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## Fruit fly infestation in mango: A threat to the terai and hilly agro ecological region of West Bengal

**G Roy, N Laskar and S Sarkar**

**Abstract**

Fruit flies (Diptera: Tephritidae) are one of the most important insect pests to fruits worldwide. In West Bengal, fruit flies have inflicted considerable yield losses especially in mangos (*Mangifera indica* L.). However, there has been no recent assessment of the associated economic damage impact despite the outcries from the farming communities. The objective of this study was to determine the intensity of infestation by fruit flies in important fruits of mango, to guide the development and improvement of fruit fly control measures in the mango orchard especially northern part of West Bengal. A survey was conducted in the major mango producing areas of the northern part of West Bengal. The fruits were collected from different locations of Cooch Behar, Alipurduar, Jalpaiguri and plains of Darjeeling district. From each location altogether one hundred (100) fruits were collected randomly at three times i.e. early, mid and late stage of the crop during 2014 and 2015. During 2014, results showed that highest fruit infestation on mango (16.33%) by fruit flies was recorded from Chilkir hat (26°53'N, 89°19'E) and lowest (7.33%) infestation was noted from Matigara (26°72'N, 88°38'E). However, in the next year i.e. during 2015, the fruit infestation was recorded higher (15.00%) from Naksalbari (26°70'N, 88°42'E) and lower (7.33%) was recorded from Pundibari (26°41'N, 89°38'E). Pooled mean of both the years of study revealed highest average infested fruit (13.67%) at Chilkir hat localities while lowest (7.83%) at Pundibari on number basis. It was common to experience 100% fruit losses across the agro-ecological zones in the absence of control measures. The situation was increasingly severest with exotic commercial varieties.

**Keywords:** Fruit fly, diptera, infestation, *Mangifera indica*

**Introduction**

In India, mango, *Mangifera indica*, is a major fruit crop with high potential for exports. Many species of the fruit flies has economic importance in tropics and subtropics region in India. The fly is distributed in the Oriental regions of Bhutan, China, Myanmar, Thailand and India. Fruit flies (Diptera: Tephritidae) are recognized worldwide as the most important insect pests on various commercial fruits such as mango (*Mangifera indica* L.) (Drew *et al.*, 2005; Vayssières *et al.*, 2008; Ekesi *et al.*, 2009) [4, 14, 5]. Female fruit flies lay eggs by inserting them beneath the skin of mature and ripening mango in clusters but a small number can also oviposit into unripe fruit (Rattanapun, 2009) [12]. Female of *B. dorsalis* usually lays eggs ranging from 10-50 eggs per cluster (Mohd *et al.*, 2011) [8]. In 1 to 2 days, the eggs hatched and the larvae (the whitish maggots) feed on the fruit flesh and contaminating it with frass and providing entry for fungi and bacteria. As a result, the fruits become soft, watery and rot and this caused fruit to damage and drop on the ground prior to harvest. Infested fruits quickly rot and become inedible or drop on the ground, thus causing direct loss to the farmer. Without control, direct damage has been reported from 30 to 100% depending on the fruit maturity stage, variety, location and season (Mwatawala *et al.*, 2006; De Meyer *et al.*, 2007; Vayssières *et al.*, 2008; 2009) [9, 3, 14, 15]. In India, the loss in fruit yield ranges from 1 to 31% with a mean of 16% (Verghese *et al.*, 2002) [17]. For instance, in (Vayssières *et al.*, 2009) reported that losses due to fruit flies ranged from 17% to 73% for mango in West Africa, whilst (Lux *et al.*, 1998) [1] reported that 30-80% of mango losses in Nguruman, Kenya. The flies not only cause economic loss but are also of quarantine importance. Their occurrence has resulted in strict fruit quarantine and export prohibitions for countries known to contain those flies. Based on the serious damage caused by fruit flies, it is very crucial to determine the infestation level in field as it is one aspect of fundamental importance in the management of fruit flies. Therefore,

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this study was aimed to determine the infestation levels of fruit flies on mango in different locations of terai and hilly agro ecological region of West Bengal.

### Materials and Methods

Intensity of fruit fly infestation on important fruit crop such as mango was determined through survey on farmers field. The fruits were collected from different location of Cooch Behar, Alipurduar and Jalpaiguri district. From each locations altogether one hundred (100) fruits were collected randomly at three times i.e. early, mid and late stage of the crop from four farmers field during 2014 and 2015. These fruits were kept in laboratory for ripening in rearing cages under observation. The ripen fruits were cut and critically examined for the presence of fruit fly maggots under magnifying lens. The fruits with maggots of fruit fly 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 fly was determined. Number of infested and fresh fruits was recorded at each instance. Percent infestation was calculated as per the following:

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

The investigation was conducted for two successive years and pooled together for final determination of intensity of infestation by fruit fly. Data obtained were analyzed by standard statistical package and presented in both tabular as well as graphical form. Geographical location of the survey areas are as follows in tabular form:

**Table 1:** Geographical location of the survey area for installation of traps, collection of infested fruits etc. 1.1. Survey locations for fruits and vegetables.

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
Jalpaiguri	Sajerpar	26° 29'N	89° 19'E
	Gadong-1	26° 55'N	89° 10'E
	Gadong-2	26° 54'N	89° 17'E
	Moinaguri	26° 57'N	88° 82'E
Alipurduar	Dhupguri	26° 58'N	89° 00'E
	Sonapur	26° 46'N	89° 39'E
Darjeeling	Falakata	26° 53'N	89° 19'E
	Chandmoni	25° 26'N	88° 02'E
	Naksalbari	26° 70'N	88° 42'E
	Matigara	26° 72'N	88° 38'E
	Kharibari	26° 55'N	88° 19'E
	Phasidewa	26° 58'N	88° 37'E

### Results and Discussion

Observation on fruit fly infestation in mango orchards from different districts under northern part of West Bengal has been presented in table-2. It appears from the presentation that there exists significant variation in intensity of fruit fly infestation on mango during both the years of study (2014 and 2015) at different locations. Higher fruit infestation was recorded in 2014 as compared to 2015. During 2014, results showed that highest fruit infestation on mango (16.33%) by fruit flies was recorded from Chilkir hat (26°53'N, 89°19'E) and lowest (7.33%) infestation was noted from Matigara (26°72'N, 88°38'E). However, in the next year i.e. during 2015, the fruit infestation was recorded higher (15.00%) from Naksalbari (26°70'N, 88°42'E) and lower (7.33%) was

recorded from Pundibari (26°41'N, 89°38'E). Pooled mean of both the years of study revealed highest average infested fruit (13.67%) at Chilkir hat localities while lowest (7.83%) at Pundibari on number basis.

The information on fruit infestation by fruit flies from different localities under northern tract of West Bengal was subjected to cluster analysis and results have been presented in table-3 and 4. In table the statistics like mean, variance, minimum value, maximum value are mentioned and 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.

**Table 2:** Percent fruit infestation (by number) by fruit flies on Mango during 2014 and 2015 in different parts of northern West Bengal.

Locations	2014	2015	Pooled over (2014-2015)
Chilkirhat	16.33 (4.04)	11.00 (3.32)	13.67 (3.70)
Morangabari	13.33 (3.65)	9.33 (3.05)	11.33 (3.37)
Posarir Hat	8.67 (2.94)	12.00 (3.46)	10.33 (3.21)
Dinhata	13.00 (3.61)	8.67 (2.94)	10.83 (3.29)
Vetaguri	15.33 (3.92)	8.00 (2.83)	11.67 (3.42)
Maruganj	11.33 (3.37)	13.00 (3.61)	12.17 (3.49)

Pundibari	8.33 (2.89)	7.33 (2.71)	7.83 (2.80)
Horir Hat	8.67 (2.94)	9.67 (3.11)	9.17 (3.03)
Sajerpar	11.67 (3.42)	7.67 (2.77)	9.67 (3.11)
Sonapur	11.00 (3.32)	14.00 (3.74)	12.50 (3.54)
Falakata	9.00 (3.00)	9.00 (3.00)	9.00 (3.00)
Gadong-1	9.67 (3.11)	13.00 (3.61)	11.33 (3.37)
Gadong-2	8.00 (2.83)	8.67 (2.94)	8.33 (2.89)
Moinaguri	8.33 (2.89)	12.00 (3.46)	10.17 (3.19)
Dhupguri	8.33 (2.89)	12.00 (3.46)	10.17 (3.19)
Chandmoni	8.67 (2.94)	12.67 (3.56)	10.67 (3.27)
Naksalbari	9.33 (3.05)	15.00 (3.87)	12.17 (3.49)
Matigara	7.33 (2.71)	10.00 (3.16)	8.67 (2.94)
Kharibari	8.00 (2.83)	9.00 (3.00)	8.50 (2.92)
Phasidewa	11.67 (3.42)	12.00 (3.46)	11.83 (3.44)

\* Figures within parenthesis are square root transformed values.

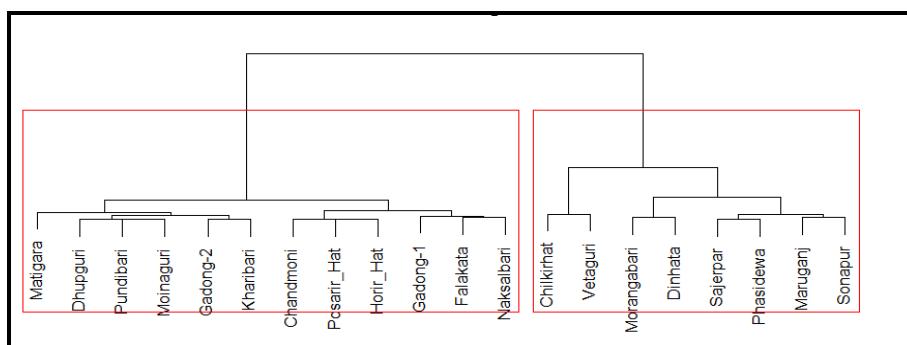
During 2014, mango fruit infestation by fruit flies was significantly higher (mean value = 13.23%) in CL1 (Cluster 1) and range varied from 11.33 - 16.33% on number basis at Sonapur, Maruganj, Phasidewa, Sajerpar, Dinjata, Morangabari, Vetaguri and Chilkirhat, while lowest fruit

infestation (mean value = 8.63%) was noted in CL2 (Cluster 2) and range varied from 8.00-9.66% on number basis at Matigara, Gadong2, Kharibari, Dhupguri, Moinaguri, Pundibari, Chandmoni, Horir Hat, Gadong-1, Posarir Hat, Falakata and Naksalbari.

**Table 3:** Cluster analysis of fruit fly infestation on mango in different locations during 2014.

Cluster no.	Percent fruit infestation				Name of the locations
	Mean	Variance	Min. value	Max. value	
CL1	13.23	3.855	11.33	16.33	Sonapur, Maruganj, Phasidewa, Sajerpar, Dinjata, Morangabari, Vetaguri, Chilkirhat
CL2	8.63	0.393	8	9.66	Matigara, Gadong2, Kharibari, Dhupguri, Moinaguri, Pundibari, Chandmoni, Horir Hat, Gadong-1, Posarir Hat, Falakata, Naksalbari
Levens test Statistic					9.63
p-value					0.006

\*CL- Cluster.



**Fig 1:** Cluster dendrogram on intensity of fruit fly infestation on Mango at different locations during 2014.

During 2015, mango fruit infestation by fruit fly was significantly higher in CL6 (15.00%) followed by CL5 (13.00%) and CL3 (12.00%) on number basis. Highest fruit infestation (15.00%) on mango was observed at Sonapur (26° 46'N, 89° 39'E) and Naksalbari (26° 70'N, 88° 42'E) and the lowest (7.83%) was recorded in CL4 and range varied from 7.66-8.00% at different location i.e. Pundibari, Sajerpar and Vetaguri.

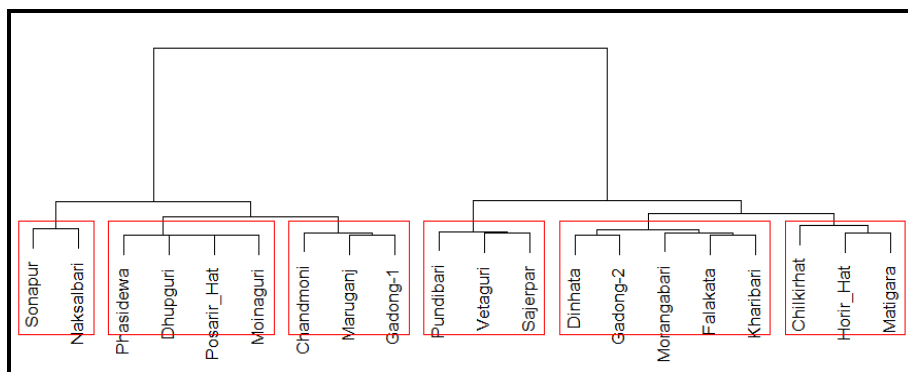
Earlier also several workers worked on fruit flies on mango across the mango growing countries of the world including India. In India, Verghese *et al.* (2002b) [18] reported *Bactrocera dorsalis* (Hendel) as the most destructive pest occurring in homesteads of Kerala and causing 25-50% fruit loss in mango when harvested at the mature ripe stage. The extent of damage on mango was up to 80% when the pest incidence occurs in an epidemic form as reported by Abdullah

(2002) [1] and Latif (2004) [6]. Verghese *et al.* (2002a) [17] reported 2.5 to 59.0% crop loss in mango due to *B. dorsalis* depending upon variety in Bangalore, India. The level of infestation due to *B. dorsalis* in mango was as high as 26.66% in Gujarat Sushil and Bhatt (2002) [13] and 30% in Karnataka Babu and Virakthmath (2003). Patel and Patel (2005) [10] reported fruit fly infestation to the tune of 16-40% on Mango in South Gujrat, India. Patel *et al.* (2013) [11] also reported that the highest fruit fly infestation (36.67%) was observed in ripening cum harvesting period of mango.

In the present study also the dominant species that infest mango was detected as *B. dorsalis*. Other findings with regard to intensity of infestation are also more or less corroborated with these literatures. Minor variations are may be due to locational as well as varietal variations of the study.

**Table 4:** Cluster analysis of fruit fly infestation on mango in different locations during 2015.

Cluster number	Percent fruit infestation				Name of the locations
	Mean	Variance	Min. value	Max. value	
CL1	10.5	0.481	10	11	Horir_Hat, Matigara, Chilkirhat
CL2	9	0.077	8.66	9.33	Dinhata, Gadong-2, Falakata, Kharibari, Morangabari
CL3	12	0.000	12	12	Dhupguri, Moinaguri, Phasidewa, Posarir Hat
CL4	7.83	0.111	7.66	8	Pundibari, Sajerpar, Vetaguri,
CL5	13	0.037	13	13	Chandmoni, Gadong-1, Maruganj
CL6	15	0.500	15	15	Sonapur, Naksalbari
Levens test Statistic					3.81
p-value					0.04

**Fig 2:** Cluster dendrogram on intensity of fruit fly infestation on mango at different locations during 2015.

### Conclusion

Studies on intensity of infestation by fruit fly on fruit revealed that highest fruit infestation on mango was found to be 13.67% at Chilkir hat locality while lowest i.e. 7.83% at Pundibari. The infestation rate was found to be diverse in mango orchards due to the different location, season and the harvesting time. So it is one aspect of fundamental importance in the management of fruit flies.

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