



EFFICACY OF TAKUMI 20% WG AGAINST RICE STEM BORERS AND LEAF FOLDER

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ABSTRACT

Insect pests pose major menace to the rice production and amongst these stem borer *Scirpophaga incertulas* (Walker) and rice leaf folder *Cnaphalocrocis medinalis* (Guen.) are important and cause enormous yield losses. This study evaluates the efficacy of newer insecticide, Takumi 20WG (flubendiamide 20%) against these, compared with checks, Fame 480SC (flubendiamide 39.35%) and Coragen 18.5SC (chlorantraniliprole 18.5%). The insecticides were applied on economic threshold basis (ETL) for stem borers (2% deadhearts on basmati and 5% deadhearts on non-basmati) and/or leaf folders (10% damaged leaves) in randomized block design. The results revealed that Takumi 20WG @ 125 g/ha was statistically at par with the checks, Fame 480SC and Coragen 18.5SC but significantly superior to its lower dosages of 100 and 75 g/ha.

Key words: Rice, basmati, Takumi 20WG, flubendiamide 20%, Fame 480SC, flubendiamide 39.35%, Coragen 18.5S, chlorantraniliprole *Scirpophaga incertulas*, *Cnaphalocrocis medinalis*, deadhearts, white ears, yield

Rice (*Oryza sativa* L.) is one of the most important cereal (FAO, 2004) that accounts for >50% of the daily calorie intake (Khush, 2005), and it is a chief staple food crop (Mathur et al., 1999; Sarwar, 2012). In India, it is cultivated almost in one-fourth of the total cropped area providing food to about half of the Indian population (Seni and Naik, 2018). Approximately 300 species of insect pests attack rice and amongst them only 23 species cause notable damage (Pasalu and Katti, 2006). Among these, stem borer, *Scirpophaga incertulas* (Walker) is the most important and devastating insect pest causing yield losses up to 87.66% (Pallavi et al., 2017). When the infestation occurs at the flowering stage, the ear heads become chaffy, whitish, erect called, “white ears” (Jadhao and Khurad, 2012; Muralidharan and Pasalu, 2006). Another important insect causing yield losses is the rice leaf folder *Cnaphalocrocis medinalis*, which is widespread with high yielding rice varieties and accompanying changes in the cultural practices (Teng et al., 1993). Insecticides are always used against such pests and indiscriminate use of these has resulted in the failure of control due to development of resistance to insecticides. Under such conditions, use of novel insecticides having specificity towards target insects is the need (Narayanaswamy, 1995). Hence, the present study to evaluate the comparative efficacy of some newer insecticide against stem borer and leaf folder in rice and basmati.

MATERIALS AND METHODS

The experiment was conducted during the main

cropping season of 2019/2020. Takumi 20WG (flubendiamide), a phthalic acid diamide group of insecticide (green toxicity category) of M/s Rallis India Ltd., Bangalore was evaluated @ 75, 100 and 125 ml/ha (15, 20 and 25 g a.i. ha⁻¹) against stem borers and leaf folder infesting rice/basmati in four research trials (02 trials, each on basmati and non-basmati) conducted at Ludhiana, Patiala and Rupnagar, Punjab during *Kharif* 2019 and 2020 crop seasons and compared with the checks, Fame 480SC (flubendiamide 39.35%) @ 50 ml/ha (24 g a.i. ha⁻¹) and Coragen 18.5SC (chlorantraniliprole 18.5%) @ 150 ml/ha (30 g a.i. ha⁻¹). An untreated control was also kept for comparison. Flubendiamide 20WG is a registered insecticide by Central Insecticide Board and Registration Committee at a dose of 25g a.i./ha against rice leaf folder and stem borer in rice. The variety for non-basmati was PR 121 and Pusa Basmati 1121 for basmati. The experiments were laid out in randomized block design with three replications and insecticides were applied on economic threshold basis (ETL) for stem borers (2% deadhearts on *basmati* and 5% deadhearts on non-basmati) and leaf folders (10% damaged leaves). All other agronomic practices were done as recommended for the crop by Punjab Agricultural University, Ludhiana, Punjab. The observations on stem borer incidence as dead-hearts at vegetative stage and leaf folder damage as damaged leaves were recorded one day before insecticide application and then 5 and 10 days after the application. White-ears incidence (caused by stem borers) was recorded about a week before the crop harvest. Natural

Table 1. Efficacy of flubendiamide against rice stem borers and leaf folder and yield (q/ha) in Punjab- kharif 2019, 2020

Treatment	Dose		2019		2020		Pooled Mean	PROC
	g a.i./ha	per ha	Expt. 1	Expt. 2	Expt. 3	Expt. 4		
Deadhearts (%) Before Insecticide Application								
Takumi 20WG (flubendiamide 20%)	15	75 g	3.16± 0.00 ^a	4.36± 0.01 ^a	6.02± 0.01 ^a	2.82± 0.00 ^a	4.09± 0.01 ^a	--
	20	100 g	3.18± 0.01 ^a	4.35± 0.00 ^a	6.01± 0.01 ^a	2.79± 0.00 ^a	4.08± 0.02 ^a	--
	25	125 g	3.27± 0.00 ^a	4.49± 0.00 ^a	6.00± 0.02 ^a	2.81± 0.00 ^a	4.14± 0.01 ^a	--
Fame 480SC (flubendiamide 39.35%)	24	50 ml	3.26± 0.02 ^a	4.41± 0.01 ^a	5.96± 0.00 ^a	2.84± 0.01 ^a	4.12± 0.01 ^a	--
Coragen 18.5SC (chlordantraniliprole)	30	150 ml	3.20± 0.01 ^a	4.45± 0.02 ^a	5.97± 0.00 ^a	2.90± 0.02 ^a	4.13± 0.01 ^a	--
Untreated Control	--	---	3.25± 0.00 ^a	4.67± 0.01 ^a	6.01± 0.01 ^a	2.91± 0.01 ^a	4.21± 0.01 ^a	--
Deadhearts (%) 5 DAA								
Takumi 20WG (flubendiamide 20%)	15	75 g	2.93± 0.09 ^c	4.10± 0.13 ^b	4.32± 0.08 ^b	2.54± 0.29 ^c	3.47± 0.19 ^c	30.18
	20	100 g	2.17± 0.14 ^b	2.60± 0.32 ^a	4.15± 0.17 ^b	1.77± 0.25 ^b	2.68± 0.30 ^b	46.08
	25	125 g	1.36± 0.09 ^a	2.07± 0.18 ^a	1.80± 0.21 ^a	1.17± 0.10 ^a	1.60± 0.22 ^a	67.81
Fame 480SC (flubendiamide 39.35%)	24	50 ml	1.34± 0.11 ^a	2.11± 0.09 ^a	1.78± 0.15 ^a	1.20± 0.05 ^a	1.61± 0.10 ^a	67.61
Coragen 18.5SC (chlordantraniliprole)	30	150 ml	1.36± 0.09 ^a	1.98± 0.18 ^a	1.76± 0.17 ^a	1.18± 0.10 ^a	1.57± 0.21 ^a	68.41
Untreated Control	--	---	4.05± 0.14 ^d	5.49± 0.31 ^c	7.12± 0.07 ^c	3.24± 0.15 ^d	4.97± 0.19 ^d	--
Deadhearts (%) 10 DAA								
Takumi 20WG (flubendiamide 20%)	15	75 g	3.04± 0.10 ^c	3.83± 0.13 ^b	4.47± 0.13 ^b	2.51± 0.03 ^c	3.46± 0.14 ^c	42.24
	20	100 g	1.36± 0.11 ^b	1.52± 0.18 ^a	4.19± 0.13 ^b	1.20± 0.10 ^b	2.07± 0.20 ^b	65.44
	25	125 g	0.76± 0.00 ^a	0.99± 0.05 ^a	1.48± 0.10 ^a	0.61± 0.08 ^a	0.88± 0.05 ^a	85.31
Fame 480SC (flubendiamide 39.35%)	24	50 ml	0.78± 0.10 ^a	0.95± 0.04 ^a	1.16± 0.11 ^a	0.59± 0.10 ^a	0.87± 0.13 ^a	85.48
Coragen 18.5SC (chlordantraniliprole)	30	150 ml	0.81± 0.12 ^{ab}	1.01± 0.09 ^a	1.13± 0.17 ^a	0.64± 0.05 ^a	0.90± 0.10 ^a	84.98
Untreated Control	--	---	4.98± 0.13 ^d	5.64± 0.15 ^c	8.04± 0.21 ^c	4.30± 0.14 ^d	5.99± 0.11 ^d	--
White ears (%) At Harvest								
Takumi 20WG (flubendiamide 20%)	15	75 g	4.31± 0.15 ^b	5.05± 0.17 ^b	6.20± 0.10 ^b	4.98± 0.10 ^c	5.14± 0.12 ^c	30.35
	20	100 g	2.73± 0.11 ^a	3.18± 0.13 ^a	5.76± 0.15 ^b	3.93± 0.10 ^b	3.90± 0.09 ^b	47.15
	25	125 g	2.56± 0.07 ^a	3.03± 0.10 ^a	2.58± 0.12 ^a	3.06± 0.11 ^a	2.81± 0.10 ^a	61.92
Fame 480SC (flubendiamide 39.35%)	24	50 ml	2.52± 0.12 ^a	3.08± 0.12 ^a	2.54± 0.15 ^a	4.00± 0.19 ^a	2.81± 0.11 ^a	61.92
Coragen 18.5SC (chlordantraniliprole)	30	150 ml	2.65± 0.10 ^a	3.04± 0.05 ^a	2.51± 0.10 ^a	3.20± 0.09 ^{ab}	2.85± 0.10 ^a	61.38
Untreated Control	--	---	7.25± 0.20 ^c	7.67± 0.31 ^c	7.58± 0.25 ^c	7.03± 0.21 ^d	7.38± 0.19 ^d	--
LF Damaged leaves (%) Before Insecticide Application								
Takumi 20WG (flubendiamide 20%)	15	75 g	9.02± 0.00 ^a	11.13± 0.00 ^a	8.02± 0.02 ^a	11.22± 0.02 ^a	9.85± 0.02 ^a	--
	20	100 g	9.06± 0.01 ^a	11.27± 0.00 ^a	8.00± 0.03 ^a	11.43± 0.04 ^a	9.94± 0.03 ^a	--
	25	125 g	8.90± 0.02 ^a	11.14± 0.02 ^a	8.01± 0.01 ^a	11.35± 0.03 ^a	9.85± 0.05 ^a	--
Fame 480SC (flubendiamide 39.35%)	24	50 ml	9.14± 0.05 ^a	11.20± 0.03 ^a	8.04± 0.00 ^a	11.51± 0.02 ^a	9.97± 0.02 ^a	--
Coragen 18.5SC (chlordantraniliprole)	30	150 ml	9.15± 0.04 ^a	11.38± 0.03 ^a	8.03± 0.02 ^a	11.55± 0.04 ^a	10.03± 0.02 ^a	--
Untreated Control	--	---	9.08± 0.01 ^a	11.44± 0.00 ^a	7.97± 0.03 ^a	11.60± 0.03 ^a	10.02± 0.01 ^a	--
Leaffolder damaged leaves (%) 5 DAA								
Takumi 20WG (flubendiamide 20%)	15	75 g	6.35± 0.11 ^c	7.62± 0.14 ^c	4.88± 0.19 ^b	8.06± 0.14 ^c	6.73± 0.12 ^c	41.48
	20	100 g	2.87± 0.11 ^b	3.92± 0.13 ^b	4.48± 0.21 ^b	3.84± 0.21 ^b	3.78± 0.18 ^b	67.13
	25	125 g	1.95± 0.09 ^a	2.87± 0.15 ^a	2.12± 0.09 ^a	2.92± 0.12 ^a	2.47± 0.15 ^a	78.52
Fame 480SC (flubendiamide 39.35%)	24	50 ml	1.96± 0.10 ^a	2.92± 0.14 ^a	2.11± 0.10 ^a	2.89± 0.14 ^a	2.47± 0.19 ^a	78.52
Coragen 18.5SC (chlordantraniliprole)	30	150 ml	1.86± 0.11 ^a	2.73± 0.09 ^a	2.10± 0.10 ^a	2.86± 0.15 ^a	2.38± 0.11 ^a	79.30
Untreated Control	--	---	10.27± 0.17 ^d	13.11± 0.20 ^d	9.27± 0.14 ^c	13.34± 0.16 ^d	11.50± 0.17 ^d	--
Leaffolder damaged leaves (%) 10 DAA								
Takumi 20WG (flubendiamide 20%)	15	75 g	6.58± 0.11 ^c	8.97± 0.14 ^c	5.34± 0.10 ^b	8.15± 0.14 ^c	7.26± 0.17 ^c	47.69
	20	100 g	2.54± 0.10 ^b	3.89± 0.13 ^b	5.14± 0.14 ^b	3.72± 0.17 ^b	3.82± 0.16 ^b	72.48
	25	125 g	1.38± 0.09 ^a	2.18± 0.11 ^a	1.26± 0.15 ^a	1.97± 0.14 ^a	1.70± 0.09 ^a	87.75
Fame 480SC (flubendiamide 39.35%)	24	50 ml	1.48± 0.05 ^a	2.17± 0.13 ^a	1.23± 0.10 ^a	2.04± 0.13 ^a	1.73± 0.08 ^a	87.54

(contd.)

Coragen 18.5SC (chlorantraniliprole)	30	150 ml	1.52± 0.09 ^a	2.21± 0.15 ^a	1.21± 0.09 ^a	2.13± 0.11 ^a	1.77± 0.13 ^a	87.25
Untreated Control	--	---	12.80± 0.19 ^d	15.18± 0.22 ^d	11.52± 0.17 ^c	16.01± 0.15 ^d	13.88± 0.13 ^d	--
Natural Enemies (Spiders/ hill) at 10 DAA								
Takumi 20WG (flubendiamide 20%)	15	75 g	0.53± 0.05 ^a	0.57± 0.00 ^a	0.67± 0.01 ^a	0.53± 0.04 ^a	0.58± 0.03 ^a	--
	20	100 g	0.57± 0.01 ^a	0.53± 0.02 ^a	0.65± 0.04 ^a	0.57± 0.02 ^a	0.58± 0.03 ^a	--
	25	125 g	0.53± 0.03 ^a	0.53± 0.02 ^a	0.65± 0.04 ^a	0.53± 0.03 ^a	0.56± 0.00 ^a	--
Fame 480SC (flubendiamide 39.35%)	24	50 ml	0.50± 0.01 ^a	0.53± 0.00 ^a	0.65± 0.02 ^a	0.53± 0.04 ^a	0.55± 0.03 ^a	--
Coragen 18.5SC (chlorantraniliprole)	30	150 ml	0.50± 0.04 ^a	0.53± 0.02 ^a	0.67± 0.01 ^a	0.57± 0.02 ^a	0.57± 0.03 ^a	--
Untreated Control	--	---	0.57± 0.00 ^a	0.57± 0.02 ^a	0.69± 0.03 ^a	0.57± 0.00 ^a	0.60± 0.00 ^a	--

			Yield				Pooled Yield		% Increase over control	
			Mean Yield* (q/ha)				(q/ha)			
			Expt. 1	Expt. 2	Expt. 3	Expt. 4	Non-Basmati	Basmati	Non-Basmati	Basmati
Takumi 20WG (flubendiamide 20%)	15	75 g	30.33± 0.12 ^a	71.07± 0.19 ^c	53.20± 0.10 ^b	29.83± 0.12 ^b	62.13± 0.09 ^c	30.08± 0.20 ^c	+ 5.4	+ 17.7
	20	100 g	33.33± 0.09 ^a	74.93± 0.23 ^b	55.00± 0.20 ^b	32.00± 0.15 ^a	64.97± 0.12 ^b	32.67± 0.15 ^{ab}	+ 10.3	+ 17.0
	25	125 g	34.50± 0.16 ^a	78.40± 0.18 ^a	62.20± 0.19 ^a	34.17± 0.15 ^a	70.30± 0.15 ^a	34.33± 0.11 ^a	+ 19.3	+ 22.9
Fame 480SC (flubendiamide 39.35%)	24	50 ml	34.67± 0.10 ^a	78.13± 0.15 ^a	62.33± 0.11 ^a	33.83± 0.09 ^a	70.23± 0.19 ^a	34.25± 0.15 ^{ab}	+ 19.2	+ 22.7
Coragen 18.5SC (chlorantraniliprole)	30	150 ml	34.17± 0.12 ^a	77.87± 0.10 ^{ab}	62.57± 0.19 ^a	33.33± 0.15 ^a	70.22± a	33.75± 0.13 ^{ab}	+ 19.2	+ 20.9
Untreated Control	--	---	28.33 ^c	68.93 ^c	48.93 ^c	27.50 ^c	58.93 ^d	27.92 ^d	--	--

*Means within same column followed by same letter not significantly different (Duncan's MRT, $p < 0.05$); PROC: % reduction over control

enemies were also recorded ten days after insecticide application. The yield (q/ ha) was also recorded at harvest. Pesticide residue studies at proposed and double the proposed dose were also conducted at PAU, Ludhiana. Data were subjected to ANOVA with statistical software SPSS v 20.0 (SPSS, 2011). The comparison of means was done using Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

The plots treated with Takumi 20WG @ 125 g/ ha recorded 1.36 & 2.07 % deadhearts in trials conducted at Ludhiana and Patiala during 2019, and 1.80 & 1.17 % at Ludhiana and Ropar during 2020, after 5 days of insecticide application, with an overall pooled mean of 1.60% which were statistically at par with the checks, Fame 480SC and Coragen 18.5SC (Table 1). Arulkumar et al. (2019) evaluated the foliar spray of flubendiamide 20WG. The present findings also corroborate with results of Sahu et al., (2020) on chlorantraniliprole either as granule or as spray against rice stem borer. The observations recorded in the present investigation after 10 days of insecticide application, reported overall 0.88% mean deadhearts with Takumi 20WG @ 125 g/ ha which was statistically at par with Fame 480SC and Coragen 18.5SC. Present results agree with those of

Shyamrao and Raghuraman (2019) that flubendiamide 20WG @ 25 g a.i./ ha is the most effective against stem borer, followed by chlorantraniliprole 18.5SC @ 30 g a.i./ha (4.23%). Similar results were obtained by Devi and Singh (2016) with flubendiamide 39.35SC @ 24 g a.i./ha. Chormule et al. (2014) observed that Takumi 20WG proved to be the most effective in reducing the stem borer. Takumi 20WG @ 125 g/ha with an overall mean of 2.81 % white ears, was statistically at par with Fame 480SC and Coragen 18.5SC (Table 1). Suri (2011) and Suri and Brar (2012) compared chlorantraniliprole at different doses with thiocyclam hydrogen oxalate @ 400 g a.i.ha⁻¹ and cartap hydrochloride @ 1000 g a.i.ha⁻¹ and reported that chlorantraniliprole is significantly superior in reducing deadhearts and white ear heads effectively.

Against leaf folder, Takumi 20WG @ 125 g/ ha recorded 1.95 & 2.87% damage in trials conducted at Ludhiana and Patiala during 2019 and 2.12 & 2.92% damage at Ludhiana and Ropar during 2020, after 5 days of insecticide application, with an overall pooled mean of 2.47% which were statistically at par with Fame 480SC and Coragen 18.5SC (Table 1). Zala and Sipai (2021) reported that application of flubendiamide 20WG @ 25 g a.i. ha⁻¹ recorded 12.51% leaf damage due to *C. medinalis*. Jaglan and Chaudhary (2021) reported that foliar spray of flubendiamide 20WG @

25 g a.i. ha⁻¹ effectively reduced the infestation of leaf folder and yellow stem borer. Takumi 20WG @ 125 g/ha (25 g a.i. ha⁻¹) gave yields at par with Fame 480SC and Coragen 18.5SC at all the test locations; pooled data revealed that a yield of 70.30 q/ha was obtained in case of non-basmati rice with Takumi 20WG @ 125 g/ha. Similar was the case with Basmati rice, yield of 34.33 q/ha was observed with Takumi 20WG @ 125 g/ha, that was on par with Fame 480 SC (34.25 q/ha) and Coragen 18.5SC (33.75 q/ha). These results are in agreement with those of Shyamrao and Raghuraman (2019) using flubendiamide 20WG @ 25 g ai./ha. Ghoghari et al. (2019) observed for control of stem borer in rice, flubendiamide 20 WG gave maximum yield. Sridhar and Sharma (2015) also observed that flubendiamide 20WG @ 60 g a.i. ha⁻¹ was the most effective. In non-basmati rice also, similar yields were observed with Takumi 20WG. The spider counts recorded in various treatments over the test locations ranged from 0.50 to 0.69/hill at 10 days after insecticide application (Table 1). These results agree with those of Sekh et al., (2007) that flubendiamide 480SC @ 24 and 30 g a.i./ha was soft to egg parasitoids of yellow stem borer. Similar results were also reported by Tohnishi et al. (2005) Kubendran et al. (2006) and Thilagam et al. (2006) with flubendiamide being the least toxic against beneficial arthropods.

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