

ENHANCING THE EFFICACY OF FRUIT FLY (DIPTERA: TEPHRITIDAE) TRAPS BY ADDING CHICKEN FAECES, UREA, AND MOLASSES

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ABSTRACT

The research trials on enhancing the efficacy of fruit fly traps using different protein and ammonia gas emitting sources were conducted at mixed fruit orchards in Swat, Pakistan. The first experiment comprised para-pheromone, methyl eugenol alone, and a combination of Ammonia emitting sources, molasses, urea, and chicken faeces in compartments in traps were used. The para-pheromone methyl eugenol, Cu-lure, and Nu-lure consist of 85% lures, 10% sugar, and 5% Diptrex[®] insecticides. Similar procedures were adopted in the second and third trials with Cue lure (CL) and Nu lure (NL). The experimental results showed that the lure, methyl eugenol baited traps with local baits in the compartment of bait (ME, urea, molasses) recorded the highest catch of flies (37.22) as compared to lure trap alone (18.05). In the same method fruit flies' attractants, Nu-lure and Cue lure were used in traps separately resulted 2.83, 15.33 flies captured while in addition of local bait with Nu lure (NL, CF, Urea, Molasses) and Cu-lure (Urea, CF, and Molasses) gave 16.00, 48.91 dead flies counted. The experimental results proved that if the partition of fruit fly traps comprised with methyl eugenol or Cue lure or Nu lure filled with local bait chicken faeces (CF), urea, and molasses, they increased the efficiency of commercial fruit fly attractants, among this urea or animal manure as bait have a high potential of attractiveness to different fruit fly's species.

Keywords: Baited trap, Chicken Faeces, Efficacy, Fruit Fly, Molasses,

INTRODUCTION

The fruits orchards of Swat district in Khyber Pakhtunkhwa (KP) province in Pakistan include apples, peaches, and persimmons, and are also well known for producing different vegetables including tomatoes, potatoes, and onions (Ali, 2010; Khan, 2012). The fruit flies are of economic importance because it causes heavy losses to various fruits and vegetables (Vayssières et al., 2005).

The eleven fruit flies species e.g. *Bactrocera zonata*, *Bactrocera cucurbitae* and *Bactrocera dorsalis* reported in various parts of Pakistan (Stonehouse et al., 2002). Among these, the peach fruit fly, *Bactrocera zonata* (Saunders) damages to various fruit orchards in Pakistan (Saeed et al., 2022). It is reported as a serious pest globally (Sharma et al., 2022) as well. The various methodology of management including chemical control were adopted to manage its heavy infestation (Ullah et al., 2012). Flies' eggs remain in the host tissue even after the application of toxic chemicals. Therefore, chemical treatments are not very much effective (Sharma et al., 2017). Besides, excessive use of toxic chemicals worldwide pose health hazards (Edwards et al., 2007). Therefore alternative method of para pheromone Methyl eugenol baited traps (Nahid et al., 2021) ,numerous group of biopesticides including *Lecanicillium muscarium* (Rahman et al., 2019) ,aqueous neem and eucalyptus leaf extracts (Amin et al., 2018) and food-based attractant or protein bait was adopted because, they are relatively safe and free of pollution (Mwungu et al., 2020). The researchers were used various protein based food attractants, bird dropping, chicken faeces (Pinero, et al 2003), human urine (Mahmoud et al., 2017), and livestock manure as an alternative fruit flies attractants in fruit orchards (Filgueiras et al., 2016). The different protein-based food baits including GF-120, Bio lure and ammonium acetate release volatiles of ammonia which attract the flies species (Mazor, 2018; Pinero et al., 2011). Moreover, researchers tested these ammonia emitting sources on molasses, juices of various fruits (Alves et al., 2019) and different types of yeast against fruit flies species with valuable results (Shelly et al., 2022) . Given the above, the aim of the study was to evaluate the efficacy of local bait of fruit fly attractants and its comparison with the para-pheromone methyl eugenol, Cue-lure along with commercial bait Nu lure[®] in fruits or vegetables orchards.

MATERIALS AND METHODS

Study site

The research work on enhancing efficacy of fruit fly traps using ammonia sources was carried out at the mixed fruit orchards of peaches, plums with summer vegetables located at 8-acre-area in the vicinity of Agricultural Research Institute (ARI), Mingora, and Swat, Pakistan.

Bait, trap, and data collection

The plastic traps were cylindrical in shape and the bottom area was divided into partition for filling any local bait along with artificial lures i-e Methyl eugenol, Cue lure, hung with cotton swab at maximum eight meters height of tree branches. The traps have holes surrounding on them for entry of fruit fly easily. The Methyl eugenol is familiar throughout worldwide to managed oriental fruit fly and *Bactrocera zonata* while Cue lure comprised raspberry ketone used in cucurbits cultivation to control *Bactrocera cucurbitae* in cucurbits orchard or in field. The Protein hydrolyzate (Nu-lure®) is bait used to attract and kills the fruit fly species. The protein sources are molasses (100 ml water+ 25 ml diptrex 80%sp (trichlorphon)+1g potassium metabisulphite), chicken faeces, CF (20g chicken faeces +100 ml water+ 5ginsecticide Diptrex + 1g potassium metabisulphite preservatives + glycerine),5 g Urea (Fuji Fertilizer Pvt. Ltd. + 5 g diptrex 80 SP® insecticide) The ratio of lure, sugar and insecticide was maintained at 85:10:5 during treatments preparations. The experiment was comprised of 8 treatments; viz, T₁: methyl eugenol (ME) baited traps alone, T₂: ME + CF, T₃: ME+ urea, T₄: ME + molasses, T₅: ME + CF + molasses, T₆: ME+ CF+ molasses), T₇: ME+ urea+ molasses and T₈: ME+ urea+ CF+ molasses. Partition of traps were filled with any of the component of treatments. The layout of experiment was two factorial CRD with 3 replications. Similar procedures were adopted in other two experiments. The data were collected weekly interval during June to September for each treatment and were analysed by Statistix 8.1 software with mean comparison through LSD test.

RESULTS AND DISCUSSION

The ME, CL and NL baited traps were resulted 18.05, 15.33 and 2.83 dead flies reported in the trials when both the lures and NL bait were used in the compartment of the traps at eight-meter height of tree as shown in table (1,2 and 3). Mean numbers of dead flies were counted as 37.22 in first experiment table (1) , 16 in 2nd experiment table (2) and 48.91(3rd experiment table.03)

from ME based traps (ME, urea, molasses) in table (1), NL based traps (NL, urea, CF, molasses) in table (2) and CL based traps (CL, urea, CF, molasses), table (3) respectively.

The fruit fly's species identified from ME Baited traps in first experiment were *Bactrocera zonata* 2296 (79.39%) followed by *Bactrocera dorsalis* 556 (19.22%) and limited mean numbers of *Bactrocera tau* 40 (1.38%), respectively.

Similarly, from NL baited traps *Bactrocera cucurbitae* was the most predominant 469 (82.2%) catch reported and followed by *Bactrocera tau* 77 (13.5%) and *Bactrocera zonata* 24 (4.21%), while CL baited traps captured *Bactrocera cucurbitae* 1914 (59.46%), *Bactrocera tau* 1358 (39.11%) and minimum mean numbers of *Bactrocera diversa* 46 (1.43%) flies.

Moreover, non-targeted insect species of orders belong to Diptera and Hemiptera reported in the fly traps. The identification of fruit flies was done by using binocular microscope and keys discussed as an earlier research investigators ([Ganie et al., 2013](#); [Prabhakar et al., 2012](#)).

Table 1: The efficacy of fruit fly species with different Baits with Methyl eugenol

Treatments	Weeks						Means
	1	2	3	4	5	6	
T1 (ME)	31.00	23.00	14.33	18.66	14.66	6.66	18.05f
T2 (ME, CF)	35.33	30.00	21.00	15.00	10.66	3.33	19.22ef
T3 (ME, Urea)	43.00	36.00	24.00	15.33	22.33	7.00	24.61d
T4 (ME, Molasses)	38.00	26.00	20.00	23.33	19.33	6.33	22.1 de
T5 (ME, CF, Urea)	56.33	45.66	35.66	22.66	28.00	11.00	33.22 b
T6 (ME, CF, Molasses)	35.00	30.00	24.66	22.66	20.66	10.00	23.83 d
T7 (ME, Urea, Molasses)	56.66	52.33	37.66	26.33	35.00	15.33	37.22 a
T8 (ME, Urea, CF, Molasses)	49.66	40.66	37.00	17.66	25.00	10.00	30.00 c
Means	43.12a	35.45b	26.79c	20.20d	21.95d	8.71e	26.04

*Probability level 0.05; LSD values for Treatments=3.06 weeks=2.65

Table 2: The efficacy of fruit fly species with different Baits with Nu lure

Treatments	Weeks						Means
	1	2	3	4	5	6	
NL	3.66	2.66	1.33	6.33	1.33	1.66	2.83 e
NL, CF	7.00	4.33	3.00	7.33	1.00	1.33	4.00 de
NL, Urea	18.00	13.66	8.33	9.00	4.66	3.00	9.44 b
NL, Molasses	9.00	7.33	2.66	3.33	1.66	1.00	4.16 d
NL, CF, Urea	17.00	15.66	10.33	6.00	3.66	5.33	9.66 b
NL, CF, Molasses	16.33	12.33	7.00	6.33	3.00	1.66	7.77 c
NL, Urea, Molasses	19.00	11.00	6.66	7.33	2.66	1.00	7.94 c
NL, Urea, CF, Molasses	28.66	22.33	16.66	14.66	9.00	4.66	16.00 a
Mean	14.83a	11.16b	7.00c	7.54c	3.37d	2.46d	7.73

*Probability level 0.05; LSD for Treatments=1.21; weeks=1.05.

Table 3: The efficacy of fruit fly species with different Baits with Cue lure

Treatments	Weeks				Means
	1	2	3	4	
CL	21.33	17.33	13..33	9.33	15.33f
CL, CF	32.00	28.00	20.33	22.66	25.66 d
CL, Urea	39.33	35.33	28.00	24.00	31.58 c
CL, Molasses	29.33	20.00	18.00	14.66	20.50 e
CL, CF, Urea	47.33	35.33	29.33	25.00	34.33 b
CL, CF, Molasses	33.33	25.00	21.33	20.00	24.91 d
CL, Urea, Molasses	36.00	26.33	23.33	18.00	25.91 d
CL, Urea, CF, Molasses	59.33	52.00	45.33	39.33	48.91 a
Means	37.25a	29.87b	24.83c	21.62d	28.39

*Probability level 0.05 LSD for Treatments=2.13, weeks=1.50.

Chicken faeces as the bait sources used in the first experiment in Methyl eugenol baited traps captured (T1) 18.05 mean numbers of flies but when (CF) used in the compartment of trap 19.22 dead flies were reported. It was showed that with the presence of CF the efficiency trap increased. But when the Nu lure without CF tested baited trap 2.83 flies were recorded but CF addition in the compartment of Nu lure traps 4.00 flies were counted. In third experiment, CL baited traps alone captured 15.33 mean flies but the addition of CF in partition to this trap the fly's population increased to 25.66 mean numbers. These results show similarity index with earlier observations reported by different authors ([Mondal et al., 2022](#); [Maung et al., 2019](#)).

The manure urea as local bait tested in partition to the ME baited trap increased the efficiency of trap with catches 24.61 flies in six weeks duration, while in NL and CL baited trap 9.44 and 31.58 mean flies were counted. Our results were supported by earlier different researchers who carried out various studies on protein-based bait against fruit fly ([Bajaj and Singh, 2018](#); [Mazor, 2009](#); [Piñero et al., 2011](#)). but fertilizer (di-ammonium phosphate) along with *Eucalyptus* oils were tested and found effective attractants against Medfly *Ceratitidis capitata* in previous findings ([Sadraoui-Ajmi et al., 2022](#)).

The addition of molasses in trap fly catch were increased to 22.1 mean number of flies in case of ME flies' attractants and with NL and CL traps molasses in compartment catch increased to 4.20.50 flies. The similar findings were observed by earlier researchers ([Pandey et al., 2010](#); [Schutze et al., 2018](#) ; [Nai et al., 2022](#)). The Nu-lure is not effective when used alone but in combination with other treatments show best results as in previous study it was reported that protein hydrolyzate with jaggery increased the captured of flies in traps ([Hasnain et al., 2022](#); [Sruthi et al., 2022](#)). The weekly interval base data revealed that the fly catches was decreased from first weeks to last week which proved that if the artificial lures and local baits were tested in fruit orchard the potential of the bait decreased gradually with time. It means the ammonia- base baits were effective for two to three weeks if they are not exposed to rainwater. These research work shows similarity to previous trials of different scientist ([Mangan et al., 2006](#))

CONCLUSION

Separately used two lures -methyl eugenol, Cue lure and artificial Ammonia -based bait and their presence with local bait of chicken faeces (CF), urea and molasses placed in compartments of the trap revealed that all these natural constituent-based protein and ammonia gas emitting are effective and increased the efficiency synthetic fruit fly attractants but among them, the ammonia source's urea is the most effective. Therefore, it is recommended that urea or different types of local manure is cheap, easily handled and should be tested in the laboratory and field or orchards in future.

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