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# Efficacy of different attractants for management of fruit flies infesting mango in Konkan region

**AC Parab, SD Desai, VS Desai, SK Mehendale and GM Golvankar**

**Abstract**
The present study was carried out on the efficacy of different attractants for management of fruit flies infesting mango in Konkan region at Horticulture Nursery, Department of Horticulture, College of Agriculture, Dapoli during May to July 2017. The data on total number of fruit flies trapped during May to July 2017 per trap revealed that the fruit flies trapped per trap were in the range of 0.00 to 363.67. The maximum (363.67) number of fruit flies were trapped in the treatment $T_2$ (Black *Ocimum* + Malathion) which was significantly superior over the rest of the treatments except treatment $T_8$ (Black *Ocimum* + Spinosad) which recorded 325.33 number of fruit flies and both the treatments were at par with each other. The next best treatments in order of efficacy were $T_1$ (Green *Ocimum* + Malathion), $T_7$ (Green *Ocimum* + Spinosad) and $T_3$ (Black Jaggery + Malathion) which recorded 258.67, 222.67 and 211.33 number of fruit flies, respectively. The minimum fruit flies were recorded in the treatment $T_{10}$ (common Jaggery + Spinosad) which recorded 90 fruit flies per trap. Among the bait material used for attracting fruit flies all were more or less effective but the treatment $T_2$ (black *Ocimum* (leaf extract) + Malathion) and treatment $T_8$ (black *Ocimum* (leaf extract) + Spinosad) attracted the maximum number of fruit flies.

**Keywords:** Attractant, Baits, *Ocimum* sp., Fruit flies etc.

## Introduction
Mango *(Mangifera indica* L.) is the oldest and choicest fruit of the world. It is considered as 'National fruit of India' and known as 'King of fruits' owing to its nutritional richness, unique taste, pleasant aroma and its religious and medicinal importance. Due to its good qualities and high medicinal values, it is enjoyed by masses and classes from all corners of the world.
The total world production of mango is 43,300,000 tonnes (Anon., 2015)[3]. It is commercially grown in more than 111 countries but nowhere it is as greatly valued as in India where 40 per cent of area under fruit crops is only under mango. India is the major mango producer in the world, with an area of 2.218 million hectares and the annual production of 18.832 million tonnes with productivity of 8.49 MT/ha. (Anon., 2015) [2]. India contributes about 64 per cent of the world mango production. In Maharashtra, mango is occupying an area of 4.82 lakh ha with the annual production of 6.33MT and productivity of 1.3MT/ha (Anon., 2014) [1].
In Konkan region, 1, 82,000 ha area is under mango cultivation with annual production of 3.25 lakh MT. The productivity of mango in Konkan is about 2.5 t/ha, which is about three times less than the average productivity of the country (Anon., 2014) [1]. In Konkan, about 90 per cent area of mango is occupied by single cultivar "Alphonso", which is locally called as "*Hapus*".
In spite of all good points, the mango crop suffers a regular colossal loss due to the ravages of pest. Among the insect-pests, fruit fly is the serious and destructive pest of mango. Eight species of fruit fly infest mango in India. The fruit fly species infesting mango in India are *Bactrocera zonata* Saunders, *Bactrocera diversa* Coquillett, *Bactrocera hageni* de Meijere, *Bactrocera cucurbitae* Coquillett, *Bactrocera tau* Walker, *Dacus correctus* Bezzi and *Dacus incisus* Walker (Kapoor 1970) [4].
Methyl eugenol is commonly used for trapping mango fruit flies. However, commercial synthesizing process of methyl eugenol is expensive and importation of required chemicals for the methylation process is difficult due to its high toxic nature. Therefore, development of an effective, plant based insect attractant, at an affordable price and easily available to the farmers is urgently needed. Most of the fruit flies are having limited distribution, perhaps due to physical, climatic and vegetative factors and host specificity. Adult flies feed in the neighborhoods and when they come to the target tree they are ready to lay their eggs.

Under these conditions the poison baits are helpless. People in general are not equipped to apply pesticides and it would not be recommended in backyards within inhabited areas. One control option is fruit bagging, but it would be unfeasible in tall trees and expensive also. Though the crop is economically important, the information on the fruit flies attractant is very much lacking particularly in Konkan region of Maharashtra. Hence, the present investigations were undertaken to study the efficacy of different attractants for management fruit flies infesting mango in Konkan region.

## Materials and methods

### Experimental detail

| | | | |
|---|---|---|---|
| 1. | Crop | : | Mango |
| 2. | Variety | : | Alphonso |
| 3. | Statistical Design | : | Randomized Block Design |
| 4. | No. of replications | : | 3 |
| 5. | No. of Treatments | : | 13 |
| 6. | Period of study | : | May to July 2017 |
| 7. | Treatment details | : | |

| | | |
|---|---|---|
| $T_1$ | : | Green *Ocimum* (leaf extract) (3ml) + Malathion (2ml) |
| $T_2$ | : | Black *Ocimum* (leaf extract) (3ml) + Malathion (2ml) |
| $T_3$ | : | Black Jaggery solution (3ml) + Malathion (2ml) |
| $T_4$ | : | Common Jaggery solution (3ml) + Malathion (2ml) |
| $T_5$ | : | Cinnamon (leaf extract) (3ml) + Malathion (2ml) |
| $T_6$ | : | Molasses (3ml) + Malathion (2ml) |
| $T_7$ | : | Green *Ocimum* (leaf extract) (3ml) + Spinosad (2ml) |
| $T_8$ | : | Black *Ocimum* (leaf extract) (3ml) + Spinosad (2ml) |
| $T_9$ | : | Black Jaggery solution (3ml) + Spinosad (2ml) |
| $T_{10}$ | : | Common Jaggery solution (3ml) + Spinosad (2ml) |
| $T_{11}$ | : | Cinnamon (leaf extract) (3ml) + Spinosad (2ml) |
| $T_{12}$ | : | Molasses (3ml) + Spinosad (2ml) |
| $T_{13}$ | : | Control (Without Attractant) |

### Procedure for preparation of extracts of attractant

The mature leaves of green *Ocimum*, black *Ocimum* and Cinnamon were properly washed with water and after proper cleaning grinded with the help of pestle and mortar for about 3 to 4 minute separately. The grinded material was passed through muslin cloth to obtain the clear extract which was used as an attractant material. In case of black Jaggery and common Jaggery, the solutions were prepared by adding 100 g of each in 200 ml distilled water separately and then used as an attractant material. Other attractants such as molasses, Malathion and Spinosad were used as such.

### Experimental layout

A block of uniform sized Mango trees (13 trees per replication) of Alphonso variety were randomly selected for the field experiment. Each trap was charged with attractant material as per the treatment details at 15 days interval. The traps containing various attractant materials were placed hanging randomly on the mango trees.

### Method of recording observation

The fruit flies trapped in each treatment were collected at five days interval. The data on number of fruit flies per trap was subjected to $\sqrt{n+1}$ transformation and analysed statistically.

## Results and Discussion

### Mean number of fruit flies trapped in different baiting material during May to July 2017.

The observations on the efficiency of different baiting material for trapping fruit flies during May to July-2017 are presented in Table 1.

The mean number of fruit flies trapped per trap during May was in the range of 0.00 to 46.67. The data revealed that the maximum (46.67) number of fruit flies were trapped in treatment $T_2$ (Black *Ocimum* + Malathion) which was significantly superior over the rest of the treatments except treatment $T_8$ (Black *Ocimum* + Spinosad) which recorded 41.78 mean number of fruit flies and the treatment was at par with $T_2$. The next best treatments in order of efficacy were $T_1$ (Green *Ocimum* + Malathion), $T_3$ (Black Jaggery + Malathion) and $T_6$ (Molasses +Malathion) which recorded 34.11, 29.56 and 28.56 mean number of fruit flies, respectively.

The mean number of fruit flies trapped per trap during June was in the range of 0.00 to 31.67. Data revealed that the maximum (31.67) number of fruit flies were trapped in the treatment $T_2$ (Black *Ocimum* + Malathion) which was significantly superior over the rest of the treatments except treatment $T_8$ (Black *Ocimum* + Spinosad) which recorded 28.83 mean number of fruit flies and both the treatments were at par with each other. The next best treatments in order of efficacy were $T_1$ (Green *Ocimum* + Malathion) and $T_7$ (Green *Ocimum* + Spinosad) which recorded 22.28 and 19.67 mean number of fruit flies, respectively.

The mean number of fruit flies trapped per trap during July was in the range of 0.00 to 6.73. The maximum (6.73) number of fruit flies were trapped in the treatment $T_2$ (Black *Ocimum* + Malathion) and was significantly superior over the rest of the treatments except treatment $T_8$ (Black *Ocimum* + Spinosad) which recorded 5.40 mean number of fruit flies and the treatment was at par with $T_2$. The next best treatments in order of efficacy were T1 (Green *Ocimum* + Malathion) and $T_7$ (Green *Ocimum* + Spinosad) which recorded 4.53 and 3.40 mean number of fruit flies, respectively.

The data on the mean number of fruit flies trapped per trap is presented in Table 4 and depicted in Fig.4. The data on total cumulative trap catches during month of May to July was in the range of 0.00 to 85.07. The maximum (85.07) number of fruit flies were trapped in treatment $T_2$ (Black *Ocimum* + Malathion) and the treatment was significantly superior over the rest of the treatments except treatment $T_8$ (Black *Ocimum* + Spinosad) which recorded 76.01 number of fruit flies and the treatment was at par with $T_2$. The next best treatments in order of efficacy were $T_1$ (Green *Ocimum* + Malathion), $T_7$ (Green *Ocimum* + Spinosad) and $T_3$ (Black Jaggery + Malathion) by recording 60.92, 52.29 and 50.50 number of fruit flies, respectively and all the three treatments were at par with each other.

### Total number of fruit flies trapped in different baiting material during May to July 2017.

The data on the total number of fruit flies trapped during May to July 2017 per trap is presented in Table 2.

The data revealed that the fruit flies trapped per trap were in the range of 0.00 to 363.67. The maximum (363.67) number of fruit flies were trapped in the treatment $T_2$ (Black *Ocimum* + Malathion) which was significantly superior over the rest of the treatments except treatment $T_8$ (Black *Ocimum* + Spinosad) which recorded 325.33 number of fruit flies and

both the treatments were at par with each other. The next best treatments in order of efficacy were $T_1$ (Green *Ocimum* + Malathion), $T_7$ (Green *Ocimum* + Spinosad) and $T_3$ (Black Jaggery + Malathion) which recorded 258.67, 222.67 and 211.33 number of fruit flies respectively. The minimum fruit flies were recorded in the treatment $T_{10}$ (common Jaggery + Spinosad) which recorded 90 fruit flies per trap during the period of May to July 2017.

Earlier many workers worked on the effect of bait material in attracting Tephritids. Roomi *et al.* (1993) [8] reported that natural attractant of plant origin *i.e.*, from Tulsi (*Ocimum sanctam* L.) was isolated and extracted with a view to applying for the control of fruit flies. A cotton pad treated with 0.25 ml leaf extract in ethyl acetate is found to be a potent attractant for luring and trapping the fruit flies (*Dacus* spp.) from a distance of 0.8 km. The effectiveness of *Ocimum* was reported earlier by Jiji *et al.* (2003) [7], Thomas *et al.* (2005) [10] and Singh (2008) [9]. Thomas *et al.* (2005) [10] found that a 50:50 mix of banana and jaggery caught more flies than banana alone, jaggery alone and trap containing *Ocimum* and protein hydrolysate and indicated a positive interaction in mixing of banana with jaggery as bait. Jhala *et al.* (2005) [6] concluded that, overall, banana and jaggery, at 10 per cent (mass: volume) in water and in isolation or combination (and with added fresh fruit when this is seasonally available and inexpensive), are generally cost-effective baits for Tephritid management in India. Akhtaruzzaman *et al.* (2000) [4] reported that application of molasses + Malathion + water in the ratio of 1:0.1:100 provided good control of *B. cucurbitae* in Japan. Dharmadasa *et al*. (2015) [5] described the morphology, essential oil content, composition and bioassay on ability of essential oil of two *Ocimum tenuiflorum* morphotypes as a fruit fly attractant. The main constituents found in the oil of $MT_1$ were methyl eugenol. They reported that the essential oil of *Ocimum tenuiflorum* can be used as potential natural Para pheromone source for fruit fly control and monitoring in the fruit industry in Sri Lanka.

**Table 1:** Mean number of fruit flies trapped in different baiting material during May to July 2017

| Treatment No. | Treatment Detail | Mean fruit flies trapped/trap/month | | | Total |
|---|---|---|---|---|---|
| | | May | June | July | |
| $T_1$ | Green *Ocimum* + Malathion | 34.11 (5.92)* | 22.28 (4.82) | 4.53 (2.33) | 60.92 (7.87) |
| $T_2$ | Black *Ocimum* + Malathion | 46.67 (6.90) | 31.67 (5.71) | 6.73 (2.77) | 85.07 (9.28) |
| $T_3$ | Black Jaggery + Malathion | 29.56 (5.52) | 17.94 (4.35) | 3.00 (2.00) | 50.50 (7.18) |
| $T_4$ | Common Jaggery + Malathion | 15.00 (3.99) | 8.56 (3.08) | 1.13 (1.45) | 24.69 (5.07) |
| $T_5$ | Cinnamon + Malathion | 25.44 (5.13) | 14.78 (3.96) | 1.93 (1.71) | 42.16 (6.57) |
| $T_6$ | Molasses +Malathion | 28.56 (5.43) | 16.28 (4.15) | 2.13 (1.77) | 46.97 (6.93) |
| $T_7$ | Green *Ocimum* + Spinosad | 29.22 (5.49) | 19.67 (4.54) | 3.40 (2.10) | 52.29 (7.30) |
| $T_8$ | Black *Ocimum* + Spinosad | 41.78 (6.53) | 28.83 (5.46) | 5.40 (2.52) | 76.01 (8.78) |
| $T_9$ | Black Jaggery + Spinosad | 26.44 (5.23) | 14.83 (3.96) | 2.53 (1.87) | 43.81 (6.69) |
| $T_{10}$ | Common Jaggery+ Spinosad | 14.89 (3.95) | 7.17 (2.85) | 0.47 (1.20) | 22.52 (4.85) |
| $T_{11}$ | Cinnamon + Spinosad | 20.67 (4.63) | 12.78 (3.70) | 1.27 (1.49) | 34.71 (5.98) |
| $T_{12}$ | Molasses + Spinosad | 22.22 (4.81) | 14.11 (3.89) | 1.60 (1.61) | 37.93 (6.24) |
| $T_{13}$ | Control (Trap without attractant) | 0.00 (1.00) | 0.00 (1.00) | 0.00 (1.00) | 0.00 (1.00) |
| | S.E. | 0.23 | 0.11 | 0.09 | 0.23 |
| | C.D. at 5% | 0.66 | 0.31 | 0.28 | 0.69 |

*Figures in parentheses are $\sqrt{n+1}$ transformed values.

**Table 2:** Total number of fruit flies trapped in different baiting material during May to July 2017.

| Treatment No. | Treatment Detail | Total No. of fruit fly trapped/trap/month | | | Total |
|---|---|---|---|---|---|
| | | May | June | July | |
| $T_1$ | Green *Ocimum* + Malathion | 102.33 (10.16) | 133.67 (11.60) | 22.67 (4.81) | 258.67 (16.11) |
| $T_2$ | Black *Ocimum* + Malathion | 140.00 (11.87) | 190.00 (13.81) | 33.67 (5.85) | 363.67 (19.10) |
| $T_3$ | Black Jaggery + Malathion | 88.67 (9.46) | 107.67 (10.41) | 15.00 (3.99) | 211.33 (14.57) |
| $T_4$ | Common Jaggery + Malathion | 45.00 (6.76) | 51.33 (7.20) | 5.67 (2.51) | 102.00 (10.15) |
| $T_5$ | Cinnamon + Malathion | 76.33 (8.77) | 88.67 (9.45) | 9.67 (3.24) | 174.67 (13.25) |
| $T_6$ | Molasses +Malathion | 85.67 (9.29) | 97.67 (9.93) | 10.67 (3.40) | 194.00 (13.96) |
| $T_7$ | Green *Ocimum* + Spinosad | 87.67 (9.41) | 118.00 (10.90) | 17.00 (4.24) | 222.67 (14.96) |
| $T_8$ | Black *Ocimum* + Spinosad | 125.33 (11.23) | 173.00 (13.18) | 27.00 (5.27) | 325.33 (18.06) |
| $T_9$ | Black Jaggery + Spinosad | 79.33 (8.94) | 89.00 (9.44) | 12.67 (3.67) | 181.00 (13.49) |
| $T_{10}$ | Common Jaggery + Spinosad | 44.67 (6.69) | 43.00 (6.60) | 2.33 (1.82) | 90.00 (9.54) |
| $T_{11}$ | Cinnamon + Spinosad | 62.00 (7.89) | 76.67 (8.78) | 6.33 (2.65) | 145.00 (12.08) |
| $T_{12}$ | Molasses + Spinosad | 66.67 (8.21) | 84.67 (9.25) | 8.00 (2.99) | 159.33 (12.66) |
| $T_{13}$ | Control (Trap without attractant) | 0.00 (1.00) | 0.00 (1.00) | 0.00 (1.00) | 0.00 (1.00) |
| | S.E. | 0.40 | 0.26 | 0.25 | 0.61 |
| | C.D. at 5% | 1.16 | 0.78 | 0.75 | 1.79 |

*Figures in parentheses are $\sqrt{n+1}$ transformed

## Conclusion

From the present investigation it can be concluded that all the bait material used for attracting fruit flies were more or less effective but the treatment $T_2$ (black *Ocimum* (leaf extract) + Malathion) and treatment $T_8$ (black *Ocimum* (leaf extract) + Spinosad) attracted maximum number of fruit flies as well as five different species of fruit flies. Black *Ocimum* (leaf extract) + Malathion and black *Ocimum* (leaf extract) +

Spinosad can be used as baiting material for trapping fruit flies in mango orchard. The baiting material is easily available at farmer's field, cheaper and effective therefore can be replaced in the absence of methyl eugenol. Similarly, the results envisages that the fruit fly traps can be installed in the mango orchard up to July *i.e.* till left over mango fruits are available that can destroy leftover fruit fly population which is going to be diapuse as pupal stage in soil and that will reduce fruit fly population in next year.

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