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Population dynamics of leaf miner (*Acrocercops gemoniella* Stainton) in relation to weather parameters on sapota under western Maharashtra conditions

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Abstract
The population dynamics of Sapota Leaf miner *Acrocercops gemoniella* Stainton (Gracillaridae: Lepidoptera) 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 chiku leaf miner *A. gemoniella* was active for the period from 28th to 46th MWs during July to November and recorded 0.10 to 5.69 per cent leaf damage with peak infestation (5.69 %) during 38th MW in September month. The correlation studies between chiku leaf miner and weather parameters releaved that the relationship was positively correlated with minimum temperature, morning as well as evening relative humidity, wind velocity and rainfall. Whereas, maximum temperature and sunshine hours found negatively correlated with the pest infestation.

Keywords: population dynamics, leaf miner 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 [8]. 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. (Anonymous, 2017). 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 [2]. 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 [3]. Among the different insect pests attacking sapota in Maharashtra, *Anarsia achrasella*, *Nephopteryx eugraphella* and *Acrocercops gemoniella* are regularly occurring insect pests on sapota [2]. It was noticed that the pest was not much serious on sapota in Western Maharashtra. The leaf miner caterpillars found feeding on mesophyll tissues within the leaf and made shallow tunnels. Newly emerged leaflets (known as a flush) were preferred feeding site for leaf miner. They leave mining tracks which were usually slender, white, winding trails. Heavily mined leaflets have large white spots. The leaves injured by leaf miners tend to drop prematurely.
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 leaf miner (*A. gemoniella*) on sapota was carried out under prevailing agro-climatic conditions of Western Maharashtra.

2. Materials and Methods
2.1 Population dynamics of leaf miner
To study the population dynamics of leaf miner *A. gemoniella* 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 leaf miner. 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 leaf miner leaf damage per twigs recorded at weekly interval were worked out for both the years and the data on 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. Results and Discussion
The tiny larva of leaf miner, *A. gemoniella* mined into epidermal layers of young leaves and the affected leaves showed glistering galleries which later distorted dried and ultimately fell down. The population dynamics of chiku leaf miner was studied for both the years (2016-17 and 2017-18) and the data are presented in Table 1 with graphical depiction in Fig. 1. The results indicated that the infestation of chiku leaf miner recorded was in the range of 0.20 to 4.54 per cent leaf damage from of July to November, 2016. The pest damage was noticed for the period from 28th to 46th MWs except 44th MW with highest leaf damage (4.54 %) in 34th MW during August, 2016. During the subsequent year (2017-18), the leaf damage was observed within the range of 0.18 to 7.89 per cent from 28th to 39th MWs in the months of July, August and September, 2017 with peak infestation in 38th MW. The pooled data showed that the pest was active for the period of 28th to 46th MWs exhibiting 0.10 to 5.69 per cent leaf damage with the highest infestation (5.69 %) during 38th MW in September. However, the pest damage was not observed during winter as well as summer months from 47th MW to 27th MW of the subsequent year. Thus, it indicates that the leaf miner was minor pest of sapota in Western Maharashtra.

The results of the current study are in corroboration with the findings of Jhala *et al.* (1986) [5] who recorded maximum of 1.83 per cent infestation of leaf miner in the month of September. The occurrence of this pest was found throughout the year in South Gujarat with its peak activity in July - August [6] as well as in June - July and September - October [7]. Moreover, the infestation of *A. gemoniella* was mostly confined during May to September under South Gujarat conditions. The pest infestation recorded as high as 36.07 per cent during second fortnight of August in widely grown variety Kalipatti [4]. Such variation in the pest infestation might be location specific. The above stated observations of the earlier workers except Deshmukh (2001) [4] could support the present findings.

3.1 Correlation between leaf miner, *A. gemoniella* and weather parameters
The results presented in Tables 2 and 3 revealed that the correlation among leaf miner infestation and weather parameters was found to be consistent during both the years (2016-17 and 2017-2018) of study. During 2016-17 (Table 2), the leaf miner oriented damage showed significant positive correlation with minimum temperature (r = 0.383**), morning relative humidity (r = 0.558**), evening relative humidity (r = -0.673**) and rainfall (r = 0.346*). Also, there existed positive correlation between the pest damage and wind velocity (r = 0.197). However, it had significant negative correlation with maximum temperature (r = -0.324*) and sunshine hours (r = - 0.679**).

Almost similar trend was noticed during 2017-18 in respect of correlation between the pest damage and weather parameters (Table 3). The leaf miner infestation showed significant positive correlation with minimum temperature (r = 0.296*), morning relative humidity (r = 0.433**), evening relative humidity (r = 0.485**) and rainfall (r = 0.534**). Whereas, it was negatively correlated with maximum temperature (r = - 0.213) and wind velocity (r = - 0.045) but significantly negative correlation with sunshine hours (r = - 0.339*).

Similarly, Patel (1990) [6] from South Gujarat reported that the infestation of *A. gemoniella* as a leaf miner had positive significant correlation with minimum and average temperature, relative humidity, rainfall and rainy days, while significant negative correlation with maximum temperature and sunshine hours. Significant negative correlation with maximum temperature and positive correlation with minimum temperature as well as rainfall had also been reported from South Gujarat [1].

Deshmukh (2001) [4] mentioned that the leaf miner infestation was positively influenced by minimum temperature, while negatively by maximum temperature in variety Kalipatti at Navsari in South Gujarat. Thus, the present observations in these respects are in agreement with the earlier reports.

Table 1: Leaf damage caused by chiku leaf miner, *A. gemoniella* in sapota orchard at MPKV, Rahuri

Month & Week	Std. Met. Week (MW)	Leaf damage (%)		
		2016-17	2017-18	Mean
February I	6	0.00	0.00	0.00
II	7	0.00	0.00	0.00
III	8	0.00	0.00	0.00
IV	9	0.00	0.00	0.00
March I	10	0.00	0.00	0.00
II	11	0.00	0.00	0.00
III	12	0.00	0.00	0.00
IV	13	0.00	0.00	0.00
April I	14	0.00	0.00	0.00
II	15	0.00	0.00	0.00
III	16	0.00	0.00	0.00
IV	17	0.00	0.00	0.00
V	18	0.00	0.00	0.00
May I	19	0.00	0.00	0.00
II	20	0.00	0.00	0.00
III	21	0.00	0.00	0.00

IV	22	0.00	0.00	0.00
June I	23	0.00	0.00	0.00
II	24	0.00	0.00	0.00
III	25	0.00	0.00	0.00
IV	26	0.00	0.00	0.00
July I	27	0.00	0.00	0.00
II	28	1.78	0.68	1.23
III	29	2.78	1.18	1.98
IV	30	0.80	0.18	0.49
V	31	0.90	0.18	0.54
August I	32	3.08	2.78	2.93
II	33	3.63	2.34	2.99
III	34	4.54	2.05	3.30
IV	35	1.03	1.54	1.29
September I	36	2.33	1.97	2.15
II	37	2.13	0.67	1.40
III	38	3.48	7.89	5.69
IV	39	2.90	3.90	3.40
October I	40	0.78	0.00	0.39
II	41	3.36	0.00	1.68
III	42	3.08	0.00	1.54
IV	43	0.20	0.00	0.10
V	44	0.00	0.00	0.00
November I	45	0.34	0.00	0.17
II	46	0.69	0.00	0.35
III	47	0.00	0.00	0.00
IV	48	0.00	0.00	0.00
December I	49	0.00	0.00	0.00
II	50	0.00	0.00	0.00
III	51	0.00	0.00	0.00
IV	52	0.00	0.00	0.00
January I	1	0.00	0.00	0.00
II	2	0.00	0.00	0.00
III	3	0.00	0.00	0.00
IV	4	0.00	0.00	0.00
V	5	0.00	0.00	0.00

Table 2: Correlation coefficient between chiku leaf miner, *A. gemoniella* and weather parameters (2016-17)

Sr. No.	Weather parameter	'r' values for Leaf damage
1	Maximum temperature (^{0}C)	-0.324*
2	Minimum temperature (^{0}C)	0.383**
3	R.H. morning (%)	0.558**
4	R.H. evening (%)	0.673**
5	Wind velocity (km/hr)	0.197
6	Sunshine (hrs)	-0.679**
7	Rainfall (mm)	0.346*

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

Table 3: Correlation coefficient between chiku leaf miner, *A. gemoniella* and weather parameters (2017-18)

Sr. No.	Weather parameter	'r' values for Leaf damage
1	Maximum temperature (^{0}C)	-0.213
2	Minimum temperature (^{0}C)	0.296*
3	R.H. morning (%)	0.433**
4	R.H. evening (%)	0.485**
5	Wind velocity (km/hr)	-0.045
6	Sunshine (hrs)	-0.339*
7	Rainfall (mm)	0.534**

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

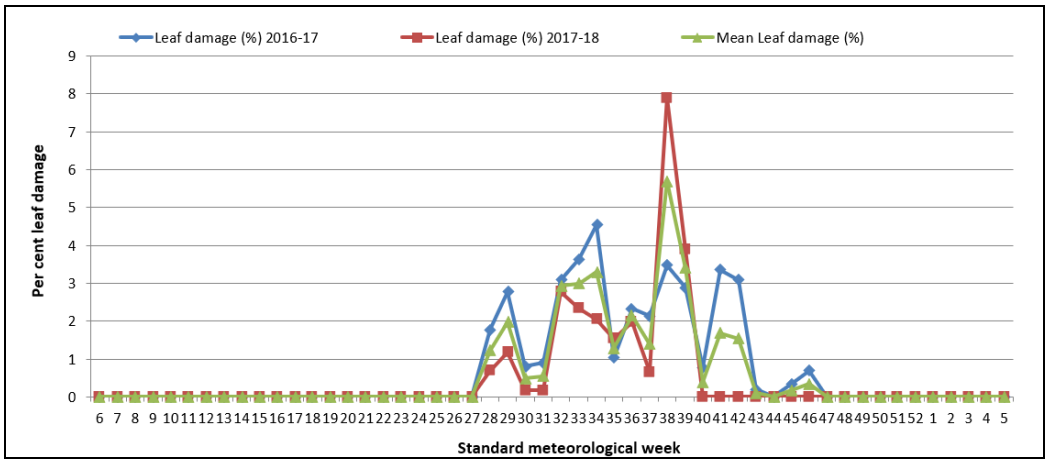

Fig 1: Leaf damage by chiku leaf miner, *A. Gemoniella* during 2016-17 and 2017-18

4. Conclusion

The leaf miner *A. gemoniella* incidence was noticed in the range of 1.0 to 5.69 per cent mean leaf damage from 28th to 46th MWs during the months of July to November with relatively high (5.69 %) during 38th MW. It was regarded as minor pest of sapota in Western Maharashtra. The incidence of leaf miner, *A. gemoniella* was positively correlated with minimum temperature, morning and evening relative humidity and rainfall, whereas maximum temperature, wind velocity and sunshine hours had negative influence on the pest damage.

5. References

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