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ORIGINAL ARTICLE

Impact of Weather Parameters on Seasonal Abundance of *Amritodus atkinsoni* (Leth.) in Lakhimpur Kheri and Shahjahanpur of Uttar Pradesh

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ABSTRACT

Amritodus atkinsoni (Leth.) is among the economically important mango pests. The present study was conducted at two sites - Lakhimpur Kheri and Shahjahanpur of Terai region of Uttar Pradesh, where there are a lot of mango orchards. The collection of hoppers was done by Bag Trap and Sweep Net methods. The data on maximum and minimum temperature was recorded by Six's Thermometer (maximum-minimum thermometer); whereas data on relative humidity was recorded by using hygrometer. In the month of December and January no hopper was recorded from the mangoes trees at both the study sites. The mean maximum temperature and mean minimum temperature were very low and the relative humidity was high at those months. During the second half of February, when hoppers started appearing, mean maximum temperature (26.46°C at Lakhimpur Kheri and 27.14°C at Shahjahanpur) and mean minimum temperature (12.85°C at Lakhimpur Kheri and 12.78°C at Shahjahanpur) also started rising; whereas, relative humidity (71.24% at Lakhimpur Kheri and 69.48% at Shahjahanpur) was declining. The peak of the hopper population (4.56 at Lakhimpur Kheri and 5.88 at Shahjahanpur) was seen in the first half of May. At this time mean maximum temperature (39.40°C at Lakhimpur Kheri and 39.98°C at Shahjahanpur) and mean minimum temperature (24.43°C at Lakhimpur Kheri and 24.53°C at Shahjahanpur) were also high. However, relative humidity was very low (52.44% at Lakhimpur Kheri and 57.00% at Shahjahanpur). The correlation coefficient (r) between hopper population and mean maximum temperature from Lakhimpur Kheri and Shahjahanpur areas were calculated 0.8040 and 0.8737 respectively; whereas, the 'r' values of mean minimum temperature in both the study sites were 0.8396 and 0.8825 at Lakhimpur Kheri and Shahjahanpur areas, respectively, which were highly significant. On the other hand, mean relative humidity is negatively correlated with the population of A. Atkinsoni. The 'r' values of relative humidity were -0.2784 and -0.2751 at Lakhimpur Kheri and Shahjahanpur areas, respectively, which is not much significant.

Keywords: *Mango Leafhoppers, Seasonal Abundance, Weather parameters, Temperature, Relative Humidity*

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INTRODUCTION

The mango is an ancient fruit of India. In our country maximum production of mango is recorded from Uttar Pradesh. In the terai region of Uttar Pradesh there are a lot of mango orchards. In proportion to its area of cultivation, its production is very low due to attack of insect pests. Among the different mango pests, mango hoppers are most serious and widespread insect pests throughout the country. The nymphs and adults of the hoppers puncture and suck the sap from tender shoots, leaves and inflorescence of the trees, due to which flowers are unable to develop normally and fruits drop off from the trees before maturity. This results in reduction in overall mango production (Gundappa and Shukla, 2016). It produces black mould on various parts of mango trees. It affects the photosynthesis of the trees due to which flowers do not set at normal and fruits drop off from the trees before they get matured. This condition is named as Honey Dew Disease (Butani, 1993). As these hoppers feed on fresh leaves and inflorescence, they were

recorded on branches of trees when trees bloom otherwise they hide in cracks and crevices of mango trunk (Patel *et al.,* 1994). Through many workers (Sood *et al.,* 1971; Dalvi and Dumbre, 1994; Hiremath and Hiremath, 1994; Dwivedi *et al.,* 2003) have provided data on seasonal abundance and effect of weather parameters on the development of these hoppers, but information pertaining to its population growth in local ecological conditions is lacking. Hence detailed studies were carried out to determine the effect of some weather parameters on seasonal abundance of *Amritodus atkinsoni* (Leth.) in Terai region of Uttar Pradesh.

MATHERIALS AND METHODS

The experimentation was done in Terai region of Uttar Pradesh from April 2021 to March 2022. The hoppers were collected from Lakhimpur Kheri and Shahjahanpur Districts. The geographical location of Lakhimpur Kheri is at 27.94° North and 80.77° East, whereas, that of Shahjahanpur is 27.35° North and 79.37° East. A mango orchard was selected for the study at the both the districts. In each orchard, five trees were first selected and no control measures were used on those trees. Five inflorescences from each tree were then selected at random from four sides and one from the interior of each mango tree. Hoppers were collected fortnightly from January to April by bag trap method (Verghese and Rao, 1987) for collection of nymphs and adults of hoppers, as nymphs are more abundant during these months. In this method, polythene begs were tied around each of the selected inflorescence containing a piece of cotton dipped in ethyl acetate. All the life stages of hoppers were collected inside the bags and after segregation the nymphs and adults were counted. The sweep net method was employed during remaining months of year, as adult hoppers were more abundant. Sweeps were undertaken from each of the four geographical directions and on the tree trunk on each mango tree by using an insect collecting net. Overall, there were 5 bag traps or 5 sweeps undertaken in each study area. The hoppers were collected and preserved and then were brought to the laboratory and identified. Identification was done on the basis of morphological features. The adults of *A. atkinsoni* are characterized by a broad, rounded head, extending little between the eyes and a general 'wedge' shape. Their body color is dark brown, while the scutellum has an arrow like mark on it.

Weather parameters recorded included maximum, minimum temperature and relative humidity. The data on maximum and minimum temperature was recorded daily by Six's Thermometer (maximum-minimum thermometer); whereas data on relative humidity was recorded daily by using Thermohygrometer and then their average was calculated fortnightly.

RESULTS AND DISCUSSION

A look at the data shown in table 1 and 2 clearly reveals that in the month of December and January when no hopper was seen on mangoes in both the study sites, the mean maximum temperature (25.80°C, 23.43°C, 18.27°C and 17.56°C at Lakhimpur Kheri and 25.00°C, 23.44°C, 18.66°C and 16.88°C at Shahjahanpur) and mean minimum temperature (9.33°C, 9.16°c, 9.00°C and 9.19°C at Lakhimpur Kheri and 10.84°C, 10.06°C, 9.60°C and 7.25°C at Shahjahanpur) were very low. The relative humidity (79.88%, 82.46%, 85.50% and 80.60% at Lakhimpur Kheri and 78.89%, 80.16%, 83.18% and 81.08% at Shahjahanpur) was high (Table 1 & 2).

During the second half of February, when hoppers started appearing, mean maximum temperature (26.46°C at Lakhimpur Kheri and 27.14°C at Shahjahanpur) and mean minimum temperature (12.85°C at Lakhimpur Kheri and 12.78°C at Shahjahanpur) also started rising; whereas, relative humidity (71.24% at Lakhimpur Kheri and 69.48% at Shahjahanpur) was declining. The mean hopper population at this time was recorded 0.40 and 0.44 at Lakhimpur Kheri and Shahjahanpur, respectively. The peak of the hopper population (4.56 at Lakhimpur Kheri and 5.88 at Shahjahanpur) was seen in the first half of May. It was also noted that at this time mean maximum temperature was high (39.40°C

at Lakhimpur Kheri and 39.98°C at Shahjahanpur). Mean minimum temperature was also comparatively high (24.43°C at Lakhimpur Kheri and 24.53°C at Shahjahanpur). However, relative humidity was very low (52.44% at Lakhimpur Kheri and 57.00% at Shahjahanpur). Thereafter hopper population started declining till first fortnight of July. However, it again began to rise and a second peak was observed in first fortnight of August in both the study areas. This second peak was not as high as the first one. This was due to second generation of the hoppers, as *A. atkinsoni* breeds twice in a year. Thereafter, hopper population again declined and the least hopper population was recorded in the first fortnight of December at both the sites, with the mean hopper population recorded being 0.72 and 0.44 at Lakhimpur Kheri and Shahjahanpur areas. No hopper was recorded from second fortnight of December to first fortnight of February. These observations reveal that the hopper population increased with the increase in mean maximum and mean minimum temperature and decline in relative humidity (Table 1 & 2).

Table 1: Effect of Temperature and Relative Humidity on Population Buildup of Mango leafhopper *Amritodus atkinsoni* (Leth.) at Lakhimpur Kheri

Fortnights		Maximum Temperature (°C)	Minimum Temperature (°C)	Relative Humidity (%)	Hopper Population
April	1-15	37.86	21.33	51.72	2.00
	16-30	38.86	24.06	46.88	3.88
May	1-15	39.40	24.53	52.44	4.56
	16-31	42.25	27.18	57.32	4.04
June	1-15	43.06	29.06	63.60	2.96
	16-30	40.33	29.66	67.08	2.04
July	1-15	35.26	27.33	81.60	1.92
	16-31	34.00	28.75	84.32	3.76
Aug.	1-15	33.60	25.26	88.54	4.24
	16-31	33.93	26.50	85.36	3.24
Sep.	1-15	34.26	25.26	82.84	3.04
	16-30	34.66	25.46	80.18	2.44
Oct.	1-15	34.26	24.20	76.12	2.00
	16-31	33.37	22.41	71.34	1.68
Nov.	1-15	32.26	18.53	74.66	1.24
	16-30	27.80	12.80	77.24	0.96
Dec.	1-15	25.80	9.33	79.88	0.72
	16-31	23.43	9.16	82.46	0.40
Jan.	1-15	18.27	9.00	85.50	0.00
	16-31	17.56	9.19	80.60	0.00
Feb.	1-15	22.66	10.33	75.14	0.00
	16-28	26.46	12.85	71.24	0.40
Mar.	1-15	28.88	14.33	64.12	1.00
	16-31	34.62	17.94	56.14	1.44

Table 2: Effect of Temperature and Relative Humidity on Population Buildup of Mango leafhopper *Amritodus atkinsoni* (Leth.) at Shahjahanpur

Fortnights		Maximum Temperature (°C)	Minimum Temperature (°C)	Relative Humidity (%)	Hopper Population
April	1-15	35.53	20.73	54.66	2.80
	16-30	38.48	23.36	51.57	4.40
May	1-15	38.98	24.53	57.00	5.88
	16-31	41.85	29.00	59.44	5.04
June	1-15	42.96	30.42	61.48	4.24
	16-30	41.06	29.04	65.44	3.48
July	1-15	36.44	28.88	82.44	2.88
	16-31	35.25	28.15	85.33	4.24
Aug.	1-15	34.20	26.37	86.22	4.56
	16-31	34.44	26.80	89.56	3.48
Sep.	1-15	34.87	25.87	80.67	3.16
	16-30	34.67	25.47	78.33	2.56
Oct.	1-15	34.07	25.00	74.36	2.20
	16-31	33.88	21.81	69.14	1.96
Nov.	1-15	31.44	17.12	71.27	1.08
	16-30	28.16	14.06	74.65	0.84
Dec.	1-15	25.00	10.84	78.89	0.44
	16-31	23.44	10.06	80.16	0.00
Jan.	1-15	18.66	9.60	83.18	0.00
	16-31	16.88	7.25	81.08	0.00
Feb.	1-15	23.33	11.06	73.17	0.00
	16-28	27.14	12.78	69.48	0.44
Mar.	1-15	28.03	15.08	62.28	0.80
	16-31	33.88	18.44	58.27	1.52

Table 3: Correlation Coefficient between Weather parameters and *Amritodus atkinsoni* (Leth.) population

Study Site	Correlation Coefficient (r)		
	Maximum Temperature	Minimum Temperature	Relative Humidity
Lakhimpur Kheri	0.8040	0.8396	-0.2784
Shahjahanpur	0.8737	0.8825	-0.2751

Correlation co-efficient between hopper population and different weather parameters i.e. mean maximum temperature, mean minimum temperature and relative humidity were worked out, and the results are shown in table 3. The 'r' values of mean maximum

temperature obtained from Lakhimpur Kheri and Shahjahanpur areas were 0.8040 and 0.8396, respectively; whereas, the 'r' values of mean minimum temperature in both the study sites were 0.8737 and 0.8825 at Lakhimpur Kheri and Shahjahanpur areas, respectively, which were highly significant. On the other hand, mean relative humidity is negatively correlated with the population of *A. atkinsoni*. The 'r' values of relative humidity were -0.2784 and -0.2751 at Lakhimpur Kheri and Shahjahanpur areas respectively which was not much significant (Table 3).

Pushpalatha *et al.* (2008) studied the mango leafhopper population and observed peak incidence during the flowering season (March-April). The population showed a positive and negative correlation with maximum temperature and relative humidity, respectively. Vijaylaxmi *et al.* (2010) reported that the correlation coefficient showed that the population of mango hoppers significantly impacted and there were positive effect of wind velocity, evaporation, and maximum temperature and negative effect of relative humidity. Debnath *et al.,* (2013) observed that the mango hoppers correlated negatively and significantly with morning relative humidity (r=-0.445) and evening relative humidity (r=-0.118) respectively whereas temperature had significant and positive correlation with hopper population. Sharama and Tara (2013) reported the first appearance of this hopper species in February and March with the peak population Recorded in May and June, thereafter population declined but a second peak was observed in August-September. They observed negative correlation between hopper population and relative humidity and positive correlation with maximum and minimum temperature.

Sarode and Mohite (2016) reported that temperature was positively correlated (r=0.302) with the incidence of mango hopper and rainfall (r=-0.062) and relative humidity (-0.383) was negatively correlated with the incidence of mango hopper. Namni *et al.* (2017) reported that mango hoppers showed a significant positive correlation with temperature and relative humidity, while exhibiting a significant negative correlation with light intensity. Patel *et al.* (2018) observed a population density of 8.46 hoppers/ panicle observed on 14th standard week (SW) coinciding with stone sized fruit stage was found positively influenced by maximum temperature, sunshine and evaporation. There existed a negative correlation with relative humidity (evening and average), wind velocity and rainfall. Jha *et al.* (2018) recorded peak hopper populations during April to May. The study found a strong positive correlation between hopper population and maximum temperature (+0.690). However, there was a significant negative relationship with morning relative humidity (-0.752) and evening relative humidity (-0.404). Total rainfall had a negative influence on hopper population, but it was not statistically significant. According to Anant *et al.* (2019), the correlation coefficient studies revealed that hopper population and weather parameters were found negative and non-significant correlation with temperature and rainfall whereas, positive and non-significant correlation was calculated with relative humidity.

Rajkumar *et al.* (2020) reported the highest mean population of leafhoppers during the fruiting period. Maximum and minimum temperatures showed a significant positive correlation with leafhopper population. Relative humidity (both maximum and minimum) showed a significant negative correlation (r = -0.50 to -0.66). Minimum temperature showed a significant positive correlation (r = 0.52 to 0.70). Minimum relative humidity had a significant negative correlation (r = -0.57 to -0.71). Das *et al.* (2023) recorded the peak population of mango hopper and thrips during the first to twelfth standard weeks, coinciding with the onset of panicle development. Abiotic factors like temperature, 12 relative humidity, rainfall, sunshine hours, and wind speed exhibited significant correlations with the pests. Kaushik and Nirmalkar (2021) recorded maximum hopper population in 2nd fortnight of March in Chhattisgarh and stated that maximum and minimum temperature positively affected hopper population, while relative humidity has negative effect, thus supporting the present findings. Prajapati *et al.* (2024) reported that leafhopper populations had a highly significant positive correlation with wind velocity

(r=-0.577*) and rainfall (r=0.823), and a significant negative correlation with minimum temperature (r=-0.495) and morning relative humidity (r=-0.414).

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