

Original Research Article

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Damage Intensity in Relation to Fruit Fly Incidence in Guava (*Psidium guajava* L.) in Orchards of Eastern India

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ABSTRACT

Incidence of fruit fly and damage intensity in guava (*Psidium guajava* L.) in orchards of eastern India, Ranchi, were studied during rainy and winter season in 2013 and 2014 under ICAR-RCER. The observations were recorded on number of flowers and fruits /plant, which indicated that flowers and fruits were higher in number during rainy season. However, the weights of fruits were higher in winter season as compared to rainy. The number of fruits drop were recorded higher in rainy season about 7.72 % in normal planting (NP) and 8.85 % in high density planting (HDP) during first year study (2013). In second year of study (2014), the damages were of rainy season 7.25 % and 8.49% in NP and HDP, respectively. The maximum and minimum winter losses (2013) were 7.50 % and 5.02% in NP and HDP planting, respectively. Furthermore, identification of fruit fly species was studied at Patna and Ranchi during 2014, simultaneously. It has been found that *Bactrocera zonata* was trapped more (83.00%) in rainy season as compared to other species (*B. dosalis*, *B. cucurbitae* and *B. tau*) at ICAR-RCER Patna, India, whereas *B. correcta* was trapped more (47.25%) followed by *B. zonata*, *B. dorsalis* and *B. cucurbitae* in the same season in ICAR-RCER, Ranchi.

Keywords

Fruit flies, guava crop loss, methyl eugenol trapping, *Bactrocera sp.*

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Introduction

In agricultural crops, despite of taking suitable crop protection measures, insect pests yet are responsible for an average of 16–18% yield losses (Oerke, *et al.*, 1994 and Oerke 2006). The guava (*Psidium guajava* L.) is one of major fruit crops after mango, banana and citrus grown in the subtropical and tropical region in India. Due to its ease of cultivation

and fetching lower prices in India, guava fruit is known as poor man's apple or apple of tropics. The area and production of this crop are 268.2 Th ha and 3667.9 Th MT (NHB Database, 2014) in India. The infestation of different fruit fly species is the major limiting factor in production of rainy season guava. Infestation in the range of 20-46 per cent with losses of 16 - 40 per cent is observed in U.P., India (Haseeb, 2007).

Rainy season fruits are mainly damaged in a range of 30% through the infestation of guava fruit fly. In USA and in severe case fruit loss reaches up to 3-100% through *Bactrocera zonata*. In Pakistan, the losses are about 50-90%. In Ghana, South Africa, losses of fruit and vegetables are about 70 % due to infestation of different species of *Bactrocera* (GNA, 2016). In guava, 80 % crop loss has been found in India and Pakistan (FAO, 2010). Although detailed studies on crop loss are lacking, the infestation of fruit fly in winter guava is relatively less due to low temperature and dry winter in most parts of the India. In Northern India, guava fruit flies namely; *B. zonata*, *B. dorsalis*, *B. cucurbitae* are the prominent which cause havoc loss on the crop. In South India, *B. correcta* is one of the important fruit fly of guava and emerging recently as an important insect, which can cause 80% damage. A reduction in the total phenolic content in fruits of susceptible cultivars also causes damage (Manoukas, 1993; Md. Jalaluddin and Sadakathulla, 1999). *Dorsalis-zonata-correcta* complex are found in southern India in case of mango and guava crops. Population of *B. correcta* in guava orchards when co-occurring with *B. dorsalis* and *B. zonata* has been the cause of concern of major crop loss for the fruit growers of Southern India. Sometimes population is of 80 % higher than those of both the *B. dorsalis* and *B. zonata* (Kapoor, 2002).

Guava fruit fly, a polyphagous pest, namely; *Bactrocera correcta* (Bezzi) in India, invades wide variety of fruit crops in Ranchi, Jharkhand and may become prominent in the areas of south-western coastal (Kerala, Karnataka, Tamilnadu, Maharashtra and Gujarat) parts of India by 2050 and 2070 (Choudhary *et al.*, 2019). Hence, in the present study, we estimated the crop loss and identified different fruit fly species with critical observations.

Materials and Methods

A field trial was conducted to investigate the level of infestation of fruit flies in guava under east India condition, particularly in the state of Jharkhand and Bihar. Survey was conducted to study the per cent infestation of guava of their respective ecological regions like sub-humid sub-tropical region of Ranchi and subtropical hot and humid region of ICAR RCER, Patna in different orchards. In both the locations two each different orchards of guava with the spacing's of 5m x 5m (NP) and 1m x 2m (HDP) were under study. The no of traps (methyl eugenol) /ha was 12-14. Yield of the orchards and fruit infestation by different fruit flies were calculated. The level of infestation was studied by counting all infested and dropped fruits randomly. The data regarding infestation caused by fruit flies guava were recorded daily in each of the experimental unit. Data were recorded for two consecutive years i.e., 2013 and 2014 from fruit set to maturity. The age of the plants was 4-6 years. The total number of fruits and number of infested fruits were counted and converted into per cent infestation by the following formula.

$$\text{Fruits infestation (\%)} = \frac{\text{No. of infested fruits}}{\text{Total Number of Fruits}} \times 100$$

Data were analyzed according to the procedure of appropriate Randomize Block Design (RBD) with four replications. WASP 2.0 (ICAR, India) package was used for analysis of variance for production and yield loss of guava.

For different types of fruit fly species infestation, the significant means were separated with in the column by using least significant difference (LSD) test (Jan *et al.*, 2009). The cultivar for experiment was Lucknow-49.

Bio-enzyme for source sink relationship (SSR) 3.0 g was applied to (NP) normal planting for guava cultivation (5m x 5m spacing) whereas to get maximum yield in both the years, 40-50 % pruning was imposed for high density planting (HDP). However, species identification was done in both Patna and Ranchi station simultaneously during 2014. Treatments were as follows:

Treatment	Planting Distance	Seasons of Cultivation	Design
T1 NP	5m x 5m	Rainy	RBD
T2 NP	5m x 5m	Winter	RBD
T3 HDP	1m x 2m	Rainy	RBD
T4 HDP	1m x 2m	Winter	RBD

Results and Discussion

A close perusal of the table-1 revealed that during 2013, the maximum no. of flowers (182.94/plant) and fruits (147.11/plant) were produced by the rainy season crop as compared to winter in normal spacing (5m x 5m). The similar trends were also observed by second year regarding rainy crop (table-2). This results were also in corroborated by Menzel and Paxton (1986) regarding total yield in NP orchard and Mehta *et al.*, (2010)

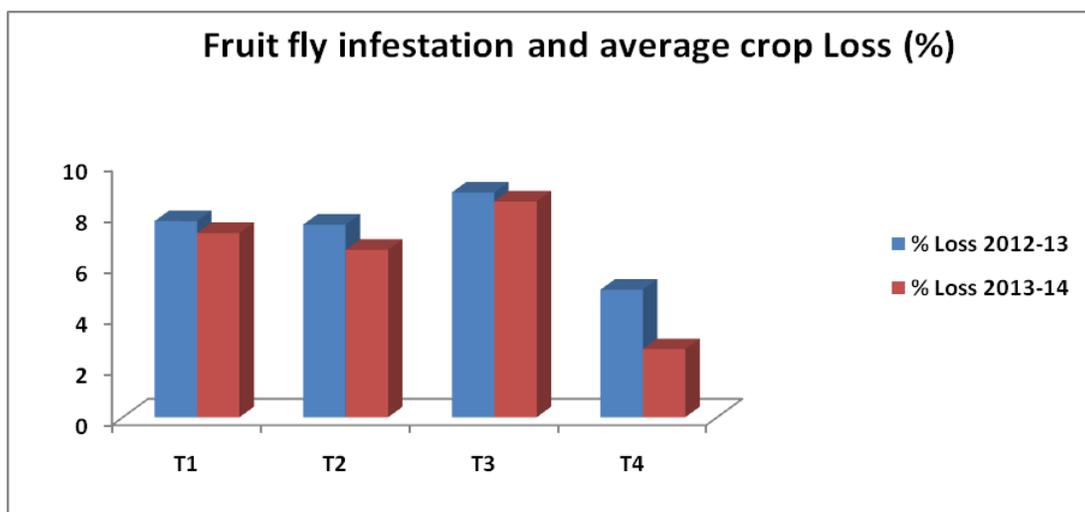
in HDP guava crop under sub-humid, subtropical climate of Jharkhand. In both the years' winter fruit weight were the maximum (>190.0g). These results were also in conformity with the findings of Jana *et al.*, (2010). In case of high density orcharding (HDP) and during rainy season, the productions were 21.61 t/ha and 23.31 t/ha during 2013 and 2014, respectively. The damaged fruits during rainy seasons were 2.097 t/ha and 2.163 t/ha during 2013 and 2014, respectively in NP. Regarding loss during rainy season under HDP was 8.85% in 2013 and 8.49% in 2014 (Fig-1). These results were in accordance with the findings of Kapoor (2002), in India where they noticed that *Bactrocera spp.* were major threat to guava cultivation and damaged about 40 % due to these flies. Jalaluddin *et al.*, (1999) recorded *B. correcta* damaging guava fruits to the extent of 60-80 per cent. Hasseb (2007) reported the infestation of fruit fly *Bactrocera* species to the extent of 20-46 per cent with crop loss of 16-40 per cent in U.P., India. Khanh *et al.*, (2008) observed that the infestation of *Bactrocera* species to the extent of 4.0 per cent, 16.0 per cent and 94.0 per cent in early season, mid-season and late season, respectively, in 2007, in the North Vietnam.

Table.1 Yield and loss assessment of guava due to fruit fly during 2013 at Ranchi

Treatments	No. of Flowers/plant	No. of Fruits /plant	Fruit Weight(g)	Yield (t/ha)	Fruit Drop (Fruit Fly) t/ha	Total yields (t/ha)
T1	182.94	147.11	151.57	8.918	0.746	9.664
T2	72.54	68.23	195.66	5.339	0.438	5.837
T3	42.59	33.15	130.42	21.61	2.097	23.707
T4	30.08	24.82	190.55	23.64	1.249	24.889
CD at 5%	2.26	5.05	4.23	1.23	0.22	2.45

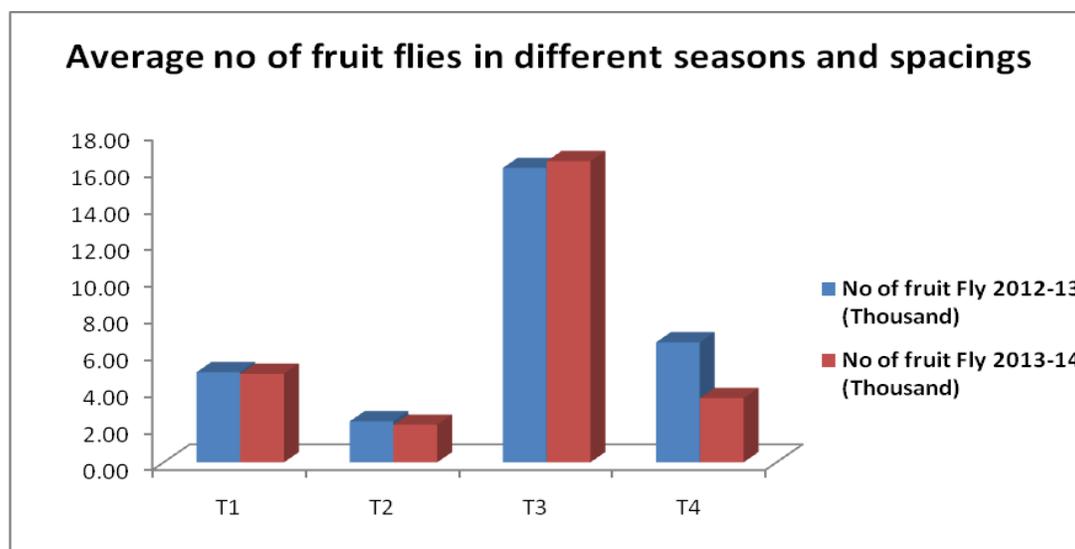
Table.2 Yield and loss assessment of guava due to fruit fly during 2014 at Ranchi

Treatments	No. of Flowers/plant	No. of Fruits /plant	Fruit Weight(g)	Yield (t/ha)	Fruit Drop (Fruit Fly) t/ha	Total yields (t/ha)
T1	204.33	154.69	152.22	9.42	0.736	10.156
T2	83.19	72.75	196.84	5.73	0.404	6.134
T3	47.35	35.46	131.45	23.31	2.163	25.473
T4	31.05	25.45	192.42	24.49	0.674	25.164
CD at 5%	15.53	9.52	10.98	2.91	0.37	3.21



Means were significant at p

Fig.1 Estimation of loss % of guava fruits due to fruit flies during 2012-14



Means were significant at $p > 0.05$

Fig.2 Average population of fruit flies at different spacing of guava orchards at Ranchi



Fig.3 Infected and dropped guava fruits under rainy season in NP (5m x 5m spacing)



Fig.4 *Bractocera zonata* on guava fruits

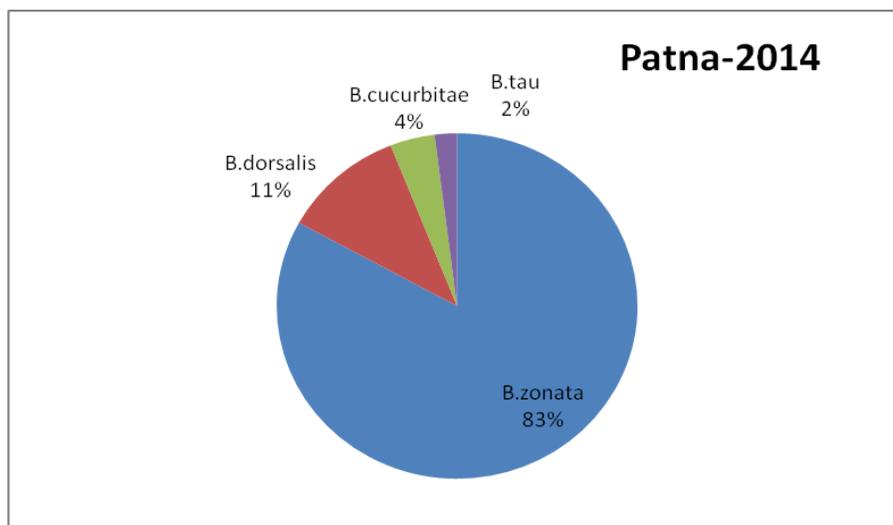


Fig.5 Species of guava fruit flies at Patna 2014

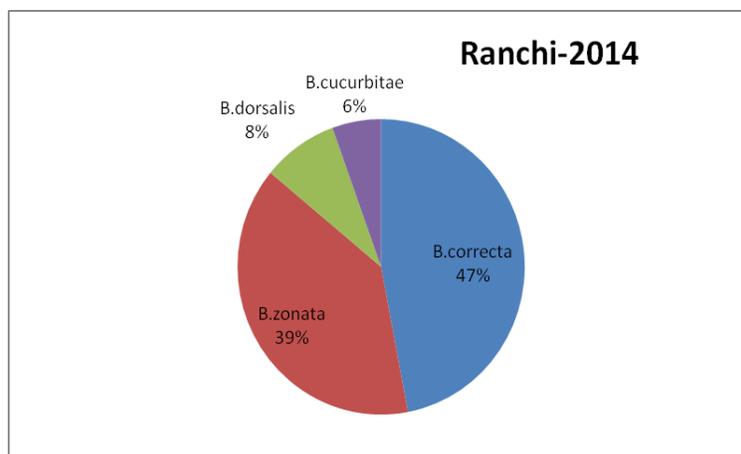


Fig.6 Species of guava fruit flies at Ranchi 2014

In our present study, we found that *Bactrocera zonata* was major fruit fly which causes havoc losses in Patna whereas *B. correcta* at Ranchi (Fig-5-6). In NP, average loss was 7.72 % in 2013 and 7.25 % in 2014 under Ranchi agro-climatic condition during rainy season. But in case of HDP, the per cent loss was 5.02% in 2013 and 2.67 % in 2014 in winter season (Fig-1). Similar results regarding damage of guava fruit crops during rainy season were also reported by Kapoor (2002), Haseeb (2007) and Khanh (2008).

From methyl eugenol trapping, different species were identified. These species were *B. zonata* (83.0%) *B. dosalis* (11.0%) *B. cucurbitae* (4%) and *B. tau* (2.0%), which infested the guava orchards in Patna, India (rainy) (Fig-5). In Ranchi, fruit flies were *B. correcta* (47.0%), *B. zonata* (39.0%), *B. dorsalis* (8.0%) and *B. cucurbitae* (6.0%) (rainy). Rajitha and Viraktamath (2006) also reported the infestation of *Bactrocera spp.* in guava orchards during August and September in Karnataka states of India. Choudhary *et al.*, 2019 also stated that *Bactrocera correcta* was the most prominent fruit fly for guava in eastern India. From infected fruits and fruit fly traps, the average no. of fruit flies was calculated and it has been observed that under HDP in second year rainy season crop, the total no. of fruit flies was the maximum

of 16.45 thousand/ha in the 6 months crop (May to October) (Fig-2). Fig: 3-4 were crop loss view and view of *Bactrocera zonata* on guava fruit at Patna.

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