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Management of leaf folder and stem borer on coarse and *Basmati* rice with organic and inorganic practices

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ABSTRACT: **An experiment on the management of rice leaf folder and stem borer in two rice varieties, *viz.*, PR 116 and *Basmati* 386, was conducted in the organic field area of Department of Agronomy and Agromet, PAU, Ludhiana, by comparing three treatments, *viz.* organic, recommended and integrated practices. Organic practices and integrated practices (seven releases of *Trichogramma chilonis* and *T. japonicum* @ 100000 each at weekly interval starting 30 DAT) proved to be effective in the management of rice leaf folder and stem borer in both the rice varieties.**

KEY WORDS: *Basmati* rice, egg parasitoids, organic rice, rice leaf folder, stem borer

INTRODUCTION

In India, rice is grown under diverse environmental conditions and different cropping sequences and it is attacked by 385 species of insects causing 31.5-86.0 per cent losses in yield (Gunathilagaraj and Kumar, 1997). Kushwaha *et al.* (1995) reported that *Basmati* rice is heavily infested by rice leaf folder, *Cnaphalocrocis medinalis* (Guenee) and stem borer, *Scirpophaga incertulas* (Walker), accounting for 19.0 per cent and 23.0 – 26.0 per cent damage incidence, respectively. Most pests attacking rice are themselves attacked by an array of natural enemies. In rice ecosystem, 524 species of parasitoids in 181 genera belonging to 6 superfamilies and 19 families have been identified, which intensively and extensively exercise natural control of rice pests (Dey *et al.*, 1999). Over 26 trichogrammatids have been recorded, of which *Trichogramma chilonis* and *T. japonicum* are of significance (Singh and Jalali, 1994). Six releases of *T. chilonis* and *T. japonicum* @ 100000 ha^{-1} each at weekly interval starting at 30 days after transplanting proved to be effective for the control of leaf folder and stem borer on coarse rice (Brar *et al.*, 1999a; 2001). Broad spectrum, persistent pesticides greatly reduce the number of natural enemies and disrupt their potential as pest control agents. The well-documented side effects of indiscriminate use of insecticides make it imperative to study indigenous parasitoids and their role in control of insect pests of rice. Hence, with the increasing demand for organic crops, the present study was designed to evaluate the comparative efficacy of egg parasitoids against rice leaf folder and stem borer under organic, integrated and recommended practices on rice and *Basmati* rice.

MATERIAL AND METHODS

The present study was conducted in the organic field area of Department of Agronomy and Agromet, Punjab Agricultural University, Ludhiana. The experiment was conducted with three treatments, *viz.*, recommended, organic and integrated practices and six replications in a randomized block design. The experiment was separately conducted on coarse rice (variety PR 116) and *Basmati* rice (variety *Basmati* 386). Inorganic fertilizers at recommended doses were applied in recommended practices plot whereas in integrated plot, inorganic fertilizers and organic manures were applied at 50: 50 ratio. Green manuring with *Dhaincha* was done in organic plots. For pest management, one to two sprays of monocrotophos @ 1.4 l / ha was given in recommended practice, whereas in organic and integrated plots, seven releases of *T. chilonis* and *T. japonicum* each @ 100000 ha^{-1} were made simultaneously at weekly interval starting from 30 DAT. The plot size was 240 sq.m. for each treatment. The observations were recorded at 45 and 60 DAT for leaf folder and stem borer. The incidence of white ears was recorded once near maturity.

The data on per cent leaves folded, dead hearts and white ears were recorded by randomly selecting five plants from each subplot. The data for the yield was recorded on the whole sub-plot basis.

RESULTS AND DISCUSSION

Management of leaf folder and stem borer in PR 116 rice variety

The incidence of leaf folder at 60 DAT during 2004 and 2005 was lower in organic practice (0.72% and 0.22%), as compared to integrated practice (0.97% and 0.34%) and recommended practice (1.32% and 3.19%) (Table 1 and 2). The stem borer incidence at 60 DAT during 2004 and 2005 followed the same trend as that of leaf folder and was lower in organic practice (2.14% and 1.17%) as compared to integrated practice (3.64% and 2.08%) and recommended practice (4.00% and 6.32%) (Table 1 and 2). Organic practice was significantly superior to integrated and recommended practices with respect to per cent leaves folded and dead hearts. The per cent white ears during 2004 was lower in organic practice (0.22%) compared to that of integrated practice (0.44%) and recommended practice (0.49%), whereas during 2005, it was lower in recommended practice (1.96%) compared to that of integrated practice (2.33%) and organic practice (4.44%).

Table 1. Incidence of leaf folder and stem borer and grain yield in rice variety PR 116 with different management practices during *kharif* 2004

Treatments	Per cent leaf folder damaged leaves		Per cent dead hearts		Per cent white ears	Yield (q ha^{-1})
	45 DAT	60 DAT	45 DAT	60 DAT		
Organic practice	0.00 (4.05)	0.72 (4.84)	0.00 (4.05)	2.14 (8.40)	0.22 (2.49)	61.54
Recommended practice	0.35 (5.27)	1.32 (6.59)	0.00 (4.05)	4.00 (11.53)	0.49 (3.97)	62.04
Integrated practice	0.00 (4.05)	0.97 (5.63)	3.64 (11.73)	3.64 (10.99)	0.44 (3.75)	66.93
LSD (P=0.05)	(0.42)	(0.10)	(0.19)	(0.65)	(0.40)	0.15

Table 2. Incidence of leaf folder and stem borer and grain yield in rice variety PR 116 with different management practices during *kharif* 2005

Treatments	Per cent leaf folder damaged leaves		Per cent dead hearts		Per cent white ears	Yield (q ha^{-1})
	45 DAT	60 DAT	45 DAT	60 DAT		
Organic practice	1.18 (6.22)	0.22 (2.49)	0.50 (4.05)	1.17 (6.19)	4.44 (12.16)	46.60
Recommended practice	0.93 (5.37)	3.19 (10.28)	0.50 (4.05)	6.32 (14.54)	1.96 (8.04)	60.80
Integrated practice	0.50 (4.05)	0.34 (3.26)	2.16 (8.44)	2.08 (8.28)	2.33 (8.77)	54.30
LSD (P = 0.05)	(1.20)	(0.66)	(0.26)	(0.17)	(0.81)	0.12

During 2004, the yield was highest in integrated practice (66.93 q ha^{-1}) as compared to recommended practice (62.04 q ha^{-1}) and organic practice (61.54 q ha^{-1}), whereas during 2005, the yield was highest in recommended practice (60.80 q ha^{-1}) as compared to integrated practice (54.30 q ha^{-1}) and organic practice (46.60 q ha^{-1}) (Table 1 and 2).

Management of leaf folder and stem borer in *Basmati* rice

During 2004, the incidence of leaf folder at 60 DAT was lower in organic practice (0.29%), followed by integrated practice (0.78%) and recommended practice (0.96%). It indicated that organic practice was significantly better than integrated and recommended practice (Table 3). During 2005, the leaf folder incidence at 60 DAT was slightly lower in recommended practice (2.60%), as compared to integrated practice (3.39%) and organic practice (3.63%) (Table 4). The incidence of stem borer during 2004 was lower in recommended practice (2.00% at 45 DAT and 0.60% at 60 DAT) as compared to integrated practice (4.67% at 45 DAT and 3.33% at 60 DAT) (Table 3). The per cent white ears was lowest in recommended practice (0.53%) as compared to organic practice (0.97%) and integrated practice (1.15%). During 2005, dead hearts were fewer in integrated practice (1.11% at 45 DAT and 6.70% at 60 DAT) as compared to recommended practice (1.90% at 45 DAT and 9.83% at 60 DAT) and organic practice (5.00% at 45 DAT and 8.10% at 60 DAT). Similarly, white ears were fewer in integrated practice (2.41%) as compared to recommended practice (3.23%) and organic practice (5.08%) (Table 4).

The yield during 2004 in integrated practice was higher (31.76 q ha^{-1}) as compared to organic practice (27.90 q ha^{-1}) and recommended practice (26.96 q ha^{-1}) (Table 3), whereas during 2005, it was highest in integrated practice (35.70 q ha^{-1}) as compared to recommended practice (35.60 q ha^{-1}) and organic practice (31.20 q ha^{-1}) (Table 4).

It can be concluded that organic practice and integrated practice (seven releases of *T. chilonis* and *T. japonicum* @ 100000 each at weekly interval starting 30DAT) were effective for the management of rice leaf folder and stem borer in both the varieties.

The present study corroborates the findings of Brar *et al.* (1999b) who found that nine simultaneous releases of *T. chilonis* and *T. japonicum* at weekly interval @100000 ha^{-1} were effective for the control of leaf folder and stem borer on rice. Brar *et al.* (2001) evaluated *Trichogramma*

Table 3. Pest incidence and grain yield in *Basmati* rice during *kharif* 2004

Treatments	Per cent leaf folder damaged leaves		Per cent dead hearts		Per cent white ears	Yield (q ha^{-1})
	45 DAT	60 DAT	45 DAT	60 DAT		
Organic practice	0.00	0.29 (2.98)	6.67 (14.96)	1.36 (6.69)	0.97 (5.63)	27.90
Recommended practice	0.00	0.96 (5.61)	2.00 (8.12)	0.60 (4.41)	0.53 (4.13)	26.96
Integrated practice	0.00	0.78 (5.04)	4.67 (12.47)	3.33 (10.51)	1.15 (6.14)	31.76
LSD (P=0.05)	-	(0.35)	(0.11)	(0.25)	(0.16)	3.77

Table 4. Pest incidence and grain yield in *Basmati* rice during *Kharif* 2005

Treatments	Per cent leaf folder damaged leaves		Per cent dead hearts		Per cent white ears	Yield (q ha^{-1})
	45 DAT	60 DAT	45 DAT	60 DAT		
Organic practice	1.25 (6.41)	3.63 (10.98)	5.00 (12.91)	8.10 (16.52)	5.08 (13.01)	31.20
Recommended practice	0.22 (2.45)	2.60 (9.27)	1.90 (7.91)	9.83 (18.26)	3.23 (10.35)	35.60
Integrated practice	0.91 (5.46)	3.39 (10.63)	1.11 (6.04)	6.70 (14.99)	2.41 (8.92)	35.70
LSD (P=0.05)	(0.59)	(0.34)	(0.13)	(0.20)	(0.66)	0.15

species over a large area in Punjab and observed reduction in leaf folder damage and white ear head infestation by 40.0 and 47.6 per cent, respectively, in bio-control plots as compared to untreated control, which in turn increased the yield by 12.3 per cent. They reported that six releases of *T. chilonis* and *T. japonicum* per ha at weekly interval starting from 15 DAT is highly effective in managing stem borer infestation and thereby getting higher yield. Saikia and Parameswaran (2002) found that six releases of *T. chilonis* alone or four releases of the egg parasitoid followed by application of Bt, NSKE and buprofezin, alone or in combination significantly reduced the leaf folder damage and gave higher grain yield compared to control plots. Sehrawat *et al.* (2002) from Haryana reported that cartap hydrochloride @ 0.75kg a.i. ha^{-1} and five releases of *T. chilonis* @ 125000 ha^{-1} at 10, 30, 50, 70 and 90 DAT proved to be effective in reducing the leaf folder infestation and in obtaining maximum grain yield.

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