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Anand Kumar Ojha
Department of Entomology, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

SPS Tomar
Department of Entomology, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Naveen
Department of Entomology, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Neeraj Kumar
Department of Entomology, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Shivani Suman
Department of Entomology, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Sakshi Saxena
Department of Entomology, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Corresponding Author
Naveen
Department of Entomology, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Population dynamics of major insect pests complex of green gram, [*Vigna radiata* (Linn.)] and their correlation

Anand Kumar Ojha, SPS Tomar, Naveen, Neeraj Kumar, Shivani Suman and Sakshi Saxena

Abstract
The present investigation was carried out at Research Farm, RVSKVV, Gwalior during the *Kharif* season of 2019. The green gram crop was sown with Sikha variety by following recommended agronomic practices and fertilizer application, except pest control measures. The results revealed that five insect species were observed infesting mung bean crops on the Sikha variety at various phases of crop growth. Sap feeders such as whitefly (*Bemisia tabaci* Gennadius), aphid (*Aphis craccivora* Koch), jassid (*Empoasca kerri* Walsh), thrips (*Thrips tabaci* Lindeman), and bean pod borer (*Maruca vitrata* Fabricius) were found in Gwalior, Madhya Pradesh. The activity of *B. tabaci*, *A. craccivora*, and *E. kerri* was recorded from 32nd SMW, during the vegetative stage and persisted until crop maturity, *i.e*., the 38th SMW. The *B. tabaci* population gradually rose to the 34th SMW (7.40 whiteflies/plant) with its peak in 36th SMW, with an average of 12.40 whiteflies/plant, and then steadily fell. The *A. craccivora* population gradually rose to the 34th SMW (5.40 aphids/plant) and 36th SMW had the highest population, with an average of 8.70 aphids/plant. Furthermore, the *E. kerri* infestation significantly decreased up to the 34th SMW (2.50 jassid/plant) and 35th SMW had the highest population, with an average of 7.50 jassid/plant. *T. tabaci* activity, on the other hand, was seen during the 33rd SMW, at the vegetative stage and lasted until crop maturity, *i.e*., the 38th SMW. The largest population, however, was seen during 35th SMW), with an average of 7.00 thrips/plant. Furthermore, *M. vitrata* activity was noticed from 34th SMW, at the reproductive stage and persisted until crop maturity, *i.e*., in 38th SMW; nevertheless, the largest population was found in 36th SMW with an average of 2.30 larvae/plant. The populations of *B. tabaci* and *T. tabaci* had a significant positive correlation with maximum temperature (r= 0.75 and r= 0.77), respectively. *E. kerri* and *T. tabaci* populations revealed a significant positive correlation with minimum temperature (r= 0.78) and (r= 0.76), respectively. Rainfall had a significant negative correlation with the population of *E. kerri* (r=-0.78).

Keywords: *Bemisia tabaci*, *Aphis craccivora*, *Empoasca kerri*, *Thrips tabaci*, *Maruca vitrata*, population dynamics, abiotic factors

1. Introduction
Mung bean (Synonyms: golden bean or green gram), *Vigna radiata* (Linn.) Wilczek (Family: Leguminosae, Subfamily: Papilionaceae) is the third most important pulse crop of India after chickpea and pigeon pea. India alone accounts for 65% of its world acreage and 54% of the production (Singh and Singh, 2014) [13]. Green gram is cultivated throughout the year in all cropping seasons due to its short duration and suitability for crop rotation and crop mixtures. Conventionally, pulses have been an important constituent of the Indian diet. It also supplies vitamin 'B' in sufficient quantity. They are consumed in various ways in different regions of the country (Tamang *et al*., 2017a) [15]. Green gram is an important source of easily digestible high-quality protein for vegetarians and sick persons. The composition of mature mung bean seeds per 100 g edible portion is water 9.1 g, energy 347 kcal, fat 1.2 g, carbohydrate 62.6 g, dietary fibre 16.3 g (Swaminathan, Singh and Nepalia, 2012) [14]. Green gram is consumed as whole grain, sprouted form as well as dhal in a variety of ways in homes. It is also used as a green manuring crop. Mung beans can be used as a feed for cattle even husk of seed can be soaked in water and used as cattle feed. In India, these crops are cultivated in three different seasons, *viz.*, Kharif, rabi, and summer. Summer mung bean can be grown after harvesting chickpea, lentil, pea, potato, mustard, wheat and cotton. Cultivation of Zaid Mung bean is important to increase soil fertility in these areas where paddy-wheat crop rotation is used.
In India, nearly 60 species of insect pests have been recorded from mung bean but only some

cause economic damage and are more common in large areas. It is attacked by different species of insect pests but sucking insect pests (aphid, jassid, leafhopper and whitefly) is of major importance (Islam *et al*., 2008) [6]. The major insect pests infesting the crop are whitefly (*Bemisia tabaci*), jassid (*Empoasca kerri*), thrips (*Caliothrips indicus*), pod borers (*Maruca vitrata*). These insect pests not only reduce the vigour of the plant by sucking the sap but also transmit diseases and affect photosynthesis as well (Sachan *et al*., 1994) and ultimately yield losses. The annual yield loss due to the insect pests has been estimated at 30% in mung bean and urdbean (Tamang *et al*., 2017b) [16]. The quantitative avoidable losses due to the pest complex on mung beans ranged from 27.03 to 38.06% with an average of 32.97% (Duraimurugan and Tyagi, 2014) [4]. Pest appearance, population fluctuation, infestation rate and crop yield are very much dependent on sowing time (Kabir *et al*., 2014) [7]. Most farmer's usually sown mung beans just after harvesting the rabi crops without considering optimum sowing dates (Hossain *et al*., 2000) [5]. Keeping in view, all the facts the present research was conducted on the population dynamics of the major insect pest complex of green gram and their correlation with abiotic factors.

2. Material and Methods

The present investigation was carried out at Research Farm, RVSKVV, Gwalior during the *Kharif* season of 2019. Gwalior is situated in the northern part of Madhya Pradesh and lies at 26º14'N and 78º16'E at 211.52 masl. The region has a sub-tropical climate receiving 820.4mm average annual rainfall. The green gram crop was sown on 24-07-2019 with Sikha variety by following recommended agronomic practices and fertilizer application, except pest control measures, with 30 cm row to row and 10 cm plant to plant spacing. Observations were recorded at weekly intervals starting from the infestation of the pest. 3 compound leaves *viz.*, top, middle and bottom from ten randomly selected plants will be observed to count the number of sucking insect pests. Observations on the borer complex population will be recorded from 10 randomly selected plants. At harvest 5 plants will be selected randomly and the number of healthy and damaged pods will be counted to work out the per cent pod damaged by the pest. The meteorological data of the corresponding weeks was also recorded. The insect population was correlated with the meteorological data using a suitable method of analysis.

3. Result and Discussion

3.1 Succession of insect complex of green gram.

A study on insect pest succession revealed that five species of insect pests viz; whitefly (*Bemisia tabaci* Gennadius*)*, aphid (*Aphis craccivora* Koch*)*, jassid (*Empoasca kerri* Walsh), thrips (*Thrips tabaci* Lindeman) and bean pod borer (*Maruca vitrata* Fabricius) were observed, which were associated with various stages of the crop growth at Gwalior, Madhya Pradesh during *Kharif*, 2019 (Table 1). The major insects that attack at the vegetative stage of the crop growth were whitefly, aphid, jassid and thrips they were available on the crop from the vegetative stage to till maturity of the crop. The attack of bean pod borer was observed at the reproductive stage and they were active till the maturity of the crop.

The activity of *B. tabaci*, *A. craccivora* and *E. kerri* was observed from 15 DAS *i.e.*, 32nd SMW at vegetative stage and continued till maturity of the crop *i.e.*, in 38th SMW. However, the activity of *T. tabaci* was observed from 22 DAS *i.e.*, 33rd SMW at the vegetative stage and continued till maturity of the crop *i.e*., 38 SMW and the activity of *M. vitrata* was observed from 29 DAS *i.e.*, 34th SMW at the reproductive stage and continued till maturity of the crop *i.e.*, in 38 SMW.

Present findings are supported by the findings of Singh *et al.*, (2019a) [11]. The initiation of the jassid and whitefly population was recorded in the first week of August (32nd SMW) which reached its peak in the first week of September, i.e., 36th SMW (12.90 jassids and 14.20 whitefly/ three leaves). Singh and Kalra (1995) reported the peak population of *Empoasca kerri* and *Bemisia tabaci* to be 6.4 and 16.65 adults/plant, respectively on *Vigna radiata*.

Table 1: Succession of major insect pests complex of green gram during *Kharif* 2019.

Standard metrological week	Insect pests and their natural enemies				Crop age (DAS)	Crop stage
	Name		Order	Family		
	Common	Scientific				
32-33	Whitefly	*Bemisia tabaci* (Genn.)	Hemiptera	Aleyrodidae	15-28	VS*
	Aphid	*Aphis craccivora* (Koch)	Hemiptera	Aphididae		
	Jassid	*Empoasca kerri* (Walsh)	Hemiptera	Cicadellidae		
	Thrips	*Thrips tabaci* (Lindeman)	Thysanoptera	Thripidae		
34	Whitefly	*Bemisia tabaci* (Genn.)	Hemiptera	Aleyrodidae	29-35	RS**
	Aphid	*Aphis craccivora* (Koch.)	Hemiptera	Aphideae		
	Jassid	*Empoasca kerri* (Walsh)	Hemiptera	Cicadellidae		
	Thrips	*Thrips tabaci* (Lindeman)	Thysanoptera	Thripidae		
	Bean pod borer	*Maruca vitrata* (Fab.)	Lepidoptera	Crambidae		
35-38	Whitefly	*Bemisia tabaci* (Genn.)	Hemiptera	Aleyrodidae	36-57	RS** & MS***
	Aphid	*Aphis craccivora* (Koch.)	Hemiptera	Aphideae		
	Jassid	*Empoasca kerri* (Walsh)	Hemiptera	Cicadellidae		
	Thrips	*Thrips tabaci* (Lindeman)	Thysanoptera	Thripidae		
	Bean pod borer	*Maruca vitrata* (Fab.)	Lepidoptera	Crambidae		

VS* – vegetative stage RS** – Reproductive stage MS*** – Maturity stage

3.2 Seasonal incidence of major insect pest complex of green gram

During the cropping season *i.e., Kharif* 2019 the population and activity of major insect pests complex were recorded individually as depicted in Table 2 and their correlation with the abiotic factors are depicted in Table 3.

3.2.1 Whitefly [*Bemisia tabaci* (Gennadius)]
B. tabaci was observed to suck the cell sap from the lower surface of leaves. It appeared during 32th SMW (2.20 whiteflies/plant) and remained active till the maturity of the crop (1.10 whiteflies/plant). The peak period for the incidence of *B. tabaci* (12.40 whiteflies/plant) was recorded on 36th SWM. Correlation studies revealed that the population of *B. tabaci* showed a significant positive correlation (r= 0.75) with maximum temperature. Further, the *B. tabaci* population showed a non-significant positive correlation (r= 0.72 and 0.32) with minimum temperature and evaporation, respectively while they showed a non-significant negative correlation with morning and evening relative humidity and rainfall (r= -0.24, -0.44 and -0.26, respectively). Sahoo and Patnaik (1994) [10], Nath (1994) [8], Borah (1995) [2] and Dar *et al.* (2002) [3] have also reported *Bemisia tabaci* to be the major pest of green gram.

3.2.2 Aphid [*Aphis craccivora* (Koch)]
A. craccivora appeared on the crop on 32nd SMW (1.20 aphids/plant) and infestation continued till 38th SMW. Its nymph and adults were sucking cell sap from the leaves. The peak population (8.70 aphids/plant) for the incidence of *A. craccivora* was recorded on 36th SMW. Correlation studies revealed that none of the weather parameters showed any significant correlation with the *A. craccivora* population. Further, the *A. craccivora* population showed a non-significant positive correlation (r= 0.64, 0.59 and 0.36) with maximum and minimum temperature and evaporation, respectively while they showed a non-significant negative correlation with morning and evening relative humidity and rainfall (r= -0.32, -0.45 and -0.14, respectively). Present findings are also supported by the findings of Bairwa and Singh (2017) [1] who studied the population dynamics of *Bemisia tabaci*, *Caliothrips indicus*, *Maruca vitrata*, *Aphis craccivora* and *Empoasca kerri* and reported that the correlation of *Bemisia tabaci* was found positive and significant with maximum temperature.

3.2.3 Jassid *[Empoasca kerri* (Walsh)]
E. kerri appeared on the crop on 32th SMW (3.50 jassid/plant) and infestation continued till 38th SMW. Its nymph and adults were sucking cell sap from the leaves. The peak population (7.50 jassid/plant) for the incidence of *E. kerri* was recorded on 35th SMW. Correlation studies revealed that the population of *E. kerri* showed a significant positive correlation (r= 0.78) with minimum temperature and a significant negative correlation with rainfall (r= -0.78). Further, the *E. kerri* population showed a non-significant positive correlation (r= 0.74 and 0.35) with maximum temperature and evaporation, respectively while they showed a non-significant negative correlation with morning and evening relative humidity (r= -0.51, and -0.50, respectively). Yadav and Singh (2006) [17] developed forecasting models for jassid (*Empoasca kerri*), and whitefly (*Bemisia tabaci*) attacking mung bean crop, incorporating various weather parameters and insect populations. They suggested in the summer season jassid population was adversely affected by high humidity to a significant level but it markedly increased by maximum and minimum temperature.

3.2.4 Thrips [*Thrips tabaci* (Lindeman)]
T. tabaci appeared on the crop on 32th SMW (2.10 thrips/plant) and infestation continued till 38th SMW. Its nymph and adults were sucking cell sap from the leaves. The peak population (7.00 thrips/plant) for the incidence of *T. tabaci* was recorded on 35th SMW. Correlation studies revealed that the population of *T. tabaci* showed a significant positive correlation (r= 0.77 and 0.76) with maximum and minimum temperature respectively. Further, the *T. tabaci* population showed a non-significant positive correlation (r= 0.30) with evaporation while they showed a non-significant negative correlation with morning and evening relative humidity and rainfall (r= -0.33, -0.46 and -0.48, respectively). Present findings are supported by the findings of Tamang *et al.*, (2017b) [16]. The Sucking pest viz., thrips and whitefly highly significant positive correlation with maximum temperature (r= 0.78 and r= 0.79). Yadav and Singh (2006) [17] developed forecasting models for thrips (*Caliothrips indicus*) and whitefly (*Bemisia tabaci*) attacking mung bean crop, incorporating various weather parameters and insect populations. They suggested that the rainy season was adverse to the thrips population.

3.2.5 Bean pod borer [*Maruca vitrata* (Fabricius)]
M. vitrata appeared on the crop on 34th SMW (0.90 larvae/plant) and the infestation continued till 38th SMW, larvae were observed to feed on the tender parts of the plants. The peak population (2.30 larvae/plant) of *M. vitrata* was recorded on 36th SMW. Correlation studies revealed that none of the weather parameters showed any significant correlation with *M. vitrata* population. Further, *M. vitrata* population showed a non-significant positive correlation (r= 0.52, 0.41, 0.11, 0.34 and 0.10) with maximum and minimum temperature, rainfall and morning relative humidity, respectively while they showed a non-significant negative correlation with evening relative humidity (r= -0.26). Present findings are also supported by the findings of Bairwa and Singh (2017) [1] who studied the population dynamics of *Bemisia tabaci*, *Caliothrips indicus*, *Maruca vitrata*, *Aphis craccivora* and *Empoasca kerri* and reported that the correlation of *Bemisia tabaci* was found positive and significant with maximum temperature.

Table 2: Population of insect pe sts of mung bean at Gwalior during *Kharif* season 2019

SMW	Period of observations	Population				
		Sucking insect pests (Nymph and adult)/ plant				Lepidopteran insect pests (larvae/plant)
		B. tabaci	*A. craccivora*	*E. kerri*	*T. tabaci*	*M. vitrata*
32	4-10 August	2.20	1.20	3.50	2.10	0.00
33	11-17 August	4.00	2.90	3.00	2.80	0.00
34	18-24 August	7.40	5.40	2.50	3.40	0.90
35	25-31 August	11.50	7.50	7.50	7.00	1.20
36	1-7 September	12.40	8.70	3.70	5.40	2.30
37	8-14 September	6.70	3.10	2.80	3.50	1.80
38	15-21 September	1.10	1.50	0.50	1.00	0.70

SMW= Standard Meteorological Week

Table 3: Correlation coefficient of insect pest population with meteorological parameters.

Weather factors	The population of insect pests									
	B. tabaci		*A. craccivora*		*E. kerri*		*T. tabaci*		*M. vitrata*	
	R	Byx	R	Byx	r	byx	r	byx	r	byx
Maximum Temperature (°C)	0.75*	0.568	0.64 NS	-	0.74 NS	-	0.77*	0.595	0.52 NS	-
Minimum Temperature (°C)	0.72 NS	-	0.59 NS	-	0.78*	0.601	0.76*	0.579	0.41 NS	-
Rainfall (mm)	-0.26 NS	-	-0.14 NS	-	-0.78*	0.603	-0.48 NS	-	0.11 NS	-
Morning Relative Humidity (%)	-0.24 NS	-	-0.32 NS	-	-0.51 NS	-	-0.33 NS	-	0.34 NS	-
Evening Relative Humidity (%)	-0.44 NS	-	-0.45 NS	-	-0.50 NS	-	-0.46 NS	-	-0.26 NS	-
Evaporation (mm)	0.32 NS	-	0.36 NS	-	0.35 NS	-	0.30 NS	-	0.10 NS	-

* Significant at 5% level, NS = non-significant

4. Conclusion

During the 2019 Kharif season, five insect species were observed infesting mung bean crops on the Sikha variety at various phases of crop growth. Sap feeders such as whitefly (*Bemisia tabaci* Gennadius), aphid (*Aphis craccivora* Koch), jassid (*Empoasca kerri* Walsh), thrips (*Thrips tabaci* Lindeman), and bean pod borer (*Maruca vitrata* Fabricius) were found in Gwalior, Madhya Pradesh, during the Kharif season of 2019. The activity of *B. tabaci*, *A. craccivora*, and *E. kerri* was recorded from 15 DAS, *i.e*., the 32nd SMW, during the vegetative stage and persisted until crop maturity, *i.e*., the 38th SMW. The *B. tabaci* population gradually rose to the 34th SMW (7.40 whiteflies/plant). The pest population peaked on the 36th SMW, with an average of 12.40 whiteflies/plant, and then steadily fell. The *A. craccivora* population gradually rose to the 34th SMW (5.40 aphids/plant). The 36th SMW had the highest population, with an average of 8.70 aphids/plant. Furthermore, the *E. kerri* infection significantly decreased up to the 34th SMW (2.50 jassid/plant). The 35th SMW had the highest population, with an average of 7.50 jassid/plant. *T. tabaci* activity, on the other hand, was seen during the 33rd SMW, at the vegetative stage and lasted until crop maturity, *i.e*., the 38th SMW. The largest population, however, was seen during 35th SMW), with an average of 7.00 thrips/plant. Furthermore, *M. vitrata* activity was noticed from 34th SMW, at the reproductive stage and persisted until crop maturity, *i.e*., in 38 SMW; nevertheless, the largest population was found in 36th SMW with an average of 2.30 larvae/plant. The populations of *B. tabaci* and *T. tabaci* had a significant positive correlation with maximum temperature (r= 0.75 and r= 0.77), respectively. *E. kerri* and *T. tabaci* populations revealed a significant positive correlation with minimum temperature (r= 0.78) and (r= 0.76), respectively. Rainfall had a significant negative correlation with the population of *E. kerri* (r=-0.78).

5. References

1. Bairwa B, Singh PS. population dynamics of major insect pests of mung bean [*Vigna radiata* (L.) Wilczek] in relation to abiotic factors in Gangetic plains, The Bioscan an international quarterly journal of life sciences. 2017;12(3):1371-1373.
2. Borah RK. Insect pest complex in summer green gram (*Vigna radiata* L.). Annals Agric. Res. 1995;16(1):91-92.
3. Dar MH, Rizvi PQ, Naqvi NA. Insect pest complex and its succession on mung bean and urd bean. Indian J. Pulses Res. 2002;15(2):204.
4. Duraimurugan P, Tyagi K. Pest Spectra, succession and yield Losses in Mung bean and Urd bean under changing climatic scenario. Legume Res. 2014;37(2):212-222.
5. Hossain MA, Islam KMS, Mondal ATMAI. Effect of sowing date on lentil aphid, *Aphis craccivora* Koch infestation and yield contributing characters of lentil (*Lens culinaris* Medik). J Bio-sci. 2000;8:115-117.
6. Islam MS, Latif MA, Ali M, Hossain MS. Population dynamics of whitefly on some recommended mung bean varieties in Bangladesh and its impact on the incidence of Mung bean Yellow Mosaic Virus disease and yield. International Journal of Sustainable. Agricultural Technology. 2008;5(4):41-46.
7. Kabir M, Afzal Hossain M, Farhat T, Yasmin S, Rahman N, Md. F. Effects of Different Botanicals and Chemicals on the Incidence of Sucking Insect Pests and their Impact on Mosaic Disease of Mung bean. Niaz Md. Farhat Rahman. 2014;3:62-68.
8. Nath PD. Effect of sowing time on the incidence of yellow mosaic virus disease and whitefly population on the green gram. Annals Agric. Res. 1994;15(2):174-177.
9. Sachan JN, Yadava CP. Ahmad R and Katti G. Insect Pest Management in Pulse Crop. In: Dhaliwal GS and Arora R. (eds.) Agricultural Insect Pest Management. Common Wealth Publishers, New Delhi, India. 1994, 45-48 pp.
10. Sahoo BK, Patnaik NC. Insect pests in green gram and black gram in the south coastal region of Orissa with notes on their seasonal activity. Orissa J Agric. Res. 1994;7:74-76.
11. Singh M, Bairwa DK, Dadrwal BK, Chauhan J. Screening of green gram genotypes for resistance against sucking insect pests, Journal of Pharmacognosy and Phytochemistry. 2019a;8(2):933-938.
12. Singh R, Kalra VK. Studies on the insect-pest complex associated with summer mung bean, *Vigna radiata* (L.) Wilczek and urdbean, *Vigna mungo* (L.) Hepper in Haryana. J Insect Sci. 1995;8(2):181-184.
13. Singh, SK, Singh PS. Screening of mung bean (*Vigna radiata*) genotype against major insects. Current Adv. Agric. Sci. 2014;6(1):85-87.
14. Swaminathan R, Singh K, Nepalia V. Insect Pests of Green Gram *Vigna radiata* (L.) Wilczek and Their Management, Agricultural Science, Dr. Godwin Aflakpui (Ed.), 2012, ISBN: 978-953-51-0567-1, InTech,
15. Tamang S, Venkatarao P, Chakraborty G. Varietal screening of Mung bean cultivars for resistance/tolerance against insect pests under Terai Agro-ecological zone of West Bengal. Int. J Pl. Prot. 2017a;10(1):7-13.
16. Tamang S, Venkatarao P, Chaterjee M, Chakraborty G. Population dynamics of major insect pests of mung bean [*Vigna radiata* (L.) wilczek] and correlation with abiotic factors under terai agroclimatic zone of West Bengal; The bioscan an international quarterly journal of life science, 2017b;12(2):893-897.
17. Yadav DK, Singh SK. Forecast model of major insect pests of mung bean. Annals Plant Prot. Sci. 2006, 14(2).