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Field evaluation of different modules against yellow stem borer *Scirpophaga incertulas* and its effect on natural enemies in rice

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ABSTRACT: Field evaluation of different modules against yellow stem borer, *Scirpophaga incertulas* and effects on natural enemies in rice ecosystem during *kharif* and *rabi* seasons with five modules namely chemical module, bio intensive module, neem based module, integrated module and farmers practice module evaluated revealed that the chemical module had significantly less stem borer damage 2.36 per cent followed by bio intensive module 3.56 per cent and found to be superior than the farmers practice module (8.95 %) in kharif season. The per cent damage was low in the treatment with a chemical module (3.25 %) followed by integrated module (4.61 %) and found to be superior to the farmers practice module (8.84 %) in rabi season. The overall mean population of spiders ranged from 0.14 to 0.25/hill and there was no significant difference among the treatments in both the field experiments and the highest population was observed in farmers practice module. The integrated module recorded a maximum yield of 5513 and 5563 kg/ha while the farmers practice module recorded the lower yield of 3200 and 3063 kg/ha in the khariff and rabi respectively.

KEYWORDS: Modules, rice, *Scirpophaga incertulas*, natural enemies

In India, yellow stem borer, *Scirpophaga incertulas* has assumed the number one pest status as national pest (Pasalu *et al*., 2002). It was reported that the extent of damage caused by the yellow stem borer in rice ranged from 3 to 95 per cent (Ghose *et al*., 1960). For many decades, insecticides have been widely used to control this pest. However the continuous use of pesticides has caused many side effects including loss of biodiversity, residual toxicity, the resurgence of insect pests and environmental pollution (Heinrich and Mochida, 1984; Ganeshkumar and Velusamy, 1996 and Holland *et al*., 2000). Due to these constraints, researchers developed an alternative, economical and eco-friendly method of insect control (Chatterjee *et al*., 2009). The progressive modernization of Indian agriculture involving the use of integrated pest management practices gaining more popularity in recent years due to their effectiveness in controlling pests and environment friendliness; hence the present study was undertaken.

The field trials were conducted in a RBD with five treatments and four replications at PAJANCOA & RI, Karaikal, Puducherry in two consecutive

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seasons *i.e.,* June – September (*kharif*) and November to March (*rabi*) in 2012-13. The plot size was 5 x 4 m with spacing of 15 x 10 cm. There were ADT 45 variety sown in both the seasons. The treatments of experiment are given in the table 1. The recommended dose of fertilizer is 120:40:40 kg / ha of N: P_2O_5: K_2O, respectively. 25 per cent N and K_2O, 100 per cent P_2O_5 as basal, remaining amount of N and K_2O applied in three equal doses at tillering, panicle initiation and flowering stages. The incidence was recorded at weekly intervals. The observation on the damage symptom was recorded on ten randomly selected plants at weekly intervals from 7 DAT and continued upto harvest. The foliar treatments were given using high volume sprayer (Hand operated knapsack sprayer) and the release of parasitoids, pheromone traps were set as per the module (Table 1). Assessment of dead heart and white ears damage symptom caused by yellow stem borer, *S. incertulas* in each of the treatment were made on ten randomly selected plants per plot and the damage was worked out as below:

per cent dead hearts =

$$\frac{\text{No. of damaged tillers}}{\text{Total No. of tillers}} \times 100$$

per cent white ears =

$$\frac{\text{No. of damaged productive tillers}}{\text{Total No. of productive tillers}} \times 100$$

(Heinrichs *et al*., 1985)

The population of natural enemies mostly coccinellids (*Brumoides suturalis* F., *Cheilomenes sexmaculata* F., *Coccinella transversalis* F., *Coccinella transversalis* F., *Harmonia*

Table 1. Management of yellow stem borer, *Scirpophaga incertulas* (Walker) in rice

Sl. No.	T_1 Chemical module	T_2 Bio intensive module	T_3 Neem based module	T_4 Integrated module	T_5 Farmers practice (control)
1.	Application of Carbofuran 3G in nursery at 72 g a.i./20 cents	Set up Pheromone traps at 30 DAT and subsequent at 15 days intervals	Neem cake half dose (125 kg/ha) at basal application	Clipping of terminal leaves at the time of transplanting	Clipping of terminal leaves at transplanting
2.	Spraying Cartap hydrochloride 50 SP @ 250 g a.i./ ha at 30 DAT	Release of *Trichogramma japonicum* at 30 DAT and subsequent at 15 days intervals	Spray of NSKE 5% at 30 DAT	Application of Carbofuran 3G in nursery at 72 g a.i./ 20 cents	At ETL spray recommended insecticide (Fenthion 100 EC at 500 g a.i. / ha)
3.	Application of Cartap hydrochloride 4 G @ 800g a.i./ha at 45 DAT	Spray of *Bacillus thuringiencis* 1 lit/ha at 45 and 60 DAT	Application of neem cake remaining dose at 45 DAT	Set up Pheromone traps at 30 DAT and subsequent at 15 days intervals	-
4.	If one more spray needed spray Cartap hydrochloride 50 SP at 250 g a.i./ha	-	Spray of neem oil 3% at 60 DAT	Release of *Trichogrammajapo-nicum* at 30 DAT and subsequent at 15 days intervals	-
5.	-	-	-	Application of neem cake ¼ dose at 45 DAT	-
6.	-	-	-	Spray of Fipronil 5 SP at 50 g a.i./ha based on the ETL.	-

Table 2. Efficacy of different modules against *Scirpophaga incertulas*, spiders and coccinellids on rice (Mean of four replications)

Treatments	Mean % stem borer damage #		Mean number of coccinellids/hill #		Mean number of spiders / hill #	
	Field experiment I	Field experiment II	Field experiment I	Field experiment II	Field experiment I	Field experiment II
Chemical module	2.36(8.78)[a]	3.25(10.26)[a]	1.01(0.89)[c]	0.82(0.85)[c]	0.14(0.43)[c]	0.33(0.61)[d]
Bio intensive module	3.56(10.80)[b]	5.21(13.10)[b]	1.09(0.98)[bc]	1.64(1.23)[b]	0.18(0.48)[b]	0.54(0.76)[c]
Neem based module	4.00(11.37)[bc]	4.65(12.32)[b]	1.28(1.08)[ab]	1.52(1.19)[b]	0.24(0.53)[a]	0.57(0.77)[c]
Integrated module	4.36(11.94)[c]	4.61(12.32)[b]	1.14(0.99)[bc]	1.72(1.26)[b]	0.19(0.48)[b]	0.75(0.88)[b]
Farmers practice	8.95(17.28)[d]	8.84(17.10)[c]	1.68(1.16)[a]	4.17(1.91)[a]	0.25(0.54)[a]	1.18(1.08)[a]
CD (P= 0.05)	1.58**	1.52**	0.25**	1.32**	0.09**	0.14**

- Mean of 10 hills; Values in parantheses are arc sine transformed values
**- Significant at 1% level
In a column, means followed by common letters are not significantly different by DMRT (P = 0.05)

octomaculata F., *Micraspis discolor* F. and *Propylea dissecta* M.) and spiders (*Araneus* spp. C., *Argiope catenulata* D., *Argiope pulchella* T., *Callitrichia formosana* Oi., *Clubiona japonicola* Bosenberg & Strand, *Leucage decorata* W., *Lycosa* spp., *Oxyopes javanus* T. and *Tetragnatha javana* T.) were recorded. *In situ* counts were taken at weekly intervals on ten randomly selected plants leaving the border rows. The total number of natural enemies presents in plant and they were counted and expressed as numbers per hill.

Among the treatments, the chemical modules recorded significantly less stem borer damage 2.36 per cent followed by bio intensive module 3.56 per cent and found to be superior than the farmers practice module (8.95 %) in field experiment I. The per cent damage was low in the treatment with a chemical module (3.25 %) followed by integrated module (4.61 %) and found to be superior than the farmers practice module (8.84 %) in field experiment II. These results are comparable with the findings of Saljoqi *et al.* (2002); Suresh *et al.* (2011); Tej Kumar (2001) and Karthikeyan *et al.* (2007) who observed the significant decrease of pest infestation. In the present investigation, natural enemies *viz.,* spiders and coccinellids were more abundant in farmers practice module in both the trials.It was found that the overall mean population of predatory coccinellids was high in the farmers practice module (1.68/hill) compared to the other modules. Similar trend was observed in the field experiment II.The overall mean population of spiders ranged from 0.14 to 0.25/hill and there was no significant difference among the treatments in both the field experiments and highest population was observed in farmers practice module. These results are comparable with the findings of Elakkiya (2011) and Punithavalli *et al.* (2011) who reported that the natural enemies *viz.,* coccinellids and spiders were found more in untreated control compared to other treatments.

The integrated module recorded a maximum yield of 5513 and 5563 kg/ha while the farmers practice module recorded the lowest yield of 3200 and 3063 kg/ha in the field experiment I and II respectively. These are also in agreement with findings of Dash *et al*. (2006); Ramandeep *et al.* (2007) and Elakkiya (2011). Among the management practices, even though the chemical module showed a significant reduction of the infestation by rice yellow stem borer, *S. incertulas*, the integrated module recorded a higher yield and benefit cost ratio and also safer to natural enemies.

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