International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; 9(12): 06-09
www.biochemjournal.com
Received: 08-09-2025
Accepted: 11-10-2025

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Effect of weather parameters on incidence of *Aphis craccivora* Koch on cowpea (*Vigna unguicul*ata Linn.)

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DOI: https://www.doi.org/10.33545/26174693.2025.v9.i12a.6428

Abstract
The experiment on seasonal incidence of cowpea aphids, *Aphis craccivora* Koch was carried out at the Instructional Farm, Department of Entomology, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra during *kharif* 2024. The study revealed that, cowpea aphid, *A. craccivora* Koch population ranged from 1.8 to 35.8 aphids/10 cm twig/plant during the crop growth period. First incidence of cowpea aphid was noticed in 28th standard meteorological week (SMW) (1.8 aphids/10 cm twig/plant) *i.e.* 2nd week of July and continued upto 38th SMW (9.6 aphids/10 cm twig/plant) *i.e.* 3rd week of September. Minimum population of cowpea aphid was noticed in 28th SMW *i.e.* 2nd week of July afterwards population of cowpea aphid gradually increased upto 32nd SMW *i.e.* 1st week of August (28.6 aphids/10 cm twig/plant) and reached to its peak of 35.8 aphids/10 cm twig/plant during 33rd SMW *i.e.* 3rd week of August. In this study highly significant positive correlation was noticed between incidence of cowpea aphid and maximum temperature (r = 0.641*). However, it had non-significant and negative correlation with minimum temperature (r = -0.112), morning relative humidity (r = -0.051), evening relative humidity (r = -0.221) and rainfall (r = -0.361).

Keywords: Seasonal incidence, *Aphis craccivora* Koch, correlation, cowpea, maximum temperature

Introduction
Cowpea (*Vigna unguicul*ata Linn.) is most significant leguminous crops, commonly known as lobia, and belongs to the family Fabaceae. *V. unguiculata* is originated in Africa and later disseminated to various parts of the world. Today, it is cultivated in Africa, Latin America, South-East Asia and the southern parts of the United States. It is major pulse crops and is also popularly called chala or choli, chavli, bobbarlu, southern pea and black-eyed bean. It performs well even in infertile soils with more than 85 percent sand, less than 0.2 percent organic carbon, and deficient phosphorus. Cowpea is utilized as a vegetable, fodder, green manure and pulse crop. It is considered the most affordable source of dietary protein and energy for economically weaker populations, earning it the names “vegetable meat” and “poor man’s meat.” On a dry matter basis, its grains contain about 24.8 percent protein, 1.9 percent fat, 6 percent fiber and 63.6 percent carbohydrates. They are also a rich reservoir of calcium, iron, and vitamins such as A and C, while being low in anti-nutritional compounds. Additionally, cowpea provides soil cover that helps prevent erosion. (Davis *et al.*, 1991) [4].
According to 2024-24 production data, in India pulses are cultivated on approximately 27.5 million hectares, contributing about 24.25 million tonnes to national production (Anonymous, 2024) [1]. The significance of cowpea in Maharashtra lies in its brief growing period, rapid establishment, and high yield potential, in addition to its substantial protein content.
V. unguiculata is infested by diverse insect pests, with nearly 21 species reported to cause damage at various developmental stages, spanning germination through to maturity (Sardhana and Verma, 1986) [9]. The major insect pest infesting this crop include the aphid, *Aphis craccivora* Koch; jassid, *Empoasca fabae* (Harris); thrips, *Megaleurothrips distalis* Karny; armyworm, *Mythimna separata* (Walker); semilooper, *Thysanoplusia orichalcea* (Fab.); leaf miner, *Phytomyza horticola* Meigen and pod borer, *Helicoverpa armigera* (Hubner), all of which are known to inflict substantial yield losses (Prasad *et al.*, 1983; Satpathy *et al.*, 2009) [8, 10].

Among these, the cowpea aphid, *Aphis craccivora* Koch, is recognized as the most destructive pest across various regions of India (Ganguli and Raychaudhuri, 1984) [6], with reported losses ranging between 20-40 percent (Singh and Allen, 1980) [11].

The cowpea aphid, *Aphis craccivora*, belongs to the family Aphididae under the order Hemiptera and suborder Homoptera. Damage is caused by both nymphs and adults through sap-sucking from leaves, petioles, young stems, flowers and developing pods and seeds. Owing to their rapid rate of multiplication, aphids can colonize the entire surface of apical shoots within a short period. Continuous feeding by such dense populations leads to yellowing, curling and drying of leaves, which results in poorly filled pods, shriveled grains, and overall yield reduction. Besides to direct damage, *A. craccivora* also functions as a vector of viral diseases such as cowpea mosaic virus and papaya mosaic virus (David and Kumaraswami, 1982) [5]. The regulation of aphid populations is often aided by natural enemies, particularly coccinellid beetles and syrphid flies (Singh and Jackai, 1985) [12].

Cowpea farming has expanded over the world, making the crop more susceptible to various environmental and biotic challenges, resulting in increased insect infestations. Temperature and relative humidity are important factors that influence insect population dynamics, development rates, and seasonal incidence. Such knowledge is critical for creating integrated pest management solutions that are both environmentally friendly and cost effective. Keeping this in mind, an experiment was conducted to investigate the prevalence of insect pests on cowpea crops and their relationship with weather conditions.

Materials and Methods

The field experiment was carried out in *kharif* 2024 at Instructional Farm, Department of Entomology, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, to investigate the seasonal incidence of cowpea aphids, *Aphis craccivora* Koch. Cowpea variety Phule Sonali was sown in an area measuring 10 m × 10 m, with 45 cm x 10 cm spacing. All approved agronomic procedures were used to raise the crop.

To record observations, the plot was divided into three equal sections, with five plants selected at random from each sector. Weekly observations of the number of aphids/10 cm twig/plant were made on five randomly selected and tagged plants. The acquired data was used to compute the mean population of aphids, as well as the Pearson correlation coefficient. The observations began with the first appearance of the pest and lasted until the crop was harvested at weekly intervals. The entire experimental plot was kept pesticide-free. The data on aphid population was connected with several climatic indicators, such as temperature (maximum and minimum), relative humidity (morning and evening), and rainfall, using established procedures.

Results and Discussion

Effect of weather parameters on incidence of *Aphis craccivora* Koch on cowpea

Standard meteorological week wise data on incidence of cowpea aphid, *Aphis craccivora* Koch during *Kharif* 2024 is presented in Table 1 and graphically depicted in Fig. 1

From the data it was observed that, incidence of *A. craccivora* Koch in cowpea began during 28th Standard Meteorological Week (SMW) which corresponds to 2nd week of July with 1.8 aphids/10 cm twig/plant. The incidence continued throughout the crop season and lasted upto 38th SMW *i.e.* 3rd week of September with 9.6 aphids/10 cm twig/plant. During the entire crop growth period, the incidence of cowpea aphid, *A. craccivora* ranged from 1.8 to 35.8 aphids/10 cm twig/plant indicated a clear seasonal trend in pest activity.

Initially pest incidence was low but as the crop progressed, aphid population increased steadily. After 28th SMW, a gradual rise in aphid population was recorded and reached to its peak in 33rd SMW which corresponds to 3rd week of August wherein maximum of 35.8 aphids/10 cm twig/plant were observed. This increasing trend in aphid incidence may be attributed due to favorable weather conditions during this period, which provided an ideal environment for pest development and feeding activity.

During peak infestation period *i.e.* in 33rd SMW, recorded weather parameters included a maximum temperature of 36.4 °C, minimum temperature of 22.9 °C, morning relative humidity of 87.0 percent, evening relative humidity of 55.0 percent and total rainfall of 1.4 mm. These conditions contributed to an increase in aphid population on cowpea.

Correlation studies of cowpea aphid population with weather parameters

The data corresponding to correlation coefficients between incidence of cowpea aphid, *A. craccivora* and various weather parameters as presented in Table 2. The incidence of *A. craccivora* showed significant positive correlation with maximum temperature (r = 0.641*), suggested that rising maximum temperatures encouraged growth of pest population. On the other hand, negative correlations were also recorded between pest incidence and other weather parameters such as minimum temperature, morning and evening relative humidity, rainfall and rainy days but these relationships were found statistically non-significant. This suggested that, as these factors may also influence pest activity to some extent but their individual effects were not strong enough to show significant association during study period.

The present study indicated that, population of cowpea aphids, *A. craccivora* was significantly and positively correlated with maximum temperature while other weather parameters showed no significant association. These results are in line with Gauns *et al.* (2014) [7] who also reported that, aphid population showed significant positive correlation with maximum temperature. Similarly, Anandmurthy *et al.* (2018) [2] also reported a similar positive correlation between aphid incidence and maximum temperature. The results of present findings are in line with Choudhary *et al.* (2021) [3] who also observed that, maximum temperature had a significant positive influence on incidence of cowpea aphids. Collectively, these studies reinforce the present results, suggested that maximum temperature play a critical role in influencing population dynamics of *A. craccivora.*

Table 1: Seasonal incidence of cowpea aphids, *Aphis craccivora* Koch during *kharif* 2024

SMW	No. of aphids/10 cm twig/plant	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)
		Max.	Min.	Morn.	Even.	
27	0.0	31.6	24.3	83.1	58.4	6.6
28	1.8	30.2	23.5	83.8	63.4	39.2
29	8.6	29.3	23.7	87.2	63.4	79.8
30	18.8	29.2	23.7	85.0	67.0	31.6
31	24.2	30.0	23.6	83.0	62.0	3.6
32	28.6	33.7	23.0	84.0	64.0	3.0
33	35.8	36.4	22.9	87.0	55.0	1.4
34	5.6	29.2	22.7	90.0	74.0	253.4
35	7.5	29.8	22.8	83.0	62.0	36.8
36	10.4	29.7	22.6	85.0	62.0	4.0
37	18.2	30.2	21.5	78.0	59.0	3.2
38	9.6	31.7	21.0	81.0	53.0	3.0

Table 2: Correlation between incidence of cowpea aphids, *Aphis craccivora* Koch and weather parametres

Sr. No.	Weather Parameter	Correlation Coefficient
1	Maximum temperature (°C)	0.641*
2	Minimum temperature (°C)	-0.112 ^{NS}
3	Morning relative humidity (%)	-0.051^{NS}
4	Evening relative humidity (%)	-0.221 ^{NS}
5	Rainfall (mm)	-0.361^{NS}

*Significant at 5 % level of significance N.S.-non-significant

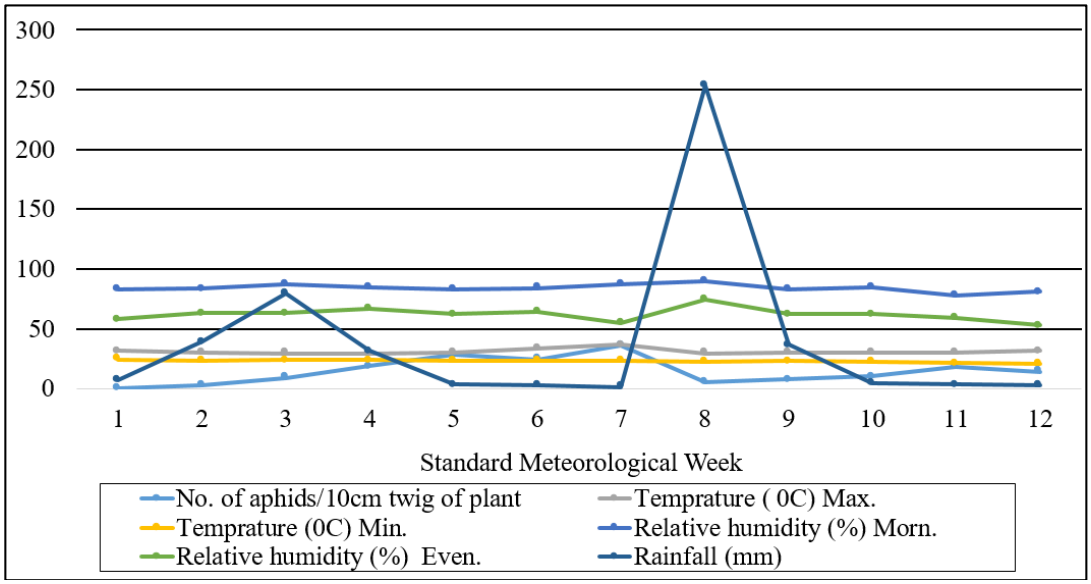

Fig. 1: Correlation between incidence of cowpea aphids, *Aphis craccivora* Koch and weather parameters

Conclusion

The Cowpea aphid incidence started from 28th SMW (1.8 aphids/10 cm twig/plant) and lasted upto 38th SMW (9.6 aphids/10 cm twig/plant). Highest aphid population (35.8 aphids/10 cm twig/plant) has been observed during 33rd SMW *i.e.* 3rd week of August. This will help us in scheduling management strategies in cowpea crop for aphids.

Acknowledgement

Authors express sincere thanks to the Head, Department of Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, for providing necessary facilities and encouragement during investigation.

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