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Field efficacy of *Trichogramma chilonis* against rice leaf folder, *Cnaphalocrocis medinalis* in Kangra Valley of Himachal Pradesh

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Abstract

A field trial was carried out to evolve the effective dose of egg parasitoid, *Trichogramma chilonis* against rice leaf folder. Different doses of *T. chilonis*, viz., 50,000, 75,000, 100,000, 125,000 and 150,000 parasitized eggs per hectare were tried and results revealed that among the different dosages, maximum control was achieved when 150,000 parasitized eggs per hectare were released. However, this treatment was found to be at par with 100,000 and 125,000 parasitized eggs per hectare.

Keywords: Damaged leaves, efficacy, parasitized eggs, rice leaf folder, *Trichogramma*

Introduction

Rice (*Oryza sativa* L.) is the only staple food for more than 65 percent of the people of India with production of 157.9 million tones^[1]. In Himachal Pradesh, rice occupies third position in acreage after wheat and maize with 76.34 thousand ha area under its cultivation and total production of 132.49 thousand metric tonnes^[2].

Rice is affected by number of insect pests during its different growth stages. In Himachal Pradesh the rice crop is mainly infested with *Scirpophaga innotata*, *Cnaphalocrocis medinalis*, *Nymphula depunctalis*, *Diadisa armigera*, *Hydrellia philippina* and *Heteronychus lioderes* etc.^[18]. The rice leaf folder, *C. medinalis* is one of the most common insect-pests of rice prevalent in Himachal Pradesh which was earlier a pest of minor importance but has now gained the status of an important major pest with the introduction of high yielding varieties, adoption of new agronomic practices, prophylactic use of pesticides and monoculture over large area along with the humid environment favour the proliferation of insect-pests^[11]. Leaf folder larvae feed inside the fold by scraping the green matter and the scraped leaves become membranous, turn whitish and finally wither. In case of severe infestation, the leaf margins and tips are dried up and crop gives a whitish appearance. Leaf folder damage can be noticed at any stage of the crop growth but generally it is more damaging during active tillering to booting stage and causes significant yield losses^[17].

For the management of rice leaf folder, farmers have been relying mostly on chemical pesticides. Indiscriminate use of pesticides however, has led to several problems including pest resurgence, outbreak of new pests, destruction of natural enemies and pesticides residue problem in rice^[13]. To overcome these problems, an ecologically sound strategy, i.e., use of biocontrol agents was felt necessary for developing management practice for this pest through successive releases of biocontrol agents. The biological control agents silently devour pests and keep the population under check. Egg parasitoids in the genus *Trichogramma* (Hymenoptera: Trichogrammatidae) have been widely used for biological control of lepidopteran insect pests^[10, 16]. The inundative releases of bioagents for control of lepidopteran pests are being practiced in more than 32 million hectares each year around the world^[7]. Egg parasitoid, *Trichogramma chilonis* is an effective egg parasitoid of rice leaf folder. Khan *et al.* reported that the increase in paddy yield after inundative releases of *T. chilonis*, over control, ranged from 33.0 to 89.5 kg per acre^[9]. In Punjab augmentative release of *T. chilonis* and *T. japonicum* @ 100,000 each have found effective for the biological suppression of yellow stem borer and leaf folder in organic rice^[8]. "Keeping in above in mind, an attempt was made to evaluate the effect of *T. chilonis* for the management of rice leaf folder in the Kangra valley of Himachal Pradesh.

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Materials and Methods

Mass production: Adults of *T. chilonis* were multiplied on the eggs of rice moth, *Corcyra cephalonica* as per method of Varma *et al.* [19]. The eggs of *C. cephalonica* were procured from the Biocontrol Laboratory, Palampur. The eggs were mounted on tricho cards @ 10,000 eggs per card and kept under ultraviolet light for half an hour. The initial culture of *T. chilonis* was procured from NBAIR, Bangalore and released in the glass jar having unparasitized cards and kept in incubator at $26\pm 1^\circ\text{C}$ and 70 ± 5 percent RH. After 6-7 days, the cards with parasitized eggs which turned black were collected and further used for multiplication of culture to study the efficacy of *T. chilonis*.

Field release: The field experiments to assess the relative efficacy of *T. chilonis* against rice leaf folder were conducted in RBD during 2015 and 2016 with six treatments including control and three replications. The treatments comprised releases of parasitoids at the rate of 50,000, 75,000, 100,000, 125,000 and 150,000 parasitized eggs per hectare.

Each treatment was replicated thrice and size of each plot was 70 m². Each plot was separated by a distance of 3 m² from each other. In these treatments, parasitoid cards were cut into bits and were stapled on the lower side of rice leaves to avoid the direct exposure of the parasitized eggs to sunlight at 10 days interval. In each treatment, parasitoids were released with the appearance of the leaf folder moth, *i.e.*, about 40 DAT. Four releases were made for each treatment. Infestation of rice leaf folder was recorded at one day before release and 10 days after the release and subsequent releases were made after every 10 days. The releases were made at 10 days interval. The data on total number of leaves and damaged leaves were recorded on 20 randomly selected plants from

each treatment and percent infestation was calculated.

Data for experiment planned in respective design were subjected to analysis of variance after transformation of data through CPCS-1 software as per the procedure suggested by Gomez and Gomez [6].

Results and Discussions

Efficacy of *T. chilonis* during Kharif 2015

The efficacy of different dosages of parasitoids, *viz.*, 50,000, 75,000, 100,000, 125,000 and 150,000 parasitized eggs per hectare along with an untreated check was recorded by observing percent damaged leaves caused by rice leaf folder during 2015 and 2016. Prior to the release of different levels of *T. chilonis*, data on percent damaged leaves ranged between 2.12 to 2.76 percent which indicated that there were no significant differences in leaf damage in different plots (Table 1) during 2015.

The leaf damage after first release @ 150,000 parasitized eggs per hectare (T₅) was found to be lowest (7.19%), however, it was at par when parasitoids were released at the rate of 125,000 (T₄) with 7.39 percent damage and release of 100,000 parasitized eggs per hectare (T₃) registering 7.85 percent damaged leaves. However, the maximum number of damaged leaves to the extent of 8.98 and 9.95 percent were recorded in the plots where 75,000 (T₂) and 50,000 (T₁) parasitized eggs per hectare, respectively, were released which also remained at par with untreated check (T₆) having 10.02 percent damaged leaves. Similar trend of percent damaged leaves was also observed after second release with minimum (8.02%) and maximum damaged leaves (14.25%) in treatments T₅ and T₆, respectively. It was followed by plots treated with T₄, T₃, T₂ and T₁ having 9.52, 10.14, 11.35 and 13.25 percent damaged leaves, respectively.

Table 1: Field efficacy of *Trichogramma chilonis* against *Cnaphalocrocis medinalis* during Kharif 2015

Treatment (Parasitized eggs/ ha)		Damaged leaves (%)*				
		Pre count	1 st release	2 nd release	3 rd release	4 th release
T ₁	50,000	2.76	9.95	13.25	15.70	17.70
T ₂	75,000	2.12	8.98	11.35	13.65	14.98
T ₃	100,000	2.42	7.85	10.14	9.92	8.90
T ₄	125,000	2.51	7.39	9.52	9.02	8.00
T ₅	150,000	2.70	7.19	8.02	7.12	7.10
T ₆	Untreated check	2.62	10.02	14.25	17.72	19.85
CD (P=0.05)		NS	1.34	1.77	1.92	1.41

*Mean of three replication

Observations after third release revealed that treatment T₅ was superior to all other treatments including untreated check registering 7.12 percent damaged leaves. It was followed by plots treated with T₄, T₃, T₂ and T₁ having 9.02, 9.92, 13.65 and 15.70 percent damaged leaves, respectively. However, treatment T₃, T₄ and T₅ were found to be at par with each other. Among all the treatments T₁ recorded higher percent damaged leaves rendering it to be the least effective.

The percent damaged leaves due to different treatments of *T. chilonis* over untreated check after fourth release indicated that treatment T₅ was superior to other treatments registering 7.10 percent damaged leaves. It was followed by plots treated with T₄, T₃, T₂ and T₁ having 8.00, 8.90, 14.98 and 17.70 percent damaged leaves, respectively. However, treatment T₃, T₄ and T₅ were found to be at par with each other.

Efficacy of *T. chilonis* during Kharif 2016

Data presented in Table 2 on percent damaged leaves revealed that there were no significant differences in the damaged

leaves in different plots prior to the various releases of *T. chilonis* during 2016. The observations on percent damaged leaves taken after first release in treatments *viz.*, T₄, T₅, T₃, T₂, T₁ and T₆ in ascending order were 6.92, 7.00, 7.23, 7.28, 10.00 and 10.42 percent, respectively. Treatment T₄ with lowest damaged leaves was found to be at par with T₂, T₃ and T₅. However, treatment T₁ was found to be at par with untreated check.

The data after second release showed that the most effective treatments were T₄ and T₅ which recorded 8.12 and 8.20 percent damaged leaves, respectively, and remained at par with each other, whereas, treatments *viz.*, T₃ (9.79%) and T₂ (10.42%) were also at par with each other. Maximum percent damaged leaves were shown by treatments T₁ and T₆ with 12.12 and 13.89 percent damaged leaves, respectively. The observations recorded after third release indicated that treatment T₅ was found to be the most effective and superior among all the treatments with 7.82 percent damaged leaves. The percent damaged leaves in treatments namely, T₄, T₃, T₂

and T₁ were 7.97, 9.04, 12.24 and 14.45 percent, respectively, while T₅ was found to be at par with T₃ and T₄.

Almost similar trend of leaf damage was observed after fourth release where T₅ was found to be the most superior treatment registering 7.02 percent damaged leaves and was at par with

T₄ and T₃ with leaf damage of 7.71 and 8.82 percent, respectively. The percent leaf damage in treatments viz., T₁, T₂, and T₆ was 16.12, 14.22 and 17.53, respectively. Among all the treatments T₁ and T₂ were found to be least effective in controlling the leaf damage.

Table 2: Field efficacy of *Trichogramma chilonis* against *Cnaphalocrocis medinalis* during Kharif 2016

Treatment (Parasitized eggs/ ha)		Damaged leaves (%)*				
		Pre count	1 st release	2 nd release	3 rd release	4 th release
T ₁	50,000	1.99	10.00	12.12	14.45	16.12
T ₂	75,000	2.00	7.28	10.42	12.24	14.22
T ₃	100,000	2.04	7.23	9.79	9.04	8.82
T ₄	125,000	2.05	6.92	8.12	7.97	7.71
T ₅	150,000	2.03	7.00	8.20	7.82	7.02
T ₆	Untreated check	1.97	10.42	13.89	15.25	17.53
CD (P=0.05)		NS	0.62	1.46	1.12	1.36

*Mean of three replication

So from present study on evaluation of efficacy of *T. chilonis*, it can be concluded that the *T. chilonis* released @ 150,000 parasitized eggs per hectare was found to be most superior treatment. However, this treatment was found to be at par with 100,000 and 125,000 parasitized eggs per hectare. These findings are in accordance with those of Khan *et al.* and Sagheer *et al.*, who reported that the inundative releases of egg parasitoids at the rate of 100,000 per hectare are superior over the lower doses [9, 15]. Garg *et al.* reported that two to four releases of the parasitoid provided effective management

of leaf folder [5].

The percent reduction in damaged leaves over untreated check is presented in Fig. 1 which clearly indicated that when the percent damaged leaves decreased in the field due to successive releases of *T. chilonis*, the percent reduction over untreated check also increased after four releases. The percent reduction in leaf damage over control was quite high (upto 63.34%) when 150,000 parasitized eggs per hectare were released while it was as low as 12.57 percent when 50,000 eggs per hectare were released.

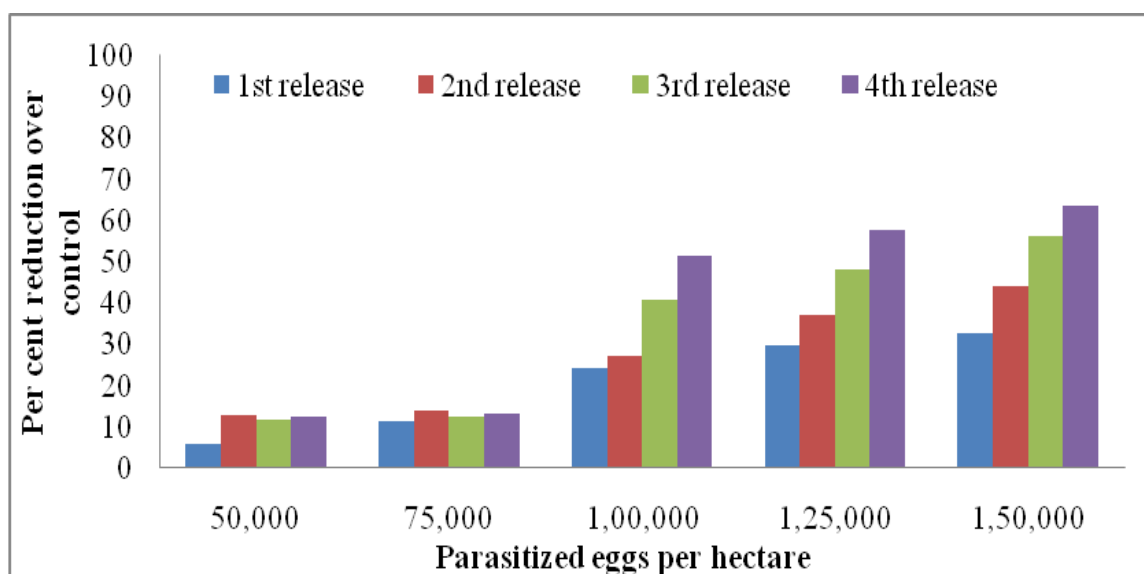


Fig 1: Percent reduction in *C. medinalis* damaged leaves in different treatments of *T. chilonis* during 2015 and 2016 (Pooled over two years)

Almost similar observations were also made by Bentur *et al.* who reported that four to nine releases of *Trichogramma* sp. @ 100,000/ ha starting from 20 to 38 days after transplanting with a mean of 6.6 to 9.8 days duration between the releases resulted in 3.7 to 59.0 percent decrease in leaf damage [4]. Balagurunathan and Rabindra reported 8 to 40 percent reduction of rice leaf folder damage through the releases of *T. chilonis* [3].

Kumar and Khan & Mishra and Kumar reported higher reduction in percent damaged leaves ranging between 72.6 to 81.8 percent, when the *T. chilonis* were released @ 100,000/ ha [12,14]. However, the present study revealed that percent reduction over control was 50.40 percent when 100,000 parasitized eggs per hectare were released. The variations in

percent reduction over control might be due to variable number and duration of successive releases.

Conclusion

Studies on efficacy of *Trichogramma chilonis* indicated that the damaged leaves decreased in the field due to successive releases of *T. chilonis*. The percent reduction in leaf damage over control was highest (upto 63.29%) when 150,000 parasitized eggs per hectare were released while it was as low as 12.57 percent when 50,000 parasitized eggs per hectare were released. Among the six treatments, maximum control was achieved when 150,000 parasitized eggs were released per hectare. However, this treatment was found to be at par with 100,000 and 125,000 parasitized eggs per hectare.

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