SHORT COMMUNICATION

STUDIES ON ANTIXENOSIS MECHANISM OF ADVANCED RICE GENOTYPES AND BIO-EFFICACY OF VARIOUS BIOPESTICIDES AND BOTANICALS AGAINST BROWN PLANTHOPPER

Akruti Ben Rout* and D.K. Rana

Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh

Received-06.08.2021, Revised-15.09.2021, Accepted-26.09.2021

Abstract: The bioefficacy of three biopesticide namely, *Beauveriabassiana, Metarhiziumanisopliae, Lecaniciliumlecanii* and two botanicals namely, Neem seed kernel extract and Pongamia leaf extract along with Buprofezin @25% SC as check insecticide and one control treatment were evaluated on 1 month old plants of susceptible genotype State Unified Varietal Trial -4-11. After the 1st week of treatment, plants treated with Buprofezin showed significant reduction whereas there was a negligible reduction in nymph population of the plants that were treated with *Metarhiziumanisopliae, Beauveriabassiana, Lecaniciliumlecanii* , Neem seed kernel extract and Pongamia leaf extract. The 2nd and 3rd week onwards, the plants treated with NSKE registered reduction in nymphs which was at par with Buprofezin. Pongamialeaf extract also showed significant reduction than the three entomofungal bio pesticides. Out of the three entomofungalbiopesticides, *Metarhiziumanisopliae* was found to be more effective than *Beauveriabassiana*and *Lecaniciliumlecanii* . It was hence concluded that botanicals are better prospects for brown planthopper reduction than biopesticides (*M. anisopliae* ,*B. bassiana and L. lecanii*) which are only able to suppress the brown planthopper population by about 8-17%.

Keywords: Brown planthopper, Biopesticides, Rice

INTRODUCTION

Rice (*Oryza sativa* L.)has evolved alongside human civilization from the dawn of agriculture itself. Based on archeological evidence, rice was believed to have first been domesticated in the region of the Yangtze River valley in China but as agricultural practices expanded around the globe it became an indispensable part of the daily diet and is now consumed by more than 60% of the world's population especially by South-East Asians.At this moment, there are several types of losses occurring from the time of sowing to selling it to the consumers. The losses maybe biotic like pests, weeds etc or abiotic like milling losses, procurement losses. The research work around rice is mainly focused on the biotic losses and significantly on losses due to insect pest attack. Out of 52 % loss due to biotic factors every year, 21% accounts for insect pest attack (Brookes and Barfoot, 2003). Out of all the insect pests attacking rice,many regard Brown plant hopper as the number-one insect pest of rice in Asia today, primarily because of the unpredictability of the infestation and the severe damage that it causes. The pest is responsible for transmission of various virus diseases like grassy stunt, ragged stunt (Ling et al. 1978) and wilted stunt. The amount of grain loss due to BPH infestation in the entire India must be worth at least USD 20 million. Pesticide application was found to be ineffective as the infestation is rapid and hidden somehow in the early stages due to damage at the plant base level (Sarao, 2015). Therefore, the switch from synthetic pesticides to alternative agricultural practices is pertinent (Samyetal, 1995). Use of bio pesticides and botanicals are one of the best alternatives as they are biodegradable and don't have harmful effects on other beneficial organisms (Alliance, 2015). Hence, switching to non-chemical biological approaches such as entomopathogens (Burges, 1981), organic pesticides, botanicals (Sarwar and Salman, 2015) has substantial potential for curtailing the losses.

MATERIALS AND METHODS

Bioefficacy of various biopesticides and botanicals were evaluated as per the method adopted by Mohan *et al*.(2016).Ten 2nd and 3rd instar nymphs of brown plant hopper were released onto the Mylar tubes covering 30 day old seedlingsof a susceptible genotype namely SUVT- 4- 11 with a damage rating of 9 . Four replications of each treatment were maintained. After a week of release, recommended doses of three biopesticides and two botanicals (as shown in table below) were mixed with water and mixed thoroughly and then the solution is sprayed into the mylar tubes on the plants using a hand atomizer. Water spray served as untreated control and Buprofezin25%SC was sprayed as check insecticide.Untreated control line was maintained for calculating the reduction percentage.Washing of sprayer was done before the application of another pesticide, by flushing sufficient clean water.Counts were taken 1, 2, 3, 4 weeks thereafter. At each count live insects were counted.

*Corresponding Author

Sl. No.	Treatments	Formulation	Dosage equivalent
1.	*Metarhiziumanisopliae*(green muscardine fungus)	1.15%WP	5 ml/l
2.	*Beauveriabassiana* (white muscardine fungus)	1.15%WP	7 g/l
3.	*Lecaniciliumlecanii*	1.15%WP	10 ml/l
4.	Neem seed kernel extract	5% azadirachtin	1kg /l
5.	Buprofezin (check insecticide)	25%SC	250 ml/l
6.	Pongamia leaf extract	5%	3 ml/l
7.	Untreated control	Water spray	-

The mean original data of percentage reduction was calculated reduction over with the following formula (Abbott's 1925)

$$\text{Percent reduction} = \frac{C - T}{C} \times 100$$

Where, T = Insect population reduction in treated replication

C = Insect population reduction in control(untreated) replication

Statistical analysis

The reduction data was converted into mean values then trans- formed into square root values for one-way ANOVA in CRD design.

RESULTS AND DISCUSSION

Over all mean nymphal population of BPHvaried in various treatments from4.50 to 9.68per five replications. It was noted that check insecticide Buprofezin @25% SC recorded the lowest average population of nymphs that is (4.50) but the botanical Neem seed kernel extract @5% recorded (6.31 nymphs) which was at par with the check insecticidal spray . After that Pongamia leaf extract @5% (7.56 nymphs) was found to be third most effective followed by bio pesticide *Metarhiziumanisopliae* @1.15% WP (8.06 nymphs) and *Beauveriabassiana* @1.15% WP (8.25 nymphs). Maximum population was recorded in*Lecaniciliumlecanii*@1.15% WP (8.87) as against 9.68 nymphs in untreated control replications, hence making it the least effective treatment out of the six treatments.

Table 1. Bio-efficacy of biopesticides and botanicals against brown plant hopper in rice crop in greenhouse conditions.

SL. NO.	TREATMENT	1 DAT	7 DAT	14 DAT	21 DAT	Mean No. of nymphs	Percent reduction of insect population over control
1.	Neem seed kernel extract @5%	9.00* (3.16)**	8.25* (3.03)**	5.25* (2.49)**	2.75* (1.93)**	6.31	35%
2.	*Metarhiziumanisopliae @1.15% WP*	9.50 (3.23)	9.00 (3.16)	7.50 (2.91)	6.25 (2.69)	8.06	17%
3.	*Pongamia leaf extract @5%*	9.25 (3.19)	9.00 (3.16)	6.50 (2.73)	5.50 (2.54)	7.56	22%
4.	Buprofezin (check insecticide) @25%SC	7.00 (2.82)	5.75 (2.59)	3.75 (2.17)	1.50 (1.56)	4.50	54%
5.	*Beauveriabassiana* @1.15% WP	9.50 (3.23)	9.50 (3.23)	7.50 (2.91)	6.50 (2.73)	8.25	15%
6.	*Lecaniciliumlecanii*@1.15% WP	9.75 (3.27)	9.75 (3.27)	8.50 (3.08)	7.50 (2.91)	8.87	8%
7.	Control	10 (3.31)	10 (3.31)	9.50 (3.23)	9.25 (3.20)	9.68	0%
	SEm(±)	0.06	0.05	0.07	0.07		
	CD at 5%	0.18	0.15	0.22	0.21		

**Figures in the parentheses are square root transformed value

*Average of four replications

The bioefficacy of three biopesticide and two botanicals along with Buprofezin @25% SC as check insecticide were evaluated on 1 month old plants of susceptible genotype State Unified Varietal Trial -4-11. After the 1st week of treatment,plants treated with Buprofezin showed significant reduction whereas there was a negligible reduction in nymph population of the plants that were treated with *Metarhiziumanisopliae*, *Beauveriabassiana*, *Lecaniciliumlecanii* ,Neem seed kernel extract and Pongamia leaf extract. The 2nd and 3rd week onwards, the plants treated with NSKEregistered reduction in nymphs which was at par with Buprofezin. Pongamialeaf extract also showed significant reduction than the three entomofungal bio pesticides. Out of the three entomofungalbio pesticides, *Metarhiziumanisopliae* was found to be more effective than *Beauveriabassiana and Lecaniciliumlecanii*. It is hence concluded that botanicals are better prospects for brown planthopper reductionthan biopesticides (*M. anisopliae ,B. bassiana and L. lecanii)* which are only able to suppress the brown planthopper population by about 8-17%.

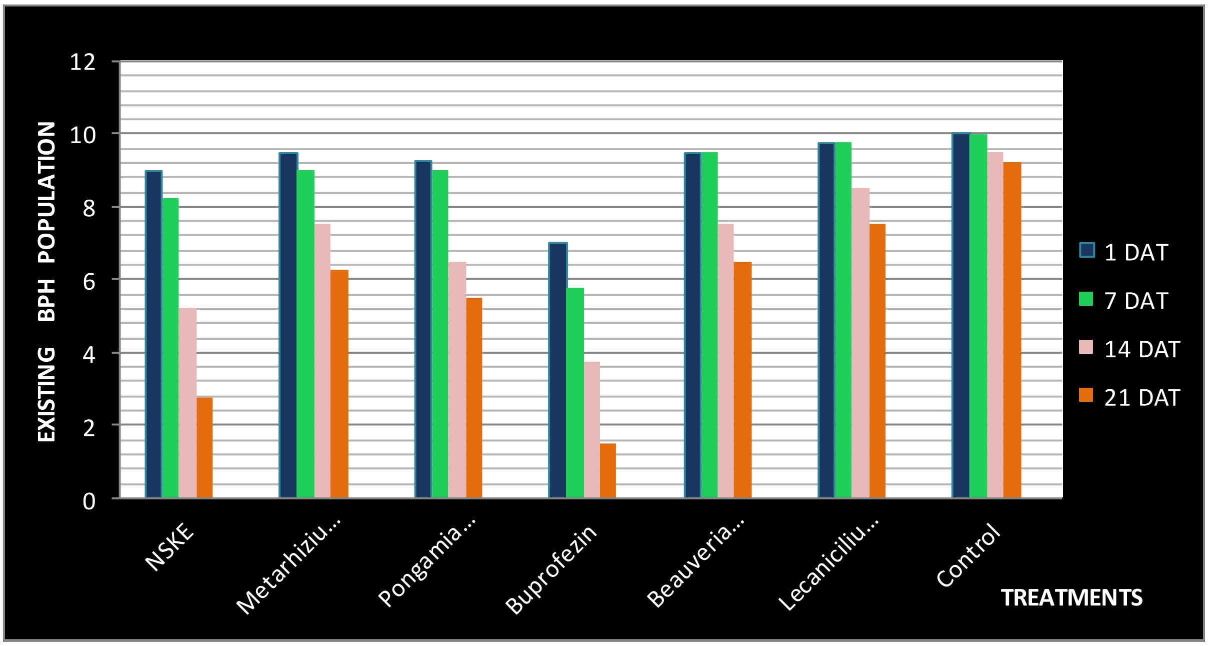

Figure 1. Mean reduction in nymph population of various biopesticidesover 3weeks time period

Out of all the treatments tested to find out the most effective of them all, the results indicated that, botanicalNeem seed kernel extract showed better reduction potential followed by Pongamia leaf extract . Hence, concluding that botanicals are better at reducing BPH population in comparison to entomopathogenic fungal biopesticides.And out of the bio pesticides used*M. anisopliae*was found to be more effective than B. *bassiana*and *L. lecanii*.

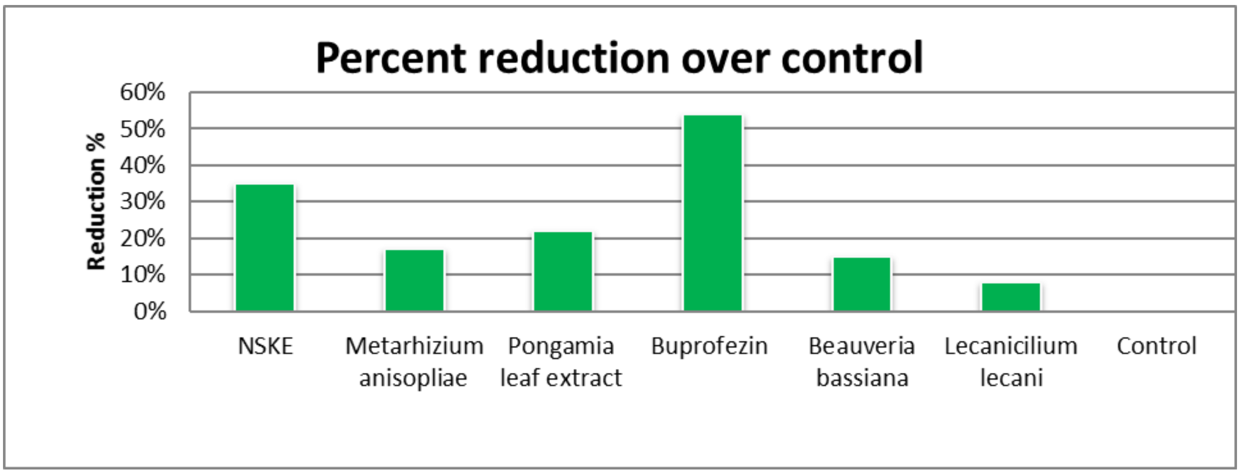

Figure 2. Percent reduction in nymph population of BPH

CONCLUSION

The study concludes that neem seed kernel extract @5% is the best treatment out of the lot and organic sustainable bio control agents for BPH are slow acting but effective in the long run and thus a better alternative against chemical pesticides to opt for sustainable future in agriculture without disturbing the eco system.

REFERENCES

Abbott, W. S. (1925). *J. Econ. Ent.* **18**, 265.

Alliance, B. I. (2015). Biopesticides Offer Multiple Benefits for Agricultural Dealers and Consultants. from: ⟨http://www.bpia.org/wp-content/uploads/2014/01/dealer_ consultant-final.pdf⟩, 2015.

Brookes, G. and Barfoot, P. (2003). GM Rice: Will this Lead the Way for Global Acceptance of GM Crop Technology? Brief No. 28 Los Baños, Philippines, ISAAA

Burges, H.D. (éd.) (1981). Microbial control of pest and plant diseases 1970-1980. Academic Press, London and New York.pp.949.

Ling, K.C., Tiongco, E.R. and Aguiero, V.M. (1978). Rice ragged stunt, a new virus disease. Plant Dis. Rep., 62(8): 701–705.

Mohan, C., Sridhar, R.P. and Nakkeeran, S. (2016). Studies on efficacy of entomopathogenic fungi metarhiziumanisopliae (metchnikoff) sorokin against nilaparvatalugens (stål).International Journal of Agricultural Science and Research (IJASR) ISSN(P): 2250-0057; ISSN(E): 2321-0087 Vol. 6, Issue 6, Dec 2016, 227-234.

Samy, S.J., Xaviar, A., Rahman, A.B. and Sharifuddin, H.A.H. (1995). June. Effect of EM onrice production and methane emission from paddy fields in Malaysia. In KyuseiNature Farming (Fourth International Conference).

Sarao, P.S. (2015). Integrated Management of insect-pests of rice and basmati. Prog. Farm, 51: 9–12.

Sarwar, M. and Salman, M. (2015). Toxicity of oil formulations as a new useful tool in crop protection for insect pest's control. International Journal of Chemical and Bio molecular Science 1(4): 297-302.