Environment and Ecology 42 (4C) : 2068—2074, October—December 2024
Article DOI: https://doi.org/10.60151/envec/HMFA2674
ISSN 0970-0420

Seasonal Incidence of the Guava Fruit Fly, *Bactrocera* spp. in Talwandi Sabo, Punjab

Ajaypal Singh, Khushwinder Singh, Baljinder Singh

Received 25 July 2024, Accepted 2 December 2024, Published on 27 December 2024

ABSTRACT

The current study entitled "Seasonal incidence of guava fruit fly, *Bactrocera* spp. were carried out during both rainy and winter season at farmer's field at village Talwandi Sabo, District Bathinda, Punjab during 2018-19. The maggot population of guava fruit fly, *Bactrocera* spp. started appearing from 2nd week of July (2.83 maggots/infested fruit) reaching its peak in 2nd week of August (26.17 maggots/infested fruit). During winter season, the maggot population was at its peak during 4th week of October (12.62 maggots/infested fruit). During termination phase of winter crop season, a low maggot population i.e. 2.2 and 2.25 maggots/infested fruit were recorded in 2nd and 3rd week of March, respectively. The fruit infestation in rainy season guava due to fruit fly ranged from 40 to 86.67% on number basis while 34.53 to 83.33% on weight basis, being highest during 4th week of August and lowest during 2nd week of July both on number basis and weight basis. During winter season guava, the highest fruit infestation due to fruit fly i.e. 86.67 and 75.52% on number basis and weight basis, respectively was recorded during last week of October.

Keywords Guava, Fruit fly, Maggot population, *Bactrocera* spp.

INTRODUCTION

Fruits and vegetables are vital for human health, providing essential vitamins (C, A, B6, Thiamin, Niacin E), minerals and fiber (De and De 2019). Their consumption is linked to reducing cancer and cardiac disease risks. An average person should consume 120 g of fruits daily for health. Guava (*Psidium guajava* L.) is significant, rich in phosphorus and calcium, making it a valuable addition to a balanced diet. In India, it occupies an area of 264.9 thousand ha and 8.69 thousand ha in Punjab with a production of 4053.5 and 195.60 thousand metric tons, respectively (National Horticulture Board 2017-2018).

Various factors contribute to the low yields of guava, insects are the main ones that are reported to infested guava in different stages. Guava is effected by around 80 species of insect pests like fruit flies, bark eating caterpillar, capsule borer, mealy bug, hairy caterpillar and many sucking pests (Butani 1979,

Mr Ajaypal Singh[1]

[1]Thematic Expert, Reliance Foundation, Ludhiana, Punjab 141001, India

Mr Khushwinder Singh[2]*, Mr Baljinder singh[3]

[2,3]Assistant Professor
Faculty of Agriculture, Guru Kashi University, Talwandi Sabo, Punjab 151302, India

Email: khushsidhuji@gmail.com
*Corresponding author

Verghese *et al.* 2004, Verghese and Sudhadevi 1998, Singh *et al.* 2003, Rajitha and Viraktamath 2006, Atwal and Dhaliwal 2009, Gundappa *et al.* 2018) Fruit flies, especially the major species, heavily impact crop yields. Losses vary from a few to 100%, depending on factors like population, locality, variety, and season. (Kumar *et al.* 2011, Singh and Sharma 2013, Sarwar *et al.* 2014).

Fruit flies, belonging to the Tephritidae family, are a vast and diverse group within Diptera, with around 4000 species in 500 genera (Geldenhuys 2015). They breed on guava and mango, with *Bactrocera dorsalis* (Hendel) and *B. correcta* (Bezzi) as common guava pests. Economically significant globally, *B. dorsalis*, *B. correcta* and *B. zonata* (Saunders) cause substantial losses to horticultural crops (Danjuma *et al.* 2013, Megha *et al.* 2023). Fruit flies lay eggs on ripe fruits, and upon hatching, larvae feed on pulp, leading to discoloration and premature fruit dropping (Khan and Hugar 2019).

Therefore, present study was conducted with the objective to investigate the pattern of population dynamics and seasonal fluctuations in order to comprehend the underlying causes and mechanisms of these population variations. Moreover, this exploration may serve as a scientific foundation for developing practical management approaches for fruit flies.

MATERIALS AND METHODS

Materials

Experimental site

All the field experiments were conducted at farmer's field in village Talwandi sabo, Distt Bathinda, Punjab during both rainy and winter seasons 2018-19. These experiments were conducted in the Department of Entomology, University College of Agriculture, GKU.

Seasonal incidence of *Bactrocera* spp. in guava crop

Five randomly selected untreated guava trees in the orchard were observed to study the seasonal incidence and damage potential of the guava fruit fly. Each tree was treated as one replication for recording observations.

Recording of observations

Fruit infestation

During rainy season crop & winter crop season fruit infestation (%) both on number and weight basis were recorded from 1st week of July till end of fruiting season and last week of October till end of fruiting season on weekly basis respectively. Fruits were randomly collected per replication at weekly intervals during both rainy and winter crop seasons. Infested fruits (identified by oviposition punctures) and healthy fruits were counted and weighted separately, as illustrated in Plate 1. The fruit weights were measured using a weighing machine.

The percentage of fruit infestation was worked out with the help of following formula given by Abbott (1925).

$$\frac{\text{Number of damaged fruits percentage of fruit damage (no. basis)}}{\text{Total no. of fruits}} \times 100$$

$$\frac{\text{Weight of damaged fruits percentage of fruit damage (wt. basis)}}{\text{Total wt. of fruits}} \times 100$$

After recording observations on fruit infestation on weekly basis, the infested fruits were dissected on the same day and the number of maggots per infested fruit was recorded Plate 2. Fallen fruits infested by fruit flies were collected and destroyed every other day by burying them in the soil at a distant location to prevent the multiplication of the fruit fly population. The fruit fly catches/trap were collected, counted and removed from the traps every week.

The data so generated was analyzed statistically to work out correlation with abiotic factors such as temperature, humidity, evaporation, wind speed and rainfall.

(A) (B)

Plate 1. A) Oviposition puncture on guava, (B) Damaged fruit due to oviposition puncture.

For this, a sample of 15 fruits was randomly collected weekly from each replication. Infested fruits (identified by oviposition punctures) and healthy fruits were counted and weighed separately. The fruit infestation both on a number and weight basis, was calculated using formula provided by Abbott (1925) as mentioned earlier.

Identification of fruit flies

The fruit flies collected from the traps were pinned, labeled and got identified up to species level in the

(A) (B)

Plate 2. A) Infested fruit by fruit fly (maggots), (B) Fruit fly maggots in petri dish.

department of Entomology, UCoA, Guru Kashi University, Talwandi Sabo.

RESULTS AND DISCUSSION

Present studies on the experiments on the seasonal incidence of guava fruit fly, *Bactrocera* spp on guava were carried out both during rainy and winter seasons.

Seasonal incidence of *Bactrocera* spp. in guava

The data presented in Table 1 showed that observations of the maggot population of fruit flies on per infested fruits were recorded from 2nd week of July up to 2nd week of September (end of rainy season crop). The initial appearance of maggots of fruit flies (2.83 ±8 maggots/infested fruit) were observed during 2nd week of July and reaching its peak in 2nd week of August (26.17±8 maggots/infested fruit). During rainy season, after harvesting of fruits at the 2nd week of September, 15 ±8 maggots/infested fruit was recorded (Fig. 1).

Table 1. Fruit fly (maggots) population per infested fruit during rainy season. *= Data of 15 observations, SD= Standard deviation.

Sl. No.	Weeks	Maggot population / infested fruit*
1	2nd week of July	**2.83**
2	3rd week of July	**4.27**
3	4th week of July	**10.50**
4	1st week of August	**14.67**
5	2nd week of August	**26.17**
6	3rd week of August	**23.73**
7	4th week of August	**22.08**
8	1st week of September	**21.70**
9	2nd week of September	**15.00**
	Mean±SD	**15.66 ±8**

Table 2. Correlation co-efficient between weather parameters and maggot population during rainy season. Table 'r' values at 5% is 0.632, α= Significant positive correlation, β= Significant negative correlation, NS= Non-significant.

Sl. No.	Weather parameters	Fruit fly (maggots)
1	Temperature (minimum)	**0.721**$^{\alpha}$
2	Temperature (maximum)	**-0.736**$^{\beta}$
3	Relative humidity (%) morning	**0.164** ^{NS}
4	Relative humidity (%) evening	**0.636** ^{NS}
5	Rainfall (mm)	**-0.266** ^{NS}

Correlation between abiotic factors and maggot population of fruit flies on guava during rainy season.

In Table 2 the abiotic factors was correlated with the maggot population of fruit flies. The meteorological data pertaining to temperature, relative humidity and rainfall were obtained from KVK regional research center, Bathinda, Punjab. The maggot populations of fruit flies had non-significant correlation with morning relative humidity (72.3–86.7%) and evening relative humidity (55.6–63.3%) and rainfall therefore the significant positive correlation with minimum temperature (23.3°–26.6°C). There was significant negative correlation between maximum

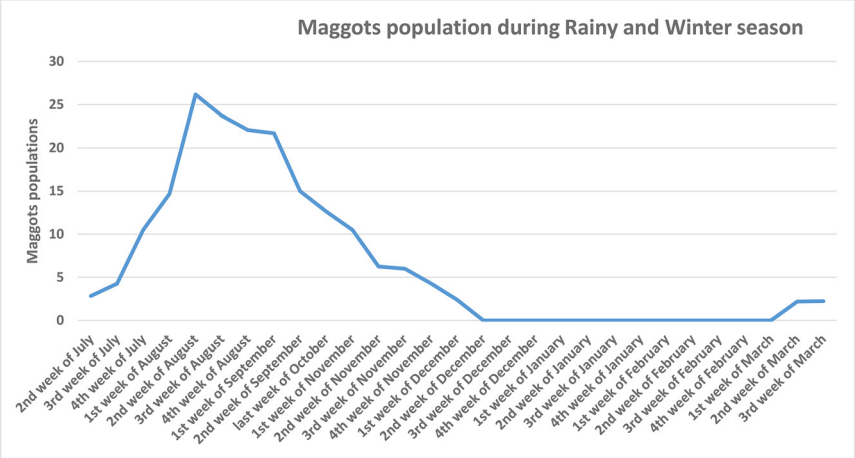

Fig. 1. Maggots population during rainy and winter season.

Table 3. Fruit fly (maggots) population per infested fruit during winter season. There were no fruits available from 2nd week of December to 3rd week of March, SD= Standard deviation, * = data of 15 observation.

Sl. No.	Weeks	Maggot population/ infested fruit*
1	last week of October	**12.62**
2	1st week of November	**10.5**
3	2nd week of November	**6.25**
4	3rd week of November	**6**
5	4th week of November	**4.3**
6	1st week of December	**2.4**
7	2nd week of December	**Nil**
8	3rd week of December	**Nil**
9	4th week of December	**Nil**
10	1st week of January	**Nil**
11	2nd week of January	**Nil**
12	3rd week of January	**Nil**
13	4th week of January	**Nil**
14	1st week of February	**Nil**
15	2nd week of February	**Nil**
16	3rd week of February	**Nil**
17	4th week of February	**Nil**
18	1st week of March	**Nil**
19	2nd week of March	**2.2**
20	3rd week of March	**2.25**
	Mean±SD	**5.81±3.68**

temperature (33.4°–36.7°C).

The data presented in Table 3 indicated that in winter season guava, the peak maggots population per fruit were observed during last week of October (12.62 ±3.68 maggots/infested fruit) which was decreased continuously up to 1st week of December (2.4±3.68 maggots/infested fruit). After that, the maggots population were not recorded from 2nd week of December to 1st week of March. During termination phase of winter crop season, the minimum maggot population i.e. 2.2±3.68 and 2.25 ±3.68 maggots/

Table 4. Correlation co-efficient between weather parameters and maggot population uring winter season. Table 'r' values at 5% is 0.433, α= Significant positive correlation, β= Significant negative correlation, NS= Non-significant.

Sl. No.	Weather parameters	Fruit fly (maggots)
1	Temperature(minimum)	**0.758$^{\alpha}$**
2	Temperature(maximum)	**0.859$^{\alpha}$**
3	Relative humidity (%) morning	**-0.481$^{\beta}$**
4	Relative humidity (%) evening	**-0.555$^{\beta}$**
5	Rainfall (mm)	**-0.317^{NS}**

Table 5. Fruits infestation due to fruit flies in guava during rainy season. *= 15 total observations, SD= Standard deviation.

Sl. No.	Weeks	Fruits infestation (%) Number basis	Weight basis
1	2nd week of July	40	34.53
2	3rd week of July	73.33	65.57
3	4th week of July	66.67	62.28
4	1st week of August	80	76.92
5	2nd week of August	80	72.8
6	3rd week of August	73.33	70.36
7	4th week of August	86.67	83.33
8	1st week of September	66.67	63.1
9	2nd week of September	80	74.83
	Mean±SD	71.85 ±12.87	67.08 ±13.19

infested fruit were recorded in 2nd and 3rd week of March, respectively (Fig. 1).

In Table 4, the maximum temperature (17.9-28.8ºC) and minimum temperature (2.2-15.2ºC) during winter season were having significant positive

Table 6. Fruits infestation due to fruit flies in guava during rainy season. There were no fruits available from 2nd week of December to 3rd week of March, SD= Standard Deviation, * = Data of 15 observations.

Sl. No.	Weeks	Fruits infestation (%) Number basis	Weight basis
1	last week of October	86.67	**75.52**
2	1st week of November	66.67	**63.64**
3	2nd week of November	80.00	**73.04**
4	3rd week of November	73.33	**70.37**
5	4th week of November	66.67	**64.00**
6	1st week of December	33.33	**32.14**
7	2nd week of December	Nil	**Nil**
8	3rd week of December	Nil	**Nil**
9	4th week of December	Nil	**Nil**
10	1st week of January	Nil	**Nil**
11	2nd week of January	Nil	**Nil**
12	3rd week of January	Nil	**Nil**
13	4th week of January	Nil	**Nil**
14	1st week of February	Nil	**Nil**
15	2nd week of February	Nil	**Nil**
16	3rd week of February	Nil	**Nil**
17	4th week of February	Nil	**Nil**
18	1st week of March	Nil	**Nil**
19	2nd week of March	33.33	**30.04**
20	3rd week of March	26.67	**25.00**
	Mean±SD	**58.33 ±22.05**	**54.22 ±19.93**

correlation therefore the morning relative humidity (74.1–123.6%) and evening relative humidity (30.6–63.7%) significant negative correlation with the maggot population of fruit fly. There was the rainfall have non-significant correlation with the maggots population of fruit fly.

Fruit infestation due to fruit flies in guava during 2018-19

The fruits infestation on number basis as well as on weight basis due to fruit flies were observed both during rainy and winter crop seasons in guava during 2018-19.

In Table 5, the fruit infestation was started after fruit setting in the 2nd week of July during rainy crop season, the infestation varied from 40 ±12.87 to 86.67 ±12.87% on number basis while 34.53 ±13.19 to 83.33 ±13.19% on weight basis. The highest fruit infestation was recorded during 4th week of August and the lowest infestation was observed during 2nd week of July both on number basis and weight basis.

The data presented in Table 6 indicates that in winter season, guava experienced the higher fruit infestation due to fruit flies i.e. 86.67 ±22.05 and 75.52 ±19.9% on number basis and weight basis were recorded during last week of October whereas, the minimum fruits infestation were reported i.e. 26.67 ±22.05 and 25 ±19.93% at 3rd week of March during winter season of 2018-19.

There was no fruiting from 2nd week of December to 1st week of March. But, the minor fruit infestation i.e.33.33 ±22.05 to 26.67 ±22.05 and 30.04 ±19.93 to 25 ±19.93% were recorded during 2nd to 3rd week of March on number basis and weight basis, respectively with the completion of winter crop season of guava during 2018-19.

Seasonal incidence of *Bactrocera* spp. in guava

The seasonal incidence of guava fruit fly, *Bactrocera* spp. was observed on guava crop during rainy as well as winter season 2018-19. During rainy season crop, the initial appearance of fruit fly maggot (2.83 ±8 maggots/infested fruit) was noticed during 2nd week of July reaching its peak (26.1 ±8 maggots/infested fruit) in 2nd week of August. After that the population of fruit fly maggot decreased up to crop maturity till 2nd week of September (15 ±8 maggots/infested fruit) during rainy season crop. The abiotic factors prevailing during second week of July was similar observations were reported by (Rajitha and Viraktamath 2006, Dale and Patel 2010, Yadav *et al*. 2014).

The maggot population of fruit fly has significant positive correlation with minimum temperature and significant negative correlation with maximum temperature. The present studies are in agreement with (Singh and Sharma 2013, Jena *et al.* 2022).

In winter season guava, the maggot population of fruit fly, *Bactrocera* spp. was at its peak during last week of October (12.62 ±3.68 maggots/infested fruit) which went on reducing till 1st week of December (2.4 ±3.68 maggots/infested fruit). There was no maggot population found from 2nd week of December to 1st week of March. During termination phase of winter crop season, a low maggot population i.e. 2.2 ±3.68 and 2.25 ±3.68 maggots/infested fruit were recorded in 2nd and 3rd week of March, respectively.

The maggot population of fruit fly was having significantly positive correlation with maximum temperature and minimum temperature. These findings are in agreement with the observations recorded by (Sarada *et al.* 2001, Danjuma *et al.* 2014).

The fruit infestation in rainy season guava due to fruit fly ranged from 40 ±12.87 to 86.67±12.87% on number basis while 34.53 ±13.19 to 83.33 ±13.19 per cent on weight basis, being highest during 4th week of August (86.67% on number basis and 83.33% on weight basis). Similar findings have been reported by (Kumar *et al.* 2011 , Singh and Sharma 2013, Amin *et al*. 2019).

ACKNOWLEDGMENT

The authors thank the department of agriculture at Guru Kashi University for providing the resources and support needed to complete this work.

REFERENCES

Abbott WS (1925) A method of computing the effectiveness of insecticide. *Journal of Economic Entomology* 18: 265—267.

Amin MR, Khisa S, Rahman H, Jannat R, Badruzzaman M (2019) Seasonal abundance of major sucking and chewing insects of guava. *Bangladesh Journal of Zoology* 47 (1) : 97—105. https://doi.org/10.3329/bjz.v47i1.42025

Atwal AS, Dhaliwal GS (2009) *Agricultural pests of South Asia and their management*. Kalyani Publishers, pp 380.

Butani DK (1979) *Insects and Fruits*. Periodical Expert Book Agency, New Delhi.

Dale NS, Patel RK (2010) Population dynamics of fruit flies (*Bactrocera* spp.) on guava and its correlation with weather parameters. *Current Biotica* 4 (2) : 245—448.

Danjuma S, Boonrotpong S, Thaochan N, Permkam S, Satasook C (2013) Biodiversity of the genus *Bactrocera* (Diptera : Tephritidae) in guava *Psidium guajava* L. orchards in different agro-forested locations of Southern Thailand. *International Journal of Chemical, Environmental and Biological Sciences* (IJCEBS), 1(3) : 538—544.

Danjuma S, Thaochan N, Permkam S, Satasook C (2014) Effect of temperature on the development and survival of immature stages of the carambola fruit fly, *Bactrocera car ambolae* and the Asian papaya fruit fly, *Bactrocera papayae*, reared on guava diet. *Journal of Insect Science* 14 (1) : 126. https://doi.org/10.1093/jis/14.1.126

De LC, De T (2019) Healthy food for healthy life. *Journal of Global Biosciences* 8 : 6453—6468.

Geldenhuys M (2015) Fruit fly (Diptera : Tephritidae) ecology in the Western Cape, South Africa (Doctoral dissertation).

Gundappa B, Balaji Rajkumar M, Singh S, Rajan S (2018) Pests of guava. *Pests and their managementt* 491—516.

Jena MK, Patel SR, Patel ZK (2022) Population dynamics of fruit fly, *B. dorsalis* (Hendle) on mango and correlation with weather parameters. *International Journal of Environment and Climate Change* 12 (12) : 1630—1638. https://doi.org/10.9734/ijecc/2022/v12i121605

Khan S, Hugar PS (2019) Studies on biology of guava fruit fly, *Bactrocera correcta* (Bezzi) (Diptera : Tephritidae). *Journal of Experimental. Zoology*. India 22 (1).

Kumar P, Abubakar LA, Ketelaar JW, Shanmugam V (2011) Fruit fly damage and crop losses. In: *Field exercise guide on fruit flies integrated pest management, Asian fruit fly IPM project*, Bangkok, Thailand, pp 17.

Megha R, Singh SK, Srivastav M, Kalia V, Sharma N, Kumar C, Singh N (2023) The population dynamics of fruit flies and correlation matrix with weather and host variables in mango (*Mangifera indica*) orchards. *The Indian Journal of Agricultural Sciences* 93 (10) : 1132—1138. https://doi.org/10.56093/ijas.v93i10.138967

Rajitha AR, Viraktamath S (2006) Monitoring fruit flies (Diptera : Tephritidae) in guava orchard in Dharwad, Ka nataka. *Karnataka Journal of Agricultural Sciences* 19 : 35—39.

Sarada G, Maheswari TU, Purushotham K (2001) Seasonal incidence and population fluctuation of fruit flies in mango and guava. *Indian Journal of Entomology* 63 : 272—276.

Sarwar M, Hamed M, Yousaf M, Hussain M (2014) Surveillance on population dynamics and fruit infestation of tephritid fruit flies (Diptera: Tephritidae) in mango (*Mangifera indica* L.) orchards of Faisalabad, Pakistan. *International Journal of Scientific Research in Environmental Sciences* 2 (4) : 113. https: //doi.org/10.12983/ijsres-2014-p0113-0119

Singh G, Misra AK, Masarrat H, Tandon DK, Pathak RK (2003) The Guava. Central institute of subtropical horticulture, Lucknow, pp 38.

Singh S, Sharma DR (2013) Management of fruit flies in rainy season guava through male annihilation technique using methyl eugenol based traps. *Indian Journal of Horticulture* 70 (4): 512—518.

Verghese A, Sudhadevi K (1998) Relation between trap catches of *Bactrocera dorsalis* (Hendel) and abiotic factors. Adv. IPM Hortic. crops. proceedings of the First National Symposium on pest management in horticultural crops, Bangalore, India, pp 15—18.

Verghese A, Tandon PL, Stonehouse JM (2004) Economic evaluation of the integrated management of the oriental fruit fly, *Bactrocera dorsalis* (Diptera: Tephritidae) in mangoin India. *Crop Protection* 23 : 61—63. https://doi.org/10.1016/S0261-2194(03)00087-5

Yadav SS, Bangarwa KS, Dhankhar SS, Pannu RK (2014) Major insect pests of fruit crops and their management. *Entomology. Nematology* 4 (1) : 169.