

RESEARCH ARTICLE

SEASONAL OCCURRENCE OF MAJOR SUCKING INSECT-PESTS AND THEIR NATURAL ENEMIES ON OKRA (*ABELMOSCHUS ESCULENTUS* L. MOENCH) DURING SUMMERFanendra Kumar¹, G.P. Painkra*², K.L. Painkra³, P.K. Bhagat³, S.K. Sinha⁴ and Neelam Chouksey⁵¹Department of Entomology, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Raj Mohini Devi College of Agriculture and Research Station, Ambikapur (C.G.) India²Department of Entomology, Indira Gandhi Krishi Vishwavidyalaya, Raipur, College of Agriculture and Research Station, Shankargarh, Distt- Balrampur -Ramanujganj (C.G.) India³Department of Entomology, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Raj Mohini Devi College of Agriculture and Research Station, Ambikapur (C.G.) India⁴Department of Genetics and Plant Breeding, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Raj Mohini Devi College of Agriculture and Research Station, Ambikapur (C.G.) India⁵Department of Agricultural Statistics, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Raj Mohini Devi College of Agriculture and Research Station, Ambikapur (C.G.) IndiaEmail: fanendrasahu2000@gmail.com

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Abstract: The present study investigated the seasonal occurrence of major sucking insect pests of okra (*Abelmoschus esculentus* L. Moench) and their natural enemies during the summer. Field observations were recorded from seedling stage to crop maturity on leafhopper, whitefly, and aphid populations, along with associated natural enemies, and were correlated with weather parameters. Pest populations appeared soon after crop establishment and peaked during the mid-season, with leafhopper being the most predominant pest. Natural enemy activity closely followed pest population trends, while temperature and relative humidity significantly influenced population fluctuations. The findings highlight the importance of understanding seasonal pest dynamics for developing effective and eco-friendly Integrated Pest Management strategies.

Keywords: Aphid, Coccinellids Okra, Leafhopper, Whitefly

INTRODUCTION

Okra (*Abelmoschus esculentus* L. Moench), commonly known as bhindi or lady's finger due to the characteristic shape of its pods, is an important vegetable crop widely cultivated in tropical and subtropical regions of the world. In India, okra is grown extensively during the kharif and summer seasons. It is cultivated throughout the country, with major contributions from states such as Andhra Pradesh, West Bengal, Bihar, Gujarat, Odisha, Jharkhand, Maharashtra, Madhya Pradesh, Chhattisgarh, Assam, Uttar Pradesh, and Haryana. The crop occupies an area of about 532.66 thousand hectares with an annual production of approximately 6,513 thousand metric tonnes. In Maharashtra alone, okra is cultivated over an area of 8.91 thousand hectares, producing nearly 139.28 thousand tonnes annually (Anonymous, 2021).

Okra is attacked by several insect pests that cause significant yield losses. The major pests include shoot

and fruit borers, *Earias insulana* (Boisd.) and *Earias vittella* (Boisd.); leafhopper, *Amrasca biguttula biguttula* (Ishida); leaf roller, *Sylepta derogata* (Fab.); whitefly, *Bemisia tabaci* (Genn.); aphid, *Aphis gossypii* (Glover); and red spider mite, *Tetranychus cinnabarinus* (Boisd.). Among these, sucking pests such as leafhoppers, whiteflies, and aphids pose a major threat to okra production. The leafhopper (*A. biguttula biguttula*) is considered one of the most destructive pests, as it feeds on the sap from the undersurface of leaves, leading to leaf margin curling, chlorosis, and ultimately substantial reduction in yield.

Effective management of insect pests at the appropriate stage of crop growth is essential to ensure higher yield and better-quality produce. Although the use of chemical insecticides has contributed significantly to increased agricultural productivity, their indiscriminate and excessive use has resulted in several adverse effects, including the development of insecticide resistance, pest resurgence, secondary pest

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outbreaks, and accumulation of pesticide residues in the environment. Insecticide resistance has emerged as a major challenge in modern pest management, often leading to unexpected and severe crop losses.

Under the present scenario of climate change, insect pest dynamics are undergoing significant alterations due to variations in abiotic factors. Therefore, understanding the relationship between insect pest populations, their natural enemies, and prevailing weather parameters is crucial for predicting pest outbreaks and developing effective management strategies. Despite their importance, natural enemies have received relatively limited attention as biological control agents, highlighting the need for further research in this area.

MATERIALS AND METHODS

The experiment was conducted during summer at research-cum-Instructional farm of Raj Mohini Devi College Agriculture and Research Station, Ajirma, Ambikapur, District, Surguja (C.G.). The observations of leafhopper, aphids, and whiteflies were recorded on a per-plot basis. For each observation, five plants were randomly selected from each plot, and three leaves (one each from the bottom, middle, and top) of each plant were examined visually to assess pest infestation levels.

The seasonal occurrence of sucking insect-pests population was recorded weekly on five randomly selected plants per plot from their appearance until harvest. Populations of sucking pests (leafhopper, whitefly, and aphids) were counted. The population of natural enemies were also recorded from the same plants. Weekly pooled meteorological data (temperature, rainfall, morning and evening relative humidity) from RMD CARS, Ambikapur (C.G.) were correlated with pest incidence.

RESULTS AND DISCUSSION

Seasonal occurrence of aphids

Okra crop was sown during the March and recorded aphid populations ranging from 4.42 to 18.51 aphids per three leaves from five selected plants throughout the summer season. The initial presence of aphids was observed in the 12th Standard Meteorological Week (SMW), approximately 15 days after sowing, with a population of 4.42 aphids per three leaves per plant. The population gradually increased, reaching a peak of 18.91 aphids per three leaves per plant in the 17th SMW, corresponding to the last week of April. Interestingly, the aphid population remained relatively stable at 18.51 aphids per three leaves per plants until the end of the cropping season.

The present findings are consistent with those of Parasai and Shastri (2009), who observed the highest incidence of aphid populations during the first week of September, corresponding to the 37th SMW. Similarly, the results align with the observations of

Thara *et al.* (2019), who reported a gradual increase in aphid population, reaching its peak during the second week of October.

Seasonal occurrence of leafhopper

During the summer season, leafhopper infestation on okra began in the 12th SMW with a population of 7.56 leafhoppers per five leaves per plant. The population gradually increased, reaching 18.10 leafhoppers per five leaves per plant in the 17th SMW, followed by a temporary decline. However, it rose again and peaked in the 26th SMW, corresponding to the last week of June, with 21.45 leafhoppers per five leaves per plant. Throughout the season, the leafhopper population ranged from 7.56 to 21.45 leafhoppers per five leaves. Similar observations were reported by Mahmood *et al.* (1990), who noted that leafhoppers began emerging in June and remained active until the end of the cropping season. These findings are also supported by Hegde *et al.* (2004), who recorded peak populations during August to September. The present results are further in agreement with those of Potai and Chandrakar (2018), who reported that the major activity period of leafhoppers occurred between August and October, with a distinct peak during the 38th SMW. Likewise, Thara *et al.* (2019) observed that leafhopper incidence began in the second week after sowing and peaked in the fourth week of September, corresponding to the 39th SMW.

Seasonal occurrence of whitefly

During the summer, whitefly infestation on the okra crop was observed throughout the growing season. The initial infestation appeared in the second week of March, corresponding to the 11th SMW, with a mean population of 5.52 whiteflies per five leaves per plant. The population ranged from 5.52 to 10.67 whiteflies per five leaves per plant. The highest infestation was recorded in the 18th SMW, with a peak population of 10.67 whiteflies per five leaves per plant. Thereafter, a gradual decline in the population was observed.

The present findings are broadly in agreement with those of earlier researchers. Yadav and Singh (2013) and Aarwe *et al.* (2016) reported that the whitefly population peaked in August, during the 34th SMW. These results are also supported by Potai and Chandrakar (2018), who observed the initial appearance of the pest in the second week of August, with peak population levels recorded in the third week of September, corresponding to the 38th SMW.

Seasonal occurrence of coccinellids

During the summer season, predatory coccinellids were observed throughout the cropping period, co-existing with various pest species. The initial population was recorded in the 13th SMW (last week of March) at 1.82 coccinellids per five leaves per plant. Over the season, the population fluctuated between 1.82 and 4.51 coccinellids per five leaves per plant. The highest activity was recorded in the 22nd SMW, with a peak population of 4.51 coccinellids per five leaves.

The findings of Purohit *et al.* (2006) and Singh *et al.* (2013) also support the present results, as they recorded peak coccinellid activity during the first week of September and the second week of October, respectively. Similarly, the present observations are in

agree with those of Gaikwad *et al.* (2020), who reported the initial appearance of coccinellids during the 31st SMW, followed by a gradual increase in population in the subsequent weeks.

Table 1. Seasonal occurrence of sucking insect-pests and natural enemies on okra during summer.

SMW	Weather parameters					Population of sucking pests/plant			Population of natural enemies/plant
	Max. T. (°C)	Min. T. (°C)	RH-I (%)	RH-II (%)	Rainfall (mm)	Aphids	Leafhoppers	Whitefly	Coccinellids (Grubs/ Adults)
10	31.1	11.00	79.7	47.9	0.00	0.00	0.00	0.00	0.00
11	34.3	14.3	50.3	34.0	0.00	0.00	0.00	5.52	0.00
12	31.4	15.8	98.3	94.1	0.00	4.42	7.56	5.30	0.00
13	35.9	15.4	69.1	43.9	0.00	8.50	15.10	5.87	1.82
14	38.6	23.4	72.0	41.6	0.00	9.30	13.50	4.50	2.56
15	36.3	22.1	72.1	43.3	5.10	8.93	18.30	5.83	2.79
16	27.4	22.3	95	89.3	0.00	15.63	16.3	5.23	4.23
17	37.2	22.3	79.1	33.7	0.00	18.91	20.11	7.62	4.50
18	34.1	23.6	77.0	45.4	4.10	16.24	17.36	8.33	3.14
19	36.8	27.2	71.7	38.0	1.30	13.65	15.85	7.50	3.99
20	39.4	27.9	77.7	36.4	0.20	10.17	14.67	9.30	3.90
21	32.9	26.3	80.6	59.1	11.4	11.42	14.21	2.30	3.64
22	34.4	21.2	67.2	64.2	4.70	14.61	17.93	8.89	3.49
23	36.8	26.3	84.1	75.3	3.40	17.39	19.6	5.45	4.51
24	36.2	28.1	81.0	64.4	0.10	15.47	18.61	7.82	3.45
25	26.0	22.0	94.7	75.6	16.4	11.50	18.46	6.30	3.98
26	28.1	20.1	93.6	84.6	0.00	18.51	21.45	8.00	2.37

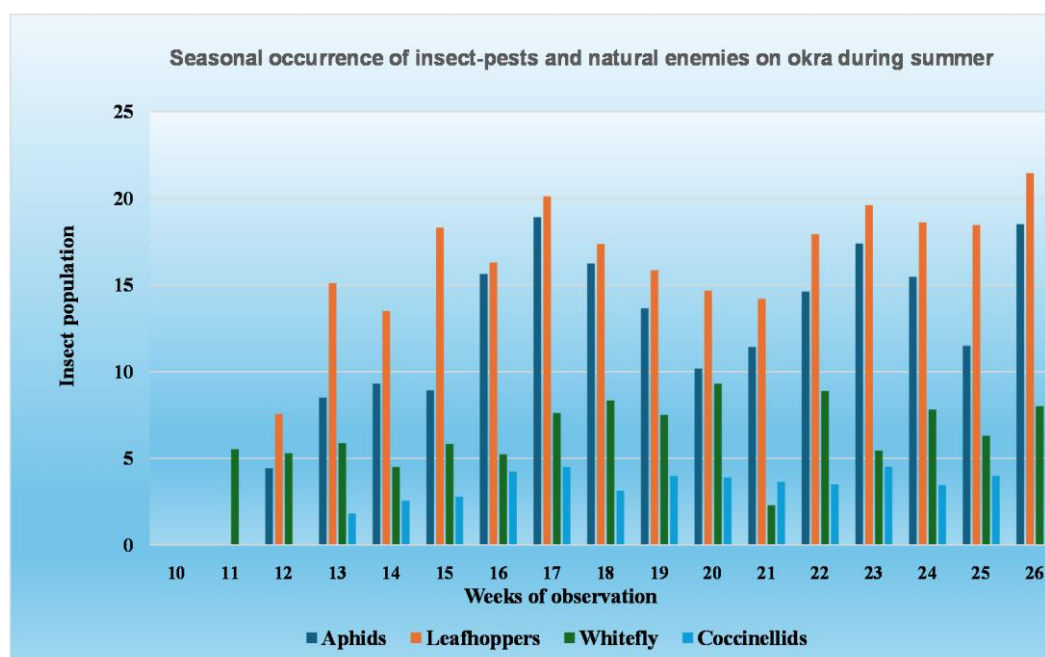


Fig. 1 Correlation of insect-pest and natural enemies with weather parameters during summer.

Correlation of insect-pests and natural enemies with weather parameters during summer.

Correlation coefficients between various weather parameters with the population of sucking pests viz., aphids, leafhoppers and whitefly and their natural enemies i.e., Coccinellids presented in Table 2.

Table 2. Correlation of insect-pests and natural enemies with weather parameters during summer.

Weather parameters	Correlation coefficient value			
	Aphid	Leafhopper	Whitefly	Coccinellid
Max. Temperature	0.425*	0.265	0.456*	0.160
Min. Temperature	-0.586**	-0.548*	-0.276	-0.209
Morning RH	-0.028	0.339	0.165	0.212
Evening RH	-0.575**	-0.213	-0.182	-0.026
Rain fall	-0.104	-0.056	0.114	-0.338

*5% level of significance $t_{15}=0.412$, **1% level of significance $t_{15}=0.558$

Correlation study investigated the relationship between maximum temperature and various insect populations. The positive correlation was observed between maximum temperature, leafhopper and Coccinellid. However, these correlations were not statistically significant, with correlation coefficients of 0.265 and 0.160 respectively. In contrast, a significant positive correlation (coefficient 0.425* and 0.456*) was observed between maximum temperature, aphid and whitefly populations.

Minimum temperature showed negative significant correlation with the aphid (-0.586**), leafhopper (-0.548*) population. In contrast, a non-significant and negative correlation was observed between min. temperature and whitefly (-0.276) and Coccinellid (-0.209) population.

The aphid population correlated negatively and non-significant with the morning relative humidity with correlation coefficient value -0.003. In contrast a positively non-significant correlation was observed between morning RH and leafhopper (0.035), whitefly (0.235) and coccinellid (0.075) population.

The negative correlation was recorded between evening relative humidity the Aphid and leafhopper which was negatively significant with correlation coefficient value (-0.609**) and (-0.472*) respectively. And negatively non-significant correlation observed between evening RH and whitefly (-0.286) and coccinellid (-0.185) population.

As regards rainfall positive non-significant correlation showed with the whitefly with correlation coefficient value (0.114). Whereas aphid, leafhopper and coccinellid with correlation coefficient value (-0.105), (-0.005) and (-0.109) respectively showed negative non-significant correlation with rainfall.

The correlation studies between pests, natural enemies and major weather parameters during summer season revealed that there was a negative correlation between aphid and minimum temperature, morning relative humidity, evening relative humidity and rainfall, while positive correlation with maximum temperature. Investigations by Dhandge *et al.* (2018) revealed that aphid population showed positive correlation with maximum temperature while, negative correlation

with morning and evening relative humidity. Potai and Chandrakar (2018) reported negative correlation between aphid and minimum temperature in confirmation with the present findings.

There was a positive correlation between leafhopper and maximum temperature. Whereas leafhopper showed negative correlation with minimum temperature, morning and evening RH and rainfall. The present findings are in close agreement with Ratanpara *et al.*, (1994) reported that minimum temperature showed negative correlation with leafhoppers. Another findings by Dhandge *et al.* (2018) revealed that pest population showed positive correlation with maximum temperature while, negative correlation with evening relative humidity.

Investigations revealed the positive correlation between whitefly and maximum temperature, minimum temperature, morning RH, evening RH and rainfall. Reports of Purohit *et al.* (2006) stated positive correlation of whitefly with all the abiotic factors. These results are in confirmation with the findings of Yadav and Singh (2013) who revealed positive correlation between whitefly and maximum temperature.

The present study revealed that there was a positive correlation between coccinellid and maximum temperature, minimum temperature, morning RH, evening RH and rainfall. Reports of Purohit *et al.* (2006) stated correlation between coccinellid and minimum temperature and rainfall in confirmation with the present findings. These findings are similar with reports by Dhaka and Pareek (2007) who revealed correlation between Coccinellid and evening relative humidity. Potai and Chandrakar (2018) reported positive correlation between aphid and morning relative humidity in confirmation with the present findings and Kumar *et al.* (2025) on seasonal occurrence of pests and natural enemies of okra.

CONCLUSION

During the summer of 2025, major sucking insect pests of okra, namely aphids, leafhoppers, and whiteflies and natural enemy were observed

throughout the crop growth period. Aphids appeared in the third week of March and peaked in the last week of April, while leafhoppers persisted throughout the season with maximum abundance in late June. Whiteflies showed moderate fluctuations, attaining peak activity in mid-May. Coccinellids, the predominant natural predators, appeared from late March and reached their highest population in mid-June. Correlation analysis indicated that aphid and leafhopper populations were positively influenced by maximum temperature but negatively affected by minimum temperature, relative humidity, and rainfall. Whitefly incidence was also positively correlated with maximum temperature. In contrast, coccinellid

populations showed positive associations with temperature, morning relative humidity, and rainfall, but a negative correlation with evening relative humidity.

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Fig.1. *Amrasca biguttula biguttula*



Fig. 2. *Bemisia tabaci*



Fig.3. *Aphis gossypii*



Fig. 4. *Coccinella septempunctata*

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