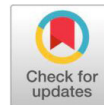# AATCC Review

Research Article

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Seasonal Incidence of Mango, Guava and Sapota Pests in Tiruvannamalai District of Tamil Nadu, India

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ABSTRACT

The roving survey was conducted to document the seasonal incidence of insect pests of mango, guava and sapota in the Thandrampattu block of Tiruvannamalai District. During the survey on mango, it was observed pests like mango leaf hopper (Idioscopus niveoparsus), mango gall midge (Procontarinia pustulate) and mango leaf twisting weevil (Apoderus tranquebaricus). In sapota, leaf webber (Nephopteryx eugraphella), bud worm (Anarsia epotias) were seen. In Guava, tea mosquito bug (Helopeltis antonii) and mealy bug (Ferrisia virgata) were seen. The incidence of mango leaf hopper was seen higher during the 14th Standard Mean Week (SMW) with 48 percent while the minimum during the 28th SMW with 22 percent. The incidence of leaf gall was maximum during the 28th SMW with 44 percent while the minimum was seen during the 14th SMW with 28.0 percent. The incidence of mango leaf twisting weevil was seen high during the 20th SMW at 65 percent while the minimum incidence was recorded during 14th the SMW at 37 percent with 7 numbers. Considering the natural enemies, the incidence of lady bird beetle per tree was found high during the 20th SMW per plant while the minimum was seen during the 22nd SMW with 4 numbers per tree. Leaf gall and leaf twisting weevil incidence were positively correlated with maximum temperature, minimum temperature, relative humidity and wind speed and negatively correlated with rainfall while the hoppers were negatively correlated with minimum temperature, relative humidity and rainfall. In sapota, the incidence of sapota leafwebber damage was seen high during the 14th SMW with 26 percent while the minimum was recorded during 18th SMW at 18 per cent. The incidence of sapota budworm was high during 24th SMW with 42 percent while the minimum was recorded during the 22nd SMW with 8 percent. Incidence of ladybird beetle was found high during the 16th and 28th week with 7 numbers each per plant respectively while the minimum was seen during the 22th week with 4 number per plant. The incidence of spiders was seen high during 26th and 30th MSW with 9 numbers per plant respectively while the minimum was recorded during the 14th and 18th SMW with 4 numbers per plant respectively. In sapota, leaf webber was positively correlated with maximum temperature, minimum temperature, relative humidity and wind speed and negatively correlated with rain fall while the budworm was negatively correlated with minimum temperature, relative humidity and rainfall. In guava, the incidence of tea mosquito bug was high during the 14th MSW at 40 per cent while the minimum was recorded during 16th MSW at 23 percent. The incidence of mealybug was high during 28th MSW with 30 per cent while the minimum was recorded during the 14th and 16th MSW with 14 percent. The mean incidence of lady bird beetle was high during 20th MSW with 9 numbers per plant while the minimum was recorded during the 22nd and 30th SMW with 2 numbers per plant respectively. The mean incidence of spiders was seen higher during 16th SMW with 9 while the minimum was recorded during the 22nd and 26th SMW with 3 per plant. Guava tea mosquito bug was positively correlated only with wind speed and negatively correlated with maximum temperature, minimum temperature, relative humidity and rainfall whereas the mealybug incidence was positively correlated with maximum temperature, minimum temperature and relative humidity and negative correlation with wind speed and rainfall.

Keywords: Mango, Guava, Sapota, Insect Pests, Seasonal Incidence, Weather Parameters Correlation, Pests Forcasting

Introduction

India is predominantly an agriculture-based country with more than two-thirds of its population living in rural areas. Agriculture contributes 29.4 percent of Indian gross domestic product and also provides working for 64 percent of the country's workforce [11]. Mango (*Mangifera indica* L.) is one of the world's most important cultivated tropical fruits that are grown in India. World production of mango was about 28.5 million tonnes accounting for nearly 50 percent of the world tropical fruit production [1]. Bengal concerns 70-80 thousand hectares of mango cultivation field sharing 44 percent of the total area occupied for food crop cultivation of the state [4] and Malda tops the list within the state with an annual net production of about 270 thousand tons [2].

The climate as an extrinsic integrative factor plays a crucial role in determining the abundance and distribution of insect pest population. abiotic factors are believed to be responsible for pest population dynamics [16]. The hatching and transformation of different stages of life cycle depend on certain environmental conditions. The mango mealybug female deposits eggs in the cracks in the soil in the month of April-May

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[8] that remain in diapauses from May to the middle of December [17] and hatched in the last of December sometimes extending up to January [19] depending upon the climatic factors.

Sapota or sapodilla, *Manilkara achras* (Mill) Fosberg belongs to family Sapotaceae, commonly known as 'Chiku' is evergreen fruit tree. India is considered to be the largest producer of sapota in the world. Though sapota is considered as a hardy fruit crop, various factors affect the yield and economic value of fruit. Among them, damage done by various insect pests and mites is a major constraint. As many as 25 insect pests have been reported attacking sapota trees in India [7] whereas, in Gujarat 16 insect pests and mites were found damaging to sapota [15]. In South Gujarat fruit fly, *Bactrocera dorsalis* is one of the important pests of sapota. Information on its seasonal incidence on the crop is lacking. The present investigation therefore, was to conceptualize the population dynamics of *B.dorsalis* to plan management strategies against this pest. Guava (*Psidium guajava* Linn.) is one of the most important fruit crop belonging to the family Myrtaceae and is popularly known it as the "Poor man's apple" or "Apple of tropics". It is native to Central America and was introduced in to India by the Portuguese during the 17th century. In India guava is the fourth largest commercially cultivated fruit crop, it contributes about 4.0 per cent of total fruit production. While comparing the productivity of guava with other nations; our country is poor in productivity due to several insect pest problems. Guava is attacked by nearly 80 species of insect and mite pests; however, only few of them have been noted as regular pest and causing serious damage. The most important regular insect pest which attacks guava is fruit flies, *Bactrocera* spp. and it is potent enough to cause 60 to 80 per cent damage. The seasonal variations in abiotic factors such as temperature, relative humidity, rainfall, and other factors are ubiquitous and play a vital role on the species diversity and its population dynamics, seasonal variation in the strength of the population and its dispersal pattern.

Materials and Methods

Roving survey was made to assess the the damage of major pests of mango, guava and sapota at Thandrampattu block of Tiruvannamalai District. Also, the incidence of pests data was correlated with weather data like minimum temperature, maximum temperature, relative humidity, rainfall and wind speed which were collected from the satellite data available online. At each location, survey for the mango leafhopper was done with five trees from which five areas (4 directions and one centre) of 10x10 m with leaves /panicle/trunk was assessed to record the mean incidence and percent damage/ tree. The survey was made on leaves of mango tree to assess the damage of leaf gall and leaf twisting weevil/tree. Five trees were selected and from each tree, 50 leaves were surveyed. In each tree, the leaf damage was assessed to work out the percent damage of leaf gall and leaf twisting weevil. In sapota, the survey was made to assess the damage of sapota leaf webber and budworm. Five trees were selected, in each plant, 50 shoots were observed for the webbings to document the number and percent damage/tree. Five trees were selected, in each tree, 50 buds were observed to assess the population and damage of sapota budworms. In guava, the survey was made in each direction (East, West, North and South) to assess the damage shoots or fruit /shoots with corky symptom. Five trees were selected and in each tree 50 fruits were observed. Out of 50 fruits the fruits with corky symptoms were noted and finally worked out the percent damage/tree. The survey was made on five trees from which 50 leaves were observed to assess the damage of guava mealy bug. The experimental data on the percent damage of pests in different fruit crops were correlated with weather parameters and the regression equation was calculated using MS Excel.
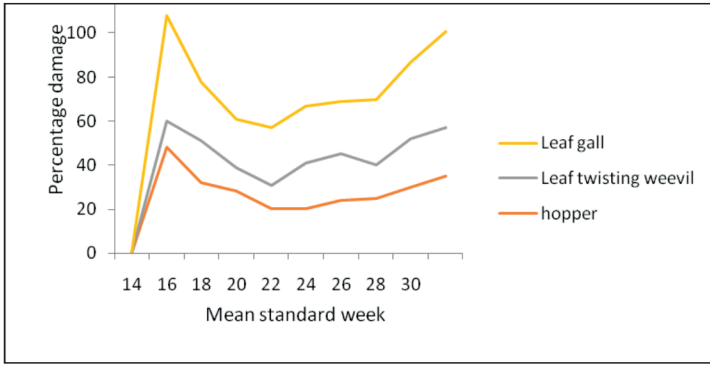
Results

The mean incidence of mango leaf hopper per panicle was seen high during the 14th SMW with 48 percent while the minimum was recorded during the 28th SMW with 22 percent. The incidence of leaf gall was maximum during 28th standard mean week with 44 percent while the minimum was seen during the 14th SMW with 28.0 percent. The damage of mango leaf twisting weevil was seen high during the 20th SMW with 65 percent while the minimum incidence was recorded during 14th the SMW with 37 percent with 7 numbers per plant. Considering the natural enemies, the incidence of lady bird beetle was found high during 20th SMW per plant while the minimum was seen during the 22nd SMW with 4 per plant (Table 1 and Fig. 1). Hoppers were positively correlated with maximum temperature (r=0.0971) and wind speed (r=0.0020) and negatively correlated with minimum temperature (r=-0.41192), relative humidity (r=-0.0568) and rainfall (r=-0.6231). Leaf gall and leaf twisting weevil incidence were positively correlated with maximum temperature (r=0.6205), minimum temperature (r=0.3022), relative humidity (r=0.6739) wind speed (r=0.3566) and negatively correlated with rainfall (r=-0.544). Leaf twisting weevil incidence were positively correlated with maximum temperature (r=0.6304), minimum temperature (r=0.3023), relative humidity (r=0.4309) wind speed (r=0.4567) and negatively correlated with rainfall (r=-0.3456)

Table 1. Incidence of Key Pests of Mango through Roving Survey at Thandrampattu Block, Tiruvannamalai during 2022-2023

Standard Mean Week	Hoppers		Leaf Gall	Leaf Twisting Weevil		No. of Coccinellid/tree	No. of Spider/tree
	Damage %	No./Tree	Damage %	Damage %	No./Tree		
14	48	14	48	12	10	5	3
16	32	9	27	19	14	5	4
18	28	5	22	11	5	6	9
20	20	11	26	11	15	7	7
22	20	8	26	21	15	4	5
24	24	14	24	21	15	5	5
26	25	15	30	15	10	6	6
28	30	20	35	22	20	5	8
30	35	22	44	22	10	5	8

**Fig. 1. Incidence of key pests of mango recorded at Thandrampattu Block of Tiruvannamalai District**

In sapota, the incidence of sapota leafwebber damage was seen high during the 14th SMW with 26 percent while the minimum was recorded during 18th SMW at 18 per cent. The incidence of sapota budworm was high during 24th SMW with 42 percent while the minimum was recorded during the 22nd SMW with 8 percent. Incidence of ladybird beetle was found high during the 16th and 28th week with 7 numbers each per plant respectively while the minimum was seen during the 22th week with 4 numbers per plant. The incidence of spiders was seen high during 26th and 30th MSW with 9 numbers per plant respectively while the minimum was recorded during the 14th and 18th SMW with 4 numbers per plant respectively (Table 2 and Fig. 2). In sapota, leaf webber was positively correlated with maximum temperature (r=0.5309), minimum temperature (r=0.4523), relative humidity (r=0.3422), wind speed (r=0.4657) and negatively correlated with rain fall (r=-0.3250) while the budworm was negatively correlated with minimum temperature (r=-0.2675), relative humidity (r=-0.7283) and rainfall (r=-0.7230).

Table 2. Incidence of Key Pests of Sapota through roving Survey at Thandrampattu Block, Tiruvannamalai during 2022-2023

Mean Standard Week	Sapota leaf webber		Sapota bud worm		Coccinellid (No./tree)	Spider (No./tree)
	Damage%	No/ tree	Damage%	No/ tree		
14	26	4	16	3	5	7
16	20	5	10	4	4	5
18	18	4	20	5	5	6
20	20	5	18	4	6	6
22	23	5	8	4	7	3
24	26	5	42	5	6	6
26	21	5	33	6	7	7
28	20	5	25	6	6	6
30	25	5	25	4	5	5

Fig. 2 Incidence of Key Pests of Sapota through roving Survey at Thandrampattu Block, Tiruvannamalai during 2022-2023
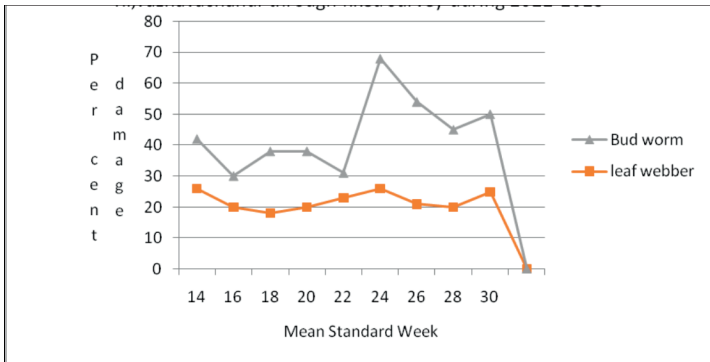
In guava, the incidence of tea mosquito bug was high during the 14th MSW with 40 per cent while the minimum was recorded during 16th MSW at 23 per cent. The incidence of mealybug was high during 28th MSW with 30 per cent while the minimum was recorded during the 14th and 16th MSW with 14 per cent. The mean incidence of ladybird beetle was high during 20th MSW with 9 numbers per plant while the minimum was recorded during the 22nd and 30th SMW with 2 numbers per plant respectively. The mean incidence of spiders was seen higher during 16th SMW with 9 while the minimum was recorded during 22nd and 26th SMW with 3 per plant (Table 3 and Fig. 3).. Guava tea mosquito bug was positively correlated only with wind speed (r=0.0180) and negatively correlated with maximum temperature (r=-0.2768), minimum temperature (r=-0.3431), relative humidity (r=-0.4394) and rainfall (r=-0.3423) whereas the mealybug incidence was positively correlated with maximum temperature (r=0.3531), minimum temperature (r=0.2698) and relative humidity (r=0.1679) and negative correlation with wind speed (r=-0.0255) and rainfall (r=-0.7234) (Table 4). The coefficient of determination (R2) was 0.56, 0.45, 0.51, 0.43, 0.68, 0.44 and 0.39 showed that as much as 56%, 45%, 51%, 43%, 68%, 44%, 39% variation in the incidence of pests in mango, sapota and was due to the effect of weather factors in the Thandrampattu block, Tiruvannamalai District (Table 5).

Table 3. Incidence of Key Pests of Guava through roving Survey at Thandrampattu Block, Tiruvannamalai during 2022-2023

Mean Standard Weak	Tea mosquito bug		Mealybug		Coccinellid (No./tree)	Spider (No./tree)
	Mean Shoot Damage %	No./ Shoot	Mean shoot Damage%	No./ shoot		
14	40	0.7	17	5	5	6
16	23	0.3	14	5	6	6
18	25	0.6	14	4	5	5
20	29	0.4	22	5	5	5
22	31	0.5	16	5	6	7
24	29	0.9	17	5	6	6

26	27	0.2	25	5	5	7
28	30	0.1	30	4	4	4
30	25	0.3	26	5	5	6

Fig. 3. Per cent Damage of Key Pests of Guava through roving Survey at Thandrampattu Block, Tiruvannamalai during 2022-2023
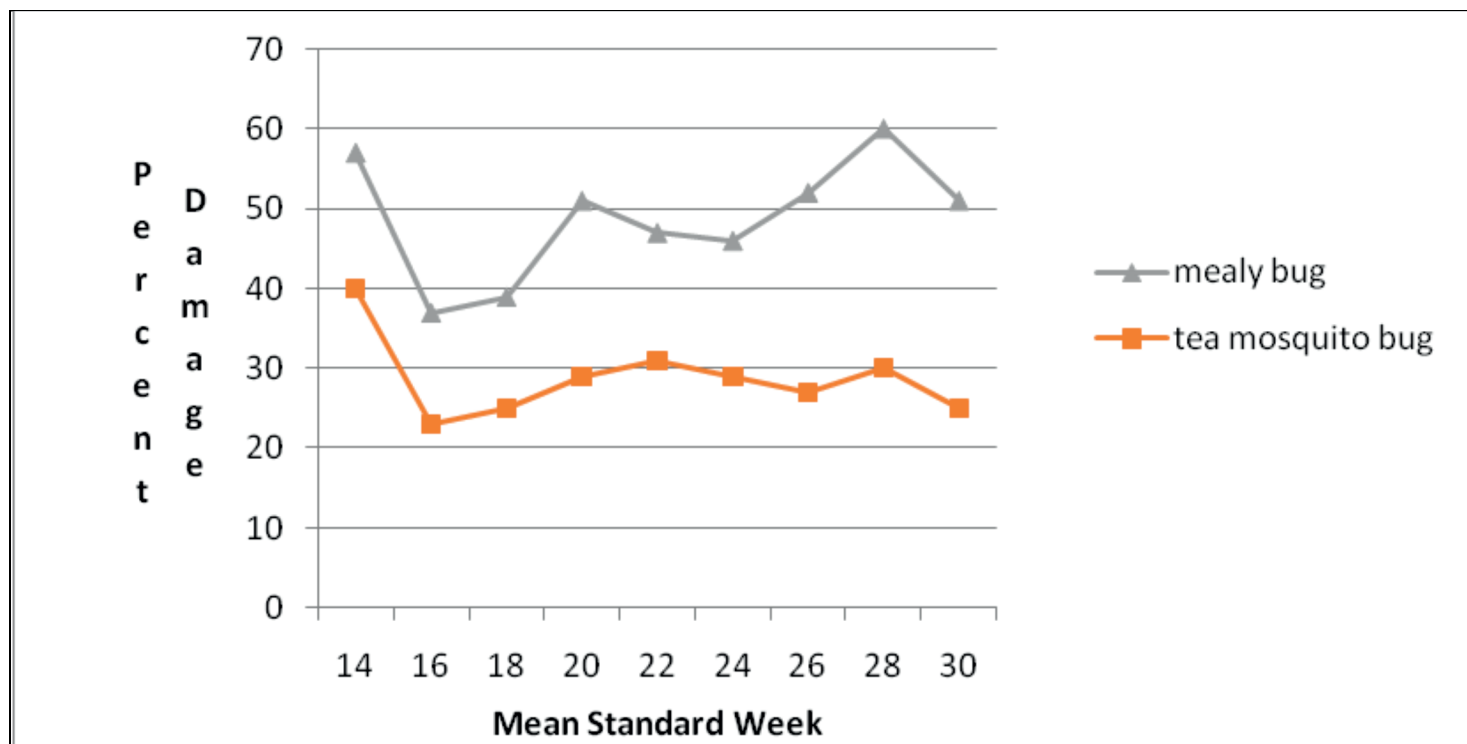

Table 4. Correlation co-efficient between insect pests of mango, sapota and guava with weather parameters in Thandrampattu Block 2022-2023

Weather parameters	R values						
	Mango			Sapota		Guava	
	Hopper	Leaf gall	Leaf twisting weevil	Sapota leaf webber	Sapota bud worm	Tea mosquito bug	Guava mealy bug
Maximum Temperature	0.0971	0.6205	0.6304	0.5309	0.1954	-0.2768	0.3531
Minimum Temperature	-0.41192	0.3022	0.3023	0.4523	-0.2675	-0.3431	0.2698
Relative Humidity	-0.0568	0.6739	0.4309	0.3422	-0.7283	-0.4394	0.1679
Wind Speed	0.0020	0.3566	0.4567	0.4657	0.0526	0.0180	-0.0255
Rainfall	-0.6231	-0.544	-0.3456	-0.3250	-0.7230	-0.3423	-0.7234

Table 5 Regression of Mango hoppers and weather parameters at Thandrampattu block, during 2022-2023

Pests	Regression Equation	R^2 value
Mango hoppers	Y=-0.4234+(-0.0326)X1+(0.0222) X2+(0.0937)X3+(-0.0024)X4	0.56
Leaf Gall	Y=-0.1285+(-0.1023)X1+(0.0099) X2+(0.0609)X3+(-0.0045)X4	0.45
Leaf twisting weevil	Y=-0.0539+(-0126)X1+(0.0927) X2+(0.0801)X3+(-0.0234)X4	0.51
Sapota Leaf Webber	Y= -2.4536+(0.0531)X1+(-0.0202)X2+(0.0426)X3+(-0.0034)X4	0.43
Sapota budworm	Y= -1.0793+(0.0059)X1+(-0.0093)X2+(0.0834)X3+(-0.0075)X4	0.68

Guava Tea Mosquito Bug	Y= -5.0730+(0.0526)X1+(-0.0607)X2+(0.0323)X3+(-0.0023)X4	0.44
Guava mealy bug	Y= -4.003+(0.0093)X1+(-0.0272)X2+(0.0999)X3+(-0.0092)X4	0.39

Discussion

The present findings are in accordance with the findings of [14] who studied the seasonal incidence pattern of mango leaf hopper and leaf twisting weevil on mango during kharif season of the year 2011-12 and reported that the average adult population of mango leaf hopper attained its peak during 9th SMW, followed by 8th SMW and the lowest population was recorded during 11th SMW. Per cent pod damage was recorded highest (26.8%) during the 9th SMW followed by 21 percent damage during 8th SMW. A similar trend of population buildup of sapota budworm was also observed. The results obtained were in partial accordance with [21] who reported that sapota leafwebber infestation was started during 35th SMW and continued up to 48th SMW. Similarly, [15] also reported that the first occurrence of tea mosquito bug on guava tree during 40th SMW and it attained peak during 44th and 45th SMW. The present results also confirmed the findings of [19] who reported negative impact of rainfall on the pest population. In the present investigation also, rainfall exhibited significant negative relationship with pest population. Moreover [16] also reported that both maximum and minimum temperature exhibited positive impact on the pest population that further supported the present findings. On the contrary, [15] found that the temperature, relative humidity and water evaporation had negative and non significant correlations with population buildup of leaf hopper. This result is in consistent with [10] who showed that variations of different weather variables like temperature, relative humidity, sunshine hours, and wind velocity caused approximately 91.1 per cent variation in the mango leafhopper population in ecosystem. These reports further strengthen the findings of the present study.The present study indicates that leafhopper was emerging as a serious insect pest of mango in the Varanasi region during the reproductive stage of mango crop and its activity increased with increasing maximum temperature and decreased with decreased rainfall recorded morning or evening. From the present findings, it can also be inferred that there was only single peak without any multiple peaks or overlapping broods. Hence the farmers can be alerted during February month to take up suitable management practices for effective management of this insect pest on sapota. Such studies on population buildup of insect pests and their relationship with weather parameters provide a clue to improve the IPM strategy against insect pests infestation and also help in making timely predictions of the occurrence of the pest. In conclusion, the study of seasonal incidence of insect pests is one of the most important objectives of pest management. This provides the data of seasonal fluctuation and peak activity of insect pests. Correlation study of insect-pest populations with weather parameters also provides information about weather influence on insect pest population. The information collected in this study was very useful for taking necessary forecasting measures to manage pests. The present findings are in accordance with the findings of [11] who studied the seasonal incidence pattern of guava tea mosquito bug and guava mealy bug on the guava during kharif season of the year 2017-18 who reported that average adult population of tea mosquito bug attained its peak on 9th standard week, followed by 8th SMW and lowest population of was recorded in the 11th standard week. Per cent mealybug damage was recorded highest during 9th MSW (26.8%) followed by 21 percent damage in 8th SMW. A similar trend of population buildup of sapota budworm was also observed in the present investigation. The results are also in partial accordance with [16] who reported that sapota leafwebber infestation started in the 35th SMW and continued up to 48th SMW. The present results also confirmed the findings of [6] that the findings were negatively correlated with pest of sapota like budworm and sapota leafwebber, they also reported a negative impact of rainfall on the pest population. In our findings also rainfall exhibited a significant negative relationship with pest population. Both maximum and minimum temperature exhibited positive impact on the pest population further supported the present findings [10]. On the contrary, [15] found that temperature, relative humidity and water evaporation had negative non non-significant correlation with population buildup of budworm. Similar trend seen in variations of different weather variables like temperature, relative humidity, sunshine hours and wind velocity caused approximately 91.1 per cent variation in sapota budworm population in the ecosystem [25]. The results obtained were in partial accordance with [13] who reported that sapota leafwebber infestation was started during 35th SMW and continued up to 48th SMW. Similarly, [23] also reported that the first occurrence of guava tea mosquito bug on guava tree was recorded during 40th SMW and it attained peak during 44th and 45th SMW. On the contrary, [16] found that the temperature, relative humidity and water evaporation had a negative non significant correlation with population buildup of budworm. Similar observations were seen with [15] that the variations of different weather variables like temperature, relative humidity, sunshine hours and wind velocity caused approximately 62.2 percent variation in the sapota budworm population in the ecosystem.

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