

A EFFECT OF WEATHER PARAMETERS ON SEASONAL INCIDENCE OF SAPOTA LEAF WEBBER, *NEPHOPTERYX EUGRAPHELLA* RAGONOT (LEPIDOPTERA: PYRALIDAE) IN CHHATTISGARH PLAIN

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ABSTRACT

The field studies revealed that infestation of leaf webber was appeared more or less throughout the year. The minimum leaf infestation of 19.25 per cent was observed during 23 SMW, with 23.0, 18.0, 17.0 and 19.00 per cent leaf infestation in North, South, East and West direction, respectively it increased gradually and reached maximum of 47.5 per cent leaf infestation during 45 SMW with 46.0, 52.0, 41.0 and 51.0 per cent leaf infestation in North, South, East and West direction, respectively. The minimum leaf area infestation of 11.96 per cent was observed during 42 SMW, with 11.03, 13.65, 10.78 and 12.38 per cent infestation in North, South, East and West direction. The maximum leaf area infestation of 40.47 per cent were recorded during 14 SMW with 36.14, 42.71, 45.66 and 37.38 per cent leaf area infestation in North, South, East and West direction, respectively and then dropped down gradually. The correlation studies between leaf infestation and weather parameter revealed that, only minimum temperatures ($r = -0.483$), average temperatures ($r = -0.433$) and sun shine hours ($r = -0.384$) showed significant negative correlation at 1 and 5 per cent level of significance. Similarly correlation coefficient between leaf area infestation and weather parameter showed that, morning relative humidity (-0.327), evening relative humidity (-0.467), average relative humidity (-0.449) and sun shine hours (-0.360) had significant negative correlation at 1 and 5 per cent level of significance. Maximum leaf damage observed at 23 SMW with average temperature and relative humidity recorded 36.40 °C and 31.60 per cent respectively.

INTRODUCTION

Sapota, popularly known in India as chiku, is native to tropical America. Sapota [*Manilkara achras* (Mill.) Forsberg] is atropical fruit, belongs to family Sapotaceae. Sapota fruits contain more sugar during ripening stage it makes delicious in among the fruit crops (Gohlani and Bisen, 2012). In India, sapota ranks fifth in both production and consumption next to mango, banana, citrus and grape (Tsomu *et al.*, 2012). India is considered to be the largest producer of sapota in the world with an area of about 1.60 lakh hectares and production of 1424 metric tones (Anonymous, 2011). In Chhattisgarh, it covers 220 hectare area and yielding 748.5 metric tones of fruits (Anonymous, 2012). Sapota tree is attacked by more than 25 insect pests which include leaf webber, bud worm, midrib folder, leaf miner, fruit flies and sucking pests (Sathish *et al.*, 2012 and Butani, 1979). Among these, leaf webber, *Nephoptyx eugraphella* Ragonot, is a major and regular pest causing damage to the sapota crop under plain zone of Chhattisgarh. This pest is active throughout the year. It was first recorded on sapota in 1919 at Pusa (Fletcher, 1920). The larvae scrap to skeletonize the tender leaves in the terminals that are usually joined together by silken threads. They remain hiding in between the leaves and under loose web of excreta. Later the larvae devour buds, flowers and also bore into the fruits thus reducing the yield considerably (Sandhu, 1974).

Similar work on seasonal incidence of *Nephoptyx eugraphella* R. in relation to weather parameters conducted by Hajare *et al.*, (2012) showed that infestation of chiku moth *Nephoptyx eugraphella* was appeared more or less throughout the year. The larval population was minimum in first and in second week of May, it increased gradually and reached maximum in the second week of September and then dropped down gradually. Larval population had significantly negative correlation with maximum temperature, while morning relative humidity, evening relative humidity and rainfall were found favorable for pest population in the field. The aim of this study was to determine the changes in the incidence of sapota leaf webber, *Nephoptyx eugraphella* Ragonot and it's relation with the abiotic factors. It is hoped that the findings from the present study can contribute to the more ecological precise ways in dealing with outbreaks and control of sapota leaf webber.

MATERIALS AND METHODS

The observations was started from August, 2013 to June 2014, on five medium sized trees of sapota (cv Kalipatti) randomly selected from the Horticultural orchard of TCB College of Agriculture and Research Station, Bilaspur, (Chhattisgarh). Trees were tagged for recording the observations. For this purpose, four twigs (North, South, East and West) from each tree was

Table 1: Seasonal incidence of sapota leaf webber, *Nephtopteryx eugraphella* Ragonotin relation to weather parameter

Weather week	Date of observation	Temperature °C		Avg	Relative humidity (%)		Sunshine (hrs)	Rain fall (mm)	Leaf Damage (%)		E*	W*	Avg	Leaf area damage (%)		E*	W*	Avg
		Max.	Min.		I	II			N*	S*				N*	S*			
32	06/08/2013	31.70	24.90	28.30	95.00	85.00	1.80	45.00	16.00	22.00	25.00	23.00	21.50	19.80	27.84	24.55	23.31	
33	13/08/2013	31.70	24.60	28.20	97.00	77.60	87.30	3.20	13.10	21.00	32.00	30.00	24.80	24.79	29.49	24.97	25.83	
34	20/08/2013	28.90	23.80	26.40	96.00	87.30	91.70	1.00	67.40	27.00	28.00	18.00	25.25	31.77	30.93	27.49	28.23	
35	27/08/2013	30.60	23.60	27.10	96.70	83.00	89.90	3.10	119.80	21.00	24.00	28.00	24.25	15.19	12.40	11.44	13.30	
36	03/09/2013	32.80	24.60	28.70	94.30	77.10	85.70	6.10	15.80	32.00	38.00	26.00	29.00	23.22	23.99	23.19	21.24	
37	10/09/2013	33.20	24.90	29.10	93.10	77.40	85.30	5.30	11.80	31.00	29.00	39.00	38.25	15.82	22.35	17.25	17.62	
38	17/09/2013	30.90	24.20	27.60	94.40	79.10	86.80	2.80	39.40	48.00	33.00	41.00	40.25	25.37	21.75	27.53	24.23	
39	24/09/2013	33.00	24.30	28.70	96.10	70.40	83.30	6.50	6.20	40.00	32.00	38.00	37.25	27.48	30.09	24.32	27.23	
40	01/10/2013	30.30	23.60	27.00	95.70	82.30	89.00	2.60	71.80	46.00	41.00	42.00	41.50	28.30	18.81	24.41	23.29	
41	08/10/2013	29.90	22.50	26.20	91.40	80.00	85.70	4.30	51.60	48.00	33.00	46.00	42.75	19.06	15.41	17.03	20.68	
42	15/10/2013	30.50	20.40	25.50	93.00	69.00	81.00	8.10	0.00	41.00	46.00	39.00	41.00	11.03	13.65	10.78	11.96	
43	22/10/2013	30.90	22.40	26.70	92.00	76.00	84.00	3.20	9.20	44.00	37.00	37.00	42.25	20.95	19.07	21.08	19.14	
44	29/10/2013	30.80	16.60	23.70	95.40	50.80	73.10	8.50	0.00	43.00	40.00	45.00	42.75	11.31	13.03	11.51	13.20	
45	05/11/2013	29.60	14.60	22.10	93.40	54.00	73.70	8.50	0.00	46.00	52.00	41.00	47.50	15.22	12.65	14.50	12.69	
46	12/11/2013	25.50	12.30	18.90	91.10	43.30	67.20	7.60	0.00	39.00	48.00	44.00	43.75	22.29	18.70	17.79	21.26	
47	19/11/2013	29.80	14.10	22.00	90.70	47.10	68.90	7.90	0.00	45.00	47.00	41.00	43.00	20.01	20.54	22.86	25.93	
48	26/11/2013	29.80	13.40	21.60	92.30	51.60	72.00	8.50	0.00	38.00	46.00	47.00	41.50	22.09	25.13	27.16	21.74	
49	03/12/2013	28.20	11.00	19.60	91.10	40.60	65.90	8.60	0.00	39.00	27.00	31.00	31.00	21.38	26.71	25.60	26.03	
50	10/12/2013	28.00	9.10	18.60	92.40	51.00	71.70	8.50	0.00	32.00	47.00	36.00	38.75	26.63	35.50	27.71	25.47	
51	17/12/2013	28.00	11.00	19.50	93.60	49.00	71.30	8.10	0.00	47.00	28.00	39.00	39.50	29.15	27.49	44.82	28.40	
52	24/12/2013	27.80	12.70	20.30	92.40	56.00	74.20	6.90	0.00	33.00	30.00	22.00	28.25	28.57	31.04	35.66	34.19	
1	31/12/2013	27.90	12.60	20.30	96.10	78.80	87.50	7.10	1.80	35.00	44.00	40.00	38.00	39.29	29.92	29.38	31.72	
2	07/01/2014	27.10	10.80	19.00	92.00	64.00	78.00	5.60	0.00	44.00	39.00	42.00	42.50	24.61	24.77	28.90	24.65	
3	14/01/2014	28.20	15.50	21.90	91.40	60.40	75.90	3.60	0.00	43.00	36.00	34.00	36.75	20.93	24.74	30.84	26.97	
4	21/01/2014	27.60	13.80	20.70	91.10	48.10	69.60	7.30	0.00	37.00	33.00	44.00	35.75	26.08	30.77	27.54	27.60	
5	28/01/2014	28.00	10.00	19.00	85.60	35.60	60.60	9.90	0.00	47.00	30.00	37.00	39.00	24.34	31.79	28.36	37.20	
6	04/02/2014	31.30	13.90	22.60	91.30	40.70	66.00	9.60	0.00	28.00	28.00	33.00	30.50	31.28	29.95	31.26	32.84	
7	11/02/2014	27.40	14.20	20.80	31.00	49.30	40.20	6.40	2.20	27.00	43.00	34.00	35.50	26.95	25.07	29.70	26.57	
8	18/02/2014	28.70	13.40	21.10	87.60	46.10	66.90	7.40	9.60	40.00	39.00	43.00	38.75	25.32	26.84	28.01	26.87	
9	25/02/2014	27.80	16.30	22.10	95.40	65.30	80.40	4.80	51.80	38.00	39.00	54.00	41.00	26.46	32.24	32.22	35.89	
10	04/03/2014	27.60	16.60	22.10	76.40	54.40	70.90	6.20	4.40	38.00	42.00	35.00	40.75	29.78	26.19	34.89	35.05	
11	11/03/2014	32.80	18.60	25.70	91.10	51.80	71.50	7.60	19.00	46.00	36.00	36.00	39.50	34.56	37.06	39.44	39.97	
12	18/03/2014	35.50	18.40	27.00	79.80	33.80	56.80	8.80	0.00	35.00	36.00	38.00	39.00	31.34	32.52	34.40	36.42	
13	25/03/2014	37.50	21.50	29.50	71.10	36.70	53.90	8.20	0.00	39.00	36.00	42.00	47.00	30.17	35.20	31.03	32.65	
14	01/04/2014	37.60	20.70	29.20	77.20	32.10	54.70	8.00	0.00	41.00	43.00	41.00	39.75	36.14	42.71	45.66	37.38	
15	08/04/2014	36.00	21.40	28.70	69.00	36.30	52.70	8.30	19.20	40.00	50.00	38.00	41.25	35.11	36.26	41.16	38.40	
16	15/04/2014	36.50	22.20	29.40	77.10	39.40	58.30	8.40	0.00	29.40	38.75	33.50	34.54	31.26	36.94	29.41	40.53	
17	22/04/2014	40.00	23.50	31.80	64.80	27.40	46.10	10.20	0.00	35.00	33.00	31.00	32.00	26.15	26.43	31.29	33.63	
18	29/04/2014	40.20	24.20	32.20	66.80	35.30	51.05	8.80	0.00	31.00	35.00	31.00	31.75	23.17	26.32	26.64	30.29	
19	06/05/2014	37.90	24.40	31.20	71.00	44.70	57.85	7.90	2.60	28.00	31.00	25.00	28.00	34.85	23.16	33.21	30.35	
20	13/05/2014	40.40	24.90	32.70	54.10	28.30	41.20	9.60	0.00	30.00	31.00	32.00	33.00	31.01	31.80	28.51	35.57	
21	20/05/2014	39.70	25.50	32.60	69.10	39.10	54.10	6.70	11.60	29.00	20.00	25.00	32.00	26.50	24.85	24.87	22.87	
22	27/05/2014	40.30	26.80	33.60	69.40	37.10	53.25	8.80	0.00	24.00	17.00	20.00	22.50	21.20	24.85	24.87	23.45	
23	03/06/2014	43.00	29.80	36.40	63.00	31.60	47.30	9.70	0.00	23.00	18.00	17.00	19.00	20.36	22.58	24.72	22.06	
Seasonal Mean										36.01	35.40	34.94	36.51	25.49	25.65	27.60	27.19	26.48

*N = North, *S = South, *E = East, *W = West

selected and observed weekly for recording the incidence of leaf webber. Twenty leaves were observed from each direction per tree to record the damage caused by leaf webber. The per cent leaf infestation due to leaf webber was calculated with the help of formula described by Sathish *et al.* (2012).

$$\text{Per cent leaf/leaf area infestation} = \frac{\text{Number of damaged leaves/leaf area}}{\text{Total number of leaves/leaf area}} \times 100$$

Assessment of leaf injury was made on the basis of per cent leaf area infested which was obtained by plotting hundred randomly selected leaves on square graph paper. The per cent leaf area infestation due to leaf webber was calculated as per method given by Shukla (2008). The data thus, obtained were correlated with various abiotic factors and simple correlation coefficient (r) was worked out by using the following formula as per method given by Gomez and Gomez (1985).

RESULTS

Weekly observation, on the incidence of leaf damage on sapota, revealed that the damaged leaves with 21.5 per cent infestation first observed during first week of August. The highest leaf infestation of 47.5 per cent was noticed during first week of November with 46.0, 52.0, 41.0 and 51.0 per cent leaf infestation in North, South, East and West direction, respectively. In subsequent observations, there was gradual decrease reached to the 19.25 per cent leaf infestation during first week of June with 23.0, 18.0, 17.0 and 19.00 per cent infestation in North, South, East and West direction, respectively. The leaf infestation range (19.25 to 47.5%) was

noticed during August to June months. Correlation studies revealed that, there was a significant and positive correlation between leaf damage and rainfall ($r = 0.327^*$) and negatively significant and highly significant correlation with sun shine hours ($r = -0.384^*$) and minimum temperatures ($r = -0.483^{**}$), average temperatures ($r = -0.433^{**}$), respectively.

The minimum leaf area damage of 11.96 per cent recorded during third week October with 11.03, 13.65, 10.78 and 12.38 per cent infestation in North, South, East and West direction, whereas highest leaf area damaged of 40.47 per cent recorded in first week of April with 36.14, 42.71, 45.66 and 37.38 per cent infestation in North, South, East and West direction, respectively. After fourth week of October onwards, the leaf area damage was gradually increased reaching to 32.46 per cent. The leaf area damage range (11.96 to 40.47 %) was noticed during August to June months. In present investigation correlation coefficient between leaf area infestation and weather parameter revealed that, only morning relative humidity (-0.327^*), evening relative humidity (-0.467^{**}), average relative humidity (-0.449^{**}) and sun shine hours (-0.360^*) showed significant negative correlation at 1 and 5 per cent level of significance. Remaining other variables had not significant correlated with leaf area damage.

DISCUSSION

Present study is in agreement with the finding of Sran and Sandhu (1979) observed that the peak activity was confined to the warm humid period between June and November and least activity during (March-April). Similarly Patel *et al.* (1993) also reported two peaks of infestation, the first in late September and the second in early November of *N. eugraphella*. Peak

Table 2: Simple correlation co-efficient (r) between meteorological parameters and sapota leaf webber, *Nephoteryx eugraphella* Ragonot during 2013 -14

Weather data Leaf webber damage (%)	Temperature (°C)			Relative humidity (%)			Sun shine (hours)	Rainfall (mm)
	Maximum	Minimum	Average	Morning	Evening	Average		
Leaf damage	-0.303	-0.483 **	-0.433 **	0.095	-0.129	-0.036	-0.384 *	0.327 *
Leaf area damage	0.208	-0.186	-0.009	-0.327 *	-0.467 **	-0.449 **	-0.360 *	0.125

*: Significant at 5% level; **: Significant at 1% level

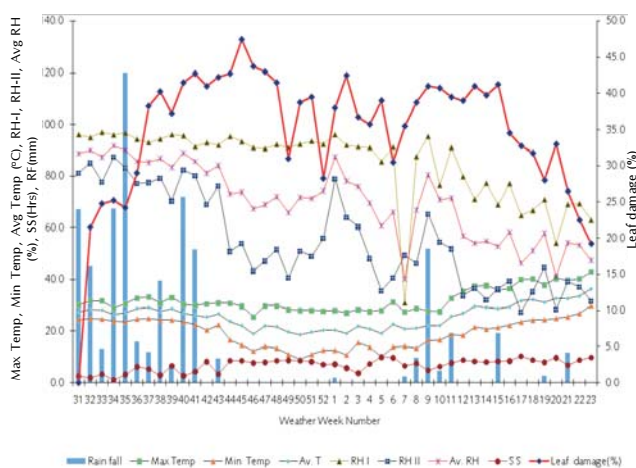


Figure 1: Seasonal incidence of sapota leaf webber on sapota (leaf) at Bilaspur during 2013 -14

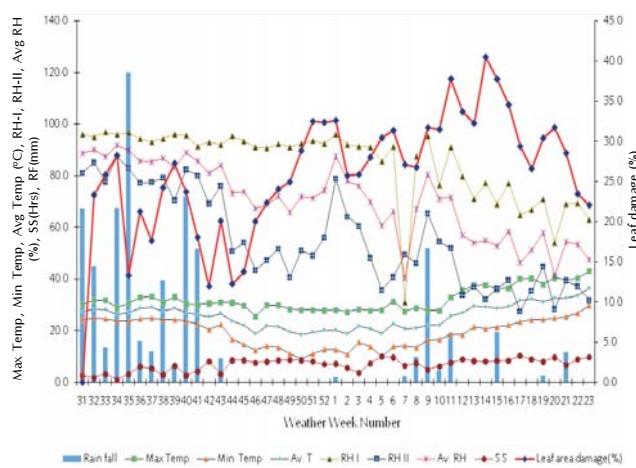


Figure 2: Seasonal incidence of sapota leaf webber on sapota (leaf area) at Bilaspur during 2013 -14

activity of leaf webber recorded during first week of November in present investigation is more or less similar to those of the reports of Anonymous (1997) mentioned that the maximum incidence of chiku moth recorded, during July to November on sapota. Present investigation more or less corroborates with the reports of Patel *et al.* (1993) wherein the minimum temperature, average temperature and average relative humidity had significant negative correlation with larval population of *Nephoteryx eugraphella*. Hajare *et al.* (2012) also observed that rainfall and maximum temperature were found favorable for build-up of pest population in the field.

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