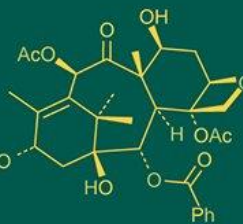
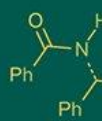


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Management of fruit flies and fruit sucking moth infesting Nagpur mandarin

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Abstract

Nagpur mandarin (*Citrus reticulata* Blanco) is one of the most economically important citrus crops grown in the region of Nagpur district of Maharashtra. Its commercial production is severely reduced by the infestation of fruit flies (Diptera: Tephritidae) and fruit sucking moths (Lepidoptera: Erebidae) which cause the most pre and post-harvest losses. Keeping this in view, the present investigation entitled "Management of Fruit Flies and Fruit Sucking Moths Infesting Nagpur Mandarin" was undertaken during Ambiya bahar 2025 to evaluate the efficacy of botanical oils, fish oil, fruit fly traps and fruit sucking moth baits.

Field evaluation revealed that cumulative fruit damage due to fruit flies after three sprays ranged from 7.43 to 23.41 per cent, with Pongamia oil 1.0 per cent proved most effective (7.43 per cent infestation) in reducing damage, followed by fish oil 1.0 per cent (10.98 per cent) at par with neem oil 1.0 per cent (11.53 per cent), horticultural mineral oil 1.0 per cent (13.11 per cent), and fruit fly trap (15.82 per cent) with respect to control (23.41 per cent). Similarly, fruit damage due to fruit sucking moth ranged from 5.78 to 11.49 per cent, with pongamia oil 1.0 per cent recorded the lowest damage (5.78 per cent), followed by fish oil 1.0 per cent (7.14 per cent) at par with neem oil 1.0 per cent (7.37 per cent), horticultural mineral oil 1.0 per cent (8.41 per cent), and fruit sucking moth bait (9.17 per cent) with respect to control (11.49 per cent).

The study concludes that an integrated approach of using pongamia oil (1 per cent) in combination with fruit fly traps and fruit sucking moth baits offers an effective, economically viable, and eco-friendly strategy for managing the pests in Nagpur mandarin orchards.

Keywords: Fruit Sucking Moth, Fruit fly, Fish oil, horticultural mineral oil, trap, baits

Introduction

Citrus belongs to family Rutaceae, is among the most economically important fruit crops globally, with sweet orange, mandarin, lime, and lemon being the major commercial species. Mandarin alone accounts for a global production of over 67 million tonnes, and India contributes significantly to this with around 3.85 million tonnes annually (FAO 2024). Within India, Nagpur Mandarin, grown extensively across Vidarbha region of Maharashtra (Nagpur, Amravati, Akola, and Wardha districts), holds a prominent position due to its unique two-season fruiting pattern (Ambia and Mrig) and its Geographical Indication (GI) tag (Kumar *et al.* 2023), which denotes its export potential.

Despite its commercial importance, citrus productivity is severely constrained by insect pests and diseases, with reports indicating yield losses of up to 30 per cent in Maharashtra alone. Among the numerous pests recorded on citrus, fruit flies (*Bactrocera* and *Zeugodacus* spp.) and fruit sucking moths (*Eudocima* spp.) are particularly damaging, directly affecting fruit quality and marketability of Nagpur Mandarin. Conventional management of these pests relies heavily on synthetic insecticides, which raises concerns regarding pesticide resistance, residues, and environmental safety. This has increased interest in eco-friendly alternatives such as botanical oils (neem, pongamia, and other plant-based oils) and fish oil, which offer insecticidal, repellent, and antifeedant properties with minimal toxicity to non-target organisms. These botanicals are increasingly recognized as viable components of integrated pest management (IPM) programmes for sustainable citrus cultivation. Against this background, the present study was undertaken to evaluate the efficacy of botanical oils and fish oil in managing fruit flies and fruit sucking moth infesting Nagpur Mandarin with the

broader goal of supporting sustainable and economically viable pest management strategies for citrus growers.

Materials and methods

The present investigation, entitled "Management of Fruit Flies and Fruit Sucking Moth Infesting Nagpur Mandarin," was carried out during the *Ambiya bahar* 2025 on a farmer's field at Wajbodi village, Tahsil Katol, District Nagpur, Maharashtra. The study site lies in the renowned Nagpur

Mandarin belt of Central India, within the Central Plateau and Hills agro-climatic zone, at approximately 21.27° N latitude and 79.17° E longitude (350-450 m elevation). The region experiences a tropical dry sub-humid climate with distinct summer, monsoon, and winter seasons, an average annual rainfall of 1055-1065 mm, and deep black cotton soils (Vertisols) with neutral to slightly alkaline pH (7.0-8.2), all of which favour commercial Nagpur Mandarin cultivation.

Table 1: Details of treatments used in efficacy study against fruit flies and fruit sucking moth

Sr. No.	Tr. No.	Treatment details	Concentration (per cent)
1.	T ₁	Neem Oil	1.0
2.	T ₂	Horticultural mineral oil	1.0
3.	T ₃	Karanj oil	1.0
4.	T ₄	Fish oil	1.0
5.	T ₅	Control	Water+ Soap spray
6.	T ₆	Poison bait trap	
7.	T ₇	Methyl eugenol trap	

A field experiment was laid out in Randomized Block Design (RBD) with 7 treatments and 5 replications on bearing Nagpur Mandarin trees (spacing 6 m × 6 m) during 2025-26. The treatments comprised neem oil (1.0 per cent), horticultural mineral oil (1.0 per cent), karanj oil (1.0 per cent), fish oil (1.0 per cent), a water + soap spray as a control, poison bait trap, and methyl eugenol trap as shown in table 1. Five trees per treatment were selected, and three spray applications were given at monthly intervals starting from the second fortnight of August, September, and

October. Fallen fruits were collected and examined fortnightly for external and internal damage symptoms of fruit fly and fruit sucking moth infestation. Per cent fruit infestation was calculated as:

$$\text{Fruit infestation (\%)} = (\text{No. of damaged fruits} / \text{Total fallen fruits}) \times 100$$

Statistical analysis: Data on fruit infestation by fruit flies and fruit sucking moth were statistically analyzed as per RBD to compare the effect of treatments.

Table 1: Effect of botanical oils, fish oil, traps against Fruit flies infesting Nagpur Mandarin (Nagpur 2025-26)

Tr. No.	Treatment	Conc. (per cent)	Percent fruitfly Infestation recorded at 15 days intervals						Cumulative Percent Infestation	Per cent reduction over control
			First Spray		Second Spray (30 th DAY)		Third Spray (60 th Day)			
			(Pre-treatment)	I (After)	II (Before)	III (After)	IV (Before)	V (After)		
T ₁	Neem Oil	1.0	7.42 (2.70)	5.77 (2.41)	6.53 (2.56)	10.58 (3.26)	15.03 (3.87)	19.76 (4.45)	11.53 (3.40)	50.74
T ₂	HMO	1.0	8.72 (2.89)	7.16 (2.66)	7.69 (2.77)	11.93 (3.45)	16.72 (4.09)	22.07 (4.70)	13.11 (3.63)	43.99
T ₃	Pongamia Oil	1.0	8.17 (2.85)	3.91 (1.96)	4.95 (2.19)	7.32 (2.68)	10.06 (3.17)	10.91 (3.22)	7.43 (2.72)	68.26
T ₄	Fish Oil	1.0	7.98 (2.83)	4.98 (2.23)	6.32 (2.50)	9.67 (3.11)	14.65 (3.83)	19.27 (4.39)	10.98 (3.32)	53.09
T ₅	Control		7.42 (2.72)	12.75 (3.58)	16.62 (4.07)	21.82 (4.67)	29.01 (5.39)	36.83 (5.93)	23.41 (4.81)	-
T ₇	Trap		7.84 (2.79)	8.54 (2.92)	9.63 (3.10)	15.09 (3.88)	21.06 (4.58)	24.77 (4.98)	15.82 (3.98)	32.42
	F Test		NS	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	-
	SEm. ±		0.09	0.06	0.06	0.06	0.06	0.08	0.05	-
	CD @ 5 per cent		-	0.17	0.17	0.17	0.18	0.22	0.15	-
	CV		15.78	10.88	9.91	8.31	7.18	8.23	7.09	-

* Figures in parenthesis are Square root transformed values

Table 2: Effect of botanical oils against Fruit Sucking Moth infesting Nagpur Mandarin (Nagpur 2025-26)

Tr. No.	Treatment	Conc. (per cent)	Percent Fruit Sucking Moth infestation recorded at 15 days intervals						Cumulative Percent Infestation	Per cent reduction over control
			First Spray		Second Spray (30 th DAY)		Third Spray (60 th Day)			
			Pre-treatment	I (After)	II (Before)	III (After)	IV (Before)	V (After)		
T ₁	Neem Oil	1.0	4.54 (2.12)	4.00 (2.00)	5.92 (2.44)	6.95 (2.64)	9.50 (3.08)	10.5 (3.25)	7.37 (2.72)	35.85
T ₂	HMO	1.0	5.26 (2.28)	4.72 (2.18)	6.96 (2.65)	7.89 (2.82)	10.72 (3.28)	11.76 (3.44)	8.41 (2.91)	26.81

T ₃	Pongamia Oil	1.0	5.07 (2.25)	2.61 (1.54)	4.49 (2.00)	5.89 (2.36)	7.43 (2.63)	8.51 (2.87)	5.78 (2.39)	49.69
T ₄	Fish Oil	1.0	5.45 (2.30)	3.80 (1.95)	5.53 (2.36)	6.98 (2.65)	8.91 (2.98)	10.51 (3.25)	7.14 (2.68)	37.86
T ₅	Control		5.02 (2.22)	6.57 (2.57)	7.91 (2.82)	10.07 (3.18)	13.60 (3.69)	15.06 (3.88)	11.49 (3.39)	-
T ₆	Bait		4.79 (2.18)	5.56 (2.37)	6.86 (2.62)	8.98 (3.00)	12.09 (3.48)	12.33 (3.52)	9.17 (3.04)	20.19
	F Test		NS	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	-
	SEm. ±		0.07	0.05	0.06	0.05	0.06	0.06	0.04	-
	CD @ 5 per cent		-	0.16	0.18	0.16	0.18	0.18	0.12	-
	CV		14.72	12.84	12.62	9.48	9.54	8.87	7.28	-

* Figures in parenthesis are Square root transformed values

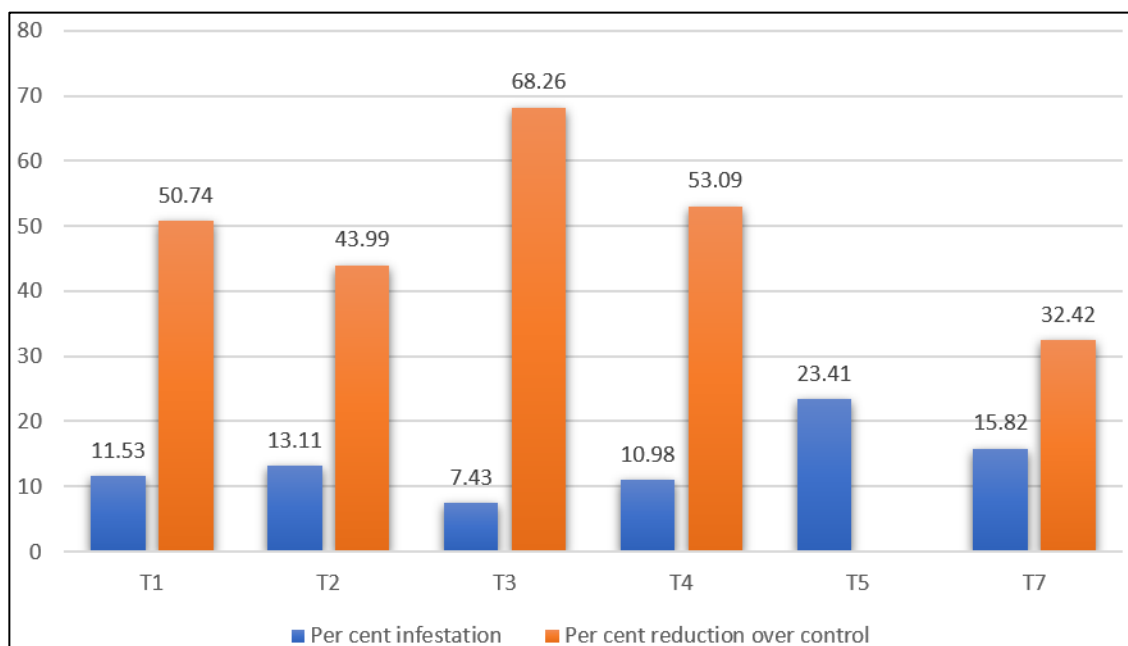


Fig 1: Effect of botanical oil, fish oil and trap against fruit flies infesting Nagpur mandarin (Nagpur 2025-26)

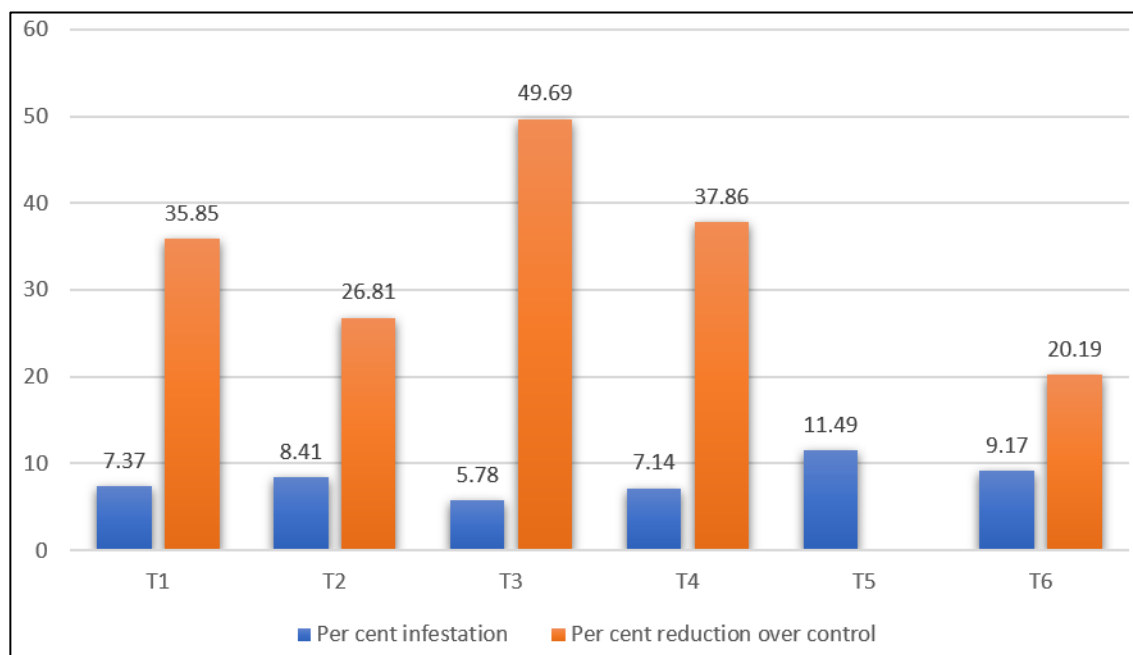


Fig 2: Effect of botanical oils, fish oil and bait against Fruit Sucking Moth infesting Nagpur Mandarin (Nagpur 2025-26)

Summary and Conclusion

The field experiment conducted during Ambia bahar 2025-26 demonstrated that botanical oils, fish oil, horticultural mineral oil (HMO), traps and bait were effective in reducing

fruit fly and fruit-sucking moth infestation in Nagpur mandarin. Among the treatments, pongamia oil at 1.0% was consistently the most effective, recording the lowest cumulative infestation of fruit flies (7.43%) with 68.26%

reduction over control, and fruit-sucking moth (5.78%) with 49.69% reduction over control. It was followed by fish oil 1.0%, which recorded 10.98% fruit fly infestation (53.09% reduction) and 7.14% fruit-sucking moth infestation (37.86% reduction), and neem oil 1.0%, which recorded 11.53% (50.74% reduction) and 7.37% (35.85% reduction), respectively. HMO and trap/bait treatments provided comparatively moderate protection. Pongamia oil 1.0% also recorded the highest fruit yield of 17.20 t ha⁻¹. Pre-treatment infestation was non-significant, indicating uniform pest pressure among the treatments, whereas post-treatment observations showed significant differences. Overall, pongamia oil 1.0% emerged as the most promising botanical treatment for the management of both fruit flies and fruit-sucking moths in Nagpur mandarin, followed by fish oil and neem oil, and may be considered as an important component of an eco-friendly pest management strategy.

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