Original Research Article

IMPACT OF KEY INSECT PESTS ON COWPEA AND THEIR RELATIONSHIP WITH WEATHER PARAMETERS

ABSTRACT

Cowpea (*Vigna unguiculata* L.) is an important pulse crop with a major nutritional impact in India. Biotic and abiotic factors hinder the production of cowpea. Important biotic factors that affect the production include pests like *Maruca vitrata*, *Riptortus pedestris*, and *Aphis craccivora*. This study examined the seasonal incidence of these pests and their correlation with weather parameters in Thiruvananthapuram, Kerala. *Riptorus pedestris* peaked at 7.54 bugs per five plants in the 16th Standard Meteorological Week (SMW), with a positive correlation, r = 0.637 at maximum temperature, r = 0.559 at minimum temperature and negative correlation r = -0.480 with evening relative humidity. The population of *Maruca vitrata* also peaked in the same week with 2.65 larvae per five plants, with similar temperature correlations. Aphids reached their highest incidence of 3.02 per three leaflets in the 20th SMW with a positive correlation r =0.383 at minimum temperature. These observations emphasize the temperature-dependent nature of these pests, thereby emphasizing the importance of integrated pest management strategies in cowpea cultivation to counteract climate effects and support sustainable production. This data can be used for forecasting pest incidence in the future.

Keywords: *pest incidence, seasonal correlation, cowpea pest, pod bug*

INTRODUCTION

Major pulse crops grown in India include pigeonpea, mungbean, urdbean, chickpea, horse gram and cowpea. Among these, cowpea (*Vigna unguiculata* L.) from the Fabaceae family is one of the oldest known food sources. It provides essential daily nutrition to a large portion of the population. India is

considered to be the largest producer and consumer of pulses, accounting for nearly 25% of global production and 27% of global consumption [1]. As reported by Sekhar and Bhatt, 2012 [2] pulse production remained nearly stagnant for around 40 years. The total production of food grains in India has declined from 16% in 1950 to 8% in 2022-23 [3]. The biotic and abiotic factors such as the presence of pests, diseases and parasitic weeds are the causes of this reduction. Drought and poor soil fertility is another reason for declining harvests [4].

A total of 21 insect pest species have been recorded damaging the cowpea crop from germination to maturity with most pests emerging during the pod-bearing stage of cowpea. *Maruca vitrata* is regarded as the most dangerous and significant pod borer that causes considerable damage during the flowering period [5]. Its destructive impact during critical stages of crop growth, especially flowering and pod development as well as its focus on economically important parts like flower buds, flowers, and pods makes it a major constraint to achieve potential productivity. Losses of 42% to 80% due to pod damage alone have been reported [6].

Pod bugs are another serious pest that attacks cowpea, particularly during the post-flowering phase. These bugs feed by extracting sap from the developing pods that affects both the quantity and quality of the harvest [7]. Both nymphs and adults pierce the pod walls and extract nutrients from the developing grains which leads to premature pod shedding, deformation and grain shrivelling that reduces grain yield [8].

The cowpea aphid (*Aphis craccivora*) is also a major sucking insect pest in various parts of India [9] that causes a yield loss of 20-40% [10]. Both nymphs and adults damage crops by sucking sap from leaves, petioles, tender stems, inflorescences and pods. The reduction in yield due to aphid attack occurs due to continuous feeding which results in yellowing, curling and drying of leaves. They can also act as a vector for viral diseases such as cowpea mosaic [11].

The present study was to know the seasonal incidence of pod bug, pod borer and aphids that infest cowpea with weather parameters during the year 2024.

MATERIALS AND METHODS

A field study was conducted at the College of Agriculture, Vellayani in 2024 to monitor the seasonal incidence of pod bugs, pod borers and aphids in cowpea. The variety used in the study was Githika, released by Kerala Agricultural University.

1. Seasonal Incidence of Pod Bug, *Riptortus pedestris* in Cowpea

Data on the incidence of pod bugs were collected using a fixed plot sampling technique. From each plot, five plants were randomly selected and tagged to count the number of nymphs on each of the tagged plants. The sampling was done through direct counting at biweekly intervals during different phases of crop. Observations were taken in the morning hours to count the number of nymphs of pod bugs in the experimental plots. The average number of pod bug nymphs that attack cowpea was

counted at each stage of crop. Then the values were correlated with weather parameters recorded during the crop period to assess the impact of temperature, relative humidity, rainfall, and wind speed on the population dynamics of the pests.

2. Seasonal Incidence of Pod borer, *Maruca vitrata* in Cowpea

The seasonal incidence of *M. vitrata* was observed by taking five plants randomly and the total number of larvae was recorded. Observations were made biweekly from the flowering period until the maturity stage. Finally, the larval population of *M. vitrata* was correlated with various weather parameters to assess their correlation effects. For this purpose, weekly data on different weather parameters were collected from the meteorological observatory of CoA, Vellayani.

3. Seasonal Incidence of Aphids, *Aphis craccivora* in Cowpea

Observations on the population dynamics of aphids were recorded from the field. Aphid populations were monitored biweekly on the 10 cm apical shoot length of five randomly selected plants. The relationship between aphid populations and weather parameters were also calculated.

3. RESULTS AND DISCUSSION

3.1. Seasonal Incidence of Pod Bug, *Riptortus pedestris* in Cowpea

In cowpea, the incidence of *R. pedestris* was observed on 9th Standard Meteorological Week (SMW) (0.60 bugs/five plants) which gradually increased and reached peak level during 16th MSW (7.54 bugs/five plants). Thereafter, the population gradually decreased to 0.6 bugs per five plants at 31st SMW (Fig. 1). These results were in compliance with the study conducted by Rahman *et al*., 2022 [11], where a similar temperature pattern was observed for pod bug in mungbean and peak population densities of nymphs (4-6 bugs/10 plants) was recorded in their study during mid-April which was followed by a gradual decrease. A comparable pattern was observed in the current study, where *R. pedestris* populations in cowpea surged during the 16th SMW (7.54 bugs/5 plants) and then gradually declined (Table 1).

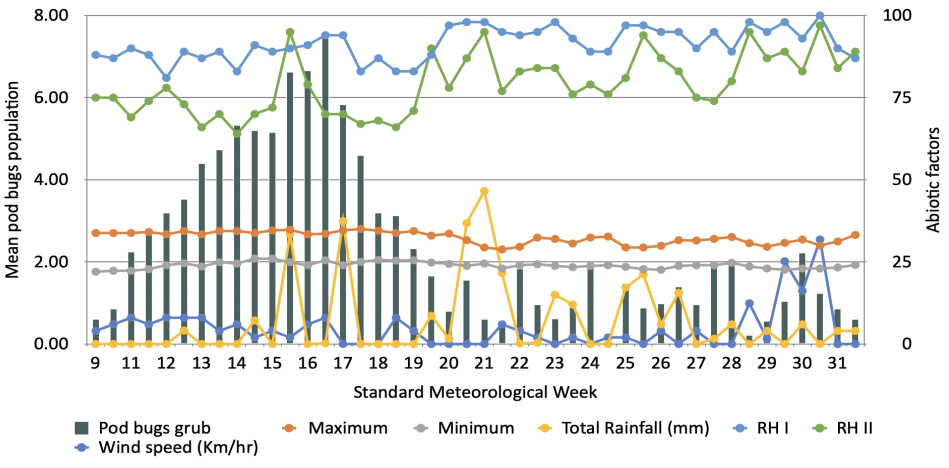

Fig. 1. Seasonal incidence of pod bugs in relation to weather parameters

Correlation studies with weather parameters revealed that incidence of *R. pedestris* exhibited a significant positive correlation with atmospheric maximum temperature (r = 0.637) and atmospheric minimum temperature (r = 0.559). A significantly negative correlation was observed with evening relative humidity (r = -0.480) and did not show any significant correlation with other abiotic factors (Fig. 2).

The current correlation study is in line with the temperature-dependent trends observed by Mahipal *et al*., 2017 [12] . A significantly negative correlation with evening relative humidity (r = -0.480) supports the theory that drier conditions favour the pest activity. These findings of the current study also align with similar trends observed in the study conducted by Soratur *et al*., 2017 [13].

The study on pod bugs reported a high significant negative correlation with morning relative humidity (r = -0.643) and a positive correlation with maximum temperature (r = 0.466). This implies that a higher temperature promotes the growth of the pod bug population. Whereas, the increased humidity during morning or evening hours tends to limit the activity of pod sucking bugs.

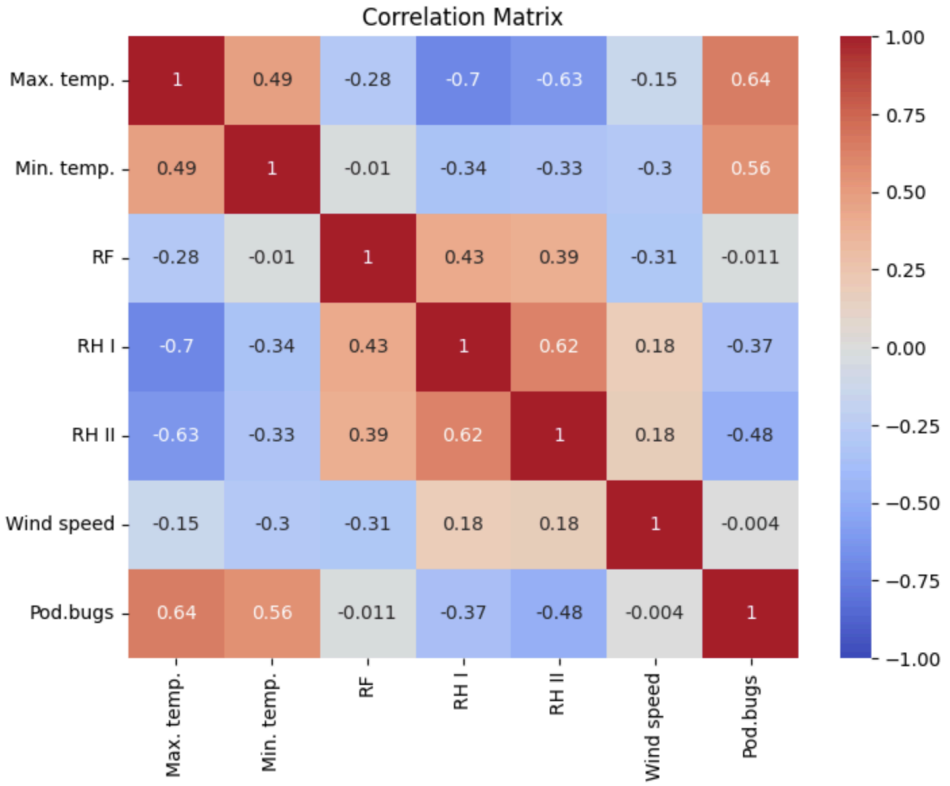

Fig. 2. Seasonal incidence of pod bugs in relation to weather parameters

3.2. Seasonal Incidence of Pod borer, *Maruca vitrata* in Cowpea

Pooled data on incidence of Maruca vitrata indicated that the number of pod borers per five plants was highest during the 16th SMW with 2.65. The pod borer population was noticed in the crop

from 12th SMW and continued up to 31st SMW with a reduced incidence of 0.88 larvae per five plants (Fig. 3). The incidence of pod borer was more from 13th SMW to 19th SMW (Table 1).

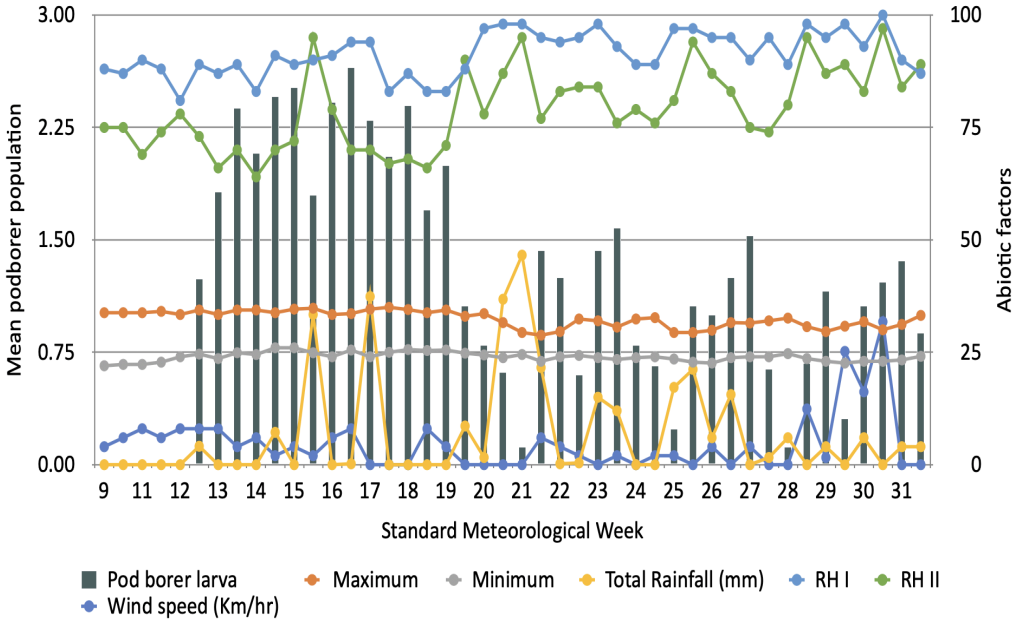

Fig. 3. Seasonal incidence of pod borers in relation to weather parameters

Correlations between pod borer population on cowpea and maximum temperature (r= 0.345), minimum temperature (r= 0.630) were found to have a positive correlation, whereas with evening relative humidity (r= -0.396) it was found to have a significant negative correlation (Fig. 4).

The results of this study and the one conducted by Patel *et al*., 2022 [14], on the incidence of *M. vitrata* in cowpea are similar. The peak incidence was observed during the reproductive stages and the maximum temperature exhibited a positive influence on the pest population. The study reported that a high population of *M. vitrata* was observed during the 41st SMW with 6.97 larvae per plant. This was in correlation to maximum temperature (r = 0.625) and bright sunshine hours (r = 0.586), where the studies highlighted that the temperature-dependent nature of *M. vitrata* with higher temperatures promoted the population.

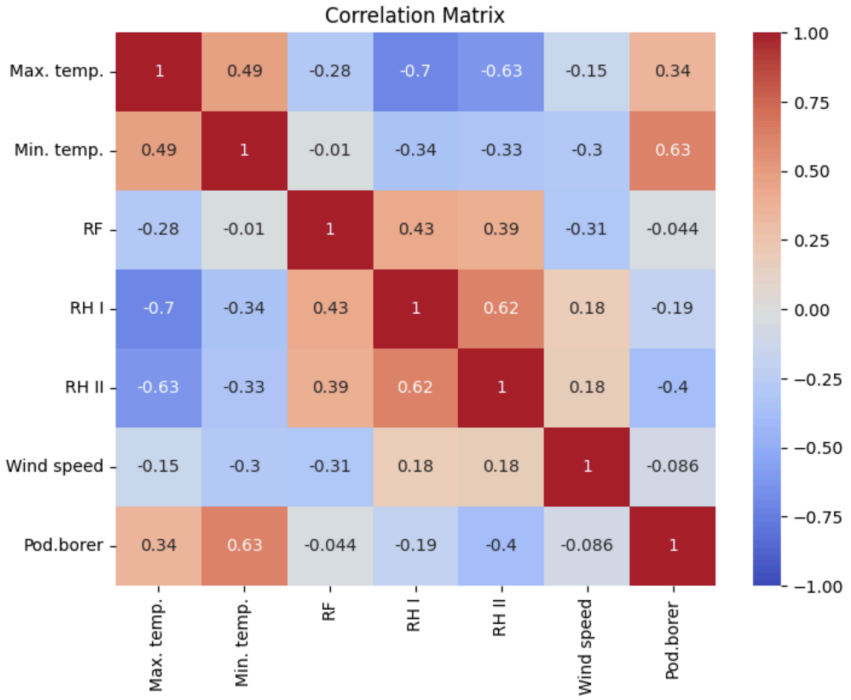

Fig. 4 Correlation matrix of pod borers in relation to weather parameters

3.3. Seasonal incidence of Aphids in cowpea (*Vigna unguiculata* L.)

Data on the incidence of aphids indicated that the number of aphids per three leaflets was highest during the 20th SMW with 3.02. The aphids population started to be noticed in the crop from 11th SMW and continued up to 31st SMW with a reduced incidence of 0.32 aphids per three leaflets by 27th SMW (Fig. 5). The incidence of aphids were high from 16th SMW to 21st SMW (Table 1).

In the study, incidence of aphids were higher during 20th SMW, reaching 3.02 aphids per three leaflets. This finding aligns with the study conducted by Anandmurthy *et al*., 2018 [15], which reported that the aphid population peaked earlier around the fifth week of April, with an aphid index of 3.82 per plant.

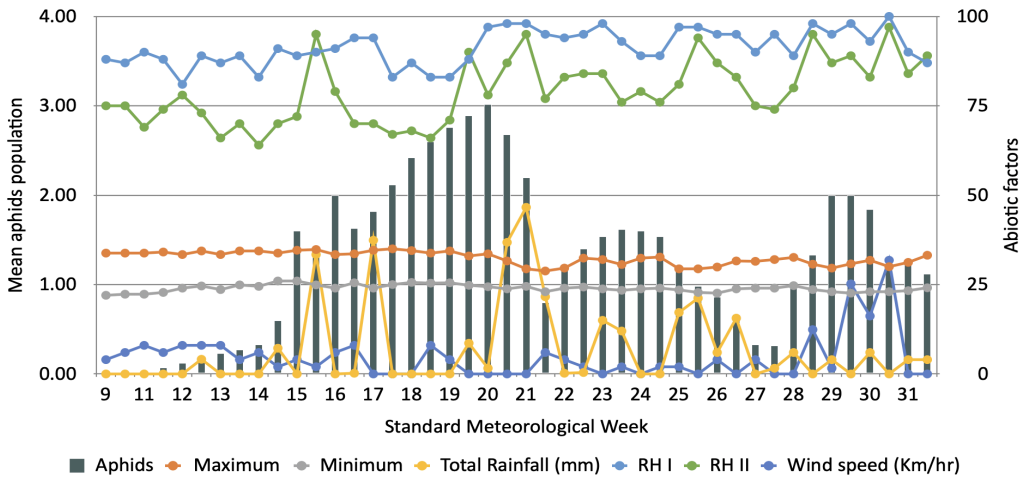

Fig. 5. Seasonal incidence of aphids in relation to weather parameters

Correlations between aphids population on cowpea was found to have a significant positive correlation with minimum temperature (r= 0.383). Aphid population showed no significant correlation with other abiotic factors (Fig. 6). The present findings are consistent with those of Sharma *et al*., 2019 [16], who demonstrated that aphids exhibit a positive correlation with temperature and a significant negative correlation with rainfall.

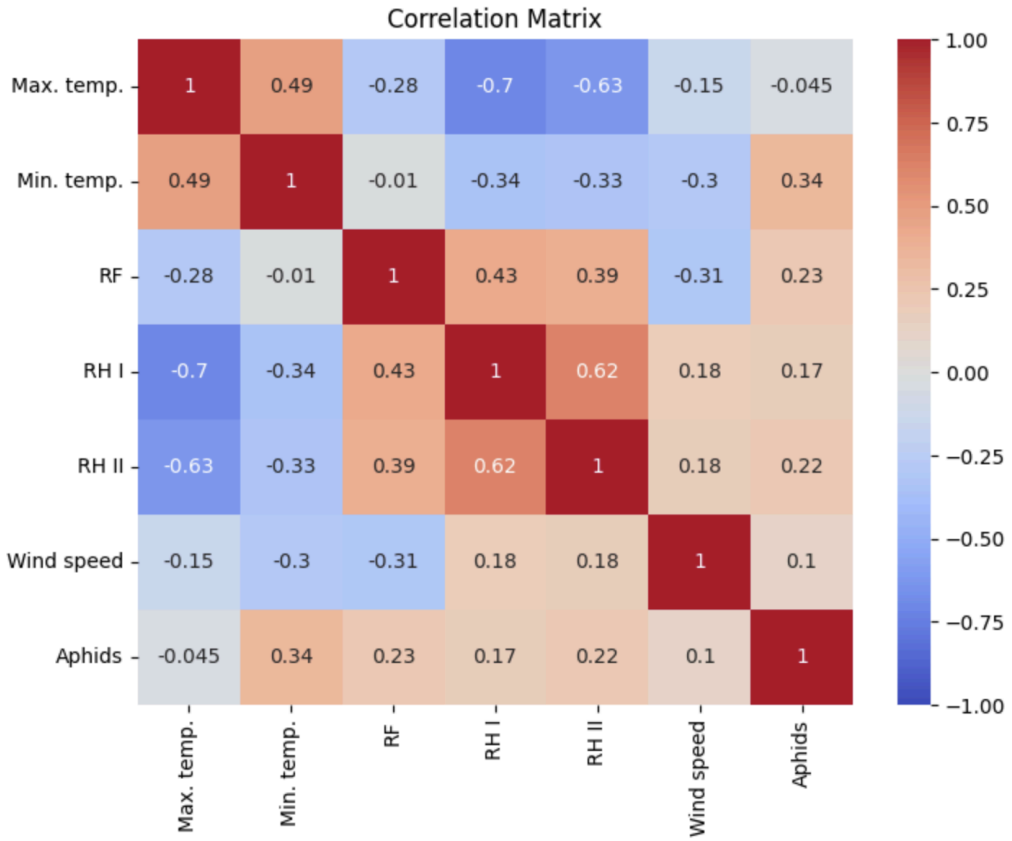

Fig. 6. Correlation matrix of aphids in relation to weather parameters

Table 1: Effect of biotic and abiotic factors on the incidence of major insect pests of cowpea

SMW	Month	Atmospheric Temperature (°C)		Total Rainfall (mm)	Relative humidity (%)		Wind speed (Km/hr)	Mean no. of pest population/ five plants		Aphids
		Maximum	Minimum		I	II		Pod borer larva	Pod bugs grub	
9	4-Mar	33.8	22	0	88	75	4	0.00	0.60	0
10	8-Mar	33.8	22.3	0	87	75	6	0.00	0.86	0
11	11-Mar	33.8	22.3	0	90	69	8	0.00	2.24	0
11	15-Mar	34.1	22.8	0	88	74	6	0.00	2.66	0.07
12	19-Mar	33.4	24	0	81	78	8	0.00	3.20	0.12
12	23-Mar	34.4	24.6	4.1	89	73	8	1.24	3.53	0.2
13	26-Mar	33.4	23.6	0	87	66	8	1.82	4.40	0.23
13	29-Mar	34.4	24.9	0	89	70	4	2.38	4.73	0.27
14	1-Apr	34.4	24.5	0	83	64	6	2.08	5.33	0.33
14	5-Apr	33.8	26	7.2	91	70	2	2.46	5.20	0.6
15	9-Apr	34.6	26	0	89	72	4	2.52	5.16	1.6

15	12-Apr	34.8	24.9	33.4	90	95	2	1.80	6.62	1.4
16	16-Apr	33.4	24	0	91	79	6	2.42	6.66	2
16	19-Apr	33.6	25.5	0.2	94	70	8	2.65	7.54	1.63
17	25-Apr	34.6	24	37.4	94	70	0	2.30	5.83	1.82
17	29-Apr	35	25	0	83	67	0	2.06	4.60	2.12
18	3-May	34.5	25.6	0	87	68	0	2.40	3.20	2.42
18	6-May	33.8	25.4	0	83	66	8	1.70	3.13	2.6
19	10-May	34.4	25.5	0	83	71	4	2.00	2.33	2.76
19	13-May	33	24.8	8.6	88	90	0	1.06	1.66	2.89
20	16-May	33.6	24.4	1.6	97	78	0	0.80	0.80	3.02
20	20-May	31.6	23.8	36.8	98	87	0	0.62	1.56	2.68
21	23-May	29.4	24.5	46.6	98	95	0	0.12	0.60	2.2
21	27-May	28.8	23	21.6	95	77	6	1.43	0.50	0.8
22	31-May	29.6	24	0.2	94	83	4	1.25	1.83	1.2
22	3-Jun	32.4	24.3	0.4	95	84	2	0.60	0.96	1.4

23	6-Jun	32	23.8	15	98	84	0	1.43	0.62	1.54
23	10-Jun	30.6	23.4	12	93	76	2	1.58	1.02	1.62
24	14-Jun	32.4	23.8	0	89	79	0	0.80	1.93	1.6
24	17-Jun	32.7	24	0	89	76	2	0.66	0.00	1.54
25	21-Jun	29.4	23.5	17.2	97	81	2	0.24	1.48	1.2
25	24-Jun	29.4	22.8	21.2	97	94	0	1.06	0.88	0.98
26	28-Jun	29.9	22.6	6	95	87	4	1.00	0.98	0.86
26	1-Jul	31.6	23.8	15.6	95	83	0	1.25	1.40	0.67
27	4-Jul	31.5	24	0	90	75	4	1.53	0.96	0.33
27	8-Jul	32	24	1.6	95	74	0	0.64	1.98	0.32
28	12-Jul	32.6	24.7	6	89	80	0	0.12	2.02	1
28	15-Jul	30.7	23.6	0	98	95	12.4	0.68	0.22	1.33
29	19-Jul	29.6	23	4	95	87	1.6	1.16	0.56	2
29	22-Jul	30.8	22.6	0	98	89	25.2	0.31	1.04	2
30	25-Jul	31.8	23	6	93	83	16.2	1.06	2.22	1.84

30	29-Jul	30	23	0	100	97	31.8	1.22	1.24	1.2
31	1-Aug	31.2	23.3	4	90	84	0	1.36	0.86	1.24
31	5-Aug	33.2	24.1	4	87	89	0	0.88	0.60	1.12

4. CONCLUSION

The study shows the population dynamics of key pests like pod bugs, pod borers and aphids, affecting cowpea, with weather parameters. It proves that *R. pedestris* and *M. vitrata* populations exhibited peak incidence during the 16th SMW with a positive correlation with temperature and a negative correlation with humidity. This study highlights the important role of abiotic factors in pest outbreak that is usually favoured by the activity of pests. Conversely, *A. craccivora* reached its highest incidence during the 20th SMW, further supporting the relationship between temperature and aphid populations. The results of pest correlation with climatic factors indicates that higher temperatures are responsible for increased pest population, whereas presence of rainfall has a negative impact on their population. Adequate monitoring of these pests and their environmental correlations are essential for developing effective management practices to reduce yield losses in cowpea cultivation.

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