

## Comparative Assessment of the Efficacy of Yellow Stem Borer (*Scirpophaga incertulus*) Egg Parasitoids in Pesticide Treated and Untreated Paddy Fields at Raiganj, Uttar Dinajpur, West Bengal, India

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**Abstract:** During *kharif* season (winter crop) of 2003-2006, *Trichogramma* sp., *Telenomus* sp. and *Tetrastichus* sp were the most important numerically abundant egg parasitoids of paddy yellow stem borer (*Scirpophaga incertulus*) in pesticide untreated paddy fields of *Swarna mashuri* (MTU 7029) at Raiganj, Uttar Dinajpur, West Bengal, India. The maximum rate of parasitization (%) by the parasitoids taken together was  $74.6 \pm 4.34$  and  $44.1 \pm 3.12$  in pesticide untreated and treated field respectively. Numerical abundance of the three parasitoids varied significantly in respect of season and growth stages of paddy.

**Key words:** Egg parasitoids • Yellow stem borer (YSB) • Paddy field • Sex ratio

### INTRODUCTION

Pesticides used in the paddy fields globally accounting for nearly 15% of the total pesticides used for crop protection [1] Indiscriminate application of pesticide often cuts rice productivity instead of improving it if the associated environmental hazards are counted as post production cost [2]. Judicious selection and application of pesticides are fundamentally and essentially required to suppress the paddy pest complexes by enhancement of natural enemy population in modern IPM practices. Yellow stem borer (YSB) *Scirpophaga incertulus* causes more than 10% grain loss depending on the agro ecological situation in India. Suppression of YSB population is effectively possible only by encouraging the promising egg parasitoids together with the limited field application of the broad spectrum toxic chemicals.

### MATERIALS AND METHODS

**Experimental Layout:** Field experiment was conducted with transplanted 35-day old seedlings of widely cultivated variety *Swarna mashuri* (MTU 7029) during three consecutive *kharif* season (winter crop) of during 2003-2006 at Raiganj [ $26^{\circ}35'15''$ (N)– $87^{\circ}48'37''$ (W)], Uttar Dinajpur, West Bengal. The soil of the experimental field

was sandy loam with pH value 6.8 and EC value 0.28mmhs/cm. N,  $P_2O_5$  and  $K_2O$  contents were 305, 59 and 342 kg/ha, respectively. Experiment was conducted in three replications with 15x15 cm spacing with the healthy seedlings transplanted at 22 standard meteorological weeks (SMW). Fertilizer input and other required management practices were done in due times following the National protocol after little modifications. Field was treated with three pesticides per hectare depending on the growth stage of paddy, methyl parathion (2% @ 6kg ) during seed bed preparation, endosulfan during (35% @ 1500ml) during vegetative stage and finally phorate (10% @ 1kg) during reproductive stage of the paddy. Field without pesticide treatment was considered as control.

**Assessment on YSB Egg Mass Parasitization:** YSB egg masses were collected periodically from both the pesticide treated and untreated (control) fields. Four freshly cut leaves from each of the two fields with YSB's egg clutches were collected at different growth stages at 15-day intervals and put separately inside a plastic vial which was plugged with wet tissue paper. The vials were kept with open end down in a jar/basin having 5 mm standing water for continuous wetting. A total of 64 leaves were collected from each paddy field (200 x 200m)

and kept in 16 vials, each with 4 leaves, allowing necessary time for parasite emergence. The average value of the emergence (%) of the parasitoid and their numerical abundance (individuals  $\pm$  SE) were recorded. There were 3 replications for each experiment.

## RESULTS

Field experiment in three consecutive *kharif* paddy (winter crop) during 2003-2006 with the transplanted cultivar *Swarna mashuri* (MTU 7029) at Raiganj, Uttar Dinajpur, West Bengal, showed relatively higher abundance of parasitoid complex that resulted in high rate of egg mass parasitization in pesticide untreated fields than in the pesticide treated ones.

**In Relation to Season (Table 1 and 2):** Initially the number of all the three parasitoids were low, the number increased gradually as the growth stage of paddy advanced, then declined initially slowly and then steadily. During *kharif* season maximum number of *Trichogramma* was noted in September in both pesticide untreated (22.09 $\pm$ 4.32) and treated fields (9.78 $\pm$ 1.07). The minimum number was recorded in November in untreated (2.53 $\pm$ 0.56) and in treated pesticide field (0.34 $\pm$ 0.11). *Telenomus* sp. parasitized maximum number of YSB eggs in August in both untreated (47.14 $\pm$ 3.12) and treated (1.02 $\pm$ 0.34) field. The minimum was noted in June in both untreated (4.09 $\pm$ 0.94) and treated field (0.46 $\pm$ 0.21). The total number of *Tetrastichus* sp was highest in July in both untreated (81.96 $\pm$ 5.45) and treated (40.12 $\pm$ 5.44)

fields. The lowest of this parasitoids was recorded in June, 6.09 $\pm$ 1.12 and 1.23 $\pm$ 0.34 in untreated and in treated fields, respectively. Irrespective of the parasitoid species, grossly, maximum parasitization was noted in August while the minimum was in November.

**Parasitization in Relation to the Growth Stages of Paddy (Table 3):** Egg mass parasitization was noted corresponding to the numerical abundance of the parasitoids. In pesticide untreated field, low parasitization (14.58 % of the egg masses) at early vegetative stages increased steadily and remained constant during mid-tillering stage (34.45%), but then improved again during the ripening stage (63.56%). Egg mass parasitization by *Trichogramma* sp., *Telenomus* sp. and *Tetrastichus* sp was 36.54-65.52, 34.23-58.67 and 21.56-33.56 per cent respectively. At vegetative stage abundance of *Telenomus* sp. was maximum and *Tetrastichus* sp was minimum and vice versa from mid-tillering stage. Numerical abundance of *Trichogramma* sp was paddy growth stage independent.

In pesticide treated field the abundance of parasitized eggs was poor though the overall dynamic of the parasitoids follow the same pattern. The rate of parasitization (%) at early vegetative stages was 7.34% which then improved gradually and invariably remained static during mid-tillering stage (24.05%). But at the ripening stage, the rate of parasitization attained up to 43.36%. The percentage of egg mass parasitization by *Trichogramma* sp., *Telenomus* sp. and *Tetrastichus* sp was 23.54-45.31, 24.23-38.67 and 11.56-23.51 respectively.

Table 1: Abundance of parasitoids (individuals/75 YSB egg clutches) from both pesticide treated and untreated field

Months	<i>Telenomus</i>		<i>Trichogramma</i>		<i>Tetrastichus</i>	
	A	B	A	B	A	B
June	4.09 $\pm$ 0.94	1.02 $\pm$ 0.34	12.54 $\pm$ 2.21	3.15 $\pm$ 0.56	6.09 $\pm$ 1.12	1.23 $\pm$ 0.34
July	4.67 $\pm$ 1.02	1.02 $\pm$ 0.33	9.12 $\pm$ 1.32	1.24 $\pm$ 0.67	81.96 $\pm$ 5.45	40.12 $\pm$ 5.44
Aug	47.14 $\pm$ 3.12	9.12 $\pm$ 1.23	14.78 $\pm$ 2.45	4.56 $\pm$ 1.09	24.22 $\pm$ 6.34	12.45 $\pm$ 2.12
Sept	10.21 $\pm$ 1.21	2.11 $\pm$ 0.34	22.09 $\pm$ 4.32	9.78 $\pm$ 1.07	32.21 $\pm$ 5.34	18.45 $\pm$ 2.31
Oct	9.55 $\pm$ 1.34	2.14 $\pm$ 0.45	10.65 $\pm$ 3.12	7.89 $\pm$ 1.08	76.67 $\pm$ 5.45	37.49 $\pm$ 4.34
Nov	5.21 $\pm$ 1.11	1.05 $\pm$ 0.34	2.53 $\pm$ 0.56	0.34 $\pm$ 0.11	29.66 $\pm$ 6.33	14.56 $\pm$ 2.34

A: Pesticide untreated B: Pesticide treated

Table 2: Extent of parasitization (%) of YSB egg mass during *kharif* season

Months	Pesticide untreated	Pesticide treated
June	32.2 $\pm$ 2.14	11.9 $\pm$ 2.11
July	47.6 $\pm$ 3.32	19.2 $\pm$ 1.78
Aug	74.6 $\pm$ 4.34	44.1 $\pm$ 3.12
Sept	63.7 $\pm$ 4.11	33.1 $\pm$ 3.11
Oct	54.6 $\pm$ 4.12	26.4 $\pm$ 2.90
Nov	29.8 $\pm$ 3.12	06.1 $\pm$ 3.21

Table 3: Abundance of YSB egg parasitoids (individuals/10 hills) in relation to the growth stages of paddy

Growth stages of paddy	<i>Trichogramma</i>		<i>Telenomus</i>		<i>Tetrastichus</i>	
	A	B	A	B	A	B
Vegetative	5.48±0.67	1.47±0.67	10.21±1.31	3.42±0.67	6.34±0.45	2.21±0.43
Mid-tillering	5.32±0.81	1.51±0.31	2.11±0.34	0.42±0.12	9.67±0.89	4.21±0.83

A:Pesticide untreated B:Pesticide treated

## DISCUSSION

No specific observation on pesticides on the YSB egg parasitoids in relation to the growth stages of paddy was done earlier. Works so far done elsewhere were mostly concerned with the assessment of the superiority of the pesticide(s) in respect of their pest suppression capacity with little or no impact pesticidal assessment on the YSB egg parasitoid complexes. Srivastava [4] discussed a number of situations in India where poor or negative yield were obtained after pesticide application due to perennial incorporation in the biotic agents. Raman [3] noted positive correlation between sex ratio and resurgence ratio for brown plant hopper in pesticide treated fields but without any concern to natural enemies. Kobayashi [5] reported superficially that the high incidence of brown plant hopper population was related with the application of methyl parathion due to the destruction of natural enemies. Destruction of such natural enemies had been confirmed as key factor for the emergence of the brown plant hopper as secondary pest [6, 7, 8]. Ishihara [9] had referred to the elimination of parasites such as *Temelucha* (= *Cremastus*) *biguttula* in many parts of Japan after the second world war due to the consequence of inundative application of DDT. The borer, *Chilo suppressalis* increased in many areas of Japan followed by destruction of the egg parasite viz, *T. japonicum* due to the excessive use of pesticide [10, 11].

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