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Comparative study on the efficiency of different dispenser blocks in trapping mango fruit flies using methyl eugenol

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Abstract
Mango fruit fly is a serious pest that damages mango fruits by laying eggs inside them, leading to significant yield losses. Methyl eugenol is a potent male attractant commonly used in traps to monitor and manage fruit fly populations. The present study was conducted at the Centre of Excellence for Mango, Dapoli, to evaluate the efficacy of ten different dispenser materials cork, lantern wick, drumstick wood, bhend wood, shivan wood, pangara wood, plywood, coco peat, sphagnum moss, and cotton in attracting fruit flies when soaked with a 6:4 ratio of methyl eugenol and ethanol. The study was carried out over a period of 32 weeks, during which weekly observations were taken, and mean fruit fly counts were calculated for every 8-week period. Results revealed that drumstick wood consistently captured the highest number of fruit flies across all installments, followed by cotton and sphagnum moss. This study highlights the importance of choosing suitable dispenser materials to enhance the effectiveness of methyl eugenol traps in integrated pest management programs for mango cultivation.

Keywords: Mango fruit fly, methyl eugenol, dispenser blocks, persistence, trap

Introduction
Originating in the Indo-Burma region, the mango (*Mangifera indica* L.) (Family: Anacardiaceae) has naturalized and adapted throughout the tropics and subtropics. With over a thousand recognized types, India boasts the most diversity of mangoes (Mukherjee, 1997). India holds the top position and contributes around 50 per cent of the global mango production, with 2.371 million hectares yielding 20.94 million tons of mangos annually (Agricultural Statistics at a Glance, 2022).

India, faces significant challenges in exporting fresh mangoes due to insect infestations, particularly by quarantine pests like the Oriental fruit fly and stone weevil. Although over 400 insect pests attack mangoes globally, fruit flies are a major concern, as fruits infested by these pests are banned in many countries (Reddy *et al*. 2018) [5]. Despite India's leadership in mango production, its market share is only 15%, largely due to the impact of fruit flies, which can destroy over 35% of mangoes at the harvesting stage and reduce yields by up to 80 per cent (Dandamudi, 2022) [1].

Among the different management techniques, the Male Annihilation Technique (MAT) is widely used to control the fruit fly population. This involves using traps laced with methyl eugenol, a powerful male attractant that helps in monitoring and reducing the male fruit fly population.

Although methyl eugenol is effective, the success of this technique also depends on the type of material used to hold and release the chemical. The dispenser block should absorb and retain the attractant, release it slowly over time, and withstand outdoor conditions. Selecting the right dispenser material can enhance the trap's effectiveness and reduce the frequency of reapplication.

This study was carried out to compare the trapping efficiency of ten different dispenser materials soaked in a 6:4 mixture of methyl eugenol and ethanol. The goal was to identify the most suitable material for use in traps under field conditions for effective fruit fly management in mango orchards.

Materials and Methods

The study on the persistence of methyl eugenol in different dispenser materials for attracting mango fruit flies was conducted at the Centre of Excellence for Mango, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra, from 1st December 2023 to 12th July 2024. The objective was to assess the trapping efficiency and persistence of methyl eugenol in ten different dispenser materials under field conditions.

The dispenser materials tested included cork, lantern wick, drumstick wood (*Moringa oleifera*), bhend wood (*Thespesia populnea*), shivan wood (*Gmelina arborea*), pangara wood (*Erythrina variegata*), plywood, coco peat, sphagnum moss, and cotton. Each material was cut into uniform blocks of 2.5 cm × 2.5 cm × 2.5 cm.

All blocks were soaked overnight in a 6:4 mixtures of ethanol and methyl eugenol. Ethanol served as a dispersing agent to enhance the absorption of methyl eugenol into the dispenser blocks. The soaked blocks were then suspended within Rakshak traps using thread. The traps were installed in a mango orchard at 1.5 meters above ground level. Three replications were maintained for each treatment, totaling 30 traps across the study site. The traps were placed according to the recommendation of four Rakshak traps per hectare as followed by the Centre of Excellence for Mango.

To evaluate the quantity of methyl eugenol absorbed by each dispenser material, blocks were weighed before and after soaking. The absorbed methyl eugenol was calculated using the formula:

Absorbed ME (g) = W_2 - W_1

Where W_1 is the initial dry weight of the block, and W_2 is the final weight after soaking.

The study was carried out for 32 weeks and divided into four 8-week installments. Weekly observations were recorded for each trap to monitor the number of fruit flies captured. After every 8-week interval, the traps were recharged with fresh methyl eugenol solution, and the same procedure was repeated for the next installment. The mean fruit fly catch per treatment was calculated for each installment, and average values were used for comparison.

The trapping efficiency was evaluated using the following formula:

Efficacy (flies/g ME) = Total number of flies trapped / Absorbed methyl eugenol (g).

Treatment details

Tr. No.	Treatment name
T_1	Cork
T_2	Lantern wick
T_3	Drumstick wood block
T_4	Bhend wood block
T_5	Shivan wood block
T_6	Pangara wood block
T_7	Plywood block
T_8	Coco peat block
T_9	Sphagnum moss block
T_{10}	Cotton

Results and Discussion

Table 1: Efficacy of trapping in terms of flies trapped per gram of methyl eugenol

Dispenser Blocks	Fruit flies trapped	ME Absorbed (g)	Efficacy (Flies/gram of ME)
T_1 Cork	29.92	0.67	44.88
T_2 Lantern Wick	353.17	9.95	35.49
T_3 Drumstick	1025.17	12.97	79.06
T_4 Bhend	177.25	6.99	25.37
T_5 Shivan	128.75	3.93	32.73
T_6 Pangara	155.75	3.00	51.92
T_7 Plywood	436.08	6.44	67.75
T_8 Coco peat	406.08	5.52	73.52
T_9 Sphagnum Moss	600.17	7.65	78.49
T_{10} Cotton	821.42	12.27	66.96

In the persistence study of methyl eugenol using various dispenser blocks for managing the mango fruit fly (Bactrocera dorsalis), the efficiency of each block was evaluated based on the number of flies caught per gram of methyl eugenol absorbed. Table 1 shows the efficacy of trapping in terms of flies trapped per gram of methyl eugenol.

Drumstick (T_3) demonstrated the most efficient fly capture at 79.06 flies per gram of methyl eugenol. Sphagnum moss (T_9) followed closely with an efficiency of 78.49 flies per gram of methyl eugenol. T_8-Coco peat, T_7-Plywood and T_{10}-Cotton showed efficiencies of 73.52, 67.75 and 66.96 flies trapped per gram of methyl eugenol, respectively. T_4-Bhend was the least efficient, caught only 25.37 flies per gram of methyl eugenol. This was followed by T_5-Shivan (32.73 flies/ gram of ME), T_2-Lantern wick (35.49 flies/ gram of ME), T_1-Cork (44.88 flies/ gram of ME) and T_6-Pangara (51.92 flies/ gram of ME).

The efficacy of methyl eugenol (ME) as an attractant for managing Bactrocera dorsalis has been extensively validated, especially in relation to the quantity of ME absorbed and the number of fruit flies captured per gram of ME. In the present study, drumstick wood emerged as the most efficient dispenser block, trapping 79.06 flies per gram of ME, closely followed by sphagnum moss (78.49 flies/g), coco peat (73.52 flies/g), and plywood (67.75 flies/g). These findings reinforce the results of Nasruddin *et al*. (2022) [4], who demonstrated that the combination of optimal ME dosage and trap design significantly enhances trapping efficiency. Likewise, Kumar and Laskar (2019) [2] reported superior attractiveness of plywood dispensers in field trials, supporting their observed efficacy in this study. Furthermore, Shelly *et al.* (2022) [6] confirmed that solid dispensers maintain high residual ME levels and effective field performance over extended periods. Most notably, the foundational work by Vargas *et al.* (2000) [7] emphasized that both the lure-release rate and dispenser type play crucial

roles in the successful use of male annihilation techniques for Bactrocera control, establishing ME as a cornerstone in integrated pest management (IPM) strategies. These collective findings underscore the critical role of dispenser material in optimizing the cost-effectiveness and sustainability of fruit fly management programs.

Conclusion

The present study highlights the significant role of dispenser block material in determining the trapping efficiency of methyl eugenol (ME) against Bactrocera dorsalis. Among the various dispenser types tested, drumstick wood exhibited the highest trapping efficacy, recording 79.06 flies per gram of ME, followed closely by sphagnum moss and coco peat. These findings clearly demonstrate that the physical and absorptive properties of dispenser materials influence both the retention and release of ME, directly affecting fruit fly attraction. The results are in strong agreement with previous studies, affirming that optimizing dispenser type not only enhances fruit fly suppression but also improves the cost-efficiency of lure-based trapping systems. Incorporating the most effective dispenser blocks, such as drumstick wood and sphagnum moss, can significantly strengthen integrated pest management (IPM) strategies aimed at reducing fruit fly populations in mango orchards and other susceptible crops. Continued research into dispenser material properties, along with long-term field validation, will further refine the use of methyl eugenol in sustainable pest control programs.

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