INFESTATION SUPPRESSION UNDER EVALUATION OF ECOFRIENDLY INSECTICIDES AGAINST MAJOR INSECT PESTSOF RICE IN EASTERN UTTAR PRADESH CONDITIONS

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

ABSTRACT

The present study was undertaken to analysis thesuppression of infestation over check plot under evaluation of ecofriendly insecticidesagainst major insect pests of rice ineastern Uttar Pradesh conditions for the two consecutive years (2014 and 2015) at farmer field of district Deoriaunder the supervision of Department of Entomology, B.R.D.P.G. College, Deoria, Uttar Pradesh, India.There were 10 treatments (09 insecticides + 01 check) evaluated under randomized block design (RBD) by transplanting method of rice cultivation on localized popular rice cultivar Samba Mahsuri (BPT-5204). The insecticide treatments comprise 9 insecticides (CartapHcl, 50 SP, Indoxacarb 14.5 SC, Imidacloprid 17.8 SL, Chlorpyriphos 20 EC, Thiamethoxam 25 WG, Chlorantraniliprole 18.5 SC, Azadirachtin (Neem Oil) 0.03 EC, *Bacillus thuringiensis kurstaki*(Btk) 3.5 WP, and combination of Neem Oil 0.03 EC + Btk 3.5 WP).This evaluation was observed most effective ecofriendly insecticides concerned to lowest infestation, highest suppression of infestation over check plot, and highest yield. The inferences of suppression over check plot and yield of rice crop were based on non-significant ecofriendly insecticides for lowest infestation.There were 2 insecticides (CartapHcl and Imidacloprid) inference non-significant for highest suppression of infestation over check. There were 3 insecticides (CartapHcl, Imidacloprid, and Neem Oil + Btk) inference non-significant for lowest infestation and highest yield respectively. The mean ranking and inference of suppression over check were similar to inference of non-significant ecofriendly insecticides for lowest infestation as, Imidacloprid, CartapHcl, and Neem Oil + Btk respectively.

*Key words:*Infestation suppression, Ecofriendly insecticides, Major Insect Pests of rice, Eastern Uttar Pradesh, India.

1. INTRODUCTION

Rice (Oryza sativa Linn.) is one of the moststaple foods of the world as well as India.[18; 16; 8; 12; 26]The rice productionprovides livelihood and food security to the about half of the world population and more than half of the India population.It is mostly produced and consumed in Asian countries.The rice fragrance makes meal delicious to the entire world.[5; 17; 10]India shares, 22.46 % (109.7 mt) of the world rice production (488.31 mt) and occupies second position after China, 28.18% (137.64 mt). [5; 17; 10]The Uttar Pradesh state shares, 12.53 % (13.75 mt)of the national rice production ofIndia occupies second position followed by West Bengal state (17%) and first position in rice production area. [5; 17; 10]Being occupying first position in rice crop area,the Uttar Pradesh state is not standing onhighest rice production in India. The major concern of this lower production of rice is non-modern approach of production and crop stress. Theinsect pestsare major biotic stresses of rice. The rice crop losses caused by insect pests have been sharing about 60 to 95 % over the world and about 21 to 51 % in the India respectively.[18; 16; 8; 12; 26]There are about 800 insect pest species infesting rice crop over the world.Being the most favorable environment congenial for rice production and proliferation for insect pests, there are about 250 insect pest species infesting rice crop in India.Among 20 major insect pests of rice ofmajor economic significance, there have been recognized12 of national significance and 08 of regional significance respectively. The infestation of rice insect pests effects every growth stage and plant parts of rice. [18; 12; 26].

Insect pest management is the continuous process varied among complex ecosystem of nature. The regular efforts are necessary to develop effective strategy for insect pest management with particular agroecosystem under changing climatic conditions. [18; 12; 26]Being practicing modern approaches of rice production in India, Most of the farmers are applying rice insect pest management practicesas finishing approach of insect pests without considering the significant role of bioagents in suppression of insect pests infestations.[12; 26]Being the most effective role of pesticides in the pest management, chemical insecticides are continuously applying pesticides for insect pest management in rice crop production. [12; 26]The augmentation of crop production needs pesticides as essential inputs has been universally considered. The insecticides application always be perceived last resort for insect pest management.[12; 26]The scientific community have been continuously evaluating the efficacy for various insecticides including conventional and novel chemical insecticides and biorational insecticides forecofriendly pest management. The evaluation of efficacy of novel chemical and biorational insecticides have been reported scanty for ecofriendlypest management under eastern Uttar Pradesh conditions.Therefore, the present research work was conducted the evaluation of efficacy of novel chemical and biorational insecticidesfor effective ecofriendly pest management based on market availability and scientific community thrustunder Eastern Uttar Pradesh conditions.

Chakraborty [2] and Chakraborty and Deb [3] both have been studied that, theinfestations ofyellow stemborer (*Scirpophagaincertulus* Walker) and common rice leaffolder(*Cnaphalocrocismedinalis*Guenee)werelowered byImidacloprid.Kulagod et al.[14] have beenfound that,the infestations ofyellow stemborer(*Scirpophagaincertulus* Walker) and common rice leaffolder(*Cnaphalocrocismedinalis*Guenee)werelowered by biorationals as Azadirachtin and *Bacillus thuringiensis,* Berliner (Bt) formulations.Rath et al.[23] have beenobserved that,theinfestations ofyellow stemborer (*Scirpophagaincertulus* Walker)and rice earhead bug(*Leptocorisa acuta*

Thunberg)were recorded lowest in Imidaclopridand highest grain yield was recorded inThiamethoxam treated plots.Sarao et al.[24] andTigga et al.[28] have beenstudiedthat, theinfestation ofyellow stemborer(*Scirpophagaincertulus*Walker) andrice earhead bug(*Leptocorisa acuta* Thunberg) werelowered by Imidacloprid.

2. MATERIALS AND METHODS

The present study was undertaken to analysis the suppression of infestation over check plot under evaluation of ecofriendly insecticides against major insect pests of rice in Eastern Uttar Pradesh conditions for the two consecutive years (2014 and 2015) at farmer field of district Deoriaunder the supervision of Department of Entomology, B.R.D.P.G. College, Deoria, Uttar Pradesh, India.There were 10 treatments (09 insecticides + 01 check) evaluated under randomized block design (RBD) by transplanting method of rice cultivation on localized popular rice cultivar 'Samba Mahsuri (BPT-5204)'. The insecticide treatments comprise 9 insecticides (CartapHydrochloride (CartapHcl), 50 SP, Indoxacarb 14.5 SC, Imidacloprid 17.8 SL, Chlorpyriphos 20 EC, Thiamethoxam 25 WG, Chlorantraniliprole 18.5 SC, Azadirachtin (Neem Oil) 0.03 EC, *Bacillus thuringiensis kurstaki*(Btk) 3.5 WP, and combination of Neem Oil 0.03 EC + Btk 3.5 WP). This confined spot of study, represents theconductive environment for survival and proliferation of insect pests in rice ecosystem under Eastern Uttar Pradesh conditions. The Spray formulations selected as recommended for lowland rice ecosystems to avoid leaching and toxicity to beneficial soil inhabitants of granular formulations despite effectivity. Application of insecticides spraying were taken for two times at 30 days and 45 days after transplanting (30 DAT and 45 DAT). Samples were taken 03 times at 03, 07 and 14 days after spraying per spray of insecticides and single sample before first spray of insecticides respectively. The duration of rice crops started from pre week of August to mid-week of November for about 110 days. There were 5 samples collected per plot at the size of 20 m^2. Each plot was selected 5 spots (4 in the corner and one in the center) at 01 hill/spot to observe infestation, and also at each plot, 05 net sweeps were made randomly at every 05 steps to observe abundance of insect pest species. The spraying of insecticides was made by manually operated knapsack sprayer with hollow cone nozzle @ 500 l/ha spray volume. The timing of sampling was 9.30 A.M. to 12.30 P.M. and timing of spraying was 2.30 P.M. to 4.30 P.M. respectively.Each observation was recorded % infestation of major insect pestsand yield of rice crop to evaluate efficacy of treated ecofriendly insecticides.This observation was analyzed the suppression ofinfestation over check plotof major insect pests of rice during evaluation most effective ecofriendly insecticides concerned to lowest infestationand highest yield respectively.

Surveillance was conducted as per methodology of agroecosystem analysis (AESA) (Pontius et al. [19]) modified as accessibility. Taxonomic identification was verified with texts of reference, *i.e.*, Dale [6], Barrion and Litsinger[1], Pathak and Khan [18], David and Ananthakrishnan[7]; Rice knowledge management portal (RKMP); and Subject experts respectively. The statistical inferences were verified with texts of reference, *i.e.*, Dhamu& Ramamoorthy [9], and Rangaswamy[21].The formula of suppression of infestation over check was adopted as follows,

1. Suppression of infestation over check (%) =

(% of Infestation in treated plot over thecheck plot - 100)

2. % of Infestation in treated plot over the check plot =

$$\frac{\text{Infestation of insect pest in treated plot x100}}{\text{Infestation of insect pest in check plot}}$$

3. RESULTS AND DISCUSSION

The suppression of infestation over check plot was observed under evaluation of efficacy of some novel ecofriendly insecticides oninfestation of major insect pests of rice for the two consecutive years 2014 and 2015 respectively. The infestations of major insect pests of rice were observed for most serious insect pests, which were 1.Yellow stemborer (*Scirpophagaincertulus* Walker), 2.Common rice leaffolder (*Cnaphalocrosismedinalis*Guenee), 3.Brown planthopper (*Nilaparvatalugens*Stal), 4.Rice hispa (*Dicladispaarmigera* Oliver), and 5.Rice earhead bug (*Leptocorisa acuta* Thunberg).Of the total observed evaluation of ecofriendly insecticideson infestation of major insect pests of rice for pooled of both the years 2014 and 2015 were inference non-significant for highest suppression over check (SPOC) as, 3 insecticides (CartapHcl, Imidacloprid, and Neem Oil + Btk) for Yellow stemborer (*Scirpophagaincertulus* Walker), Common rice leaffolder (*Cnaphalocrosismedinalis*Guenee), and Brown planthopper (*Nilaparvatalugens*Stal); 1 insecticide (Imidacloprid) for Rice hispa (*Dicladispaarmigera* Oliver); and 2 insecticides (Imidacloprid and Chlorpyriphos) for Rice earhead bug (*Leptocorisa acuta* Thunberg) respectively. (Table and Figure 1).

Of the total observed evaluation of ecofriendly insecticides against major insect pests of rice under suppression over check (SPOC) for pooled of both the years 2014 and 2015, there were 3 insecticides (CartapHcl, Imidacloprid, and Neem Oil + Btk) inference non-significant for highest suppression over check (SPOC) under first application (30 DAT) and second application (45 DAT), based on evaluation of non-significant ecofriendly insecticides for lowest infestation as, CartapHcl, Imidacloprid, and Neem Oil + Btk respectively. The mean of evaluation under suppression over check was observed as, 2 insecticides (CartapHcl and Imidacloprid) inference non-significant for highest suppression over check under mean of first application and second application, based on mean evaluation of non-significant ecofriendly insecticides for lowest infestation as, CartapHcl, Imidacloprid, and Neem Oil + Btk respectively. Of the total observed infestation of major insect pests of rice for pooled of both the years 2014 and 2015, there were 3 insecticides (CartapHcl, Imidacloprid, and Neem Oil + Btk) inference non-significant for lowest infestation under first application (30 DAT); and 4 insecticides (CartapHcl, Imidacloprid, Chlorantraniliprole, and Neem Oil + Btk) inference non-significant for lowest infestation under second application (45 DAT) respectively.The mean of evaluation was observed as, 3 insecticides (CartapHcl, Imidacloprid, and Neem Oil + Btk) inference non-significant for lowest infestation under mean of major insect pests of rice and mean of first application and second application; and along with 3 insecticides (CartapHcl, Imidacloprid, and Neem Oil + Btk) were also inference non-significant for highest yield respectively.Of the most effective

ecofriendly insecticidesobserved on infestation of major insect pests of rice for pooled of both the years 2014 and 2015, there were 2 insecticides (CartapHcl and Imidacloprid) inference non-significant for highest suppression over check (SPOC); 3 insecticides (CartapHcl, Imidacloprid, and Neem Oil + Btk) inference non-significant for lowest infestation; and 3 insecticides (CartapHcl, Imidacloprid, and Neem Oil + Btk) inference non-significant for highest yield for mean of major insect pests of rice respectively. (Table and Figure 2).

The ranking of evaluation under suppression over check was observed as, Imidacloprid >CartapHcl> Neem Oil + Btk> Chlorantraniliprole > Indoxacarb > Chlorpyriphos > Thiamethoxam > Neem Oil >Btkfor highest suppression over check; Imidacloprid >CartapHcl> Neem Oil + Btk> Chlorantraniliprole > Indoxacarb > Chlorpyriphos > Thiamethoxam > Neem Oil >Btkfor lowest infestation;CartapHcl> Imidacloprid > Neem Oil + Btk> Chlorantraniliprole > Indoxacarb > Chlorpyriphos > Neem Oil > Thiamethoxam >Btkfor highest yield; and Imidacloprid >CartapHcl> Neem Oil + Btk> Chlorantraniliprole > Indoxacarb > Chlorpyriphos > Thiamethoxam > Neem Oil >Btkfor mean of infestation, suppression over check (SPOC), and yield respectively. (Table 3). Similar findings were reported byChakraborty [2],Chakraborty and Deb [3], Kulagod et al. [14], CRRI [4],Rath et al.[23],Sarao et al. [24] and Tigga et al. [28].

Table 1. Mean Evaluation of Ecofriendly Insecticides for Major Insect Pests (Pooled of 2014 &15)* (% Infestation (Infestation) and % Suppression of Infestation over Check (SPOC))

Treatments	Yellow Stemborer	Common Rice Leaffolder	Brown Planthopper	Rice Hispa	Rice Earheadbug	Total Mean SPOC DAAp	Total Mean Infestation DAAp
	SPOC	SPOC	SPOC	SPOC	SPOC		
1.Cartap Hcl	61.85 $^{1\,NS}$ (7.87)	53.19 $^{1\,NS}$ (7.28)	40.04 $^{2\,NS}$ (6.36)	49.59 (7.05)	69.62 (8.32)	54.86 $^{2\,NS}$ (7.38)	3.39 $^{2\,NS}$ (1.91)
2.Indoxacarb	50.63 (7.10)	39.27 (6.23)	26.87 (5.20)	37.39 (6.12)	69.02 (8.29)	44.64 (6.59)	4.16 (2.09)
3.Imidacloprid	59.45 $^{2\,NS}$ (7.73)	48.97 $^{3\,NS}$ (7.00)	41.81 $^{1\,NS}$ (6.50)	50.83 $^{1\,NS}$ (7.14)	75.95 $^{2\,NS}$ (8.71)	55.41 $^{1\,NS}$ (7.44)	3.38 $^{1\,NS}$ (1.90)
4.Chlorpyriphos	43.15 (6.55)	25.32 (5.03)	28.94 (5.42)	34.98 (5.93)	83.91 $^{1\,NS}$ (9.18)	42.71 (6.38)	4.39 (2.12)
5.Thiamethoxam	46.51 (6.78)	33.75 (5.79)	26.74 (5.21)	33.58 (5.80)	66.18 (8.11)	41.43 (6.35)	4.41 (2.14)
6.Chlorantraniliprole	52.01 (7.22)	38.99 (6.24)	33.57 (5.83)	41.93 (6.48)	63.41 (7.92)	46.72 (6.74)	4.03 (2.06)
7.Neem Oil	41.08 (6.39)	28.78 (5.36)	29.61 (5.48)	38.07 (6.17)	54.21 (7.30)	38.91 (6.18)	4.52 (2.18)
8.Btk	48.65 (6.96)	36.09 (6.00)	23.85 (4.92)	31.16 (5.58)	41.57 (6.39)	36.47 (5.99)	4.65 (2.21)
9.Neem Oil + Btk	58.97 $^{3\,NS}$ (7.69)	50.63 $^{2\,NS}$ (7.10)	38.21 $^{3\,NS}$ (6.22)	46.66 (6.83)	55.36 (7.38)	49.97 (7.04)	3.68 $^{3\,NS}$ (1.98)
10.Untreated Check	–	–	–	–	–	–	7.27 (2.73)
$SE_{(m)}$	0.15	0.15	0.14	0.02	0.20	0.04	0.03
CD $_{(5\%)}$	0.45	0.46	0.41	0.05	0.59	0.11	0.08
CV $_{(\%)}$	2.96	3.47	3.40	0.38	3.50	0.78	1.90

* Values in parentheses are square root transformation ($\sqrt{(x + 0.5)}$) for uniform sample size (Steel and Torrie[27]); 1,2,3 numerals are rank orders and NS stands for non-significant respectively; Comparison of all data respective to the non-significant lowest insect pest infestation.

Figure 1. Mean 1 Evaluation of Ecofriendly Insecticides for Major Insect Pests (Pooled of 2014 & 15). (% Infestation (Infestation) and % Suppression of infestation over Check (SPOC))

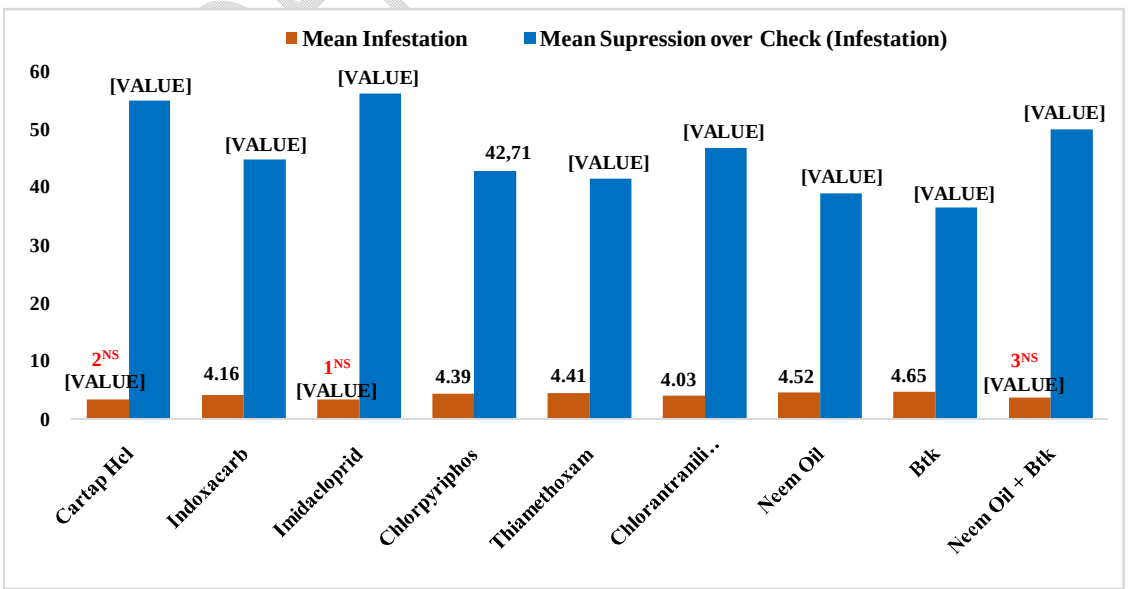

Table 2. Mean Evaluation of Ecofriendly Insecticides for Major Insect Pests (Pooled of 2014 &15)* (% Infestation (Infestation) and % Suppression of Infestation over Check (SPOC))

Treatments	First Application (Mean)		Second Application (Mean)		Total Mean SPOC DAAp	Total Mean Infestation DAAp	Mean Yield (q/ha)
	SPOC	Infest	SPOC	Infest			
1.Cartap Hcl	48.96 $^{2\ NS}$ (6.98)	4.26 $^{2\ NS}$ (2.10)	60.75 $^{1\ NS}$ (7.77)	2.52 $^{1\ NS}$ (1.71)	54.86 $^{2\ NS}$ (7.38)	3.39 $^{2\ NS}$ (1.91)	35.00 $^{1\ NS}$
2.Indoxacarb	39.58 (6.22)	5.10 (2.27)	49.70 (6.96)	3.22 (1.90)	44.64 (6.59)	4.16 (2.09)	31.74
3.Imidacloprid	50.59 $^{1\ NS}$ (7.08)	4.23 $^{1\ NS}$ (2.08)	60.22 $^{2\ NS}$ (7.75)	2.58 $^{2\ NS}$ (1.73)	55.41 $^{1\ NS}$ (7.44)	3.38 $^{1\ NS}$ (1.90)	34.80 $^{2\ NS}$
4.Chlorpyriphos	38.14 (6.03)	5.37 (2.31)	48.38 (6.81)	3.52 (1.97)	42.71 (6.38)	4.39 (2.12)	31.72
5.Thiamethoxam	36.63 (5.96)	5.35 (2.32)	46.08 (6.72)	3.43 (1.95)	41.43 (6.35)	4.41 (2.14)	31.37
6.Chlorantraniliprole	41.32 (6.39)	4.87 (2.23)	52.20 $^{4\ NS}$ (7.09)	3.18 $^{4\ NS}$ (1.90)	46.72 (6.74)	4.03 (2.06)	31.75
7.Neem Oil	33.37 (5.75)	5.41 (2.35)	44.33 (6.53)	3.53 (1.99)	38.91 (6.18)	4.52 (2.18)	31.39
8.Btk	32.11 (5.65)	5.45 (2.36)	40.42 (6.30)	3.82 (2.06)	36.47 (5.99)	4.65 (2.21)	31.18
9.Neem Oil + Btk	43.49 $^{3\ NS}$ (6.60)	4.52 $^{3\ NS}$ (2.17)	56.44 $^{3\ NS}$ (7.48)	2.83 $^{3\ NS}$ (1.80)	49.97 (7.04)	3.68 $^{3\ NS}$ (1.98)	34.28 $^{3\ NS}$
10.Untreated Check	–	7.92 (2.83)	–	6.61 (2.63)	–	7.27 (2.73)	31.02
SE $_{(m)}$	0.20	0.04	0.24	0.06	0.04	0.03	0.25
CD $_{(5\%)}$	0.56	0.12	0.69	0.18	0.11	0.08	0.72
CV $_{(\%)}$	6.98	4.05	7.74	7.26	0.78	1.90	1.33

* Values in parentheses are square root transformation ($\sqrt{(x + 0.5)}$) for uniform sample size (Steel and Torrie[27]); 1,2,3 numerals are rank orders and NS stands for non-significant respectively; Comparison of all data respective to the non-significant lowest insect pest infestation.

Figure 2. Mean Evaluation of Ecofriendly Insecticides for Major Insect Pests (Pooled of 2014 & 15). (% Infestation (Infestation) and % Suppression of infestation over Check (SPOC))

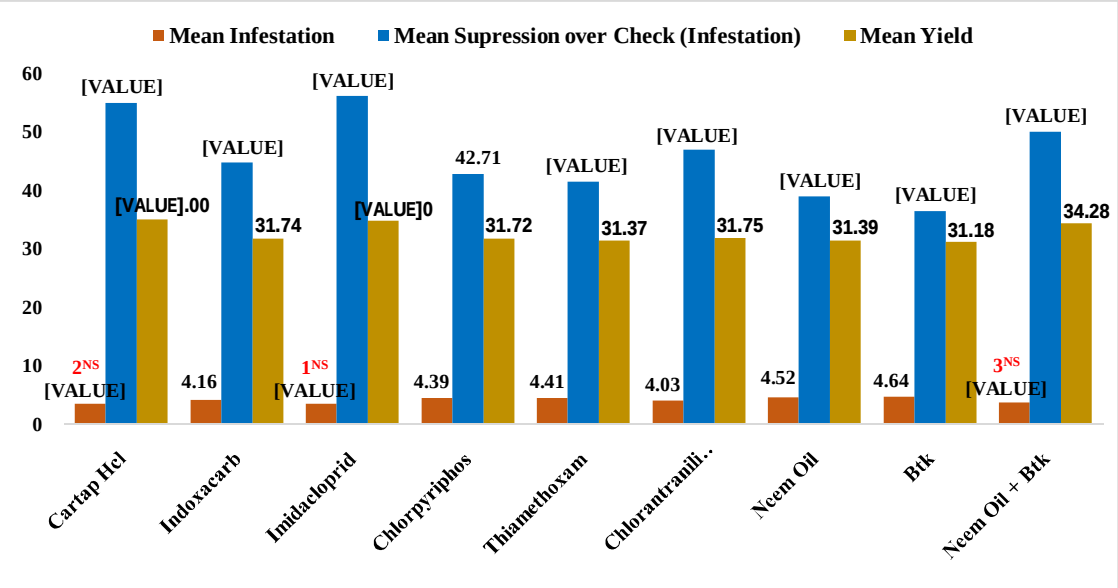

Table 3. Rank Evaluation of Ecofriendly Insecticides for Major Insect Pests (Pooled of 2014 &15)* (Infestation/ SPOC/ Yield/ Mean)

Rank	Infestation (%) (Lowest)	SPOC (%) (Highest)	Yield (q/ ha) (Highest)	Mean Rank
1	**Imidacloprid** **3.38** [1 NS] (1.90)	**Imidacloprid** **55.41** [1 NS] (7.44)	**CartapHcl** **35.00** [1 NS]	**Imidacloprid** **1.33** [1 NS]
2	**CartapHcl** **3.39** [2 NS] (1.91)	**CartapHcl** **54.86** [2 NS] (7.38)	**Imidacloprid** **34.80** [2 NS]	**CartapHcl** **1.67** [2 NS]
3	**Neem Oil + Btk** **3.68** [3 NS] (1.98)	**Neem Oil + Btk** **49.97** (7.04)	**Neem Oil + Btk** **34.28** [3 NS]	**Neem Oil + Btk** **3.00** [3 NS]
4	**Chlorantraniliprole** **4.03** (2.06)	**Chlorantraniliprole** **46.92** (6.76)	**Chlorantraniliprole** **31.75**	**Chlorantraniliprole** **4.00**
5	**Indoxacarb** **4.16** (2.09)	**Indoxacarb** **44.64** (6.59)	**Indoxacarb** **31.74**	**Indoxacarb** **5.00**
6	**Chlorpyriphos** **4.39** (2.12)	**Chlorpyriphos** **42.71** (6.38)	**Chlorpyriphos** **31.72**	**Chlorpyriphos** **6.00**
7	**Thiamethoxam** **4.41** (2.14)	**Thiamethoxam** **41.43** (6.35)	**Neem Oil** **31.39**	**Thiamethoxam** **7.33**
8	**Neem Oil** **4.52** (2.18)	**Neem Oil** **38.91** (6.18)	**Thiamethoxam** **31.37**	**Neem Oil** **7.67**
9	**Btk** **4.65** (2.21)	**Btk** **36.47** (5.99)	**Btk** **31.18**	**Btk** **9.00**
$SE_{(m)}$	**0.03**	**0.04**	**0.25**	**–**
CD (5%)	**0.08**	**0.11**	**0.72**	**–**
CV (%)	**1.90**	**0.78**	**1.33**	**–**

***** Values in parentheses are square root transformation ($\sqrt{(x + 0.5)}$) for uniform sample size (Steel and Torrie[27]); 1,2,3 numerals are rank orders and NS stands for non-significant respectively; Comparison of all data respective to the non-significant lowest insect pest infestation.

Present research work was adopted the non-significant lowest infestation for observation of highest suppression of infestation over check plot as scale to confined efficacy of insecticides as ecofriendly. There were 3 insecticides (CartapHcl, Imidacloprid, and Neem Oil + Btk) inference non-significant for lowest infestation and highest yield respectively. Though, CartapHcl was being most effective insecticides for major insect pests of rice among 3 insecticides (CartapHcl, >Imidacloprid>Neem Oil + Btk) as inference non-significantly for highest yield, butthis observation was changed in highest suppression of infestation over check plot most effectively as, Imidacloprid >CartapHcl> Neem Oil + Btk respectively. The mean ranking and inference of suppression over check were similar to inference of non-significant ecofriendly insecticides for lowest infestation as, Imidacloprid>CartapHcl>Neem Oil + Btk respectively. Though, all these 3 insecticides were being most effective ecofriendly insecticides as, the Imidacloprid and CartapHcl arethe chemical insecticides, while Neem Oil + Btkare the biological insecticides (biorationals). Hence, Neem Oil + Btk as biorationals primarily would be the best choice before Imidacloprid and CartapHcl for the ecofriendly management of major insect pests of rice.Similar recommendation has also been reported by Schoenly et al. [25], Heong et al. [13], Gallagher et al. [11], Norton et al. [15], Prakash et al. [20], Heinrichs and Muniappan[12] and Rao [22].

4. CONCLUSION

The infestations of major insect pests of rice were observed for most serious insect pests, which were 1.Yellow stemborer (*Scirpophagaincertulus* Walker), 2.Common rice leaffolder (*Cnaphalocrosismedinalis*Guenee), 3.Brown planthopper (*Nilaparvatalugens*Stal), 4.Rice hispa (*Dicladispaarmigera* Oliver), and 5.Rice earhead bug (*Leptocorisa acuta* Thunberg).The inferences of suppression over check were based on non-significant ecofriendly insecticides for lowest infestation. There were 3 insecticides (CartapHcl, Imidacloprid, and Neem Oil + Btk) inference non-significant for lowest infestation and highest yield respectively. The mean ranking and inference of suppression over check were similar to inference of non-significant ecofriendly insecticides for lowest infestation as, Imidacloprid, CartapHcl, and Neem Oil + Btk respectively. Though, all these 3 insecticides were being most effective ecofriendly insecticides as, the Imidacloprid and CartapHcl are chemical insecticides, while Neem Oil + Btk are the biological insecticides (biorationals). Hence, Neem Oil + Btk as biorationals primarily would be the best choice before Imidacloprid and CartapHcl for the ecofriendly management of major insect pests of rice.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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