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Population Dynamics of Chickoo Moth, *Nephopteryx eugraphella* (Ragonot). (Pyralidae : Lepidoptera) in Relation to Weather Parameters

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ABSTRACT

The studies were carried out during 1989-90 on population dynamics of *Nephopteryx eugraphella* (Regonot) infesting sapota trees, *Manilkara echras* (Mill). The infestation was found to remain higher in late monsoon to early winter period (September to January). There were two peaks of infestation on bud, first in second fortnight of September and second in first fortnight of November. The infestation on leaves remained below 5 per cent throughout the year with peak activity in the first fortnight of January. Per cent infestation on buds was significantly positively correlated with minimum (X_2) and average (X_3) temperature, evening relative humidity (X_5) and rainy days (X_9) while significantly negatively correlated with sunshine hours (X_7). The correlation with maximum temperature (X_1), morning (X_4) and average (X_6) relative humidity and rainfall (X_8) was not significant. The per cent infestation on leaves was significantly aegatively correlated with X_2, X_3, X_5 and X_6 while it was not-significant with other meteorological factors. The multiple linear regression equation was : $Y = 5.387 + 360\ (X_2) - 0.035\ (X_3) - 0.097\ (X_5) - 0.438\ (X_7) - 0.002\ (X_9)$ for the infestation on bud while it was : $Y = 3.779 - 0.042\ (X_2) - 0.033\ (X_3) + 0.011\ (X_5) + 0.003\ (X_6)$ for the infestation on leaves. Only 47.10 and 22.8 per cent variation was explained by various weather parameters in the per cent infestation on buds and leaves, respectively.

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INTRODUCTION

Among the various factors affecting the yield of fruit crops, damage caused by insect pests is very important. More than 25 insect pests are reported attacking sapota tree (*Manilkara achras* (Mill.) Fosbarg), (Butani, 1979). Amongst, Chickoo moth (*Nephoteryx eugraphella*) is one of the major insect-pest in South Gujarat damaging leaves and bud of sapota. The pest causes considerable damage to young terminals affecting the buds and fresh leaves and reported that the damage caused by this pest is alarming one as flowering parts of sapota are badly affected and considered as potential insect pest of sapota in South Gujarat (Jhala *et al.*, 1986).

Before developing Insect Pest Management Programme for specific agro ecosystem, it is necessary to have the basic information on abundence and distribution of pest in relation to weather parameters which help in determining appropriate time of action

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and suitable effective method of control. Published information on population dynamics of this pest is very limited and this pest has also remained unattended from the view point of effect of weather parameters on its population fluctuation. Therefore, the present investigation was carried out with a view to study the effect of different weather parameters on the population fluctuation of the pest throughout the year.

MATERIALS AND METHODS

On order to study the population dynamics of this insect-pest, sapota trees were selected randomly in the orchard at two locations *e.i.*, College Farm, N. M. College of Agriculture, Navsari and farmer's orchard (Dr. Vasadia's farm) near college farm. Ten trees in each orchard were observed at 15 days interval starting from July 1989 and continued upto June, 1990. Randomly selected ten terminal shoots with flower buds and leaves were observed critically in each tree and damaged and healthy flower buds and leaves were counted. Thus in all 100 shoots were observed in each orchard at each observation. Based on this data, per cent buds and leaves damaged by various pest were worked out.

In order to study the instantaneous effect of weather parameters *viz.*, maximum temperature, minimum temperature, average temperature, morning relative humidity, evening relative humidity, average relative humidity, sunshine hours, rainfall and rainy days on population of the pest, correlation coefficient and multiple/simple regression were worked out by takiny average infestation of both the locations. Weekly meteorological data as recorded at meteorological observatory in college farm, N. M. College of Agriculture, Navsari for the period during July 1989 to June 1990 were used. The weekly meteorological data were transferred into fortnightly average and utilized for present study.

RESULTS AND DISCUSSION

It can be seen from the data presented in Table 1 and depicted in figure 1 that the infestation of this pest on buds was more or less throughout the year. The infestation was higher in late monsoon to early winter period i. e., September to January. There were two peaks of infestation on bud, first in second fortnight of September (7.07%) and second in first fortnight of November (6.36%) recording more than 5 per cent infestation on buds. Thus higher activity period was found in the month of September and November, while lower activity was found during December to August (Below 5%).

In Gujarat, the higher infestation by *N. eugraphella* on buds has been reported in September during 1985-86 (Anonymous, 1986 a), 1986-87 (Anonymous, 1987) and 1989-90 (Anonymous, 1990), while in November during 1979-81 (Patel, 1981). These reports are in close agreement with present findings. However, higher activity of this pest has been also reported in October during 1981-83 (Jhala *et al.*, 1986; Anonymous, 1989 b), in August during 1984-85 (Anonymous, 1985) and 1985-86 (Anonymous, 1986 b) and in June during 1987-88 (Anonymous, 1989 a). The present finding differed from above reports. The minimum activity of this pest on buds has been observed in May-June during 1979-81 (Patel, 1981), in March-April during 1981-83 (Jhala *et al.* 1986), in January during 1984-85, (Anonymous, 1985) in March during 1985-86, (Anonymous, 1986a), in March and May to July

TABLE 1

Per cent infestation by chickoo moth *N. eugraphella* on sapota (1989-90).

Sr. No.	Moth and Fortnight	Per cent infested buds			Per cent infested leaves		
		At College orchard	At Farmer's orchard	Average	At College orchard	At Farmer's orchard	Average
1.	2.	3.	4.	5.	6.	7.	8.
1.	July 1989	I 3.35	4.61	3.98	0.97	1.20	1.09
2.		II 5.01	4.34	4.68	2.27	1.85	2.06
3.	August	I 3.46	3.80	3.63	2.04	1.57	1.81
4.		II 4.38	5.30	4.84	0.76	0.93	0.85
5.	September	I 4.48	5.21	4.85	2.50	1.02	1.76
6.		II 7.96	6.18	7.07	1.47	0.36	0.92
7.	October	I 3.85	2.92	3.39	3.77	2.07	2.92
8.		II 2.41	2.85	2.63	1.68	2.37	2.03
9.	November	I 7.94	4.78	6.36	2.87	2.53	2.70
10.		II 3.29	4.59	3.94	2.96	4.04	3.50
11.	December	I 2.38	3.20	2.79	2.38	1.91	2.15
12.		II 2.29	1.34	1.82	2.05	1.58	1.82
13.	January, 1990	I 2.31	1.07	1.69	4.20	4.40	4.30
14.		II 1.94	0.84	1.39	3.68	0.62	2.15
15.	February	I 1.76	1.00	1.38	1.94	1.29	1.62
16.		II 1.71	1.08	1.40	2.11	1.09	1.60
17.	March	I 2.54	1.16	1.85	1.50	0.78	1.14
18.		II 1.47	1.78	1.63	1.05	0.44	0.75
19.	April	I 2.09	1.68	1.89	0.95	0.73	0.84
20.		II 1.96	1.95	1.96	1.04	0.90	0.97
21.	May	I 1.88	1.32	1.60	0.98	1.00	0.99
22.		II 2.10	2.08	2.09	1.14	0.99	1.07
23.	June	I 2.96	3.31	3.14	1.24	0.87	1.06
24.		II 3.79	2.43	3.11	1.78	1.09	1.44

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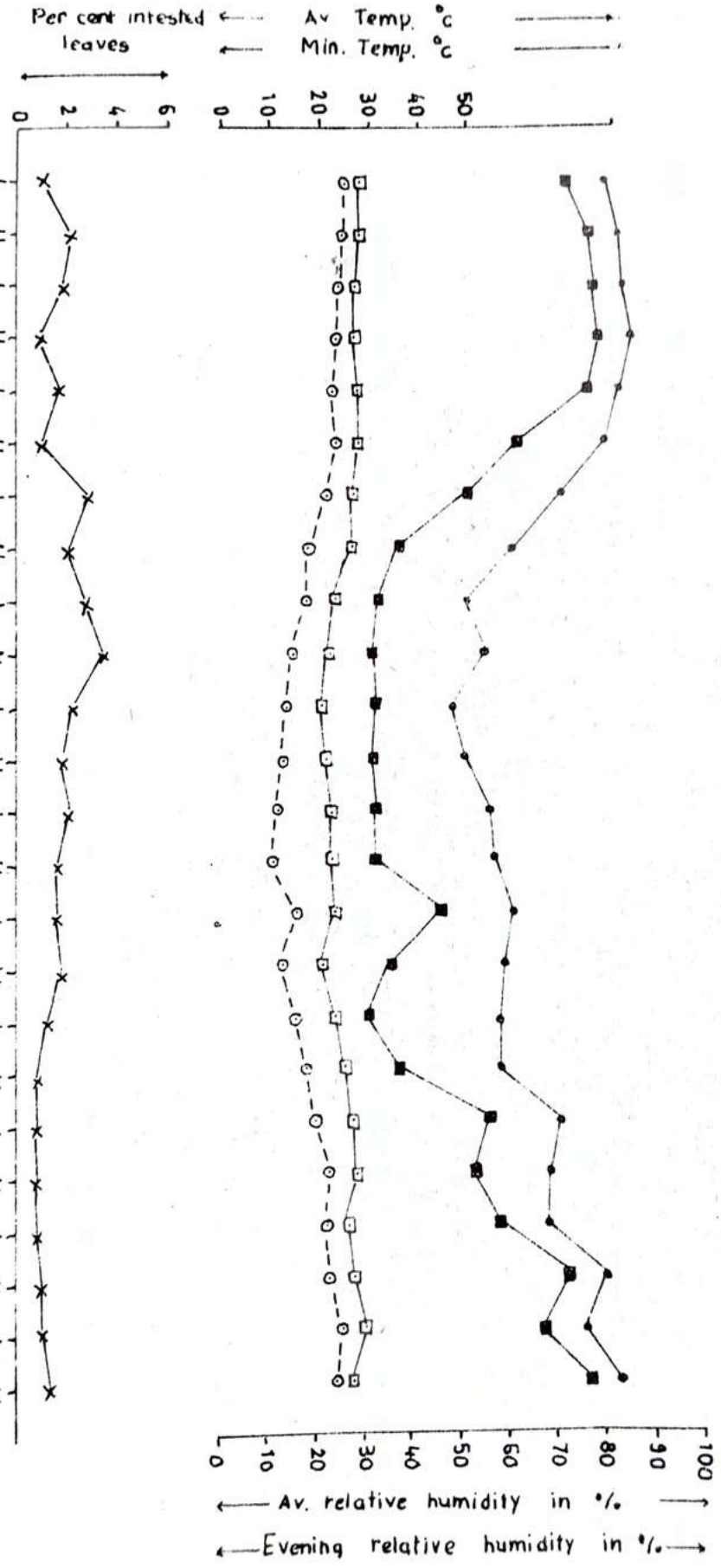


Figure 2 Level of infestation by N. eugraphella on Sapota leaves in relation to weather parameters during different months of the year 1993-96.

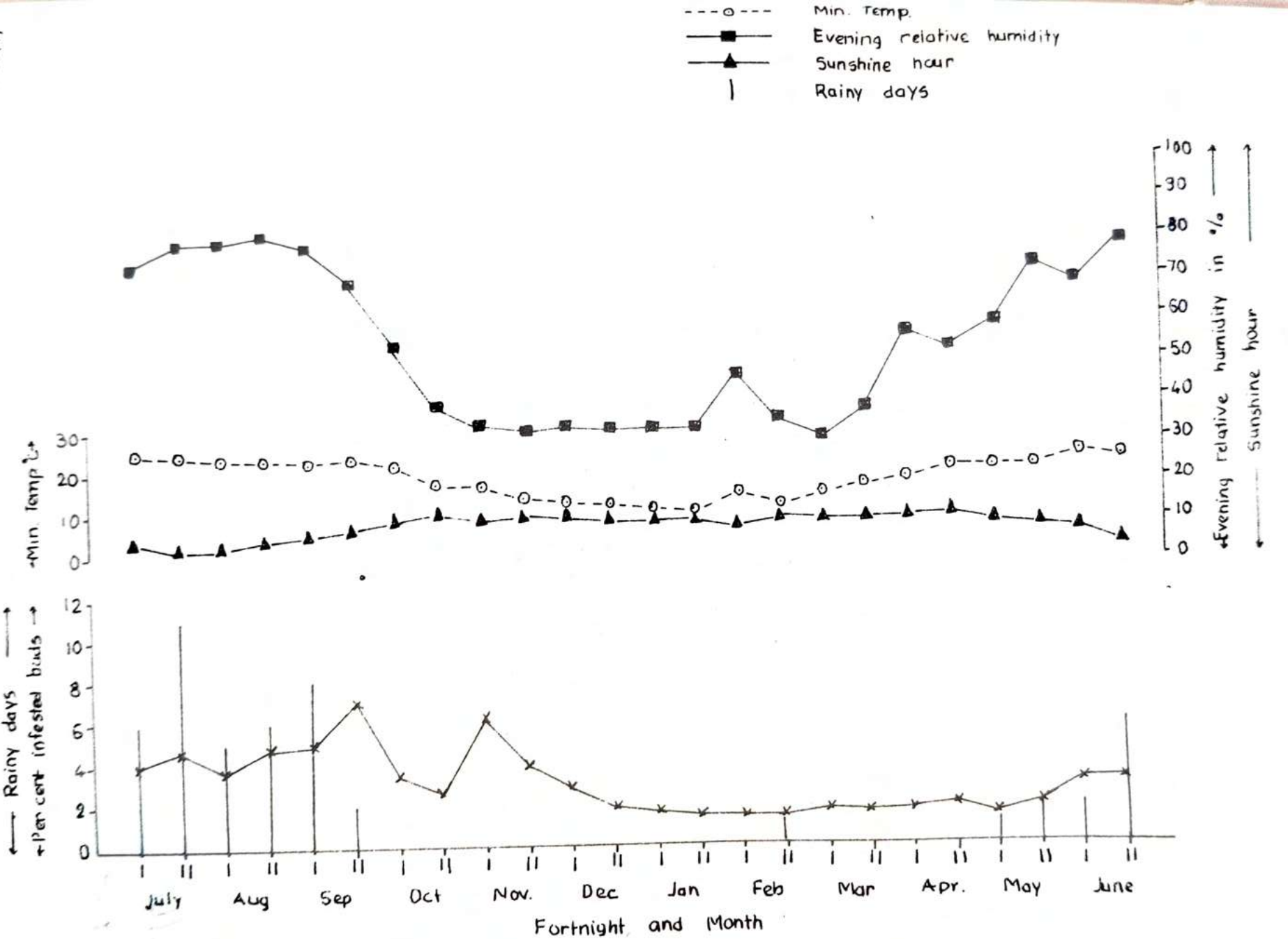


Figure: 1 : Level of infestation by *N. eugraphella* on sapota buds in relation to weather parameters during different months of the year 1989-90.

during 1985-86 (Anonymous, 1986b), in December and February during 1986-87 (Anonymous, 1987), in April during 1987-88 (Anonymous, 1989a) and 1989-90 (Anonymous, 1990) and in February during 1988-89 (Anonymous, 1989b). The present finding of lower activity of the pest on buds observed during December to August mostly tally with above reports. Further, the higher infestation of this pest on buds during late monsoon to early winter in the present study is in confirmation to earlier report made by Patel (1981) and Jhala *et al.*, (1986). However, the variation reported in higher activity of this pest on buds during different period of study might have been due to effect of weather parameters and other ecological factors.

As regard the infestation if *N. eugraphella* on leaves, it can be seen from the data presented in Table 1 and depicted in figure 2 that the infestation remained throughout the year below 5 per cent. However, it was comparatively higher during November and January. Maximum infestation (4.30%) was in the first fortnight of January, while minimum (0.75%) was in second fortnight of March. Further most of the peak infestation period on leaves coincided with that of infestation on buds as can be seen from figure 1 and 2. In Gujarat, higher activity of *N. eugraphella* on leaves has been reported in October during 1985-86 to 1987-88 (Anonymous, 1986 a, 1987, 1989a), in August during 1988-89 (Anonymous, 1989b) and in November during 1989-90 (Anonymous, 1990). These reports differed from present finding, might be due to different effect of weather parameters and ecological condition at various location in different years.

Analytical data presented in Table-2 indicated that the correlation between dependent variable *viz.*, chickoo moth infestation on buds (Y_1) and minimum temperature (X_2), average temperature (X_3), evening relative humidity (X_5) and rainy days (X_9) was positive and significant at 5% level of significance. This revealed that as the above variable increased, the infestation was also increased significantly and vice versa. Highly significant negative correlation was observed between sunshine hours (X_7) and chickoo moth infestation on buds (Y_1) indicating that as sunshine hours increased, the infestation of the pest decreased (Figure 1). The multiple linear regression equation fitted to the data taking chickoo moth infestation on bud (Y_1) as a dependent variable and meteorological factors having significant coefficient as independent variable was $Y_1 = 5.387 + 0.360 (X_2) - 0.035 (X_3) - 0.097 (X_5) \; 0.438 (X_7) - 0.002 (X_9)$ (Table 3). The coefficient of determination (R^2) was 0.471 showing thereby that only 47.10 per cent variation in the dependent variable was explained by various independent variable. However, it was statistically not significant indicating that the factors other than climatic ones were also responsible for contributing to pest infestation on buds.

As regard the correlation between dependent variables, chickoo moth infestation on leaves (Y_2) and climatic factors, it can be seen from Table 2 that with minimum temperature (X_2), average temperature (X_3), evening relative humidity (X_5) and average relative humidity (X_6), there was a significant negative correlation. This indicated that as the above variable increased, the chickoo moth infestation decreased and vice versa (Figure 2). The correlation between maximum temperature (X_1), morning relative humidity (X_4), sunshine hour (X_7), rainfall (X_8) and rainy days (X_9) was non-significant indicating that there was no correlation between above factors and chickoo

TABLE 2

Correlation coefficient values of chickoo moth (*N. eugraphella*) infestation on chickoo with respect to weather parameters.

X	*Maximum temperature* (°C)	*Minimum tempe-rature* (°C)	*Average tempe-rature* (°C)	*Morning relative humidity* (%)	*Evening relative humidity* (%)	*Average relative humidity* (%)	*Sun shine hours*	*Rainfall (mm)*	*Rainy days*
Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
1.	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*	*8.*	*9.*	*10.*
Chickoo moth on buds (Y_1)	-0.170	0.502*	0.413*	0.262	0.408*	0.394	-0.535*	0.348	0.483*
Chickoo moth on leaves (Y_2)	0.007	-0.478*	-0.429*	-0.306	-0.450*	-0.440*	0.142	-0.006	-0.176

* Significant at 5 per cent level of significance.

** Significant at 1 per cent level of significance.

TABLE 3

Multiple/simple regression equations to predict incidince of pest(*N. augraphella*) on the basis of weather parameters having significant correlation.

Sr. No.	Insect pests	A Value	Maximum temperature (°C) X_1	Minimum tempera-ture (°C) X_2	Average tempera-ture (°C) X_3	Morning relative humidity (%) X_4	Evening relative humidity (%) X_5	Average relative humidity (%) X_6	Sun shine hours X_7	Rainfall (mm) X_8	Rainy days X_9	R
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1	Chickoo moth on buds (Y_1)	5.387	–	0.360	-0.035	–	-0.097	–	-0.438	–	-0.002	0.471
2	Chickoo moth on buds (Y_2)	3.779	–	-0.042	-0.033	–	0.011	0.003	–	–	—	0.228

moth infestation on leaves (Y_2). The multiple linear regression equation fitted taking chickoo moth infestation on leaves (Y_2) as dependent factor and meteorolgical factors having significant regression coefficient as independent variable was $Y_2 = 3.779-0.042 (X_2) - 0.033 (X_3) + 0.011 (X_5) +0.003 (X_6)$ (Table 3). The coefficient of detemination (R^2) was 0.228 showing thereby that only 22.8 per cent variation in the dependent variable was explained by various independent variables. However it was statistically non-significant signifying that the factors other than climatic ones were also responsible for contributing to pest infestation on leaves.

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