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ORIGINAL ARTICLE

Effect of weather Parameters on Population Buildup of Mango Leafhopper *Idioscopus clypealis* (Leth.) in Terai Region of Uttar Pradesh

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ABSTRACT

Idioscopus clypealis (Leth.) is most common and destructive species of hoppers, which cause heavy damage to mango crop. These hoppers puncture and suck the sap from tender shoots, inflorescence and leaves of mango crop, which cause non-setting of flowers and dropping of immature fruits, thereby reducing the yield. Mango leafhoppers were collected from two districts of Uttar Pradesh i.e., Lakhimpur Kheri and Shahjahanpur. Bag trap method was adopted for recording the hopper population from January to April. From May to December, the sweep method was used for collecting the hoppers with the help of insect collecting net. 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 the mean maximum temperature and mean minimum temperature were very low. The relative humidity was high and no hopper was recorded on mangoes trees at both the study sites. 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 (7.36 at Lakhimpur Kheri and 7.04 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).The correlation coefficient (r) between hopper population and mean maximum temperature from Lakhimpur Kheri and Shahjahanpur areas were calculated 0.8577 and 0.7999, respectively; whereas, the 'r' values of mean minimum temperature in both the study sites were 0.7700 and 0.6790 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 I. clypealis. The 'r' values of relative humidity were -0.6191 and -0.6289 at Lakhimpur Kheri and Shahjahanpur, respectively.

Keywords: *Mango leafhoppers, weather parameters, temperature, relative humidity.*

INTRODUCTION

The Mango, *Mangifera indica* (Linn.) is grown in India in large extent and is considered as a king of all the fruits. The largest producer state of mango is Uttar Pradesh. In proportion to its area of cultivation, its production is very low due to insect pests. Among the mango pests, mango hoppers are most serious and widespread pests throughout the country. *Idioscopus clypealis* (Leth.) is most common and destructive species of hoppers, which cause heavy damage to mango crop. Large number of nymphs and adults of the hoppers puncture and suck the sap from tender shoots, inflorescence and leaves of mango crop, which cause non-setting of flowers and dropping of immature fruits, thereby reducing the yield. Hoppers also excrete a secretion, called honey dew. In moist weather, it encourages the development of fungi like *Meliola mangiferae* (Earle), resulting in growth of sooty mould on dorsal surface of leaves, branches and fruits. This black coating interferes with the normal photosynthetic activity of the plant, ultimately resulting in non-setting of flowers and dropping of immature fruits. This damage is called as Honey Dew Disease (Butani, 1993). Through many workers (Sood *et al.,* 1971; Dalvi and Dumbre, 1994; Hiremath and Hiremath, 1994; Dwivedi *et al.,* 2003) have provided data on population buildup 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 population buildup of *I. clypealis* in Terai region of Uttar Pradesh.

MATERIALS & METHODS

Mango leafhoppers were collected from two districts of Uttar Pradesh *i.e.,* Lakhimpur Kheri and Shahjahanpur from April 2021 to March 2022. Lakhimpur Kheri is situated between 27.6°-28.6° North Latitude and 80.34°-81.30° East Longitudes and Shahjahanpur is located at 27.35° North Latitude and 79.37° East Longitudes. Three mango orchard from every 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 geographical directions and one from the inner quadrant of each mango tree. Hoppers were collected fortnightly. Bag trap method (Verghese and Rao, 1987) was adopted for recording the hopper population from January to April. In the bag trap method, each inflorescence was covered with a polythene bag (60 x 30 cm), having with a cotton swab, soaked in ethyl acetate. Both adults and nymphs were trapped inside the bags. The bags were brought to the laboratory and nymphs and adults were counted. From May to December, when adult hoppers were abundant, as compared to nymphal stages, the sweep method was used for collecting the hoppers with the help of insect collecting net. Sweeps were undertaken from each of the four geographical directions and on the tree trunk on each mango tree. Immediately after the sweeps, the loop of the net was rotated at 90°, so as to avoid the exit of adult hoppers from the bag of the net. In all, 5 bag traps or 5 sweeps from each tree were made 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. Mango leafhoppers are characterized by a broad, rounded head, extending little between the eyes and a general 'wedge' shape. Their body colour is light-brown and the scutellum is creamish colored, having two triangular dark spots on it.

Weather parameters recorded were included maximum temperature, minimum temperature and relative humidity. The data on maximum and minimum temperature was recorded on daily basis by Six's Thermometer (maximum-minimum thermometer) at every experimental site; whereas data on relative humidity was recorded daily by using hygrometer 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 peak of the hopper population (7.36 at Lakhimpur Kheri and 7.04 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 and vanished by the end of November at both the sites, with the least mean hopper population recorded being 0.16 and 0.28 at Lakhimpur Kheri and Shahjahanpur areas respectively in first half of November. 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 weather parameters on population buildup of mango leafhopper *Idioscopus clypealis* (Leth.) at Lakhimpur Kheri

Fortnights		Maximum Temperature (°C)	Minimum Temperature (°C)	Relative Humidity (%)	Hopper Population
April	1-15	37.86	21.33	51.72	5.92
	16-30	38.86	24.06	46.88	6.44
May	1-15	39.40	24.43	52.44	7.36
	16-31	42.25	27.18	57.32	6.92
June	1-15	43.06	29.06	63.60	5.40
	16-30	40.33	29.66	67.08	5.04
July	1-15	35.26	27.33	81.60	4.28
	16-31	34.00	28.75	84.32	4.12
Aug.	1-15	33.60	25.26	88.54	3.88
	16-31	33.93	26.50	85.36	3.68
Sep.	1-15	34.26	25.26	82.84	3.52
	16-30	34.66	25.46	80.18	2.80
Oct.	1-15	34.26	24.20	76.12	1.60
	16-31	33.37	22.41	71.34	0.80
Nov.	1-15	32.26	18.53	74.66	0.16
	16-30	27.80	12.80	77.24	0.00
Dec.	1-15	25.80	9.33	79.88	0.00
	16-31	23.43	9.16	82.46	0.00
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	0.76
Mar.	1-15	28.88	14.33	64.12	1.80
	16-31	34.62	17.94	56.14	4.76

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 0.8577 and 0.7999, respectively; whereas, the 'r' values of mean minimum temperature in both the study sites were 0.7700 and 0.6790 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 *I. clypealis*. The 'r' values of relative humidity were -0.6191 and -0.6289 at Lakhimpur Kheri and Shahjahanpur areas respectively (Table 3).

Table 2: Effect of weather parameters on population buildup of mango leafhopper *Idioscopus clypealis* (Leth.) at Shahjahanpur

Fortnights		Maximum Temperature (°C)	Minimum Temperature (°C)	Relative Humidity (%)	Hopper Population
April	1-15	35.53	20.73	54.66	5.92
	16-30	38.48	23.36	51.57	6.84
May	1-15	38.98	24.53	57.00	7.04
	16-31	41.85	29.00	59.44	6.76
June	1-15	42.96	30.42	61.48	4.96
	16-30	41.06	29.04	65.44	4.24
July	1-15	36.44	28.88	82.44	3.88
	16-31	35.25	28.15	85.33	3.24
Aug.	1-15	34.20	26.37	86.22	3.04
	16-31	34.44	26.80	89.56	2.88
Sep.	1-15	34.87	25.87	80.67	2.24
	16-30	34.67	25.47	78.33	2.00
Oct.	1-15	34.07	25.00	74.36	1.20
	16-31	33.88	21.81	69.14	0.60
Nov.	1-15	31.44	17.12	71.27	0.28
	16-30	28.16	14.06	74.65	0.00
Dec.	1-15	25.00	10.84	78.89	0.00
	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	1.08
Mar.	1-15	28.03	15.08	62.28	1.68
	16-31	33.88	18.44	58.27	5.08

Table 3: Correlation coefficient between weather parameters and *Idioscopus clypealis* (Leth.) population

Study Site	Correlation Coefficient (r)		
	Maximum Temperature	Minimum Temperature	Relative Humidity
Lakhimpur Kheri	0.8577	0.7700	-0.6191
Shahjahanpur	0.7999	0.6790	-0.6289

In the previous study, 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). 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, relative humidity, rainfall, sunshine hours, and wind speed exhibited significant correlations with the pests. 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).

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. 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.

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. 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. Sathe and Kamble (2015) reported that increase in temperature and decrease in humidity resulted in increase in population of *I. clypealis*. However, rain fall have less impact on the population dynamics of the Jassids on mango.

Kumar *et al.* (2014) reported that the hoppers were found in maximum number on leaves in early morning and they gradually migrated to branches and stem when the temperature increased, but they again came back on leaves when the temperature decreases. It was recorded that the population of hoppers was maximum in the first week of April which continuously to decrease and reached to minimum in the last week of May. The considerable reduction was found in the population from April to May. Debnath *et al.,* (2013) observed that the mango hoppers correlated negatively and significantly with morning relative humidity (-0.445) and evening relative humidity (-0.118) respectively whereas temperature had significant and positive correlation with hopper population. There was no significant effect of rainfall and rainy days on different sites of mango plant.

The population of mango hoppers significantly impacted and positively corrected with wind velocity, evaporation, and maximum temperature and also showed negative effect with relative humidity (Vijaylaxmi *et al.* 2010). Varshneya and Rana (2008) reported that maximum and minimum temperature positively affected the hopper population, whereas, relative humidity had negative effect, but rainfall showed no significant effect. 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. Pezman (2005) reported a negative correlation between the incidence of leafhoppers and Relative humidity and a positive correlation with temperature. Rajamanicka *et al.* (1997) recorded the highest population of *I. clypealis* throughout the early summer months. They further reported that *I. clypealis* occurrence was directly correlated with high relative humidity, maximum temperature, but hot, humid climates were inversely correlated.

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