	White	(0.82)	(62.49)	(49.99)	(51.15)
T ₆		5	72.33	43.00	45.33
	Red	(0.69)	(58.27)	(40.97)	(42.32)
T ₇		5.33	74.33	49.33	57.66
	Purple	(0.72)	(59.56)	(44.61)	(49.41)
SE(m)±		0.52	1.83	0.85	1.36
CD at (5per cent)		1.72	5.57	2.59	4.10

Values in parentheses are angular transformed and logarithmic transformed value

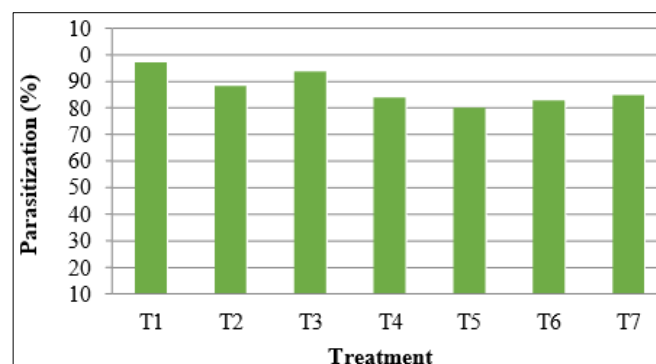


Fig 1: Parasitization in different colour trichocard

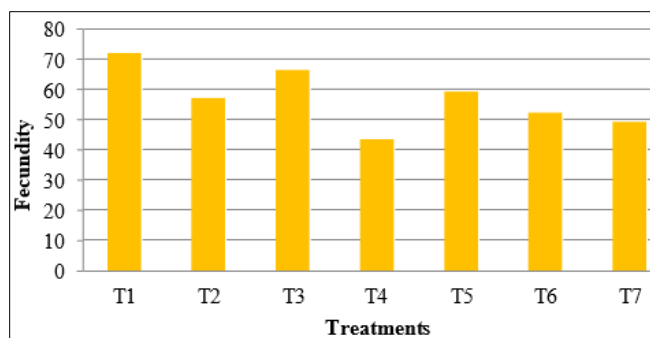


Fig 2: Fecundity in different colour trichocard

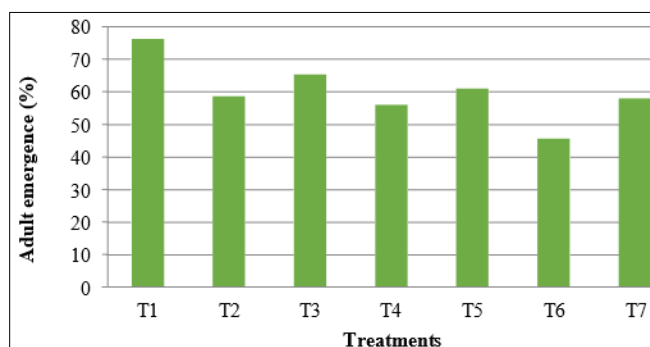


Fig 3: Adult emergence in different colour trichocard

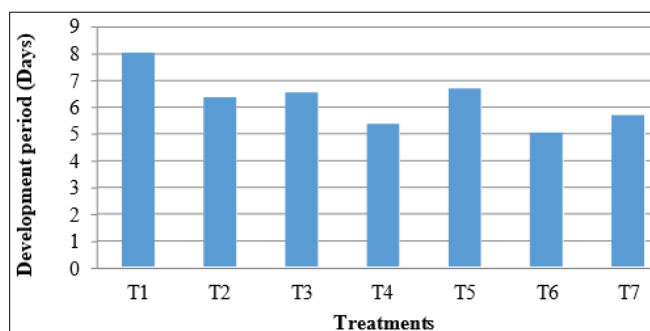


Fig 4: Development period on different colour trichocard

The present results are closer proximity with findings of Nirvesh Singh, Agrawal & Singh, 2017^[7]. The findings revealed that yellow cards achieved the highest parasitism rates 86.0per cent in 2014 and 85.5per cent in 2015 while white cards resulted in the lowest parasitism, at approximately 75–77per cent. Additionally, emergence rates were highest from pink cards (87.6per cent in 2014; 86.9per cent in 2015) and lowest from white cards (76–77per cent). Similar results were also found by Singh *et al.* (2017)^[7], which found that pink color cards produced the greatest emergence while yellow color cards had a preference for parasitization. Similar result was found by Bhattacharya *et al.*, (2003)^[2] that under multiple choice conditions, maximum parasitization was observed on mint-green colour egg cards (64.7 per cent), followed by jade green (56.75 per cent), golden yellow (54.25 per cent), deep orange (52.25 per cent), bus green (49.25 per cent), canary yellow (46.25 per cent) and white (40.50 per cent). The lowest parasitization was observed on chassiss gray (11.50 per cent), followed by dawn (14.50 per cent) and wild lilac (15.75 per cent) coloured cards.

In present investigation maximum lifetime fecundity was recorded from the female developed on yellow colour cards with 71.85 eggs per female which was significantly superior

over all other colour cards tested under study. Next in order was a pink colour card recording 66.33 eggs per female. The results were similar with the findings of Baitha and Sinha (2002) ^[1] significantly higher fecundity on white trichocard (110) followed by green (86.80). Similar results were found by Bhattacharya *et al.* (2003) ^[2] who observed maximum fecundity on mint green cards (87.50per cent), followed by deep orange (87.33per cent) and golden yellow (87.17per cent), indicating the role of colour in influencing not only parasitization and adult emergence but also different biological parameters including fecundity, supporting the results obtained in present investigations.

In present investigation female longevity was significantly more on yellow colour card followed by pink colour cards, white and green colour card with recording 8.33, 6.85, 6.59 and 6.43 days, respectively. Baitha and Sinha (2002) ^[1] revealed that the longevity of female *T. chilonis* varied from 5 to 8 days on different colours of trichocard. Green colour supported maximum and significantly higher longevity (8 days) of female individuals than other colours which supports present findings.

Acknowledgement

I wish to express my sincere gratitude to my advisor Dr. Rajendra Singh for guidance and support during the course of this research work. I also acknowledge the facilities and assistance provided by my institution.

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