

Research Article

INTENSITY OF INFESTATION BY FRUIT FLIES ON GUAVA UNDER TERAJ AGRO ECOLOGICAL REGION OF WEST BENGAL

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ABSTRACT

The experiments were conducted to determine the intensity of infestation by fruit flies in guava orchard in the northern districts of West Bengal, India. A survey was conducted in the major guava growing areas of the terai and hilly regions of West Bengal especially in northern districts. Total one hundred (100) fruits were collected randomly at three times from each orchard of different locations and then taken to the laboratory for critical examination of fruit flies infestation. During 2014, results showed that highest fruit infestation (25.00%) was recorded from Posarir Hat area of Cooch Behar district and lowest infestation (9.67%) was found in Kharibari area of Darjeeling district whereas in 2015, the highest infestation (28.33%) was recorded in Posarir Hat and lowest infestation (8.67%) was recorded in Matigara area of Darjeeling district. The present findings may be useful information for development of effective management practices of fruit flies to avoid huge yield loss in guava in northern part of West Bengal.

INTRODUCTION

India is the second largest producer of fruits in the world with an annual production of 3648 million tonnes, from an area of 262 million hectares, and contributes to more than 9% of world's fruit production. Among the Indian states Uttar Pradesh ranks first with 919.94 million tonnes from 49.01 million hectares followed by West Bengal with 202.95 million tonnes from an area of 15.67 million hectares (Anonymous, 2017). To date, with increasing globalization, it has become a challenge for our country not only to feed its own population but also to export fruits and vegetables to various developed countries so as to earn foreign currency. This requires strict quality control and restrictive quarantine measures. Guava is one of the most common and a major fruit of India and it is also considered as the fifth most important fruit in respect of its area and production after mango, citrus, banana and apple. Guava, the "poor man's fruit" or "apple of the tropics" was a popular fruit tree of the tropical and subtropical climates. In spite of high economic value, fruit is seriously damaged by different environmental factors and pests which include diseases, birds, insects and mites. About 80 species of insects have been recorded on guava trees, affecting yield and quality of fruits. Of these, fruit flies, bark-eating caterpillars, fruit borer and coccids (scale insects and mealy bugs) are considered as major pest of guava, while aphids,

white flies, thrips, stem borers and fruit borers etc., are the minor pests (NHM, 2012). Tephritid fruit flies are one of the most high profile insect pests of commercial fruit and vegetable growers, marketing exporters, government regulatory agencies, and the scientific community. Locally, fruit growers face huge losses due to fruit fly without any management options advocated. At the national and international level, plant protection agencies strictly regulate the movement of potentially infested products.

The infestation of fruit flies is a major limiting factor in production of guava. Guava fruit has high demand but severe fruit flies infestation during summer by *Anastrepha striata* Schiner and *Bactrocera zonata* Saunders badly reduces the marketable yield, which results in significant economic losses to growers (Khan et al., 2017). Sharma et al. (2011) mentioned that *B. dorsalis* had been reported to cause up to 100% fruit damage in rainy season guava. Fruit fly prefers guava as a host and maggot causes the main damage by feeding inside the fruit during their growth and development (Stonehouse et al., 2005). Rottaning of infested fruit results in excessive fruit drop and also make it inedible for the consumers.

Northern part of West Bengal substantially produces different kinds of fruits. Fruit fly infestation being the major obstacle in the production and marketing of guava,

successful cultivation and export are highly dependent on sound management of fruit fly. Before emphasizing on development of appropriate management practices of fruit flies and subsequently application in field, severity and extent of damage by fruit flies on guava need to be determined in a particular region. Therefore, the present study was aimed to determine the infestation levels of fruit flies on guava in different locations of terai and hilly agro ecological region of West Bengal.

MATERIALS AND METHODS

The present study was conducted in a commercial guava orchard located in Cooch Behar, Jalpaiguri, Alipurduar and Darjeeling districts of West Bengal. Intensity of fruit flies infestation on guava was determined through survey of twenty guava growing areas from four districts on commercial guava orchards of 4-12 years old. The information on fruit infestation by fruit flies from different localities under northern tract of West Bengal was subjected to cluster analysis. The fruits were collected from different locations of Cooch Behar, Alipurduar, Jalpaiguri and plains of Darjeeling district. Total one hundred (100) fruits were collected randomly at three times i.e. early, mid and late stage of the crop during September, 2014 to April, 2015.

Table 1. Geographical locations of the survey area to study the level of fruit flies infestation in guava

District	Location	Latitude	Longitude
Cooch Behar	Chilkirhat	26°53'N	89° 19'E
	Morangabari	21°91'N	87° 26'E
	Posarir Hat	23° 73'N	88° 23'E
	Dinhata	26° 13'N	89° 46'E
	Vetaguri	26° 20'N	89° 48'E
	Maruganj	26° 30'N	89° 56'E
	Pundibari	26° 41'N	89° 38'E
	Horir Hat	26° 39'N	89° 49'E
	Sajerpar	26° 29'N	89° 19'E
Jalpaiguri	Gadong-1	26° 55'N	89° 10'E
	Gadong-2	26° 54'N	89° 17'E
	Moinaguri	26° 57'N	88° 82'E
	Dhupguri	26° 58'N	89° 00'E
Alipurduar	Sonapur	26° 46'N	89° 39'E
	Falakata	26° 53'N	89° 19'E
	Chandmoni	25° 26'N	88° 02'E
	Naksalbari	26° 70'N	88° 42'E
Darjeeling	Matigara	26° 72'N	88° 38'E
	Kharibari	26° 55'N	88° 19'E
	Phasidewa	26° 58'N	88° 37'E

The collected fruits were kept in laboratory for few days to exhibit infestation if any egg deposited by fruit flies inside the fruit. Then all fruits were cut and critically examined for the presence of fruit fly maggots under magnifying lens. The fruits with maggots of fruit flies were treated as infested fruits and without maggots were treated as healthy fruits. The observations on numbers of healthy and infested fruits were recorded and then percent infestation due to fruit flies was determined. Data obtained were analyzed by standard statistical package after suitable transformation. The places or location which are more or less approximately similar based on have been categorised in respective clusters. Significant differences have been detected among the clusters by performing Levens test of analysis. Number of infested and fresh fruits was recorded at each instance. Percent infestation was calculated as per the following formula:

$$\% \text{ infestation} = \frac{\text{Infested fruits (No.)}}{\text{Total fruits observed (No.)}} \times 100$$

Table 2. Fruitflies infestation (by number) on guava during 2014 and 2015 in different parts of northern West Bengal

Locations	Percent fruit flies infestation at different locations		Mean percent infestation (Pooled of two years)
	2014	2015	
Chilkirhat	22.00(4.69)	24.00(4.90)	23.00(4.80)
Morangabari	13.33(3.65)	21.00(4.58)	17.17(4.14)
Posarir Hat	25.00(5.00)	28.33(5.32)	26.67(5.16)
Dinhata	14.33(3.79)	21.67(4.66)	18.00(4.24)
Vetaguri	21.00(4.58)	17.33(4.16)	19.17(4.38)
Maruganj	18.00(4.24)	14.33(3.79)	16.17(4.02)
Pundibari	11.33(3.37)	11.00(3.32)	11.17(3.34)
Horir Hat	15.00(3.87)	12.67(3.56)	13.83(3.72)
Sajerpar	11.33(3.37)	11.00(3.32)	11.17(3.34)
Sonapur	24.00(4.90)	24.33(4.93)	24.17(4.92)
Falakata	12.00(3.46)	19.67(4.44)	15.83(3.98)
Gadong-1	12.67(3.56)	24.00(4.90)	18.33(4.28)
Gadong-2	12.00(3.46)	12.00(3.46)	12.00(3.46)
Moinaguri	13.67(3.70)	13.67(3.70)	13.67(3.70)
Dhupguri	13.67(3.70)	22.33(4.73)	18.00(4.24)
Chandmoni	13.00(3.61)	12.33(3.51)	12.67(3.56)
Naksalbari	17.67(4.20)	11.00(3.32)	14.33(3.79)
Matigara	12.33(3.51)	8.67(2.94)	10.50(3.24)
Kharibari	9.67(3.11)	11.33(3.37)	10.50(3.24)
Phasidewa	17.67(4.20)	17.00(4.12)	17.33(4.16)

* Figures within parenthesis are square root transformed values.

RESULTS AND DISCUSSION

The observations pertaining with fruit flies infestation on guava at different locations of four districts of northern part of West Bengal have been presented in Table-2. The data revealed that infestation by fruit flies on guava at different districts were significantly varied from location to location in both the years. The percent fruit infestation on guava varied from 9.67% to 25.00% and 8.67% to 28.33% during 2014 and 2015, respectively. However, two years pooled data showed that the highest infested fruit (26.67%) was observed at Posarir Hat locality and lowest (10.50%) was noted at Matigara and Kharibari area. The results of cluster analysis have been presented in Table 3 & 4.

Cluster analysis showed that, during 2014, the mean values indicated that highest infestation was recorded as 21.28% in CL1 (Cluster 1) followed by 12.89% in CL2 (Cluster 2) presented in Table 3. The highest percentage of fruit infestation was found to vary from 17.67% to 25.00% at different locations i.e. Naksalbari, Phasidewa, Maruganj, Posarir Hat, Vetaguri, Chilkirhat, Sonapur under northern part of West Bengal and the lowest infestation varied from 11.33% to 15.00% at Kharibari, Pundibari, Sajerpar, Falakata, Gadong2, Matigara, Gadong1, Chandmoni, Morangabari, Dhupguri, Moinaguri, Dinhata and Horir Hat in cluster 2 (Figure 1).

Table 3. Cluster analysis of fruit flies infestation on guava at different locations during 2014

Cluster number	Percent fruit infestation				Name of the locations
	Mean	Variance	Min. value	Max. value	
CL1	21.28	9.470	17.67	25.00	Naksalbari, Phasidewa, Maruganj, Posarir Hat, Vetaguri, Chilkirhat, Sonapur
CL2	12.89	2.027	11.33	15.00	Kharibari, Pundibari, Sajerpar, Falakata, Gadong2, Matigara, Gadong1, Chandmoni, Morangabari, Dhupguri, Moinaguri, Dinhata, Horir Hat
Levens test Statistic			14.32		
p-value			0.001		

*CL- Cluster.

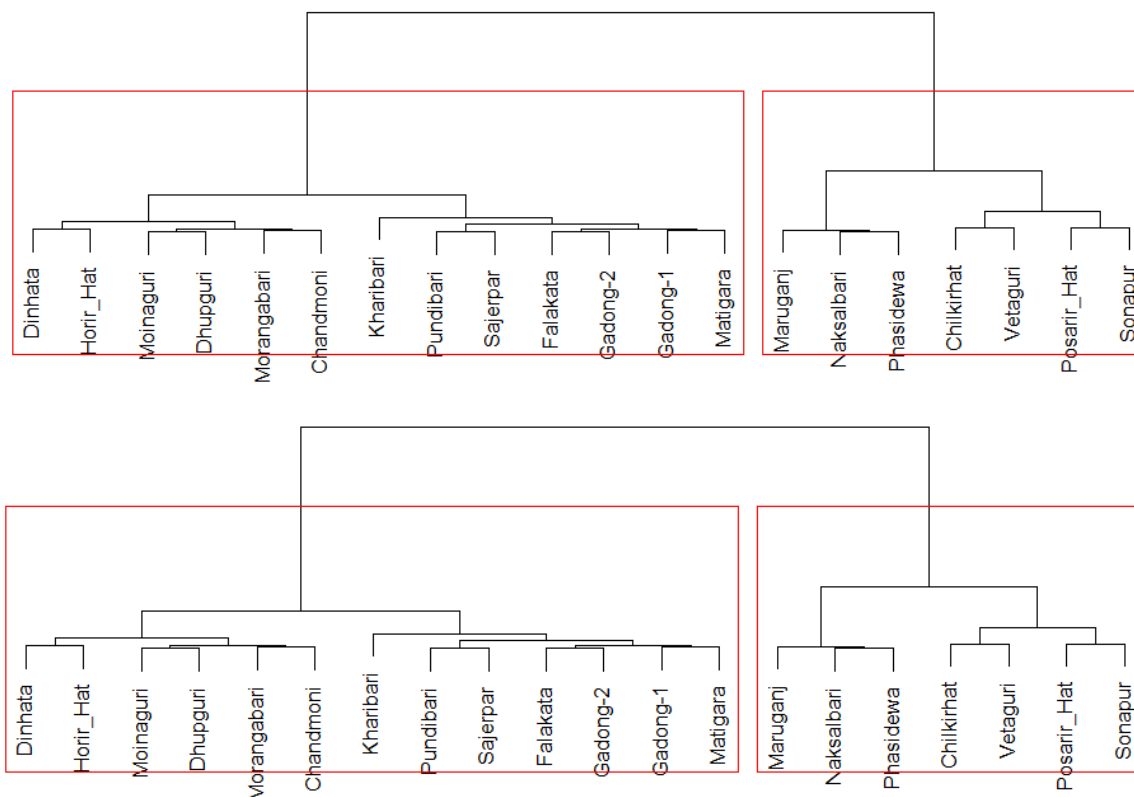


Fig. 1. Cluster dendrogram on intensity of fruit flies infestation on guava at different Locations during 2014

During 2015, mean values of the data revealed that the fruit fly inflicted highest infestation (22.52%) on guava in CL1 (Cluster 1) followed by CL2 (Cluster 2) (12.15%) presented in Table 4. The highest percentage of infestation was varied from 17.33% to 28.33% at Phasidewa, Vetaguri, Falakata, Moranga, Dinhata, Dhupguri, Chilkirhat, Gadong1, Sonapur, Posarir Hat and the lowest infestation was varied from 11.00% to 14.33% at Matigara, Naksalbari, Pundibari, Sajerpar, Kharibari, Gadong2, Chandmoni, Horir Hat, Moinaguri and Maruganj (Figure 2).

The fruit flies infestations in guava studied earlier by many researchers from different part of the world. Wide variation

of fruit flies damage in guava were recorded from different locations by earlier workers. The present findings are in agreement with the results of Hasseb (2007) who found 20-46% fruit fly infestation on guava. Highest crop loss of about 80% in guava was reported by Kafi (1986) and Ishtiaque *et al.* (1999) in Pakistan. Similarly, Jalaluddin *et al.* (1999) reported 60-80% loss in guava fruit by *Bactrocera correcta* (Bezzii) while Verghese *et al.* (2002b) reported infestation by fruit flies to guava ranged from 5-7%. Mehmood and Mishkatullah (2007) reported the highest percentage (80%) of fruit fly infestation in guava orchards during ripening stage.

Table 4. Cluster analysis of fruit fly infestation on guava at different locations during 2015

Cluster number	Percent fruit infestation				Name of the locations
	Mean	Variance	Min. value	Max. value	
CL1	22.52	11.887	17.33	28.33	Phasidewa, Vetaguri, Falakata, Morangaba, Dinhata, Dhupguri, Chilkirhat, Gadong1, Sonapur, Posarir Hat
CL2	12.15	2.548	11.00	14.33	Matigara, Naksalbari, Pundibari, Sajerpar, Kharibari, Gadong2, Chandmoni, Horir Hat, Moinaguri, Maruganj
Levens test Statistic			4.85		
p-value			0.04		

*CL- Cluster.

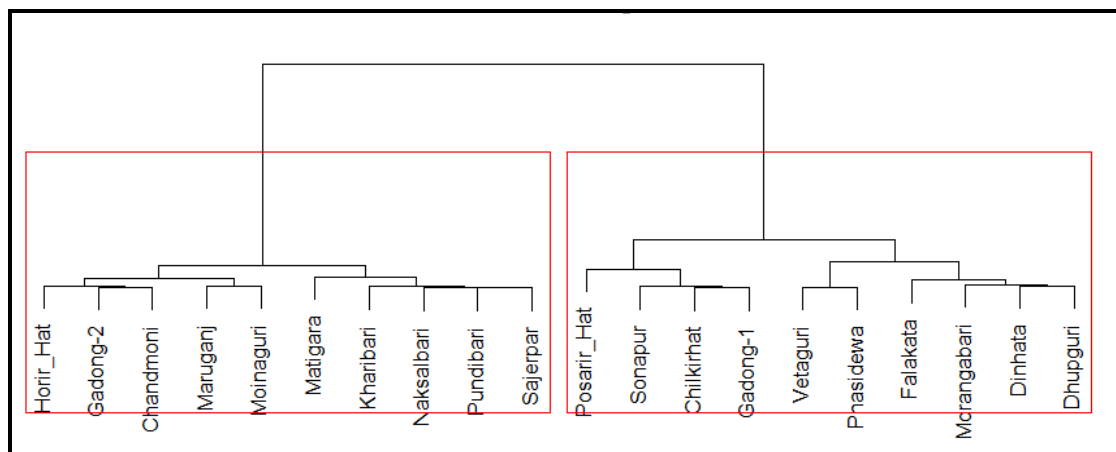


Fig. 2. Cluster dendrogram on intensity of fruit flies infestation on guava at different locations during 2015

Yan-mei *et al.* (2011) also reported that the fruit damage rate of guava was 6.67-7.33% by oriental fruit fly. Fruit loss in guava orchards due to fruit fly infestation was estimated to the extent of 13.40 to 46.60% and 12.50-42.86%, respectively on weight basis and number basis (Ukey *et al.*, 2012). Kakar *et al.* (2014) also reported that the fruit fly infestation was varied from 3.00-49.67% on guava in Khyber Pakhtunkhwa. Thus, findings of the present study may be augmented the information on severity of fruit flies infestation in guava particularly under northern part of West Bengal.

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