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Impact of Antixenotic Mechanism of Mungbean on the Incidence of Thrips (*Megalurothrips* sp.) and Aphid (*Aphis cacccivora*) in the Gangetic Plains of West Bengal

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ABSTRACT

Background: At every stage of crop cycle, from seedling to storage, insect pests attack green gram or mungbean (*Vigna radiata* L.), the third most important pulse crop in India following chickpea and pigeonpea and severely reduce crop productivity. This situation along with the increased use of toxic chemicals for their management prompts the researchers to divert their efforts to Integrated Pest Management (IPM) which includes the use of resistant varieties. Specific genotype of any crop bears distinguished biophysical and biochemical parameters which have definite impact on the occurrence and distribution of pests of pulse crops. In this context, an experiment was undertaken on five germplasms of green gram *viz*. BCM 20-46, BCM 20-47, BCM 21-133, Sukumar and Virat to study the impact of crop morphology on the incidence of key insect pests attacking mungbean.

Methods: The present study has been carried out at District Seed Farm (AB Block) of BCKV Mohanpur, Kalyani, Nadia, West Bengal during pre-*kharif* season of 2022 and 2023. Statistical design followed was RBD, with 4 replications and 5 germplasms as treatments.

Result: Major insect pests recorded during the investigation were aphid, thrips, spotted pod borer and gram pod borer. Among them thrips and aphid played vital role. Incidence of flower thrips was significantly and negatively correlated with trichome density on leaf and pod along with plant height, whereas total no. of pods and primary branches exhibited significant positive correlation. Similarly, significant negative associations were observed between aphid infestation and trichome density on leaf and pod; total number of pods; and plant height, whereas total number of primary branches was positively and significantly correlated. Regression studies revealed that, total number of primary branches and trichome density on leaf described flower thrips population up to 85% and 86% during 2022 and 2023, respectively. While, in case of aphid infestation, trichome density on leaf and on pod exhibited most influence up to 85% and 81% during the same, respectively.

Key words: *Aphis craccivora*, Correlation, *Megalurothrips*, Morphological parameters, Regression, *Vigna radiata*.

INTRODUCTION

Greengram [*Vigna radiata* (L.) Wilczek] is one of the most extensively grown leguminous, versatile and drought resistant pulse crops of India. It is also considered as “Golden Bean” because of its nutritive values and ability to increase soil fertilty by adding nitrogen to the soil. It is primarily a *kharif* season crop but with the development of early maturing varieties, it has also proved to be an ideal crop for spring and summer seasons (Dhakal *et al*., 2016; Raghu *et al*., 2016; Sowmya *et al*., 2023). Production of mungbean in India was 3.10 million tonnes, during 2024 from an area of 5.19 million ha with a productivity of 598 kg/ ha (Pratap, 2025). Like other crops, green gram also suffers from different production constraints. Among them, biotic stress is an important factor. Insect pests infest mungbean in all stages of crop cycle from seedling to maturity, which can lead to heavy losses in crop productivity. While some insect pests cause direct crop harm, others serve as disease vectors that spread viruses. Whitefly, aphid, thrips, stem fly, spotted pod borer, gram pod borer and bruchids are recognized as the major pests of green gram worldwide (Panda and Raju, 1972; Chhabra *et al*., 1979; Chiang and Talekar, 1980; Prakit *et al*., 2007; Zahid *et al*., 2008; Singh

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et al., 2017). Reliance on synthetic pesticides for pest management has led to challenges such as insecticide resistance, environmental concerns and adverse effect on non-target organisms, highlighting the need for sustainable alternatives. Among these, host plant resistance offers a promising and eco-friendly strategy for reducing pest pressure. Specific crop genotypes possess distinct biophysical and biochemical traits and earlier studies confirm that these factors significantly influence pest occurrence and distribution in pulse crops (Hossain *et al.*, 2008; Girija *et al.*, 2008; Haralu *et al.*, 2018; Golla *et al.*, 2018). The information regarding the effect of crop morphology (biophysical factors) on the abundance of insect pests associated with green gram is scarce and understanding these relationships is essential for developing resistant varieties. In this context, an experiment has been planned in the lower Gangetic plains of West Bengal to evaluate the antixenotic effect of green gram on flower thrips and aphid and to figure out the sources of resistance among the tested green gram germplasms.

MATERIALS AND METHODS

The field experiment was carried out at District Seed Farm (AB Block) of Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal (Latitude: 22°87′N, Longitude: 88°20′E), during two consecutive pre-*kharif* seasons of the year 2022 and 2023. Five gremplasms of green gram were taken, of which Sukumar and Virat were popular varieties of the zone and BCM 20-46, BCM 20-47 and BCM 21-133 were advanced lines. The study was conducted in an experimental setup following randomized block design (RBD) involving five treatments with four replications. Observations were recorded starting three weeks post-sowing at weekly intervals upto crop maturity. Five plants were randomly selected per plot. For counting thrips, ten flowers per plant were tapped on white paper and the number of thrips was counted. Population of aphid was recorded by visual counting method. The total number of adults (both alate and apterous forms) and nymphs of aphid were counted from 10 cm apical twigs. A hand-held magnifying lens (10x) was used to count the insects in the field. Aspirator was used to collect necessary sample insects for further identification. Mean population was worked out in case of both the insects.

In this study, different morphological parameters were considered to evaluate antixenotic mechanism of mungbean against incidence of insect pests. Trichome density on leaf was assessed by collecting uniformly developed leaflets from three sample plants of each treatment during the pod developing stage when the pest load was high. From each leaf a bit of 1 mm^2 was cut and observed under binocular microscope at 100x magnification and number of trichomes was counted (Karthik and Vastrad, 2018). Same procedure was followed to determine trichome density on pod. Other parameters such as no. of primary branches and plant height were recorded at 50% flowering stage. Pod length and width was measured during maturity and total no. of pods was counted at the time of harvest.

The experimental data were analyzed using appropriate statistical methods. Correlation between mean pest population and crop morphological parameters were worked out to find out the effect of the crop morphology on tolerance or susceptibility of different varieties of green gram against flower thrips and aphid. Further multiple step wise linear regression analysis was conducted between incidence of insect pests, per cent pod damage and the above-mentioned morphological parameters (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Morphological characterization of different green gram germplasms

Trichome density on leaf

Number of trichomes per unit area of leaves of different green gram gremplasms differed significantly, ranging from 9.8/ mm^2 to 17.6/ mm^2 (Table 1). The highest density of trichome was recorded in Sukumar (17.6/ mm^2) followed by BCM 20-47 (15.8/ mm^2) and BCM 21-133 (15.4/ mm^2). Minimum density of trichome on leaf was found in Virat (9.8/ mm^2) followed by BCM 20-46 (11.4/ mm^2).

Trichome density on pod

Density of trichomes per unit pod area differed significantly across various germplasms ranging from 11.4/ mm^2 to 18.4/ mm^2 (Table 1). Maximum density of trichomes on pod was found

Table 1: Morphological parameters of different green gram gremplasms.

Gremplasms	PH (cm)	PB (No./ plant)	TP (No./ plant)	PW (mm)	PL (cm)	TDL (No./ mm^2)	TDP (No./ mm^2)
BCM 21-133	48.0	5.0	8.96	0.53	7.78	15.4	14.8
BCM 20-46	43.0	5.2	9.12	0.46	9.18	11.4	11.4
BCM 20-47	49.0	4.8	7.96	0.45	8.68	15.8	15.8
Sukumar	48.4	4.6	7.85	0.39	8.42	17.6	18.4
Virat	39.0	5.6	9.25	0.46	6.78	9.8	13.4
SEm (±)	NS	0.30	1.74	0.05	0.15	0.57	0.74
CD (5%)		0.87	5.08	0.15	0.45	1.65	2.17
CV (%)		12.86	18.76	27.89	4.21	9.04	11.27

N.B.: PH = Plant height, PB = Total no. of primary branches, TP = Total no. of pods / plant, PW = Pod width, PL = Pod length, TDL = Trichome density on leaf, TDP = Trichome density on pod.

in Sukumar (18.4/ mm^2) followed by BCM 20-47 (15.8/ mm^2) and BCM 21-133(14.8/ mm^2). Minimum density of trichome on pod was recorded from BCM 20-46 (11.4/ mm^2) followed by Virat (13.4/ mm^2).

Total number of primary branches

Gremplasms were significantly differed in number of primary branches ranging from 4.6 to 5.6 (Table 1). Maximum and minimum number of primary branches was observed in Virat (5.6) and Sukumar (4.6), respectively.

Plant height

Plant height was non-significantly variable across different gremplasms of mungbean ranging from 39.0 cm to 49.0 cm (Table 1). The tallest gremplasms was BCM 20-47 (49.0 cm) followed by Sukumar (48.4 cm) and BCM 21-133 (48.0 cm). Whereas Virat (39.0 cm) and BCM 20-46 (43.0 cm) having medium length.

Pod length

The significantly highest pod length was recorded from BCM 20-46 (9.18 mm) followed by BCM 20-47 (8.68 mm) and Sukumar (8.42 mm) (Table 1). Minimum pod length was recorded from Virat (6.78 mm) followed by BCM 21-133 (7.78 mm).

Pod width

Significant variation in pod width was found in different green gram gremplasms ranging from 0.39 mm to 0.53 mm (Table 1). Maximum pod width was found in BCM 21-133 (0.53 mm) followed by BCM 20-46 (0.46 mm), Virat (0.46 mm) and BCM 20-47 (0.45 mm). The shortest pod width was found in Sukumar (0.39 mm).

Total no. of pods/ plant

Total no. of pods/ plant varied significantly among the tested gremplasms ranging from 7.85 to 9.25 (Table 1). Maximum pod count per plant was observed in Virat (9.25) followed by BCM 20-46 (9.12). Moderate number of pods was present in BCM 21-133 and BCM 20-47 whereas, the lowest number of pods was recorded from Sukumar (7.85).

Effect of crop morphology on *Megalurothrips* sp. population recorded on green gram

Effect of different morphological characters of green gram on incidence of *Megalurothrips* sp. is presented in Table 2. Total no. of primary branches was significantly and positively correlated with flower thrips population in both the years (r = 0.934 and 0.917 during 1st and 2nd year, respectively) which indicates that the pest preferred the gremplasms having dense canopy with more branches. Plant height showed significant negative correlation in both the years of experimentation (r = -0.923 and -0.946 during 1st and 2nd year, respectively) revealing the non-preference of the pest towards taller gremplasms. Pod length exhibited non-significant negative correlation during both the years of experimentation (r = -0.295 and -0.303 during 1st and 2nd year, respectively) which also signifies the less preference of the pests to larger pods. While, pod width exhibited non-significant positive correlation (r = 0.236 and 0.247 during 1st and 2nd year, respectively). Number of trichomes of leaf per unit area exhibited significant negative correlation (r = -0.926 and -0.952 during 1st and 2nd year, respectively) with thrips population. Trichome number on pods per unit area also showed significant negative correlation (r = -0.875 and -0.883) in both the years. Both these results clearly suggest that flower thrips prefers green gram gremplasms having leaves and pods with less trichomes. On the contrary total no. of pods/plant (r = 0.852 and r = 0.868) exhibited significant positive correlation with thrips population which means thrips prefer gremplasms having more pods per plant. According to Tamta and Jha (2021), the lowest incidence of thrips was reported in SSME 21-70 (1.52 thrips/10 flowers) germplasm having highest trichome length (1357µm) and highest trichome density on both upper (193.0) and lower surface (215.6) per 5 mm^2 followed

Table 2: Correlation of *Megalurothrips* sp. population with crop morphological parameters.

Year	Correlation coefficient (r) values in respect to crop morphology						
	Trichome density on leaf	Trichome density on pod	Pod length	Pod width	Total no. of pods	Total no. of primary branches	Plant height
2022	-0.926*	-0.875*	-0.295	0.236	0.852*	0.934*	-0.923*
2023	-0.952*	-0.883*	-0.303	0.247	0.868*	0.917*	-0.946*

*Significance at 5 % level (p≤0.05) (two tailed test).

Table 3: Multiple step-wise linear regression analysis between population of *Megalurothrips* sp. and crop morphological traits.

Year	Regression equation	R^2 value	Variables	Remarks
2022	Y = 1.84 - 0.041X*	0.85	Y = Thrips population X = Total number of primary branches	Total no. of primary branches became the major influencing factor on pest population
2023	Y= 2.28 - 0.208X*	0.86	Y = Thrips population X = Leaf trichome density	Trichome density on leaf became the major influencing factor on pest population

*Significance at 5% level.

by SSME 21-53 (1.80) as compared to PM 05 (3.69 thrips/10 flowers) which had the lowest trichome length (918 µm) and lowest trichome density on both upper (104.3) and lower (118.3) surface per 5 mm^2. Yasmin *et al*. (2022) recorded that, thrips population showed significant negative associations with trichome density, the lower incidence was linked to plants having higher trichome density. Revathi and Selvanarayanan (2024) also found that the resistant accession IC-329039-1 exhibited the highest trichome density, followed by the tolerant accession IC-39380, while the susceptible accession IC-103862 showed the lowest density. A negative correlation was observed between trichome density of mungbean and the colonization of *M. distalis*, another thrips species. These results corroborate the present findings.

Regression studies among *Megalurothrips* sp. population and crop morphological parameters

The equation found from the multiple step wise linear regression analysis are Y = 1.84 - 0.041X* and Y = 2.28- 0.208X* in 2022 and 2023, respectively (Table 3). The results reveal that thrips population was significantly influenced by different plant morphological characters. Among them, total number of primary branches became the major governing factor on incidence and population of *Megalurothrips* sp. in 1st season, but in second season trichome density of leaf became the major governing factor for describing thrips population. The regression coefficient (R^2) values for the year 2022 and 2023 were 0.85 and 0.86, respectively which indicates that the total number of primary branches and trichome density on leaf described the thrips population up to 85% and 86% during 2022 and 2023, respectively.

Effect of crop morphology on *Aphis craccivora* population recorded on green gram

Effect of different morphological characters of green gram on incidence of *Aphis craccivora* is presented in Table 4. Total no. of primary branches was significantly and positively correlated with aphid population in both the years (r = 0.898 and 0.907 during 1st and 2nd year, respectively) which indicates that the pest preferred the gremplasms having dense canopy with more branches. Plant height showed significant negative correlation in the both the years (r = -0.896, -0.910 in 2022 and 2023, respectively). Pod length exhibited non-significant negative correlation during both the years (r = -0.012 and -0.005, respectively) while, pod width exhibited non-significant positive correlation (r = 0.132 and 0.174 during 1st and 2nd year, respectively). Number of trichomes on leaf per unit area exhibited significant negative correlation (r = -0.922 and -0.915 during 1st and 2nd year, respectively) with aphid population. Trichome density on pods also significantly and negatively correlated (r = -0.912 and -0.926) in both the years. Total pod count (r = -0.884 and -0.908) also exhibited significant negative correlation with incidence of aphid. All these observations reveal the aphid's non-preference towards green gram gremplasms having taller height, larger pod, dense trichome density on both leaves and pods.

Tamang *et al.* (2017) recorded that the green gram variety Samrat (PDM 24-139) possessing the lowest trichome density (13.5 and 18.0/ cm^2) showed considerably greater aphid incidence during consecutive two cropping seasons. Mulwa *et al*. (2023) found that among the three conditions, leaf moisture content (R^2 0.18) and leaf area (R^2 0.32) was positively connected with pest infestation, whereas leaf hair density (R^2 0.30) and leaf wall thickness (R^2 0.54) were negatively correlated with pod borer and aphid counts. All these earlier findings are in accordance with our results.

Regression studies among *Aphis craccivora* population and crop morphological parameters

The equation found in multiple step wise linear regression analysis are Y = 3.49 – 0.115X* and Y= 3.43- 0.009X* in 2022 and 2023, respectively (Table 5). The results reveal

Table 4: Correlation of *Aphis craccivora* population with crop morphological parameters.

Year	Correlation coefficient (r) values in respect to crop morphology						
	Trichome density on leaf	Trichome density on pod	Pod length	Pod width	Total no. of pods	Total no. of primary branches	Plant height
2022	-0.922*	-0.912*	-0.012	0.132	-0.884*	0.898*	-0.896*
2023	-0.915*	-0.926*	-0.005	0.174	-0.908*	0.907*	-0.910*

*Significance at 5 % level (p≤0.05) (two tailed test).

Table 5: Multiple step-wise linear regression analysis between population of *Aphis craccivora* and crop morphological traits.

Year	Regression equation	R^2 value	Variables	Remarks
2022	Y = 3.49 – 0.115X*	0.85	Y = *Aphis craccivora* population X = Leaf trichome density	Trichome density of leaf became the major influencing factor on pest population
2023	Y= 3.43- 0.009X*	0.81	Y = *Aphis craccivora* population X = Pod trichome density	Trichome density of pod became the major influencing factor on pest population

*Significance at 5% level.

that aphid population was significantly influenced by different plant morphological characters. Among the different morphological characters, trichome density on leaf became the major governing factor on incidence of *Aphis craccivora* in 1st year, but in second year trichome density on pod became the major governing factor. The regression coefficient (R^2) values were 0.85 and 0.81 which indicates that the trichome density on leaf and trichome density on pod described the aphid population up to 85% and 81% during 2022 and 2023, respectively.

CONCLUSION

From this experiment, it can be concluded that trichome density on leaves and pods showed significant negative correlations with the populations of thrips and aphids, indicating that these pests prefer green gram gremplasms with less trichomes like, Virat and BCM 20-46. Influence of pod length on thrips and aphid population was non-significant and negative which also signifies the less preference of the pests to larger pods whereas, it was non-significant and positive in case of pod width. Gremplasms having more branches and dense canopy like Virat and BCM 20-46 showed highly positive effect on load of both the pests. The population build-up of thrips and aphid was negatively influenced by plant height and gremplasms with medium stature, such as Virat and BCM 20-46, were more susceptible to infestation while, taller gremplasms like, Sukumar and BCM 20-47 were less preferred. Total pod count exhibited significant positive correlation with thrips population and in contrast, it showed significant negative correlation with aphid population. Aphid prefer the gremplasms having more number of pods like Virat and BCM 20-46. Overall, both pests tend to avoid green gram gremplasms characterized by taller plant height, larger pods and dense trichome coverage on leaves and pods. Among all the studied morphological traits, total number of primary branches and trichome density on leaf were the major influencing factor in case of thirps during 2022 and 2023, respectively, while, in case of aphid, trichome density on leaf and trichome density on pod were the major governing factors during the same. The morphological characters of green gram specially trichome density on leaves and pods which showed the non-preference of pests particularly thrips and aphid may act as an important tool for the green gram breeders to develop pest resistant varieties where the gremplasms like Sukumar and BCM 20-47 may play vital role.

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Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

REFERENCES

Chhabra, K.S., Kooner, B.S. and Singh, G. (1979). Field resistance of certain cultivars of mungbean to whitefly, *Bemisia tabaci* G. and yellow-mosaic virus. *Journal of Research* (*Punjab Agricultural University*). **16(4):** 385-388.

Chiang, H.S. and Talekar, N.S. (1980). Identification of sources of resistance to the beanfly and two other agromyzid flies in soybean and mungbean. *Journal of Economic Entomology*. **73(2):** 197-199.

Dhakal, Y., Meena, R.S. and Kumar, S. (2016). Effect of INM on nodulation, yield, quality and available nutrient status in soil after harvest of green gram. *Legume Research*. **39(4):** 590-594. doi: 10.18805/lr.v0iOF.9435.

Girija, P.M., Salimath, S.A., Gowda, C.L.L. and Sharma, H.C. (2008). Biophysical and biochemical basis of host plant resistant to pod borer (*Helicoverpa armigera* Hubner) in chickpea. *Indian J. Genet.* **68(3):** 320-323.

Golla, S.K., Rajasekhar, P., Sharma, S.P., Hari Prasad, K.V. and Sharma, H.C. (2018). Antixenosis and antibiosis mechanisms of resistance to pod borer, *Helicoverpa armigera* in wild relatives of chickpea, *Cicer arietinum*. *Euphytica*. **214:** 88.

Gomez, K.A. and Gomez, A.A. (1984). Statistical Procedures for Agricultural Research. International Rice Research Institute. 2nd edition. *Wiley-Inter Science Publication. New York.* 680p.

Haralu, S., Karabhantanal, S.S., Naidu, G.K. and Jagginavar, J.B. (2018). Biophysical and biochemical basis of resistance to pod borer, *Helicoverpa armigera* (Hubner) in chickpea. *Journal of Entomology and Zoology Studies*. **6(5):** 873-878.

Hossain, A., Haque, A. and Prodhan, M. (2008). Effect of pods characteristics on pod borer (*Helicoverpa armigera*, Hubner) infestation in chickpea. *SAARC Journal of Agriculture*. **6(1):** 51-60.

Karthik, G.S. and Vastrad, A.S. (2018). Morphological characterization of chickpea genotypes and their influence on *Helicoverpa armigera* (Hubner) population and its natural enemies. *Journal of Entomology and Zoology Studies*. **6(6):** 1220-1225.

Mulwa, G.K., Kitonyo, O.M. and Nderitu, J.H. (2023). Earliness and crop morphological traits modulate field pest infestation in green gram. *Journal of Economic Entomology*. **116(2):** 462-471.

Panda, N. and Raju, A.K. (1972). Varietal resistance of green-gram (*Phaseolus aureus* Roxb.) to *Aphis craccivora* (Koch). *Indian Journal of Agricultural Sciences*. **42(8):** 670-673.

Prakit, S., Chanida, A., Peter Ooi, A.C. and Peerasak, S. (2007). Inheritance of seed resistance to bruchids in cultivated mungbean [*Vigna radiata* (L.) Wilczek]. *Euphytica*. **155(1):** 47-55.

Pratap, A. (2025). Project Coordinator's Report, 2024-25, All India Coordinated Research Project on Kharif Pulses, ICAR-Indian Institute of Pulses Research, Kanpur-208024, 146p.

Raghu, B.N., Kumar, R.P., Basave Gowda, B.G., Manjunatha, N. and Alur, R.S. (2016). Post harvest seed quality of greengram as influenced by pre-harvest spray of insecticides. *Indian Journal of Agricultural Research*. **50(2):** 113-116. doi: 10.18805/ijare.v50i2.9588.

Revathi, M. and Selvanarayanan, V. (2024). Preference and performance of thrips, *Megalurothrips distalis*. Karny on selected greengram accessions. https://doi.org/10.21203/rs.3rs-3665805/v1.

Singh, S., Srivastava, C.P., Saini, V. and Ramesh, K.B. (2017). Screening of green gram [*Vigna radiata* (L.) Wilczek] genotypes for resistance to flower thrips, *Caliothrips indicus* (Bagnall) under natural condition. *Journal of Experimental Zoology India*. **20(1):** 491-495.

Sowmya, K., Bindhu, J.S., Pillai, P.S., Jacob, D. and Gladis, R. (2023). Productivity and profitability of green gram [*Vigna radiata* (L.) Wilczek] under system of crop intensification. *Agricultural Science Digest*. **45(1):** 70-73. doi: 10.18805/ag.D-5703.

Tamang, S., Venkatarao, P. and Chakraborty G. (2017). Varietal screening of mungbean cultivars for resistance/ tolerance against insect pests under Terai agro-ecological zone of West Bengal. *International Journal of Plant Protection*. **10(1):** 7-13.

Tamta, A. and Jha, S.K. (2021). Screening of germplasms and population dynamics of major insect pests of spring green gram *Vigna radiata* (L.). (Doctoral dissertation, GB Pant University of Agriculture and Technology, Pantnagar-263145 (Uttarakhand)).

Yasmin, S., Ali, M., Rahman, M.M., Akter, M.S., Paul, A.K., Akter, M.M. and Latif, M.A. (2022). Screening certain mungbean varieties against thrips (Thysanoptera: Thripidae) and exploration of resistance sources. *Agrosystems, Geosciences and Environment*. **5(3):** e20287. doi: 10.1002/agg2.20287.

Zahid, M.A., Islam, M.M. and Begum, M.R. (2008). Determination of economic injury levels of *Maruca vitrata* in mungbean. *Journal of Agriculture and Rural Development*. **6(1):** 91-97.