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POPULATION DYNAMICS OF IMPORTANT SUCKING PESTS AND THEIR NATURAL ENEMIES ON GREEN GRAM IN THE GANGETIC PLAINS OF WEST BENGAL INDIA

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ABSTRACT

A thorough understanding of the patterns in the occurrence of insect pests and their natural enemies is essential for developing an effective pest management system. In this context, an experiment during 2022 and 2023 was undertaken considering some advanced lines of green gram including two popular varieties to study the population dynamics of major sucking pests along with their associated natural enemies as well as their correlation with prevalent weather parameters. Major sucking insect pests recorded during the investigation were black bean aphid (*Aphis craccivora*) and flower thrips (*Megalurothrips* sp.). The natural enemies recorded were coccinelid predators like *Coccinella transversalis*, *Cheliomenes sexmaculata* and *Coccinella septempunctata* along with rove beetle and spider. *Megalurothrips* sp. reached its highest peak in flowering stage while highest population of *Aphis craccivora* was recorded during pod development stage. Maximum population of Coccinelid beetles, spiders and rove beetles were recorded during pod development stage. Sukumar was identified as the least susceptible germplasm to flower thrips, followed by BCM 20-47, whereas Virat exhibited relatively higher susceptibility. A similar trend was observed for aphid infestation, with Sukumar showing the least susceptibility, followed by BCM 20-47, while BCM 20-46 was the most susceptible. The overall mean populations of natural enemies were highest in Sukumar. The correlation studies revealed that only rainfall showed significant negative correlation with the aphid population in both the years whereas, most meteorological parameters exhibited non-significant correlations with flower thrips and natural enemy population.

***Keywords* :** Vigna radiata, Aphis craccivora, Megalurothrips, Meteorological parameters, Correlation.

Introduction

Pulses are rich source of protein, dietary fiber, and various vitamins and minerals and used for both human consumption and animal feed (Didinger and Thompson, 2021). Due to supply of cheaper source of protein, it is designated as “poor man’s meat” (Potter and Hotchkiss, 1997). Pulse production reached its highest peak (23.44 million tonnes) in 2023-2024 rising from 11.13 million tonnes in 2002-2003, while productivity was improved from 543 kg/ha in 2002-2003 to 909 kg/ha (Anon., 2024). After chickpea and pigeonpea, greengram (*Vigna radiata*) is the third major pulse crop, covering about 8% of pulse-growing areas in India (Singh *et al*., 2015). In 2022–23, India produced 3.68 million tonnes from 5.55 million ha, with a productivity of 663 kg/ha (Anon.,2024). Pulse crop productivity is constrained by biotic (pests, diseases) and abiotic stresses, which degrade seed quality and can cause yield losses of up to 100%. (Nair *et al*., 2019). At every stage of the crop cycle, from seedling to storage, insect pests attack mungbeans and severely reduce crop productivity. Globally, the primary pests affecting green gram include whiteflies, aphids, thrips, stem flies, spotted pod borers, gram pod borers, and bruchids, especially during storage (Panda and Raju, 1972; Chhabra *et al.*, 1979; Chiang and Talekar, 1980; Prakit *et al.*, 2007; Zahid *et al.*, 2008; Singh *et al.*, 2017). Among them the sucking pests like aphid, *Aphis craccivora* Koch; thrips, *Thrips palmi* Karny and flower thrips, *Megalurothrips usitatus* Bagnall are known to inflict serious damage to grain legume crops (Soundararajan *et al*., 2013). *Aphis craccivora* has been reported to cause 20-40% yield losses across Asia (Singh and Allen, 1980). Chhabra and Kooner (1985) reported the combined damage inflicted by insect pest complex (*Melanagromyza phaseoli*, *Acherontia styx*, and *M. distalis*) reached up to 54.3% in mung bean. Rafes (1978) explained that insect population dynamics depend on insect–host relationships: endemic insects are mainly limited by host defenses, cyclic populations fluctuate with food availability, and outbreaks occur unpredictably due to environmental stresses acting through the host. Environmental factors play an important role on the bio-ecology of the pest and its damaging potentiality. It is important to monitor the pest population by observing the occurrence of pest correlated with the weather parameters to develop an ecologically sound, timely pest management strategy. Hence, the present research work was undertaken to find out the impact of meteorological parameters on the population of sucking insect pests along with their associated natural enemies on green gram.

Materials and Methods

The field experiment was conducted at the District Seed Farm (AB Block) of Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal (22˚87'N latitude, 88˚20'E longitude) over two successive pre-*kharif* seasons in 2022 and 2023. The farm's location comes under sub-tropical humid climatic region. The soil at the experimental site is sandy loam, alluvial type which comes under Inceptisol in the new alluvial zone of lower Gangetic plain, with a pH of 7.1. Five green gram germplasms were evaluated, including two widely cultivated varieties of the region, 'Sukumar' and 'Virat', along with three advanced breeding lines – 'BCM 20-46', 'BCM 20-47', and 'BCM 21-133'. The experiment was laid out in a randomized block design (RBD) comprising five treatments with four replications. The green gram germplasms were raised by adopting standard agronomical practices with a plot size of 10 m X 10 m maintaining a spacing of 30 cm × 10 cm. The experimental plots were kept free from the application of any insecticides. Five plants were randomly chosen from each plot and insect population (both pests and natural enemies) was recorded from the plant age of 21 days *i.e*. 3 weeks after sowing (WAS). To assess flower thrips population, ten flowers from each plant were tapped on white paper, and the thrips were subsequently counted. Aphid population was assessed using the visual counting method. The numbers of adults (both alate and apterous forms) and nymphs were recorded from 10 cm apical twigs. A hand-held magnifying lens (10X) was used for field observations, and an aspirator was utilized to collect representative specimens for further identification. Spiders and coccinellid beetles were recorded on a whole-plant basis through visual observation from the same five plants per replication used for insect pest assessment. For all insect pests and their associated natural enemies, mean population were calculated. These mean populations were then correlated with the weekly averages of six meteorological parameters, namely maximum temperature, minimum temperature, morning relative humidity (RH), evening RH, wind speed, and bright sunshine hours (BSH), to determine the correlation coefficients between insect populations and abiotic environmental factors using standard statistical procedures (Gomez and Gomez, 1984) in MS Excel 2007. In case of rainfall, the cumulative total of the preceding seven days was considered.

Results and Discussion

Succession of sucking insect pest complex on green gram

The study on insect pest dynamics indicated the presence of two sucking insect pest species, namely, black bean aphid (*Aphis craccivora* Koch) and flower thrips (*Megalurothrips* sp.). These pests were recorded in different crop phenological stages. Aphid was predominant during the vegetative stage and persisted on the crop until maturity. Thrips predominantly occurred during flowering stage of the crop.

Associated natural enemies recorded in green gram crop ecosystem

Different species of coccinellid predators *viz*. *Coccinella transversalis* Fabr., *Cheliomenes sexmaculata* Fabr., *Coccinella septempunctata* Linn. (Coleoptera: Coccinellidae) were recorded from the field as natural enemies of soft bodied insect pests. Spiders along with rove beetle were also observed in the field.

Pattern of incidence of flower thrips (*Megalurothrips* sp.)

Seasonal incidence of flower thrips on different germplasms of green gram was studied during two consecutive pre-*kharif* seasons of 2022 and 2023. *Megalurothrips* sp. population was recorded on all the tested germplasm from 13/05/22 (*i.e.* 5 WAS and 20th SMW) to 27/05/22 (*i.e.* 7 WAS on 22nd SMW) during first year (Table 1) and from 22/05/23 (*i.e.* 5 WAS and 21st SMW) to 05/06/23 (*i.e.* 7 WAS and 23rd SMW) during second year (Table 2). During first year the thrips population reached its peak (4.60 per 10 flowers) on 20/05/22 (*i.e.* 6 WAS and 21st SMW) whereas during second season pest reached the peak level (4.88 per 10 flowers) during 29/05/23 (*i.e.* 6 WAS and 22nd SMW) but in both the cases maximum population was observed during flowering stage. The previously mentioned green gram germplasms were differed among themselves in pest population significantly in both the years of study. From the findings of present experiment it can be concluded that among the tested germplasms, Sukumar (0.99 and 0.82 per 10 flowers during 2022 and 2023, respectively) was recorded as the least susceptible followed by BCM 20-47 (1.07 and 0.97 per 10 flowers during 2022 and 2023, respectively) whereas Virat (1.88 and 2.08 per 10 flowers during 2022 and 2023, respectively) was relatively more susceptible to flower thrips followed by BCM 20-46 (1.54 and 1.94 per 10 flowers during 2022 and 2023, respectively) during both the years.

Duraimurugan and Tyagi (2014) opined that *Megalurothrips usitatus*, a significant pest of green gram during the spring and summer, is now a significant nuisance during the *kharif* season as well. The results of the experiment conducted by Patel *et al.* (2025) are in conformity with the present findings. They also recorded the peak population (4.20 per 3 flowers) of flower thrips (*Megalurothrips usitatus*) at 21st SMW. However, Singh *et al.* (2022) observed peak incidence (12.40 per 10 flowers) at 19th SMW which may be due to the earlier sowing of the crop. Ojha *et al.* (2022) though observed the highest thrips population during the 35th SMW in *kharif* green gram, the mean thrips population recorded by them partially supports the present outcome

Table 1: Seasonal incidence of *Megalurothrips* sp. on green gram during 2022

Germplasm	Mean thrips population in different dates of observation (Number per 10 flowers)							Mean population
	29/04/22 (18)* 3WAS	**06/05/22 (19) 4WAS**	**13/05/22 (20) 5WAS**	**20/05/22 (21) 6WAS**	**27/05/22 (22) 7WAS**	**03/06/22 (23) 8WAS**	**10/06/22 (24) 9WAS**	
BCM 21-133	0.0 (0.71)**	0.0 (0.71)	1.20 (1.30)	4.00 (2.12)	3.40 (1.97)	0.0 (0.71)	0.0 (0.71)	1.22 (1.17)
BCM 20-46	0.0 (0.71)	0.0 (0.71)	1.00 (1.22)	6.00 (2.55)	3.80 (2.07)	0.0 (0.71)	0.0 (0.71)	1.54 (1.24)
BCM 20-47	0.0 (0.71)	0.0 (0.71)	1.20 (1.30)	3.50 (2.00)	2.80 (1.82)	0.0 (0.71)	0.0 (0.71)	1.07 (1.13)
Sukumar	0.0 (0.71)	0.0 (0.71)	1.00 (1.22)	3.33 (1.96)	2.60 (1.76)	0.0 (0.71)	0.0 (0.71)	0.99 (1.11)
Virat	0.0 (0.71)	0.0 (0.71)	1.40 (1.38)	6.17 (2.58)	5.60 (2.47)	0.0 (0.71)	0.0 (0.71)	1.88 (1.32)
Mean	0.0	0.0	1.16	4.60	3.64	0.0	0.0	1.34
SEm (+/-)								0.039
CD (5%)								0.117

Table 2: Seasonal incidence of *Megalurothrips* sp. on green gram during 2023

Germplasm	Mean thrips population in different dates of observation (Number per 10 flowers)							Mean population
	08/05/23 (19)* 3WAS	**15/05/23 (20) 4WAS**	**22/05/23 (21) 5WAS**	**29/05/23 (22) 6WAS**	**05/06/23 (23) 7WAS**	**12/06/23 (24) 8WAS**	**19/06/23 (25) 9WAS**	
BCM 21-133	0.0 (0.71)**	0.0 (0.71)	1.60 (1.45)	4.00 (2.12)	2.20 (1.64)	0.0 (0.71)	0.0 (0.71)	1.11 (1.15)
BCM 20-46	0.0 (0.71)	0.0 (0.71)	3.00 (1.87)	6.80 (2.70)	3.80 (2.07)	0.0 (0.71)	0.0 (0.71)	1.94 (1.35)
BCM 20-47	0.0 (0.71)	0.0 (0.71)	1.20 (1.30)	3.40 (1.97)	2.20 (1.64)	0.0 (0.71)	0.0 (0.71)	0.97 (1.10)
Sukumar	0.0 (0.71)	0.0 (0.71)	0.80 (1.14)	3.20 (1.92)	1.80 (1.52)	0.0 (0.71)	0.0 (0.71)	0.82 (1.06)
Virat	0.0 (0.71)	0.0 (0.71)	3.40 (1.97)	7.00 (2.74)	4.20 (2.17)	0.0 (0.71)	0.0 (0.71)	2.08 (1.38)
Mean	0.0	0.0	2.00	4.88	2.84	0.0	0.0	1.39
SEm (+/-)								0.041
CD (5%)								0.123

*Standard Meteorological Week
** Figures in the parentheses are square root transformed values ($\sqrt{x+0.5}$)

Pattern of incidence of black bean aphid (*Aphis craccivora*)

Seasonal incidence of *Aphis craccivora* on different germplasms of green gram was studied during two consecutive pre-*kharif* seasons of 2022 and 2023. Aphid population was recorded on all the experimental germplasms from 13/05/22 (*i.e.* 5 WAS and 20th SMW) to 03/06/22 (*i.e.* 8 WAS and 23rd SMW) during first year (Table 3) and from 22/05/23 (*i.e*. 5 WAS and 21st SMW) to 05/06/23 (*i.e*. 7 WAS and 23rd SMW) during second year (Table 4). The aphid population peaked (26.48 per 10 cm shoot tip) on 27/05/22 (*i.e*. 7 WAS and 22nd SMW) in 2022 whereas, in 2023, it reached its peak (24.92 per 10 cm shoot tip) on 05/06/23 (*i.e*. 7 WAS and 23rd SMW). The green gram germplasms were significantly differed among themselves regarding aphid incidence in both the years of study. Conclusion can be drawn that germplasm Sukumar was relatively less susceptible (5.00 and 3.37 per 10 cm shoot tip during 2022 and 2023, respectively) to aphid followed by BCM 20-47 (5.36 and 4.34 per 10 cm shoot tip during 2022 and 2023, respectively) whereas, BCM 20-46 (9.01 and 8.02 per 10 cm shoot tip during 2022 and 2023, respectively) was relatively more susceptible to the pest followed by Virat (8.90 and 6.74 per 10 cm shoot tip during 2022 and 2023, respectively) during both the years of study.

Tamang *et al*. (2017) reported that the peak aphid population on mungbean (cv. Sonali) reached 14.0 per 10 cm shoot tip during 7–10 weeks after sowing in the first season, and 14.18 at 6 weeks after sowing in the second season. Patel et al. (2025) also reported that aphids appeared from the 3rd week after sowing and gradually increased, peaking at 6.25 aphids per 3 leaves at 8 WAS. According to Gehlot and Prajapat (2020), during *kharif* season, the mean population of aphids reached its peak, with 10.2 aphids per 10 cm of twig per plant during the 36th SMW (7WAS). Ojha *et al.* (2022), also during *kharif* season, observed the highest population of *A. craccivora* at 36th SMW (8WAS) with an average of 8.70/ plant, followed by the 34th SMW (5.40/ plant). All these results are in line with our present findings. The report of Bordoloi *et al.* (2026) from Assam regarding overall population growth pattern of aphid in summer green gram also corroborates the present findings.

Table 3: Seasonal incidence of *Aphis craccivora* on green gram during 2022

Germplasm	Mean aphid population in different dates of observation (Number per 10 cm apical tip)							Mean population
	29/04/22 (18)* 3WAS	06/05/22 (19) 4WAS	13/05/22 (20) 5WAS	20/05/22 (21) 6WAS	27/05/22 (22) 7WAS	03/06/22 (23) 8WAS	10/06/22 (24) 9WAS	
BCM 21-133	0.0 (0.71)**	0.0 (0.71)	6.00 (2.55)	10.30 (3.29)	22.60 (4.81)	0.0 (0.71)	0.0 (0.71)	5.55 (1.92)
BCM 20-46	0.0 (0.71)	0.0 (0.71)	9.00 (3.08)	15.50 (4.00)	33.60 (5.84)	5.00 (2.35)	0.0 (0.71)	9.01 (2.48)
BCM 20-47	0.0 (0.71)	0.0 (0.71)	3.00 (1.87)	11.50 (3.46)	23.00 (4.85)	0.0 (0.71)	0.0 (0.71)	5.36 (1.87)
Sukumar	0.0 (0.71)	0.0 (0.71)	6.00 (2.55)	9.80 (3.21)	19.20 (4.44)	0.0 (0.71)	0.0 (0.71)	5.00 (1.86)
Virat	0.0 (0.71)	0.0 (0.71)	5.60 (2.47)	14.70 (3.89)	34.00 (5.87)	8.00 (2.92)	0.0 (0.71)	8.90 (2.46)
Mean	0.0	0.0	5.92	12.36	26.48	2.60	0.0	6.76
SEm (+/-)								0.62
CD (5%)								1.86

Table 4: Seasonal incidence of *Aphis craccivora* on green gram during 2023

Germplasm	Mean aphid population in different dates of observation (Number per 10 cm apical tip)							Mean population
	08/05/23 (19)* 3WAS	15/05/23 (20) 4WAS	22/05/23 (21) 5WAS	29/05/23 (22) 6WAS	05/06/23 (23) 7WAS	12/06/23 (24) 8WAS	19/06/23 (25) 9WAS	
BCM 21-133	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	9.30 (3.14)	20.40 (4.57)	0.0 (0.71)	0.0 (0.71)	4.24 (1.60)
BCM 20-46	0.0 (0.71)	0.0 (0.71)	10.20 (3.27)	13.80 (3.79)	32.20 (5.72)	0.0 (0.71)	0.0 (0.71)	8.02 (2.23)
BCM 20-47	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	7.00 (2.74)	23.40 (4.89)	0.0 (0.71)	0.0 (0.71)	4.34 (1.59)
Sukumar	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	5.80 (2.52)	17.80 (4.28)	0.0 (0.71)	0.0 (0.71)	3.37 (1.47)
Virat	0.0 (0.71)	0.0 (0.71)	5.60 (2.47)	10.80 (3.37)	30.80 (5.59)	0.0 (0.71)	0.0 (0.71)	6.74 (2.03)
Mean	0.0	0.0	3.16	9.34	24.92	0.0	0.0	5.34
SEm (+/-)								0.57
CD (5%)								1.70

*Standard Meteorological Week

** Figures in the parentheses are square root transformed values (√x+0.5)

Occurrence of associated natural enemies

Natural enemies like predacious coccinellid beetles and spiders were recorded in relatively higher number from the green gram ecosystem during two years of experiment along with occurrence of rove beetle, damsel fly, hover fly, ground beetle in smaller proportion. The population of natural enemies exhibited a gradual increase with crop age, attaining peak abundance during the mid to late phenological stages, followed by a decline towards crop maturity. In first year, the overall mean population of coccinellid beetle, spider and rove beetle was recorded highest in Virat whereas; the lowest population of coccinellid beetle was recorded in Sukumar (Fig. 1). Both spider and rove beetle populations were found minimum in number in the germplasm Sukumar indicating a significant influence of varietal differences on predator dynamics. During second year (Fig. 2), the occurrences of natural enemies followed the similar trend, though rove beetle was recorded very few in number in second year. The highest population of coccinellid beetles and spiders were recorded in Virat and the lowest population was recorded in Sukumar. The rove beetle incidence during second year was recorded only in two test germplasms of green gram *viz*. Virat and BCM 20-46. Among the predator groups, coccinellids recorded relatively higher mean population densities across all observation periods, with distinct variation among germplasms. The mean population of coccinellid beetle varies from 0.37 to 0.77 and from 0.26 to 0.66 respectively, during 2022 and 2023. The population was highest during the reproductive stage. Again, the mean population of spider varies from 0.25 to 0.67 and 0.11 to 0.69 respectively, in both the seasons. It was also maximum during the reproductive stage.

The incidence of higher number of lady bird beetles (coccinellid beetles) in spring-summer green gram var. GM-4 was earlier reported by Patel and Jena (2024). According to them, population of ladybird beetle appeared on 12th SMW, its population increased gradually and reached its peak during 17th SMW at the time of crop harvest. Yadav and Agrawal (2021) also reported Coccinellids as the major arthropod predators found in green gram crop ecosystem.

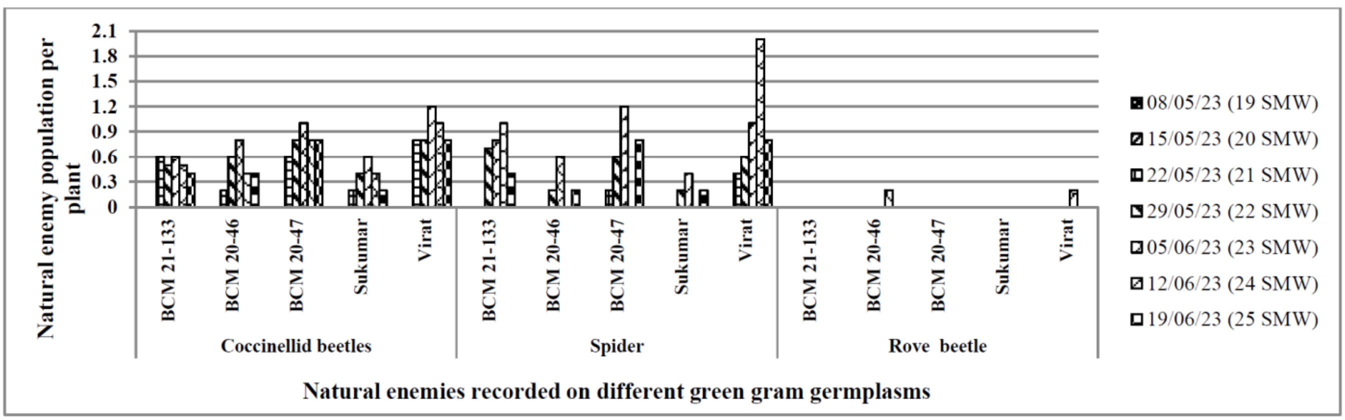

Fig. 1: Occurrence of natural enemies on green gram during 2022

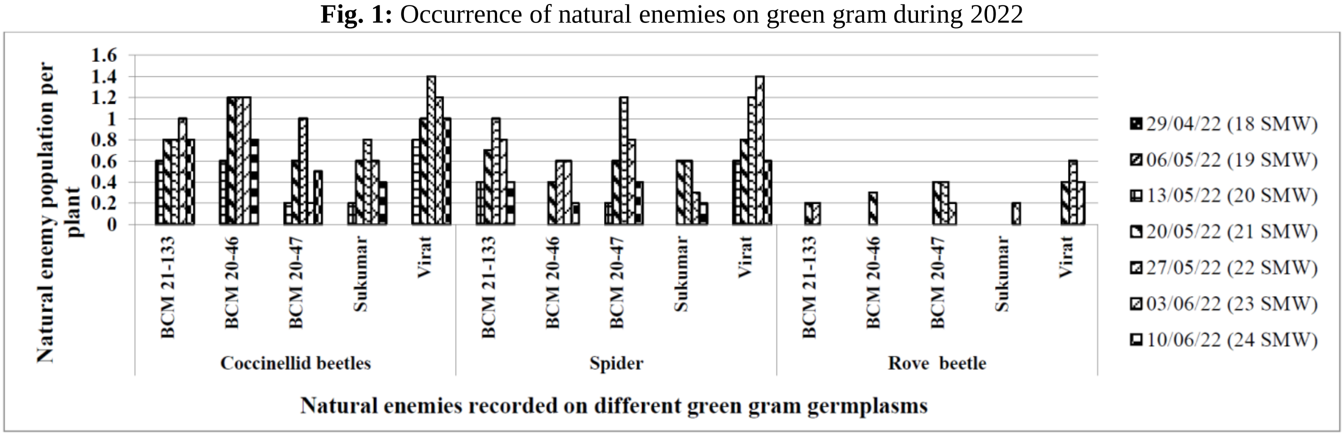

Fig. 2: Occurrence of natural enemies on green gram during 2023

Effect of prevailing weather conditions on pest and natural enemy population build-up on green gram

Effect on *Megalurothrips* sp. population

Incidence of flower thrips on green gram was correlated with meteorological factors during two consecutive pre-*kharif* seasons of 2022 and 2023 and the results are as follows.

From the correlation studies between flower thrips population and weather variables presented in Table 5, it is revealed that both maximum temperature (r = -0.180 and -0.336 in 2022 and 2023, respectively), minimum temperature (r = -0.183 and -0.327 in 2022 and 2023, respectively) and morning RH (r = -0.385 and -0.074 in 2022 and 2023, respectively) exhibited non-significant negative correlation with thrips population during both the years of experimentation whereas, evening RH (r = 0.164 and 0.261 in 2022 and 2023, respectively), wind speed (r = 0.563 and 0.312 in 2022 and 2023, respectively), BSH (r = 0.563 and 0.557 in 2022 and 2023, respectively) and rainfall (r = 0.231 and 0.479 in 2022 and 2023, respectively) exhibited non-significant positive correlation with thrips population.

Yadav and Singh (2006) developed forecast models for thrips (*Caliothrips indicus*) attacking mungbean crop by incorporating various abiotic parameters. Minimum temperature coupled with relative humidity showed a negative response during summer. Their findings justify the present outcome though they worked on different thrips species. They also opined that the summertime rainfall was only somewhat beneficial towards development of thrips population which is also in conformity with the present findings. Ahirwar and Bhowmick (2016) found that thrips population was positively and significantly correlated with sunshine hours. This report partially supports the present finding. According to them, other abiotic parameters including maximum and minimum temperature, morning and evening RH and evaporation had non-significant impact which was at par with our result.

Effect on *Aphis craccivora* population

From Table 5, it is evident that both maximum temperature (r = -0.678 and -0.863* in 2022 and 2023, respectively) and minimum temperature (r = -0.656 and -0.819* in 2022 and 2023, respectively) exhibited negative correlation with aphid population in both the years of study, though it was non-significant during first year and significant during second year. Again, both morning RH (r = 0.731 and 0.630 in 2022 and 2023, respectively) and evening RH (r = 0.781* and 0.629 in 2022 and 2023, respectively) exhibited positive correlation with aphid population in both the years of study, though it was non-significant in most of the cases excepting significant correlation between evening RH and pest population during first year. However, rainfall showed significant negative association (r = -0.802* and -0.875* in 2022 and 2023, respectively) with aphid population in both the years. Other weather factors like wind speed (r = -0.243 and 0.228 in 2022 and 2023, respectively) and BSH (r = -0.227 and 0.244 in 2022 and 2023, respectively) revealed non-significant correlations with aphid population in both the years.

Earlier, Biswas and Banerjee (2019) from West Bengal reported that aphid population on green gram had significant negative association with minimum temperature but they conducted the experiment during *kharif* season. This report partially supports the present result. Gehlot and Prajapat (2020) showed that aphid population had a positive link with humidity. This also lends support to our result. Bordoloi *et al.* (2026) also presented a significant negative correlation of aphid population on summer green gram with rainfall (r = -0.505). This result goes at par with the present findings. Similarly, Abbasi *et al.* (2019) and Patel *et al.* (2022) also documented a significant negative correlation between aphid incidence and rainfall though they studied on wheat and cotton, respectively.

Effect on natural enemy population

Table 5 reveals that all the meteorological parameters taken into consideration resulted non-significant association with populations of all the natural enemies recorded in the present experiment besides exhibiting a significant and negative association between morning RH and spider populations in the second year of study (Table 5). In both the years of research study, maximum temperature (r = -0.233 and -0.261 in 2022 and 2023, respectively), morning RH (r = -0.051 and -0.520 in 2022 and 2023, respectively) and rainfall (r = -0.113 and -0.127 in 2022 and 2023, respectively) exhibited negative correlations with the coccinellid population whereas, minimum temperature (r = 0.140 and 0.445 in 2022 and 2023, respectively), evening RH (r = 0.307 and 0.035 in 2022 and 2023, respectively) and wind speed (r = 0.246 and 0.031 in 2022 and 2023, respectively) revealed positive correlations. In case of spider also, morning RH (r = -0.277 and -0.737* in 2022 and 2023, respectively) and rainfall (r = -0.207 and -0.137 in 2022 and 2023, respectively) exhibited negative correlations in both the years whereas, other parameters like minimum temperature (r = 0.099 and 0.323 in 2022 and 2023, respectively), evening RH (r = 0.188 and 0.046 in 2022 and 2023, respectively), wind speed (r = 0.482 and 0.033 in 2022 and 2023, respectively) and BSH (r = 0.155 and 0.315 in 2022 and 2023, respectively) revealed positive correlations. Among all of these, only morning RH in the second year exhibited significant association. The population of rove beetle which was recorded during the first year only shows significant effect, whereas, exhibited non-significant negative correlations with all the weather parameters excepting morning and evening relative humidity.

Table 5: Correlation of pests and natural enemies with weather parameters

Weather parameters	2022					2023			
	Correlation coefficient (r) values in respect of different meteorological variables								
	Thrips	Aphid	Coccinellid	Spider	Rove beetle	Thrips	Aphid	Coccinellid	Spider
Maximum temperature	-0.180	-0.678	-0.233	-0.124	-0.146	-0.336	-0.863*	-0.261	0.096
Minimum temperature	-0.183	-0.656	0.140	0.099	-0.001	-0.327	-0.819*	0.445	0.323
Morning RH	-0.385	0.731	-0.051	-0.277	0.471	-0.074	0.630	-0.520	-0.737*
Evening RH	0.164	0.781*	0.307	0.188	0.334	0.261	0.629	0.035	0.046
Wind speed	0.563	-0.243	0.246	0.482	-0.372	0.312	0.228	0.031	0.033
BSH	0.563	-0.227	-0.053	0.155	-0.528	0.557	0.244	0.062	0.315
Rainfall	0.231	-0.802*	-0.113	-0.207	-0.237	0.479	-0.875*	-0.127	-0.137

Conclusion

Findings of the two years study reveal that flower thrips population appeared on green gram at its vegetative stage during first fortnight of May in low intensity, after that it reached its peak during flowering stage. Afterwards the pest population started to decline. Among the tested germplasms Sukumar was recorded as the least susceptible variety to flower thrips followed by BCM 20-47 whereas Virat was relatively more susceptible variety followed by BCM 20-46. Aphid population started to appear during vegetative stage and reached the peak during flowering stage. In case of aphid also, Sukumar was the least susceptible variety followed by BCM 20-47 but BCM 20-46 was recorded as the most susceptible germplasm followed by Virat. Among the natural enemies, the overall mean population of coccinellid beetle, spider and rove beetle was recorded highest in Sukumar whereas the lowest population of coccinellid beetle was recorded in BCM 20-46 and Virat. The correlation studies reveal that in case of flower thrips all the meteorological parameters taken into consideration were found having non-significant impact. However, aphid incidence showed relatively stronger correlation with meteorological parameters where rainfall had significantly negative correlation with the pest population. In case of natural enemies, all the weather parameters exhibited non-significant correlations except for spider where significant negative correlation was determined between maximum relative humidity and predator population during second year of the experiment.

Author's Contributions

Neha Mahato: conducted the field experiment, collected data and prepared the manuscript. **Sabyasachi Ray:** assisted in data analysis and interpretation.

Soumita Bera: contributed to manuscript preparation and literature review.

Amitava Banerjee: supervised the research work and revised the manuscript critically.

Declaration

We hereby confirm that the submitted manuscript is an original piece of work and has not been published previously in any form. The manuscript is not under consideration for publication elsewhere. All authors read and approved the final manuscript. The authors declare that there are no conflicts of interest regarding the publication of this article.

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References

Abbasi, Z., Sultana, R., Wagan, M.S. and Soomro, F. (2019). Population fluctuation of aphid on the different wheat varieties from Larkana district. *Sindh Univ. Res. J. (Sci. Ser.)*, **51**(3), 411-418. https://doi.org/10.26692/surj/2019.09.66

Ahirwar, B. and Bhowmick, A.K. (2016). Incidence of major insect pests of summer mungbean. *Ann. Biol.*, **32**(1), 55-58.

Anonymous. (2024). Project Coordinator's Report 2023-24. All India Coordinated Research Project on Kharif Pulses, ICAR-Indian Institute of Pulses Research, Kanpur-208024, 135p.

Biswas, S. and Banerjee, A. (2019). Seasonal variation in incidence of insect pests occurring on green gram [*Vigna radiata* (Linn.) Wilczek] in lower gangetic plains of West Bengal. *Int. J. Chem. Stud.*, **7**(6), 1583-1588.

Bordoloi, P.A., Rajkumari, P., Borah, N., Mishra, R., Kalita, J. and Borah, B.K. (2026). Population buildup of insect pest complex in summer green gram [*Vigna radiata* (L.)]. *Int. J. Environ. Clim. Chang.*, **16**(4), 476-485. https://doi.org/10.9734/ijecc/2026/v16i45374

Chhabra, K.S. and Kooner, B.S. (1985). Losses in summer mungbean due to insect pest in Punjab. *Indian J. Entomol.*, **47**(1), 103-105.

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. *J. Res. Punjab Agric. Univ.*, **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. *J. Econ. Entomol.*, **73**(2), 197-199. https://doi.org/10.1093/jee/73.2.197

Didinger, C. and Thompson, H. J. (2021). Defining nutritional and functional niches of legumes: A call for clarity to distinguish a future role for pulses in the dietary guidelines for Americans. *Nutrients*, **13**(4), 1100. https://doi.org/10.3390/nu13041100

Duraimurugan, P. and Tyagi, K. (2014). Pest spectra, succession and its yield losses in mungbean and urdbean under changing climatic scenario. *Legume Res.*, **37**(2), 212-222. https://doi.org/10.5958/j.0976-0571.37.2.032

Gehlot, L. and Prajapat, A.K. (2020). Seasonal incidence of insect pests on mungbean (*Vigna radiata*) in correlation with meteorological data. *Agric. Sci. Dig.*, **41**, 199-202.

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.

Nair, R.M., Pandey, A.K., War, A.R., Hanumantharao, B., Shwe, T., Alam, A.K.M.M., Pratap, A., Malik, S.R., Karimi, R., Mbeyagala, E.K., Douglas, C.A., Rane, J. and Schafleitner, R. (2019). Biotic and abiotic constraints in mungbean production - progress in genetic improvement. *Front. Plant Sci.*, **10**, 1340. https://doi.org/10.3389/fpls.2019.01340

Ojha, A.K., Tomar, S.P.S., Naveen Kumar, N., Suman, S. and Saxena, S. (2022). Population dynamics of major insect pests complex of green gram, [*Vigna radiata* (Linn.)] and their correlation. *Pharma Innov. J.*, **SP-11**(4), 145-148.

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

Patel, D.S., Deb, S., Parmar, N.L. and Joshi, V.J. (2025). Population dynamics of sucking pests in green gram, *Vigna radiata* (L.) Wilczek. *J. Agric. Ecol.*, **20**, 53-56. https://doi.org/10.58628/JAE-2520-107

Patel, P.B. and Jena, M.K. (2024). Population dynamics of sucking pests, natural enemies, and the incidence of yellow mosaic disease on *Vigna radiata* (L.) Wilczek in relation to weather factors. *Entomon*, **49**(4), 553-556. https://doi.org/10.33307/entomon.v49i4.1346

Patel, Z.K., Patel, R.D., Desai, H.R., Bhanderi, G.R. and Jena, M.K. (2022). Population dynamics of aphid, *Aphis gossypii* Glover on Bt and non Bt cotton and correlation with weather parameters. *Int. J. Environ. Clim. Chang.*, **12**(11), 1245-1251. https://doi.org/10.9734/ijecc/2022/v12i 11 31101

Potter, N.N. and Hotchkiss, J.S. (1997). *Food science*, CBS Publishers, New Delhi, India, 403p.

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.

Rafes, R.M. (1978). Biogeocoenological theory of the population dynamics of phytophagous forest insects. *Annu. Rev. Entomol.*, **8**(2), 34-51.

Singh, A.K., Singh, S.S., Prakash, V.E.D., Kumar, S. and Dwivedi, S.K. (2015). Pulses production in India: Present status, bottleneck and way forward. *J. AgriSearch*, **2**(2), 75-83.

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. *J. Exp. Zool. India.*, **20**(1), 491-495.

Singh, S.P., Singh, S.K. and Chandra, U. (2022). Incidence of insect pests on summer mungbean in relation to weather parameters. *Biol. Forum Int. J.*, **14**(3), 1492-1496.

Singh, S.R. and Allen, D.J. (1980). *Pests, diseases, resistance and protection in* cowpeas, Advances in Legume Science, pp. 419-443.

Soundarajan, R.P., Chitra, N. and Geetha, S. (2013). Host plant resistance to insect pests of grain legumes- A review. *Agric. Rev.*, **34**(3), 176-187.https://doi.org/10.5958/j.0976-0741.34.3.002

Tamang, S., Venkatarao, P., Chaterjee, M. and Chakraborty, G. (2017). 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*, **12**(2), 893-897.

Yadav, D.K. and Singh, S.K. (2006). Forecast model of major insect pests of mungbean. *Ann. Plant Prot. Sci.*, **14**(2), 323-328.

Yadav, N. and Agrawal, N. (2021). Population dynamics of arthropod predators in summer grown green gram. *Indian J. Entomol.*, **83**(3), 427-429.https://doi.org/10.5958/0974-8172.2020.00193.5

Zahid, M.A., Islam, M.M. and Begum, M.R. (2008). Determination of economic injury levels of *Maruca vitrata* in mungbean. *J. agric. rural dev.*, **6**(1), 91-97.