J. Biol. Control, 21(2): 261-265, 2007

Field evaluation of egg parasitoids, *Trichogramma japonicum* Ashmead and *Trichogramma chilonis* Ishii, against rice yellow stem borer and leaf folder

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ABSTRACT: Field evaluation of two egg parasitoids, *Trichogramma japonicum* Ashmead against rice stem borer, *Scirpophaga incertulas* (Walker), and *Trichogramma chilonis* Ishii against leaf folder, *Cnaphalocrocis medinalis* (Guenee), was carried out in farmers' fields in three locations at Karakkad village, Palakkad district, Kerala, during three seasons in 2003 and 2004 in comparison with insecticide application. Release of *T. japonicum* @ 100000 / ha followed by application of azadirachtin 1 per cent against yellow stem borer reduced dead hearts from 12.21 to 91.02 per cent and from 27.4 to 58.2 per cent over insecticide application during *kharif* and *rabi* seasons, respectively. Incidence of white ears was reduced by 72.41 to 92.86 per cent. *T. chilonis* reduced leaf folder damage by 41.68 - 98.60 per cent over conventional insecticide application. Release of egg parasitoids in rice resulted in an increase of yield by 25.79 - 45.13 per cent over insecticide treated plots, with a mean cost-benefit ratio of 1: 2.6 and 1: 1.9 in parasitoid released and insecticide applied plots, respectively.

KEY WORDS: *Cnaphalocrocis medinalis*, rice, *Scirpophaga incertulas*, *Trichogramma chilonis*, *Trichogramma japonicum*

INTRODUCTION

Among the several biotic stresses on rice crop, insect pests form the most important group that cause up to 28 per cent reduction in yield (Pasalu *et al.*, 2005). Insecticides are being used indiscriminately to control key pests like stem borer and leaffolder that cause major damage in rice. But the rice ecosystem is quite rich in natural enemies, which play a great role in the management of these pests. Several of them have been reported on these two pests from all over India (Singh, 1994). Egg parasitism has been observed to be quite effective in the biological suppression of yellow stem borer (*Scirpophaga incertulas* (Walker)) and leaffolder (*Cnaphalocrocis medinalis* (Guenee) in rice. Therefore, an attempt was made to evaluate the efficiency of the egg parasitoids, *viz.*, *Trichogramma japonicum* Ashmead and *Trichogramma chilonis* Ishii in comparison with insecticide applications for the management of stem borer and leaf folder on rice.

MATERIALS AND METHODS

The experiment was conducted in farmers' fields at three locations in Karakkad village in Palakkad district, Kerala, during two *kharif* and one *rabi* seasons in 2003 and 2004, respectively. The field study consisted of two treatments, one with the release of egg parasitoids and the other with the application of insecticides in plots of size 4000m² at three locations of the village. Twenty five-day-old seedlings (variety Kanchana) were transplanted in these plots at a spacing of 20 x 15 cm. Five quadrants of size 2.5 x 2 m² were marked (one at the centre and the rest on the four corners of the each treatment plot) at three locations of the selected village which were considered as replications, thus giving a total of 15 replications for each treatment.

In the first treatment plot, five releases of *T. japonicum* @ 100000 / ha at weekly intervals starting from 15 days after transplanting against yellow stem borer and six weekly releases of *T. chilonis* starting from 25 days after transplanting against leaf folder were made. The parasitoids were released as Trichocards cut into bits @ 50 bits / ha and installed at the rate of one bit / point in the field. Azadirachtin (Econeem plus @ 0.002 per cent) was sprayed at 20, 35, 50, 65 and 85 days after transplanting to take care of the incidence of other pests of rice.

The second treatment involved the application of conventional chemical insecticides, *viz.*, chlorpyriphos @ 500 g a.i./ ha against stem borer, triazophos @ 500 g a.i. / ha and lambdacyhalothrin @ 12.5 g a.i. / ha against leaf folder at 15, 34 and 45 days after transplanting. Observations on dead hearts, white ears and leaf folder damage on randomly selected 10 hills from five quadrants of the treatments from the three locations of the village were recorded. Grain yield at harvest was also recorded. The data were analysed statistically in randomized block design and DMRT values were worked out.

RESULTS AND DISCUSSION

The results indicated that the incidence of dead hearts ranged from 2.74 to 3.38 per cent (mean = 31.1 per cent) in the *T. japonicum* released plot whereas the incidence varied from 2.05 to 4.15 per cent (mean = 3.4 per cent) in insecticide applied plot at 25 to 65 days after transplanting during *kharif* 2003 (Table 1). In *kharif* 2004, the damage was in the range of 0.15 to 0.91 percent (mean = 0.43 per cent) in parasitoid release and 1.08 to 3.20 percent in insecticide application. In *rabi* 2004, the occurrence of dead hearts varied from 1.85 to 3.23 per cent (mean = 1.98 per cent) (25 to 65 DAT) in parasitoid released plot while insecticide applied plot showed 3.55 to 7.73 per cent (mean = 5.37 per cent) dead hearts (Table 2).

Thus, the results of three seasons indicated a lower incidence of dead hearts in parasitoid released plot than that in insecticide applied plot. The release of *T. japonicum* resulted in 12.21-24.51 per cent and 71.56–91.02 per cent reduction of dead

Table 1. Effect of *T. japonicum* on the incidence of dead hearts caused by rice yellow stem borer

Treatments	*Kharif* 2003 (%DH)*				*Kharif* 2004 (%DH)*		
	Days after transplanting				Days after transplanting		
	25	35	45	65	25	35	45
Release of *T. japonicum*	3.38 (10.6)[a]	3.24 (10.4)[a]	2.74 (9.6)[a]	3.05 (10.1)[a]	0.23 (0.8)[a]	0.91 (1.8)[a]	0.15 (0.6)[a]
Application of insecticides	3.85 (11.3)[a]	2.05 (8.2)[a]	3.53 (10.8)[a]	4.15 (11.8)[a]	1.08 (5.9)[b]	3.2 (10.3)[b]	1.67 (7.4)[b]

* Figures in parentheses are arcsine transformed values; figures followed by different letters are significantly different at P = 0.05; DH = dead hearts

Table 2. Effect of *T. japonicum* on the incidence of dead hearts caused by rice yellow stem borer

Treatments	*Rabi* 2004 (%DH)*			
	Days after transplanting			
	25	35	45	65
Egg parasitoid released plot	1.85(7.8)[a]	2.94(9.8)[a]	1.78(7.6)[a]	3.23(10.4)[a]
Insecticide applied plot	3.55(10.8)[b]	4.05(11.5)[b]	6.15(14.3)[b]	7.73(16.7)[b]

* Figures in parentheses are arcsine transformed values; figures followed by different letters are significantly different at P = 0.05; DH = dead hearts

Table 3. Effect of *T. japonicum* on the incidence of white ears caused by rice yellow stem borer

Treatments	*Kharif* 2003 (%WE)*	*Kharif* 2004 (%WE)*	*Rabi* 2004 (%WE)*
Egg parasitoid released plot	1.20(6.3)[a]	0.05(0.5)[a]	0.37(3.5)[a]
Insecticide applied plot	4.35(12.0)[b]	0.70(4.8)[b]	3.15(10.2)[b]

* Figures in parentheses are arcsine transformed values; figures followed by different letters are significantly different at P = 0.05; WE = white ear

hearts over insecticide application during *kharif* 2004 and *kharif* 2005 respectively. During *rabi* 2004 the damage was reduced by 27.4-8.2 per cent in parasitoid release over insecticide application. These findings corroborate the earlier report of Brar *et al.* (1994), wherein a reduction of 1.5-6.2 per cent of dead heart was observed due to release of *T. japonicum*. Kumar and Khan (2005) reported 50.0-81.6 per cent reduction of dead heart by the release of *T. japonicum*. The efficacy of egg parasitoids in reducting stem borer and leaf folder incidence has been reported in Tamil Nadu (Balasubramanian *et al.*, 1994).

The incidence of white ears was found to vary from 0.05 to 1.2 per cent in *T. japonicum* released plots, whereas it was 0.70-4.35 per cent (mean = 2.73 per cent) in insecticide treated plots (Table 3), thus indicating a lower incidence of white ears due to egg parasitoid release. The release of *T. japonicum* resulted in 72.40-92.86 per cent (mean = 82.63 per cent) reduction of white ears over insecticide application. Pathummalbeevi *et al.* (2002) reported a reduction of 55.59-69.8 per cent white ears by the release of *T. japonicum*.

The rice leaf folder varied from 0.60 to 3.12 per cent (mean = 1.82 per cent) and 0.35 to 0.87 per cent during *kharif* 2003 and *kharif* 2004, respectively, in *T. chilonis* released plot (Table 4). Insecticide application caused 1.63-6.06 per cent (mean = 4.14 per cent) and 3.35-32.5 per cent (mean = 20.3 per cent) leaf damage during *kharif* 2003 and *kharif* 2004, respectively. In *kharif* 2003, at 35 days after transplanting, leaf folder damage was lower (51.7% reduction) in insecticide applied plot than parasitoid released plot. However, thereafter the damage was lower in parasitoid release than that in insecticide application showing 41.68-98.60 per cent reduction of damage due to parasitoid release during *kharif* 2003 and *kharif* 2004.

A similar trend was observed in *rabi* 2004 also (Table 5) where release of *T. chilonis* resulted in 33.9-99.4 per cent reduction of damage over insecticide application. Kumar and Khan (2005) observed 63.8-81.8 per cent reduction of leaf damage due to release of *T. chilonis*, whereas Balagurunathan and Rabindra (2001) reported 8.0-40.0 per cent reduction of rice leaf folder damage by the releases of *T. chilonis*. The grain yield was

Table 4. Effect of *T. chilonis* on the incidence of leaf folder in rice

Treatments	*Kharif* 2003 (%DL)*				*Kharif* 2004 (%DL)*		
	Days after transplanting				Days after transplanting		
	35	55	65	85	35	55	65
Release of *T. chilonis*	3.38 (10.6)[a]	0.6 (4.4)[a]	0.21 (0.8)[a]	3.12 (10.1)[a]	0.82 (5.3)[a]	0.87 (4.7)[a]	0.35 (3.4)[a]
Application of insecticides	1.63 (7.4)[a]	6.06 (14.2)[b]	3.53 (10.8)[a]	5.35 (13.4)[b]	3.35 (10.5)[b]	32.50 (37.5)[b]	25.15 (30.1)[b]

* Figures in parentheses are arcsine transformed values; figures followed by different letters are significantly different at P = 0.05; DL = damaged leaves

Table 5. Effect of *T. chilonis* on the incidence of leaf folder in rice

Treatments	*Rabi* 2004 (%DL)* Days after transplanting			
	35	55	65	85
Release of *T. chilonis*	0.05(0.6)[a]	0.78(1.6)[a]	0.06(0.2)[a]	0.00(0.0)[a]
Insecticide applied plots	0.52(2.2)[a]	1.18(6.2)[b]	9.93(18.4)[b]	10.15(18.6)[b]

* Figures in parentheses are arcsine transformed values; figures followed by different letters are significantly different at P = 0.05; DL = damaged leaves

Table 6. Grain yield and cost: benefit ratio in parasitoid released and insecticide applied plots

Treatments	Kharif 2003		Kharif 2004		Rabi 2004	
	Grain yield (Kg / ha)	C: B ratio	Grain yield (Kg / ha)	C: B ratio	Grain yield (Kg / ha)	C: B ratio
Egg parasitoid released plots	5975[a]	1:3.3	4467[a]	1:2.7	1788[a]	1:1.8
Insecticide applied plots	4750[b]	1:2.3	3400[b]	1:1.2	1232[b]	1:1.06
% increase in yield over insecticide applied plot	25.79	-	31.38	-	45.13	-

higher in egg parasitoid release than that in insecticide treated plots during three crop seasons (Table 6). Release of egg parasitoids in rice resulted in an increase of yield from 25.79 to 45.13 per cent over insecticide treatment. Earlier, Pathumalbeevi *et al.* (2002) reported 20.3 per cent yield increase over insecticide treated plots.

Release of egg parasitoids in rice resulted in higher cost-benefit ratio ranging from 1: 1.8 to 1: 3.3

(Table 6). The cost-benefit ratio in insecticide applied plot varied from 1: 1.06 to 1: 2.3. Thakur *et al.* (1993) reported C: B ratio of 1: 1.97 to 1: 1.98 and 1: 1.55 to 1: 1.58 in parasitoid released and unreleased plots, respectively. It is thus revealed that release of egg parasitoids not only reduces the incidence of stem borer and leaf folder but also increases grain yield, indicating their high efficacy in rice pest management. Therefore, releases of *Trichogramma* species can be an alternative to insecticides in the management of stem borer and leaf folder in rice ecosystem.

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(Received: 04.08.2006; Revised: 03.07.2007; Accepted: 14.07.2007)