



Studies on the Effect of Biotic and Abiotic Factors on Major Sucking Insect Pests of Cowpea [*Vigna unguiculata* (L.) Walp.]

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ABSTRACT

The present investigation was conducted during *kharif* seasons of 2023 and 2024 (July to October) at the Agronomy Instructional farm, Department of Entomology, Rajasthan College of Agriculture, Udaipur, Rajasthan India to study the effect of biotic and abiotic factors on the incidence of major insect pests of cowpea. The observations on population of aphid, whitefly, leaf hopper and pod borer were recorded soon after their appearance. The study on the seasonal incidence of major sucking insect pests in cowpea revealed that aphid, (*A. craccivora*), leaf hopper, (*E. fabae*) and whitefly, (*B. tabaci*) incidence started during the last week of July (30th SMW), during both the year. The peak mean population of aphid, were recorded during the second week of September (37th SMW) and the peak mean population of leaf hopper and whitefly were recorded during last week of August (34th SMW), during *kharif*, 2023. The peak incidence of aphid, leaf hopper and whitefly were recorded during last week of August (34th SMW), first week of September (36th SMW) and second week of September (37th SMW), respectively during *kharif*, 2024. All major sucking insect pests showed a negative significant correlation with morning relative humidity and leaf hopper showed a positive significant correlation with maximum temperature during *kharif*, 2023. The whitefly showed a negative significant correlation with maximum temperature and positive significant correlation with rain fall during *kharif*, 2024.

KEYWORDS: Aphid, leaf hopper, whitefly, biotic and abiotic factors

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Data Availability Statement: Legal restrictions are imposed on the public sharing of raw data. However, author have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

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1. INTRODUCTION

Cowpea [*Vigna unguiculata* (L.) Walp.] Is one of the important legume crops grown in Rajasthan that belongs to family Leguminosae. Cowpea is called as vegetable meat due to high amount of protein in grain with better biological value on dry weight basis. The crop belongs to the family Fabaceae and well suited for cultivation across diverse Agro-ecological zones. Cowpea often referred as vegetable meat due to high amount of protein with excellent biological value on dry weight basis. Cowpea grain contains 23.4% protein, 1.8% fat and 60.3% carbohydrates on dry weight basis and it is rich source of calcium and iron (Yadav et al., 2026 and Anandmurthy et al., 2018). In Indian context, it is a minor pulse cultivated mainly in arid and semi-arid tracts, grown in pockets of Punjab, Haryana, Delhi, and West UP along with considerable area in Rajasthan, Karnataka, Kerala, Tamilnadu, Maharashtra and Gujarat (Yadav et al., 2026). In India, cowpea occupies 654 lakh ha area and production of 5991 t along with productivity of 916 kg ha⁻¹ (Anonymous, 2021). In Rajasthan, the area under cowpea was 48522 ha with the annual production of 26998 Mt and productivity of 556 kg ha⁻¹ (Anonymous, 2023). The major cowpea growing districts are Sikar, Jhunjhunu, Nagaur, Jaipur, Ajmer and Pali. The low productivity of cowpea is attributed to the infestation by insect pests and diseases. Sardhana and Verma (1986) reported 21 insect pests of different groups damaging the crop from germination to maturity. The important insect species infesting cowpea are aphid, *Aphis craccivora* Koch; jassid, *Empoasca fabae* (Harris); thrips, *Megaleurothrips distalis* Karny; army worm, *Mythimna separata* (Walker); semilooper, *Thysanoplusia orichalcea* (Fab.); leafminer, *Phytomyza horticola* meigen and pod borer, *Helicoverpa armigera* (Hubner) resulting in heavy yield losses (Yadav et al., 2026). However, its production is severely constrained by a complex of insect pests, among which sucking pests—namely aphids, leafhoppers, whiteflies, and thrips—play a dominant role (Yadav et al., 2015). These pests not only cause direct damage by sap-feeding but also act as vectors of viruses, compounding yield losses (Maradi et al., 2024). The cowpea aphid, *A. craccivora* is serious sucking insect pest of this crop and occurs in different parts of India (Ganguli and Raychaudhuri, 1984) that causes 20–40% yield loss (Yadav et al., 2026 and Choudhary et al., 2021). Both nymph and adult cause damage by sucking cell sap from leaves, petioles, tender stems, inflorescence and pods. It also acts as a vector of several viral diseases like cowpea mosaic and papaya mosaic (David and Kumar Swami, 1982). The leaf hopper, *E. fabae* sucks the cell sap from lower surface of the leaves and injects toxic substances in it, resulting in yellowing and curling of leaf margins and stunted plant growth. Narke and Suryawanshi (1987) reported severe infestation that causes

burning of leaves which fall down later resulting in 40–60% decrease in yield. The whitefly, *B. tabaci* ingest plant juice and produce a sticky substance known as honeydew which leads to sooty mould growth. In addition to damage caused by direct feeding, whiteflies transmit plant viruses also (Gerling, 1990). Some studies have reported on population dynamics of these pests in the field (e.g., seasonal incidence linked to meteorological parameters) (Jat et al., 2017 and Yadav et al., 2025), screening of cowpea genotypes against aphid, *Aphis craccivora* Koch (Choudhary et al., 2022) or their susceptibility to insecticides (Meena et al., 2020). Thus, the study was conducted to study the effect of biotic and abiotic factors on the incidence of major insect pests of cowpea.

2. MATERIALS AND METHODS

2.1. Study site

The present investigations were conducted during *kharif*, 2023 and 2024 (July to October) at the Agronomy instructional farm at Rajasthan College of Agriculture, MPUAT, Udaipur and the laboratory work was carried out at Department of Entomology, Rajasthan College of Agriculture, MPUAT, Udaipur, located at longitude of 73° 30' East, latitude of 24° 58' North and at an elevation of 581.13 m from mean sea level (MSL) in Udaipur district of Rajasthan.

To study the effect of biotic and abiotic factors on the incidence of major insect pests of cowpea, the variety RC-19 was sown in the month of July in plots of 3×2.5 m² keeping row to row and plant to plant distance of 30 cm and 10 cm, respectively.

2.2. Methods of data collection

The crop was left for natural infestation. The observations on population of aphid, whitefly, leaf hopper and pod borer were recorded soon after their appearance. All the observations were recorded early in the morning. The methods used for recording the population of major insect pests, viz, aphid, *Aphis craccivora* Koch, leaf hopper, *Empoasca fabae* (Harris), whitefly, *Bemisia tabaci* (Genn.) and pod borers has been described below.

2.2.1. Aphid, *A. craccivora*

The observations of aphid population were recorded by counting both nymph and adults from five randomly selected and tagged plants from each plot on 10 cm terminal shoots at weekly interval from the appearance till harvesting of the crop.

2.2.2. Leaf hopper, *E. fabae* and whitefly, *B. tabaci*

The population of leaf hopper and whitefly (nymphs and adults) was recorded on five randomly selected and tagged plants in each plot. Three leaves, viz, one each from top, middle and lower canopy of the plant was taken into account

for recording the leaf hopper (Rawat and Saha, 1973).

3. RESULTS AND DISCUSSION

The observations recorded on the seasonal incidence of aphid, leaf hopper and whitefly in cowpea during *kharif*, 2023 and 2024 have been tabulated in Table 1 and 2 and graphically depicted in figure 1 and 2 reveal that the aphid, leaf hopper and whitefly populations commenced in the last week of July (30th SMW) and remained active throughout the crop season. The peak mean aphid population of 121.57 and 121.40 aphids 10 cm terminal shoot⁻¹ was recorded during second week of September during *kharif*, 2023 and during first week of September in *kharif* 2024, when the prevailing maximum temperature were 33.5°C and 28.1°C and minimum temperature were 22.4°C and 21.6°C, relative humidity were 65.2 and 87.00% and rainfall were 15.00 mm and 79.6 mm, respectively, thereafter the population decreased gradually. The mean peak leaf hopper and whitefly population of 15.47 leaf hoppers three leaves⁻¹ and 13.13 whitefly three leaves⁻¹ was recorded on last week of August (34th SMW), respectively during *kharif*, 2023. The mean peak leaf hopper population of 14.56 leaf hoppers three leaves⁻¹ and whitefly population of 11.47 leaf hoppers three leaves⁻¹ were recorded during last week of August and first

week of September during *kharif*, 2024. Similar results have been reported by some of the earlier research workers like Gauns et al. (2014) who have reported that the population of aphid commenced from the first week of August in cowpea which reached to its maximum in the fourth week of August. Nitharwal (2013) observed that the leaf hopper and whitefly population commenced from the first week of August and its population reached to maximum in first week of September. Likewise Yadav et al. (2025) have reported that the peak populations of aphid (111.68 aphids 10 cm terminal shoot⁻¹), leaf hopper (13.20 three leaves⁻¹) and whitefly (8.80 three leaves⁻¹) were recorded in the first week of September (35th SMW). The findings of the present investigation also corroborate with the results reported by Choudhary et al. (2021) who have also observed that the whitefly population on cowpea commenced from the last week of July and first week of August, respectively and its population reached to maximum in third week of September. The population of aphid, leaf hopper, whitefly, showed significant negative correlation with morning relative humidity ($r=-0.800$), ($r=-0.680$) and ($r=-0.770$), respectively. The population of leaf hopper showed significant positive correlation with maximum temperature ($r=0.764$) and aphid, whitefly, showed non-significant positive correlation with

Table 1: Effect of biotic and abiotic factors on the incidence of major insect pests infesting cowpea during *kharif*, 2023.

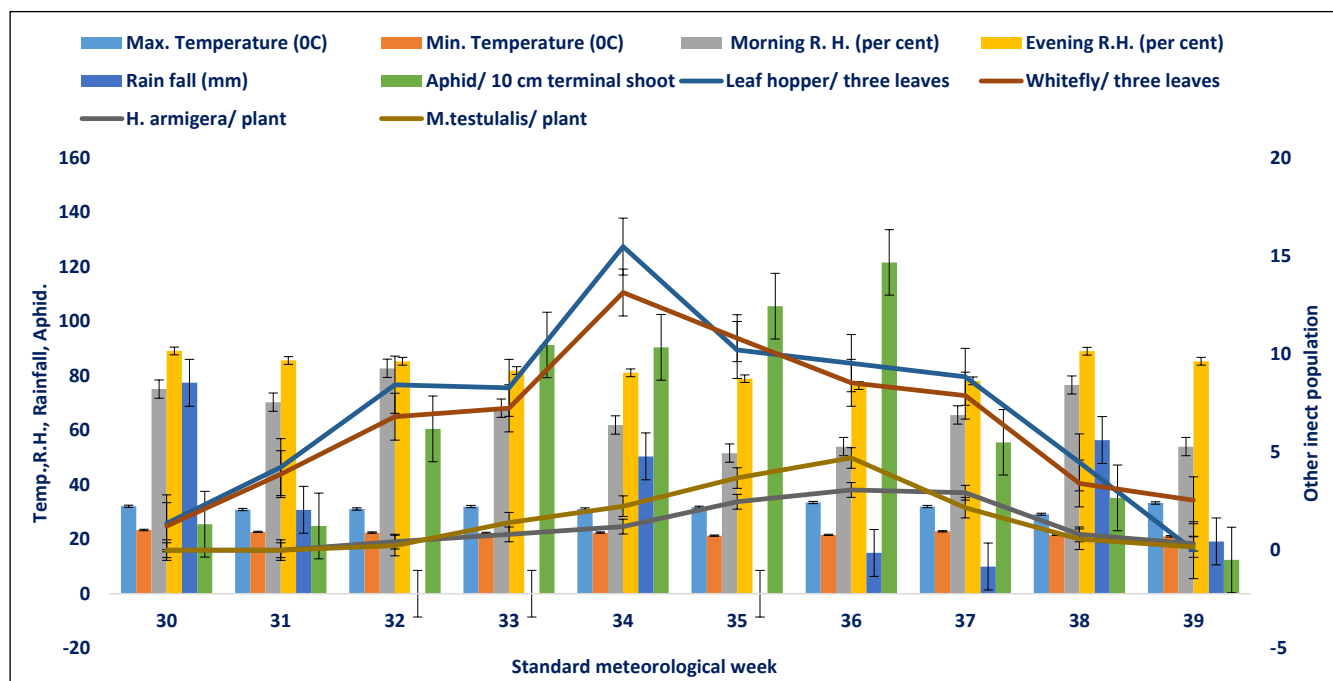
Sl. No.	Date of observation	Meteorological week (SMW)	Temperature (°C)		Relative humidity (Per cent)		Rain fall (mm)	Mean population		
			Max.	Min.	Morning RH	Evening RH		Aphids 10 cm terminal shoot ⁻¹	Leaf hoppers 3 leaves ⁻¹	Whiteflies 3 leaves ⁻¹
1.	28.07.2023	30	32.1	23.4	89.1	75.1	77.4	25.52	1.37	1.23
2.	04.08.2023	31	30.9	22.7	85.6	70.3	30.8	24.87	4.23	3.87
3.	11.08.2023	32	31.1	22.4	85.3	82.7	0.0	60.48	8.43	6.80
4.	18.08.2023	33	32.0	22.3	81.9	68.1	0.0	91.27	8.27	7.23
5.	25.08.2023	34	31.1	22.4	81.1	61.9	50.4	90.40	15.47	13.13
6.	01.09.2023	35	31.8	21.3	78.9	51.6	0.0	105.52	10.20	10.80
7.	08.09.2023	36	33.5	21.6	76.4	54.0	15.0	121.57	9.53	8.53
8.	15.09.2023	37	32.0	22.9	78.1	65.6	10.0	55.56	8.83	7.87
9.	22.09.2023	38	29.2	21.6	89.0	76.6	56.4	35.20	4.47	3.40
10.	29.09.2023	39	33.3	21.1	85.3	54.0	19.2	12.40	0.00	2.54
Correlation with maximum temperature								0.248	0.764*	0.042
Correlation with minimum temperature								-0.250	-0.006	-0.157
Correlation with morning relative humidity								-0.800**	-0.680*	-0.770**
Correlation with evening relative humidity								-0.441	-0.422	-0.422
Correlation with rainfall								-0.456	-0.299	-0.402

*. Significant at $p=0.05$ level of significance; **. Significant at $p=0.01$ level of significance

Table 2: Effect of biotic and abiotic factors on the incidence of major insect pests infesting cowpea during *kharif*, 2024

Sl. No.	Date of observation	Meteorological week (SMW)	Temperature (°C)		Relative humidity (Per cent)		Rain fall (mm)	Mean population		
			Max.	Min.	Morning RH	Evening RH		Aphids 10 cm terminal shoot ⁻¹	Leaf hoppers 3 leaves ⁻¹	Whiteflies 3 leaves ⁻¹
1.	28.07.2024	30	31.5	25.3	82.9	72.6	60.0	30.00	2.16	1.12
2.	04.08.2024	31	29.6	23.9	92.6	82.6	2.3	28.53	4.24	2.76
3.	11.08.2024	32	29.2	23.4	90.1	78.1	0.0	58.20	7.84	5.84
4.	18.08.2024	33	31.3	23.9	85.7	64.1	84.3	99.20	9.48	7.40
5.	25.08.2024	34	31.5	23.6	87.1	77.9	79.6	121.40	14.56	6.40
6.	01.09.2024	35	28.1	22.4	92.4	81.6	147.3	108.20	10.16	11.47
7.	08.09.2024	36	30.4	23.2	94.7	76.3	23.7	110.27	8.48	7.92
8.	15.09.2024	37	30.4	22.9	85.0	65.1	23.5	58.20	7.68	5.24
9.	22.09.2024	38	32.6	22.4	80.0	54.0	14.5	35.24	4.48	3.80
10.	29.09.2024	39	33.9	24.1	89.9	66.3	5.2	10.20	2.24	0.00
Correlation with maximum temperature								-0.431	0.801*	-0.683*
Correlation with minimum temperature								-0.365	-0.415	-0.621
Correlation with morning relative humidity								0.305	0.213	0.364
Correlation with evening relative humidity								0.334	0.325	0.325
Correlation with rainfall								0.648*	0.542	0.661*

*. Significant at $p=0.05$ level of significance; **. Significant at $p=0.01$ level of significance

Figure 1: Effect of biotic and abiotic factors on the incidence of major insect pests infesting cowpea during *kharif*, 2023

maximum temperature ($r=0.342$) and ($r=0.399$) respectively, during *kharif*, 2023. Similar results have been reported by earlier research workers Jat et al. (2017) who observed

a significant negative correlation with morning relative humidity ($r=-0.67$) which confirms to the present findings. The correlation of the pest population with abiotic factors

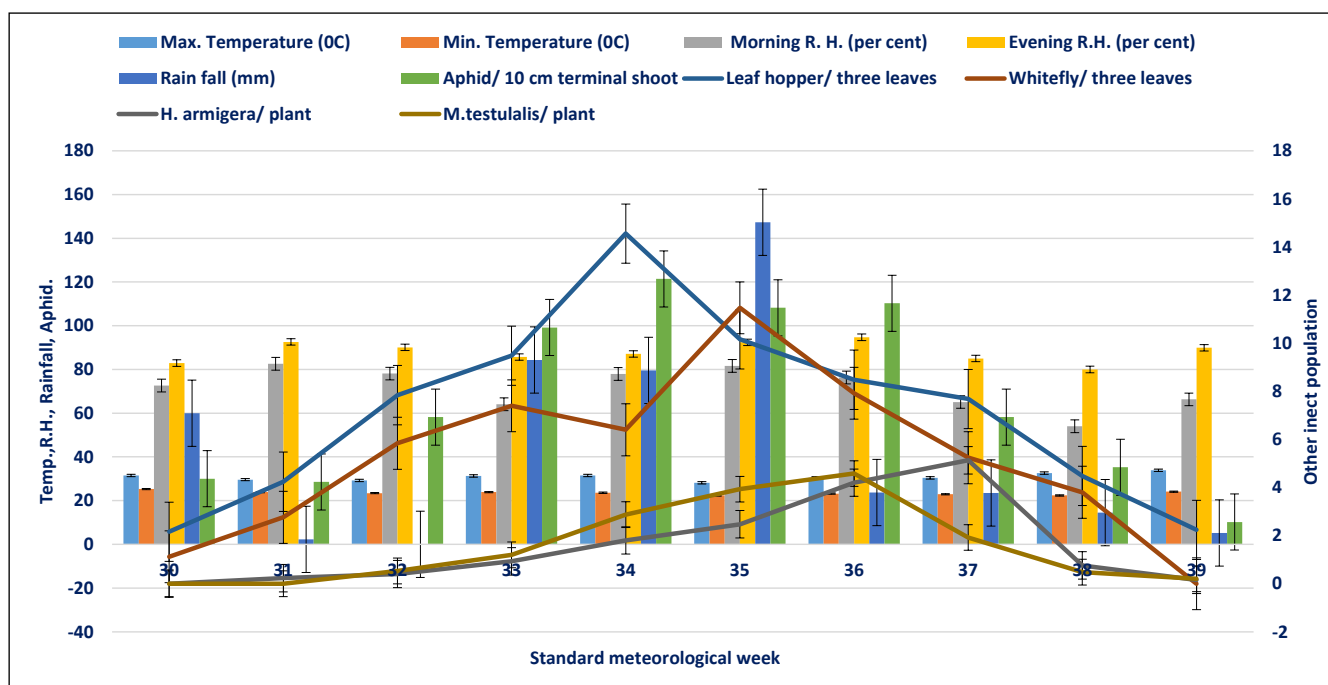


Figure 2: Effect of biotic and abiotic factors on the incidence of major insect pests infesting cowpea during *kharif*, 2024

reveals that the population of leaf hopper showed significant positive correlation with maximum temperature ($r=801$) and whiteflies population showed significant negative correlation with maximum temperature ($r=-683$). The population of white flies showed significant positive correlation with rain fall ($r=0.661$) during *kharif*, 2024. Anandmurthy et al. (2018) observed that maximum temperature showed a significant positive correlation with jassid, whitefly and aphid population in summer cowpea which is line with the present findings.

4. CONCLUSION

The aphid, leaf hopper and whitefly populations commenced in the last week of July (30th SMW) and remained active throughout the crop season. Aphid, leaf hopper, whitefly showed significant negative correlation with morning relative humidity ($r=-0.800$), ($r=-0.680$) and ($r=-0.770$), respectively. The population of leaf hopper showed significant positive correlation with maximum temperature ($r=0.764$)

5. ACKNOWLEDGEMENT

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