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Efficacy of certain bio-pesticides against sucking pests (Whiteflies and leafhosppers) of black gram

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Abstract
To observe the incidence of whitefly (*Bemisia tabaci*) and leaf hopper (*Empoasca kerri*) Comprised eight treatments *viz*. Imidacloprid 17.8 SL @ 0.4 ml/L, Jatropha oil @ 5%, Neem oil @ 3%, *Bacillus turingiensis* (BT) @1kg/ha, NSKE @ 5%, Garlic Extract (GE) @ 1%, *Beauveria bassiana* @5%. Whitefly was the most abundant insects among all other sucking pests. All the different bio-pesticides and Imidacloprid 17.8 SL had significant effect against sucking insects and pod borer attacking mung bean and reduced their population.

Keywords: Black gram, sucking pests (whitefly and leaf hopper), Imidacloprid 17.8 SL, bio-pesticides

Introduction
Black Garm (*Vigna mungo* L.) which is commonly called urdbean is an important pulse crop in India. It is a short duration, highly remunerative crop. In most parts of the country it is grown traditionally as *kharif* (wet season) crop, but in Utter Pradesh it is being cultivated mostly in *rabi*(dry) season both in uplands and in rice fallow conditions. Blackgram also known as mashkalai or Mash or Urd or Mosh belongs to the family leguminosae, sub family paplionodieae. It is believed to be originated in India. In addition, it is widely used as nutritive fodder crop especially for milch animals. (Thakur, 1975) [1]. The area covered under pulses in our country in 15.35 per cent of the total cropped area. Rajasthan, Madhya. Pradesh, Haryana, Orissa, Maharashtra, and Uttar Pradesh, account for 83.77 per cent of total area under pulses. Pulses production in India in kharif season was 16.39 million tonnes as per data from 2011-2012; however, an estimated 32 million tonnes would be required by 2030 due to the increasing population (ICAR Vision, 2030) [2]. About 200 insect pests that belong to 48 families of Coleoptera, Diptera, Hemiptera, Hymenoptera, Isoptera, Lepidoptera, Orthoptera, Thysanoptera, and 7 species of mites of order Acarina are known to infest greengram and blackgram. Under severe infestation stem fly may alone cause more than 90 per cent damage to these crops with a yield loss of 20 per cent (Talekar, 1990) [3]. On an average, 2.5 to 3.0 million tonnes of pulses are lost anually due to pest problems in India (Rabindra *et al*. 2004) [4]. Among all the pests, sucking pests such as whiteflies (*Bemisia tabaci*) and leafhopper (*Empoasca kerri*) attained major pest status and occur throughout the crop growth. They also act as vectors for viral diseases such as leaf curl and yellow mosaic virus diseases respectively, which cause major yield losses.

Materials and Methods
Field trial was conducted in R. B. D. at central field of SHUATS., Allahabad, during *kharif* season of 2017 crop were sown with spacing of 30 X 10cm. The observations on population of white fly and leafhopper count were recorded during morning hrs between 8 to 10 AM from randomly selected five plants from each plot by observing three leaves (top, middle & bottom) of each plant. The plot yield in each treatment was recorded and expressed in yield/ha. A bulk plot of 138.75 $m^2$was maintained to study the sucking pests of black gram. To observe the incidence of whitefly (*Bemisia tabaci*), leaf hopper (*Empoasca kerri*). Comprised eight treatments *viz*. Imidacloprid 17.8 SL @ 0.4 ml/ l, Jatropha oil @ 5%, Neem oil @ 3%, *Bacillus turingiensis* (Bt) @1kg/ha, NSKE @ 5%, Garlic Extract(GE) @ 1%, *Beauveria bassiana* @ 5%. Whitefly was the most abundant insects among all other sucking pests. The percentage reduction in the population of the borer on the pod were recorded from the five randomly selected plants. Observations were recorded one day before spray 3rd, 7th, 14th, days

3rd, 7th, 14th, days after spraying. The extent of the damage was computed by using the modified Abbot's formula (Fleming and Retnakaran, 1985) [5] as given below. The data thus obtained was subjected to ANOVA after using proper transformations.

$$\text{reduction \%} = 1 - \frac{\text{Post treatment population in treatment x pretreatment population in treatment}}{\text{pretreatment population in check x post treatment population in check}} \text{ X } 100$$

Results and Discussion

The data on number of white fly over control after spraying revealed that all the treatments were significantly superior over control. First spray of eight treatments along with control presented in table -1 and table -2 was applied by knapsack sprayer at 50% flowering and second spray was made at 15 days after the 1st spray presented in table -4 and table -3. Among all the treatments T1 -Imidacloprid 17.8 SL (20.54%), T5-NSKE (21.00%), T3-Neem oil (22.14%), T4-Bacillus turingiensis (Bt) (22.6%), T7-Beauveria bassiana (22.67%), T2-Jatropa oil (23.34%), T6-Garlic Extract (GE) (23.94%), T8-Untreated check (25.07%) was least effective among all the treatments. In this regard Jat *et al*. (2018) [6] conducted field experiment to evaluate the efficacy of organic components against major sucking pests on black gram. Among the three foliar spray of indigenous bio pesticide on whitefly (39.49 & 40.86%). And also, Yadav *et al*. (2015) [7] revealed that thiamethoxam 25% WG, acetamiprid 20% SP and triazophos 20% EC were found to be the most effective in reducing the population of whitefly and leafhopper. The treatments of azadirachtin 0.03% EC, jatropha oil and Beauveria bassiana 5% WP were found relatively less harmful.

The data on number of leaf hopper over control on fourteenth day after spraying revealed that all the treatments were significantly superior over control. Among all the treatments T1-Imidacloprid17.8 SL (15.85%), T5-NSKE (16.93%), T3-Neem oil (17.53%), T4-Bacillus turingiensis (Bt) (18.33%), T7-Beauveria bassiana (18.73%), T2-Jatropa oil (19.13%), T6-Garlic Extract (GE) (19.93%), T8-Untreated check (21.73%), was least effective among all the treatments. Similarly Gailce (2015) [8] has evaluated the efficacy of different insecticidal treatments against leafhopper, Empoasca kerri Pruthi, imidacloprid 17.8 SL @ 0.4 ml/l (2.36,2.12 no./ plant) was significantly better than the untreated control. And also Justin *et al*. (2014) [9] has evaluated the efficacy of different insecticidal treatments against, leafhopper, Empoasca Kerri Pruthi, on black gram. The results showed that spraying of imidacloprid 17.8 SL @ 0.4 ml/ l with 71.61 per cent reduction over control.

The data in respect of agronomical practices were same for all treatments i.e., 17060 ₹/ha. Cost benefit ratio is influenced by various treatments. The highest CB ratio was recorded T1 - Imidacloprid 17.8 SL (4.27), T5-NSKE (3.88), T3-Neem oil (3.74), T4-Bacillus turingiensis (BT) (3.48), T7-Beauveria bassiana WP (3.34), T2-Jatropa oil (3.24), T6-Garlic Extract (GE) (3.09), T8-Untreated check (1.58).

Table 1: Infestation of White fly during *kharif* season of 2017, (1st Spray)

Treatments	% Infestation				
	Before	3 days	7 days	14 days	Mean
T_1 -Imidacloprid 17.8 SL	39.27^{e}	35.20^{d}	33.07^{d}	27.47^{e}	31.91^{g}
T_2-Jatropa oil	42.07^{b}	39.47^{ab}	35.87^{ab}	30.27^{bc}	35.20^{c}
T_3-Neem oil	40.87^{c}	38.27^{bc}	34.67^{bcd}	29.07^{cde}	34.00^{e}
T_4-*Bacillus turingiensis (Bt)*	41.33^{cd}	38.73^{bc}	35.13^{bc}	29.53^{bcd}	34.46^{de}
T_5-NSKE	39.73^{de}	37.13^{cd}	33.53^{cd}	27.93^{de}	32.86^{f}
T_6-Garlic Extract(GE)	42.67^{a}	40.07^{ab}	36.47^{ab}	30.87^{ab}	35.80^{b}
T_7-*Beauveria bassiana*	41.40^{b}	38.80^{bc}	35.20^{bc}	29.60^{bc}	34.53^{d}
T_8-Untreated check	43.80^{a}	41.20^{a}	37.60^{a}	32.00^{a}	36.93^{a}
Mean	41.39	38.61	35.19	29.59	34.46
F- test	NS	S	S	S	S
S. Ed. (±)		0.932	0.872	0.752	0.245
C. D. (P = 0.05)		1.976	1.849	1.594	0.519

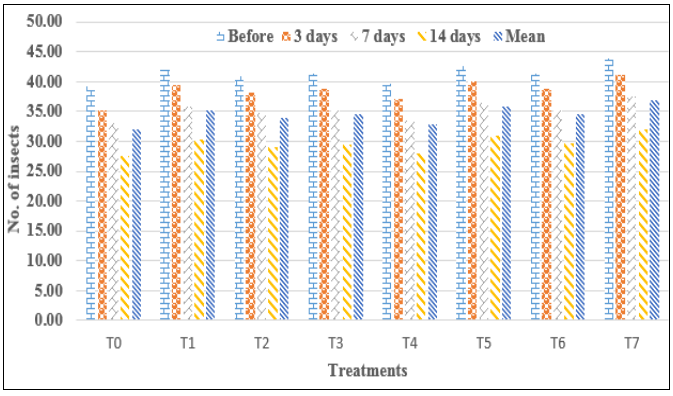

Fig 1: Graph Showing the Infestation of White fly (1st Spray)

Table 2: Infestation of White fly during *kharif* season of 2017, (2nd Spray)

Treatments	% Infestation			
	3 days	7 days	14 days	Mean
T_1 -Imidacloprid 17.8 SL	25.07^{e}	19.47^{e}	17.07^{d}	20.54^{e}
T_2-Jatropa oil	27.87^{bc}	22.27^{bc}	19.87^{ab}	23.34^{ab}
T_3-Neem oil	26.67^{cde}	21.07^{cd}	18.67^{bcd}	22.14^{cd}
T_4-*Bacillus turingiensis (Bt)*	27.13^{bcd}	21.53^{bc}	19.13^{bc}	22.60^{c}
T_5-NSKE	25.53^{de}	19.93^{de}	17.53^{cd}	21.00^{de}
T_6-Garlic Extract(GE)	28.47^{ab}	22.87^{ab}	20.47^{ab}	23.94^{ab}
T_7-*Beauveria bassiana*	27.20^{bc}	21.60^{bc}	19.20^{bc}	22.67^{b}
T_8-Untreated check	29.60^{a}	24.00^{a}	21.60^{a}	25.07^{a}
Mean	27.19	21.59	19.19	24.58
F- test	S	S	S	S
S. Ed. (±)	0.774	0.723	0.892	0.555
C. D. (P = 0.05)	1.641	1.533	1.890	1.176

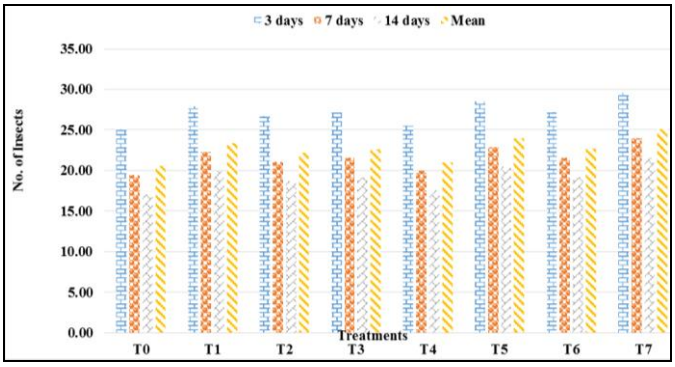

Fig 2: Graph Showing the Infestation of White fly (2nd Spray)

Table 3: Infestation of Leaf hopper during *kharif* season of 2017, (1st Spray)

Treatments	% Infestation				
	Before	3 days	7 days	14 days	Mean
T_1 -Imidacloprid 17.8 SL	26.53^{d}	24.67^{e}	22.13^{e}	20.00^{d}	22.27^{h}
T_2-Jatropa oil	30.40^{c}	28.00^{bc}	25.60^{bc}	23.20^{bc}	25.60^{c}
T_3-Neem oil	28.80^{de}	26.40^{cde}	24.00^{cde}	21.60^{bcd}	24.00^{f}
T_4-*Bacillus turingiensis (Bt)*	29.60^{cd}	27.20^{bcd}	24.80^{bcd}	22.40^{bc}	24.80^{e}
T_5-NSKE	28.20^{d}	25.80^{de}	23.40^{de}	21.00^{cd}	23.40^{g}
T_6-Garlic Extract(GE)	31.20^{b}	28.80^{ab}	26.40^{ab}	24.00^{ab}	26.40^{b}
T_7-*Beauveria bassiana*	30.00^{bc}	27.60^{bcd}	25.20^{cd}	22.80^{bc}	25.20^{d}
T_8-Untreated check	33.00^{a}	30.60^{a}	28.20^{a}	25.80^{a}	28.20^{a}
Mean	29.72	27.38	24.97	24.97	24.98
F- test	NS	S	S	S	S
S. Ed. (±)		1.011	0.965	1.154	0.039
C. D. (P = 0.05)		2.144	2.045	2.446	0.083

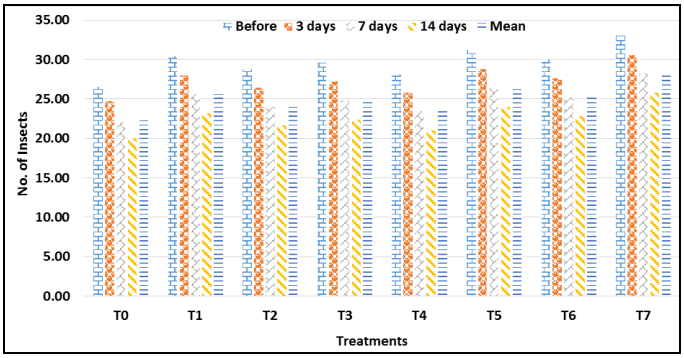

Fig 3: Graph Showing the Infestation of Leaf hopper (1st Spray).

Table 4: Infestation of Leaf hopper during *kharif* season of 2017, (2nd Spray).

Treatments	% Infestation			
	3 days	7 days	14 days	Mean
T_1 -Imidacloprid 17.8 SL	18.40^{e}	16.67^{f}	12.47^{e}	15.85^{h}
T_2-Jatropa oil	21.60^{bc}	20.00^{bc}	15.80^{bc}	19.13^{c}
T_3-Neem oil	20.00^{cde}	18.40^{de}	14.20^{cde}	17.53^{f}
T_4-*Bacillus turingiensis (Bt)*	20.80^{bcd}	19.20^{cde}	15.00^{bcd}	18.33^{e}
T_5-NSKE	19.40^{de}	17.80^{ef}	13.60^{de}	16.93^{g}
T_6-Garlic Extract(GE)	22.40^{b}	20.80^{b}	16.60^{ab}	19.93^{b}
T_7-*Beauveria bassiana*	21.20^{bc}	19.60^{bcd}	15.40^{bcd}	18.73^{d}
T_8-Untreated check	24.20^{a}	22.60^{a}	18.40^{a}	21.73^{a}
Mean	20.77	19.15	14.95	18.52
F- test	S	S	S	S
S. Ed. (±)	0.794	0.739	0.850	0.022
C. D. (P = 0.05)	1.684	1.567	1.802	0.046

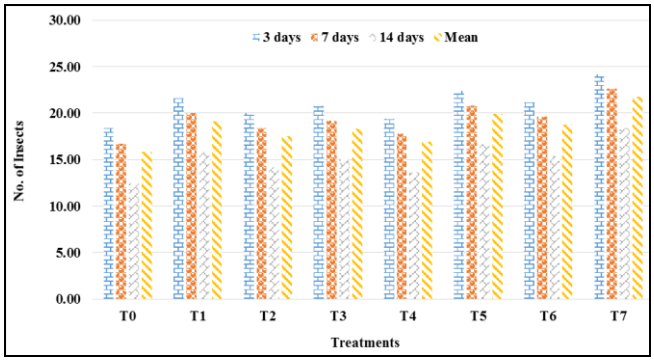

Fig 4: Graph Showing the Infestation of Leaf hopper (2ndSpray).

Conclusion

From the above results, it could be concluded that among the all applied botanical extracts, Imidacloprid 17.8 SL showed the superior performance on managing the sucking insect pests and pod borer, as well as growth and yield characteristics of black gram. Different bio-pesticides showed almost similar performance for the management of sucking insect pests (Whitefly and Leafhopper) and pod borer (*H. armigera*) of black gram.

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