J. Appl. Zool. Res (2006) **17**(2): 196 - 200

EFFICACY OF *TRICHOGRMMA JAPONICUM* ASHMEAD AGAINST YELLOW STEM BORER, *SCIRPOPHAGA INCERTULAS* WALK ON RICE IN NAGALAND

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ABSTRACT: The efficacy of *Trichogramma japonicum* Ashmead at different rates of release on suppression of yellow stem borer was studied under the agro-ecosystem of Nagaland. The rates of release had significant effect in reducing the dead heart at mid- and late vegetative stages of the crop. Single release treatment at its highest release rate (300,000 adults/ha) applied at 30 DAT had the maximum reduction in dead heart infestation with the least mean record of it followed by the treatment with 200,000 adults/ha applied in two equal split releases at 30 & 50 DAT. The white ear head infestation was lower under higher rates of release in split doses; the lowest record was by the treatment with 200,000 adults/ha splitted in four equal doses. Split releases had better impact on grain yield. A maximum increase of 12.62% in yield over untreated control was achieved from the treatment with 100,000 adults/ha applied in two equal split doses.

Key words: *Trichogramma japonicum*, yellow stem borer, *Scirpophaga incertulas*.

INTRODUCTION

More than 100 insect-species are reported to attack rice crop (PATHAK and DHALIWAL, 1981); among these Yellow stem borer (YSB), *Scirpophaga incertulas* Walk is one of the most serious pests in India. So far, farmers have been mostly relying on insecticides to control insect pests and the ill-effects on agro-ecosystem from such over-reliance on harmful chemicals are well known. The use of biological agents to manage crop pests is a key component of IPM and a promising alternate to ecologically disruptive chemical control. *Trichogramma japonicum* Ashmead, an egg-parasitoid of lepidopteron insects, has been utilized for the suppression of paddy stem borers. Therefore, an experiment was conducted in *Kharif* 2003 and 2004 at SASRD farm, Medziphema, Nagaland University.

MATERIALS AND METHOD

A field experiment was laid out in CRBD with 9 treatments replicated 3 times. Each plot of size 2m x 2m were isolated by a buffer zone of 4m in which 1m crop strip was planted along the middle of the zone to reduce interplot drifting of parasitoid. Four weeks old seedlings of variety *Jaya* were transplanted with a spacing of 20 cm x 20 cm. Altogether 9 treatments including the untreated control were taken for comparing the efficacy (Table 1). Release of *T. japonicum* adults were made in two fashions *viz.* as single release and in spilt release. Four treatments (T_2 to T_5) were applied at 30 DAT as single release @ 50,000, 100,000, 200,000 and 300,000 adults/ha, respectively. Three treatments (T_6 to T_8) with 100,000, 200,000 and 300,000 adults/ha were splitted into 2 releases each @ 5000, 100,000, and 150,000 adults/ha per release, respectively and applied at 30 DAT and 50 DAT. Moreover, 1 treatment (T_9) with 200,000 adults/ha was

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splitted in to 4 releases @ 50,000 adults/ha per release and was applied at 30, 50, 70 and 90 DAT, respectively. Releases were confined to the centre of the plots. Observation for dead heart (DH) were recorded at 15 days interval starting from 45 DAT while that of white head (WE) were taken at 90 DAT on 10 hills selected randomly from each plot. Percentage of DH and WE were estimated based on total number of damaged tiller and ear, respectively and the yield was recorded.

RESULTS AND DISCUSSION

The treatments had variable impacts on YSB showing difference in extent of dead-heart (DH) and white ear head (WE) production and in grain yield.

(a) Dead-heart (DH): Before the release of parasitoids (i.e. 30 DAT), infestation of stem borer was recorded to an average of 4.41% DH. After a fortnight of release (i.e. at 45 DAT), the effect of treatments were found insignificant; but, considerably reduced the new infestation. Treatments showed variable impact on YSB resulting in different levels of dead-heart infestation at different growth stages of crop. The treatments were at par with untreated control for dead heart infestation at early vegetative stage (45 DAT); however, some treatments showed significant effects at 60 and 75 DAT. Observations at mid-vegetative stage (60 DAT) revealed that the 200,000 adults/ha applied in 2 equal releases (@ 100,000 each) at 30 DAT and 50 DAT had emerged to be the best treatment with minimum of 0.90% DH under it as against 3.65% in untreated control (Table 1). This indicates a control of DH to a tune of 75% by this treatment over untreated control. Similar level of control (above 70%) has also been reported by BORAH (1994) recording an infestation of 2.4% DH in plots inoculated with 5 adults of *T. japonicum*/sqm (i.e. 50,000 adults ha^{-1}) as against 7.9% in untreated control at 50 DAT. However, in present investigation, all the treatments were at par with the efficacy of release of 200,000 adults ha^{-1} splitted in 2 equal releases except for the treatment with 200,000 adults applied in four split releases (@ 50,000 adults ha^{-1} per release). In late vegetative stage, as recoded at 75 DAT, all the treatments with split release had similar significant control of dead heart as compared to untreated control. However, the treatment with 2 lakh adults released in four equal split doses (T_9) had registered the lowest record of 0.39% DH closely followed by the treatment with 3 lakh adults ha^{-1} were splitted into 2 equal releases (T_8) to a tune of 0.43% DH as against 2.54% DH in control. These two treatments (T_8 & T_9) were able to control dead heart to an extent of 5.51% and 4.90%, respectively, over untreated control. However, other treatments with single dose release were at par with untreated control. On the basis of three records of DH at 45, 60 & 75 DAT, it can be concluded that the treatment with 300,000 adults per hectare applied in single dose emerged to be the most effective treatment to reduce the YSB infestation followed by the treatments with 200,000 & 100,000 adults ha^{-1}, respectively, both being applied in two equal releases. A mean record of DH to a tune of 1.28%, 1.30% and 1.36% were recorded (as against 2.87% under control) under treatments with 300,000 adults ha^{-1} applied in single dose, 200,000 and 100,000 adults/ha, respectively, both being applied in splitted fashion. The treatment with 200,000 adults/ha applied in four split releases was least effective.

(b) White ear head infestation: The percentage of white ear head infestation (WE) at pre-harvest stage at 90 DAT was estimated by counting total and infested ear heads. Except for the treatments with 200,000 adults ha^{-1} in four equal spit releases & 300,000 adults/ha in two equal releases, all the treatments were at par in WE infestation with untreated control (Table 1). The lowest infestation of 0.43% was recorded under the treatment with 200,000 adults/ha applied in four split releases (T_9), followed by 0.91% under the treatment with 300,000 adults/ha splitted into two equal releases (T_8) as against 3.20% recorded under control (T_1). BORAH (1994) had also reported 3.40% WE in plots inoculated with 5 adults of *T. japonicum* per sqm (i.e. 50,000 adults/ha) as against 6.20% WE in untreated control at 90 DAT. Only a marginal increase of infestation in all the treatments was noticed at 90 DAT as compared at 75 DAT, which may be due to reduction in number of host egg mass for shelf perpetuation.

Table 1: Impact of rates of release of *T. japonicum* on dead heart & white ear head on paddy

Rate of release (adult/ha)	# split dose	DH (%) at different growth stages of crop			Mean DH (%)	WE (%)	Yield (qt ha^{-1})	% increase over control
		45 DAT	60 DAT	75 DAT		90 DAT		
T_1 (Control)	0	2.43 (1.52)	3.65 (1.93)^{a}	2.54 (1.76)^{a}	2.87	3.20 (1.85)^{a}	50.40^{d}	0.00
T_2 (50,000)	1	1.20 (1.30)	1.19 (1.44)^{abc}	2.01 (1.55)^{ab}	1.71	2.08 (1.59)^{abcd}	52.33^{abcd}	3.83
T_3 (100,000)	1	1.64 (1.45)	1.31 (1.61)^{c}	1.46 (1.30)^{abc}	1.47	2.18 (1.62)^{abc}	53.40^{abcd}	5.95
T_4 (200,000)	1	1.77 (1.00)	1.78 (1.50)^{abc}	1.12 (1.29)^{abc}	1.56	2.22 (1.53)^{abcde}	50.86^{d}	0.91
T_5 (300,000)	1	1.06 (1.20)	1.69 (1.33)^{bc}	1.08 (1.19)^{abc}	1.28	1.80 (1.41)^{abcdef}	51.33^{bcd}	1.84
T_6 (100,000)	2	1.69 (1.33)	1.46 (1.30)^{c}	0.92 (1.06)^{bc}	1.36	2.21 (1.65)^{ab}	56.76^{a}	12.61
T_7 (200,000)	2	2.10 (1.46)	0.90 (1.14)^{c}	0.84 (1.11)^{bc}	1.30	1.59 (1.34)^{abcdef}	55.76^{abc}	10.63
T_8 (300,000)	2	2.24 (1.48)	1.75 (1.34)^{bc}	0.43 (0.91)^{c}	1.47	0.91 (1.14)^{bcdef}	52.43^{abcd}	4.02
T_9 (200,000)	4	2.30 (1.49)	3.14 (1.88)^{ab}	0.39 (0.90)^{c}	1.94	0.43 (0.91)^{f}	56.10^{ab}	11.30

*Figures bearing same letter are statistically at par according to DMRT.
*Split doses were applied at 20 days interval starting from 30 DAT.

Table 2: Impact of single release vs split release of *T. japonicum* on YSB damage

Treatment	Stem borer infestation		Yield (qt ha^{-1})	% increase over yield
	DH %	WE %		
Control	2.87	3.20	50.40	-
Single release	1.51	2.07	51.98	3.14
Split release	1.52	1.29	55.27	9.65

* Data are mean values of respective category treatment

The mean dead heart infestation of stem borer at early stage of crop decreased gradually with the release of *T. japonicum*. This is in conformity with ARASUMULLAH *et al.* (1984) who had recorded the suppression of *Scirpophaga incertulas* with the release of *T. japonicum, T. chilonis* and *T. exigua*. Treatments with single release initially showed decreased infestation but could not control the borers population in advance crop stsges; hence, the infestations increased gradually. On the other hand, the treatments with split releases consistently reduced the infestation up to 75 DAT. The higher reduction in DH % at 45 DAT under the treatment with 300,000 adults/ha applied in single dose may be attributed to higher dose of *T. japonicum* released at a time. The higher reduction at 75 and 90 DAT was recoded in split released treatments which might be due to continuous presence of the bioagent on crop over a long period of time. Decrease in DH infestation with the increase in number of parasitoid released has been clearly observed at 75 and 90 DAT. BENTURE *et al.* (1994) had also reported negative correlation between the leaf damage and the number of *T. japonicum* released.

(c) Effect on grain yield: The impact of parasitoids on grain yield was better through the treatments with split releases than that with single release (Table 2). An average yield of 55.27q ha^{-1} has been reported under split released treatments as against 51.98 q ha^{-1} and 50.40q ha^{-1} under single released treatments and untreated control, respectively. Better impact of *T. japonicum* through split releases can also be established from the observation that they had contributed higher increase (9.68%) in mean yield over control as compared to that of single releases (3.14%) over control. The maximum grain yield recorded under the treatment with 1lakh adults ha^{-1} in two equal split releases (56.76 q/ ha) followed by the treatment with 2lakh adults ha^{-1} in four equal split releases (56.10 q/ ha) as against 50.40 q/ha under the untreated control with an increase of 12.61% and 11.30% in grain yield, respectively. This is in conformity with GARG and BARWAL (1998) who had also recorded a yield of 47.71q/ha from biocontrol (*T. japonicum*) based IPM as compared to 36.26 q/ha in farmers' practiced field and in subsequent year, 56.92q/haas compared to 53.33q/ha in non-IPM fields. It indicated that the split releases had better performance in contribution towards grain yield, which might be due to suppression of pest at various stages of crop. It is evident from the plot under untreated control that the natural infestation of YSB on the paddy crop was low to moderate as reflected by dead-heart and white ear head records. However, based on overall observations, split release of *T. japonicum* of 100,000 adults/ha splitted into 2 equal releases @ 50,000 adults/ha/release applied at 30 DAT and 50 DAT may be recommended as bio-control component of IPM against YSB under the agro-ecological condition of Nagaland.

ACKNOWLEDGEMENT: The authors are sincerely acknowledge Dr. D P Chaturvedi, Professor, Department of Entomology, SASRD, Medziphema, Nagaland University for his constant support and guidance throughout the investigation.

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