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### Evaluation of insecticides and biopesticides against Scirpophaga incertulas (Walker), leaf folder (Cnaphalocrosis medinalis) and green leafhopper in basmati rice

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#### Abstract

The field trials were carried out at A.N.D.U.A.T. Crop Research Station, Masodha Ayodhya, during kharif 2019 and 2020 to evaluate the efficacy of four combination modules/treatments consisting of three insecticides Chlorantraniliprole 20% SC, Cartap hydrochloride 50% SC and Triflumezopyrim 10% SC, one commercial neem formulation - Neemazal and two oils - Neem and Eucalyptus oil procured from IIRR, Hyderabad (Telangana) were compared along with untreated control (only water spray). There were significant differences in dead heart damage among the treatments. All insecticides treatment module recorded the lowest mean damage of white ears 1.3% when compared to 28.8% in untreated control. Among other treatments, neemazal, eucalyptus oil and cartap hydrochloride combination showed lowest mean infestation of 4.1% DH. Among modules, all insecticides module was found to be the best with 1.3% mean white ear damage followed by neemazal, eucalyptus oil and cartap hydrochloride module with 4.1% WE. All insecticides module was the most effective treatment showing mean leaf damage of 2.45% followed by treatment with neemazl, Eucalyptus oil and cartap hydrochloride (4.95% DL) when compared to untreated control (17.2% DL). All insecticides combination was the most effective treatment of Green leafhopper showing mean population of 3.0 followed by neeamazal, eucalyptus oil and cartap hydrochloride combination (17.7)) and were superior to control (61.7 hoppers/10 hills). All insecticides treatment Chlorantraniliprole, Cartap hydrochloride, Triflumezopyrim recorded the highest grain yield of 3260 kg/ha with 237.1% increase over control followed by neemazal, neem oil and cartap hydrochloride with 2350 kg/ha (143.01% IOC). All the treatments were significantly superior to control plot which showed a yield of 967 kg/ha. All insecticides combination minimized the yield loss in basmati rice.

Keywords: basmati rice, stem borer, leaf folder, green leafhopper, grain yield

#### Introduction

Rice (Oryza sativa L.) is an important staple food crop for more than two third of the population of India and more than 65 per cent of the world population (Mathur et al., 1999) <sup>[10]</sup>. India is the largest rice growing country, it accounts for more than 40% food grain production. Introduction and wide adoption of basmati rice varieties has led to sever incidence of vellow stem borer in addition to the existing leaf folder menace on the rice crop all over India. There are over 70 pests infesting rice in India and 20 are of regular occurrence (Patha, 1975). The pest causes 25-30% damage to rice crop (Lal, 1996) [7]. Almost 20 insects are considered as rice pests of economic importance that include stem borers, leaf folder,gall midge, defoliators and vectors like leafhoppers and plant hoppers that cause direct damages and transmit various diseases Among the major pest attacking rice crop the stem borer, Scirpophaga incertulas (Walker) is the number one pest, which attack the crop both at vegetative and reproductive stages (Pasalu et al., 2002)<sup>[12]</sup>. All plant parts of basmati rice are vulnerable to insect infestations from sowing to harvest with an estimated 25-30% yield loss annually (Khan et al., 2003) [11]. Scented varieties are comparatively more preferred by insect pests (Khuswaha, 1994)<sup>[6]</sup>. Among these insect pests stem borers viz., yellow stem borer Scirpophaga incertulas (Walker), white stem borer Scirpophaga innotata (Walker), pink stem borer Sesamia inferens (Walker) and leaf folder Cnaphalocrocis medinalis (Guenee) are important. The rice green leafhoppers (GLH), are one of the most devastating rice pests throughout the rice growing areas of Asia (Q.M.A. Razzaque et al. 1985, E.A. Heinrichs, et al

1986) <sup>[13, 2]</sup>. The middle of the shaft of the aedeagus bears 3–5 pairs of spines (K. Sreejith, and C. D. Sebastian, 2015) <sup>[5]</sup>. The number of spines on the male aedeagus is a distinctive character of the *Nephotettix virescens* which separates it from other *Nephotettix species* (M. R. Wilson, and M. F. Claridge,1985) <sup>[8]</sup>.

To minimize the incidence of these stem borers, leaf folder and green leafhopper identification of new molecules with selective properties, low toxicity to non targets, and environmental safety is required with a view of sustainable IPM. Some of these green chemistry insecticides are highly effective against lepidopterans, of which chlorantraniliprole and spinosad are the most widely used (Hannig *et al.*, 2009; Marchesini *et al.*, 2008) <sup>[9]</sup>. The present study evaluates such insecticides belonging to anthranilamide group against stem borers, leaf folder and green leafhopper in basmati rice.

#### Material and Methods

Field experiments were conducted at the A.N.D.U.A.T. Crop Research Station, Masodha Ayodhya for which the nursery of basmati rice. Pusa Basmati 1 was sown in seed beds of 4.0x0.75 m2 on 20th and 23th June of 2019 and 2020, respectively. The nursery was raised as per the recommended agronomic practices except plant protection measures. The soil is sandy loam low in organic carbon. It is rich in potassium, medium in phosphorus and possesses good water holding capacity. The main field experiment was done in a randomized block design with three replications. Two nursery seedlings/hill were transplanted with inter and intra row spacing of 20 x 15 cm (33 hills m-2) on 20th and 21st July during 2019 and 2020, respectively in plots, each measuring 50.0 m<sup>2</sup> area. The individual plots were separated by bunds and water channel to regulate water flow and prevent movement of water and insecticide from one plot to another. The nitrogenous (urea) fertilizer was applied @ 1 q/ha in two equal splits at 3 and 6 weeks after transplanting. To evaluate the efficacy of four combination modules/treatments consisting of three insecticides Chlorantraniliprole 20% SC, Cartap hydrochloride 50% SC and Triflumezopyrim 10% SC, one commercial neem formulation - Neemazal and two oils -Neem and Eucalyptus oil procured from IIRR, Hyderabad (Telangana) were compared along with untreated control (only water spray). Botanical Insecticide 1: Neemazal 1% EC 2ml/l (25-30 DAT), Eucalyptus oil 2ml/l (45-50 DAT), Cartap hydrochloride 50% SC 2g/l (60-65 DAT), Botanical-Insecticide 2: Neemazal 1% EC 2ml/l (25-30 DAT), Neemoil 10 ml/l (45-50 DAT), Triflumezopyrim 10% SC 0.48ml/l (60-60 DAT), All Botanical: Neemazal 1% EC 2ml/l (25-30 DAT), Eucalyptus oil 2ml/l (45-50 DAT), Neem oil 10ml/l (60-65 DAT) and All Insecticide: Chlorantraniliprole 20% SC 0.2ml/l (25-30 DAT), Cartap hydrochloride 50% SC 2g/l (50-55 DAT), Triflumezopyrim 10% SC 0.48ml/l (65-70 DAT). The knapsack sprayer with hollow cone nozzle was used with spray volume @ 250 l/ha to impose the sprays, with first spray given when the Use of insecticide/biopesticide after 30 days after transplanting and 45 days after transplanting. The data on stem borer, leaf folder and green leafhopper infestation was recorded at vegetative stage as dead heart (DH%), damage of leaf/hill and total tillers and percent incidence was worked out. Similarly, white ear (WE%) and panicle bearing tillers were recorded near maturity of crop and percent white ear incidence was worked out. The DH, leaf folder and green leafhopper at 30 Days and 50 days after transplanting on 20 randomly selected hills from each plot.

The data on grain yield of each plot were recorded separately by threshing the harvested Pusa Basmati 1. The data so obtain were subjected to statistical analysis after necessary transformation for final statistical analysis (Gomez and Gomez, 1983)<sup>[3]</sup>.

#### **Results and Discussion**

#### Incidence of rice stems borer

The incidence assessed at 30 and 50 days after transplanting revealed that during both year,% incidence in the insecticidal treated plots was significantly lower (Table 1). All insecticides treatment module Chlorantraniliprole 20% SC, Cartap hydrochloride 50% SC, Triflumezopyrim 10% SC recorded the lowest mean damage of stem borer DH 1.15% when compared to 29.2% in untreated control followed by treatments, neemazal, eucalyptus oil and cartap hydrochloride combination showed lowest mean infestation of 4.1% DH. The other treatment Neemazal 1% EC, Neemoil, Triflumezopyrim 10% SC mean damage of white ears 6.15%, Neemazal 1% EC, Eucalyptus oil, Neem oil lowest mean damage of DH 15.2%.

The incidence assessed at pre harvest revealed that during both year,% incidence in the insecticidal treated plots was significantly lower. All insecticides treatment module Chlorantraniliprole 20% SC, Cartap hydrochloride 50% SC, Triflumezopyrim 10% SC recorded the lowest mean damage of stem borer WE 1.3% when compared to 28.8% in untreated control followed by treatments, neemazal, eucalyptus oil and cartap hydrochloride combination showed lowest mean infestation of 3.2%. The other treatment Neemazal 1% EC, Neemoil, Triflumezopyrim 10% SC mean damage of white ears 10.3%, Neemazal 1% EC, Eucalyptus oil, Neem oil lowest mean damage of white ears12.6%.

#### Leaf folder

Leaf folder population depicted in Table 2 reveal that all the insecticides significantly reduce them, however significantly more population was obtained with all insecticide (Bandaradeniya and Edirisinghe 2001) <sup>[1]</sup>. All insecticides treatment module Chlorantraniliprole 20% SC, Cartap hydrochloride 50% SC,Triflumezopyrim 10% SC recorded the lowest mean damage of leaf folder 2.45% when compared to 17.2% in untreated control followed by treatments, neemazal, eucalyptus oil and cartap hydrochloride combination showed lowest mean infestation of 4.95%. The other treatment Neemazal 1% EC, Neemoil, Triflumezopyrim 10% SC mean damage of white ears 7.9%, Neemazal 1% EC, Eucalyptus oil, Neem oil lowest mean damage of leaf folder 9.4%.

#### Green leafhopper

The results (Table 3) indicated that there was significant green leafhopper difference among the treatments. All insecticides treatment module Chlorantraniliprole 20% SC, Cartap hydrochloride 50% SC, Triflumezopyrim 10% SC recorded the lowest mean damage of green leafhopper 3 number 10/hill when compared to 61.7 in untreated control followed by treatments, neemazal, eucalyptus oil and cartap hydrochloride combination showed lowest mean infestation of 17.7. The other treatment Neemazal 1% EC, Neemoil, Triflumezopyrim 10% SC mean damage of white ears 18.55, Neemazal 1% EC, Eucalyptus oil, Neem oil lowest mean damage of GLH.05%.

#### Yield and Increase%

The results (Table 1) indicated that there was significant dead heart yield difference among the treatments after spray. All insecticides treatment Chlorantraniliprole, Cartap hydrochloride, Triflumezopyrim recorded the highest grain yield of 3260 kg/ha with 237.1% increase over control followed by neemazal, neem oil and cartap hydrochloride with 2350 kg/ha (143.01% IOC). The other treatment Neemazal 1% EC, Neemoil, Triflumezopyrim 10% SC grain yield of 1910 kg/ha with 97.51% increase over control, Neemazal 1% EC, Eucalyptus oil, Neem oil grain yield of 1630 kg/ha with 68.56% increase over control.

On the basis of reduction in incidence of rice stem borer, leaf folder and green leafhopper and result of yield of rice cultivation under investification. It is concluded that the application of Chlorantraniliprole 20% SC 0.2ml/l (25-30 DAT), Cartap hydrochloride 50% SC 2g/l (50-55 DAT), Triflumezopyrim 10% SC 0.48ml/l (65-70 DAT) proved most effective in control of rice stem borer, leaf folder and green leafhopper under prevailing micro farming situation.

Table 1: Efficacy	of insecticides	and biopesticide	against stem	borer on rice cron
Table 1. Lineacy	of miscenciaes	and biopesticide	against stem	boler on filee crop

			Stem borer Damage (% Dead hearts)		Stem borer Damage (% White Ears)	
S. No.	Treatment details		30DT	50DT	Mean	Pre-harvest
1	Botanical Insecticide 1	Neemazal 1% EC 2ml/l (25-30 DAT), Eucalyptus oil 2ml/l (45-50 DAT), Cartap hydrochloride 50% SC 2g/l (60-65 DAT)	4.3	3.9	4.1	3.2
2	Botanical- Insecticide 2:	Neemazal 1% EC 2ml/l (25-30 DAT), Neemoil 10 ml/l (45-50 DAT), Triflumezopyrim 10% SC 0.48ml/l (60-60 DAT)	6.7	5.6	6.15	10.3
3	All Botanical:	Neemazal 1% EC 2ml/l (25-30 DAT), Eucalyptus oil 2ml/l (45-50 DAT), Neem oil 10ml/l (60-65 DAT)	17.6	12.8	15.2	12.6
4	All Insecticide:	Chlorantraniliprole 20% SC 0.2ml/l (25-30 DAT), Cartap hydrochloride 50% SC 2g/l (50-55 DAT),Triflumezopyrim 10% SC 0.48ml/l (65-70 DAT)	1.2	1.1	1.15	1.3
5	Control	Water Spray	32.1	26.3	29.2	28.8

Table 2: Efficacy of insecticides and biopesticide against leaf folder and yield on rice crop

			Leaf Folder (%) Damaged Leaves		Grain Yield	% increase over	
S. No.	Treatment details		30DT	50DT	Mean	kg/ha	Control
1	Botanical Insecticide 1	Neemazal 1% EC 2ml/l (25-30 DAT), Eucalyptus oil 2ml/l (45-50 DAT), Cartap hydrochloride 50% SC 2g/l (60-65 DAT)	7.7	2.2	4.95	2350	143.01
2	Botanical- Insecticide 2:	Neemazal 1% EC 2ml/l (25-30 DAT), Neemoil 10 ml/l (45-50 DAT), Triflumezopyrim 10% SC 0.48ml/l (60-60 DAT)	12.4	3.4	7.9	1910	97.51
3	All Botanical:	Neemazal 1% EC 2ml/l (25-30 DAT), Eucalyptus oil 2ml/l (45-50 DAT), Neem oil 10ml/l (60-65 DAT)	13.6	5.2	9.4	1630	68.56
4	All Insecticide:	Chlorantraniliprole 20% SC 0.2ml/l (25-30 DAT), Cartap hydrochloride 50% SC 2g/l (50-55 DAT),Triflumezopyrim 10% SC 0.48ml/l (65-70 DAT)	4.0	0.9	2.45	3260	237.12
5	Control	Water Spray	21.6	12.8	17.2	967	_



Fig 1: Efficacy of insecticides and biopesticide on grain yield kg/ha

			Green Leafhopper (No./10 hills)		
S. No.	Treatment details		<b>30DT</b>	50DT	Mean
1	Botanical Insecticide 1	Neemazal 1% EC 2ml/l (25-30 DAT), Eucalyptus oil 2ml/l (45-50 DAT), Cartap hydrochloride 50% SC 2g/l (60-65 DAT)	18.8	16.6	17.7
2	Botanical- Insecticide 2:	Neemazal 1% EC 2ml/l (25-30 DAT), Neemoil 10 ml/l (45-50 DAT), Triflumezopyrim 10% SC 0.48ml/l (60-60 DAT)	19.6	17.5	18.55
3	All Botanical:	Neemazal 1% EC 2ml/l (25-30 DAT), Eucalyptus oil 2ml/l (45-50 DAT), Neem oil 10ml/l (60-65 DAT)	21.3	20.8	21.05
4	All Insecticide:	Chlorantraniliprole 20% SC 0.2ml/l (25-30 DAT), Cartap hydrochloride 50% SC 2g/l (50-55 DAT), Triflumezopyrim 10% SC 0.48ml/l (65-70 DAT)	3.2	2.8	3.0
5	Control	Water Spray	63.6	59.8	61.7

#### Table 3: Efficacy of insecticides and biopesticide against green leafhopper on basmati crop

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