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Major Insect Pests of Mung bean and their Control by Synthetic Insecticides

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ABSTRACT: Mung bean (*Vigna radiata*) is India's third most important pulse crop after chickpea and red gram. Several insect pests infested to mung bean crop and cause quality and quantity losses. The field experiment was carried out for the control of major insect pests on mung bean during Kharif season in 2019. The mung bean seeds were grown in three plot sizes of 5 m × 3m with 50 cm row to row and 20 cm plant to plant spacing. Randomly selected 10 plants from weekly intervals to record the population of insect pests before and after the spray of synthetic insecticides. The treatment of emamectin benzoate also found most effective against the population of whitefly and caused a maximum of 96.36% reduction while, the treatment of thiamethoxam was caused a maximum of 90.90% reduction. The treatment of emamectin benzoate 5 SG caused a maximum 93.02 percent reduction while, the treatment of thiamethoxam 25 WG caused a maximum 83.72 percent reduction in the population of jassids during the Kharif season 2019.Among both tested synthetic insecticides emamectin benzoate was found most effective against the population of jassids and white flyover untreated control.

Keywords: Mung bean, Whitefly, *Bemisia tabaci*, jassid, *Ampoasca motti*, synthetics pesticides.

INTRODUCTION

Farmers have been growing pulses for millennia, supplying nutritionally balanced sustenance to the people of India and many other countries worldwide (Nene, 2006). Mungbean (*Vigna radiata*) is India's third most important pulse crop after chickpea and pigeon pea (Singh and Singh 2014).

Mungbean seeds and sprouts contain significant quantities of proteins rich in essential amino acids as well as phytochemicals with therapeutic actions such as antibacterial, antioxidant, antidiabetic, anti-inflammatory, anticancer, antihypertensive, and lipid metabolism accommodation (Tang *et al.*, 2014). Mung bean seeds have a significant amount of vitamin C, iron and calcium when sprouted (Gwag *et al.*, 2010). The immature grains of the mung bean are consumed as a vegetable and include plant protein, fiber and phytonutrients, all of which have significant health advantages. It is a commercially significant crop in Asia, particularly in the Indian subcontinent (Weinberger, 2003). The majority of the world's mung bean production occurs in tropical and subtropical climates, where it adapts well to the farming practices used there (Yimram *et al.*, 2009). Rajasthan is largest producer of mung bean in India followed by Karnataka, Maharashtra, Madhya Pradesh, Telangana, and Uttar Pradesh (GOI, 2021). In India, Green gram is cultivated in 20.35 lakh/ha with production 2.01 million tons and productivity 467 kg/ha, Green gram contributing 9.41% in the total pulse production (Kapoor *et al.*, 2023).

Several biotic and abiotic factors influence mung bean productivity, the most important of which are insect pests (Kooner *et al.*, 2006). There are sixty-four insect species attacking the mungbean crop, the most common of which are sucking pests and lepidopterans (Lal, 1985). Among them, whitefly, Thrips, black aphid, leafhopper, stem fly and bihar hairy caterpillar are the most damaging insect pests (Singh and Kumar 2003). Sucking insect pests such as aphids, whiteflies, thrips, jassids, and pod sucking bugs on mungbean not only lower plant vigour by sucking the sap but also spread viral infections and negatively influence photosynthesis, resulting in production losses (Singh and Singh 2014). Whitefly and jassid cause damage mainly in the kharif or the rainy season crop.

The uncontrolled use of insecticides has resulted in serious issues such as pesticide resistance, the recurrence of insect pests, secondary pest outbreaks, the problem of residues, toxicity to nontarget organisms, environmental contamination, and so on. The effectiveness and economics of newer pesticides have made them a permanent part of our contemporary farming, despite these drawbacks (Singh *et al.*, 2019).

Even though using insecticides has a number of risks, it is nevertheless regarded as one of the best and fastest ways to reduce the number of pest insects in a field. Most frequently, it is the sole way to control insect pest outbreaks. With this in mind, a study was done to determine the effectiveness of two synthetic insecticides against major sucking insect pests whitefly (*Bemisia tabaci*) and jassid (*Ampoasca motti*) of mung bean.

MATERIALS AND METHODS

Experimental site and plots. The experimental site was a local farm in Gudrawas village (longitude of 75.01˚ east, latitude of 28.37˚ north) of Churu district in Rajasthan. The experiments were carried out in three plots (5.0 × 3.0 m) including one control plot. RMG-62 mung bean seeds were cultivated in each plot during the kharif season in 2019 by using a hand plough with row to row and plant to plant spacing of 50cm and 20cm, respectively. All additional agronomical practices were carried out in accordance with the research-based recommendations.

Selection of synthetics insecticides and their doses. Two synthetic insecticides *viz.,* emamectin benzoate 5 SG (water-soluble granule) and thiamethoxam 25 WG (water-dispersible granule) were selected duringthe experimental year. These insecticides were purchased from the local market. The doses of emamectin benzoate 5 SG @ 0.25g a.i./ltr (equivalent to 25g a.i. ha^{-1}) (Ishaaya *et al*., 2002) and thiamethoxam 25 WG @ 0.2g a.i./ltr (Mahalakshmi *et al.*, 2015) were applied.

The spray of Synthetic insecticides. There were three treatments and one control during the study. Both of the chosen insecticides, thiamethoxam and emamectin benzoate, were administered as sprays at the recommended doses. The first treatment was administered when a substantial population of insect pests accumulated on plants, and the second treatment was applied three weeks later. The pesticides were sprayed on the crop by using a backpack sprayer.

Data collection. Whitefly and jassid mean populations were counted 1 day prior to the first and second sprays, as well as 7 and 14 days after the first and second sprays. The average population of insect pests was computed from 10 randomly chosen plants in each plot. Jassid and whitefly populations were observed by counting the number of pests on two uppers, two middles and two lower leaves of a plant. The reduction percentage was calculated from the following formula:

$$\text{Reduction Percentage} = \frac{\text{No. of insect pests in treatment - No. of insect pests in control}}{\text{No. of insect pests in control}} \times 100$$

Statistical analysis. Data of presented findings were analyzed using one factor analysis method (ANOVA) (Sheoran *et al.,* 1998).

RESULTS AND DISCUSSION

During the kharif season of 2019, the efficacy of emamectin benzoate 5 SG and thiamethoxam 25 WG against insect pests of mung bean was tested. The efficacy of each treatment was determined by calculating the average reduction in the population of insect pests.

Effectiveness of synthetic insecticides against the population of whitefly. The data presented in Table 1 revealed the effectiveness of emamectin benzoate and thiamethoxam against the population of whitefly on the mung bean crop during kharif season 2019.The mean population of whitefly 1.80 and 2.40 whiteflies/6 leaves/plant were recorded with emamectin benzoate and thiamethoxam, respectively. The whitefly population reductionwith emamectin benzoate(87.00%) and with thiamethoxam (82.00%) was recorded after 7 days and 2.00 and 2.90 whiteflies/6 leaves/plant with emamectin benzoate and thiamethoxam, respectively. The reduction (80.00%) with emamectin benzoate and reduction (71.84%) percent with thiamethoxam were recorded after 14 days of the first spray.

The minimum (0.20 whiteflies/6 leaves/plant) mean population of whitefly was recorded with emamectin benzoate and the maximum (0.50 whitefly/6 leaves/plant) with thiamethoxam. The maximum (96.36%) reduction with emamectin benzoate and the minimum (90.90%) reduction was recorded with thiamethoxam after 7 days of the second spray. After 14 days of the second spray, the mean population of whitefly, minimum (0.50 whiteflies/6 leaves/plant) with emamectin benzoate and maximum (0.60 whiteflies/6 leaves/plant) with thiamethoxam was recorded. The maximum reduction in the population of whitefly was 84.37% with emamectin benzoate anda minimum of 81.25% with thiamethoxam was recorded. The findings of the present study can be proved by earlier findings of Ganapathy and Karuppiah (2004) on green gram recorded lowest whiteflies population in thiamethoxam treated plots. Joshi and Patel (2010) studied that Indoxacarb and Emamectin benzoate were found most effective insecticides in the reduced population of whitefly on soybean. Panduranga *et al.* (2011) reported that the treatments of thiamethoxam 25 WS @ 0.005% were recorded effective against population of whiteflies on mung bean. Ghosh *et al.* (2016) found that the treatments of thiamethoxam 25%WG @ 75g a.i./ha in 1st and 2nd spray were caused 83.80 percent and 96.67 percent reduction in population of whitefly on okra. Yadav *et al*. (2015) studied on effectiveness of insecticides against sucking pests of black gram was reported that the treatments of emamectin benzoate and thiamethoxam were caused reduction in population of whitefly and jassid (*Empoasca kerri*). Singh *et al.* (2016) found that the treatments of thiamethoxam 25%WG @ 180g a.i./ha in 1st and 2nd spray were caused 32.77 percent and 34.78 percent reduction in population of whitefly on mung bean. Sujatha and Bharpoda (2016) reported that thiamethoxam 25 WG and imidacloprid 70 WG were most effective against sucking pests *viz.*, aphids, whiteflies, thrips, jassids and flower thrips in green gram. Jakhar *et al.* (2018) reported that the efficacy of insecticides against aphid, whitefly and jassid on Indian bean. Among tested insecticides the treatments of thiamethoxam were caused 58.04 percent after 1st spray and 56.24 percent after 2nd spray mean reduction in population of whitefly on Indian bean. Vijayaraghavan and Kavitha (2020) reported that the treatments of thiamethoxam 25 WG @ 0.2 g/l were caused 75.29 percent and 76.82 percent reduction over untreated control in population of whitefly on blackgram during kharif 2016 and rabi 2016-2017, respectively. Abd El-Kareem *et al.*, (2022) were tested the efficiency of emamectin benzoate against the 2nd and 4th instar larvae of cotton leaf worm (*Spodoptera littoralis*) during 2019 and 2020 growing seasons. They recorded the 89.6% and 86.8% mortality in 2nd and 4th instar larvae, respectively during 2019 and 89.9% and 87.5% mortality in 2nd and 4th instar larvae, respectively during 2020.

Table 1. Effectiveness of synthetic insecticides against whitefly population during kharif – 2019.

Insecticides	Doses (g/l)	Mean Population of whitefly /6 leaves/plant						Reduction (%)			
		First Spray			Second Spray			First Spray		Second Spray	
		1DBS	7 DAS	14 AS	1 DBS	7 AS	14 AS	7DAS	14 DAS	7DAS	14 DAS
Emamectin benzoate 5 SG	0.25	9.30 (3.13)	1.80 (1.51)	2.00 (1.58)	2.50 (1.73)	0.20 (0.83)	0.50 (1)	87.00 (68.86)	80.00 (63.43)	96.36 (79.00)	84.37 (66.71)
Thiamethoxam 25 WG	0.20	10.20 (3.27)	2.40 (1.70)	2.90 (1.84)	3.00 (1.87)	0.50 (1)	0.60 (1.04)	82.00 (64.89)	71.84 (57.94)	90.90 (72.44)	81.25 (64.34)
Control		10.10 (3.25)	14.10 (3.82)	10.30 (3.28)	8.40 (2.98)	5.50 (2.44)	3.20 (1.92)				
S.E (m)		0.283	0.246	0.190	0.219	0.193	0.180				
C.D. @5%		N/A	0.736	0.568	0.654	0.579	0.537				

Figures in parentheses are √ x + 0.5 values; Percentage data converted into arcsine $\sqrt{\text{Percentage}}$

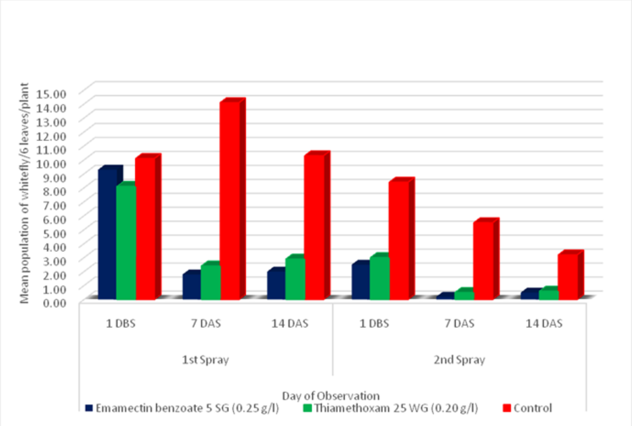

Fig. 1. Effectiveness of synthetic insecticides against whitefly population during kharif- 2019.

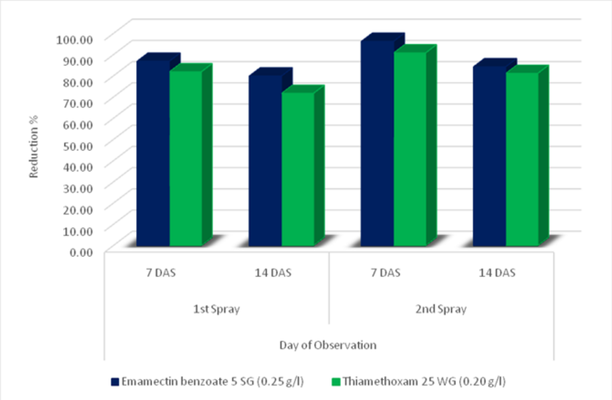

Fig. 2. Reduction % over untreated control in population of whitefly during kharif – 2019.

Effectiveness of synthetic insecticides against the population of jassid. The data presented in Table 1 revealed the effectiveness of emamectin benzoate and thiamethoxam against the population of jassid in the mung bean crop during kharif season 2019. The mean population of jassidwas recorded from the plots treated with emamectin benzoate and thiamethoxam, which were recorded 2.00 and 2.70 jassids/6 leaves/plant, respectively. The maximum reduction of 80.19% with emamectin benzoate and minimum reduction of 73.27% with thiamethoxam were recorded after 7 days of the first spray. While, 2.20 and 2.90 jassids/6 leaves/plant with emamectin benzoate and thiamethoxam, respectively. The reduction in the population of jassid was 70.27% with emamectin benzoate and 60.81 percent with thiamethoxam recorded 14 days after the first spray.

The mean population of jassidwas recorded 0.30 jassids/6 leaves/plant in the plot treated with emamectin benzoate and 0.70 jassids/6 leaves/plant in the plot treated with thiamethoxam. The maximum reduction 93.02% with emamectin benzoate and minimum reduction 83.72% with thiamethoxam were recorded in the population of jassid after 7 days of the second spray. The mean population of jassidwas recorded in the plots treated with emamectin benzoate and thiamethoxam which were 0.70 and 0.80 jassids/6 leaves/plant, respectively. The reduction in the population of jassid was recorded 78.00% and 75.00% with emamectin benzoate and thiamethoxam, respectively after 14 days of the second spray. The findings of the present study can be proved by earlier findings. Khattak *et al.* (2004) tested the efficacy of certain insecticides against the population of jassid on green gram, maximum reduction in population of jassid were noticed in plots treated with thiamethoxam. Sutaria *et al.* (2010) reported the efficacy of nine insecticides against population of jassid on soybean, among tested insecticides the treatments of thiamethoxam, acetamiprid and imidacloprid were found most effective for the control of jassid population on soybean. Patel *et al.* (2012) on cowpea reported the treatments of thiamethoxam was found most effective against the population of jassid on green gram. Justin *et al.* (2015) tested the treatment of thiamethoxam against the population of jassid on black gram and reported that thiamethoxam was caused high reduction in population of jassid. Singh *et al.* (2019) reported that the efficacy of thiamethoxam against jassid population on green gram, were caused 84.18 percent after three day of 1st spray and 78.58 percent after three days of 2nd spray reduction. Mokhtaryan *et al.* (2021) reported that the treatment of thiamethoxam was caused 85.71% reduction in larva of leopard moth in walnut trees.

Table 2: Effectiveness of synthetic insecticides against the jassid population during kharif – 2019.

Insecticides	Doses (g/l)	Mean Population of Jassid /6 leaves/plant						Reduction (%)			
		First Spray			Second Spray			First Spray		Second Spray	
		1 DBS	7 DAS	14 DAS	1 DBS	7 DAS	14 DAS	7 DAS	14 DAS	7 DAS	14 DAS
Emamectin benzoate 5 SG	0.25	8.90 (3.07)	2.00 (1.58)	2.20 (1.64)	2.60 (1.76)	0.30 (0.89)	0.70 (1.09)	80.19 (63.57)	70.27 (56.95)	93.02 (74.68)	78.00 (62.02)
Thiamethoxam 25 WG	0.20	8.20 (2.94)	2.70 (1.78)	2.90 (1.84)	3.50 (2)	0.70 (1.09)	0.80 (1.14)	73.27 (58.86)	60.81 (51.24)	83.72 (66.20)	75.00 (60)
Control		8.90 (3.06)	10.10 (3.25)	7.40 (2.81)	6.30 (2.60)	4.30 (2.19)	3.20 (1.92)				
S.E. (m)		0.220	0.256	0.173	0.175	0.166	0.182				
CD @5%		N/A	0.767	0.519	0.525	0.496	0.544				

Figures in parentheses are √ x + 0.5 values; Percentage data converted into arcsine $\sqrt{\text{Percentage}}$

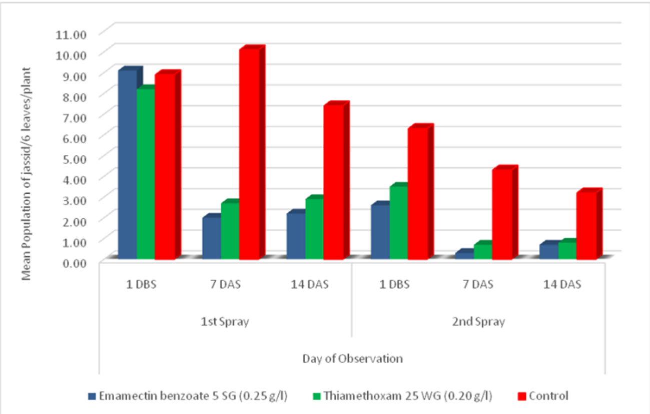

Fig. 3. Effectiveness of synthetic insecticides against the jassid population during kharif – 2019.

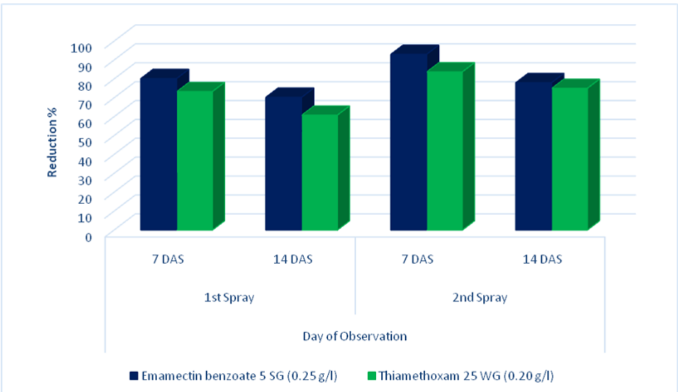

Fig. 4. Reduction % over untreated control in the population of jassid during kharif – 2019.

CONCLUSIONS

The major insect pests were found whitefly and jassid in the present study. The treatment of emamectin benzoate was found most effective against the population of both whitefly and jassid while thiamethoxam was found less effective as compared to emamectin benzoate against the population of both insects.

FUTURE SCOPE

The use of synthetic insecticides causes a significant reduction in the population of major insect pests on mung bean crop. These were use for controlling insect pests but these are had few harmful effects on the crop and environment. Therefore, these were utilized according to scientific procedures.

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Conflict of interest. None.

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