Evaluation of Botanicals Insecticide against Stem Borer *Scirpophaga incertulas* (Walker) Leaf Folder (*Cnaphalocrosis medinalis*) and Green Leafhopper and in Rice

Abstract

A field experiment was conducted during the kharif season of 2020-21 and 2021-22 at Crop Research station, Masodha, Ayodhya, India to evaluate the efficacy of insecticide-botanicals against rice stem borer, green leafhopper and leaf folder. The experiment was comprising 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 plant oils - Neem and Eucalyptus oil procured were compared along with untreated control (only water spray). The lowest stem borers incidence (1 %) of in all insecticides treatment module recorded as compared to 14.8% in untreated control. Among modules, all insecticides module was found to be the best with 1.0% mean white ear damage followed by neemazal, eucalyptus oil and cartap hydrochloride module with 5.3% WE. Green leafhopper infestation was all insecticides combination was the most effective treatment showing mean population of 110.7/10 hills followed by all botanical combination (120.7) and were superior to control (158.7/10 hills). **The** mean leaf Folder damage (1.8%) was recorded from all insecticides module followed by treatment with neemazl (? %), Eucalyptus oil (? %), and Triflumezopyrim 10% SC (3.9% DL) when compared to untreated control (14.5%)4. Grain yield all insecticides treatment - Chlorantraniliprole, Cartap hydrochloride, Triflumezopyrim recorded the highest grain yield of 5212.0 kg/ha with 95.79% increase over control (IOC) followed by neemazal, neem oil and cartap hydrochloride with 4500 kg/ha (69.04% IOC). All the treatments were significantly superior to control plot which showed a yield of 2662 kg/ha.

(Keywords: Stem borers, incidence, Green leaf hopper, Leaf folder, Grain yield,**)**

Introduction

Rice is an important food crop which is cultivated worldwide (Fritz *et al* 2011). It is the major food for half the population of the world (Zhang *et al* 2019). “The global rice production during 2018-19 was about 495.87 million tons (mt) and global consumption was recorded nearly 490.27 mt (Anonymous 2019). India has the highest rice area and stands second in production. In our

state rice crop cultivated in an area 30.46 lakh hectares with annual rice production of 199.72 lakh tones averaging 65.16 quintal yield per hectare" (Anonymous 2021). "It is a crop of warm humid environment which is also conducive for survival and proliferation of insect-pests. Rice and *Basmati* Rice are major crops for *Kharif* season. Both crops are more economical as compared to other *Kharif* crops. Therefore, farmers preferred to grow rice and basmati rice crops in *Kharif* season. The average yield of rice & basmati rice is very lower. Several factors i.e. poor source of seed, improper selection of varieties, less plant population, excessive use of fertilizers & irrigations, untimely check of weeds, deficiency of micronutrients, severe incidence of insect-pests and diseases are involved for lower productivity. Among these, the insect–pests play major role for reduction of yield and quality of produce" (Khan and Ramamurthy 2004). "The production is adversely affected by many biotic and abiotic factors. Among these, biotic factors contribute to about 52 per cent rice yield loss at global level and 25 per cent loss occurs due to various insect-pests. The number of insect pests which can be categorized according to their feeding habits like stem borers (yellow, white and pink stem borers), leaf feeders (leaf folder, rice hispa and grasshoppers), sap suckers (plant hoppers) and rice-ear-cutting-caterpillar" (Bhogadhi and Bentur 2015). "The females of leaf hoppers lay eggs in groups on leaf sheath. Both adults and nymphs of leaf hopper suck plant sap from the base of the tillers, which results in yellowing and drying of the plants. The leaf hopper also act as vector for viral diseases" (Atwal and Dhaliwal 1997). "The farmers rely heavily on insecticides for management of different insect-pests and almost 50% of the insecticides used in rice are targeted against these pests alone" (Reddy et al., 2012). Among the various strategies adopted to combat the insect-pests of rice crop, insecticides are the first line of defense. "Most of the insecticides used on rice crop are based on quite limited number of chemically different classes out of them the most important inorganic insecticides that are used against rice insect-pests belongs to synthetic pyrethroids and the indiscriminate use of these chemicals leads to adverse effects i. e. residues in rice grains, environmental contamination, resurgence, resistance and destruction of natural enemies which suggest the need to develop alternative management strategies" (Dutta 2015; Brevik and Sauer, 2015). Hence, "green chemistry insecticides are being added for their evaluation with an aim to least disruption of environmental quality" (Sarao and Randhawa 2019, Kaur et al., 2020). Therefore, an effort has been made in present investigation to evaluate the efficacy botanicals insecticides against major lepidopterous pests and green leaf hopper in rice crop.

Material and Methods

The experiments for evaluation of botanicals insecticides were conducted during WS 2020-21 and 2021-22 at Crop Research Station, Masodha, which is situated at 26.47^{0}N (latitude), 82.12 ^{0}E (longitude) and at 113 m (altitude). The 35 days old nursery of cv. Pusa Basmati-1 was transplanted in hill in the 1st week of July during experimental years. The experiments were laid out with three replication and five treatments (Chlorantraniliprole 20% SC, Cartap hydrochloride 50% SC and Triflumezopyrim 10% SC, one commercial neem formulation - Neemazal and two plant oils - Neem and Eucalyptus oil) in a randomized block design (RBD). "The plot size of each treatment was kept 20 m^2 and buffers were maintained by 1.0 and 0.5 meter between replication and treatment plots, respectively. The crop was raised by following all recommended practices except plant protection measures. The tested insecticides were sprayed by using 500 litres water per hectare at economic threshold level . Standard observation procedures were followed to record insect-pests incidence in data sheets at regular intervals throughout the crop growth period. To assess stem borer damage, observations were recorded on total tillers, dead hearts at 30 and 50 DAT, at earing stage was recorded white ears. The damage due to foliage feeders such as leaf folder was assessed based on counts of damaged leaves/10 hills (what GLH) .At maturity, the crop was harvested with single plot thresher; grains were cleaned, dried and weighed separately of each plot and yield converted into per hectare. The data recorded during the course of investigation were subjected to statistical analysis by using analysis of variance technique after square root transformations" (Sheoran et al., 1998).

Results and Discussion

One of the earliest and most widely used methods for controlling insect pests of crops is the use of plant extracts or botanicals. Botanicals can play an important role in pest management because they are environmentally friendly, safe for nontarget organisms, renewable, and cost effective. The use of botanicals in rice IPM will lessen the amount of pesticides in the environment, stop insecticide resistance, and support the preservation of populations of natural enemies. The new emphasis on natural and organic farming makes the use of botanicals in pest management all the more significant. Earlier efforts under AICRIP were primarily focused on evaluating the efficacy of various commercial botanical formulations and insecticides against insect pests. In order to determine the most efficient combination and strategically include the usage of botanicals for optimum rice IPM, it was deemed necessary to test a combination of insecticide and botanicals as modules against the primary pests of rice. Therefore, an experiment made up of diverse treatments combining efficient, easily available essential oils, neem formulations, and recommended pesticides was assessed during kharif 2021 to evaluate their performance against major insect pests.

Pest Infestation:

Stem Borers (dead hears): Infestation (table 1) was recorded during vegetative stage ranged from 1.0 to 26.8% at 30 to 50 days after transplanting (DAT). There were significant differences

in dead heart damage among the treatments. All insecticides treatment module (mention the name of insecticides) recorded the lowest mean damage of 1.0% when compared to 26.8% in untreated control. Among other treatments, neemazal, neem oil and Triflumezopyrim the mean infestation (9.5%) was recorded .

Stem Borers (white ears): The white ear infestation ranged from 1.0 to 10.0% in insecticidal treatments as compared to 28.6% untreated control. Among modules, all insecticides module was found to be the best with 1.0% mean incidence followed by neemazal, neem oil and Triflumezopyrim module with 3.9% WE.

Overall, all insecticides module was found to be superior in reducing stem borer incidence as compared to other botanical insecticidal modules and was the most effective treatment at both vegetative and reproductive phases.

Green leafhopper: infestation was high (110.7-158.7 hoppers/10 hills). All insecticides combination was the most effective treatment showing mean population of 110.7/10 hills followed by neeamazal, neem oil and Triflumezopyrim combination (120.7) and were superior to control (158.7 hoppers/10 hills).There were significant differences in hopper populations among the treatments as well as in populations.

Leaf Folder: Damage was recorded from highest leaf damage was recorded in (1.8 to 14.5%) during 30 and 50 DAT. All insecticides module was the most effective treatment showing mean leaf damage of 1.8% followed by treatment with neemazl (%), neem oil (%) and Triflumezopyrim (3.9% DL) when compared to untreated control (14. 7% DL).

Grain Yield: All insecticides treatments (Chlorantraniliprole, Cartap hydrochloride, Triflumezopyrim) recorded the highest grain yield of 5212 kg/ha with 95.79% increase over control (IOC) followed by Botanical-Insecticide-1with 4500 kg/ha (69.4% IOC). All the treatments were significantly superior to control plot which showed a yield of 2662 kg/ha.

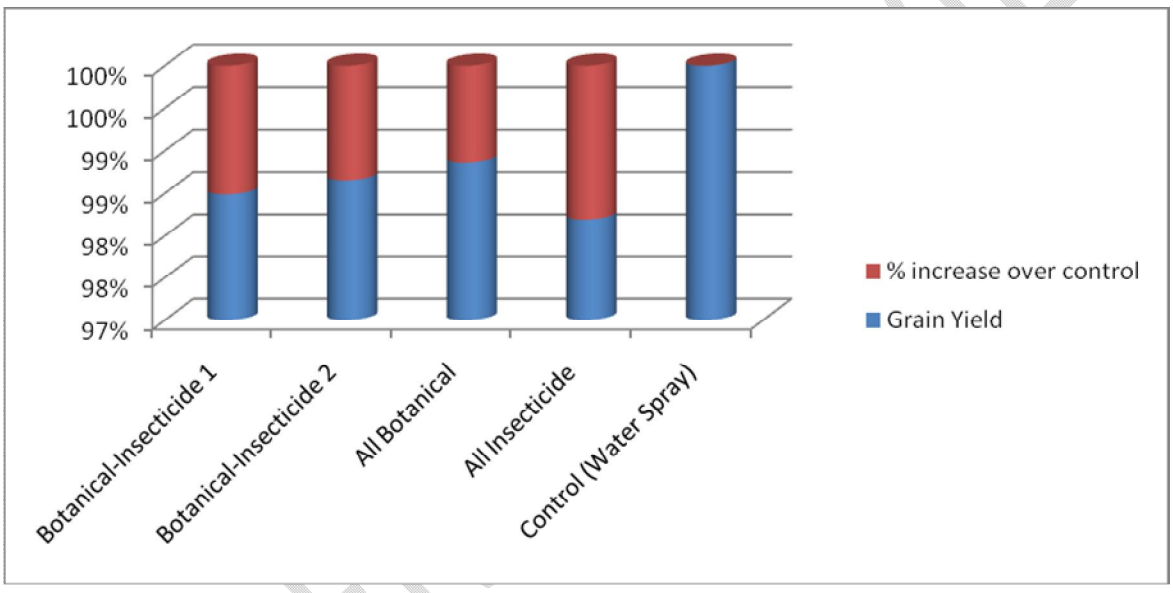
Comparing the All Insecticides module to other insecticide-botanical modules, it was discovered that it was more effective at minimising stem borer damage throughout both the vegetative and reproductive phases.

Table:1. Field efficacy of insecticidal treatments against major insect-pests of rice

Sl No	Common Name	Stem Borer DH		Mean	WE	LF		Mean	GLH	GY	% increase over control
		30 DAT	50 DAT			30 DAT	50 DAT				
1	Botanical-Insecticide 1	10.8	9.8	10.3	5.3	5.0	5.5	5.3	126.2	4500	69.04
2	Botanical-Insecticide 2	13.8	5.1	9.5	4.3	3.9	3.9	3.9	128.5	4175	56.83
3	All Botanical	20.9	14.8	17.9	10	6.6	6.8	6.7	120.7	3837	44.13
4	All Insecticide	1.3	0.7	1.0	1	1.7	1.9	1.8	110.7	5212	95.79
5	Control (Water Spray)	26.5	27.0	26.8	28.6	14.1	14.9	14.5	158.7	2662	-

DH: dead hearts, WE: white ears

Figure 1: Yield and increase % over control in different treatments, insecticide-botanicals



Conclusion

The study highlights the most suitable insecticide against rice stem borer (*Scirpophaga incertulas*) (Walker) and leaf folder (*Cnaphalocrosis medinalis*) in kharif season of rice crop. Grain Yield all insecticides treatment - Chlorantraniliprole, Cartap hydrochloride, Triflumezopyrim recorded the highest grain yield of 5212.0 kg/ha with 95.79% increase over control (IOC) followed by neemazal, neem oil and cartap hydrochloride with 4500 kg/ha (69.04% IOC). All

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