The Pharma Innovation Journal 2023; SP-12(11): 2276-2278

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; SP-12(11): 2276-2278

www.thepharmajournal.com
Received: 19-09-2023
Accepted: 29-10-2023

BN Chaudhari
Department of Entomology, College of Agriculture, Nagpur, Maharashtra, India

VR Dhepe
Department of Entomology, College of Agriculture, Nagpur, Maharashtra, India

PR Panchbhai
Department of Entomology, College of Agriculture, Nagpur, Maharashtra, India

VJ Tambe
Department of Entomology, College of Agriculture, Nagpur, Maharashtra, India

Corresponding Author:
BN Chaudhari
Department of Entomology, College of Agriculture, Nagpur, Maharashtra, India

Field demonstrations of *Trichogramma japonicum* against stem borer and *Metarhizium anisopliae* against plant hopper in rice crop

BN Chaudhari, VR Dhepe, PR Panchbhai and VJ Tambe

Abstract
Field demonstrations were conducted at Jambhali (Sadak), Tah. Sakoli, district- Bhandara on 13 farmers field on 5.2 ha (0.4 ha/farmer) by Agriculture Research Station, Sakoli in Bhandara district during *kharif* 2018. Demonstration plot consist four release *Trichogramma japonicum* @ 50,000 eggs /ha at weekly interval for stem borer management and application of *Metarhizium anisopliae* @ 2.5 kg/ha at the initiation of plant hopper, after withdrawn of water from paddy bundhies and it was compared with farmer practice plot. The results revealed that four release of *Trichogramma japonicum* was found significantly more effective with lowest incidence of stem borer i.e., 2.70 percent dead heart and 3.09 percent white ear head in demonstration plots as compared to farmer practice plots with i.e., 5.37 percent dead heart and 5.61 percent white ear head. Similarly, application of *Metarhizium anisopliae* was also found significantly effective against plant hoppers with minimum incidence demonstration plots (white backed plant hopper- 2.14 no./hill and brown plant hopper- 2.37 no./hill) as compared to farmer practice plots (white backed plant hopper- 2.67 no./hill and brown plant hopper- 3.24 no./hill). Higher grain yield of 36.49 q/ha was harvested from demonstration plots as compared to farmer practice plots (34.08 q/ha). Similarly, higher B:C ratio of 1: 2.32 was recorded from demonstration plots as compared to farmer practice plots (1: 2.03).

Keywords: Rice, stem borer, *Trichogramma japonicum,* plant hoppers, *Metarhizium anisopliae*

Introduction
One of the three most significant food crops in the world is rice (*Oryza sativa* L.). It serves as a staple diet for around 2.7 billion people. Rice production has been significantly hampered by the frequent occurrence of biotic stressors brought on by the intensive farming of rice. Numerous insect pests, including gall midges, stem borer, leaf folders, brown plant hoppers, white-backed plant hoppers, and green leaf hoppers, attack rice crop. Amongst these pest Stem borer and plant hoppers are the two pests that have substantially destruct the yield of rice. Overall losses due to insect damage in rice were estimated to be 25% (Dhaliwal *et al* 2010) [3]. Chemical insecticides have been commonly used to control these pests. However, indiscriminate use of insecticides has led to many ecological backlashes like environmental pollution, resistance to pesticides and pest resurgence, in addition to having a deadly effect on non-target creatures and posing health risks to users. Among management practices, biological control with natural enemies is one of the efficient management techniques that offers an effective and environmentally responsible method to minimize the insect damage.
Intensive research have been done in substituting chemical insecticides with biological control agents such as predator, parasitoid, bacteria, viruses, nematodes and fungus. Egg parasitoids in the genus *Trichogramma* (Hymenoptera: Trichogrammatidae) have been widely used for biological control of Lepidopteran insect pests (Brar *et al.*, 1999, Garg *et al.*, 2002, Mohammad, 2018, Sangha *et al.*, 2018) [1, 4, 6, 8]. *Trichogramma japonicum* is egg parasitoid which effectively controls egg mass of stem borer). Entomopathogenic fungi may be used as important biocontrol agents for the control of insect pests, although few effective fungal strains for the management of the rice plant hopper, a major pest of rice, have been discovered. The fungus *Metarhizium anisopliae* has good potential to suppress rice plant hopper populations under natural conditions (Peng *et al.*, 2020) [7]. As a result, it is necessary to demonstrate the usage of *Trichogramma japonicum* and *Metarhizium anisopliae* for stem borer and plant hopper management, respectively, the farmer must understand of the use and importance of *Trichogramma japonicum* and *Metarhizium anisopliae* for management of stem borer and plant hoppers, to develop skill in monitoring the presence or absence of pests

on rice crop, to make farmer more active in finding out the use of above techniques for management of stem borer and plant hoppers in the field and to promote this technology for large scale adoption at farmers' fields in the Eastern Vidarbha Zone of Maharashtra. Thus, demonstrations were conducted on four release *Trichogramma japonicum* @ 50,000 eggs /ha at weekly interval for stem borer management and application of *Metarhizium anisopliae* @ 2.5 kg/ha at the initiation of plant hopper, after withdrawn of water from paddy bundhies were conducted at Jambhali (Sadak), Tah. Sakoli, district-Bhandara on 13 farmers field on 5.2 ha (0.4 ha/farmer) by Agriculture Research Station, Sakoli in Bhandara district during *kharif* 2018.

Materials and Methods

Field demonstrations were conducted on 13 farmer's fields at Jambhali (Sadak) village of Sakoli tahsil in Bhandara district on 5.2 ha area (0.4 ha/farmer) by Agriculture Research Station, Sakoli in Bhandara district during *kharif* 2018 with two treatments *viz.*, demonstration plots consisting four release of *Trichogramma japonicum* @ 50,000 eggs/ha at weekly interval and broadcasting of biopesticide *Metarhizium anisopliae* @ 2.5 kg/ha after withdrawing of water from field for management of stem borer and plant hoppers, respectively and farmer practice plots (Untreated plots). Four *Trichogramma japonicum* releases were made from 20 DAT at weekly intervals. The trichocards must be placed in the early morning or late evening hours and should not be exposed to direct sunlight. Application of *Metarhizium anisopliae* was applied at initiation of incidence of plant hoppers.

Observations of stem borer infestation (dead hearts) were recorded from randomly selected 10 hill per plot on 60 DAT vegetative stage. For white ears incidence by stem borers observations on total panicle bearing tillers and white ear head from randomly selected 10 hill per plot were recorded prior to harvest. With respect to plant hoppers, count of population of nymphs and adults of plant hoppers was recorded from randomly selected 10 hills of each treatment on 14th days after application. Grain yield was recorded on plot basis after harvest and economics of each treatment was worked out.

Results and Discussion

Four releases of *Trichogramma japonicum* was found significantly more effective with lowest incidence of stem borer i.e., 2.70 percent dead heart and 3.09 percent white ear head in demonstration plots as compared to farmer practice plots with i.e., 5.37 percent dead heart and 5.61 percent white ear head.

Similarly, *Metarhizium anisopliae* was found to be very effective against plant hoppers, with a low incidence observed in demonstration plots. (white backed plant hopper- 2.14 no./hill and brown plant hopper- 2.37 no./hill) as compared to farmer practice plots (white backed plant hopper- 2.67 no./hill and brown plant hopper- 3.24 no./hill).

Higher grain yield of 36.49 q/ha was harvested from demonstration plots as compared to farmer practice plots (34.08 q/ha). Likewise, demonstration plots had a greater B:C ratio of 1: 2.32 as compared to farmer practice plots (1: 2.03).

Table: Effect of different treatments on incidence of stem borer and plant hopper and yield of rice crop

Treatment No.	Treatment	Incidence of Stem borer (%)		Incidence of Plant hopper (No./hill)		Yield (q/ha)	B:C ratio
		Dead heart	White earhead	White Backed Plant Hopper	Brown Plant Hopper		
T_1	Demonstration Plot	2.70	3.09	2.14	2.37	36.49	2.32
T_2	Farmer Practice	5.37	5.61	2.67	3.24	34.08	2.03
T_1 vs. T_2	't' test	Sig.	Sig.	Sig.	Sig.	Non-Sig.	-
	't' cal	5.86	4.30	2.81	4.22	0.78	

t_{tab} value at 5% level of significance and 24 degrees of freedom = 2.06

Trichogramma spp. have been employed for many years in biological management of lepidopteran pests. They have been used for inundative releases by preparing Tricho-cards. Tricho-cards have a layer of sticky substance which has pasted onto them, eggs of a surrogate host infested with Trichogramma. The trichocard have to be cut into small pieces and released in main field. *Trichogramma japonicum* is a minute wasp or parasitoid which lays around 100,000 to 120,000 eggs during its life cycle. It is the most effective biological management approach for rice stem borer, the most common pest infesting paddy crops. Adult parasitoids mate shortly after emergence, and a single female wasp is capable of parasitizing up to 50 eggs in her adult life span of 3–14 days. It destroys lepidoptera eggs by putting one or more of its own eggs inside the much bigger lepidopteran eggs. The *Trichogramma* egg hatches into a small larva, which feeds and develop inside the moth eggs ultimately killing the host egg. *Trichogramma* lays its eggs inside the eggs of moths preventing the moth egg from hatching into a caterpillar. These results are in close proximity with Mohammad (2018) [6] who found that the existence of *T. japonicum* in the field proved to successfully control the population of *Scirpophaga incertulas.*

The general mode of infection of *Metarhizium* spp. comprises six stages in the following order: adhesion, germination, appressorium formation, penetration, colonization of haemolymph, and extrusion and sporulation. The fungus *Metarhizium anisopliae* infects insects that come in contact with it. Once the fungus spores attach to the outer surface of the insect, they germinate and begin to grow. After penetrating the integument of the insect, they grow rapidly inside the insect, causing the insect to die. Entomopathogenic fungus such as *Metarhizium* spp. has been widely studied because of its narrow host range, safety to non target insect, environmental friendliness and easy mass production technology.

These findings are in agreement with the findings of Kiran and Veeranna (2012) [5] who reported that the efficacy of *M. anisopliae* was similar to that of Thiomethoxam and Imidacloprid against BPH. Shaikh and Mohite (2015) revealed that the treatment with *M. anisopliae* with conidial concentration 1 x 10^{10}, 1 x 10^{9} per ml was the most consistently effective and significantly superior over all other fungal treatments throughout the trial followed by *B. bassiana* 1 x 10^{10}, 1 x 10^{9} and *V. lecanii* in reducing the brown plant hoppers population. *M. anisopliae* is superior to *B. bassiana* and *V. lecanii* on 3 DAS and 7 DAS, whereas on 10 DAS, *M. anisopliae* 1 x 10^{10} and *B. bassiana* 1 x 10^{10} recorded 70-80

percent reduction in survival population. Chinniah, *et al.* (2016) [2] revealed that *Metarhizium anisopliae* based liquid formulations (Bio-Magic®1.50%) @ 4000 ml ha^{-1} (84.08 and 83.21 percent) and 2000 ml ha^{-1} (82.76 and 81.62%) statistically on par in terms of efficacy in suppressing the population of BPH after two rounds of application during both the seasons with increase in grain yield of 89.58 and 88.60 percent over untreated check. The lower dose of Biomagic®1.5 LF @ 1500 ml ha^{-1} ranked second in the order of efficacy; however, it was better than the standard check (Quinolphos 25 EC @ 1500 ml ha^{-1}). All the three doses of Biomagic® tested were safer to the natural enemies and were on par with untreated check without any phytotoxic effect. Peng *et al.* (2020) [7] showed that *M. anisopliae* the fungal agent has good potential against the control of rice plant hoppers with no significant effects on rice microbial communities, representing an alternative strategy for the control of rice pests.

Conclusion

The present findings conclude that the four release of *Trichogramma japonicum* @ 50,000 eggs/ha at weekly interval and broadcasting of biopesticide *Metarhizium anisopliae* @ 2.5 kg/ha after withdrawing of water from field was found significantly effective for management of stem borer and plant hoppers, respectively in rice crop on farmers field and getting higher grain yield of rice crop. It could be a viable option for the ecofriendly management of key rice pests under organic farming.

References

1. Brar KS, Singh J, Shenhmar M, Bakhetia DRC, Singh J. Insect and Environment. In: Pajni HR, Tewari PK, Kaur D. (Eds.) Evaluation of *Trichogramma chilonis Ishii* and *T.* japanicum Ashmead for the control of leaf folder and stem borer of rice in Punjab Society of Environment Scientists, Chandigarh; c1999. p. 206-210.
2. Chinniah C, Ravikumar A, Kalyanasundaram M, Parthiban P. Field evaluation of *Metarhizium anisopliae* liquid formulation (Bio-Magic®) against brown plant hopper, *Nilaparvata lugens* Stal on rice. Journal of Biopesticides. 2016;9(2):211-219.
3. Dhaliwal GS, Jindal V, Dhawan AK. Insect pest problems and crop losses: Changing trends. Indian J Ecol. 2010;74:1-7.
4. Garg DK, Kumar P, Singh RN, Pathak M. Role of parasitoid *Trichogramma japonicum* and other natural enemies in the management of yellow stem borer and leaf folder in basmati rice. Indian J Ent. 2002;64:117-123.
5. Kiran R, Veeranna R. Evaluation of bio-pesticide *Metarhizium anisopliae* against brown plant hopper (*Nilaparvatha lugens*) and its efficiency on the improvement of the productivity of paddy. International Journal of Plant Protection. 2012;5(1):81-83.
6. Yunus M. Effectiveness of *Trichogramma japonicum* utilization for biological control agents on *Scirpophaga incertulas* in Indonesia. Asian J Crop Sci. 2018;10(1):31-39.
7. Yifan P, Tang J, Hong M, Xie J. Suppression of rice plant hopper populations by the entomopathogenic fungus *Metarhizium anisopliae* without affecting the rice microbiota. Applied and Environmental Microbiology. 2020;86(21):AEM01337-20.
8. Sangha KS, Shera PS, Sharma S, Kaur R. On-farm impact of egg parasitoid, *Trichogramma* spp. against lepidopteran pests in organic basmati rice. Journal of Biological Control. 2018;32(2):116-120.
9. Shoaib SH, Mohite P. Effect of entomopathogenic fungi against brown plant hopper, *Nilaparvata lugens* (Stal.) (Hemiptera: Delphacidae) infesting rice. International Journal of Science and Research (IJSR). 2015;4(10):905-907. https://www.ijsr.net/search_index_results_paperid.php?id=SUB154890