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Evaluate the effect of insecticides and bio pesticides on the spiders population

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Abstract
The research was conducted at Crop Research Centre of Sardar Vallabhbhai Patel university of Agriculture and technology Meerut, During the *Kharif* season of 2018. The data revealed spider population, that Lambda cyhalothrin 5 EC @ 500 ml/ha was the highly effective for the spiders among all treatments followed by Fipronil 5 SC @ 1 ltr/ha and Cartap hydrochloride 4G @ 750 gm/ha whereas all the bio- pesticides were safe for the spider.

Keywords: BPH, biopesticides, insecticides, rice and spiders

Introduction
Rice (*Oryza sativa* Linn.) belongs to the family-Graminae, is the second largest produced cereal in the world. It has two cultivated and 22 wild *spp.* It is only cultivated cereal plant adapted to growing in flooded and non- flooded soil. Rice is the major food crop which is providing about 80 percent of the calories to over 2 billion Asian's. Rice grown area is 44.50 M ha with production of 115.63 Mt in India (Anonymous, 2019) [1]. Rice is the major staple food for half of the world (Khush, 2004) [7]. It is important crop because its nutritional as well as commercial value as 100 g of rice supplies 365 kcal energy, 0.12 g sugar, 7.12 g protein 1.3 g dietary fiber and traces of thiamine, riboflavin, zinc, calcium, iron, manganese (Anonymous, 2010) [2].

Various factors are responsible for the reduction of rice yield along with many of the diseases and insect pest. One of the main reasons for the low productivity of rice is insect-pests, diseases and weeds. Many most of the insect *spp*. has been reported to attack rice crop out of which aprrox. 20 *spp* have been found to be major including Brown plant hopper, White Backed Plant Hopper, Yellow stem borer and some other insect pests (Singh and Dhaliwal, 1996) [11].

The Brown plant hopper is the monophagus, small or tiny insect with 2.0 to 3.5 mm body length. It is a brownish color insect which feed on the phloem of plant. Adult and nymphs, both damage to the phloem of rice plant. Though this insect is known to occur in Asia since late forties, it was earlier only a minor pest of rice. Serious outbreaks of BPH were reported in various parts of India during early 70s. BPH damages plant directly by sucking to plant sap and indirectly by transmitting viral disease like grassy stunt and ragged stunt. BPH caused economic damage by sucking phloem sap which in turn leads to "hopper burn" and sever yield loss (Rao *et al.*, 2003) [8].

Both the nymphs and adults of these hoppers suck the sap from phloem and xylem resulting in drying up of the rice plant. Agriculture consumes 52 per cent of the total insecticides in India, and intern rice crop alone accounts for 17 per cent of it. Large scale use of various chemical compounds has caused BPH to develop resistance and detrimental impact on natural enemies. Because of this, the investigation was also undertaken the bio efficacy of three different microbial pesticides like *Metarhizium anisoplea*, *Beauveria bassiana* and *Verticellium lecanii*. More than 700 species of fungi, mostly Deuteromycetes and Entomophorales from about 90 genera are pathogenic to insects (Rombach *et al.*, 1986) [9].

Keeping mind the idea of agro ecosystem the research program was undertaken to investigate the effectiveness of different approaches of chemical and biological control against Brown Plant Hopper, *Nilaparvata lugens* (Stal.).

Materials and Methods

The present investigation was carried out during *Kharif*, 2018 in randomized block design with variety Pusa Basmati 1 replicated thrice and have a plot size of 5x 4 m^2. The seedlings transplanted in July 18th, 2018. The population of spiders on 5 randomly selected hills per plots were recorded and continued till the availability of population in the field, through visual inspection one day before and 3, 7, 14 and 21 days after application of treatments.

Results and Discussion

First application Pre treatment observation

One day before of spray the data was taken from the plot, revealed the occurrence of spiders in the field. The range of spiders varied from 1.60 to 2.53. The population of spiders was showing that it was statically non significant difference in different treatments and indicating as approx. uniform population in all treatment of the field. Data represented in Table-1 and Figure-1.

Table 1: Bio efficacy of different treatments against Spiders after following first application

Treatment no.	Treatment name	Dose/ha	Spiders/hill				
			DBS	3 DAS	7 DAS	14 DAS	21 DAS
T_1	Imidacloprid 17.8 SC	200 ml/ha	2.13 (8.39)	2.07 (8.26)	2.07 (8.26)	2.20 (8.52)	2.20 (8.91)
T_2	Thiamethoxam 25 WG	100 gm/ha	2.53 (9.14)	2.27 (8.65)	2.33 (8.78)	2.47 (9.03)	2.53 (9.27)
T_3	Fipronil 5 SC	1000 ml/ha	2.20 (8.52)	1.40 (6.78)	1.27 (6.46)	0.93 (5.51)	0.87 (5.33)
T_4	Lambda cyhalothrin 5 EC	500 ml/ha	2.00 (8.12)	1.33 (6.62)	1.20 (6.27)	0.80 (5.13)	0.47 (3.89)
T_5	Cartap hydrochloride 4 G	750 gm/ha	1.67 (7.41)	1.73 (7.56)	1.33 (6.62)	1.20 (6.29)	1.20 (6.29)
T_6	*Beauveria bassiana* 2 x 10^9 c.f.u./gm	2.5 kg/ha	1.73 (7.54)	1.73 (7.41)	1.73 (7.56)	1.87 (7.85)	1.87 (7.85)
T_7	*Metarhizium anisopliae* 4.7 x 10^8 c.f.u./gm	2.5 kg/ha	1.60 (7.25)	1.80 (7.70)	1.87 (7.85)	2.20 (8.53)	2.33 (8.78)
T_8	*Verticellium lacani* 2 x 10^8 c.f.u./ml	2.5 ltr./ha	2.13 (8.38)	2.33 (8.78)	2.40 (8.91)	2.40 (8.90)	2.60 (9.53)
T_9	Control		2.67 (8.65)	2.13 (8.38)	2.53 (9.15)	2.60 (9.27)	2.60 (9.27)
	SEm(±) CD at 5%		0.27 0.82	0.18 0.55	0.16 0.50	0.17 0.52	0.17 0.51

Figures in parenthese are angular transformed value
DAS= Days after spray

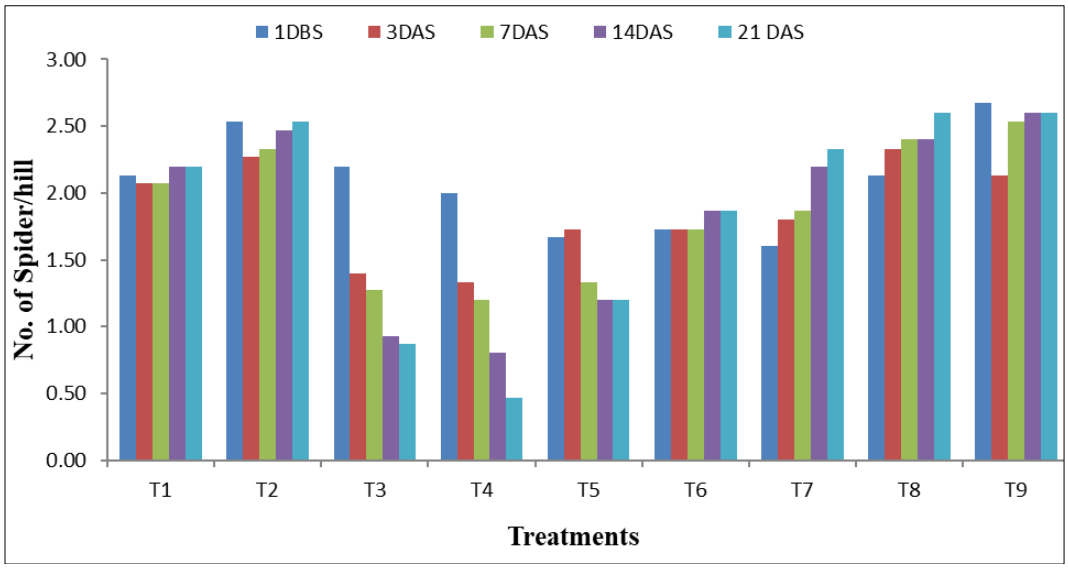

Fig 1: Bio efficacy of different treatments against Spiders following first spray

3rd day after spray

Data recorded on 3rd day after the spray and it was indicate that only three treatments reduced the population of spiders. The lowest population of spiders were observed in the plot which was treated by Lambda cyhalothrin 5 EC @ 500ml/ha and 1.33 was the mean population followed by Fipronil 5 SC @ 1000 ml/ha (1.4 spiders). Cartap hydrochloride 4G @ 750gm/ha also effected to the population of spiders. The reduced population of spiders available in the plot was 1.73. Except these treatments, all the treatment were safe for the spiders. The maximum population of spiders were found in *Verticellium lacani* 2 x 108 c.f.u./ml @ 2.5 ltr/ha (2.33 spiders), Thiamethoxam 25 WG @ 100gm/ha (2.27 spiders), Imidacloprid 17.8 SC @ 200ml/ha (2.07 spiders), *Metarhizium anisopliae* 4.7 x 108 c.f.u./gm @ 2.5 kg/ha (1.8) and *Beauveria bassiana* 2 x 109 c.f.u./gm @ 2.5 kg/ha (1.73) whereas in the untreated control population of spiders were 2.13.

7th day after spray

The data observed after 7 day of first application, observation indicated the lowest no. of spiders were presented in the plot which was treated with Lambda cyhalothrin 5 EC @ 500ml/ha (1.20 spiders) followed by Fipronil 5 SC @ 1000 ml/ha (1.27 spiders) and Cartap hydrochloride 4G @ 750gm/ha (1.33 spiders), respectively. *Verticellium lacani* 2 x 108 c.f.u./ml @ 2.55 ltr/ha (2.40 spiders), Thiamethoxam 25 WG @ 100 gm/ha (2.33 spiders), Imidacloprid 17.8 SC @ 200ml/ha (2.07 spiders), *Metarhizium anisopliae* 4.7 x 108 c.f.u./gm @ 2.5 kg/ha (1.87 spiders) *Beauveria bassiana* 2 x 109 c.f.u./gm @ 2.5 kg/ha (1.73 spiders) was safe for the population of spiders. Highest number of spiders was found in untreated control (2.53 spiders).

14th day after spray

On 14th day after spray, data revealed that Lambda cyhalothrin 5 EC @ 500ml/ha was highly effective among all the treatments for the spiders population. 0.8 spiders were

observed in the plot treated with Lambda cyhalothrin 5 EC @ 500 ml/ha. In the order of toxic effect, Fipronil 5 SC @ 1000 ml/ha was next toxic chemical with 0.97 population of spiders. It was significantly effective followed by Cartap hydrochloride 4G @ 750gm/ha with 1.20 population of spiders. Highest no. of spiders observed in *Verticellium lacani* 2 x 108 c.f.u./ml @ 2.5 ltr/ha (2.40 spiders), Thiamethoxam 25 WG @ 100gm/ha (2.47 spiders), Imidacloprid 17.8 SC @ 200ml/ha (2.20 spiders), *Metarhizium anisopliae* 4.7 x 108 c.f.u./gm @ 2.5 kg/ha (2.20 spiders) and *Beauveria bassiana* 2 x 109 c.f.u./gm @ 2.5 kg/ha (1.87 spiders). The mean population of spiders recorded in the untreated was 2.60.

21st day after spray

Observations recorded on 21st day from first application indicated that Lambda cyhalothrin 5 EC @ 500ml/ha maintained efficacy and recorded lowest spiders population (0.47) and it was statically at par with Fipronil 5 SC @ 1000 ml/ha with 0.87 population of spiders followed by Cartap hydrochloride 4G @ 750gm/ha with 1.2 spiders. Except these treatments, all other treatment superior in population such as *Verticellium lacani* 2 x 108 c.f.u./ml @ 2.5 ltr/ha (2.60 spiders) > Thiamethoxam 25 WG @ 100gm/ha (2.53 spiders) > Imidacloprid 17.8 SC @ 200ml/ha (2.20 spiders) > *Metarhizium anisopliae* 4.7 x 108 c.f.u./gm @ 2.5 kg/ha (2.33 spiders) *Beauveria bassiana* 2 x 109 c.f.u./gm @ 2.5 kg/ha (1.87 spiders), respectively. Number of spiders remains same from the last observation (2.60 spiders).

Second application

For the efficacy of insecticides and bio pesticides against spider, there was almost similar pattern recorded after second application from first application. Data is given in the Table-2 and Figure-2.

Table 2: Bio efficacy of different treatments against Spiders after second application

Treatment no.	Treatment name	Dose/ha	Spiders/hill			
			3 DAS	7 DAS	14 DAS	21 DAS
T_1	Imidacloprid 17.8 SC	200 ml/ha	1.80 (7.70)	1.87 (7.84)	2.13 (8.38)	2.27 (8.65)
T_2	Thiamethoxam 25 WG	100 gm/ha	2.13 (8.39)	2.33 (8.778)	2.4 (8.90)	2.6 (9.27)
T_3	Fipronil 5 SC	1000 ml/ha	1.27 (6.44)	0.93 (5.51)	1.00 (5.71)	0.87 (5.33)
T_4	Lambda cyhalothrin 5 EC	500 ml/ha	1.13 (6.10)	0.87 (5.33)	0.87 (5.33)	0.33 (3.27)
T_5	Cartap hydrochloride 4 G	750 gm/ha	1.67 (7.41)	1.07 (5.90)	1.13 (6.10)	0.93 (5.53)
T_6	*Beauveria bassiana* 2 x 10^9 c.f.u./gm	2.5 kg/ha	1.73 (7.56)	1.93 (7.99)	2.00 (8.12)	2.07 (8.25)
T_7	*Metarhizium anisopliae* 4.7 x 10^8 c.f.u./gm	2.5 kg/ha	2.13 (8.39)	2.27 (8.65)	2.47 (9.03)	2.47 (9.03)
T_8	*Verticellium lacani* 2 x 10^8 c.f.u./ml	2.5 ltr./ha	2.20 (8.52)	2.40 (8.90)	2.60 (9.27)	2.73 (9.51)
T_9	Control	-	2.07 (8.26)	2.53 (9.15)	2.87 (9.74)	3.13 (10.19)
	SEm(±) CD at 5%		0.18 0.55	0.24 0.72	0.24 0.74	0.21 0.63

Figures in parenthese are angular transformed value
DAS= Days after spray

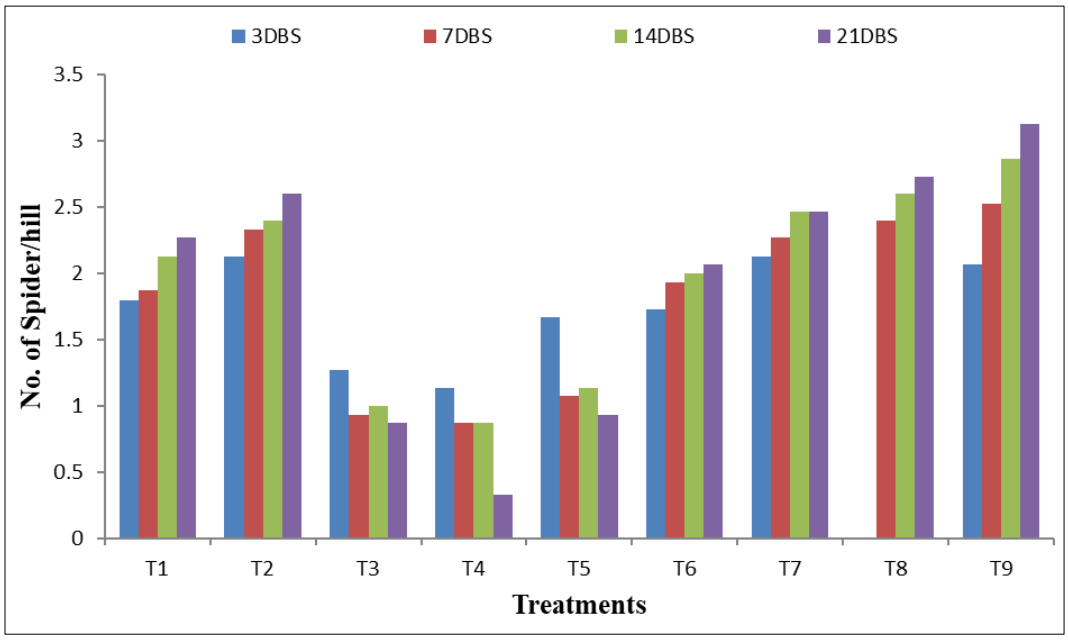

Fig 2: Bio efficacy of different treatments against Spiders following second spray

3rd day after spray

The data recorded after 3rd day of spray and it was observed that Lambda cyhalothrin 5 EC @ 500ml/ha was found inferior with minimum no. of spiders (1.13 spiders) followed by Fipronil 5 SC @ 1000 ml/ha with 1.27 reduced population of spiders. Cartap hydrochloride 4G @ 750gm/ha was the next in inferior efficacy with 1.67 spiders in the treated plot while 2.07 spiders were found in untreated control. *Verticellium lacani* 2 x 108 c.f.u./ml @ 2.5 ltr/ha (2.20 spiders**),** Thiamethoxam 25 WG @ 100gm/ha (2.13 spiders)**,** Imidacloprid 17.8 SC @ 200ml/ha (1.80 spiders), *Metarhizium anisopliae* 4.7 x 108 c.f.u./gm @ 2.5 kg/ha (2.13 spiders) and *Beauveria bassiana* 2 x 109 c.f.u./gm @ 2.5kg/ha (1.73 spiders) were safe for the population of spider.

7th day after spray

Data recorded on 7th day after spray of second spray, it revealed that again Lambda cyhalothrin 5 EC @ 500ml/ha was found effective with the least no. of spiders (0.87 spiders) followed by Fipronil 5 SC @ 1000 ml/ha with 0.93 spiders in the treated plot. Cartap hydrochloride 4G @ 750gm/ha was effective against spiders population. 1.07 spiders were found in that plot which was treated with Cartap hydrochloride 4G @ 750 gm/ha. Highest no. of spiders were found in untreated control (2.53 spiders), *Verticellium lacani* 2 x 108 c.f.u./ml @ 2.5 ltr/ha (2.40 spiders), Thiamethoxam 25 WG @ 100gm/ha (2.33 spiders), Imidacloprid 17.8 SC @ 200ml/ha (1.87 spiders), *Metarhizium anisopliae* 4.7 x 108 c.f.u./gm @ 2.5 kg/ha (2.27 spiders) and *Beauveria bassiana* 2 x 109 c.f.u./gm @ 2.5kg/ha (1.93 spiders), respectively. These were the safe treatment for spiders population.

14th day after spray

On 14th day of second spray, the minimum population of spiders were observed (0.87 spiders) in Lambda cyhalothrin 5 EC @ 500ml/ha treated plot and was found effective followed by Fipronil 5 SC @ 1000 ml/ha (1.00 spiders) and Cartap hydrochloride 4G @ 750gm/ha (1.13 spiders), respectively. Other treatments except these treatment, were safe for the spiders *viz. Verticellium lacani* 2 x 108 c.f.u./ml @ 2.5 ltr/ha (2.60 spiders), Thiamethoxam 25 WG @100gm/ha (2.40 spiders), Imidacloprid 17.8 SC @ 200ml/ha (2.13 spiders), *Metarhizium anisopliae* 4.7 x 108 c.f.u./gm @ 2.5 kg/ha (2.47 spiders) and *Beauveria bassiana* 2 x 109 c.f.u./gm @ 2.5kg/ha (2.00 spiders), respectively. The highest populations of spiders were observed in untreated control (2.87 spiders).

21st day after spray

On the last observation of this objective data indicate that Lambda cyhalothrin 5 EC @ 500ml/ha was the highly effective for the spiders among all treatments with the reduced number of spider (0.33). It was followed by Fipronil 5 SC @ 1000 ml/ha with 0.87 spiders and Cartap hydrochloride 4G @ 750gm/ha with 0.93 spiders in treatment. Except these treatments, all other treatments were safe for the spiders. On the basis of population safe treatment were *Verticellium lacani* 2 x 108 c.f.u./ml @ 2.5 ltr/ha (2.73 spiders**),** Thiamethoxam 25 WG @ 100gm/ha (2.60 spiders), Imidacloprid 17.8 SC @ 200ml/ha (2.27 spiders), *Metarhizium anisopliae* 4.7 x 108 c.f.u./gm @ 2.5 kg/ha (2.47 spiders) and *Beauveria bassiana* 2 x 109 c.f.u./gm @ 2.5kg/ha (2.07 spiders), respectively. The highest population of spiders was found in untreated control (3.13 spiders).

On the basis of performance of all treatment, Data indicates that Lambda cyhalothrin 5 EC @ 500ml/ha was highly effective among all the treatment which were used in experimental work. Least population of spiders was found in this treatment. The present finding showed agreement with the finding of Devotto *et al.,* (2007) [3] who revealed that broad-spectrum insecticide Lambda-cyhalothrin, which disrupted the generalist predator assemblage more severely. Shinde *et al.,* (2008) also reported that Lambda cyhalothrin 5 EC @ 30 g a.i./ha found toxic to spiders and lady bird beetle in okra ecosystem. Elanchezhian *et al.,* (2008) [4] observed that Lambda-cyhalothrin applied at 50, 25 and 12.5 g a.i.ha-1 were more effective against brown plant hoppers. Kharbade *et al.,* (2016) [6] also indicated that bio-pesticide *M. anisopliae* was observed to be comparatively least effective though relatively safe to natural enemies. Fipronil 5 SC @ 1000 ml/ha was used which was effective against spiders and this is agreed by Jaafar *et al.,* (2013) [5] who also observed that Fipronil and Cartap hydrochloride treatments had significantly reduced natural enemy populations. Thiamethoxam 25 WG @ 100gm/ha, Imidacloprid 17.8 SC @ 200ml/ha, *Metarhizium anisopliae* 4.7 x 108 c.f.u./gm @ 2.5 kg/ha, *Verticellium lacani* 2 x 108 c.f.u./ml @ 2.5 ltr/ha, and *Beauveria bassiana* 2 x 109 c.f.u./gm @ 2.5kg/ha were found safer in present studies, which is an agreement with result obtained by Sangamithra *et al.,* (2018) [10] and Zhang *et al.,* (1996) [12].

Conclusion

The spiders population, data revealed that Lambda cyhalothrin 5 EC @ 500 ml/ha was the highly effective for the spiders among all treatments with the reduced number of spiders. It was followed by Fipronil 5 SC @ 1000 ml/ha and Cartap hydrochloride 4G @ 750 gm/ ha. Except these three treatments, all other treatment were safe for the spiders. On the basis of population, safe treatment were *Verticellium lacani* 2 x 108 c.f.u./ml @ 2.5 ltr/ha, Thiamethoxam 25 WG @ 100gm/ha**,** Imidacloprid 17.8 SC @ 200 ml/ha, *Metarhizium anisopliae* 4.7 x 108 c.f.u./gm @ 2.5kg/ha and *Beauveria bassiana* 2 x 109 c.f.u./gm @ 2.5 kg/ha, respectively.

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