

EFFECT OF AMBIENT WEATHER ON POPULATION DYNAMICS OF MAJOR INSECT PESTS OF TAMARIND

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Abstract: The present investigation was conducted at Shaheed Gundadhoor College of Agriculture and Research Station, Jagdalpur, Chhattisgarh during *khariif-rabi*, 2015–16 to saw the effect of different abiotic factor on major insect pests of tamarind. Three species of different insect pests *viz.* fruit borer, mealy bug, scale insect was recorded as a major pests. Maximum fruit borer infestation of 19.91 infested pods / unit area was recorded during second week of October. Peak population of mealy bugs was recorded during second week of October with 29.58 nymphs and adults / unit area. Two peaks of scale insects were observed, first in the fourth week of September followed by second week of November with 28.83 and 29.95 scale insects / unit area. Morning relative humidity around 95 per cent and evening relative humidity around 60 per cent were found congenial for the fruit borer multiplication on tamarind. Mealy bug and scale insects were also significantly positively influence with morning relative humidity.

Keywords: Abiotic factor, Insect pests, Population dynamics, Peak population, Tamarind

INTRODUCTION

Tamarind (*Tamarindus indica* L.) is an important tree of semi arid tropical conditions. Tamarind belongs to dicotyledonous family leguminaceae sub family caesalpiniaceae which has multipurpose use.

Every part of the plant is used for different purpose. The fruit pulp, sweetish in taste, is used for serving curries, chutneys, sauces and soups because of its anti scorbic properties, pulp is used by sailers in place of lime or lemon. Tamarind kernel powder (TKP) is used as a sizing material in textile and leather industries. (Anon., 2013a).

In India, the tree is found abundantly in Chhattisgarh, Madhya Pradesh, Telangana, parts of Maharashtra, Tamil Nadu, Orissa, Bihar and Bengal.

The Bastar Division joins boundaries with states of Orissa, Andhra Pradesh, Maharashtra and Dhamtari, Rajnandgaon and Durg districts of Chhattisgarh. Bastar division is southern part of Chhattisgarh spread over 39114.00 sq. k.m. divided into 32 revenue blocks. Most of the area (852953.00 ha) is covered by forest. (Anon., 2013b).

The annual harvest of tamarind from Chhattisgarh is about 15000 tonnes, which values about Rs. 4.5 crores, is harvested from Bastar region alone and constitutes one of the major components of tribal economy (Anon., 1994). Marothia and Gauraha (1992) studied the marketing mechanisms of minor forest produce (MFPs) in Raipur district, Madhya Pradesh, India. They reported that 80 per cent of villagers were engaged in collection of MFPs including tamarind and earned their livelihood by consuming and marketing these products. Salim *et al.* (1998) reported that the fruit borers cause serious damage to the mature fruits causing losses to marketable yield.

Among various factors responsible for low yield,

losses due to insect-pests attack are of prime importance. Tamarind tree is attacked by more than 40 species of insect pests, although only few of them are economic importance (Joseph and Oommen, 1960). There is paucity of information in the dynamic of insect pests of tamarind. Therefore, this information will help in designing a successful pest management strategy in Tamarind. The effects of different meteorological factors on the insect pests population in tamarind were studied in the prevailing agro climatic condition of Jagdalpur.

MATERIAL AND METHOD

For the field study two blocks of Bastar district namely Jagdalpur and Tokapal were selected. In each blocks, five villages were selected where, eight trees per village were tagged randomly. For the present investigation, area of one square meter and one square feet (30 cm²) was marked in all four directions (N, S, E and W) in each selected tree. Fortnightly observation on insect pests population were observed on randomly selected trees during the cropping season *i.e.* July to March. Fruit borer infestation was recorded fortnightly from one square meter (100 cm²) area in all directions of selected trees randomly on the basis of total number of fruits and number of fruit borer infested fruits. Insect pests population was subjected to simple correlation (r) where insect population was as dependent factor and weather parameters, such as temperature, humidity and rainfall as independent factors. The meteorological data were obtained from the observatory of SGCARS, Jagdalpur. For the ease of analysis and findings, meteorological data were also pooled out at weekly interval. The data on infestation of various insect pests were correlated with prevailing abiotic factors *viz.* temperature, relative

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humidity, sunshine hours and wind velocity. The correlation study was worked out by using formula as given below:

$$r = \frac{\sum XY - nxy}{\sqrt{\sum X^2 - nX^2} \times \sqrt{\sum Y^2 - nY^2}}$$

Where,

X = Mean of first factor

Y = Mean of second factor

n = Total no. of observations

r = Correlation coefficient

After correlating significant and non-significant findings, t-test value n-2 degrees of freedom were calculated on the following formula:

$$t = \frac{\sqrt{n-2}r \sim t \text{ with } (N-2) d}{f\sqrt{1-r^2}}$$

RESULT AND DISCUSSION

Seasonal incidence of major insect pests and effect of various weather parameters on their population fluctuation were observed during *kharif-rabi*, 2015 - 16. During the period of observation, fortnightly fluctuation of maximum and minimum temperatures ranged from 27.97 °C to 34.64 °C and 8.80 °C to 24.70 °C, respectively. Similarly, the morning and evening relative humidity ranged from 86.14 to 95.86 and 25.14 to 74.0 per cent, respectively. Rainfall during the observation varied from 1.70 to 144.1 mm. The sunshine hours ranged from 1.8 lux and 7.60 lux..

Fruit borer, *Cryptophlebia ombrodelta*

Fruit borer made its first appearance on tamarind during second week of July with 1.97 fruit borer larvae / unit area, which was associated with maximum and minimum temperatures of 30.2 °C and 24.7 °C and morning and evening relative humidity of 90.00 and 70.57 per cent, respectively with the rainfall of 87.50 mm. The insect gradually increased its density and exhibits peak activity in the second week of October with 19.91 fruit borer larvae / unit area. It was associated with 31.73 °C and 22.81 °C maximum and minimum temperatures, 94.71 and 55.00 per cent morning and evening relative humidity, respectively with the association of no rainfall. The fruit borer population consistently declined up to 1.88 fruit borer larvae / unit area in the second week of March.

Fruit borer population was highly significantly positively correlated with Morning relative humidity with the correlation coefficient values (r) of 0.717. While the maximum temperature was non significant, which negatively influenced the population of fruit borer. The present finding are in conformity with the finding of Patel (2015) at Jagdalpur who also reported that fruit borer population was significantly positively correlated with morning relative humidity. (Table 1)

Regression equation for relative humidity (morning) was

$$y = a - bx$$

y = Dependent variable / fruit borer

a = Constant

x = Independent variable / relative humidity (morning)

$$y = 1.6257x - 140.12$$

$$R^2 = 0.552$$

To observe the effect of morning relative humidity on the population of tamarind fruit borer, correlation studies were carried out between morning relative humidity and fruit borer (Table 1 and Fig. 1), which revealed a significant positive relationship with r = 0.717. From the result it was concluded that the morning relative humidity increases infestation of fruit borer.

Based on the present investigation, morning relative humidity around 95 per cent was found congenial for the pest multiplication on tamarind.

Mealy bug, *Nipaecoccus viridis* Newstead

Mealy bug was first observed on tamarind in the second week of July with 0.55 mealy bug / unit area, which was associated with 30.20 °C and 24.70 °C maximum and minimum temperatures and 90.00 and 70.57 per cent morning and evening relative humidity, respectively with the rainfall of 87.50 mm. It continued to damage the tree throughout the fruiting period and reached maximum population in the second week of October with 29.58 mealy bug / unit area which was associated with 31.73 °C and 22.81 °C maximum and minimum temperature followed by 94.71, 55.00 per cent morning and evening relative humidity, respectively with no rainfall. Mealy bug population was significantly positively correlated with the relative humidity (morning) and sunshine hours with the correlation coefficient values (r) of 0.787 and 0.510, respectively. Whereas, maximum temperature and rainfall were non significant negatively correlated with mealy bug population. (r = -0.136 and -0.006)

Table 1

Regression equation for relative humidity (morning) was y = a - bx

y = Dependent value / mealy bug

a = Constant

x = Independent variable / relative humidity (morning)

$$y = 2.879x - 253.2$$

$$R^2 = 0.619$$

Regression equation for sunshine hours

$$y = 2.963x - 2.253$$

$$R^2 = 0.260$$

To observe the combined effect of morning relative humidity and sunshine hours on the population of mealy bug, multiple correlation studies were carried out between different weather parameter and mealy bug (Table 1 and Fig 2, 3), which revealed a positively significant relationship with R = 0.787 and 0.510. From the result it was concluded that the relative humidity (morning) and sunshine hours increased the infestation of mealy bug.

The present findings are contradictory with the finding of Patel (2015) who reported that the mealy bug population was significantly negatively correlated with sunshine hours. Whereas in present studies it was

significant positive correlated. Similarly, Patel (2015) found that the rainfall positively influenced the fruit borer population. While in present investigation, Non significant negative relationship was recorded between them.

Scale insect, *Aonidiella orientalis* Newst

Scale insect was first seen on the tree in first week of July with 0.25 scale insects / unit area with the combination of 30.20 °C and 24.70 °C maximum and minimum temperatures and 90.00 and 70.57 per cent morning and evening relative humidity, respectively with the rainfall of 87.50 mm. The pest population was continuously fluctuated on the tree to greater or lesser extent throughout the observational period till the second week of March. Two peaks of 28.83 and 29.95 scale insects / unit area were observed during fourth week of September and second week of November.

The first peak was associated with 28.73 °C and 24.07 °C maximum and minimum temperatures and 94.14 and 72.71 per cent morning and evening relative humidity, respectively with the association of 144.10 mm rainfall. Similarly, second peak was associated with 28.96 °C and 20.06 °C maximum and minimum temperatures and 93.57 and 53.29 per cent morning and evening relative humidity, respectively with no

rainfall. The scale insect population was non-significantly correlated with maximum temperature. While, it was highly significant positively correlated with morning relative humidity. The values of correlation coefficient (r) are shown in Table 1

Regression equation for relative humidity (morning)

$$y = a - bx$$

$$y = \text{Dependent value} / \text{scale insect}$$

$$a = \text{Constant}$$

$$x = \text{Independent variable} / \text{relative humidity (morning)}$$

$$y = 3.192x - 281.7$$

$$R^2 = 0.637$$

To observe the effect of morning relative humidity on the population of scale insect, correlation studies were carried out between morning relative humidity and scale insect, which revealed a significant positive relationship with r = 0.798.

Patel (2015) reported significant positive correlation between scale insect and morning relative humidity which is similar to the present investigation. The present investigation may help in giving so many information about pest population and its correlation with favourable period as per the weather parameters are concerned, which help in planning the management strategies of various pests of tamarind in future.

Table 1. Effect of weather parameters on seasonal fluctuation of major insect pests on tamarind during *kharif – rabi*, 2015 - 16

SMW	Date of Observation	Mean population per plant			Weather parameter					
		Fruit borer	Mealy bug	Scale insect	Temperature(°C)		Rainfall	Relative humidity (%)		Sunshine hours
		(per 100cm ²)	(per 30cm ²)	(per 30cm ²)	Maximum	Minimum	(mms)	Morning	Evening	(lux)
28	09/07/2015	1.97	0.55	0.25	30.16	24.70	87.50	90.00	70.57	1.81
30	23/07/2015	3.25	1.09	0.59	29.56	24.66	23.00	87.14	67.43	1.90
32	09/08/2015	4.14	1.53	0.67	29.26	24.04	56.80	91.00	74.00	2.41
34	23/08/2015	9.61	1.83	1.56	30.51	24.30	34.60	89.29	70.43	3.87
36	09/09/2015	13.92	17.64	16.03	31.29	24.13	21.20	93.71	61.57	4.91
38	23/09/2015	18.08	26.53	28.83	28.73	24.07	144.10	94.14	72.71	2.34
40	09/10/2015	19.91	29.58	25.83	31.73	22.81	0.00	94.71	55.00	7.49
42	23/10/2015	17.23	25.75	26.08	32.03	19.99	0.00	95.14	37.43	7.60
44	09/11/2015	18.12	22.73	29.95	28.96	20.06	0.00	93.57	53.29	5.79
46	23/11/2015	15.62	19.95	21.69	28.79	15.81	0.00	95.14	42.00	5.34
48	09/12/2015	13.23	18.57	20.97	30.01	16.77	0.00	93.57	48.86	5.44
50	23/12/2015	9.89	17.68	19.36	30.97	16.39	0.00	95.86	46.43	6.52
2	09/01/2016	6.76	8.12	8.31	28.96	8.96	0.00	91.14	25.14	4.67
4	23/01/2016	5.23	5.42	6.74	27.97	8.80	0.00	94.14	31.29	5.87
6	09/02/2016	3.39	4.00	5.58	31.44	13.61	0.00	90.57	32.14	5.36
8	23/02/2016	2.72	2.75	2.17	34.64	16.69	0.00	86.14	29.00	5.14
10	09/03/2016	1.88	2.01	0.00	34.27	17.71	1.70	91.43	29.71	5.86
	Seasonal mean	9.70	12.10	12.62						
	Correlation coefficient (r)			Fruit borer	-0.230	0.215	0.033	0.717**	0.188	0.420
				Mealy bug	-0.136	0.100	-0.006	0.787**	0.044	0.510*
				Scale insect	-0.251	0.047	0.002	0.798**	0.045	0.470

*Significant at 5% level of significance (Table value = 0.482 at 15 d.f.) ** Significant at 1% level of significance (Table value = 0.606 at 15 d.f.)

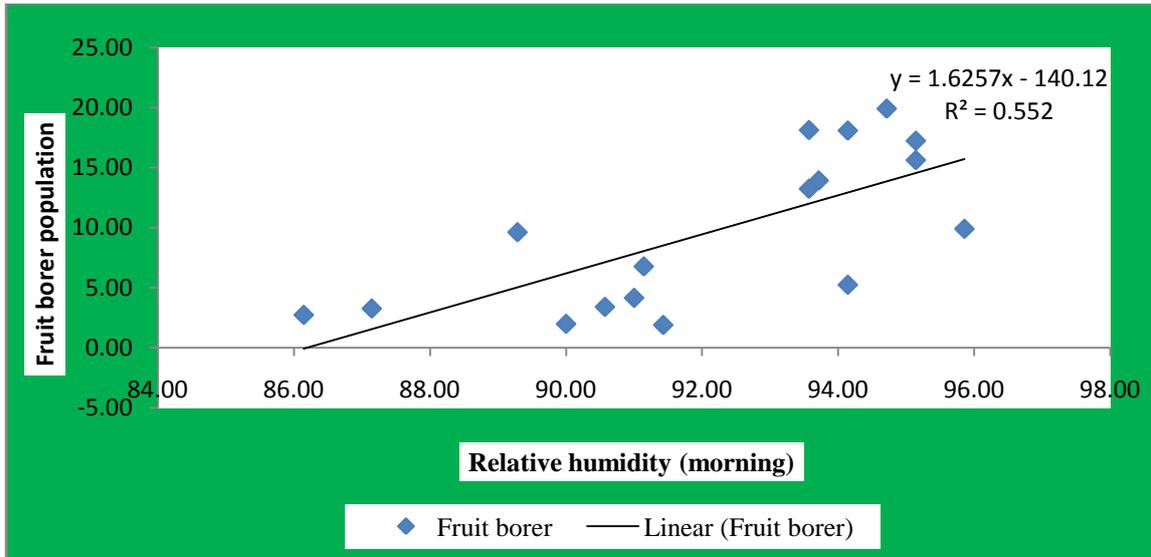


Fig. 1: Regression line showing relative humidity (morning) and fruit borer population

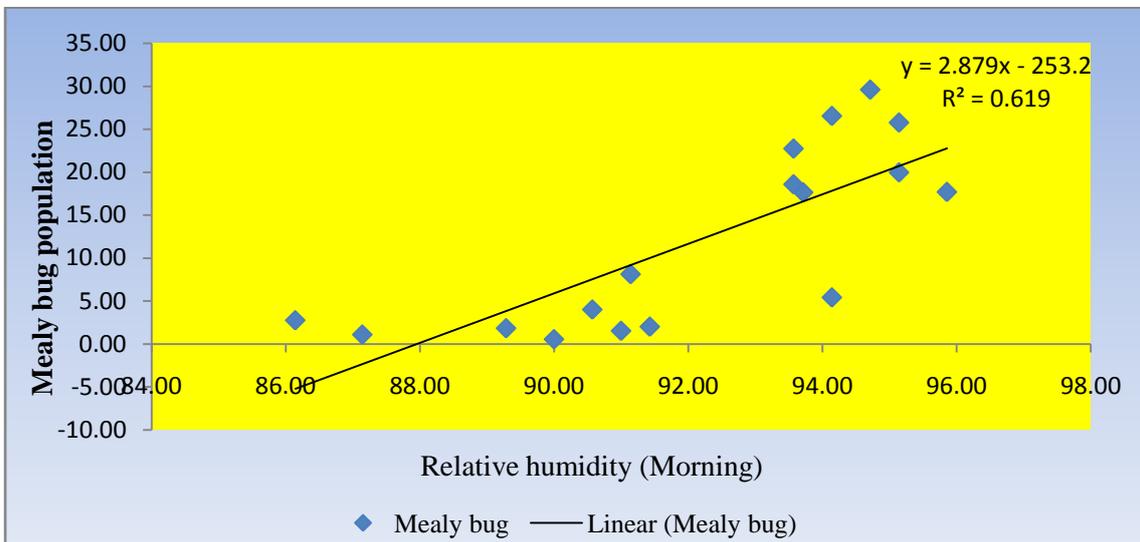


Fig 2: Regression line showing Relative humidity (morning) and mealy bug population

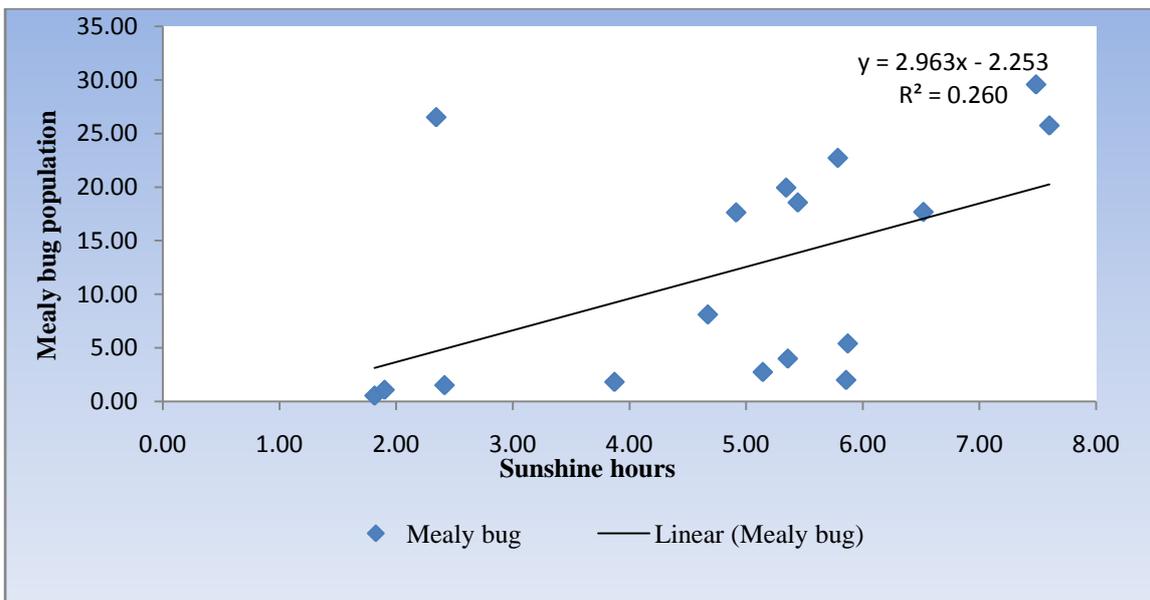


Fig 3: Regression line showing sunshine hours and mealy bug population

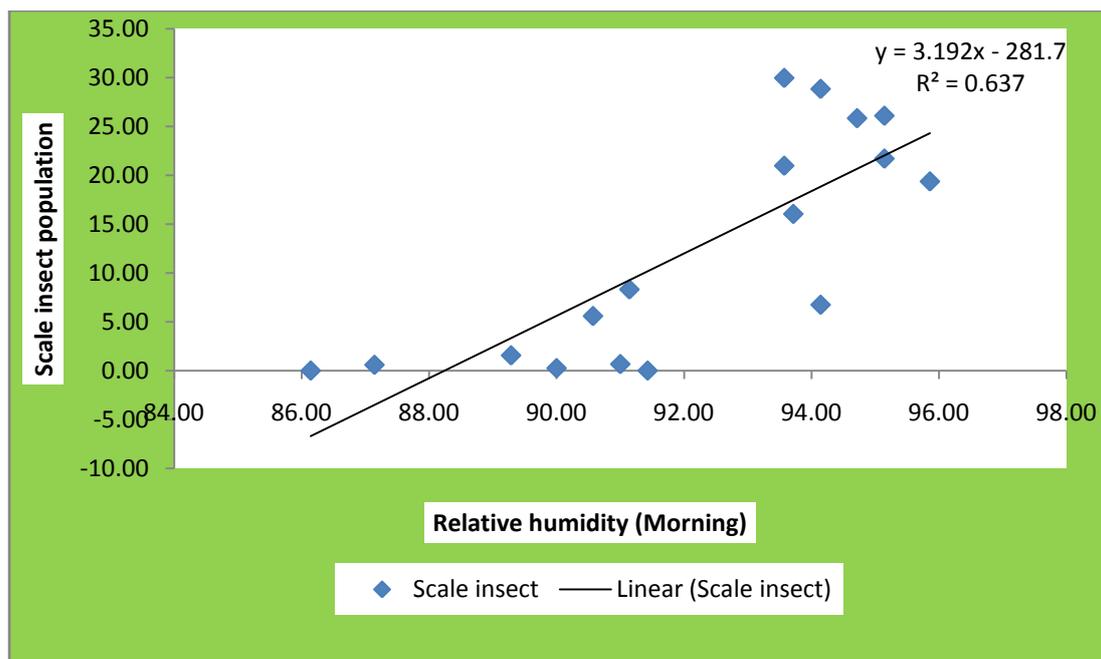


Fig 4: Regression line showing relative humidity (morning) and scale insect population

CONCLUSION

From present studies we can conclude that Morning relative humidity around 95 per cent and evening relative humidity around 60 per cent were found congenial for the fruit borer multiplication on tamarind. Mealy bug and scale insects were also significantly positively influence with morning relative humidity.

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