

## Monitoring Fruit Fly Using Different Lures in Watermelon (*Citrullus lanatus*) Field in Nuwakot, Nepal

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### ABSTRACT

A study conducted in the watermelon field of Panchakanya Rural Municipality, Nuwakot district focused on monitoring of fruit fly species through methyl eugenol (ME) and cue lure (CL) with their different quantities from 10th of April to 21st of May, 2024 for six weeks till harvesting. This study extensively focused on effectiveness of different lures and their quantity used for the monitoring of different fruit fly species by using 1 liter plastic bottle as a trap in watermelon field. This study was designed by six treatments where lure types i.e. ME and CL was used with their quantity of 0.25 ml, 0.50 ml, and 1.00 ml with three replications. Out of total 597 fruit flies, ME traps captured 363 (61%) and 52 (9%) of *Bactrocera dorsalis* and *B. zonata*, whereas CL traps trapped 167 (28%) and 15 (2%) of *Zeugodacus cucurbitae* and *Z. tau* throughout monitoring period. Result revealed that at Panchakanya during April to May on watermelon field *Bactrocera* genus were highly sensitive to ME and captured in massive numbers throughout the observation period, while *Zeugodacus* genus were sensitive to CL and trapped during fruit ripening stage. Through data analysis, 0.50 ml quantity trapped high number of fruit flies in overall population of species in both ME and CL traps on watermelon field at Nuwakot during April to May.

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### INTRODUCTION

Watermelon, scientifically, known as *Citrullus lanatus* (Thunberg), is a delightful and refreshing fruit that many people love, particularly during the hot summer months, which is a part of Cucurbitaceae family (Trinklein, 2020). Globally, watermelon output has been increased by an average of 3.31% every year, rising from 21.9 million tons to 100 million from 1973 to 2022 (Knoema, 2022). Additionally, according to the fiscal year 2021/22, 52,550 metric tonnes (mt) watermelons were produced under the area of 2,473 hectares (ha) in Nepal (MoALD, 2023). Farmers face various challenges in the production of watermelon, from cultivation to harvesting and even during marketing, causing extensive losses. Additionally, watermelon, being a summer season fruit, is more susceptible to infestations of insect pests compared to other seasons. Among them, the fruit fly is one of the most serious and economically important insect pests (Allwood and Leblanc, 1997).

Fruit flies, belonging to the family Tephritidae, are considered to be destructive and well-known pests of fruits and vegetables worldwide (Allwood and Leblanc, 1997). Female fruit flies deposit their eggs through ovipositor within the tissues of developing fruits by, causing significant agricultural damage (Sharma et al., 2015). Adhikari et al. (2020) stated that cucurbit family is affected by 79% by fruit flies. In Nepal, among different fruit fly species, *Zeugodacus cucurbitae* (Coquillett), *Zeugodacus tau* (Walker), and *Zeugodacus scutellaris* (Bezzi) are some of the fruit fly species typically seen in cucurbit crops (Kapoor et al., 1980). Cue lure (CL) and methyl eugenol (ME) are commonly used as male fruit fly attractants in traps to monitor and manage fruit fly population (Adhikari et al., 2020).

In Nuwakot, commercial watermelon farming just started around five years ago, thus there is limited research on the pests of this crop. The major objective of this research is to monitor and identify the fruit fly species using different lures on watermelon field at Nuwakot district through traps made from plastic bottles which are eco and budget friendly.

## MATERIALS AND METHODS

### Preparation of plastic bottle trap

For the preparation of plastic bottle trap based on Steiner trap design, tops of bottles were cut, half of the mouth part was covered by mesh, and inverted into the body. Then, hook or metal wire was placed at the middle to hold attractant piece. A coin-sized hole made on bottom side, half was covered by mesh and 20 cm long thread was tied up for hanging, as shown in Figure 1 (Guaman, 2009).

### Installation of trap

A total of 18 traps were set on a watermelon field having the area of 0.15 ha (3 ropani), which were made from 1 liter plastic bottles and used with male fruit fly attractants i.e. methyl eugenol and cue lure in three lure amount i.e. 0.25 ml, 0.5 ml, and 1 ml. The traps were replicated thrice and hanged at 1.0 m height with bamboo sticks at 5.0 m distance. Lures were measured through syringe as required amount i.e. 0.25 ml, 0.5 ml, and 1.0 ml and later poured in rolled cotton wool which had an area of approximately 19.6 cm<sup>2</sup> (circumference = 15.7 cm) at the top side, whereas 1.00 ml of Malathion 50% EC as killing agent at the bottom side, which then be placed inside the trap. Lures and Malathion 50% EC were replaced every 2 weeks using syringes (Bhusal *et al.*, 2020).



Figure 1: Fruit fly trap using plastic bottle

### Field observation and identification

The installed traps were monitored weekly on farmer's field from 10<sup>th</sup> of April to 21<sup>st</sup> May, 2024 at Baniyatar, Panchakanya-1, Nuwakot (27.9084° N and 85.2698°E), where planting and other operations were carried by the farmer themselves. The caught fruit flies from traps were brought to the laboratory at Plant Quarantine and Pesticide Management Center (PQPMC), Hariharbhawan in Lalitpur. The species was determined through examination of their morphological characteristics, with especially attention on their thorax, wing and abdomen during the determination procedure.

### Data analysis

The collected data were documented in Microsoft excel 2013, through which results were represented visually as pie charts, Tables and graphs as per need. All the data was analyzed in Microsoft excel 2013 through documented data in tabular form.

## RESULTS AND DISCUSSION

### Monitoring of fruit fly species

As shown in Figure 2, the increment of fruit flies in traps was seen over the course of monitoring. During monitoring period, a total of 597 fruit flies were trapped over the course of 6 weeks monitoring through ME and CL male attractants, where 415 (70%) *Bactrocera* genus was captured in the ME traps, while 182 (30%) *Zeugodacus* genus was trapped in the CL traps, as represented in Figure 3. On the contrast, *Zeugodacus* genus was seen when fruits started to ripen, whereas *Bactrocera* genus population started to decline when fruits matured.

Different species attract to different lures, and the same species of fruit fly is not attracted to different lures; for example, *B. dorsalis* and *B. zonata* are only attracted to ME, not to CL male attractant, while *Z. tau* and *Z. cucurbitae* are attracted to CL, not to ME male attractant (PQPMC, 2023). Due to the handling of several lures simultaneously and the setting of traps caused lure contamination, resulted in that cross-attraction (Sharma *et al.*, 2015).

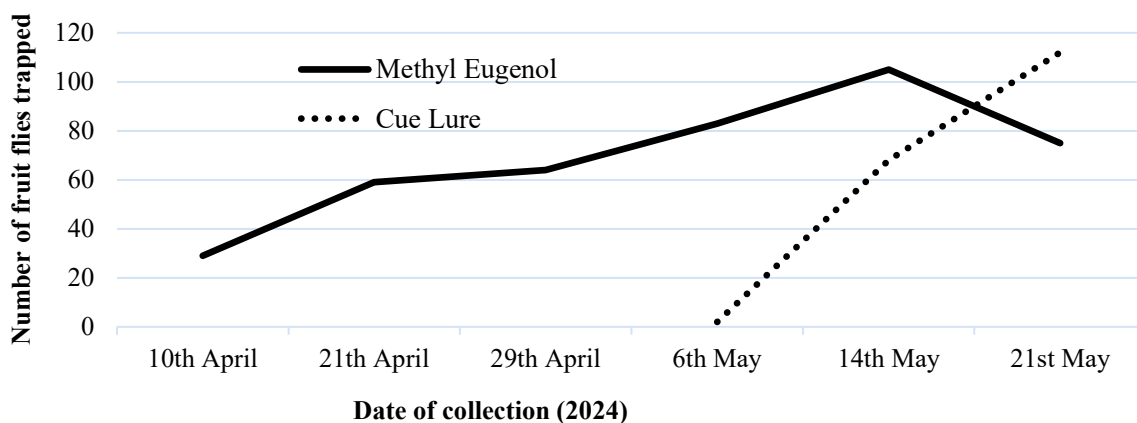
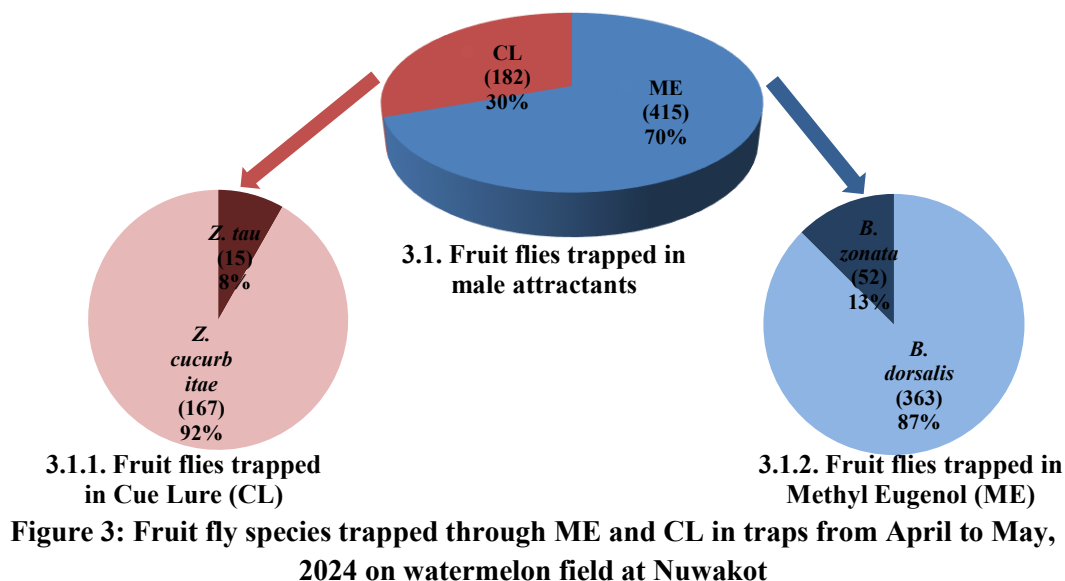
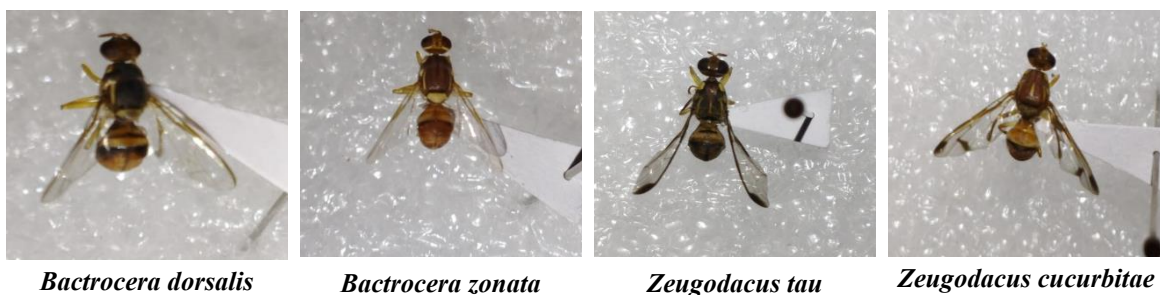
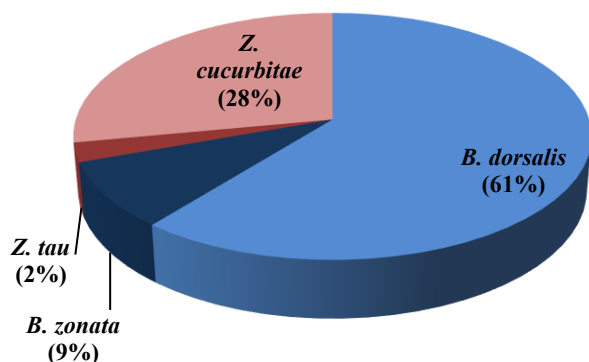


Figure 2: Fruit flies trapped in CL and ME traps from 10<sup>th</sup> April to 21<sup>st</sup> May, 2024 on watermelon field at Nuwakot



Furthermore, 363 (61%) were *B. dorsalis* and 52 (9%) were *B. zonata* were identified from methyl eugenol traps, whereas 15 (2%) were *Z. tau* and 167 (28%) were *Z. cucurbitae* were identified from cue lure traps, as presented in Figure 4.



**Figure 5: Identified fruit fly species on watermelon field at Nuwakot during April to May, 2024**

**Comparison of lures and their different quantities**

Even though the result tabulated in Table 1 showed that mean number of fruit flies attracted to ME (103.75) is significantly higher than that attracted to CL (45.50), but from Figure 2, *Bactrocera* genus was seen sensitive to ME throughout the six weeks of monitoring but dropped gradually when fruits ripped, whereas *Zeugodacus* genus was only sensitive to CL and trapped from first week of May when fruits started to ripen on watermelon field at Nuwakot indicating ME to be effective from seedling to growth period, while CL to be effective during ripening stage on watermelon field, especially from April to May at Nuwakot.

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**Table 1: Fruit flies trapped in methyl eugenol and cue lure from April to May on watermelon field at Nuwakot**

Lure types	<i>B. dorsalis</i>	<i>B. zonata</i>	<i>Z. tau</i>	<i>Z. cucurbitae</i>	Total fruit flies trapped	Mean fruit flies trapped
Methyl eugenol (ME)	363	52	-	-	415	103.75
Cue lure (CL)	-	-	15	167	182	45.50

As for the lure quantities, the mean of fruit flies trapped from watermelon field was seen higher in 0.5 ml quantity of lure from April to May (2024) at Nuwakot, followed by 1.0 ml, and least number was in 0.25 ml, as present in Table 2. Thus, in overall, 0.5 ml quantity was resulted effective during that period of monitoring on watermelon field.

**Table 2: Fruit flies trapped in different lure quantities from April to May on watermelon field at Nuwakot**

Quantity (ml)	<i>B. dorsalis</i>	<i>B. zonata</i>	<i>Z. tau</i>	<i>Z. cucurbitae</i>	Total number of trapped fruit flies	Mean number of trapped fruit flies
0.25	104	18	6	39	167	41.75
0.5	144	21	5	69	239	59.75
1	115	13	4	59	191	47.75

Additionally, the similar research conducted by Bhusal et al. (2020) on cucurbit vegetables in Sindhuli reported methyl eugenol effective for *B. dorsalis* and *B. zonata* at 0.1% level of significance, whereas cue lure and mixture of ME and CL were effective for *Z. tau* and *Z. cucurbitae* at 1% and 0.1% level of significance respectively.

The differences between two similar research could be due to environmental conditions, host preference, time of the traps installment (here 10th April to 21st May, 2024 as monitoring period), surface area or material used for holding lures (here, rolled cotton ball of area 19.6 cm<sup>2</sup> with circumference of 15.7 cm), error in measurement of lures, limited period for monitoring, or the high population specific lure sensitive fruit fly species at the time of monitoring.

### CONCLUSION

The plastic bottle traps based on Steiner trap design are effective, cheap, sustainable and eco-friendly as well as budget friendly. *B. dorsalis* and *B. zonata* in ME traps were captured and identified species at the time of growing phase, whereas *Z. cucurbitae* and *Z. tau* in CL traps were trapped when fruits were near harvest time and identified species from April to May on watermelon field at Nuwakot, Nepal. In *Bactrocera* genus, *B. dorsalis* and in *Zeugodacus* genus, *Z. cucurbitae* were in great number from April to May on watermelon field at Nuwakot, Nepal. In terms of lure amount, 0.5 ml lure quantity was seen effective on watermelon field during that specific period of monitoring at Nuwakot, while 0.25 ml might was insufficient amount and 1.0 ml might cause over spill outside the traps, thus unable to trap fruit flies in the bottle traps.

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