

Population Dynamics and Damage Potential of Fruit Flies by Using the Pheromone Traps (Fruit fly traps) in Guava Orchard

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Abstract— A field investigation was undertaken at KVK, Katni, Madhya Pradesh, from September 2025 to January 2026 to characterize the population dynamics and damage potential of fruit flies (*Bactrocera* spp.) in a guava (*Psidium guajava* L.) orchard. Seasonal activity was monitored using fruit fly traps with a methyl eugenol-based biodegradable lure. The relationships between fruit fly population and weather parameters were also examined. Fruit fly abundance exhibited a progressive increase from the 36th SMW, attaining a maximum of 42.50 flies/trap/week in the 43rd SMW, and subsequently declined gradually. A comparable pattern was observed in fruit infestation, which increased from 8.33 per cent to 41.67 per cent during the study period. Significant positive correlations were observed between fruit fly population and maximum temperature, minimum temperature and relative humidity, whereas rainfall and wind speed showed non-significant relationships. The regression model accounted for approximately 81 per cent of the variation in fruit fly population through the selected weather parameters. These findings establish a close relationship between fruit fly population abundance and fruit infestation and support the use of methyl eugenol traps for monitoring seasonal activity and facilitating timely management of fruit flies in guava orchards.

Keywords— *Bactrocera* spp., Guava, Population dynamics, Methyl eugenol, Fruit infestation, Weather parameters, Fruit fly trap.

I. INTRODUCTION

Guava (*Psidium guajava* L.), a member of the family Myrtaceae, is an important tropical fruit crop cultivated widely for its nutritious value. Commonly referred to as the "Apple of the Tropics," it originated in tropical America and is now extensively grown throughout tropical and subtropical regions (Baloda et al., 2018). India is the world's largest guava producer, contributing nearly 46% of global production. During 2024-25, guava was cultivated on 3.58 lakh ha with an estimated production of 53.50 lakh tonnes. Uttar Pradesh and Madhya Pradesh are the leading producing states (Anonymous, 2025). Guava production is constrained by several insect pests, of which fruit flies (*Bactrocera* spp.) are the most economically damaging. Other important pests include the mealybug (*Ferrisia virgata*), fruit and shoot borer (*Conogethes punctiferalis*), tea mosquito bug (*Helopeltis antonii*), and bark-eating caterpillar (*Indarbela tetraonis*) (Gundappa et al., 2018). Fruit fly infestation can cause severe quantitative and qualitative losses, with damage varying according to pest abundance, cultivar, and environmental conditions (Kumar et al., 2011). Fruit flies belong to the family Tephritidae, which comprises over 4,000 described species. Among them, the genus *Bactrocera* is one of the most economically significant, containing nearly 500 species distributed mainly across Asia and Australia (Majeed et al., 2024). While numerous species are known to infest fruits, merely a limited number are encountered within orchard environments. The recorded data concerning fruit fly population fluctuations in guava cultivation systems presents both prospects and obstacles for adequate strategic planning and implementing appropriate management interventions at optimal timings (Vignesh et al., 2020).

II. MATERIAL AND METHODS

The experiment was conducted at Krishi Vigyan Kendra (KVK), Katni, (23.736181° N, 80.316522° E), affiliated with Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Jabalpur, Madhya Pradesh from September 2025 to January 2026.

2.1 Trap and lure

Me-Gel traps were made of durable plastic with a yellow bowl and a 4 cm entry hole. Each trap contained a plastic dispenser loaded with a wax matrix-based biodegradable lure comprising methyl eugenol, malathion 50 EC, and inert ingredients (water, wax, oils, proteins, food-grade emulsifiers, and preservatives) to attract fruit flies.

2.2 Observations

Fruit fly population was monitored using four traps installed at four observation sites in the guava orchard. Monitoring began during the 36th Standard Meteorological Week (SMW) at the onset of fruiting. Adult catches were recorded weekly and expressed as flies/trap/week. Weekly trap catches were correlated with meteorological variables, including maximum and minimum temperature, relative humidity, rainfall and wind speed, using correlation and regression analyses. Fruit infestation was assessed weekly from the 36th SMW (September 2025) until the end of the fruiting period. Three randomly selected trees at each site were tagged, and five fruits were sampled from each tree (15 fruits per site). Fruits showing oviposition punctures were considered infested. Fruit infestation was calculated as (Umesh, 2018; Abbott, 1925):

$$\text{Fruit infestation (\%)} = \frac{\text{Number of infested fruits}}{\text{Total no. of observed fruits}} \times 100 \quad (1)$$

III. RESULT AND DISCUSSION

3.1 Population dynamics of fruit fly in guava orchard

Fruit fly activity commenced during the 36th Standard Meteorological Week (SMW) and increased steadily, reaching a peak of 42.50 flies/trap/week in the 43rd SMW. Thereafter, the population declined gradually, with the lowest catch (1.00 fly/trap/week) recorded in the 52nd SMW. Peak abundance coincided with the fruiting stage of guava, while the winter season was associated with a sharp decline in adult population (Table 1 and Fig. 1).

TABLE 1
POPULATION DYNAMICS OF FRUIT FLY AND WEATHER PARAMETERS IN GUAVA ORCHARD DURING SEPTEMBER TO JANUARY IN 2025-26

SMW	Average No. of fruit flies/trap/week	Max. Temp. (°C)	Min. Temp. (°C)	R.H. (%)	Rainfall (mm)	Wind speed (km/h)
36	11.5	29.36	23.17	89.15	6.26	2.98
37	19	29.49	23.31	88.55	6.13	2.04
38	26.25	30.13	22.77	84.57	1.85	2.01
39	27.5	29.55	22.7	87.88	5.27	3.11
40	30.5	30.55	22.7	87.88	5.27	3.11
41	35.5	27.48	18.01	80.71	0.06	1.92
42	38.75	28.26	18.2	79.49	0.62	1.97
43	42.5	28.43	19.25	83.63	1.04	2.28
44	38.5	28.23	19.79	82.51	2.69	2.69
45	31.25	24.96	12.87	65.7	0	1.87
46	25.75	23.47	10.49	66.51	0.05	1.8
47	16.5	24.34	10.95	75.24	0	1.83
48	15.75	23.77	10.53	74.01	0	2.28
49	11.5	24.02	9.61	63.24	0	2.23
50	8.25	24.32	8.9	64.46	0	2.03
51	5.5	23.44	8.51	71.04	0	2.29
52	1	23.91	7.36	65.7	0	2.36
1	1.75	23.62	8.29	70.35	0	2.64
2	2.25	25.01	8.37	63.1	0	2.64
3	3.25	26.67	9.82	54.38	0.01	2.48
4	4.5	26.67	11.5	63.59	0.32	2.78
5	5.25	27.14	11.6	61.8	0.01	2.68

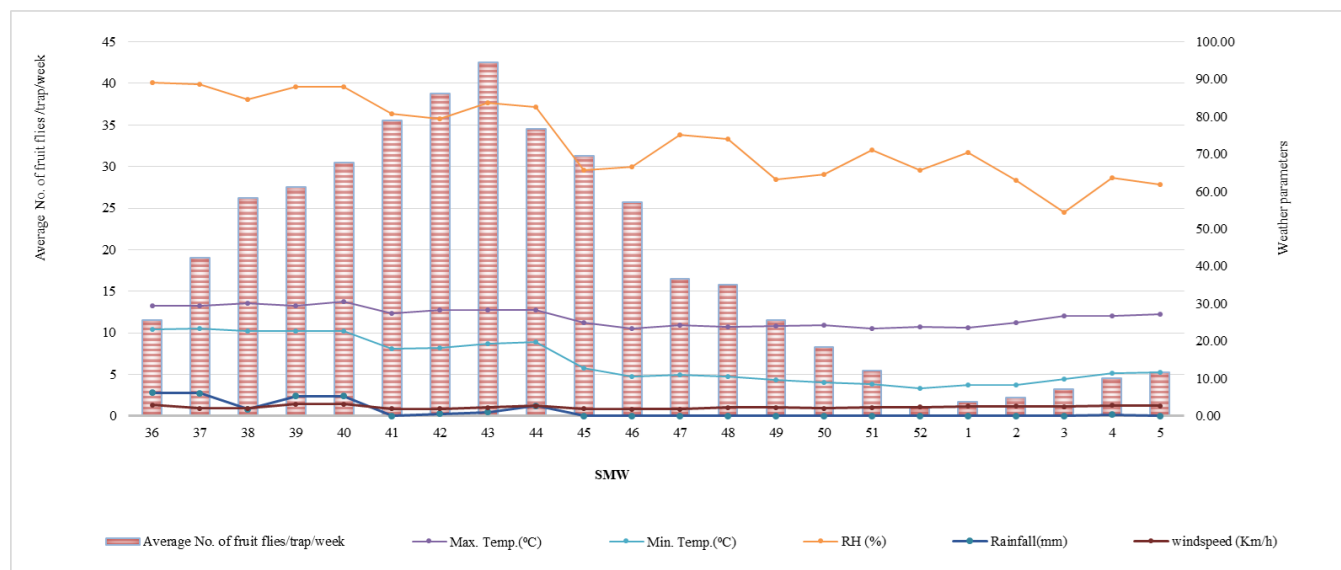


FIGURE 1: Population dynamics of fruit fly and its relation with weather parameters in guava orchard during September to January in 2025-26

TABLE 2

CORRELATION OF FRUIT FLY POPULATION TRAPPED IN FRUIT FLY TRAPS WITH WEATHER PARAMETERS

Weather parameters	Fruit fly	Weather parameters	Fruit fly
Maximum Temperature	0.519*	Relative humidity	0.630**
Minimum Temperature	0.670**	Rainfall	0.275NS
Wind speed	-0.225NS		

**** Significant at 1% level of significance, *Significant at 5% level of significance, NS - Non-significant**

The present findings agree with Sarada et al. (2001) and Verghese and Sudhadevi (1998), who reported maximum fruit fly activity during fruit ripening followed by a decline after harvest. Similar observations were made by Su (1984) and Shukla and Prasad (1985), who found a positive association between temperature and fruit fly catches. The seasonal trend observed in this study is also consistent with reports of Vignesh et al. (2020), Math et al. (2018) and Gupta and Bhatia (2000), who identified *Bactrocera dorsalis* as the predominant species in guava and recorded peak populations during the fruiting period. Chandra et al. (2022) further demonstrated that temperature and relative humidity were the major weather factors influencing fruit fly abundance. In agreement with Raina et al. (2023) and Khomane et al. (2023), weather variables significantly affected fruit fly incidence. The regression model developed in the present study explained approximately 81% of the variation in fruit fly population, indicating that weather parameters had a strong influence on seasonal population dynamics under the prevailing conditions.

3.2 Damage potential of fruit fly in guava orchard

Fruit infestation began during the 36th SMW (8.33%), increased progressively with adult trap catches and reached a maximum of 41.67 per cent in the 43rd SMW. Thereafter, infestation declined steadily and no damaged fruits were observed from the 1st to 5th SMW, indicating a close relationship between adult fruit fly abundance and fruit damage (Table 3 and Fig. 2).

These findings are consistent with Agarwal and Kumar (1999), Haseeb (2007) and Kruthika et al. (2025), who reported that fruit infestation increased with fruit maturity and peaked during periods of maximum fruit fly activity. Similar observations were made by Math et al. (2018), Khomane et al. (2023), Singh et al. (2024) and Giddi and Emmanuel (2023), who found that infestation was highest during the fruiting period and declined after harvest. Umesh et al. (2025) also reported fruit losses ranging from 18-68 per cent in guava due to *Bactrocera* spp. and emphasized the importance of methyl eugenol traps for monitoring and management. The close association between trap catches and fruit damage observed in the present study

highlights the usefulness of pheromone traps as an effective tool for forecasting infestation and supporting timely management decisions.

TABLE 3
DAMAGE POTENTIAL CAUSED BY FRUIT FLY IN GUAVA ORCHARD

SMW	Total No. of infested fruits	Total No. of observed fruits	Damage potential (%)
36	5	60	8.333
37	7	60	11.667
38	9	60	15
39	11	60	18.333
40	12	60	20
41	14	60	23.333
42	17	60	28.333
43	25	60	41.667
44	23	60	38.333
45	20	60	33.333
46	18	60	30
47	16	60	26.667
48	11	60	18.333
49	4	60	6.667
50	4	60	6.667
51	2	60	3.333
52	1	60	1.667
1	0	60	0
2	0	60	0
3	0	60	0
4	0	60	0
5	0	60	0

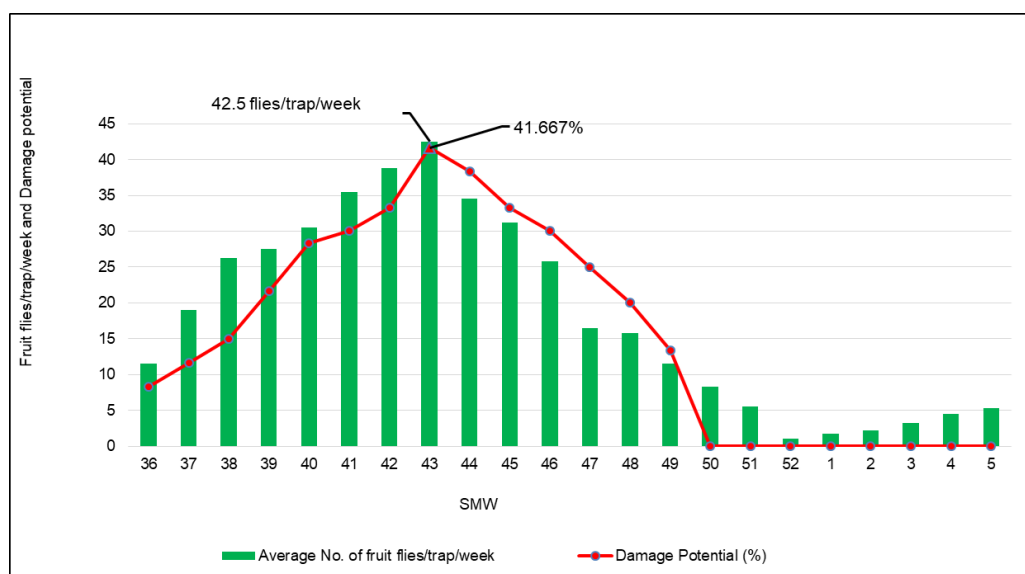


FIGURE 2: Damage potential caused by fruit fly in guava orchard

IV. CONCLUSION

The fruit fly population exhibited a clear seasonal pattern, first appearing in the 36th SMW, reaching its peak in the 43rd SMW, and declining thereafter. The highest trap catch (42.50 flies/trap/week) and maximum fruit infestation (41.67%) were both recorded during the 43rd SMW, identifying this as the most critical period for fruit fly damage in guava. Fruit infestation closely followed adult fly abundance, indicating that pheromone trap catches are a reliable predictor of infestation. Multiple regression analysis showed that weather variables explained approximately 81% of the variation in fruit fly population, confirming the important role of climatic factors in seasonal population dynamics.

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CONFLICT OF INTEREST

The author(s) declare that there is no conflict of interest regarding the publication of this work as this research work was conducted for the partial fulfillment of the degree of M.Sc. Ag. Entomology.

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