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Evaluation of different doses of *Trichogramma* species for the management of leaf folder and stem borer on *Basmati* rice

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ABSTRACT: **Different doses of *Trichogramma* species were evaluated against leaf folder and stem borer on *Basmati* rice in farmers' field. Seven releases of *Trichogramma chilonis* Ishii and *T. japonicum* Ashmead each @ 100000, 125000 and 150000 hectare^{-1} at weekly interval starting at 30 DAT (days after transplanting) were made. All the three doses were effective for the control of leaf folder and stem borer and also helped to increase the parasitization and yield. Thus the lower dose (100000 ha^{-1}) of both the parasitoids can be used for the control of two pests. The incidence of leaf folder was significantly lower in the plots where cartap hydrochloride 4G @ 25kg ha^{-1} was applied three times. The releases of egg parasitoids at all the doses were equally and significantly better than control.**

KEY WORDS: Leaf folder, parasitization, releases, stem borer, *Trichogramma chilonis*, *Trichogramma japonicum*

INTRODUCTION

Basmati occupies a special status in rice cultivation and is known for excellent cooking and eating qualities. However, *Basmati* varieties occupy about four to five per cent rice area in the state. Insect pests are one of the major limiting factors in the production of *Basmati* rice in India. In India about 26 trichogrammatids are recorded, of which *Trichogramma chilonis* Ishii and *T. japonicum* Ashmead (Hymenoptera: Trichogrammatidae) are of significance (Singh and Jalali, 1994). Brar *et al.* (1999a, b) evaluated *T. chilonis* and *T. japonicum* for the control of leaf folder, *Cnaphalocrocis medinalis* (Guenee) and stem borer, *Scripophaga incertulas* (Walker) on rice and found it promising in Punjab. In Pondicherry, Rajendran (1992) found that *T. japonicum* releases reduced the leaf folder damage. Keeping the above facts in mind, the present study was planned to find out the effective dose of *Trichogramma* species for the management of leaf folder and stem borer on *Basmati* rice and integration of *Trichogramma* species with cartap hydrochloride 4G.

MATERIALS AND METHODS

The experiment was carried out in farmers' field with Basmati 386 variety, planted in Karni Khera (Fazilka) villages and in the Biological Control Laboratory, Department of Entomology, Punjab Agricultural University, Ludhiana, during *Rabi*, 2005. The plot size was 500 m^2. The experiment was conducted in a randomized block design with three

replications. Three doses of *T. chilonis* and *T. japonicum*, *i.e.*, 100000, 125000 and 150000 ha^{-1}, were evaluated along with chemical control and untreated control. *T. chilonis* and *T. japonicum* were released simultaneously seven times at weekly intervals starting at 30 DAT by stapling. Trichocards at 100 spots per ha. In chemical control, three applications of cartap hydrochloride (Padan 4G) were made, with the first dose at 30 DAT @ 25kg ha^{-1}, followed by two more doses at 50 and 70 DAT. Incidence of leaf folder and stem borer was recorded at 45 and 60 DAT from ten plants from each plot selected at random. Parasitization of *S. incertulas* eggs was recorded by collecting egg masses from different plots. The recovery tests were carried out by stapling small bits of cards containing *Corcyra cephalonica* (Stainton) eggs @ 100 eggs in each plot. These cards were removed after 48 hours and brought to the laboratory for recording parasitization. The data were analyzed statistically in randomized block design using the software CPCS 1 after appropriate transformations.

RESULTS AND DISCUSSION

Leaf folder incidence

The incidence of leaf folder at 45 DAT in control was 3.41 per cent and it was significantly higher than chemical control but was on par with the remaining treatments (Table 1). The per cent leaves folded in the plots treated with cartap hydrochloride was 0.69, which was significantly lower than that in all other treatments. Among the parasitoid release treatments, the lowest incidence of leaf folder (2.32%) was observed when both parasitoids were made @ 100000 each / ha and it was on par with releases of both parasitoids @ 125000 each / ha (2.67%) and 150000 each / ha (2.83%). The highest incidence (5.69%) of leaf folder at 60 DAT was observed in the control and it was significantly higher than all other treatments (Table 1). In the treatment where cartap hydrochloride was applied, the incidence was 1.06 per cent and it was significantly lower than all other treatments. Among the released plots, the lowest incidence (2.08%) was observed where 150000 parasitoids each/ha were released, while the other treatments with releases of both parasitoids @ 100000 and 125000 were on par with each other. The releases of egg parasitoids at all the doses were equally three times. The releases of egg parasitoids at all the doses were equally and significantly better than untreated control.

Stem borer incidence

The incidence of dead hearts at 45 DAT was highest in control (4.61%) and it was significantly higher than all other treatments (Table 1). The per cent dead hearts in the plots where cartap hydrochloride was applied was 1.12 per cent and on par with the *Trichogramma* releases at different rates. The incidence on parasitoid released plots was on par with each other. The per cent head hearts at 60 DAT in control (5.23) was significantly higher than all the treatments (Table 1). The incidence in chemical control (1.35%) was significantly lower than the plots where releases @ 125000 each ha^{-1} (1.89%) were made. Among released plots, the lowest incidence (1.21%) was observed with releases @ 150000 each ha^{-1} and it was on par with releases @ 100000 each ha^{-1} (1.33%) while the plots where parasitoids were released @ 125000 each / ha were significantly inferior to the treatment with releases @ 150000 each ha^{-1}. On the basis of dead hearts, it can be concluded that chemical control was the best followed by releases @ 150000 ha^{-1} each.

White ears

The white ears were observed near maturity (Table 1) and the incidence was significantly higher in control (10.70%) as compared to all other treatments. The per cent white ears in cartap hydrochloride treatment (2.12) was significantly lower than all other treatments. The incidence in the *Trichogramma* released plot @ 100000 each ha^{-1} (3.91%) was on par with releases @ 125000 each ha^{-1} (4.19%) and releases @ 150000 each ha^{-1} (4.14%). The releases of parasitoids at all the doses were equally effective and significantly better than control, though chemical control was overall better.

Table 1. Pest incidence and yield at different doses of releases of *Trichogramma* spp.

Treatment	Per cent leaves folded		Per cent dead hearts		Percent White ears	Yield (q ha^{-1})
	45 DAT	60 DAT	45 DAT	60 DAT		
T. chilonis and *T. japonicum* @ 100000 each ha^{-1}	2.32 (8.72)	2.18 (8.45)	1.83 (7.72)	1.33 (6.54)	3.91 (11.38)	22.30
T. chilonis and *T. japonicum* @ 125000 each ha^{-1}	2.67 (9.37)	2.21 (8.51)	1.68 (7.38)	1.89 (7.89)	4.19 (11.79)	21.31
T. chilonis and *T. japonicum* @ 150000 each ha^{-1}	2.83 (9.66)	2.08 (8.25)	1.86 (7.79)	1.21 (6.22)	4.14 (11.72)	22.09
Cartap hydrochloride 30, 50, 70 DAT	0.69 (4.51)	1.06 (5.79)	1.12 (5.97)	1.35 (6.59)	2.12 (8.33)	24.10
Untreated control	3.41 (10.62)	5.69 (13.79)	4.61 (12.38)	5.23 (13.21)	10.70 (19.17)	16.80
LSD (P = 0.05)	2.13	2.12	2.14	1.15	1.47	0.89

DAT – Days after transplanting; figures in parentheses are arc-sine transformations

Table 2. Parasitization of sentinel eggs at different doses of releases of *T. chilonis*

Treatment	Per cent parasitization of Corcyra eggs				
	47 DAT	54 DAT	61 DAT	68 DAT	Mean
T. chilonis and *T. japonicum* @ 100000 each ha^{-1}	9.40 (17.84)	15.40 (23.09)	19.40 (26.12)	28.60 (32.32)	18.20 (24.85)
T. chilonis and *T. japonicum* @ 125000 each ha^{-1}	8.40 (16.84)	10.80 (19.18)	32.90 (34.99)	44.50 (41.83)	24.15 (28.21)
T. chilonis and *T. japonicum* @ 150000 each ha^{-1}	13.40 (21.46)	19.60 (26.27)	37.40 (37.69)	41.90 (40.32)	28.08 (31.44)
Cartap hydrochloride 30, 50, 70 DAT	1.20 (6.19)	2.80 (9.60)	3.80 (11.22)	4.00 (11.52)	2.95 (9.67)
Untreated control	0.80 (4.94)	1.40 (6.72)	2.20 (8.49)	2.40 (8.88)	1.70 (7.34)
CD (P = 0.05)	1.95	1.49	1.11	1.19	7.12

DAT – Days after transplanting; figures in parentheses are arc-sine transformations

Recovery of the parasitoids

The mean data presented in Table 3 revealed significantly lowest parasitization in control (1.70%), which was on par with chemical control (2.95%). Among parasitoid released treatments, the highest parasitization of 28.08% was observed where releases were made @ 150000 each ha^{-1}, which was on par with releases @ 125000 each ha^{-1} (24.15%) and @ 100000 each ha^{-1} (18.20%). The parasitization increased with the increase in doses of the parasitoids.

lower in untreated control (16.80 q ha^{-1}), compared to other treatments (Table 1). The plots treated with cartap hydrochloride gave the highest grain yield (24.10q ha^{-1}), significantly higher than that in all other treatments. Among the parasitoid released plots, highest grain yield was obtained where *Trichogramma* species were released @ 100000 each ha^{-1} (22.30q ha^{-1}) and it was on par with plots where releases were made @ 150000 each ha (22.09q ha^{-1}). The lowest grain yield (21.31q ha^{-1}) was obtained in the plots where releases were made @ 125000 each ha^{-1}.

Table 3. Parasitization of stem borer eggs at different doses of releases

Treatment	Per cent parasitization of stem borer eggs		
	47 DAT	57 DAT	Mean
T. chilonis and *T. japonicum* @ 100000 each ha^{-1}	7.90 (16.31)	18.80 (25.68)	13.35 (21.00)
T. chilonis and *T. japonicum* @ 125000 each ha^{-1}	8.80 (17.25)	20.70 (27.05)	14.75 (22.15)
T. chilonis and *T. japonicum* @ 150000 each ha^{-1}	10.80 (19.18)	23.90 (26.25)	17.35 (24.22)
Cartap hydrochloride 30, 50, 70 DAT	1.10 (5.91)	2.80 (9.60)	1.95 (7.82)
Untreated control	0.70 (4.55)	1.70 (7.43)	1.20 (6.14)
CD (P = 0.05)	2.06	1.38	7.14

DAT – Days after transplanting; figures in parentheses are arc sine transformations

Parasitization of stem borer eggs

Egg masses of stem borer were collected from the field and per cent parasitization was calculated (Table 3). The data revealed that significantly lowest parasitization was observed in untreated control (1.20%) and chemical control (1.95%). Among parasitoid released treatments, highest parasitization (17.35%) was observed where releases were made @ 150000 each ha^{-1}, on par with releases @ 125000 each ha^{-1} (14.75%) and @ 100000 each ha^{-1} (13.35%).

Yield

The yield of *Basmati* 386 was significantly

On the basis of per cent damage by leaf folder, per cent dead hearts, per cent white ears, parasitization and yield of *Basmati*386, it can be concluded that seven releases of *T. chilonis* and *T. japonicum* simultaneously @ 100000 hectare^{-1} at weekly interval starting at 30 DAT were effective in controlling leaf folder and stem borer, and increased the parasitization and yield.

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