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# EFFICACY OF DIFFERENT FOOD LURES IN ATTRACTING FRUIT FLY SPECIE: A COMPARATIVE STUDY

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**Abstract**

The experiments entitled "Efficacy of different food lures in attracting fruit fly specie: A comparative study" was conducted at the Agriculture Research Institute Tarnab, Peshawar, Pakistan during spring, 2024. The experiment was arranged using Randomize Complete Block (RCB) Design having seven treatments and three replications. Data recorded weekly revealed that the pest appeared within the first hour of trap installation in the first week of September, with the highest initial population observed in T2 (75% methyl eugenol + 10% guava essence + 10% sugar solution + 5% spinosad). The population peaked during the third week of October, with T2 recording the highest average trap catch (108.67 fruit flies per trap), followed by T4 and T6, while T5 consistently showed the lowest population. A gradual decline in pest numbers was observed through November. Overall, T2 demonstrated superior efficacy in reducing fruit fly populations compared to other treatments, with a mean reduction of 68.15 flies per trap. These findings emphasize the importance of timely interventions and the effectiveness of attractant-based formulations in managing fruit fly populations in persimmon orchards.

**Key words:** Fruit flies, persimmon orchards, methyl eugenol, spinosad, attractant traps

## Introduction

Fruit flies, or Diptera: Tephritidae, are among the most significant insect pest groups in the world. Dacine, the most significant of the Tephritidae's numerous subfamilies, is found in Asia, the Pacific, and Africa. Over 5000 fruit fly species have been described worldwide (Bhatnagar and Yadava, 1992), with about 200 of these species having economic significance (White and Elson-Harris, 1992). Of these, 68% are members of the genus *Bactrocera*, and 32% are members of the genus Dacus (Drew and Hancock, 2000). Fruit flies with pest characteristics include *Bactrocera dorsalis, Bactrocera zonata, Bactrocera correcta, Bactrocera cucurbitae, Dacus ciliates, Bactrocera scutellaris, Bactrocera longistylus, Carpomyia vesuviana,* and *Myiopardalis pardalina*. There have been reports of several fruit fly species from Pakistan, Myanmar, Sri Lanka, and Nepal; however, *Bactrocera zonata*, *B. dorsalis*, and *B. cucurbitae* are the major fruit fly species that severely damage fruits and vegetables in Pakistan (Kakar et al., 2014). Around the world, fruit flies severely reduced the amount of fruits and vegetables in temperate, tropical, and subtropical climates (Alim et al., 2012). Fruit flies attack a variety of fruit species, resulting in substantial financial losses (White and Elson-Harris, 1992). According to Stonehouse et al. (1998), the yearly financial loss of Pakistan's citrus, guava, mango, pomegranate, apricot, plum, persimmon, loquat, jujube, pear, melon, watermelon, bitter gourd, bottle gourd, pumpkin, cucumber, tomato, and sponge gourd is close to seven billion rupees. There infections can occasionally exceed 80%, causing significant loss. Mangos, guavas, and persimmones are among the fruit flies' preferred hosts (Ghafoor et al., 2010). Several techniques have been employed to lessen the damage caused by this pest, and the implementation of pre-harvest management tactics is crucial to minimizing direct losses and improving the effectiveness of post-harvest quarantine treatments. These include biological control (Sinha and Saxena, 1999), field sanitation, and non-chemical control techniques such fruit bagging (Jaiswal et al., 1997). These techniques can reduce the number of pests below the economic threshold, preventing losses, which are the growers' top priority. Males must be eliminated using cue-lure traps and para-pheromones (Zaman, 1995). In comparison to traps used as food attractants for *Bactrocera* species monitoring, these cue lure traps, which are employed as sex attractants, have been proven to be more effective. Weather parameters like minimum temperature, rainfall, and minimum humidity have a positive correlation with cue-lure trap catches (Stonehouse et al., 2004). The current studies examine the effectiveness of several traps based on the food essence of orange, guava, and persimmon against the population density of fruit fly species in persimmon orchards in light of these findings.

**Materials and Methods**

The experiments entitled "Efficacy of different food lures in attracting fruit fly specie: A comparative study" was conducted at the Agriculture Research Institute Tarnab, Peshawar, Pakistan during spring, 2024. The experiment was arranged using Randomize Complete Block (RCB) Design having seven treatments and three replications. This experiment was based on the evaluation of various food essences incorporated in standard fruit flies attractant, based on cue lure, against the major fruit flies species. Details of the doses and combination of different components of the mixtures/treatments were T1 (75% methyl eugenol+10% Peach essence with 10% sugar solution and 5% Spinosad), T2 (75% methyl eugenol+10% Guava essence with 10% sugar solution and 5% Spinosad), T3 (75% methyl eugenol+10% Orange essence with 10% sugar solution and 5% spinosad), T4 (75% methyl eugenol+10% mango with 10% sugar solution and 5% Spinosad), T5 (75% methyl eugenol+10% lemon essence with 10% sugar solution and 5% Spinosad), T6 (75% methyl eugenol+10% banana with 10% sugar solution and 5% , spinosad) and control (85% methyl eugenol + 10% sugar solution and 5% Spinosad).

**Preparation of trap**

A simple bottle made of plastic material was taken and four holes having 2.3cm diameter was made for trapping flies. Traps were made, which were installed in persimmon orchard with the help of a flexible iron wire having two hooks one at each side (the upper one hooks were used for hanging the trap, while the other one was for holding the cotton swab). A cotton wick was dipped in the mixture and was attached to the lower end of iron wire. In control trap, only (85% Methyl eugenol + 10% sugar + 5% insecticide) was used.

**Insecticide spinosad**

The insecticide**s** *spinosad*, which is most effective insecticide against fruit flies, was purchased from local market of Peshawar, Khyber Pakhtunkhwa-Pakistan.

**Total number of fruit flies per trap**

For recording the population density of fruit flies, five randomly selected trees in each plot were selected on which treatment traps were installed in such a way that each trap was installed in one plot per replication. Data were taken as number of fruit flies captured in 24 hours as a base line and then weekly data for whole season was continued up to 10 weeks. The traps were weekly observed for fruit flies and replenished with fresh solution. The collected specimen was added to a zip lock bag and tagged and afterwards were brought to laboratory. The collected specimen was separate based on gender and placed in separate zip lock bags after proper identification using taxonomical keys.

**Statistical Analysis**

Data were analysed by using software (Statistix 8.1). Analysis of variance (ANOVA) was constructed and for the differentiation of means, Least Significant Difference (LSD) test was performed.

**Results and Discussion**

Data was recorded on weekly basis to monitor the population trend of fruitflies in persimmons orchards during 2024. The pest appears in the field with in 1$^{st}$ hour of traps installation during 1$^{st}$ week of September, where maximum number of fruitflies was recorded from T2 (19.67 No. of fruitflies trap$^{-1}$) as followed by T4 (15.33 No. of fruitflies trap$^{-1}$), T6 and T1 (13.67 No. of fruitflies trap$^{-1}$) and T3 (12.33 No. of fruitflies trap$^{-1}$) while minimum number of fruitflies was recorded on T5 (10.67 No. of fruitflies trap$^{-1}$), compared with control treatment (9.33 No. of fruitflies trap$^{-1}$). The similar pattern was observed at the end of 1$^{st}$ week of September, maximum number of fruitflies population was recorded on T2 (43.67 No. of fruitflies trap$^{-1}$) as followed by T4 (35.00 No. of fruitflies trap$^{-1}$), T6 (30.67 No. of fruitflies trap$^{-1}$), T1 (28.00 No. of fruitflies trap$^{-1}$) and T3 (23.33 No. of fruitflies trap$^{-1}$) while minimum number of fruitflies was recorded onT5 (21.67 No. of fruitflies trap$^{-1}$) as compared with control treatment (18.00 No. of fruitflies trap$^{-1}$). The pest continues to increased its population gradually till its peak was recorded during 3$^{rd}$ week of October where highest population was recorded from T2 (108.67 No. of fruitflies trap$^{-1}$) as followed by T4 (101.00 No. of fruitflies trap$^{-1}$), T6 (96.00 No. of fruitflies trap$^{-1}$), T1 (94.00 No.

of fruitflies trap$^{-1}$) and T3 (89.67 No. of fruitflies trap$^{-1}$) while lowest number of fruitflies was recorded onT5 (87.00 No. of fruitflies trap$^{-1}$) as compared with control treatment (84.00 No. of fruitflies trap$^{-1}$). After that, pest population started to decline gradually till 2$^{nd}$ week of November, where highest population was recorded from T2 (29.00 No. of fruitflies trap$^{-1}$) as followed by T4 (28.33 No. of fruitflies trap$^{-1}$), T6 (30.33 No. of fruitflies trap$^{-1}$), T1 (28.33 No. of fruitflies trap$^{-1}$) and T3 (26.33 No. of fruitflies trap$^{-1}$) while lowest number of fruitflies was recorded onT5 (23.33 No. of fruitflies trap$^{-1}$) as compared with control treatment (22.33 No. of fruitflies trap$^{-1}$). The overall mean population was maximum reduced on T2 (68.15 No. of fruitflies trap$^{-1}$) as followed by T4 (61.15 No. of fruitflies trap$^{-1}$), T6 (57.12 No. of fruitflies trap$^{-1}$), T1 (55.15 No. of fruitflies trap$^{-1}$) and T3 (51.03 No. of fruitflies trap$^{-1}$) while lowest number of fruitflies was recorded onT5 (48.84 No. of fruitflies trap$^{-1}$) as compared with control treatment (46.03 No. of fruitflies trap$^{-1}$). Thus, interaction between treatment and interval showed the highest population reduction was recorded on 3$^{rd}$ October (94.33 No. of fruitflies trap$^{-1}$) and this month appears to be great time frame for the improvement of fruitflies population. The study aimed to monitor the population dynamics of fruit flies in persimmon orchards using various attractant formulations during 2024. The findings highlight distinct differences in population trends across treatments, reflecting the efficacy of the attractants and their potential applications for integrated pest management (IPM). The initial rapid pest appearance within the first hour of trap installation underscores the strong attractant properties of the tested formulations. Among all treatments, T2 (75% methyl eugenol + 10% guava essence + 10% sugar solution + 5% spinosad) consistently recorded the highest fruit fly captures across all observation periods. This aligns with prior research demonstrating the effectiveness of methyl eugenol-based formulations in attracting fruit flies, particularly in tropical fruit systems (Manrakhan et al., 2017). The incorporation of guava essence might have enhanced the attractant's appeal due to its high volatile organic compound content, which is known to strongly attract fruit flies (*Bactrocera* spp.). The population trends revealed that fruit fly activity peaked during the third week of October, consistent with findings by other studies in similar agro-climatic zones, which indicate that *Bactrocera dorsalis* and related species exhibit population peaks during fruit maturity periods (Chinajariyawong et al., 2000). This emphasizes the need for intensive monitoring and control measures during these critical periods to prevent economic damage. The gradual decline in population after October, as observed in the study, is likely associated with declining host availability and environmental conditions less conducive to pest activity. Similar seasonal trends have been documented in related works, highlighting the importance of time-targeted management strategies (Drew and Raghu, 2002). The superior performance of T2 could be attributed to the synergistic effects of guava essence and spinosad. Spinosad, a biopesticide, has demonstrated efficacy against *Bactrocera* spp. by disrupting neural activity in adults and larvae (Vargas et al., 2001). Moreover, treatments incorporating other fruit essences (T4 - mango and T6 - banana) also showed promising results, suggesting the potential to customize attractants based on local pest preferences. While T5 (lemon essence) recorded the lowest fruit fly captures among the tested formulations, it still outperformed the control, underscoring the added benefit of combining methyl eugenol with fruit essences and sugar solutions. These findings are consistent with research indicating that less attractive formulations can still contribute to overall pest suppression when integrated into a broader IPM strategy (Piñero et al., 2013). The study's outcomes suggest that T2 holds the most promise for large-scale deployment in persimmon orchards, particularly during peak pest activity in October. However, further trials incorporating economic analyses are recommended to optimize cost-effectiveness and assess potential impacts on non-target organisms.

**Table 1: Population trend of fruitflies with different fruit essence using Pheromone traps in persimmons orchard.**

| Treatments | 1 hr | September | | | | October | | | | November | | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Weeks | | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | |
| **T1** | 13.67r | 28.00k | 40.00e | 52.00y | 64.00t | 74.00n | 84.00j | 94.00e | 79.67l | 49.00z | 28.33k | 55.15d |
| **T2** | 19.67o | 43.67c | 55.00w | 67.00rs | 79.67l | 89.00g | 99.00c | 108.67a | 94.00e | 64.67t | 29.33j | 68.15a |
| **T3** | 12.33s | 23.33m | 35.67g | 47.67a | 59.00u | 69.00q | 79.67l | 89.67g | 74.00n | 44.67b | 26.33l | 51.03e |
| **T4** | 15.33q | 35.00g | 47.00a | 59.67u | 71.00p | 81.00k | 91.67f | 101.00b | 85.67i | 57.00v | 28.33k | 61.15b |
| **T5** | 10.67t | 21.67n | 33.67h | 45.00b | 57.00v | 67.67r | 77.00m | 87.00h | 72.670 | 41.67d | 23.33m | 48.84f |
| **T6** | 13.67r | 30.67i | 42.00d | 54.00x | 66.67s | 76.67m | 86.00i | 96.00d | 80.67k | 51.67y | 30.33i | 57.12c |
| **Control** | 9.33u | 18.00p | 30.00ij | 42.00d | 54.67w | 64.00t | 74.00n | 84.00j | 74.00n | 39.00f | 22.33n | 46.03g |
| **Mean** | 13.52k | 28.61i | 40.47h | 52.47f | 64.57e | 74.47d | 84.47b | 94.33a | 79.38c | 49.66g | 26.90j | - |

## Conclusion and recommendations

The study demonstrated that T2 (75% methyl eugenol + 10% guava essence + 10% sugar solution + 5% spinosad) was the most effective formulation for managing fruit fly populations in persimmon orchards, particularly during the peak infestation period in October. These findings highlight the importance of timing control measures to coincide with pest population peaks and integrating attractant-based formulations with biopesticides into sustainable pest management strategies. Further recommendations include large-scale adoption of T2, region-specific customization of attractants, economic viability studies, and environmental impact assessments to ensure effective, eco-friendly, and economically feasible pest management practices.

## References


Alim, M. A., M. A. Hossain, M. Khan, S. A. Khan, M. S. Islam and M. Khalequzzaman. 2012. Seasonal variations of melon fly, *Bactrocera cucurbitae* (Coquillett) (Diptera: Tephritidae) in different agricultural habitats of Bangladesh. ARPN J. Agric. Biol. Sci., *7*(11): 905-911.

Bhatnagar, K. N., and S.R.S. Yadava. 1992. An insecticidal trial for reducing the damage of some cucurbitaceous fruits due to *Dacus cucubitae* Coq. Ind. J. Entomol. 54:66–69.

Chinajariyawong, Apichart, Kritsaneepaiboon, Suraphan, Drew, A. I. Richard, and H. Chuenchit. 2000. Seasonal population dynamics of fruit flies (*Bactrocera* spp.) in Thailand. Entomologia Experimentalis et Applicata. 95(1): 55-62.

Drew, R. A. I. and D. L. Hancock. 2000. Phylogeny of the tribe Dacini (Dacinae) based on morphological, distributional, and biological data. Fruit flies (Tephritidae): phylogeny and evolution of behavior. 491-504.

Drew, R. A. Itturalde, and R. Siva. 2002. The fruit fly fauna of Australia: their biology and natural enemies. Crop Protection. 21(5): 535-544.

Ghafoor, A., K. Mustafa, I. Zafar and K. Mushtaq. 2010. Determinants of Mango Export from Pakistan. Agric. Res., 48: 105-120.

Jaiswal, R. C., P. Nath, and K. P. Srivastava. 1997. Effectiveness of non-chemical techniques such as fruit bagging for pest management in horticultural crops. Crop Protection. 16(6): 553-559.

Kakar, M. Q., F. Ullah, A. U. R. Saljoqi, S. Ahmad and I. Ali. 2014. Determination of fruit flies (Diptera: Tephritidae) infestation in guava, persimmon and bitter gourd orchards in Khyber Pakhtunkhwa. Sarhad J. Agric., 30(2): 241-246.

Manrakhan, Ali, Ekesi, Sunday, Mohamed, A. Samira, and A. Stefan. 2017. Efficacy of attractants for monitoring *Bactrocera* spp. in tropical fruit systems. Pest Management Science. 73(2): 285-294.

Piñero, C. Jaime, Jáuregui, M. Victoria, Aluja, Martín, and R. Juan. 2013. Tailored attractant formulations for sustainable fruit fly management. Journal of Integrated Pest Management. 4(2): 1-7.

Stonehouse, J. M., J. D. Mumford, and G. Mustafa. 1998. Economic losses to tephritid fruit flies (Diptera: Tephritidae) in Pakistan. Crop Prot., 17(2): 159-164.

Stonehouse, M. John, M. A. T. Poswal, Mumford, D. John, F. A. Baloch, A. H. Makhdum, and B. J. Hughes. 2004. Weather-based forecasting and management of *Bactrocera* populations using cue-lure traps. International Journal of Pest Management. 50(3): 223-232.

Vargas, I. Roger, Peck, L. Steven, McQuate, T. Grant, Jackson, G. Chad, Stark, D. John, and A. W. John. 2001. Evaluation of spinosad as a replacement for organophosphate insecticides in fruit fly bait stations. Journal of Economic Entomology. 94(4): 817-823.

White, I. M., and M. M. Elson-Harris. 1992. Fruit flies of economic significance: their identification and bionomics. CAB International.

Zaman, Q. 1995. Efficacy of cue-lure and para-pheromones for controlling male populations of fruit flies (*Bactrocera* spp.). Pakistan Journal of Agricultural Research. 11(2): 102-108.