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Evaluation of bio intensive pest management module against yellow stem borer, *Scirpophaga incertulas* and leaf folder, *Cnaphalocrocis medinalis* on rice crop at Raipur (C.G.)

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Abstract
BIPM methods employed in the present study had an impact on the percent incidence of dead heart, white ear head, leaf folds, natural enemies and yield. The percent damage of dead heart, white ear head and leaffolder were highest (12.60% DH) (15.55% WEH) (7.40% folded leaves) in untreated plots, moderate (6.78% DH) (9.97% WEH) (3.20% folded leaves) in farmer practice and very less (4.29% DH) (7.44% WEH) (1.47% folded leaves) in BIPM practice plots, indicating BIPM modules maintain good diversity and maintains the pest populations below damaging levels. The population of natural enemies *viz.* spider and coccinellid were highest (3.16 spider/hill) (2.20 coccinellid/hill) in untreated plots followed by BIPM (2.26 spider/hill) (1.73 coccinellid/hill) and least (0.81 spider/hill) (0.39 coccinellid/hill) in farmer practice. BIPM practices (32.47 kg/plot) had shown better yields as compared to farmer practices (27.91 kg/plot) and untreated plots (24.36 kg/plot).

Keywords: BIPM, rice, *Scirpophaga incertulas*, *Cnaphalocrocis medinalis*

Introduction

Bio-intensive Pest Management (BIPM) targets proactive measures to update the agricultural environment to deter a pest and to benefit its natural enemies (Dufour, 2001) [7]. Organic farming makes the soil sustainable for organic crop production by enhancing soil organic carbon, upgrading nutrient content, and improving microbial population / enzymatic activity. The current global scenario firmly emphasizes the need to adopt eco-friendly agricultural practices for sustainable food production. In order to produce the maximum crop yield with optimum input level and to sustain soil fertility, it is a prerequisite to use balanced nutrients through organic sources (Gadhave *et al.*, 2016) [10].

Predators and parasitoids are significant biocontrol agents. The most important predators of rice insect pests are coccinellids and spiders. Only spiders constitute 80% of the predatory fauna in the ecosystem of the rice. In rice fields, host insect population reduction has been reported by various species of spider. The utilization of synthetic compounds is the most favored approach for the control of insect pests. However, extreme and indiscriminate utilization of chemical pesticides has contaminated nature, yet in addition, influenced the health of non-target living beings, including humans. An improved awareness about environmentally safe food has stimulated organic farming.

BIPM is a systems approach that deals with pest management based on an understanding of pest ecology. It starts with steps to precisely analyze the nature and source of pest difficulties. Then, it depends on various preventive strategies and biological controls to maintain pest populations within acceptable limits. Pesticides at reduced risk use different strategies have not been sufficiently compelling, if all else fails, and with care to limit dangers. BIPM targets proactive measures to update the agricultural environment to deter a pest and to benefit its natural enemies. (Dufour, 2001) [7].

Materials and Methods

To observed the seasonal incidence of insect pests on rice crop, weekly populations were recorded on randomly selected 10 plants starting from their appearance till the harvesting of the crop. The population of *Scirpophaga incertulas*, and *Nymphula depunctalis* were recorded by visual observing at weekly intervals on randomly selected 10 plants and expressed in per hill basis.

Also observed the population of natural enemies on rice crop, weekly populations were recorded on randomly selected 10 plants starting from their appearance till the harvesting of the crop.

The percent of yellow stem borer damage were calculated by using following formula:

$$\%\ \text{Dead heart} = \frac{\text{Number of dead hearts / hill}}{\text{Total number of tillers/ hill}} \times 100$$

$$\%\ \text{White ear head} = \frac{\text{Number of white ear heads/ hill}}{\text{Total number of panicles/ hill}} \times 100$$

The percent of leaffolder damaged leaves (LFDL) were calculated by using following formula:

$$\%\ \text{LFDL} = \frac{\text{Number of damaged leaves/ hill}}{\text{Total number of leaves/ hill}} \times 100$$

BIPM	Farmer practice	Control
Seed treatment with *Trichoderma harzianum* (1:10) @ 15 gm/kg of seeds	Spray of Chlorocyper (Chloropyriphos 50% EC + Cypermethrin 5% EC) @ 2 ml/lit water	Untreated
Seedling dip with *Pseudomonas fluorescence* (1:10) 2% solution	Seed treatment with Carbendazim 50% WP @ 2g/kg seed	
Spray of neem oil 1500 PPM @ 3 ml/litre at 45 and 65 DAT against foliar pests		
Release of *Trichogramma chilonis* and *Trichogramma japonicum* @ 1,00,000/ha (5cc eggs/ha) (5 releases were made during the season) at 10 days interval starting from 25 DAT for stem borer and leaffolder infestation		

Results and Discussion

The percent incidence of dead hearts appeared during 34th SMW i.e., 3rd week of August with a mean percent incidence of 4.89% per hill. The percent incidence of dead hearts build up gradually and reached to its peak in the 39th SMW, afterwards the percent incidence of dead hearts declined.

The percent incidence of white ear heads appeared during 45th SMW i.e., 2nd week of November with a mean percent incidence of 7.37% per hill. The percent incidence build up gradually and reached to its peak in the 47th SMW, afterwards the percent incidence of white ear heads declined gradually.

In case of dead heart, the lower damage percent found in T_1-BIPM practice (5.98%) as compare to T_2-farmer practice (6.11%) and T_3-control (12.61%). Both treatments (T_1-BIPM practice and T_2-farmer practice) are significantly better than untreated plots.

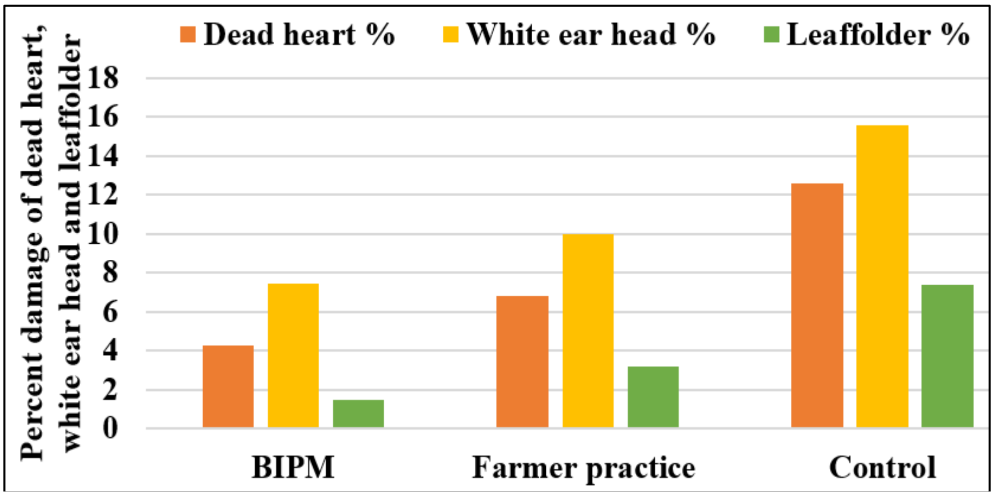
In case of white ear head, the lower damage percent found in T_1-BIPM practice (7.81%) as compare to T_2-farmer practice (8.98%) and T_3-control (15.55%). Both treatments (T_1-BIPM practice and T_2-farmer practice) are significantly better than untreated plots.

The rice leaffolder appeared during 34th SMW i.e., 4th week of August with a mean percent leaf damage of 2.20% per hill. The percent incidence build up gradually and reached to its peak in the 40th SMW, after the percent leaf damage of leaffolder declined gradually.

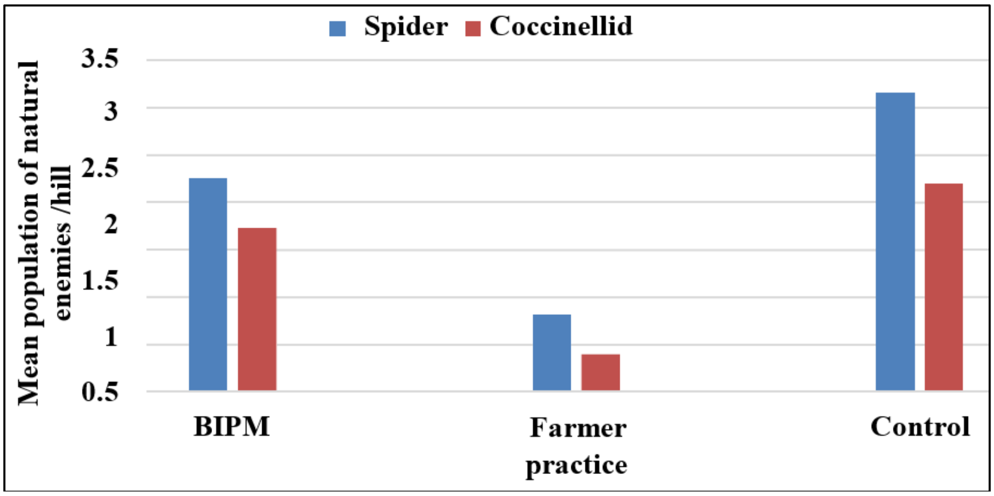
The lower damage percent found in T_1-BIPM practice (2.10%) as compare to T_2-farmer practice (2.59%) and T_3-control (7.42%). Both treatments (T_1-BIPM practice and T_2-farmer practice) are significantly better than untreated plots.

The results indicated that the natural enemies *viz.* spider and coccinellid in *kharif* is highest (3.16 spider/hill) (2.20 coccinellid/hill) in untreated plots followed by BIPM (2.26 spider/hill) (1.73 coccinellid/hill) and least (0.81 spider/hill) (0.39 coccinellid/hill) in farmers' practice.

BIPM practices (32.47 kg/plot) had shown better yields as compared to farmer practices (27.91 kg/plot) and untreated plots (24.36 kg/plot). Thus, rice producers can rely on BIPM practices for sustainable and ecofriendly crop production.



Percent damage of dead heart, white ear head and leaf folder



Mean population of natural enemies /hill

Table 1: Percent reduction over control of yellow stem borer and leaffolder during *Kharif* 2023

Treatment	Yellow stem borer				Leaf folder %	Percent reduction over control
	Dead heart (%)	Percent reduction over control	White ear head (%)	Percent reduction over control		
T_1 (BIPM)	4.29 (11.94)	65.96	7.44 (15.82)_	52.16	1.47 (6.97)	80.14
T_2 (FP)	6.78 (15.04)	46.19	9.97 (18.28)	35.88	3.20 (10.30)	56.76
T_3 (Untreated)	12.60 (20.78)		15.55 (23.21)		7.40 (15.79)	
CD	0.890		0.575		0.519	
SE(m) ±	0.448		0.188		0.169	

Table 2: Overall mean population of natural enemies during *Kharif* 2023

Treatment	Spider	Coccinellid
T_1 (BIPM)	2.26 (1.75)	1.73 (1.59)
T_2 (FP)	0.81 (1.31)	0.39 (1.17)
T_3 (Untreated)	3.16 (1.99)	2.20 (1.76)
CD	0.436	0.334
SE(m) ±	0.142	0.112

Table 3: Percent increase in yileld over control in all treatments during *Kharif* 2023

Treatment	Grain yield		% increase in yield over control
	(Kg/plot)	(Kg/ha)	35.43
T_1 (BIPM)	32.47	3855.86	
T_2 (FP)	27.91	3302.46	15.99
T_3 (Untreated)	24.36	2847.06	
CD	0.153		
SE(m)±	0.432		

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