Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(3): 4081-4085
Received: 01-03-2019
Accepted: 03-04-2019

AR Hajare
Junior Research Asstt., Department of Agril Entomology, MPKV, Rahuri, Maharashtra, India

DS Pokharkar
Head, Department of Agril Entomology, MPKV, Rahuri, Maharashtra, India

SR Kulkarni
Professor, Department of Agril Entomology, MPKV, Rahuri, Maharashtra, India

Correspondence
AR Hajare
Junior Research Asstt., Department of Agril Entomology, MPKV, Rahuri, Maharashtra, India

Population dynamics of chiku moth, (*Nephopteryx. eugraphella* Rogonot) in relation to weather parameters on sapota under Western Maharashtra conditions

AR Hajare, DS Pokharkar and SR Kulkarni

Abstract
The population dynamics of sapota chiku moth, *Nephopteryx eugraphella* Rogonot (Lepidoptera : Pyralidae) infesting in relation to weather parameters was carried out on sapota variety *viz*., Kalipatti, at Horticultural Instructional Farm, Department of Horticulture, MPKV, Rahuri, during 2016-17 and 2017-18. The incidence of chiku moth, *N. eugraphella* recorded higher in rainy season from June to September (5.0 to 16.5 larvae /50 twig) than remaining months with highest population during 28th MW. The leaf damage also observed higher (17.64 to 43.29 %) during the period from June to October than remaining months with maximum leaf infestation during 27th MW. The correlation between incidence of chiku moth and weather parameters indicated that the relationship was positively correlated with minimum temperature, morning and evening relative humidity, wind velocity and rainfall. Whereas, maximum temperature and sunshine hours found negatively correlated with the larval population as well as per cent leaf damage.

Keywords: Population dynamics, chiku moth and weather parameters

1. Introduction
The sapota, *Manilkara achras* (Mill.) Fosberg. (Synonym, *Achras zapota* Linn.) Belongs to family sapotaceae, is commonly known as chiku, ciku, dilly, nasberry, sapodilla, plum, chico [12]. It is native of Mexico and Central America and now widely cultivated throughout the tropics. In India, it is cultivated over an area of 1,07,000 hectares in the country with a production of 12,85,000 tonnes and productivity of 12.00 tonnes per ha. Its cultivation has spread to Maharashtra, Gujarat, Karnataka, Tamil Nadu, Andhra Pradesh, Kerala, Uttar Pradesh, West Bengal, Punjab and Haryana. Amongst these states, Gujarat, Karnataka and Maharashtra have maximum acreage under this crop. The total area under sapota cultivation in Maharashtra is 17,910 hectares with an annual production of 1,56,470 tonnes and productivity of 8.73 tonnes per ha [3]. Among 41 varieties grown all over India, 'Kalipatti' is an outstanding variety of sapota and popularly cultivated in Gujarat as well as in Maharashtra.
More than 25 insect pests attacked to sapota tree [4]. Among the different insect pests attacking sapota, chiku moth, *N. eugraphella* is a major pest of sapota and active throughout the year on sapota tree in Western Maharashtra. Day by day the cultivation of sapota is increasing in Maharashtra and simultaneously the problem of *N. eugraphella* is also increased. The caterpillar feeds on leaves, often on buds and flowers; sometimes on tender fruits also. For developing any pest management programme, specific agro-ecosystem information on abundance and distribution of pest in relation to weather parameters is the basic requirement. Therefore, a study on seasonal abundance of chiku moth (*N. eugraphella*) on sapota was carried out under prevailing agro-climatic conditions of Western Maharashtra.

2. Materials and Methods
2.1 Seasonal incidence of chiku moth
To study the population dynamics of chiku moth, *N. eugraphella* on sapota, an experiment was carried out in sapota orchards of variety 'Kalipatti' at the central campus of MPKV, Rahuri. Ten trees of uniform age in the orchard were randomly selected and kept free from insecticidal application throughout the period of experimentation. The population dynamics was studied based on the per cent leaf damage by chiku moth and larval population per 50 twig. The population of pests was recorded in each meteorological week for both the consecutive years 2016-17 and 2017-18.

2.2 Statistical analysis
Average of larval population of chiku moth and its leaf damage per twigs recorded at weekly interval were worked out for both the years and the data on pest population and their per cent damage were correlated with weather parameters to determine the influence of various physical factors of environment for causing population fluctuation of the sapota pests

3. Result and Discussion
3.1 Seasonal incidence of chiku moth
3.1.1 Larval population
The population of chiku moth as well as its damage recorded throughout the year during 2016-17 and 2017-18 starting from 6th MW of February, 2016 to 5th MW of January, 2018 of the subsequent year. The data on population dynamics of chiku moth are presented in Table 1 and the influence of different weather parameters during the period on chiku moth population are graphically depicted in Fig. 1 and 2.

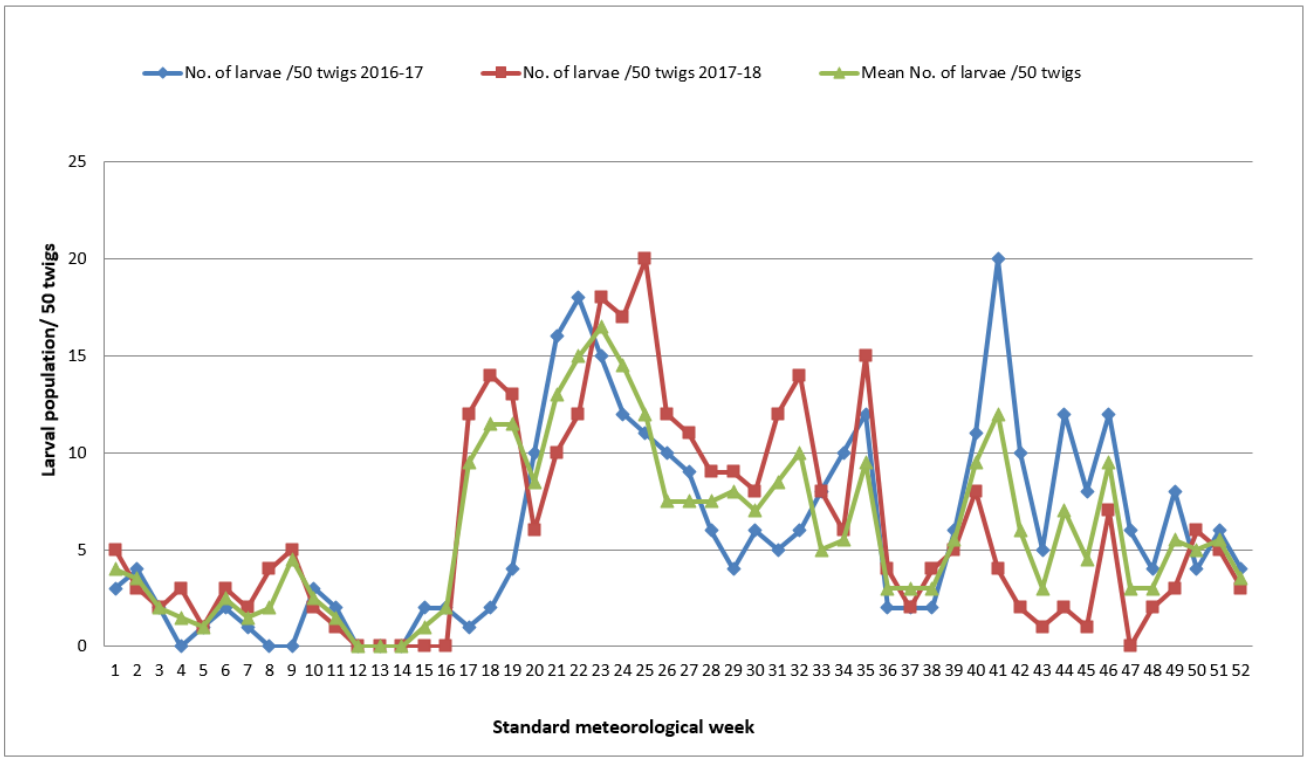

Fig 1: Population dynamics of chiku moth, *N. eugraphella* during 2016-17 and 2017-18

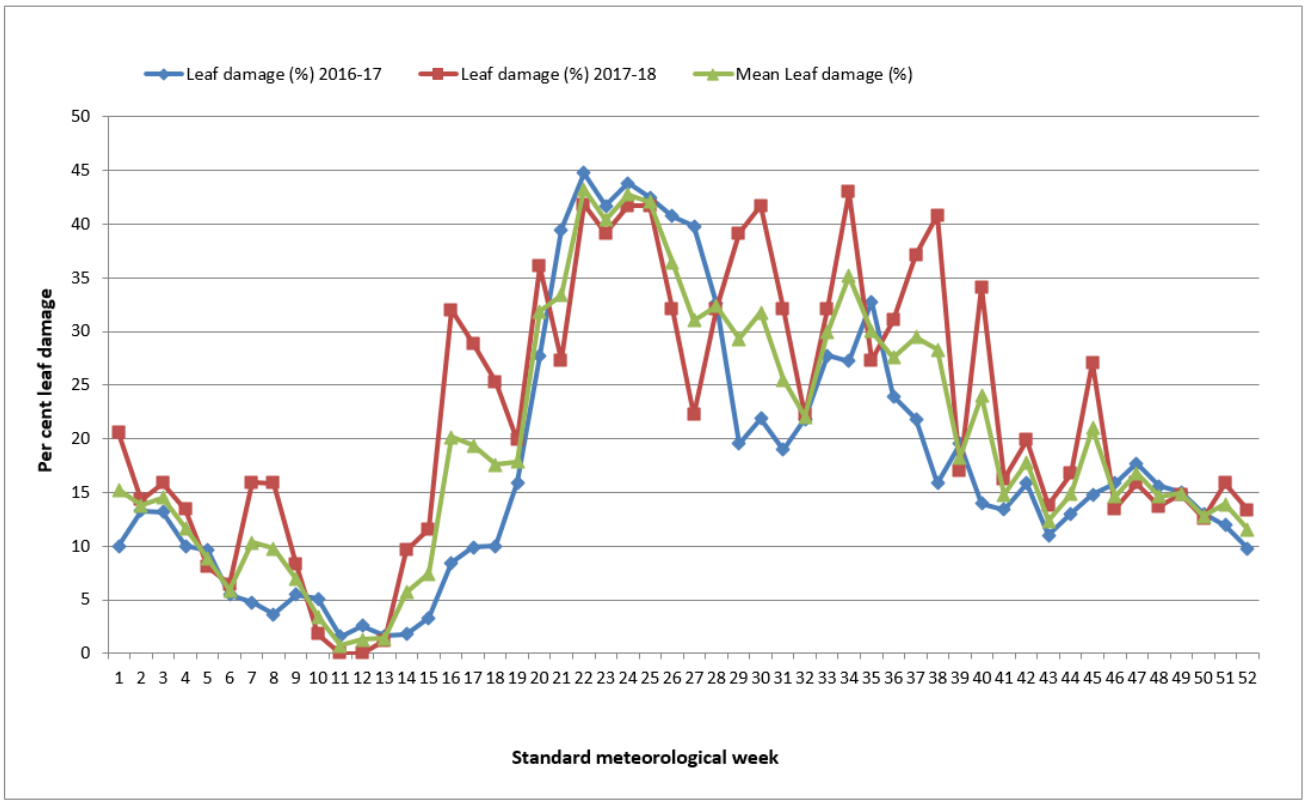

Fig 2: Leaf damage by chiku moth, *N. eugraphella* during 2016-17 and 2017-18

Table 1: Population dynamics of *N. eugraphella* and its damage in sapota orchard at MPKV, Rahuri

Month & Week	Std. Met. Week (MW)	No. of larvae /50 twigs			Leaf damage (%)		
		2016-17	2017-18	Mean	2016-17	2017-18	Mean
February I	6	3.0	5.0	4.0	9.99	20.54	15.27
II	7	4.0	3.0	3.5	13.31	14.27	13.79
III	8	2.0	2.0	2.0	13.21	15.88	14.55
IV	9	0.0	3.0	1.5	9.99	13.39	11.69
March I	10	1.0	1.0	1.0	9.60	8.08	8.84
II	11	2.0	3.0	2.5	5.46	6.42	5.94
III	12	1.0	2.0	1.5	4.77	15.90	10.34
IV	13	0.0	4.0	2.0	3.68	15.83	9.76
April I	14	0.0	5.0	4.5	5.50	8.29	6.90
II	15	3.0	2.0	2.5	5.10	1.83	3.47
III	16	2.0	1.0	1.5	1.58	0.00	0.79
IV	17	0.0	0.0	0.0	2.58	0.00	1.29
V	18	0.0	0.0	0.0	1.63	1.18	1.41
May I	19	0.0	0.0	0.0	1.83	9.58	5.71
II	20	2.0	0.0	1.0	3.38	11.58	7.48
III	21	2.0	0.0	2.0	8.43	31.98	20.21
IV	22	1.0	12.0	9.5	9.90	28.88	19.39
June I	23	2.0	14.0	11.5	9.99	25.28	17.64
II	24	4.0	13.0	11.5	15.90	19.88	17.89
III	25	10.0	6.0	8.5	27.74	36.07	31.91
IV	26	16.0	10.0	13.0	39.52	27.29	33.41
July I	27	18.0	12.0	15.0	44.79	41.79	43.29
II	28	15.0	18.0	16.5	41.72	39.11	40.42
III	29	12.0	17.0	14.5	43.83	41.69	42.76
IV	30	11.0	20.0	12.0	42.50	41.68	42.09
V	31	10.0	12.0	7.5	40.78	32.08	36.43
August I	32	9.0	11.0	7.5	39.80	22.25	31.03
II	33	6.0	9.0	7.5	32.60	32.08	32.34
III	34	4.0	9.0	8.0	19.53	39.11	29.32
IV	35	6.0	8.0	7.0	21.90	41.69	31.80
September I	36	5.0	12.0	8.5	19.00	32.08	25.54
II	37	6.0	14.0	10.0	21.83	22.25	22.04
III	38	8.0	8.0	5.0	27.81	32.08	29.95
IV	39	10.0	6.0	5.5	27.26	42.98	35.12
October I	40	12.0	15.0	9.5	32.82	27.29	30.06
II	41	2.0	4.0	3.0	24.00	31.04	27.52
III	42	2.0	2.0	3.0	21.83	37.16	29.50
IV	43	2.0	4.0	3.0	15.81	40.83	28.32
V	44	6.0	5.0	5.5	19.53	17.01	18.27
November I	45	11.0	8.0	9.5	13.98	34.09	24.04
II	46	20.0	4.0	12.0	13.38	16.29	14.84
III	47	10.0	2.0	6.0	15.81	19.88	17.85
IV	48	5.0	1.0	3.0	11.00	13.78	12.39
December I	49	12.0	2.0	7.0	13.00	16.78	14.89
II	50	8.0	1.0	4.5	14.88	27.08	20.98
III	51	12.0	7.0	9.5	15.81	13.51	14.66
IV	52	6.0	0.0	3.0	17.74	15.87	16.81
January I	1	4.0	2.0	3.0	15.58	13.74	14.66
II	2	8.0	3.0	5.5	15.08	14.85	14.97
III	3	4.0	6.0	5.0	13.00	12.55	12.78
IV	4	6.0	5.0	5.5	11.98	15.84	13.91
V	5	4.0	3.0	3.5	9.78	13.34	11.56

The data of both the years revealed that the pest was active throughout the year and the mean larval population ranged from 0.0 to 16.5 per 50 twigs with peak incidence recorded during 28th MW i.e. 2nd week of July. Whereas, the sapota orchard was found to be devoid of pest incidence during 17th to 19th MWs. It is revealed from pooled data that the mean larval population of chiku moth was higher (10.0 to 16.5 larvae /50 twigs) during 23rd to 30th MWs except 25th MW in June-July, 37th MW in September and 46th MW in November. The pest population was at moderate level (5.0 to 9.5 larvae / 50 twigs) in 22nd to 25th MWs, 31st to 40th MWs except 37th MW, 44th, 45th, 47th, 49th, 51st and 2nd to 4th MWs. In general, the incidence of chiku moth was observed low during February to May months.

3.1.2 Leaf damage

The infestation of chiku moth fluctuated greatly throughout the period during both the years of investigation. It is evident from the data of both the years revealed that the leaf damage due to chiku moth ranged from 0.79 to 43.29 per cent throughout the year with least leaf damage during 16th MW in 3rd week of April and peak infestation in 27th MW in 1st week of July. Maximum leaf damage due to chiku moth (< 20 %) was recorded during the period from 21st MW (3rd week of

May) to 45th MW (1st week of November) and 50th MW (2nd week of December) except 22nd to 24th MWs and 44th MW. The pest damage observed was moderate (10.34 to 19.39 %) from 6th to 9th MWs (February), 12th MW (3rd week of March), 22nd to 24th MWs (1st week of May to 2nd week of June) and 44th MW (5th week of October) to 5th MW (January) of the subsequent year except 45th and 50th MWs.

The higher infestation by *N. eugraphella* R. on sapota leaves has been reported in August [13], September to November [8], September to January [10], monsoon [11], November [9]. The higher number of larvae per twig has been reported in June to November [13], August [1], June [2]. Larval population per twig has been reported minimum in December to May [13]. Sushil Kumar and Bhatt (2002) [14] reported that the chiku moth infestation was higher in late monsoon to winter *i.e.* October to March than rest of the period and exhibited its peak during November (45th to 48th MW). The results of the current investigations are in accordance with [7], [6] and [5] who reported that *N. eugraphella* was active throughout the year and its peak activity was observed during early rains and post rainy season. Thus, similarity in the results obtained in the present study with those of earlier reports confirmed the present findings.

3.2 Correlation between chiku moth, *N. eugraphella* and weather parameters

The correlation between average larval population of chiku moth as well as its per cent leaf damage and weather parameters for both the years (2016-17 and 2017-18) are presented in Tables 2 and 3. The result revealed that the morning and evening relative humidity and rainfall showed highly significant and positive correlation with pest activity and the corresponding 'r' values were 0.671**, 0.751** and 0.369** for pest population, and 0.833**, 0.916** and 0.432** for leaf damage. The minimum temperature and wind velocity had non-significant positive association with expressing 'r' values of 0.067, 0.054 and 0.279, 0.177 respectively which indicated that increase in magnitude of these weather parameters merely increased the pest infestation during the year. However, the maximum temperature and sunshine hours caused highly significant but negative relationship with chiku moth population and leaf damage on sapota with the 'r' values of -0.662**, -0.701** and -0.655**, -0.859**, respectively.

Furthermore, in 2017-18 similar trend was observed, the morning and evening relative humidity and minimum temperature exhibited highly significant positive association with average larval population as well as per cent leaf damage of chiku moth and the 'r' values were 0.642**, 0.703**, 0.513** and 0.734**, 0.804**, 0.484**, respectively. The wind velocity and rainfall had positive correlation with chiku moth activity but non-significant with the 'r' values of 0.291 and 0.236 for pest population and 0.317 and 0.293* for per cent leaf damage. However, maximum temperature and sunshine hours had highly significant and negative effect on the pest population and per cent leaf damage with the 'r' values of -0.284**, -0.633** and -392**, -0.440**, respectively.

Thus, it seems from the current study that the present findings are in conformity with Sushil Kumar and Bhatt (2002) [14] who noticed that chiku moth infestation had significant negative correlation with minimum temperature ('r' = 0.8018), average temperature ('r' = -0.4665), evening relative humidity ('r' = 0.7622), average relative humidity ('r' = -0.6752) and rainfall ('r' = -0.6016).

The correlation studies between leaf infestation and weather parameters carried out by [5] revealed that only minimum temperature (r = -0.483), average temperature (r = -0.433) and sunshine hours (r = - 0.384) had significant negative correlation at 1 and 5 per cent levels of significance. These observations of the earlier workers could support the present findings in this respect.

Table 2: Correlation coefficient between chiku moth, *N. eugraphella* and weather parameters (2016-17)

Sr. No.	Weather parameter	'r' values for	
		Larval population	Leaf damage
1	Maximum temperature (^{0}C)	-0.662**	-0.655**
2	Minimum temperature (^{0}C)	0.067	0.279
3	R.H. morning (%)	0.671**	0.833**
4	R.H. evening (%)	0.751**	0.916**
5	Wind velocity (km/hr)	0.054	0.177
6	Sunshine (hrs)	-0.701**	-0.859**
7	Rainfall (mm)	0.369**	0.432**

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

Table 3: Correlation coefficient between chiku moth, *N. eugraphella* and weather parameters (2017-18)

Sr. No.	Weather parameter	'r' values for	
		Larval population	Leaf damage
1	Maximum temperature (^{0}C)	-0.284**	-0.392**
2	Minimum temperature (^{0}C)	0.513**	0.484**
3	R.H. morning (%)	0.642**	0.734**
4	R.H. evening (%)	0.703**	0.804**
5	Wind velocity (km/hr)	0.291	0.317
6	Sunshine (hrs)	-0.633**	-0.44**
7	Rainfall (mm)	0.236	0.293*

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

References

1. Anonymous. The survey of important insect pests infesting chiku trees in Junagadh area. Report of Research activities of the Department of Entomology, Gujarat Agricultural University, Junagadh. Presented in XXII PPSC meeting of Agresco of Gujarat Agricultural University held on May 22-23, 1996 at Anand, Gujarat, 1986, 11-20.

2. Anonymous. The survey of important insect pests infesting chiku trees in South Gujarat. Report of Research activities of the Department of Entomology, NMCA, Gujarat Agricultural University, Navsari. Presented in XXIV PPSC meeting of Agresco of Gujarat Agricultural University held on May 4-5, 1989 at Sardarkrushinagar, Dantiwada, Gujarat, 1989, 5-13.
3. Anonymous. Indian Horticulture Database - Horticultural Statistics at a Glance. (http:// www.nhb.gov.in). 2017, 148-192.
4. Butani DK. Insect and Fruits. Periodical Expert Book Agency, Delhi. 1979, 87-94.
5. Ghirtlahre SK, Sahu CM, Nirala, Kerketta YSP. A effect of weather parameters on seasonal incidence of sapota leaf webber, *Nephopteryx eugraphella* Ragonot (Lepidoptera: Pyralidae) in Chhattisgarh plain. *The Bioscan.* 2015; 10(3):1153-1156.
6. Hajare AR, Patel JI, Shitole TD. Seasonal incidence of chiku moth (*Nephopteryx eugraphella* R.) in relation to weather parameters. Internat. J Plant Protec. 2012; 5(1):89-92.
7. Jayanthi PDK, Verghese A. Calendar of seasonal incidence and pest-vigil for major sapota pests. Pest Manag. Horti Eco. 2003; 9(2):97-102.
8. Jhala RC, Shah AH, Patel CB, Patel SH. Population dynamics of some insect pests of chiku in South Gujarat. GAU Res. J. 1986; 11(1):69-71.
9. Patange NR, Bhagat RP, Patil SR. Injury index and management of chiku leaf webber (*Nephopteryx eugraphella* Rag.) on chiku. J Soils Crops. 1997; 7(1):87-89.
10. Patel BS, Jhala RC, Patel CB. Population dynamics of chiku moth, *Nephopteryx eugraphella* (Ragonot) (Pyralidae: Lepidoptera) in relation to weather parameters. Gujarat Agricultural University Res. J. 1993; 19(1):38-46.
11. Patel PP. Bionomics and control of chiku moth, *Nephopteryx eugraphella* (Lepidoptera: Pyralidae) on sapota (*Achras zapota*). M. Sc. (Agri.) Thesis submitted to Gujarat Agricultural University, Sardarkrushinagar, Gujarat, (unpublished), 1996.
12. Purseglove JW. Tropical crops Dicotyledons. Longman Group Ltd. 1968; 1:647.
13. Sran CS, Sandhu GS. Population dynamics and economic-injury levels of *Nephopteryx eugraphella* Ragonot on sapota in Punjab. Haryana J Hort. Sci. 1979; 8(3/4):186-189.
14. Sushil Kumar, Bhatt RI. Seasonal incidence and population dynamics of major lepidopterous insect pests of sapota in relation to major abiotic factors. J Appl. Zoo. Res. 2002; 13(1):6-9.