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Evaluation of different tactics for the management of jassid, *Empoasca kerri* (Pruthi) in green gram, *Vigna radiata* (L.) Wilczek

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Abstract
Field experiment was carried out to evaluate the different tactics for the management of Jassid, *Empoasca kerri* (Pruthi) in green gram, *Vigna radiata* (L.) Wilczek during *summer* 2021 and 2022. Among all the treatments, Emamectin benzoate 5% SG was found to be most effective chemical against jassid and recorded the 0.00 incidence 10 day after application followed by the Azadirachtin 5% EC (0.73), Pongamia oil (0.90), *Verticellium lacani* (1.07) and *Beauveria bassiana* (1.23). However, the *Bacillus thuringiensis* had the highest population of jassid (5.07) compared to untreated control (6.07). The maximum pooled grain yield of 9.35 q/ha was recorded in the treatment of Emamectin benzoate 5% SG followed by *Verticellium lacani* treated plot (6.50 q/ha).

Keywords: Greengram, jassid, pesticides and population

Introduction
Pulse crops retain a distinctive place in sustainable crop production because of its high nutritional content, capacity to preserve the health, productivity of the soil and function as the primary source of protein in the Indian diet. After recognizing, pulses as an essential source of protein and a part of enhancing global nutrition, the United Nations General Assembly declared 2016 "The International Year of Pulses." The high amount of pulses are produced, imported, and eaten in India. The most commonly grown pulses in India including chickpea, pigeon pea, black gram, green gram, field bean and pea etc. Among them mungbean or Green gram, *Vigna radiata* (Linn.) Wilczek (Family: Leguminosae, Sub-family: Papilionaceae) is a cash crop and one of the important crops for the farmers. It occupies the third place after chick pea and pigeon pea in production. The major green gram producing states are M.P., U.P., Maharashtra, Rajasthan, A.P. and Karnataka where pulses grown in arid and semi-arid region. India contributes more than 70% of world's greengram production. India covered 130.04 lakh ha under *kharif* pulses as on 6th September 2019 as against 132.63 lakh ha last year. Around 30.48 lakh ha was covered under greengram, while the same was 33.73 lakh ha last year. The states of Rajasthan (18.30 lakh ha), Maharashtra (3.22 lakh ha), Karnataka (2.67 lakh ha), Madhya Pradesh (1.80 lakh ha), Odisha (1.37 lakh ha) and Telangana (0.62 lakh ha) are the major producers of greengram in India. It is grown in about 4.5 million hectare with the total production of 2.5 million tonnes with a productivity of 548 kg/ha and contributing 10 per cent to the total pulse production (Anonymous, 2021) [2].

The factor, which can affect the productivity and production of crop, varies according the climatic condition of different region but main factor for reduction in the yield are diseases and insect pest which attacked to the crop and reduce the yield. More than 200 insects from 48 families reported to attack mungbean in the field. Large scale of insect pest of the different groups if insect appeared at the different stages of crop's growth which are responsible for the huge damage and poor yield (Dar *et al.* 2002) [3]. Researches showed that approx, 2.5 to 3.0 million tonnes of leguminous crops destroyed due to pest complex with a monetary value of nearly Rs. 6,000 crores due to ravages caused by insect- pest (Reddy, 2015) [6]. Sucking pest in mungbean is another serious problem. Whitefly, Aphid, Jassid and thrips is the main sucking pest of this crop. These suck the sap from the tender leafs, stem, pods and flower as well as whole plant. It attacks to the plant in both stages either vegetative or reproductive and cause severe attack (Ahmed *et al.* 2019).

Materials and Methods

The present investigation entitled "Evaluation of different tactics for the management of Jassid, *Empoasca kerri* (Pruthi) in green gram, *Vigna radiata* (L.) Wilczek" was conducted at Crop Research Centre of Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut (U.P.) during *Summer*, 2021 and 2022. Samrat variety was used for the sowing in the plot of 4 x 3 m^2. The treatments were replicated thrice. There were seven treatments *viz.* Emamectin benzoate @ 5 SG, Azadirachtin 5% EC, Pongamia oil @ 2%, *Verticellium lacani* $1x10^8$ spores/ml, *Beauveria bassiana* $1x10^8$ spores/ml, *Bacillus thuringiensis* 2 x 10^{11} spores/ml and untreated control. The insecticides were applied when sufficient population of jassid were built up on the plants. The crop was sprayed by using a knap sack sprayer and second application was made three weeks after first application. The re-buildup of population was observed at this stage. The spray solution used for spraying the crop was 600 l/ha. The observations on the jassid and whitefly population were recorded with the help of split cage method and the insect was counted one day before application for pre-treatment population and three, seven and ten days after application of insecticides. The second spray was done after rebuild up of pest population and again the observations were recorded at three, seven and 10 days after the application of treatments.

The data recorded during the course of investigation were subjected to statistical analysis by using analysis of variance technique with square root transformations (Gomez and Gomez, 1984).

Result and Discussion

The pooled effect of different tactics on the population of jassids in greengram during *summer* 2021 and 2022 is shown in Table 1 and Figure 1. Jassid is widely distributed throughout the field, according to observations. When it compared to the untreated control, the yield greatly increased as a result of the treatment's significant effectiveness in reducing jassid in the field.

First spray of the treatment against Jassid during the summer, 2021 and 2022

Pooled observation on the efficacy of various treatments against the jassid in the mung bean during both the year, were recorded from the cage, day before treatment, 3, 7 and 10 day after the treatments. The pooled data depicted in the Table 1 and Figure 1. Observations revealed about the wide distribution of jassid in the field. The results showed that treatments were significantly effective for the reduction of jassid population in the field.

Day before treatment

The observation taken a day before treatment revealed that the pooled population of jassid varied from 7.57 to 8.43. The data taken from the experimental field revealed that the population of jassid was uniform in the field.

Three day after spray

The data taken from the experimental treated plots after the three day indicates that all the treatments were found significantly superior over the untreated control. Plot treated with the Emamectin benzoate @ 5 SG observed as the best treatment and the jassid population was lowest (1.97) among all the treatments which were followed by the Azadirachtin 5% EC @ 1% (3.50). The next order of the effectiveness was Pongamia oil @ 2%, *Verticellium lacani* $1x10^8$ spores/ml @ 2.5 l/ha. And *Beauveria bassiana* $1x10^8$ spores/ml @ 2.5 l/ha while the reduced population was 3.87,6.67 and 7.50, respectively after the 3 day of the spray. Highest number of the jassid population found in the plot treated with *Bacillus thuringiensis* 2 x 10^{11} spores/ml @ 1 l/ha (7.70) which was the non-significantly superior over untreated control (8.53).

Seven day after spray

The data taken from the experimental treated plots after the even day indicates that all the treatments were found significantly superior over the untreated control. Plot treated with the Emamectin benzoate @ 5 SG observed as the best treatment and the jassid population was lowest (0.93) among all the treatments which were followed by the Azadirachtin 5% EC @ 1% (2.27). The next order of the effectiveness was Pongamia oil @ 2%, *Verticellium lacani* $1x10^8$ spores/ml @ 2.5 l/ha. and *Beauveria bassiana* $1x10^8$ spores/ml @ 2.5 l/ha while the reduced population was 2.43, 2.57 and 3.00, respectively after the 3 day of the spray. Highest number of the jassid population found in the plot treated with *Bacillus thuringiensis* 2 x 10^{11} spores/ml @ 1 l/ha (8.20) which was the at par with the untreated control (8.83).

Ten day after spray

After ten day of the application, Emamectin benzoate @ 5 SG found most effective treatment and recorded lowest population of jassid with 0.50 per cage followed by the Azadirachtin 5% EC @ 1% with 1.20 jassid population/cage. The next order of the effectiveness was Pongamia oil @ 2%, *Verticellium lacani* $1x10^8$ spores/ml @ 2.5 l/ha and *Beauveria bassiana* $1x10^8$ spores/ml @ 2.5 l/ha while the reduced population was 1.87, 2.07 and 2.17 jassid per cage, respectively after the ten day of the spray. Highest number of the jassid population found in the plot treated with *Bacillus thuringiensis* 2 x 10^{11} spores/ml @ 1 l/ha (8.40) which was non significantly superior with the untreated control (8.93).

Second spray of the treatments against jassid during summer, 2021 and 2022

The trend of effectiveness of the various treatments was almost similar after the second application as in the first application on the reduction of jassid population. The observation was recorded after 3, 7 and 10 day from the second spray of different treatment is given in the table 1 and Figure 1.

Three day after spray

According to data collected from the experimentally treated plots after three days, all of the treatments were determined to be significantly more effective than the untreated control. The plot treated with Emamectin benzoate 5 SG was found the most effective, and the jassid population was the lowest (1.73) of all the treatments followed by Azadirachtin 5 per cent EC @ 1 per cent coming in second (2.70).The next order of the effectiveness was Pongamia oil @ 2%, *Verticellium lacani* $1x10^8$ spores/ml @ 2.5 l/ha. and *Beauveria bassiana* $1x10^8$ spores/ml @ 2.5 l/ha while the reduced population was 3.00, 3.40 and3.57, respectively after the 3 day of the spray. Highest number of the jassid population found in the plot treated with *Bacillus thuringiensis* 2 x 10^{11} spores/ml @ 1 l/ha (8.43) which was the at par with the untreated control (8.83).

Seven day after spray

After seven day of the pooled data, Emamectin benzoate @ 5 SG found most effective treatment and recorded lowest population of jassid with 0.10 per cage followed by the Azadirachtin 5% EC @ 1% with 1.37 jassid population/cage. The next order of the effectiveness was Pongamia oil @ 2%, *Verticellium lacani* 1x10^8 spores/ml @ 2.5 l/ha and *Beauveria bassiana* 1x10^8 spores/ml @ 2.5 l/ha while the reduced population was 1.53, 1.90 and 2.03 jassid, respectively after the 7 day of the spray. Highest number of the jassid population found in the plot treated with *Bacillus thuringiensis* 2 x 10^{11} spores/ml @ 1 l/ha (6.80) which was the at par with the untreated control (7.53).

Ten day after spray

After ten day of the application, pooled data revealed that Emamectin benzoate @ 5 SG found most effective treatment and recorded lowest population of jassid with 0.00 per cage followed by the Azadirachtin 5% EC @ 1% with 0.73 jassid population/cage. The next order of the effectiveness was Pongamia oil @ 2%, *Verticellium lacani* 1x10^8 spores/ml @ 2.5 l/ha and *Beauveria bassiana* 1x10^8 spores/ml @ 2.5 l/ha while the reduced population was 0.90, 1.07 and 1.23 jassid per cage, respectively after the ten day of the spray. Highest number of the jassid population found in the plot treated with *Bacillus thuringiensis* 2 x 10^{11} spores/ml @ 1 l/ha (5.07) which was non significantly superior with the untreated control (6.07).

The present findings was related with Singh and Singh (2018) [7] who estimated that Emamectin benzoate 8g *a.i.*/ha was found to be the most effective with the lowest population and highest per cent reduction over control. Similarly Gailce (2015) [4] has evaluated the efficacy of different insecticidal treatments against *Empoasca kerri* Pruthi, synthetic insecticides was significantly better than the untreated control and also Justin *et al.* (2014) [5] has evaluated the efficacy of different insecticidal treatments against, leafhopper, *Empoasca Kerri* Pruthi, on black gram. The results showed better performance of spraying synthetic insecticides with 71.61 per cent reduction over control.

Yield

The maximum pooled grain yield of 9.35 q/ha was recorded with Emamectin benzoate 5 SG followed by the azadirachtin (8.23 q/ha) and *Bt* (8.22 q/ha), here the production of *bt* was higher because it was effective against the lepidopteran insects. The next treatment was Pongamia oil (7.45 q/ha). *Beauveria bassiana* which was provided 6.88 q/ha yield followed by *Verticellium lacani* (6.50 q/ha). The yield of untreated control was 4.63 q/ha.

Table 1: Pooled efficacy of different treatments against Jassid, *Empoasca kerri* (Pruthi) after application in *Summar*, 2021 and 2022

Treatments	Name	Dose/ha.	DBT	After 1st Spray			After 2nd Spray			Mean Reduction of 10 DAT (%)
				3 DAT	7 DAT	10 DAT	3 DAT	7 DAT	10 DAT	
T_1	*Bacillus thuringiensis* @ 2×10^{11} spores/ml	1 L	7.57 (2.93)	7.70 (2.95)	8.20 (3.03)	8.40 (3.06)	8.43 (3.07)	6.80 (2.79)	5.07 (2.46)	5.94
T_2	Pongamia oil	2%	7.83 (2.97)	3.87 (2.20)	2.43 (1.85)	1.87 (1.69)	3.00 (1.99)	1.53 (1.59)	0.90 (1.38)	79.10
T_3	*Verticellium lacani* @ 1×10^8 Spores/ml	2.5 L	7.87 (2.98)	6.67 (2.77)	2.57 (1.88)	2.07 (1.75)	3.40 (2.09)	1.90 (1.70)	1.07 (1.43)	76.86
T_4	Azadirachtin 5% EC	1%	8.43 (3.07)	3.50 (2.12)	2.27 (1.81)	1.20 (1.48)	2.70 (1.92)	1.37 (1.54)	0.73 (1.32)	86.56
T_5	*Beauveria bassiana* @ 1×10^8 spores/ml	2.5 L	8.17 (3.03)	7.50 (2.91)	3.00 (1.99)	2.17 (1.78)	3.57 (2.13)	2.03 (1.74)	1.23 (1.49)	75.74
T_6	Emamectin benzoate 5 SG	10 gm *a.i.*	8.27 (3.04)	1.97 (1.72)	0.93 (1.38)	0.50 (1.22)	1.73 (1.64)	0.10 (1.05)	0.00 (1.00)	94.40
T_7	Control	-	8.27 (3.04)	8.53 (3.08)	8.83 (3.14)	8.93 (3.15)	8.83 (3.14)	7.53 (2.92)	6.07 (2.66)	0.00
	CD at 5% SE(m)		N/A -	0.33 0.11	0.23 0.08	0.20 0.07	0.31 0.10	0.26 0.08	0.20 0.07	-

Figures in parentheses are Square root transformed value

DAT= Days after treatment

DBS= Day before spray

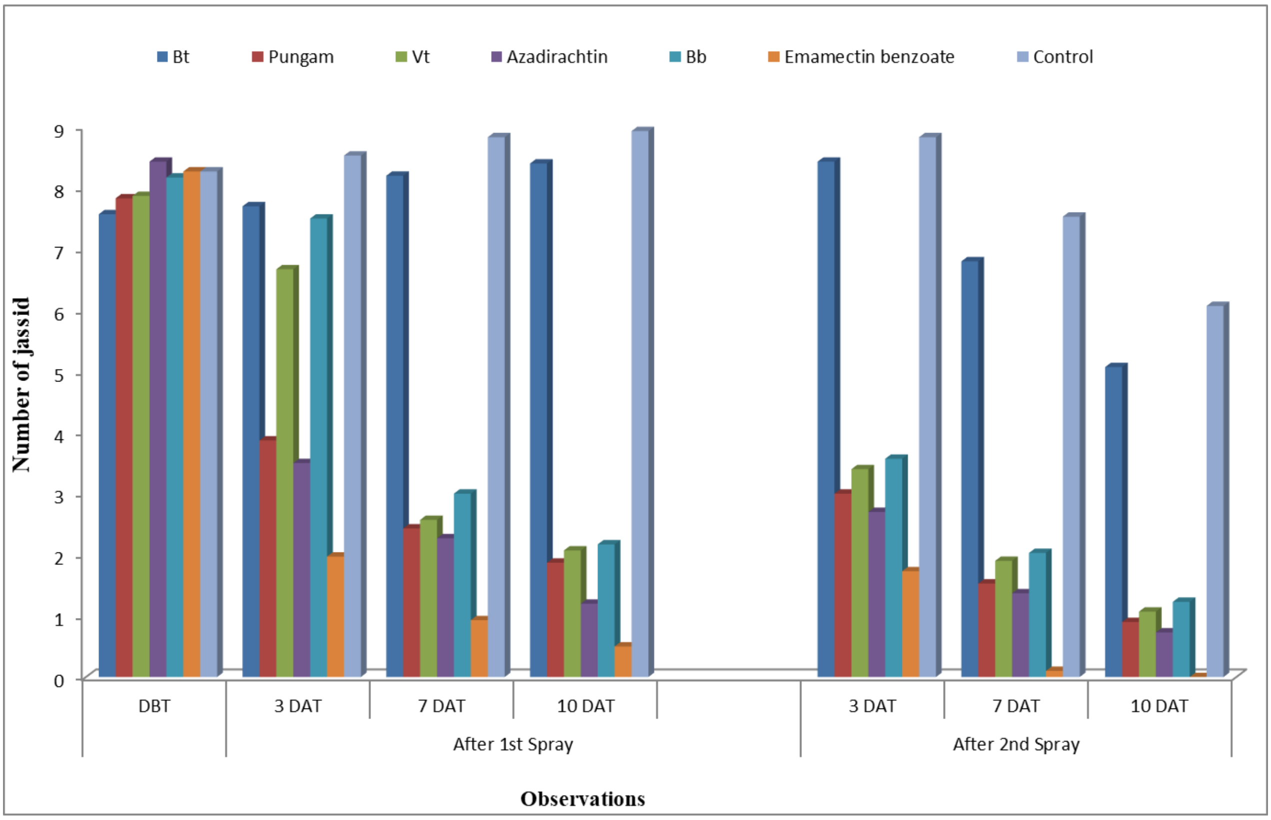

Fig 1: Evaluation of different tactics for the management of Jassid in green gram

Conclusion

It was concluded that Emamectin benzoate 5 SG was found the best among all the treatments followed by the azadirachtin in managing the jassid population on mungbean whereas *Bt* was found to be almost ineffective treatment against the jassid.

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