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Assessment of hemipteran abundance and nature of damage on blackgram (*Vigna mungo*) in agricultural fields

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Abstract

This study investigates the abundance and nature of damage of hemipterans on blackgram (*Vigna mungo*) crops in agricultural fields during 2016-2017. Hemipteran populations were assessed across different growth stages of the crop using standardized sampling methods. Results revealed the presence of diverse hemipteran species, with fluctuations in their abundance throughout the crop's development. Nature of damage of the crop was assessed, highlighting potential implications for blackgram cultivation. Insects of 5 families were observed at the time of the study. *Mylloceros undecimpustulatus* (Family Curculionidae), *Nezara viridula* (Family Pentatomidae), *Riptortus linearis* (Family Coreidae), *Cletus bipunctatus* (Family Coreidae), *Aphis craccivora* (Family Aphididae) and *Empoasca kerri* (Family Cicadellidae) represented this order. These insects harmed the plant's three most vital parts such as leaves, pods and flowers. In terms of its presence in the crop field for a longer period of time and the type of harm it caused, *Riptortus linearis* was considered as the key pest in the study. The relation of occurrence of insects with climatic factors was investigated by Karl Pearson's coefficient of correlation technique; however, the results were generally negligible. The findings underscore the need for sustainable management strategies to mitigate hemipteran-related yield losses in blackgram cultivation.

Keywords: Abundance; Assessment; Blackgram; Cultivation; Damage; Hemipteran

1. Introduction

Blackgram (*Vigna mungo*) stands as a vital leguminous crop contributing significantly to global food security and sustainable agriculture. The leguminosae family and subfamily papilionaceae comprise the black gram (*Vigna mungo* L.) [1], which is referred to as "matimah" in Assam. Black gram's high protein, phosphoric acid content, and ability to improve soil by fixing atmospheric nitrogen (Nene, 2006) [2] have made it one of Assam's most important pulse crops, especially in the Kamrup (Rural) area. However, the cultivation of this crop faces numerous challenges, including pest infestations that can profoundly impact yield. Many factors affect blackgram development, most likely insect damage being one among them. In India, insect pest complexes produce quantitatively needless losses (7.35 percent) in both black and greengram, and the extent of these losses varies with agro-climatic circumstances, according to Hamad and Dubey (1983) [3]. In blackgram, losses from insect pest damage accounted for 54.3% of total losses, according to Chhabra and Kooner (1985) [4]. Lal and Sachan (1987) [5] stated that "a variety of insect pests harm it from sowing until harvesting in the field, as well as in stored produce." Because they can spread disease and feed on plant sap, hemipterans—a broad category of insects made up of different species—represent a significant concern among these pests. It is essential to comprehend the dynamics and abundance of hemipteran populations in blackgram fields in order to develop efficient pest management plans. Managing insect incidence is a challenge for cultivators looking to boost productivity. Regardless of the approach taken to manage or control insect pests, prompt surveying and observation is always helpful for improved control. It is also helpful in anticipating problems or informing farmers when to take preventative action. These kinds of research and our knowledge of the composition of pests in the rural parts of Kamrup

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district are inadequate. As a result this study aims to assess the abundance of hemipterans across different growth stages of blackgram crops in agricultural fields, shedding light on their potential impact and implications for sustainable crop production.

2. Materials and Methods

2.1. Study Area and Experimental Design

The study was carried out on 668.5 metres of agricultural land planted with blackgram in the Village Dehar Kuriha in the Kamrup (Rural) District (26.3303^0 N, 91.5148^0 E). Three blocks and three replications were set aside for data collection in a randomised block design. Assam, which has a diverse range of flora and animals, is situated in northeastern India. The site of our experimental activity was the Hajo revenue circle in this district. The experiment was carried out in 2016 and 2017 from August to November. This project's primary objective was to survey and observe blackgram insect pests in order to ascertain their qualitative and quantitative makeup, the type of damages they cause, the frequency of their occurrences during specific seasons, and the connections between these pests and abiotic variables like temperature and relative humidity. An elevated bund measuring around 0.6 metres separated two locations in the experiment, which was set up with identical distances between plots.

2.2. Sampling Methods

Every week, samples were taken for hemipteran abundance in blackgram crops at different phases of growth, from germination to maturity. Each block's five randomly chosen plant sample points were subjected to standardised techniques like sweep netting and visual counting. The ecological factors and insect observation were conducted using the techniques outlined by Southwood and Handerson (2000) [6]. During the hours of 6 a.m. to 8 a.m., when insects are least active, observations of insects were made. Using the visual counting method in each replicate, the population of insect pests in all stages, including larva, nymph, and adult, was recorded. In every replication, the insects were seen in a "Z" sampling pattern. There were some precautions taken into the field to prevent edge effects. Before sampling the first plant, a little distance from the plot boundary was entered into the field to prevent edge effects. A template for a field data sheet was made in order to record insect numbers. Following two weeks of seeding, the data were collected in September through November of both 2016 and 2017.

2.3. Data Collection Techniques

Taxonomic keys and morphological traits were used to gather, identify, and count Hemipteran specimens. Temperature and humidity levels, among other environmental factors, were simultaneously measured. The Food and Agricultural Organization's Risk Rating Guideline (FAO, 2007) [7] was followed in order to identify the pest status. For example, if the insect exhibited plant-damaging traits, such as resemblance to other insects that feed on, dwell in, or on plants, or if the insect is recognised as a pest of plants elsewhere, or if it belongs to a taxonomic group that frequently contains known pests (species, genus, or family), these factors were taken into consideration for pest detection. From the time the pest first emerged at the crop until it was harvested, weekly observations of insect pests were conducted in the experimental field starting on the 35th standard week of 2016 and 36th standard week of 2017. The insect pests were identified to the species level. A digital camera (Nikon) was used to take pictures of the insects, and a magnifying hand lens was utilised to analyse the tiny insects. The specimens were then preserved for additional identification using tiny vials filled with alcohol.

For appropriate monitoring, a reference library of coloured photos of insects was assembled from a variety of websites and reference books, and it was always carried in the field. Specimens of insects that were unidentifiable based on the body of existing literature were forwarded to the Zoological Survey of India in Kolkata for classification and identification. A qualitative table containing the common name, scientific name, family, order and status of the pests was constructed from the observed insects. In accordance with the "Pest Risk Analysis (PRA) Training, Participant Manual" (FAO, 2007) [7], the pest status of the insects was classified. The ability of a pest to persist and establish itself across a broad range of hosts was deemed high; similarly, the ability to survive and establish itself is classified as medium when it can cover around one-third to two-thirds of the host area; low when it can only cover one-third of the host's range. Major pests were those that have developed into pests, are present for several days, require treatment, and cause financial losses; minor pests are those that cause pest incidence for a few days, require little treatment, and do not cause significant economic losses; and key pests are those that were identified as the main insect pests based on their consistent presence or attacks during the middle or end of the crop cycle and their highest abundance. Among the weather parameters only maximum and minimum temperature and maximum and minimum relative humidity was considered for the study of relationship with insect pests and these were obtained from the record of state Indian Meteorological Department.

2.4. Statistical Analysis

The collected data on hemipteran abundance and environmental variables were subjected to statistical analyses using Excel.2010. Descriptive statistics and correlation analyses were employed to examine relationships between hemipteran abundance, environmental factors, and nature of damage. Data from a field research was used to produce a quantitative estimate of pests at various stages of crop growth. To determine the insect pest's species diversity, the following statistical procedures were used to calculate Mean density, Relative density, Species Abundance, and Species Richness:

- **Mean Density** $= \frac{\sum X_i \times 100}{N}$
  Where x_i = Number of insects in i^{th} sample and
  N= Total numbers of plants sampled.
- **Relative Density** (RD)% $= \frac{\text{No.of individual of one species} \times 100}{\text{total no.s of individual of all species.}}$
- **Species Abundance:** It was measured as the number of individuals of a species found per plot. The ratio of abundance of one species to all other species living in an ecosystem is referred to as relative species abundance. These are the indicators and relevant for computing biodiversity.
- **Species richness:** It is the number of species present in a particular habitat.
- Using Karl Pearson's co-efficient of correlation technique, the relationship between pest succession and atmospheric temperature and relative humidity was measured using meteorological data obtained from the state meteorological department following the method of Fowler et al. (1998) [8].

3. Results and Discussion

3.1. Abundance and Diversity of Hemipterans

Across the growth stages of blackgram, a total of 6 hemipteran species were identified. The abundance of hemipterans varied significantly between growth stages, with a peak observed during the vegetative stage. *Mylloceros undecimpustulatus* (Fam. Curculionidae), *Nezara viridula* (Fam. Pentatomidae), *Riptortus linearis* (Fam. Coreidae), *Cletus bipunctatus* (Fam. Coreidae), *Aphis craccivora* (Fam. Aphididae), *Empoasca kerri* (Fam. Cicadellidae) represented the order Hemiptera.

Table 1 Composition and nature of damage of Hemiptera during 2016 and 2017

Sl. No.	Common name/ Scientific name	Order/Family	Nature of damage	Status of damage
1	Pod sucking bugs/ *Riptortus linearis* Fab., 1775	Hemiptera/ Coreidae	Pods	High
2	Aphid/ *Aphis craccivora* Koch	Hemiptera/ Aphididae	Leaves, stems, floral parts	High
3	Grey weevil/ *Mylloceros undecimpustulatus* Marshall	Hemiptera/ Curculionidae	Leaves	Low
4	Pentatomid bug/ *Nezara viridula* Linn., 1758	Hemiptera/ Pentatomidae	Pods, Leaves	Low
5	Pod sucking bugs/ *Cletus bipunctatus* Westwood, 1842	Hemiptera/ Coreidae	Pods	Low
6	Leaf hopper/ *Empoasca kerri* Pruthi	Hemiptera/ Cicadellidae	Leaves	Medium

3.2. Population Dynamics

As part of the study, the seasonal incidence of insect pests that appeared and spread in crop fields in 2016 and 2017 were noted by adhering to the correct protocol. The crop field was used to record the mean population/plant and total population/standard week from weekly observations conducted in 2016 and 2017. All of the pests noted in the experiment were seen in the field during the 39th and 40th standard weeks. *Empoasca kerri* posed a serious crop problem to blackgram. With an initial mean population of 1.4/plant, the pest made its appearance in 36th standard week, 2016. It then progressively increased to a peak population of 3.13/plant in the 39th standard week. With a mean population of 0.8/plant during the 37th standard week and a steady increase to a high level of 3.13/plant during the 40th standard week, the species made its first appearance in 2017. The aphid, or *Aphis craccivora*, was first observed in 2016 in the 37th standard week, with a population of just 3.40 per plant. This was followed by a gradual increase, reaching a maximum of 6.47 per plant in the 39th standard week. With a mean population of 3.4/plant during the 38th standard week of 2017, it first appeared in 2017. During the 41st standard week, it peaked at 6.47/plant. *Nezara viridula* peaked in the 39th standard week of 2016, having initially appeared in the 36th standard week with a mean population of 0.2/plant. During the 36th standard week in 2016, *Nezara viridula* was initially observed with a mean population of 0.2 plants, and reached its peak in the 39th standard week with a mean population of 0.6 plants. With a typical population of 0.13 per plants, it first surfaced in the 37th standard week of 2017, and by the 41st standard week, it had reached its peak with 0.6 per plants. With a mean population of 0.8/plant, *Riptortus linearis* first surfaced in the 37th standard week of 2016 and peaked in the 40th standard week with a mean population of 1.73 plants. With a mean population of 0.73 per plant, it first surfaced in the 38th standard week of 2017, and by the 41st standard week, it had reached its peak with 2.46 per plant. The species including *Cletus bipunctatus* and *Mylloceros undecimpustulatus,* were found in small numbers.

The mean density and relative density of the observed species in the field, along with their abundance was determined. The population of *Mylloceros undecimpustulatus*, and *Cletus bipunctatus* had the lowest. In 2017, the abundance, mean density, and relative density were nearly unchanged.

Table 2 Mean population/plant during 2016

Std. Week	***Mylloceros undecimpustulatus***		***Nezara viridula***		***Riptortus linearis***		***Cletus bipunctatus***		***Aphis craccivora***		***Empoasca kerri***	
	Per plant	**Total**	**Per plant**	**Total**	**Per plant**	**Total**	**Per plant**	**Total**	**Per plant**	**Total**	**Per plant**	**Total**
35	-	-	-	-	-	-	-	-	-	-	-	-
36	-	-	0.2	3	-	-	-	-	-	-	1.4	21
37	-	-	0.33	5	0.8	12	-	-	3.4	51	1.8	27
38	-	-	0.33	5	1.0	15	-	-	4.86	73	2.2	33
39	0.13	2	0.6	9	2.2	33	-	-	6.47	97	3.13	46
40	0.4	6	0.46	7	1.73	26	0.13	2	1.4	21	2.06	31
41	0.33	5	0.33	5	1.6	23	0.4	6	3.4	51	2.6	37
42	0.26	4	0.26	4	1.46	22	0.33	5	-	-	1.8	27
43	-	-	0.33	5	0.93	14	0.26	4	-	-	-	-
44	0.2	3	0.26	4	0.87	13	0.2	3	2.6	39	1.0	15
45	-	-	0.26	4	0.46	7	-	-	1.53	23	0.2	3
46	-	-	0.13	2	0.4	6	-	-	-	-	0.13	2
		20		53		171		20		355		242

Table 3 Mean population/plant during 2017

Standard Week	*Mylloceros undecimpustulatus*		*Nezara viridula*		*Riptortus linearis*		*Cletus bipunctatus*		*Aphis craccivora*		*Empoasca kerri*	
	Per plant	Total	Per plant	Total	Per plant	Total	Per plant	Total	Per plant	Total	Per plant	Total
36	-	-	-	-	-	-	-	-	-	-	-	-
37	-	-	0.13	2	-	-	-	-	-	-	0.8	12
38	-	-	0.2	3	0.73	11	-	-	3.4	51	2.6	39
39	-	-	0.33	5	1.4	17	-	-	4.8	72	1.93	30
40	0.13	2	0.46	7	1.8	27	-	-	4.8	72	3.13	47
41	0.4	6	0.6	9	2.46	37	0.13	2	6.47	97	2.06	31
42	-	-	0.13	2	1.46	22	0.46	7	2.46	37	2.8	42
43	0.26	4	0.26	4	0.8	12	0.4	6	1.53	23	-	-
44	-	-	0.3	5	0.93	14	0.26	4	-	-	-	-
45	0.2	3	0.2	3	0.8	12	-	-	2.6	39	1.46	22
46	0.33	5	-	-	0.26	4	-	-	-	-	0.4	6
47	-	-	0.13	2	0.93	14	0.2	3	-	-	0.13	2
		20		42		170		22		391		231

Table 4 Species Abundance with mean density and relative density in 2016

Sl. No.	Insect pest species	Abundance								Mean Density		Relative Density	
		P-I		P-II		P-III		Total					
		2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
1	*Mylloceros undecimpustulatus*	8	9	5	6	7	5	20	20	11.1	11.11	1.1	1.1
2	*Nezara viridula*	20	17	17	6	11	19	48	42	26.7	23.33	2.6	2.2
3	*Riptortus linearis*	61	61	63	48	49	61	173	170	96.1	94.44	9.2	9.1
4	*Cletus bipunctatus*	8	5	5	9	7	8	20	22	11.1	12.22	1.1	1.2
5	*Aphis craccivora*	127	141	127	127	101	123	355	391	197.2	217.22	18.9	20.9
6	*Empoasca kerri*	82	91	82	75	79	64	243	230	135.0	127.78	12.96	12.3

3.3. Relationship between abiotic factors and pest incidence

The greatest and lowest temperatures recorded throughout the study period were found to be 35 °C on October 2, the second day of the 39th standard week, and 15 °C on November 20, 2016. In 2017, September 10 of the 37th standard week had the greatest temperature of 35 °C, while November 26 of the 47th standard week had the lowest temperature of 17 °C. In 2016, the 38th, 40th, 43rd, and 46th weeks of observation saw the maximum relative humidity of 98 percent, while the 42nd, 43rd, 45th, and 46th weeks of observation had the lowest relative humidity of 55 percent. In the 42nd standard week, the highest relative humidity was discovered to be 100%, while the lowest relative humidity was discovered to be 32% in 46th standard week of observation in 2017.

A research of the correlation in 2016 found a non-significant positive link between the highest temperature and the pest populations of *Aphis craccivora*, *Empoasca kerri*, *Nezara viridula*, *Mylloceros undecimpustulatus*, and *Riptortus linearis*. There was a non-significant negative correlation between maximum temperature and the insect pest *Cletus bipunctatus*. A substantial positive correlation was observed with *Aphis craccivora* and *Cletus bipunctatus*, while a non-significant positive correlation was discovered with minimum temperature and *Empoasca kerri*, *Nezara viridula*, *Mylloceros undecimpustulatus* and *Riptortus linearis*. The investigation of the association revealed a non-significant positive relationship in 2017 between the maximum temperature and the pest populations of *Cletus bipunctatus*, *Mylloceros undecimpustulatus* and *Aphis craccivora*. The pests *Empoasca kerri*, *Nezara viridula* and *Riptortus linearis* shown a noteworthy positive correlation with maximum temperature. Similarly, minimum temperature had a non-significant positive correlation with *Empoasca kerri*, *Nezara viridula*, *Aphis craccivora* and *Riptortus linearis* and non-significant negative correlation with *Mylloceros undecimpustulatus* and *Cletus bipunctatus*.

Maximum relative humidity in 2016 was positively correlated with *Cletus bipunctatus*, but negatively correlated with *Empoasca kerri*, *Aphis craccivora*, *Nezara viridula*, and *Mylloceros undecimpustulatus*. Throughout the trial, there was a non-significant negative correlation between all insect pests and the lowest relative humidity. In 2017, *Cletus bipunctatus*, *Mylloceros undecimpustulatus* and *Aphis craccivora* were shown to have non-significant negative correlations with maximum relative humidity, whereas *Empoasca kerri*, *Nezara viridula* and *Riptortus linearis* were found to have non-significant positive connections. *Nezara viridula*, *Mylloceros undecimpustulatus*, *Cletus bipunctatus* and *Riptortus linearis* showed a non-significant negative association over the study period, while *Empoasca kerri* and *Aphis craccivora* showed a non-significant positive connection.

Table 5 Correlation coefficient (r) during 2016 and 2017

Insect pests	**Abiotic factors**							
	Maximum temperature		**Minimum temperature**		**Max. relative humidity**		**Min. relative humidity**	
	2016	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**
Empoasca kerri	0.32	0.60 S	0.49	0.39	-0.46	0.01	-0.08	0.25
Aphis craccivora	0.27	0.44	0.52 S	0.40	-0.34	-0.13	-0.03	0.09
Nezara viridula	0.34	0.58 S	0.34	0.29	-0.41	0.20	-0.21	-0.07
Mylloceros undecimpustalata	0.17	0.08	0.01	-0.3	-0.06	-0.06	-0.48	-0.31
Cletus bipunctatus	-0.48	0.11	-0.50 S	-0.21	0.25	-0.07	0.13	-0.41
Riptortus linearis	0.02	0.61 S	0.15	0.13	-0.33	0.16	-0.17	-0.26

S-correlation is significant at P-0.05, others are non-significant.

3.4. Nature of Damage

During the two-year survey, the majority of the Hemipteran insect pest species found were leaf feeders and sap suckers, with a small number also feeding on flowers. Among the most significant defoliators were *Mylloceros undecimpustulatus*, *Nezara viridula*, *Aphis craccivora* and *Empoasca kerri*. Pod-sucking insect pests in crop fields included *Nezara viridula*, *Riptortus linearis* and *Cletus bipunctatus*. Pest incidence was categorised as high, medium, or low based on the extent of damage. *Aphis craccivora* (adult and nymph) and *Riptortus linearis* (nymph) both caused considerable harm in the two years. The damage status for *Empoasca kerri*, both nymph and adult, was medium. The extent of harm inflicted by every other pest present in the agricultural field was modest.

The observed fluctuation in hemipteran abundance across different growth stages of blackgram underscores the dynamic nature of pest populations in agricultural ecosystems. The dominance of specific species during particular stages suggests potential vulnerabilities of the crop at critical growth phases.

Following the study's completion in 2016 and 2017, a number of insect pests were observed in agricultural fields; nonetheless, a total of six potentially damaging hemipteran insect pests were found from planting to harvesting. The species represented the order Hemiptera were *Mylloceros undecimpustulatus* (Fam. Curculionidae), *Nezara viridula* (Fam. Pentatomidae), *Riptortus linearis* (Fam. Coreidae), *Cletus bipunctatus* (Fam. Coreidae), *Aphis craccivora* (Fam. Aphididae) and *Empoasca kerri* (Fam. Cicadellidae). The relationship that exists between Hemipteran abundance and environmental variables—temperature and humidity, in particular—elucidates the impact of climate on insect populations. This highlights how crucial it is to use integrated pest management techniques that take the environment into account in order to reduce crop losses caused by Hemipterans. The current study on insect pest indicates that in 2016 and 2017, insects occurred in the crop from September to November. Even if several insect pests were delayed in their arrival, they nevertheless caused harm to the crop. The study period's seasonal incidence and distribution of insect pests in the crop field showed that the 39th and 40th standard weeks were when all pests were most active in the field.

The results of Yadav et al. (2015) [9] and Nayak et al. (2004) [10] on the population increase of Jassid *Empoasca kerri* (Pruthi) in the crop were in agreement. Two weeks after germination, or in the 36th standard week, the population increases to 0.27/leaf, according to Nayak et al. (2004) [10]. At 1.008/leaf, the population peaked during the 39th standard week. The pest remained there until the 42nd standard week. Nayak et al. (2004) [10] found that the influence of abiotic parameters on the incidence of black gram pests indicated that elevated relative humidity and mean ambient temperature promoted the growth of pest populations. Certain insect pests have a positive link with the lowest temperature, whereas Yadav and Singh (2013) [11] discovered a corresponding negative correlation with the highest temperature. Our results are consistent with other research showing the importance of Hemipteran pests in the production of leguminous crops. The use of focused pest management strategies, like prompting actions during vulnerable growth phases, may play a major role in promoting sustainable blackgram farming. The literature that is now available reveals that numerous researchers have examined the qualitative and quantitative makeup of black gram insect pests and have reported their findings. The bulk of the workers' results broadly agreed with our current conclusions. Numerous investigations have revealed that blackgram is afflicted by a number of insect pests throughout India. Singh and Singh (1977) [12] discovered green jassid (*E. kerri* Pruthi) and bug (*N. viridula* Linn.) from Hemiptera as significant pests in a dryland cropping in Delhi. The existence of *Empoasca kerri* Pruthi, *Nezara viridula* Linn., was consistent with the results of our current analysis, despite the fact that the conclusions of this study differ in a few aspects. The only species identified by Dhuri and Singh (1983) [13] as being similar to the current findings is *Empoasca kerri*. They noted thirty insect species, six of which were significant pests from Delhi across different crop stages. Similar to the current findings, Singh and Kalra (1995) [14] identified 16 insect pests on blackgram, with jassid species being the most prevalent. Chandra and Rajak (2004) [15] observed insect pests on urd beans during both the kharif and spring/summer seasons. Pod bugs (*Nezara viridula*) and leafhoppers (*Empoasca* sp.) were two of the most prevalent and resembled the current findings. When Nayak et al. (2004) [10] from Uttaranchal, India studied the insect pest complex of black gram during the kharif 2001, 2002, and summer 2002, they discovered over 70 species of insect pests at different stages of crop growth. Similar to the current study, jassids (*Empoasca* sp.) and *Nezara* sp. were significant insect pests on this crop during the blooming and poding stages. According to Justin et al. (2015) [16], who looked into the incidence of black gram pests in dry land conditions, 11 different insect pests were found to be feeding on black gram crops during the experimental period. Most of these pests were sucking insects, with *Nezara viridula* having a very low prevalence and Leafhopper and *Mylloceros* species having a medium prevalence.

A comprehensive analysis of the extant literature was conducted, and notable distinctions in the results of previous comparable research were identified. The most important thing to keep in mind is that the current agro-climatic conditions in the study area define the pest status of any insect. In a paddy nursery field, paddy crops surrounded our research site. Not all of the insect pests that other workers in other parts of the country have determined to be major pests were found here. Instead of *Cletus bipunctatus*, which emerged late in the crop growth stage, and *Riptortus pedestris* (Fab.), as observed in earlier studies, *Riptortus linearis* was utilised to represent members of the coreidae family. Some important information on the type of damage produced by insect pests was disclosed by research studies conducted by Dhuri and Singh (1983) [13], Chhabra and Kooner (1985) [4], Rahman (1991) [18], Swaminathan et al. (2007) [19], Chandra et al. (2010) [20], Vikrant et al. (2013) [21], and Yadav and Patel (2015) [22]. They were all persuaded that the entire plant blackgram was plagued with some deadly pests. According to a study by Dhuri and Singh (1983) [13], jassid, aphid, and spotted pod borer were the main pests that targeted plant components such as leaves, buds, flowers, and pods of black gram. Along with other sucking pests, aphid nymphs and adults feed on the sap found on the ventral surface of immature leaves, emerging shoots, flower stalks, and pods. Infested foliage develops several abnormalities. Jassid adults and nymphs harmed plants by shooting poisonous saliva into tissues and draining the cell sap from the underside of leaves. The results of this study agreed with those of Dhuri and Singh (1984) [17]. According to Kumar and Singh's (2016) [23] experiment, during the 37th standard week, there were 1.43 nymphs and adults per cage/plant of jassids, while during the 38th standard week, there was the maximum recorded population of spotted pod borer, 2.13 larvae per plant. The experiment's results are in line with recent reports of the growth in the jassid and spotted pod borer populations. The research by Jat et al. (2017) [24] indicates that the aphid pest population peaked in the first week of September in 2013 and the second week of September in 2014; In both years, the fourth and last weeks of August marked the high for jassid activity, which continued throughout the growth stage. The second week of September marked the peak for pod infestation. The highest mean and relative densities for aphids were recorded in 2013 and 2014. These observations are all consistent with the results of our study. Consequently, the results of this investigation were discovered to be generally consistent with those of other researchers. Most of blackgram's insect pest researchers investigated whether there might be a connection between the incidence of insect pests and rainfall, relative humidity and temperature. The succession and population increase of insect pests were studied by Singh and Singh (1977) [12]. In their study, Singh and Singh (1977) [12] examined the succession and population growth of insect pests on greengram and blackgram in a dry land cropping system in Delhi. They discovered that heavy rainfall, high humidity (85±5%), and average air temperature (28±2 0C) all encouraged the expansion of insect pest populations. This observation aligned with the findings of the current investigation. As per the findings of Dhuri et al. (1983) [13], a number of black gram insect pests (*Vigna mungo* L.) seemed to thrive best in environments with somewhat high mean ambient temperatures (between 30 and 32 ^{0}C). Because of the high summertime temperatures, there was a drop in the occurrence of pests. The bulk of the results from the aforementioned literatures are in line with our current research, suggesting that abiotic environmental variables have some influence on the occurrence of insect pests on blackgram. The agro-climatic conditions of the experimental field have a major influence on the diversity of insect pests that appear there. It was demonstrated that there is less consistency in the relationship between insect pests and abiotic climate elements.

Despite the fact that the results appear to be adequate, some limitations were unavoidable. The experiments were only in the field for a brief time of a year, because the crop in the study location is only cultivated during the kharif season, which runs from July to August. Because the experiment was done in a paddy nursery field that had previously been prepared, the distance between plots in the field experiments was insufficient. Research of any kind improves the quality of life for future generations. It opens a new door for further researches with new experiments. Based upon the findings and considering the limitations of this work, the recommendations for future research may be forwarded. The pest status of insects is dependent on the agro-climatic conditions of the study area. Therefore, further research is needed from different locations and under varied conditions to conclude the presence of a particular pest, their highest level of population and time duration of presence in crops. Normally there are some insects that are more damaging and some are less. It is very important to know all these insects with their predators and parasites in the form of natural enemies for better pest control planning and this type of research should be encouraged.

4. Conclusion

This study sheds light on the abundance and impact of hemipterans in blackgram cultivation, highlighting their dynamic nature across different growth stages of the crop. The identification of predominant species and their fluctuations underscores the need for tailored pest management strategies to safeguard crop yield. The correlation between hemipteran abundance and environmental factors emphasizes the influence of climatic conditions on pest populations, presenting opportunities for integrated pest management practices that consider these variables. In conclusion, this research underscores the importance of monitoring and managing hemipteran populations in blackgram crops, offering insights into sustainable pest management practices for improved crop resilience and agricultural sustainability.

Compliance with ethical standard

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Disclosure of Conflict of interest

The author has no conflicts of interest with publication of the manuscript.

Statement of Ethical approval

The present research work though contains studies performed on insect, maximal damage was avoided. Informed consent was obtained from individuals included in the study.

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