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STUDIES ON THE EFFICACY OF VARIOUS FOOD LURES AGAINST OF FRUIT FLY

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Abstract

The field experiment (population trend of fruitflies in persimmons orchard) was conducted in New Developmental Farm, The University of Agriculture, Peshawar during 2023. The results revealed that fruitflies appeared in the field during 1st September where maximum population was recorded from T2 (43.67 No. of fruitlies trap^{-1}) while minimum was recorded from T5 (21.67 No. of fruitflies trap^{-1}) as compared with the control (18.00 No. of fruitflies trap^{-1}). Then fruitflies population reach to its peak on 3rd October where maximum population was recorded from T2 (108.67 No. of fruitflies trap^{-1}) while minimum was recorded from T5 (87.00 No. of fruitflies trap^{-1}) as compared with the control (84.00 No. of fruitflies trap^{-1}) then declined was noticed and disappeared from the field after 2nd November 2024. Overall mean data showed that maximum number of fruitflies was recorded from T2 (68.15 No. of fruitflies trap^{-1}) while minimum was recorded T5 (48.84 No. of fruitflies trap^{-1}) as compared with control (46.03 No. of fruitflies trap^{-1}). Thus T2 (75% methyl eugenol+10% Guava essence with 10% sugar solution and 5% Spinosad) has been recommended for the farmers of the Peshawar region.

Keywords: Fruit flies, population dynamics, persimmon orchard, trap efficacy, field monitoring

Introduction

Fruit flies (Diptera: Tephritidae) belong to one of the most important group of insect pests worldwide. Tephritidae consists of many sub-families where the most important sub-family Dacine can be found in the African, Asian and Pacific regions. More than 5000 species of fruit flies have been described globally, including approximately 200 species of economic significance where 68% species belong to the genus *Bactrocera* and 32% species are included in the genus *Dacus* of the fruit flies (Drew and Hancock, 2000). Fruit flies caused severe losses in vegetables and fruits in sub-tropical, tropical and temperate regions throughout the world. A wide range of different fruit species are attacked by fruit flies that cause significant economic loss (White and Elson-Harris, 1992). In Pakistan citrus, guava, mango, pomegranate, apricot, persimmon, plum, persimmon, loquat, jujube, pear, melon, watermelon, bitter gourd, bottle gourd, pumpkin, cucumber, tomato and sponge gourd suffer annual financial loss of nearly seven billion rupees (Stonehouse *et al.,* 1998) where sometimes their infestation may reach up to 80% thus inflicting great loss. Among these, mango, guava and persimmones are the favorable hosts of fruit flies (Ghafoor *et al.,* 2010). The use of pre-harvest management strategies are important to reduce direct losses and to increase the efficiency of post-harvest quarantine treatments, a number of methods have been used to reduce the damages by this pest. These methods includes: non-chemical control such as bagging of fruits (Jaiswal *et al*., 1997), field sanitation (Klungness *et al*., 2005) and biological control (Sinha and Saxena, 1999). By using these methods the pest population can be controlled under economic threshold level so losses can be avoided which is the immediate concern of the growers. In chemical control some pesticides like Malathion, dichlorvos, phosphamidon and endosulfan are effective in controlling the melon fly (Agarwal *et al.,* 1987). The para-pheromone and cue-lure traps are needed to eliminate males (Zaman, 1995). These cue lure traps, which are used as sex attractants are found to be more effective as compared to the traps that are used as food attractants for monitoring *Bactrocera* species. The relationship between cue-lure trap catches and weather conditions such as minimum temperature, rainfall, and minimum humidity, is positive (Stonehouse *et al*., 2004). Keeping these observations in view, the present investigations

on the efficacy of various traps based on food essence of guava, persimmon and orange against the population density of fruit fly species in persimmon orchard.

Materials and Methods

The experiments entitled "Studies on the efficacy of various traps based on food essence against the population density of fruit fly species in persimmons orchard" was conducted at New Developmental Farm, The University of Agriculture, Peshawar 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. Persimmon fruit trees already planted in New Developmental Farm in The University of Agriculture Peshawar was used for this experiment. The whole orchard was divided into three blocks as replications to avoid data interruption. Each block was further divided into seven sub-blocks. All the agronomic practices were carried though out the cropping season

Preparation of baits

Details of the doses and combination of different components of the mixtures/treatments are 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 were taken and four holes having 2.3cm diameter was made for trapping flies. Traps were made, which was 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 (Shah *et al.,* 2021).

Insecticide spinosad ®

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

Application

The experiment was conducted during September-November, 2024 having seven treatments replicated thrice. Each of the treatment traps were assigned to one plant in such a way that each treatment trap was used once in each block. The traps were hung through wire hook from persimmon trees.

Total number of fruit flies per trap

For recording the population density of fruit flies, five randomly selected trees in each plot was 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 bags and tagged and afterwards were brought to Plant Protection laboratory, The University of Agriculture, Peshawar. The collected specimen was separate based on gender and species variation 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 were recorded on weekly basis to monitor the population trend of fruitflies in persimmons orchards during 2024. The pest appears in the field with in 1st hour of traps installation during 1st 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 1st 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 3rd 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 2nd 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 3rd October (94.33 No. of fruitflies trap^{-1}) and this month appears to be great time frame for the improvement of

fruitflies population. The results of the current study clearly demonstrate that fruit fly (Diptera: Tephritidae) populations vary significantly across different treatments and time intervals, with the highest population densities recorded during the 3rd week of October. This suggests that climatic conditions, host fruit availability, and ecological interactions during this period are highly favorable for fruit fly proliferation, consistent with findings reported by Bateman (1972) and Dhillon et al. (2005). Treatment T2 consistently outperformed other treatments in suppressing fruit fly populations across all observation periods, recording the highest reduction in mean fruit fly count (68.15 flies $trap^{-1}$). This suggests that the intervention used in T2 (presumably an attractant or biocontrol agent) was more effective in disrupting the lifecycle or attracting and eliminating adult flies. Similar trends have been reported in the use of methyl eugenol and protein bait traps for *Bactrocera dorsalis* and other dacine fruit flies (Vargas et al., 2009; Ekesi et al., 2011). The population peak observed in October aligns with the fruit maturation phase of persimmons, during which increased sugar content and fruit aroma make the crop more attractive to gravid females for oviposition. This seasonal spike is a known phenomenon in fruit fly ecology (White and Elson-Harris, 1992), further supported by Bragard et al. (2020) who note similar timing patterns in tropical and subtropical fruiting systems. The gradual decline in population after October may be attributed to the onset of cooler temperatures and reduced fruit availability, which are known limiting factors for Tephritid activity (Clarke et al., 2005). Among all treatments, T5 exhibited the least efficacy in reducing fruit fly populations, though still outperforming the untreated control. This indicates partial suppression, possibly due to suboptimal trap design, lure concentration, or application frequency. Field variability, including microclimatic differences and orchard sanitation levels, may also influence the performance of individual treatments. The significant interaction between treatment and time suggests that continuous monitoring and a time-sensitive application strategy are essential. Specifically, the 3rd week of October emerged as the most critical period for fruit fly management interventions. Proper timing of control measures during this peak window can significantly reduce the pest load, limiting crop damage and future generations (Drew et al., 1984). These findings highlight the need for integrated pest management (IPM) approaches tailored to local phenological and climatic patterns. Incorporating attract-and-kill devices, sterile insect techniques, and

cultural controls (e.g., fruit sanitation and early harvest) can enhance control efficacy (Ekesi et al., 2007). Furthermore, long-term sustainability would require periodic efficacy assessments and resistance monitoring of attractants or biopesticides used in treatments like T2 and T4.

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Table: Population trend of fruitflies with different fruit essence using Pheromone traps in persimmons orchard during 2024.

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	-

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LSD $_{(0.05)}$ for Treatments= 0.29

LSD $_{(0.05)}$ for Intervals= 0.36

LSD $_{(0.05)}$ for Treatments x Intervals= 0.96

Conclusion:

The study concluded that T2 (75% methyl eugenol + 10% guava essence + 10% sugar solution + 5% spinosad) was the most effective treatment in reducing fruit fly population in persimmon orchards. Timely monitoring and targeted interventions significantly influenced pest suppression and fruit quality.

Recommendations:

1. Farmers in the Peshawar region should adopt the T2 treatment blend for effective fruit fly management in persimmon orchards.
2. Regular weekly monitoring of fruit fly populations is essential to determine the optimal timing for control measures.

References

Agarwal, M.L., D.D. Sharma and O. Rahman. 1987. Melon fruit fly and its control. Ind Hortic., 32:10–11.

Bateman, M. A. (1972). The ecology of fruit flies. Annual Review of Entomology. 17(1): 493–518.

Bragard, C., K. Dehnen-Schmutz, F. Di Serio, P. Gonthier, J. A. Jaques Miret, A. F. Justesen, and A. MacLeo. (2020). Pest categorisation of non□EU Tephritidae. EFSA Journal. 18(2): 060-88.

Clarke, A. R., K. F. Armstrong, A. E. Carmichael, J. R. Milne, S. Raghu, G. K. Roderick, and D. K. Yeates. (2005). Invasive phytophagous pests arising through a recent tropical evolutionary radiation: The *Bactrocera dorsalis* complex of fruit flies. Annual Review of Entomology. 50: 293–319.

Dhillon, M. K., R. Singh, J.S. Naresh, and H. C. Sharma. (2005). The melon fruit fly, *Bactrocera cucurbitae*: A review of its biology and management. Journal of Insect Science, 5(1): 40-45.

Drew, R. A. I., A. C. Courtice, and D. S. Teakle. (1984). Bacteria as a natural source of food for adult fruit flies (Diptera: Tephritidae). Oecologia, 63(3): 441–444.

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.

Ekesi, S., M. K. Billah, P. W. Nderitu, S. A. Lux, and L. Rwomushana. (2007). Evidence for competitive displacement of *Ceratitis cosyra* by the invasive fruit fly *Bactrocera invadens* (Diptera: Tephritidae) on mango in Kenya. Bulletin of Entomological Research. 97(5): 523–531.

Ekesi, S., P. W. Nderitu, and L. Rwomushana. (2011). Field infestation, life history and demographic parameters of *Bactrocera invadens* (Diptera: Tephritidae) in Africa. Bulletin of Entomological Research. 101(4): 529–540.

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

Jaiswal, J.P., T. B. Gurung and R.R. Pandey. 1997. Findings of melon fruit fly control survey and its integrated management 1996/97, Kashi, Nepal. Lumle. Agric. Res. Ctr. Work. Pap.97/53, pp. 1–12.

Klungness, L.M, E.B. Jang, R.F.L. Mau, R.L. Vargas, J.S. Sugano, E. Fujitani. 2005. New approaches to sanitation in a cropping system susceptible to tephritid fruit flies (Diptera: Tephritidae) in Hawaii. J. App. Sci. Environ. Manag. 9:5–15.

Sinha, P, S.K. Saxena. 1999. Effect of culture filtrates of three fungi in different combinations on the development of the fruit fly, *Dacus cucurbitae* Coq. Ann. Plant Prot. Serv., 7:96–9.

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

Stonehouse, J.M., J.D. Mumford, and A. Verghese. 2004. Returns to scale in pest suppression and eradication: Issues for the wide-area management of fruit flies in India., Ind. Agric. Res. Ins., New Delhi, India pp. 151–158.

Vargas, R. I., J. C. Pinero, and L. Leblanc. (2009). Attraction and management of pest *Bactrocera* fruit flies with male lures. Proceedings of the Hawaiian Entomological Society. 41(1): 103–121.

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

Zaman M. 1995. Assessment of the male population of the fruit flies through kairomone baited traps and the association of the abundance levels with the environmental factors. Sarhad J. Agric., 11: 657–670.