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POPULATION DYNAMICS OF MANGO HOPPERS AND ITS RELATIONSHIP WITH WEATHER PARAMETERS IN CHHATTISGARH PLAIN

D. K. Kaushik[1] and V. K. Nirmalkar[2]

ABSTRACT

Amritodus atkinsoni **(Lethierry) and** ***Idioscopus clypealis*** **(Lethierry) are commonly known as mango hopper. The hoppers reduce mango production by causing non setting of flower and dropping of immature fruits. The first minimum appearance of hoppers population were 13.75 and 13.40 on the branches/tree trunk of mango trees recorded in September first fortnight at maximum temperature (32.70°C and 32.45° C) and minimum temperature (24.60°C and 23.25°C) and in a morning relative humidity (93.00% and 92.00%) during 2017 and 2018, respectively. The respective values recorded for first and second year in respect of peak hoppers population were 146.65 and 137.00 on the inflorescence of mango tree in second fortnight of March at maximum temperature of 36.40°C and 34.70°C and minimum of 15.95 and 20.90 with very low relative humidity (62.50 % and 70.50%).**

The maximum and minimum temperature positively affected the hopper population. where as relative humidity had negative effect. Further, fluctuating rainfall showed no significant effect on hopper population.

(Key words : ***Amritodus atkinsoni*****, mango hopper, RH, temperature)**

INTRODUCTION

Mango is one of the major fruit crop of south Asia from ancient time and at present it is a prominent horticultural fruit crop of India. Mango hoppers (*Amritodus atkinsoni* (Lethierry) and *Idioscopus clypealis*(Lethierry)) are the most important insects recorded during the flowering season throughout Chhattisgarh. These insects are most common and destructive species of hopper, which cause heavy damage to mango crop. Large number of nymphs and adults hopper puncture and suck the sap from tender shoots, inflorescences and leaves of mango crops, which cause non-setting of flowers and dropping of immature fruits, finally reducing the yield. Hoppers also excrete a secretion, called honey dew. In moist weather, it encourages the development of fungi like *Meliol amangiferae* (Earle), resulting in growth of sooty mould on dorsal surface of leaves, branches and fruits. This black interferes with the normal photosynthetic activity of the plant and resulting in non-setting of flowers and dropping of immature fruits. This disease is called as Honey Dew Disease. Mango hoppers were found colonized during both vegetative and reproductive phase of the crop. Hoppers remain active throughout the year in crakes and crevices of mango trunk (Babu *et al.,* 2002; Mishra *et al*., 2017) but they are recorded on twigs, when young leaves and inflorescence are available. Further, Dwivedi *et al.* (2003) have been provided data on seasonal incidence and influence of weather parameters on the development of the hoppers. Weather parameters play a important role for occurrence of hopper and other insects of mango. Different management methods were applied including entomo-pathogenic fungi (Nirmalkar *et al*., 2020). However, information pertaining to its development in local environment of state is lacking. Hence, the study was carried out to determine the population dynamics of mango hoppers and its relationship with weather parameters in Chhattisgarh.

MATERILAS AND METHODS

The experiment was conducted at horticulture farm, College of Agriculture and Research Station, Indira Gandhi Krishi Vishwavidyalaya, Bilaspur (Chhattisgarh) during 2017 and 2018. The place is situated at a latitude and longitude of 22°06'21.1"N 82°08'32.9"E. Mango (*Mangifera indica* linn.) varieties Langra of 20 years old were planted in 10 m X10 m spacing. Five trees from mango orchard were selected and named as A, B, C, D, E. Observations were taken on the inflorescence of respective trees at fortnightly interval. The hopper populations were recorded from January to December using bagging trap methods (Varghese and Rao, 1987). In this method the terminal part of inflorescence was

1. Subject Matter Specialist (Entomology),Krishi Vigyan Kendra, Bilaspur, IGKV, (C.G.)
2. Scientist (Plant Pathology), BTC, College of Agriculture and Research Station, Bilaspur, IGKV (C.G.)

covered with a polythene bag (60 cm X 30 cm), provided with a cotton swab and soaked in ethyl acetate. After the trapping of mango hoppers, bags were brought in the laboratory and nymphs as well as adults were separated. During the month of June to December, the populations of adults were abundant as compared to nymphs. Hence, sweeping method was applied for collection of hoppers. Meteorological data from January 2017 to December 2018 on maximum and minimum temperature, morning and evening relative humidity and rainfall were collected from meteorological station, Bilaspur (C.G.). Fortnightly averages of the parameters were calculated before their statistical analysis. The relationship was studied between these weather parameters (Nirmalkar and Lakpale, 2008[b]) and the hopper populations using the following correlation and regression analysis formula:

$$r_{xy} = s_{xy} / \sqrt{s_{xy} X s_{yy}} .$$

Where, x- weather parameter and y- hopper population.

The multiple regressions were done as per following equation:

$$Y = a+b1x1+b2x2+b3x3+b4x4+b5x5.$$

Where, y- hopper population; a, constants (intercepts), b1, b2, b3, b4, b5 constants, regression coefficients, x1- maximum temperature; x2- minimum temperature; x3- morning relative humidity; x4- evening relative humidity; x5- rainfall; The level of significance of correlation coefficient (r) and coefficient of determination (R^2) for regression analysis was tested after comparing the computed values and table values (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

It was observed (Table 1) that in the 1st fortnight of January, 41.75 and 60.25 hoppers population were seen on the mango trees during 2017 and 2018, respectively. The mean maximum temperature (28.20 °C and 28.30°C) and minimum temperature (11.90 °C and 12.20 °C) were very low, while the relative humidity was comparatively very high recorded 86.50 % and 84.50 % at morning and 33.00 % and 34.00 % at evening in respective years. During second fortnight of February mean maximum temperature (31.20°C and 31.55 °C) and minimum temperature (14.80 °C and 13.45°C) start rising, where as the morning relative humidity showed slight decline (79.50 % and 83.00 %). However, evening relative humidity slight increased (24.00 % and 26.00 %) and hopper population noted increased i.e., 113.28 and 122.95 in first and second year, respectively. The increase in the hoppers population was found to be associated with the flushing of inflorescence, as this species of hoppers bred only on inflorescence. The peak hopper populations (146.65 and 137.00) were recorded in the month of March second fortnight in both the years and it was seen that at this time mean maximum temperature (36.40° C and 34.70° C) and mean minimum temperature (15.95° C and 20.90° C) were very high. However, both morning (62.50 % and 70.50 %) and evening relative humidity was very low (18.00 % and 42.00 %). Further the hopper population started declining (143.94 and 133.35) after first fortnight of April at mean maximum temperature (40.35 °C and 37.25 °C) and mean minimum temperature (22.00 °C and 22.00 °C). Whereas, relative humidity at morning and evening decreased (48.00 % and 69.00 %) and (22.00 % and 32.00 %), respectively. Rainfall measured in 2017 and 2018 was 4.20 mm and 8.20 mm, respectively. Hopper population comes down up to 16.23 and 19.50 during second fortnight of June and they moved towards trunk of the plant. The mean maximum temperature 33.35 °C and 33.65°C decreased and minimum temperature 25.45 °C and 23.75° C increased where as morning relative humidity noted maximum (79.00 % and 82.00 %) and evening relative humidity per cent (52.50 and 61.50) increased. During the month of July and August, the hopper population disappeared recording stray movement on the plant in both the years. Again, incidence was noticed during first fortnight of September (13.75 and 13.40) with a mean maximum (32.70°C and 32.45°C) and minimum temperature (24.60°C and 23.25°C). Whereas, relative humidity at morning and evening were 93.00% and 92.00 % and 75.50 % and 71.50 % in respective year. On the other hand, rainfall measured was (126.50 mm and 46.80 mm).

The data on correlation coefficient between weather parameters and hoppers in both the study year (Table 2 and Figure 1,2,3,4) revealed that the correlation between maximum temperature and hopper population was positive (0.409 and 0.406) and significant (Table 2 and Figure 1) in both the years. The correlation between morning and evening relative humidity was negative (-0.609 and -0.628) and (-0.793 and -0.796) and significant (Table 2 and Figure 3,4). The correlation between rainfall and hopper population was negative (-0.408 and -0.606) and significant (Table 2 and Figure. 2). On the basis of the observations, *Amrito-dusatkinsoni* and *Idioscopus clypeal* was strongly affected by temperature and relative humidity, which is in accordance to the findings of many workers (Varshneya and Rana, 2008; Joshi and Kumar, 2012). Similarly, Chaudhari *et al*., (2017), Rahman and Singh (2004) and Kannan and Rao (2006) reported that there was negative relationship between the incidence of the hopper and minimum temperature as well as evening relative humidity. Such type of weather parameters based study were also reported by researcher and found correlation with other crops pests and diseases (Nirmalkar and Lakpale, 2008[a]).However, mean maximum temperature have positive effect on hopper population (Pushpalatha, *et al*., 2008; Anithakumari *et al*., 2009). The Relative Humidity has negative effect on hopper population.Same observations were recorded by Tandon *et al.* (1983). Similarly, Rain fall has negative and significant effect on hopper population (Kannan and Rao, 2006 and Varshneya and Rana, 2008).

Table 1.Effect of weather parameters on mango hoppers population

Month (Fort night)	2017						2018					
	Mean hopper population tree	Temperature (⁰C)		Rainfall (mm)	Relative Humidity (%)		Mean hopper population tree^{-1}	Temperature (⁰C)		Rainfall (mm)	Relative Humidity (%)	
		Maximum	Minimum		Morning	Evening		Maximum	Minimum		Morning	Evening
Jan.-I	41.75	28.20	11.90	0.00	86.50	33.00	60.25	28.30	12.20	0.00	84.50	34.00
Jan.-II	62.94	28.82	12.30	0.00	85.00	27.00	70.20	27.70	11.05	7.60	86.00	42.00
Feb.-I	82.25	31.70	14.30	8.40	76.00	35.00	91.20	29.30	12.74	12.60	85.00	40.67
Feb.-II	113.28	31.20	14.80	0.00	79.50	24.00	122.95	31.55	13.45	0.00	83.00	26.00
Mar.-I	137.05	35.30	17.50	3.50	71.00	30.00	134.75	35.60	17.80	0.00	85.00	31.00
Mar.-II	146.65	36.40	15.95	0.00	62.50	18.00	137.00	34.70	20.90	22.80	70.50	42.00
April-I	143.94	40.35	22.00	4.20	48.00	20.00	133.35	37.25	22.00	8.20	69.00	32.00
April-II	122.56	39.05	23.20	0.00	51.00	19.50	119.20	40.70	23.30	0.00	68.50	28.00
May-I	69.28	41.50	26.17	12.30	55.34	22.67	91.21	41.50	26.45	0.60	34.34	13.67
May-II	50.94	42.50	27.40	7.80	51.50	18.50	72.35	43.35	27.90	0.00	45.00	21.50
June-I	31.28	38.05	28.25	38.20	51.50	36.50	47.00	36.40	25.60	58.20	82.00	58.00
June-II	16.23	33.35	25.45	679.80	79.00	52.50	19.50	33.65	23.75	155.00	82.00	61.50
July-I	0.00	31.02	23.85	159.20	93.00	78.00	0.00	31.70	24.80	52.60	88.00	68.00
July-II	0.00	32.00	25.00	115.30	90.50	69.50	0.00	31.25	24.65	70.40	92.50	72.00
Aug.-I	0.00	32.30	25.20	225.70	93.00	75.00	0.00	30.80	24.95	174.20	93.33	78.34
Aug.-II	0.00	30.10	24.90	128.30	94.50	79.00	0.00	32.50	24.70	80.20	94.00	75.00
Sept.-I	13.75	32.70	24.60	126.50	93.00	75.50	13.40	32.45	23.25	46.80	92.00	71.50
Sept.-II	14.60	30.65	24.20	68.60	92.00	72.50	17.60	33.15	24.55	166.40	92.50	68.00
Oct.-I	26.25	32.50	21.35	29.00	90.00	59.00	29.40	33.65	22.95	12.60	94.00	58.00
Oct.-II	35.60	31.40	18.70	0.00	91.00	52.00	41.60	34.30	18.89	0.00	89.50	39.50
Nov.-I	43.40	29.30	16.90	7.40	88.67	45.00	43.60	32.67	15.37	0.00	88.67	38.34
Nov.-II	46.60	28.60	13.35	0.00	90.00	28.00	48.40	32.70	13.85	0.00	87.00	40.00
Dec.-I	51.40	27.90	11.10	0.00	89.50	40.50	50.20	28.70	10.95	0.00	92.50	35.50
Dec.-II	57.00	28.45	12.20	0.00	87.50	32.50	55.40	27.70	9.35	0.00	89.50	29.00

Figure 1. Regression equation between mango hoppers population and Maximum temperature

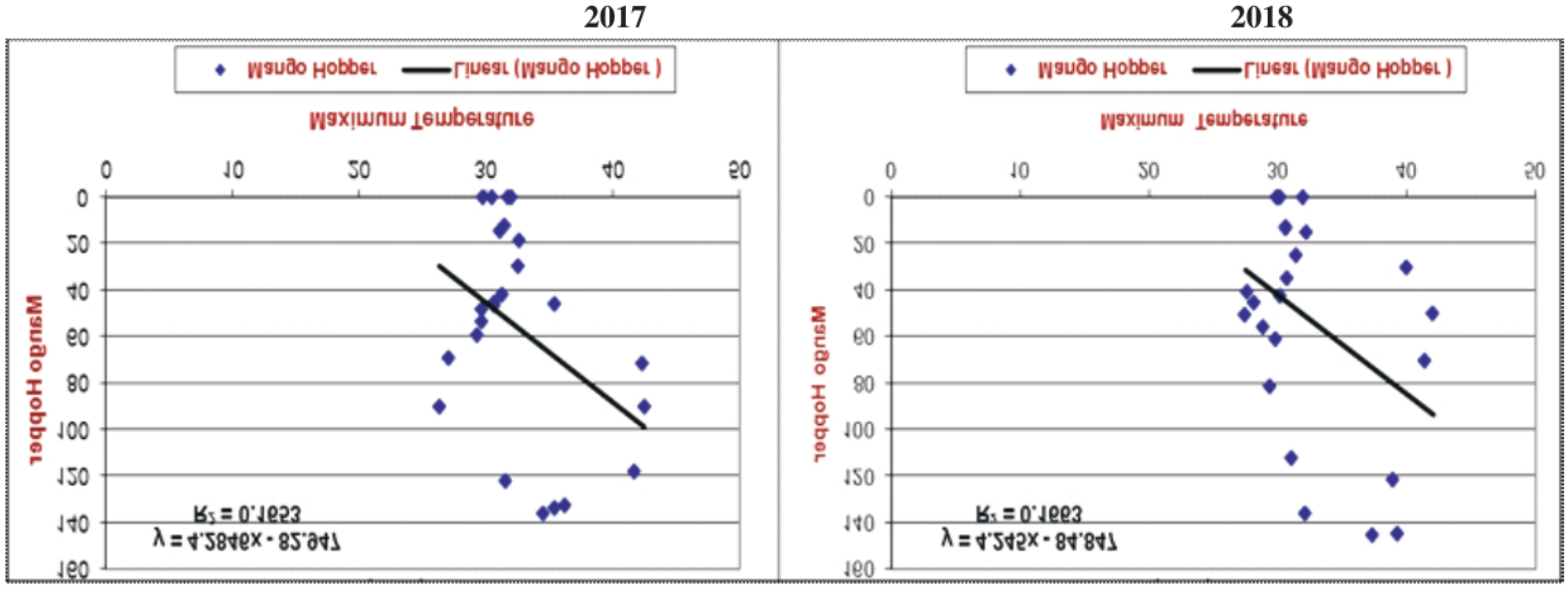

Figure 2.Regression equation between mango hoppers population and rainfall

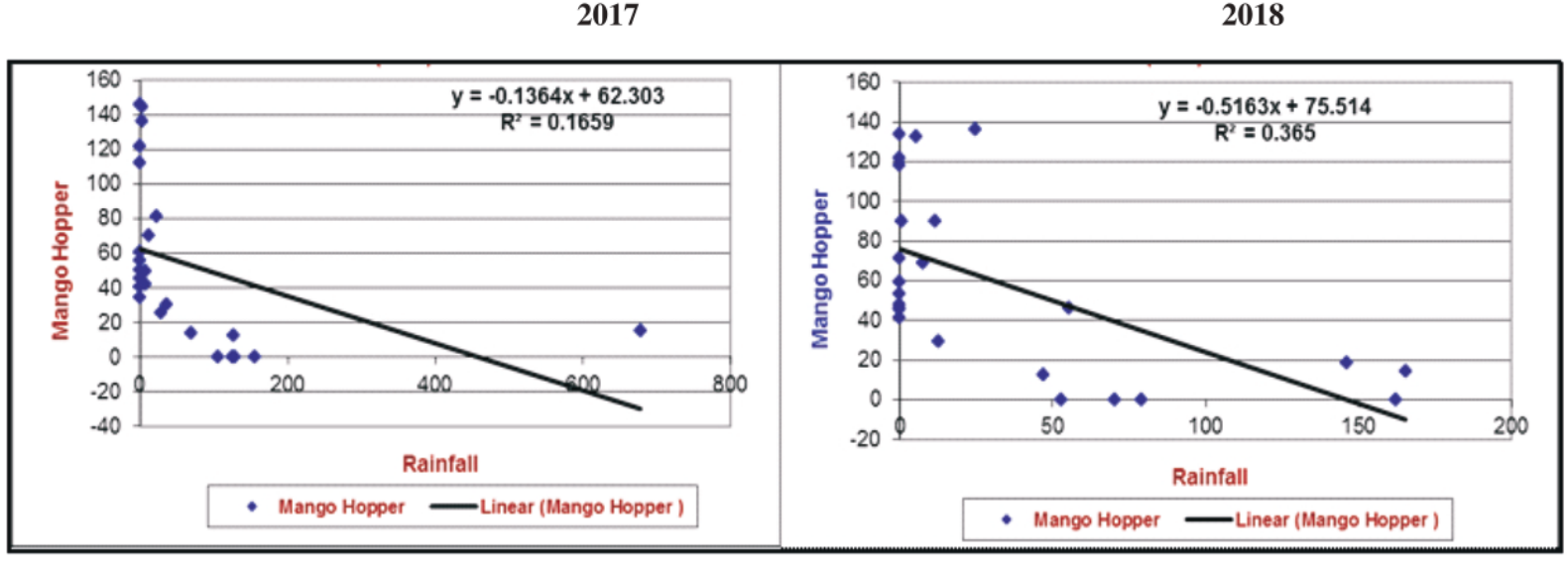

Figure 3.Regression equation between mango hoppers population and morning relative humidity

2017 **2018**

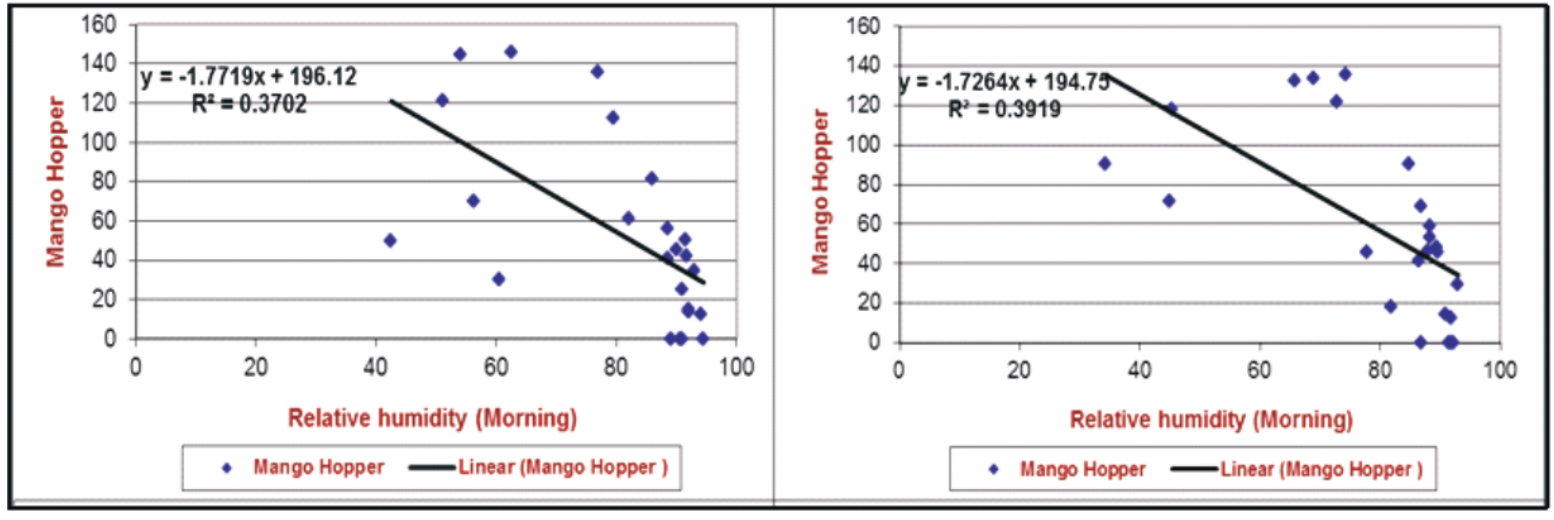

Figure4 .Regression equation between mango hoppers population and evening relative humidity

2017 **2018**

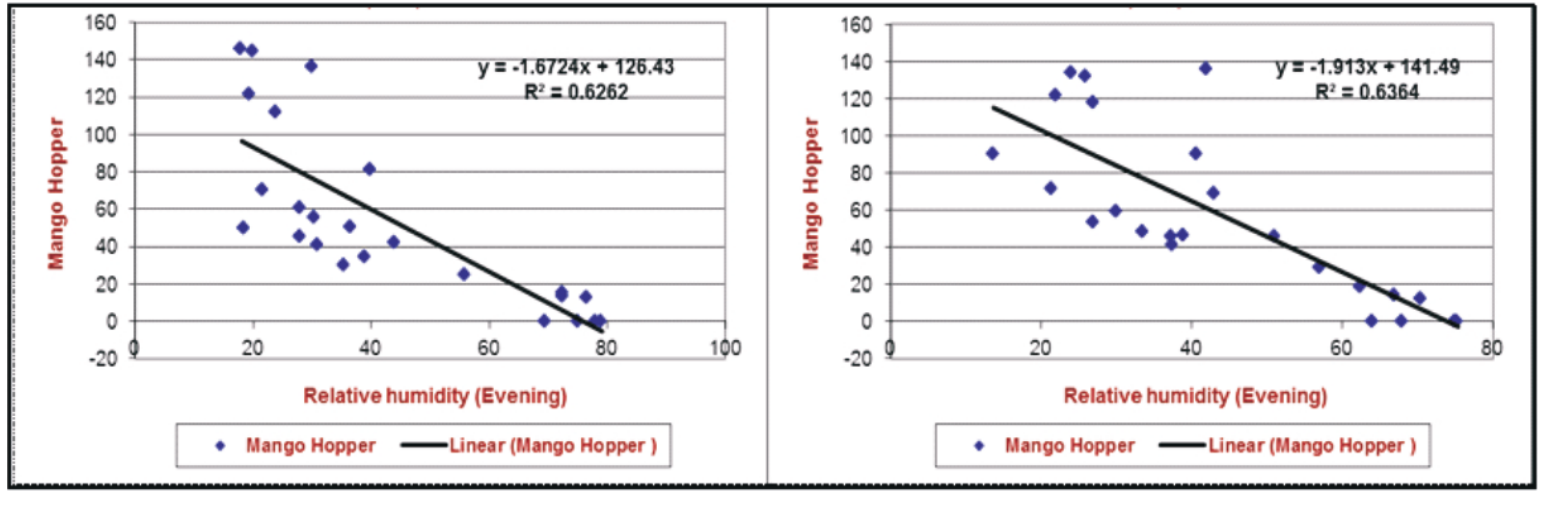

Table 2 .Correlation coefficients (r) between weather parameters and mango hoppers population

S. No.	Weather Parameter	Correlation coefficient (r)	
		2017	2018
1.	Maximum temperature (^{0}C)	0.409*	0.406*
2.	Minimum temperature (^{0}C)	-0.265	-0.296
3.	Rainfall (mm)	-0.408*	-0.606**
4.	Morning relative humidity (%)	-0.609**	-0.628**
5.	Evening relative humidity (%)	-0.793**	-0.796**

* Significant at 5% level (r table value 0.404), ** Significant at 1% level (r table value 0.515)

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