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Original Research Article

Efficacy of Biopesticide on Stem Borer and Leaf Folder of Rice in Eastern U.P.

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Yellow stem borers, infestation, Leaf folder, Biopesticide

A B S T R A C T

Agricultural crops are vulnerable to attack number of pests like bacteria, fungi, weed and insects, leading to reduced yield and poor quality of the produce. Synthetic pesticides are highly effective in pest control because only they act on a broad host range but their negative impact on the environment and the overall sustainability of the farming systems. Experiments were conducted to evaluate the compatibility of botanical insecticide evaluation against major insect pest (stem borer, leaf folder) of rice during ws 2017 and 2018. Insect pests and disease infestations are the primary constraints in rice (Oryza sativa.L) production. The rice stem borer and leaf folder causing major loss of production. The experiment consisted of six treatments viz. T1- Camphor Oil @ 1.0ml/l., T2- Cedar wood Oil @ 1.0 ml/l., T3- Eucalyptus Oil @ 1.0 ml/letter, T4- Lemon grass Oil @ 1.0 ml/l., T5- Nemazal @ 1.0 ml/l, and T6- Untreated control. During both the years incidence of yellow stem borer and leaf folder at vegetative stage was below threshold level but at reproductive stage of crop growth incidence of yellow stem borer and leaf folder were observed significantly higher, due to congenial environment for insect pest development and growth. Among Neem azal @ 1.0 ml/l was found most effective against yellow stem borer of rice resulted with lower dead heart % 3.5 (30 DAT), 3.2 (50 DAT) and white ear % 1.9. Neem azal was also found effective to control incidence of leaf folder % 3.5 (30 DAT), 5.1 (50 DAT) and yield kg/ha (4155 kg/ha) followed by Lemon grass oil @ 1.0 ml/l was effective against yellow stem borer of rice resulted with lower dead heart % 6.2 (30 DAT), 5.3 (50 DAT) and white ear 3.3%, and control incidence of leaf folder % 5.9 (30 DAT), 6.6 (50 DAT) and yield kg/ha (3982 kg/ha). The untreated control dead heart % 25.0 (30 DAT), 19.1 (50 DAT) and white ear 13.6%, and incidence of leaf folder % 15.5 (30 DAT), 15.9 (50 DAT) and yield kg/ha (2725 kg/ha).

Introduction

Agriculture is the backbone of the Indian economy and contributes 18% to the GDP. It ensuring food security for more than 1.26 billion Indian populations with diminishing cultivable land resource is a herculean task. Pesticides have been the most effective weapons and play vital role in crop protection against agricultural insect-pests. The increase of the volume in production of rice is an immediate requirement in India due to its

rapidly growing population. However, achieving this task seems impossible due to various obstacles. One of the main problems is the different kind of pest attacks on the rice fields. According to this issue, one of the important rice pests in India is the stem borers are considered the most important rice pests. particular *Scirpophaga incertulas* Walker and *S. innotata* Walker (Lepidoptera: Pyralidae) (Sigsgaard, 2000) . Among stem borers, the yellow stem borer *scirpophaga incertulas* Walker (Lepidoptera: Pyralidae) is the dominant species in India and rice plant are most prone to stem borer infestation at the tillering and flowering stage symptoms while infestation at reproductive stage produces white ear. The infestation at boot leaf stage of the crop sometimes results in heavy loss of grain yield. Rice production and productivity is affected by many biotic and abiotic factor. Insect pest and disease are the major biotic factors limiting rice productivity.

Leaf folder *Cnaphalocrocis medinalis* Guen. (Pyraustidae: Lepidoptera) are now drawing attention to a greater extent. Stem borer is responsible for an annual loss of 10-15% of rice crop with local catastrophic outbreaks causing up to 60% damage (Daryaei, 2005). Damage due to rice leaf folder may sometimes go as high as 60% (Kushwaha and Singh, 1984). 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). 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). (Patil, 1997, Senapati and Panda, 1998; Mathur *et al*., 1999) some of the new granular insecticides have been tried as nursery and main field application for their efficacy against the major pest of rice in kharif season. Eastern Uttar Pradesh. In certain cases it has been recorded to cause 63 to 80 percent yield losses in rice (Rajendaran *et al*., 1986;).The leaf folder larvae cause injury to rice leaves by scrapping folding and webbing them upto 60%.(Prakash and Rao, 1999). Biopesticides define according to the US Environmental Protection Agency (USEPA), biopesticides are pesticides derived from natural materials such as animals, plants, bacteria, and minerals. Biopesticides also include living organisms that destroy agricultural pests. Biochemical pesticides are chemicals either extracted from natural sources or synthesized to have the same structure and function as the naturally occurring chemicals. Biochemical pesticides are distinguished from conventional pesticides both by their structure and mode of action kill or control pests . Use of plant extracts or botanicals is one of the earliest and traditional practices in control of insect pests of crops. Botanicals can play a key role in management of rice pests as they are environment-friendly, safe, renewable and cost effective. Integration of botanicals in rice IPM will reduce pesticide load in environment, prevent insecticide resistance and help in conserving natural enemy populations. Recently some botanical products like Trichocards & neem products proved effective against some insect pest of rice, especially sucking pest (Saxena *et al*., 1986).In the present study use of some biopesticide in the field against rice stem borer and leaf folder the insect pest caused 25 to 30 percent yield loss in rice (Agarwala 1995, Sen 1956 and Shukla *et al*, 1986). Evaluate the efficacy of ready to use neem formulations against the insect pests of rice (Krishnaiah *et al*., 2008). But, studies on impact of neem formulations on natural enemies (i.e., beneficial predators and parasitoids that attack pests) have documented effects ranging from harmless to adverse (Lim Guan Soon and Bottrell, 1994). An alternate spraying of econeem formulation with ecofriendly insecticides

coupled with release of egg parasitoids against leaf folder and monitoring of yellow stem borer with sex pheromone traps resulted in significant reduction of stem borer and leaf folder incidence resulting in highest yield and cost benefit ratio (Karthikeyan *et al*., 2010). Increase in the effectiveness of neem products when combined with insecticides has also been reported (Sharma and Kaul, 2003).

Materials and Methods

The field experiment was conducted during kharif season of 2017 and 2018 in Crop Research Station, Masodha, Ayodhya in Randomized Block Design (RBD) with six treatment ie;T1 T1-Camphor Oil @ 1.0ml/l., T2- Cedar wood Oil @ 1.0 ml/l., T3- Eucalyptus Oil @ 1.0 ml/letter, T4- Lemon grass Oil @ 1.0 ml/l., T5- Nemazal @ 1.0 ml/l, and T6- Untreated control The susceptible rice variety Pusa Basmati-1was sown in nursery 12-18 June in both years. The 22-28 days old seedling were used for transplanting in main field. Transplanting was done at 20x15 cm spacing with recommended dose of fertilizer 120:60:40kg NPK/ha in all treatments. Biopesticides sparing were used as 17,30,43 & 53 days after transplanting. Observations were recorded after 30 days of transplanting, on 10-sample (hills) in each plot. Sample (hills) were chosen diagonally. Number of healthy and infested tillers. The data on stem borer and leaf folder 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 data on grain yield of each plot were recorded separately by threshing the harvested Pusa Basmati 1 on tarpaulin followed by proper sun drying and winnowing, grain yield measured in kilogram. The data so obtain were subjected to statistical analysis after necessary transformation for final statistical analysis (Gomez and Gomez, 1983).

Results and Discussion

It is apparent from Table 1 to 6 that the results with various treatments were significantly different from the untreated check. Infestation of stem borer and leaf folder was higher in kharif 2018 then kharif 2017 due to congenial environment for insect pest development and growth. During kharif 2018 higher humidity was observed due to excess monsoon rainfall.

Percent dead heart and white ear were calculated using the following formula:

$$\text{Dead heart (\%)} = \frac{\text{No. of infested tillers}}{\text{No. of total tillers}} \times \frac{\text{No. of infested hills x100}}{\text{No. of hills in sample area}}$$

The percentage of folded leaves was calculated by using the following formula:

$$\frac{\text{No. of infested leaves (hills)}}{\text{No. of total leaves}} \times \frac{\text{No. of infested hills x100}}{\text{No. of hills in sample area}}$$

During kharif season 2017 and 2018 mean of insect pest under study, the minimum infestation of stem borer DH 30 DAT is (3.5%), 50 DAT (3.2%), white ear% (1.9). and Leaf folder infestation of 30 DAT is (3.5%) and 50 DAT (5.1%) respectively were recorded in treatment in Neem azal both years, and the better grain yield 4155 kg/ha was recorded. While incidence of stem borer had gone to the extent of DH% 25.0, 19.1 and WE% 13.6 and leaf folder % 15.5 (30DAT), 15.9 (50DAT) respectively in unsprayed plots. In check plots reduced grain yield was recorded (2725 kg/ha).The plot treated with had also shown good response with T4- Lemon grass oil @ 2ml/l the incidence of

stem borer DH 30 DAT is (6.2%), 50 DAT (5.3%), white ear% (3.3). and Leaf folder infestation of 30 DAT is (5.9%) and 50 DAT (6.6%) In this treatment grain yield 3982 kg/ha.T3- Eucalyptus oil @ 1.0 ml/l, showed good response stem borer incidence DH is 30 DAT (9.3%), 50 DAT (6.9%), white ear% (4.4). and Leaf folder infestation of 30 DAT is (6.7%) and 50 DAT (7.8%) In this treatment grain yield 3725 kg/ha. In the plot treated with T2- Cedar wood oil @ 1.0 ml/l 28.8% incidence of stem borer DH 30 DAT is (11.2%), 50 DAT (8.6%), white ear% (5.4). and Leaf folder infestation of 30 DAT is (8.7%) and 50 DAT (9.1%) In this treatment grain yield 3475 kg/ha. In the plot treated with T1- Camphor oil @ 1.0 ml/l incidence of stem borer DH 30 DAT is (15.8%), 50 DAT (12.5%), white ear% (8.1). and Leaf folder infestation of 30 DAT is (10.8%) and 50 DAT (10.8%) In this treatment grain yield 3300 kg/ha.

Table.1 Effect of different treatment on Stem Borer(DH) incidence 30 DAT ws. 2017 and 2018

S. No.	Trade Name	Rate ml/ha	Total tiller 30 DAT (2017) 10 hill	Damage Tiller 30 DAT (2017) 10 hill	% DH 30 DAT (2017) 10 hill	Total tiller 30 DAT (2018)	Damage Tiller 30 DAT (2018)	% DH 30 DAT (2018)	Mean % DH
T1	Camphor Oil	1000	52	8	15.4	56	9	16.1	15.8
T2	Cedar wood oil	1000	58	6	10.3	58	7	12.1	11.2
T3	Eucalyptus oil	1000	56	5	8.9	62	6	9.7	9.3
T4	Lemon grass oil	1000	54	3	5.6	60	4	6.7	6.2
T5	Neem azal	1000	58	2	3.4	57	2	3.5	3.5
T6	Untreated Control (water Spary)	1000	49	12	24.5	55	14	25.5	25.0

Table.2 Effect of different treatment on Stem Borer(DH) incidence 50 DAT ws. 2017 and 2018

S. No.	Trade Name	Rate ml/ha	Total tiller 50 DAT (2017)	Damage Tiller 50 DAT (2017)	% DH 50 DAT (2017)	Total tiller 50 DAT (2018)	Damage Tiller 50 DAT (2018)	% DH 50 DAT (2018)	Mean % DH
T1	Camphor Oil	1000	67	9	13.4	69	8	11.6	12.5
T2	Cedar wood oil	1000	69	7	10.1	71	5	7.0	8.6
T3	Eucalyptus oil	1000	71	6	8.5	75	4	5.3	6.9
T4	Lemon grass oil	1000	66	4	6.1	66	3	4.5	5.3
T5	Neem azal	1000	63	3	4.8	68	1	1.5	3.2
T6	Untreated Control (water Spary)	1000	59	10	16.9	61	13	21.3	19.1

Table.3 Effect of different treatment on Stem Borer(WE) incidence ws. 2017 and 2018

S. No.	Trade Name	Rate ml/ha	Total tiller (2017) WE	Damage Tiller WE (2017)	% WE (2017)	Total tiller (2018) WE	Damage Tiller WE (2018)	% WE (2018)	Mean % WE
T1	Camphor Oil	1000	78	6	7.7	82	7	8.5	12.5
T2	Cedar wood oil	1000	82	4	4.9	85	5	5.9	8.6
T3	Eucalyptus oil	1000	85	3	3.5	77	4	5.2	6.9
T4	Lemon grass oil	1000	76	2	2.6	75	3	4.0	5.3
T5	Neem azal	1000	77	1	1.3	83	2	2.4	3.2
T6	Untreated Control (water Spary)	1000	65	9	13.8	60	8	13.3	19.1

Table.4 Effect of different treatment on Leaf folder incidence 30 DAT ws. 2017 and 2018.

S. No.	Trade Name	Rate ml/ha	Total Leaf 30 DAT (2017)	Damage Leaf 30 DAT (2017)	% Leaf Folder (2017)	Total Leaf 30 DAT (2018)	Damage Leaf 30 DAT (2018)	% Leaf Folder 30 DAT (2018)	Mean % Leaf Folder
T1	Camphor Oil	1000	225	23	10.2	229	26	11.4	8.1
T2	Cedar wood oil	1000	229	19	8.3	232	21	9.1	5.4
T3	Eucalyptus oil	1000	232	15	6.5	245	17	6.9	4.4
T4	Lemon grass oil	1000	241	13	5.4	240	15	6.3	3.3
T5	Neem azal	1000	224	7	3.1	231	9	3.9	1.9
T6	Untreated Control (water Spary)	1000	217	33	15.2	221	35	15.8	13.6

Table.5 Effect of different treatment on Leaf folder incidence 50 DAT ws. 2017 and 2018.

S. No.	Trade Name	Rate ml/ha	Total Leaf 50 DAT (2017)	Damage Leaf 50 DAT (2017)	% Leaf Folder (2017)	Total Leaf 50 DAT (2018)	Damage Leaf 50 DAT (2018)	% Leaf Folder 50 DAT (2018)	Mean % Leaf Folder
T1	Camphor Oil	1000	256	29	11.3	263	27	10.3	10.8
T2	Cedar wood oil	1000	263	26	9.9	266	22	8.3	8.7
T3	Eucalyptus oil	1000	271	23	8.5	273	19	7.0	6.7
T4	Lemon grass oil	1000	275	19	6.9	270	17	6.3	5.9
T5	Neem azal	1000	266	12	4.5	262	15	5.7	3.5
T6	Untreated Control (water Spary)	1000	249	39	15.7	256	41	16.0	15.5

Table.6 Effect of different treatment on yield kg/ha ws. 2017 and 2018.

S. No.	Trade Name	Rate ml/ha	Yield Kg/ha (2017)	Yield kg/ha 2018	Mean
T1	Camphor Oil	1000	3210	3390	3300
T2	Cedar wood oil	1000	3440	3510	3475
T3	Eucalyptus oil	1000	3659	3790	3725
T4	Lemon grass oil	1000	3910	4054	3982
T5	Neem azal	1000	4050	4260	4155
T6	Untreated Control (water Spary)	1000	2660	2790	2725

All these biopesticide were found effective in checking in insect pest severity and incidence over untreated control and increased the grain yield of rice at various extent. Neem azal was found best in the insect pest and increase the grain yield of rice over check, flowed by Lemon grass oil over check minimization of insect pest severity may be one of the possible reasons for enhancement of grain yield by the spraying of these biopesticide and safe the environment .

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