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EFFICACY OF TWO GRAVID FEMALE *TRICHOGRAMMA CHILONIS* AGAINST IMPORTANT LEPIDOPTERAN PESTS UNDER LABORATORY CONDITION

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ABSTRACT
The present study was conducted for efficient parasitization and efficacy of the two gravid female of *Trichogramma chilonis* (Ishii) against important lepidopteran pests *viz*., *H. armigera, E. vitella, P. demoleus, A. janata* and *C. cephalonica*, having 24, 48, and 72 hrs old age eggs were exposed to two gravid females of *Trichogramma chilonis*. Laboratory experiments were carried out at the college of Agriculture, Nagpur and CICR, Nagpur, Maharashtra during Kharif 2015. The results revealed that, the *T. chilonis* exhibited 70.00% parasitization on 24 hrs old eggs of *Helicoverpa armigera*, 28.25 average number of adult emergence of *T. chilonis* in 24 hrs old eggs of *Papilio demoleus* and 8.50 days required for adult emergence of *T. chilonis* in 72 hrs old eggs of *Papilio demoleus*. It is concluded that percent parasitization was more in *H. armigera* and average number of adult emergence and days required for adult emergence was more in *Papilio demoleus* as compare to all the 5 treatments. Hence, the *H. armigera* and *Papilio demoleus* eggs was more suitable for rearing of parasitoid to get good development of biological parameters of *T. chilonis.*

KEY WORDS: Gravid females, Lepidopteran pests, *Trichogramma chilonis.*

INTRODUCTION

Biological control is an essential component in integrated pest management programs and often recommended as the first defence line to face the menace of economic pests. The hymenopteran parasitoid, *Trichogramma chilonis* (Ishii) (Hymenoptera: Trichogrammatidae) is considered as important biological control agent of insects pests in greenhouse and field crops. Male yellow with blackish abdomen and mesosculum, antennal hairs somewhat sharply tapering and moderately long, forewing with four to six oblique lines setae, fringe on torn us about one sixth width of wing. Genitalia with dorsal expansion of gynobasic triangular, with lateral lobes very prominent, chelate structure markedly below level of gonophores, median chitinized ridge paired, extending interiorly to about two- third length of genitalia, aedeagus as long as apodemes, both slightly shorter than hind tibia. And female yellow with first three abdominal terga black antennae clubbed with short hairs on flagellum, ovipositor as long as or slightly longer than hind tibiae (Albo 1986).

These *Trichogramma* can be integrated with the other control measures and mass reared cheaply and conveniently in the laboratory on unnatural hosts. These Trichogrammatids have over 203 genera and used against more than 200 insect species belonging to 70 families and 8 insect orders in diversified habits, mostly on the lepidopteran pests of different crops. It is necessary to adopt biological method, as one of the components of IPM for managing the above lepidopteran pests, since biological method is eco friendly, non-toxic to human. Moreover bio agent are host specific and have high searching and dispersal ability and having no residual effect. Though several inundative releases are required to suppress the population of the pests, but once the bio agent is established in a particular area sustainable suppression of pest are achieved by this method.

There are several bio agents used to control the pests. The *Trichogramma chilonis* is an alternative bio agent that has been found to be effective against lepidopteran pests. The bio efficacy of *Trichogramma* has been tested against some lepidopteron pests. *T. chilonis* (Ishii) is most suitable egg parasitoid for controlling the lepidopteron pests (Singh and Jalali, 1994). These *Trichogramma* parasitize the eggs thus killing the lepidopteron pests before they could inflict damage to the host plant *i.e*. 'Nip at the bud' strategy. The use of bio agent reduces the chemical spraying ultimately conserve the natural enemies of pests. These tiny wasps have wide range and adoptability, host specificity, safety to use, cheap availability and inhibits almost all kinds of habitats from swampy marshland to hot dry deserts and occurs in low-laying or in strictly arboreal habitats (Sudha and Nagarakatti and Nagaraja, 1977). In India about 26 species of Trichogrammatids are recorded of which *T. chilonis* (Ishii), *T. japonicum* Ashmead, *T. achaeae* Nagaraja and Nagarkatti are most suitable egg parasitoids for managing the lepidopteran pests (Singh and Jalali, 1994). Parasitoid release and insecticidal application at a time cannot work together, hence, it is imperative to conserve the natural enemies in agro-ecosystem by avoiding the use of deleterious insecticides. However, more study regarding age- preference of host egg needs to be investigated against different major lepidopteran pests on commercially important crops. Trichogrammatids are one of the most important groups of biotic agent for the

suppression of several lepidopteron pests all over India and widely distributed species of egg parasitoid in India and abroad. Over 200 insect species are parasitized by various strains of Trichogrammatids. Out of 26 *Trichogramma* species recorded in India, *T. Chilnis, T. Japonicum, T. Acheae*, are key mortality factors for many crop pest.

Ever since 1975, *Trichogramma* are being used to control lepidopterous pests of cotton, cabbage, apple and tomato *etc*. (Smith, 1996). The quality parasitoids can be produced by studying biological features of *Trichogramma* adult as longevity, emergence and parasitism abilities (Bigler, 1991). To get high rate of emergence in laboratory in hot summer, artificial manipulation in temperature is necessary for successful rearing (Rejendran, 1999). The chemical control not only increases the cost of production but also is dangerous for the health of farmers and for environment. One of the safe measures to evade such a situation is biological control. It is an alternate or an adjunct to chemical control, and has successfully been used to control many pests including cotton bollworms (Cock, 1985).

*Trichogramma chilonis (*Ishii), for the control of lepidopterous pests is practiced in more than 50 countries and used on 32 million hectares each year (Hassan, 1993). *Trichogramma* spp. has the great potential to control bollworms in cotton IPM (Verma and Shenhmar, 1998). The *Trichogramma* are hymenopterous parasitoids of lepidopterous insect pests (Cadapan and Gonzales, 1986). They are minute (0.1 - 0.5 mm) endoparasitic insects which prey on other insects eggs. They complete their life cycle inside the eggs of other insects and kill the host before it is hatched. They belong to the chalcid group of hymenopterous insects in the family Trichogrammatidae (Cadapan, 1986).

MATERIALS & METHODS

Details of experiment:

1) Test parasitoid : *Trichogramma chilonis*
2) Experimental Designs : Completely Randomized Design (CRD)
3) No. of replications : 4
4) No. of treatments : 5

Treatments:

T_1 - *Helicoverpa armigera*
T_2 - *Earias vitella*
T_3 - *Papilio demoleus*
T_4 - *Achoea janata*
T_5 - *Corcyra cephalonica*

Procedure for test

Rearing of larvae of lepidopteran pests

Larvae of lepidopteran pests (*H. armigera, E. vitella, P. demoleus, A. janata and C. cephalonica*) were collected from different host plants and were reared in plastic containers by providing the natural diet till the pupal stage under laboratory condition. The pupae of lepidopteran pests were obtained and were kept in large size plastic jars and emerged adults were transferred into oviposition chamber for mating and oviposition.

Adult of lepidopteran pests were released into oviposition chamber by providing 40% honey diet in hanging cotton swab, folded centurary paper for oviposition. Upper opening of ovipositon chamber was closed with muslin cloth fixed with rubber band. All these materials were disinfected by using Sodium hypochloride 0.05% before the experiment.

Exposure of host eggs to gravid female of *Trichogramma chilonis*:

Eggs of all host *viz*., *H. armigera, E. vitella, P. demoleus, A. janata* and *C. cephalonica* having 24, 48, and 72 hrs old age were exposed to one gravid females of *Trichogramma chilonis*. Twenty eggs of each host were exposed to the parasitoid. The same set was replicated four times. The desired size empty cards were smeared with gum and required quantity of eggs i.e. twenty eggs on each cards were sticked on them. These cards were kept in test tubes. For identification of females of *Trichogramma chilonis*. Strip of untreated *Corcyra* eggs were placed in test tube in which a strip of parasitized tricho cards was inserted.

The adults of *Trichogramma chilonis* which emerged out from the eggs were observed. The females after mating and lapse of waiting period were attracted towards the eggs of *Corcyra* for oviposition, such females were picked up with fine camel brush and one female were placed into each test tube containing the lepidopteran pest's eggs. In this way lepidopteran eggs were exposed to one gravid female of *Trichogramma chilonis* under laboratory condition. The following observations were recorded.

The Following observations were recorded

i) Per cent egg parasitisation
ii) Number of days required for adult emergence
iii) Number of parasitoids emerged

Statistical Analysis:

The data of all sets of experiment were collected scrupulously through observation (compiled, average tabulated). The tabulated data after appropriate transformations were subjected to statistical analysis as per Gomez and Gomez (1984).

RESULTS & DISCUSSION

Screening of Trichogrammatids:

Results obtained with regards to the per cent parasitization, average number of parasitoids emerged, average number of days required for adult emergence and percentage of unhatched eggs of *Trichogramma chilonis*, in the laboratory on important lepidopteran pests (*Helicoverpa armigera, Earias vitella, Papilio demoleus, A. janata and Corcyra cephalonica*) has been presented.

Effect of two gravid female *Trichogramma chilonis* on important lepidopteran pests:

A) Percent eggs parasitization by *Trichogramma chilonis*:

The data presented in the Table 1 revealed that, the age of the host eggs, significantly influenced the parasitization by *Trichogramma chilonis*. The data showed that, the maximum amount of parasitization was recorded in 24 hrs old eggs and followed by 48 hrs and 72 hrs old eggs, the lowest parasitization was observed in 72 hrs old eggs.

TABLE 1: Effect of two gravid female *Trichogramma chilonis* on per cent egg parasitization by *Trichogramma chilonis*

Sr. No.	Treatment	No. of host eggs exposed	Mean per cent egg parasitization		
			24hrs old eggs	48 hrs old eggs	72 hrs old eggs
1	T1-*Helicoverpa armigera*	20	70.00 (56.79)	68.75 (56.02)	65.00 (53.73)
2	T2- *Earias vitella*	20	61.25 (51.51)	63.75 (52.99)	56.25 (48.59)
3	T3- *Papilio demoleus*	20	65.00 (53.73)	65.00 (53.73)	62.50 (52.25)
4	T4- *Achoea janata*	20	55.00 (47.87)	53.75 (47.15)	51.15 (45.72)
5	T5- *Corcyra cephalonica*	20	68.75 (56.02)	66.25n(54.49)	62.50 (52.25)
	'F' test		Sig	sig	sig
	SE (m) ±		0.48	0.67	0.71
	CD at 5%		1.39	1.97	2.10

(*Figures in the parentheses are corresponding values of arc sine transformation).

The maximum percent parasitization was recorded by *Trichogramma chilonis* on 24 hrs old eggs of *Helicoverpa armigera* (70.00%) and followed by *Corcyra cephalonica* (68.75%), *Papilio demoleus* (65.00%), *Earias vitella* (61.25%) and *Achoea janata* (55.00%) respectively. The highest per cent parasitization was recorded on *Helicoverpa armigera* (70.00%), however, the treatment *Corcyra cephalonica* (68.75%), found statistically on par with *Helicoverpa armigera* (70.00%). The treatments *Papilio demoleus* (65.00%), found second best in egg parasitization. The host treatments *Earias vitella* (61.25%) and *Achoea janata* (55.00%) shown parity with each other in percent egg parasitization.

After an exposure period of 48 hrs old eggs, the results showed similar trend like 24 hrs exposure with highest per cent parasitization observed in *Helicoverpa armigera* eggs (68.75%) and followed by *Corcyra cephalonica* (66.25%), *Papilio demoleus* (65.00%), *Earias vitella* (63.75%) and *Achoea janata* (53.75%) respectively. However, the percent parasitization recorded in the treatment *Corcyra cephalonica* (66.25%), *Papilio demoleus* (65.00), and *Earias vitella* (63.75) were statistically on par with the *Helicoverpa armigera* (68.75%).The host treatment *Achoea janata* (51.25%) shown least preference in percent egg parasitization, amongst other hosts.

The parasitization by *Trichogramma chilonis* against important lepidopteran pests exhibited decreasing trend on 72 hrs old eggs, exposure period in percent parasitization as compared to 24 hrs in all treatments *viz*., *Helicoverpa armigera* (65.00%) and followed by *Corcyra cephalonica* (62.50%), *Papilio demoleus* (62.50%), *Earias vitella* (56.25%) and *Achoea janata* (51.25%) respectively. However, the parasitization recorded in the treatment *Corcyra cephalonica* (62.50%) and *Papilio demoleus* (62.50%) were found statistically on par with *Helicoverpa armigera* (65.00%). The host treatments *Earias vitella* (56.25%) and *Achoea janata* (51.25%) shown parity with each other in egg parasitization.

Present study indicated that, the maximum parasitization was noticed in 24 hrs old eggs of *Helicoverpa armigera* (70.00%) and followed by 48 hrs and 72 hrs old eggs and lowest parasitization was recorded in *Achoea janata* (51.25%) in 72 hrs old eggs. The reason being *Trichogramma chilonis* mainly preferred freshly laid eggs for parasitization.

These results are comparable with the findings of earlier studies made by Krishnamoorthy and Singh (2001) who reported the per cent parasitization of *Trichogramma chilonis* in the host eggs of *Papilio demoleus* (75.90%) in laboratory. Thus these findings gave supports to present investigation. Chandish and Singh (2003) they recorded per cent parasitization of *Trichogramma chilonis* in *Helicoverpa armigera* (66.7%) eggs. Thus these findings gave supports to present investigation.

B) Average number of parasitoids emergence:

The statistical data on average number of parasitoids emergence presented in Table 2 revealed that, the development (egg to adult emergence) of *Trichogramma chilonis* among the different age groups of host eggs was significantly found more in 24 hrs old eggs. The findings on adult emergence by feeding 24 hrs old eggs, revealed that, the treatment *Papilio demoleus* exhibited maximum adult emergence to the tune of 28.25 adult emerged. However, the treatments *Helicoverpa armigera* (24.25) and *Corcyra cephalonica* (23.50) were found on par with *Papilio demoleus* (28.25) in adult emergence. The treatment *Earias vitella* was found second best in which 22.25 adult emerged. The treatment *Achoea janata* (21.75) was found on par with treatment *Earias vitella* (22.50) in adult emergence.

The observations on exposure period of 48 hrs old eggs revealed that, the treatment *Papilio demoleus* exhibited maximum adult emergence to the tune of 25.25 number of adult emerged. However, the host treatment *Helicoverpa armigera* (24.00), *Earias vitella* (23.25), *Achoea janata* (22.75) and *Corcyra cephalonica* (22.00) were found on par with each other in adult emergence.

After an exposure period of 72 hrs of old eggs, the treatment *Papilio demoleus* exhibited maximum adult emergence to the tune of 23.75 number of adult emerged. The treatment *Helicoverpa armigera* was found second best in which 22.50 adult emerged. However, the treatments *Earias vitella* (21.50), *Achoea janata* (21.50) and *Corcyra cephalonica* (21.00) were found on par with each other in adult emergence.

The data recorded on parasitoids emergence at 24 hrs, 48 hrs and 72 hrs old eggs concluded that, the treatment *Papilio demoleus* was found superior in recording maximum parasitoid emergence ranging from 28.25, 25.25 and 23.75 adult emergences respectively. The lowest number of adult emergence 21.00 was observed in

Corcyra cephalonica, because the size of the host eggs was large, which was observed in *Papilio demoleus* and also age of the host egg increases the egg cell (chorion) becomes hard.

These results are comparable with the findings of earlier studies made by Budhwant et al. (2008) who recorded maximum numbers *i.e*. 10.59 adults of *T. chilonis* were emerged out from *P. demoleus* host eggs. Thus these findings gave supports to present investigation. Thus these findings gave support to present investigation.

Kumar *et al*. (2004) they reported maximum per cent emergence of *Trichogramma chilonis* was noticed in *Helicoverpa armigera* (81.23%). Thus these findings gave support to present investigation.

C) Average number of days (period) required for adult emergence:

The observations recorded and presented in Table 3 on the time required for adult emergence at 24 hrs old eggs revealed that, the treatment *Achoea janata* (7.75 days) required maximum number of days and was found on par with *Papilio demoleus* (7.75 days) and *Earias vitella* (7.25 days). The treatment *Corcyra cephalonica* (6.75 days) took lowest period *i.e*. 6.75 days which was found on par with treatment *Helicoverpa armigera* (7.00 days).

TABLE 2: Effect of two gravid female *Trichogramma chilonis* on average number of parasitoids Emergence

Sr. No.	Treatment	No. of host eggs exposed	Average number of parasitoids emergence		
			24 hrs old eggs	48 hrs old eggs	72 hrs old eggs
1	T1-*Helicoverpa armigera*	20	24.25	24.00	22.50
2	T2- *Earias vitella*	20	22.50	23.25	21.50
3	T3- *Papilio demoleus*	20	28.25	25.25	23.75
4	T4- *Achoea janata*	20	21.75	22.75	21.50
5	T5- *Corcyra cephalonica*	20	23.50	22.00	21.00
	'F' test		Sig	Sig	Sig
	SE (m) ±		0.32	0.45	0.31
	CD at 5%		0.93	1.31	0.90

TABLE 3: Effect of two gravid female *Trichogramma chilonis* on average number of days required for adult emergence

Sr. No.	Treatment	No. of host eggs exposed	Average number days		
			24 hrs old eggs	48 hrs old eggs	72 hrs old eggs
1	T1-*Helicoverpa armigera*	20	7.00	7.75	8.00
2	T2- *Earias vitella*	20	7.25	7.25	7.25
3	T3- *Papilio demoleus*	20	7.75	8.25	8.00
4	T4- *Achoea janata*	20	7.75	8.00	8.25
5	T5- *Corcyra cephalonica*	20	6.75	7.00	7.50
	'F' test		Sig	Sig	Sig
	SE (m) ±		0.22	0.19	0.20
	CD at 5%		0.63	0.54	0.59

After on exposure period of 48 hrs old eggs, the observations recorded on the time required for adult emergence, the treatment *Papilio demoleus* (8.25 days) required maximum number of days and was found on par with treatment *Achoea janata* (8.00 days) and *Helicoverpa armigera* (7.75 days). The treatment *Corcyra cephalonica* took lowest period i.e. 7.00 days which was found on par with the treatment *Earias vitella* (7.25 days).

The observations recorded on the time required for adult emergence at 72 hrs old eggs revealed that, the treatment *Achoea janata* (8.25 days) required maximum number of days for adult emergence. However, the treatment *Papilio demoleus* (8.00 days) and *Helicoverpa armigera* (8.00 days) was found on par with *Achoea janata* (8.25 days). The treatment *Earias vitella* took lowest period i.e. 7.25 days which was found on par with *Corcyra cephalonica* (7.50 days) for adult emergence.

The study showed that, the maximum number of days (period) required for adult emergence of *Trichogramma chilonis* was observed in 72 hrs old eggs of *Papilio demoleus* (8.50 days) and lowest number of emergence was recorded in *Corcyra cephalonica* (6.75 days) in 24 hrs old eggs. These results are comparable with the findings of earlier studies made by Sajid Nadeem et al. (2009) who have reported that, the developmental period of *Trichogramma chilonis* on host eggs of *Helicoverpa armigera* was noticed in 7.3 days. Thus these findings gave supports to present investigation.

Krishnamoorthy and Singh (2001) who reported that, the *Trichogramma chilonis* readily parasitized 24 hrs and 48 hrs old eggs of *Papilio spp*, and emergence period was completed in 8.3 days. Thus these findings gave supports to present investigation.

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