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Study on Population Dynamics of Insect Pests of Cowpea in Gird Region of Madhya Pradesh, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A field experiment was conducted at Research Farm, Rajmata Vijyaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh during the *Kharif* season 2022-23. To study the population dynamics of insect pests of cowpea during *Kharif*, 2022, incidence of insect pests was observed on *kharif* cowpea, namely aphid, *Aphis craccivora* (Koch) thrips, *Megleurothrips distalis* (karny), Jassid, *Empoasca kerri* (Pruthi) and whiteflies, *Acaudaleyrodes rachipora* (Singh). Results revealed that the *A. craccivora* population first became apparent in the third week of August (33rd SMW) with 7.43. The activeness of *A. craccivora* per plant (19.89) was at peak level was recorded in the 37th standard week. The infestation of *E. kerri* and *A. rachipora* commenced in the second week of August (32nd SMW) with a mean population of 0.91 *E. kerri* per plant and 1.89 *A. rachipora* per plant. At second week of September (36th SMW), the mean value of *E. kerri* and *A. rachipora* population was reached their highest activity with 10.24 *E. kerri* and 5.45 *A. rachipora* per plant. *M.*

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distalis population appeared in first time in the fourth week of August (34th SMW) with 2.72 *M. distalis* per plant. The peak activity of *M. distalis* (6.89) was recorded in the 37th standard week, or the second week of September. The population of *A. rachipora* and *E. Kerri showed* a highly significant positive correlation with minimum temperature (r= 0.738*) and (r= 0.582*), and *A. rachipora* showed a positive correlation with maximum temperature (r= 0.580*) respectively. However, the population of *A. craccivora* and *M. distalis* showed a significant negative correlation with evening relative humidity (r= -0.519*) and (r= -0.582*).

Keywords: Cowpea; A. craccivora; M. distalis; A. rachipora; E. kerri; sucking pest.

1. INTRODUCTION

One of the main tropical pulse crops, cowpea [*Vigna unguiculata* (Linn.) Walp] is also known as southern pea, black eyed bean, chala or choli, chavli and lobia. It is a member of the *Leguminaceae* family. It may be utilised as a crop for green manure, a vegetable, a green legume, and fodder [1]. Cowpea seeds provide a rich source of proteins, calories, minerals and vitamins. A seed can consist of 23-25% protein, 50-67% carbohydrates, 8-9% moisture and a very low 3.99% fat content [2]. Cowpea has high social and economic values and cultural, nutritional and medicinal importance. It is an efficient nitrogen-fixing, heat and drought-tolerant legume (Bittenbender, 1990). In many parts of eastern and southern Africa and also Asia, cowpea is used as a leafy vegetable and the leaf of this plant is the major final product [3]. In India, pulses occupied nearly 29.99 million hectares area with a production of 25.23 million tonnes during the year 2018-19 [4]. It is grown all over India, particularly in the central and Peninsular regions. Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, Madhya Pradesh and Rajasthan are the principle states of cowpea cultivation. Cowpea is infected with 21 insect pests, including aphids, *Aphis craccivora* (Koch); leaf hoppers, *Empoasca kerri* (Pruthi); thrips, *Megaleurothrips distalis* (Karny); tobacco caterpillar, *Spodoptera litura* (Fab.), and spotted pod borer, *Maruca vitrata* (Geyer) which cause 65-100 percent losses. The study aimed in order to find out the correlation of aphid, *A. craccivora,* jassid, *E. fabae*, whitefly*, B. tabaci* and its natural enemies in Cowpea ecosystem with the abiotic parameters. Suitable understanding of the seasonal incidence of sucking insect pests is important due to variation in the weather conditions and changing sucking insect pest scenario on the cowpea.

2. MATERIALS AND METHODS

The experiment was conducted at the research farm, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India. Randomized Complete Block Design (RCBD) with 3 replications was deployed during *Kharif*, 2021. The plot size was 5.0 m X 3.6 m (18 m^2). For recording observations of insect-pest, ten plants were randomly selected and tagged in each net plot area. The observations on the insect-pest population were recorded from a marked area in three leaves (upper, middle and lower) of the same selected plants. The observations were recorded at weekly intervals starting from the second week after sowing till to the harvest of the crop. The whole experimental plot was kept free from any acaricides. The data was collected as the mean number of insect per leaf area per plant and were correlated with meteorological parameters. Then experimental data were subjected to statistical analysis using analysis of variance (ANOVA).

3. RESULTS AND DISCUSSION

The seasonal incidence of sucking insect-pest *viz*. aphid [Aphis craccivora (Kock)], Jassid [*Empoasca kerri* (Pruthi)], whitefly [*Bemisia tabaci* (Genn.)], and thrips [*Megleurothrips ditalis* (Karny)] associated with cowpea crop and their simple correlation with abiotic factor *viz*. mean atmospheric temperature, mean relative humidity and total rainfall during successive seasons of 2022 have been presented in the Tables 2 and 3.

3.1 Aphid, *Aphis craccivora* (Koch)

It is evident from the data presented in Table 2 that the results revealed that the population of *A. craccivora* first became apparent in the third week of August (33rd SMW) with 7.43 aphids per plant. The activeness of aphids per plant (19.89) was at peak level recorded in the 37th standard week, or third week of September. The aphid population per plant increased to its peak level (18.89 aphids) at 32.20ºC maximum and 24.90ºC minimum temperature, 95.40 % morning and 72.00 % evening relative humidity, 60.00 mm rainfall and 2.00 evaporation, respectively. There

was a significantly negative correlation (r=-0.519) between aphid incidence and evaporation at the 5% level. The results are supported by Soratur et al. [5] reported positive correlation of pest population with high temperature and the population of predators and other associated insect was showing negative correlation with minimum temperature, relative humidity and rainfall. Similar findings was reported by Gami et al, (2002), Prajapati et al. [6] and Choudhary et al. [7]

3.2 Jassid, *Empoasca kerri* (Pruthi)

The data recorded on Jassid during *Kharif*, 2022 presented in Table 2 indicated that the infestation of jassid commenced in the second week of August (32nd SMW). In the 36th standard week or second week of September, a mean value of jassid population was reached their highest activity with 10.24 jassid per plant. According to the results, there is a substantial positive correlation between the incidence of jassid and the minimum temperature (r=+0.582) at a 5% level. The results are supported by Khattak et al. [8] Shukla et al. [9] observed whitefly as the minor pest based on recurrent occurrence.

3.3 Thrips, *Megalurothrips distalis* (Karny)

The observations on thrips recorded during Kharif, 2022 are presented in Table 2 revealed that the thrips population appeared in first time in the fourth week of August (34th SMW). The peak activity of thrips (6.89 thrips) was recorded in the 37th standard week, or second week of September. There is a significant negative correlation between incidence of thrips and evaporation (r=-0.582) at the 5% level. The results are supported by Sharma *et al*. (2008) found that thrips (*Megalurothrips dorsalis*) cause extensive losses, Shukla et al. [9] observed thrips were designated as the major pest based on recurrent occurrence, Egho [10] demonstrated that *Megalurothrips sjostedti Trybom was* the commonest major insect-pests on cowpea based on population build-up and per cent incidence, Patel et al. [11] also recorded the populations of Megaleurothrips sp. on cowpea.

3.4 Whitefly, *Acaudaleyrodes rachipora* (Singh)

The data presented in Table 1 revealed that the thrips population appeared in first time in the fourth week of August (34th SMW). The peak activity of thrips (6.89 thrips) was recorded in the 37th standard week, or second week of September. There is a significant negative correlation between incidence of thrips and evaporation (r=-0.582) at the 5% level. The results are supported by Shukla *et al*. [9] observed thrips were designated as the major pest based on recurrent occurrence, Egho [10] demonstrated that Megalurothrips sjostedti Trybom was the commonest major insect-pests on cowpea based on population build-up and per cent incidence, Patel et al. [11] also recorded the populations of Megaleurothrips sp. on cowpea [12,13].

Table 1. Weekly meteorological observation during the study period (July, 2022 to Sept, 2022)

SMW	Week	AVT (°C)		RH (%)		Rainfall	Evaporation
		Max. (°C)	Min.(°C)	Morning	Evening	(mm)	(mm)
30	23 July -29 July	32.20	26.10	91.10	76.20	3.40	3.10
31	30 July -05 Aug.	33.40	26.60	88.80	58.50	27.00	3.00
32	06 Aug. -12 Aug.	32.80	25.90	90.70	66.40	87.00	3.90
33	13 Aug. -19 Aug.	30.30	21.70	88.40	74.40	64.60	3.70
34	20 Aug.-26 Aug.	43.00	24.30	89.20	73.20	135.00	3.20
35	27 Aug.-02 Sept.	34.20	25.90	86.20	60.50	9.80	4.40
36	03 Sept.-09 Sept.	35.30	26.00	80.40	55.50	0.00	5.70
37	10 Sept.-16 Sept.	32.20	24.90	95.40	72.00	60.00	2.00
38	17 Sept.-23 Sept.	31.00	24.10	92.50	75.00	61.00	2.20
39	24 Sept.-30 Sept.	32.50	23.80	89.10	58.00	13.80	2.50
40	01 Oct.-07 Oct.	33.60	23.30	89.00	61.40	8.40	3.10
41	08 Oct. -14 Oct.	29.90	21.70	94.20	70.20	103.00	3.20
42	15 Oct. -21 Oct.	32.50	17.60	85.40	55.80	0.00	4.50
43	22 Oct. -28 Oct.	32.90	15.30	81.00	47.40	0.00	3.90

Source: Weather data were recorded at meteorological observatory CoA, Gwalior (M.P)

Table 2. Effect of abiotic factors on the seasonal incidence of sucking insect-pests on cowpea during *kharif*, 2022

WAS	SMW	Week	Insect-pests per plant				AWT (°C)		RH (%)		Rainfall (mm)	Evaporation (mm)
			Aphid	Jassid	Whitefly	Thrips	Max. (°C)	Min. (°C)	Morning	Evening		
3	32	06 Aug.-12 Aug.	0	0.91	1.89	0.00	32.80	25.90	90.70	66.40	87.00	3.90
4	33	13 Aug.-19 Aug.	7.43	1.62	1.79	0.00	30.30	21.70	88.40	74.40	64.60	3.70
5	34	20 Aug.- 26 Aug.	11.56	5.23	5.78	2.72	43.00	24.30	89.20	73.20	135.00	3.20
6	35	27 Aug.- 02 Sept.	10.52	6.72	3.25	2.07	34.20	25.90	86.20	60.50	9.80	4.40
7	36	03 Sept -09 Sept.	11.56	10.24	5.45	3.86	35.30	26.00	80.40	55.50	0.00	5.70
8	37	10 Sept.-16 Sept.	19.89	8.63	5.10	6.89	32.20	24.90	95.40	72.00	60.00	2.00
9	38	17 Sept.-23 Sept.	18.65	7.44	3.78	6.45	31.00	24.10	92.50	75.00	61.00	2.20
10	39	24 Sept.-30 Sept.	15.25	8.11	2.55	6.18	32.50	23.80	89.10	58.00	13.80	2.50
11	40	01 Oct.- 07 Oct.	16.36	9.54	3.55	6.55	33.60	23.30	89.00	61.40	8.40	3.10
12	41	08 Oct. - 14 Oct.	9.25	7.14	1.89	3.07	29.90	21.70	94.20	70.20	103.00	3.20
13	42	15 Oct.- 21 Oct.	7.85	2.71	1.17	1.77	32.50	17.60	85.40	55.80	0.00	4.50
14	43	22 Oct. - 28 Oct.	8.3	0.00	0.00	0.00	32.90	15.30	81.00	47.40	0.00	3.90

Table 3. Correlation between sucking insect-pest population and weather parameters during *Kharif* 2022

S.N.	Pest	Average Weekly Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	Evaporation (mm)
		Maximum (°C)	Minimum (°C)	Morning	Evening		
1	Aphid	0.012	0.218	0.319	0.207	-0.142	**-0.590***
2	Jassid	0.090	0.582*	0.228	0.131	-0.129	-0.195
3	Whitefly	0.580*	0.738*	0.203	0.411	0.274	-0.122
4	Thrips	-0.032	0.399	0.436	0.209	-0.101	**-0.582***

***** *Significant at 5 % level*

4. CONCLUSION

This study investigated the population dynamics of insect pests affecting cowpea cultivation in the Gird region of Madhya Pradesh during the Kharif season of 2022-23. The findings revealed distinct patterns in the appearance and activity of various insect pests, namely *Aphis craccivora, Megleurothrips distalis, Empoasca kerri,* and *Acaudaleyrodes rachipora. A. craccivora* exhibited its initial presence in the third week of August, reaching peak activity in the 37th standard week. Similarly, *E. kerri* and *A. rachipora* infestations began in the second week of August and peaked in the second week of September. M. distalis appeared in the fourth week of August, with the highest activity observed in the second week of September. Furthermore, the study identified noteworthy correlations between pest populations and environmental factors. Specifically, *A. rachipora* and *E. Kerri* populations demonstrated a significant positive correlation with minimum temperature, while *A. rachipora* exhibited a positive correlation with maximum temperature. In contrast, *A. craccivora* and *M. distalis* populations showed significant negative correlations with evening relative humidity. These findings provide valuable insights into the seasonal dynamics of insect pests in cowpea cultivation in the Gird region. Understanding these patterns can inform more effective pest management strategies, contributing to improved crop yield and overall agricultural sustainability in the region. Further research may be warranted to explore additional factors influencing pest dynamics and to develop targeted interventions for sustainable cowpea production in this area.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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