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Ecofriendly Approaches for the Management of Sucking Pests in High Density Guava

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Treatments such as fish oil rosin soap (FORS) 0.2%, neem oil 0.2%, yellow sticky trap 5 no. / acre and imidacloprid 0.06 % including a control was implemented in ten year old high density guava orchard, Horticultural College and Research Institute for Women, Tiruchirappalli, Tamil Nadu during 2024 with Lucknow 49 variety at a spacing of 3 m x 1.5 m. Field with 60 trees were divided into blocks and within each block, treatments were randomly assigned. Treatments were implemented

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at fortnight intervals to maintain pests population below ETL throughout the study period. Yellow sticky traps placed in canopy of trees were monitored at weekly intervals. Observation on the incidence and per cent damage of sucking pests were assessed on 5th, 10th and 15th days after treatment (DAT). Imidacloprid reduced the thrips incidence by 92.09% over control followed by Neem oil @ 0.2% and fish oil rosin soap 0.2% with 78.85 and 75.13 percent reduction over control respectively. The treatment with yellow sticky trap was less effective and recorded the thrips incidence of (50.25 numbers / fruit). Per cent damage of thrips on guava fruits due to FORS @ 0.2% and Neem oil @ 0.2% was found on par with 75.13 and 78.85 per cent over control respectively. Imidacloprid significantly reduced the thrips damage by 96.06 per cent over control. Bio efficacy of the treatments inflicted significant damage of mealybug from 71.46 to 79.02 per cent; 67.88 to 75.07 per cent and 69.13 to 76.77 per cent over control at 5, 10 and 15 DAT respectively. Use of Imidacloprid @ 0.06% significantly contributed 71.46, 67.88 and 69.13 damage over control at 5, 10 and 15 DAT respectively. This was followed by FORS with 76.57, 72.74, 73.86 per cent damage over over at 5, 10 and 15 DATW respectively. Neem oil @ 0.2% recorded 75.85, 72.06 and 73.98 per cent damage after 5, 10, and 15 DAT respectively. The number of leafhoppers on leaves declared that there was significant difference in the reduction of leafhoppers for all the treatments. Imidacloprid reduced leafhopper by 36.85 per cent over control followed by neem oil, FORS and yellow sticky trap with 23.89, 7.96 and 6.30 per cent over control respectively).

Keywords: High density guava; sucking pests; ecofriendly strategies.

1. INTRODUCTION

Guava (*Psidium guajava* L.), originated in America belongs to the family Myrtaceae. It is the most widely produced fruits in India. Guava is the fourth significant fruit in terms of area and production after mango, banana and citrus crops in India. It occupies an area of about 27,600 ha with the production of 42,36,000 MT in India (Duradundi et al., 2021). Guava is rich in vitamin C, pectin, dietary fiber, iron, manganese, calcium, folic acid, potassium and phosphorus. It also has antioxidants and medicinal properties (Devi et al., 2023). Guava cultivation has become more popular due to improved agrotechniques such as high density planting (Prabakaran et al., 2021). Several insect pests have been observed on guava at different stages of growth, although only a few pose a significant threat to its cultivation. Over 80 insects and mite species have been identified on guava trees, influencing the growth and yield (Firake et al., 2013). The major sucking pests in guava are mealybug (*Ferrisia virgata*), spiralling whitefly (*Aleurodicus disperses*), tea mosquito bug (*Helopeltis antonii*), thrips (*Selenothrips rubrocinctus* and *Rhipiphorothrips cruentatus*), aphid (*Aphis gossypii*) and scale insects.

Recent studies have shown that mulching improves pest control in agricultural systems by boosting the activity of natural enemies and predators, reducing the reliance on chemical insecticides. The increased diversity of non-crop species in various fruit and field cropping systems has led to greater natural enemy abundance, lower pest populations and reduced use of herbicides and fertilizers (Bryant et al., 2013). By enhancing habitat diversity and food resources, mulching promotes biological control, indirectly lowering herbivore numbers. However, it may also compete for essential resources like water and nutrients, potentially affecting crop yield and providing refuge for pests. Additionally, mulching plays an important role in pollinator conservation by supplying nectar, pollen, nesting sites and shelter for predators (Muhammad et al., 2022). The flower and boll damage were significantly less in trash and leaflet mulch plots than in other shelter provisioned and control plots. The percentage of good quality cotton was also greater in mulch plots than in control plots. The yield of seed-cotton was also significantly greater in plots with trash mulches and coconut leaflet mulches than in control plots (Claver et al., 2003). Other insect groups were indirectly influenced by mulches through their effects on weed growth. Weeds in unmulched control likely contributed to higher populations of small plant feeders like aphids, thrips, and whiteflies. Ants and predatory beetles were more common in mulched plots, while Collembola, spiders, and parasitoid wasps showed no significant response, and leafhoppers had only minor variations (Gill et al., 2011). Straw mulch has been shown to impact arthropod pest and predator populations positively. For instance, straw mulch on potatoes reduced *Leptinotarsa decemlineata* populations, generally associated with increased predator populations.

Cheilomenes sp, which prey on *Aphis gossypii, Bemisia tabaci, Thrips tabaci* and *Amblyseius aurantia* also displayed similar trends, indicating that mulching materials effectively conserved natural enemy populations compared to controls (Mochiah and Baidoo, 2012).

Fundamentally, mulching creates a micro-climate that is suitable for plant growth and soil activities. By maintaining more stable soil temperatures and reducing water loss, mulches help plants thrive, even in challenging conditions. Mulching can also reduce soil erosion and runoff, helping to conserve the soil structure and improve its overall quality. The enhanced organic content in mulched soils leads to better soil aggregate stability, water-holding capacity, and bulk density. These improvements contribute to higher microbial activity and increased earthworm density, both of which are essential for maintaining soil health (Alyokhin et al., 2019).

2. MATERIALS AND METHODS

Fixed plot survey was conducted at 10 year old high density guava orchard, Horticultural College and Research Institute for Women, Tiruchirappalli, Tamil Nadu, India in 2024. The Lucknow 49 variety was maintained at the spacing of 3 m x 1.5 m. This experiment study was conducted on a total of 60 guava trees. The experimental layout was designed using a Randomized Block Design (RBD) to ensure that the variation among experimental units due to location was minimized. The plot was divided into blocks, and within each block, treatments were randomly assigned to the trees to control for environmental variability. The treatments imposed in the study are FORS 0.2%, neem oil 0.2%, imidacloprid 0.06 % and yellow sticky trap. The control plots were maintained separately. Each treatment was replicated three times, resulting in a total of 15 experimental units. These treatments were applied at fortnightly intervals to maintain pests population below ETL throughout the study period. Yellow sticky traps were placed in the canopy of the trees and monitored at regular intervals. Observation on per cent mealybug damage on leaves, per cent thrips damage on fruits and incidence of leafhopper over control were assessed. Pest populations were monitored through direct counts after each application on 5th, 10th and 15th DAT. These intervals were selected to capture both the immediate and residual effects of the treatments. Pest counts included both adult and immature stages of the target insect species. One way analysis of variance (ANOVA) was employed for analysing the mean abundance. Correlation coefficient were calculated for pests abundance with climatic factors. All the analyses were performed using Agress software.

3. RESULTS AND DISCUSSION

3.1 Thrips

The number of thrips incidence on the fruits is presented in the Table 1. The first two sprays of insecticide, botanicals and yellow sticky trap in the study for the management of thrips on HDP Guava provided significant resulted on 5, 10 and 15 DAT. On the day after 2nd spray low thrips count (23.30 – 44.62 / fruit) were reported significantly for Imidacloprid @ 0.06% against other treatments and untreated control (72.38 / fruit). This study showed that imidacloprid reduced the thrips incidence by 92.09 per cent over control followed by neem oil @ 0.2% and FORS @ 0.2% with 78.85 and 75.13 per cent over control respectively. The treatment with yellow sticky trap was less effective and recorded the thrips incidence of (50.25 / fruit). These results are in accordance with Asif et al. (2018) which revealed that Imidacloprid was most effective in reduction of thrips infestation followed by neem oil and neem seed water extract at 5 per cent. Noonari et al. (2016) reported that the thrips population decreased gradually but remained effective up to one week in all the botanical pesticides applied.

Table 2 showed the percent damage of thrips on guava fruits. There was no significant difference between the treatments such as FORS @ 0.2% and neem oil @ 0.2% with 87.10 and 85.12 per cent over control respectively whereas the imidacloprid significantly reduced the thrips damage by 76.06 per cent. Similar results were also obtained by Logeswaran et al. (2023) who reported that neem oil 3% recorded significantly lesser infestation of thrips followed by NSKE 5% and they were statistically on par with each other after 10 DAT. But this result is in contrast with Thangavel et al. (2011) on the effectiveness of various botanicals and fish oil rosin soap in managing thrips on coleus which declared that neem oil was better than FORS for thrips management.

3.2 Mealybug

Bio efficacy of the treatments inflicted significant variation on damage of mealybug from 71.46 to 79.02 per cent over control at 5 DAT; from 67.88 to 75.07 per cent over control at 10 DAT and from 69.13 to 76.77 per cent over control at 15

Table 1. Effect of ecofriendly approaches on the incidence of thrips population on fruits

Treatments	(No. of thrips / fruit)				
	On 5th day	On 10th day	On 15th day	Pooled Mean	Reduction from untreated control (%)
Fish oil rosin soap 0.2%	10.00 (3.22)	19.50 (4.45)	23.30 (4.83)	17.60 (4.17)c	75.13
Neem oil 0.2%	7.60 (2.85)	14.00 (3.81)	23.30 (4.88)	14.97 (3.84)b	78.85
Yellow sticky trap	59.32 (7.70)	46.80 (6.84)	44.62 (6.72)	50.25 (7.09)d	29.00
Imidacloprid 0.06%	6.00 (2.55)	6.00 (2.53)	4.80 (2.26)	5.60 (2.45)a	92.09
Control	84.90 (9.22)	55.02 (7.45)	72.38 (8.55)	70.77 (8.41)e	-
Mean	33.56 (5.11)	28.26 (5.02)	33.68 (5.45)	31.84 (5.19)	-

	CD (P = 0.05)	SEd
Treatment	0.35	0.17
Duration	0.27	0.13
Treatment x Duration	0.61	0.30

Table 2. Effect of ecofriendly approaches against thrips damage on fruits

Treatments	Per cent thrips damage / fruit				
	On 5th day	On 10th day	On 15th day	Pooled Mean	Reduction from untreated control (%)
Fish oil rosin soap 0.2%	10.00 (3.22)	19.50 (4.45)	23.30 (4.83)	17.60 (4.17)c	75.13
Neem oil 0.2%	7.60 (2.85)	14.00 (3.81)	23.30 (4.88)	14.97 (3.84)b	78.85
Yellow sticky trap	59.32 (7.70)	46.80 (6.84)	44.62 (6.72)	50.25 (7.09)d	29.00
Imidacloprid 0.06%	6.00 (2.55)	6.00 (2.53)	4.80 (2.26)	5.60 (2.45)a	92.09
Control	84.90 (9.22)	55.02 (7.45)	72.38 (8.55)	70.77 (8.41)e	-
Mean	33.56 (5.11)	28.26 (5.02)	33.68 (5.45)	31.84 (5.19)	-

	CD (P=0.05)	SEd
Treatment	4.76	2.32
Duration	3.68	1.80
Treatment x Duration	8.24	4.02

DAT. Use of Imidacloprid @ 0.06% contributed superior effect with 71.46, 67.88 and 69.13 per cent damage after 5, 10 and 15 DAT over control respectively. This was followed by the application of FORS with 76.57, 72.74 and 73.86 damage after 5, 10 and 15 DAT over control respectively and neem oil @ 0.2% effected 75.85, 72.06 and 73.98 damage over control after 5, 10 and 15 DAT respectively (Table 3). This is in agreement with Bharathi & Muthukrishnan (2017) who studied FORS @ 25g/l against *P. solenopsis*, cotton mealybug and was found superior followed by neem oil @ 3 %. Further, Tariq & Shah. (2014) studied the efficacy of different synthetic insecticides and neem oil against cotton mealybug, *P. solenopsis* and showed that neem oil was less toxic than rest of the synthetic insecticides but it significantly reduced the population of mealy bug and remained effective. Mwanauta et al. (2023) found that *P. marginatus*, mortality rate increased with time in plants treated with imidacloprid and plant essential oils

(PEOs) such as neem oil 1.5% + 0.2% isopropyl alcohol, neem oil 1.5% + paraffin oil 0.1% and citrus oil 1.5%. However, high mortality rate was observed in imidacloprid followed by PEOs.

3.3 Leafhopper

Table 4 showed the results of number of leafhoppers on leaves. Imidacloprid was found best treatment with 36.85 per cent over control followed by neem oil, FORS and yellow sticky trap with 23.89, 7.96 and 6.30 per cent over control respectively. The results are in conformity with Asif et al. (2018) which revealed that neem oil 5% significantly declined the infestation of jassid and thrips in cotton but imidacloprid proved more toxic against both insect pests. The study by Kunbhar et al. (2018) found that the

Table 3. Effect of ecofriendly approaches against mealybug damage on fruits

Treatments	Per cent damage of mealybug/ fruit				
	On 5th day	On 10th day	On 15th day	Pooled Mean (%)	Reduction from untreated control (%)
Fish oil rosin soap 0.2%	76.57 (61.05)	72.74 (58.53)	73.86 (59.26)	74.39 (59.61)[c]	4.00
Neem oil 0.2%	75.85 (60.57)	72.06 (58.09)	73.98 (59.12)	73.96 (59.26)[b]	4.56
Yellow sticky trap	79.02 (62.74)	75.07 (60.05)	76.77 (61.19)	76.95 (61.33)[d]	0.69
Imidacloprid 0.06%	71.46 (57.71)	67.88 (55.48)	69.13 (56.25)	69.49 (56.48)[a]	10.32
Control	79.65 (63.19)	75.67 (60.45)	77.15 (61.45)	77.49 (61.70)[e]	-
Mean	76.53 (61.05)	72.68 (58.52)	74.18 (59.45)	74.46 (59.68)	-

	CD (P=0.05)	SEd
Treatment	4.76	2.32
Duration	3.68	1.80
Treatment x Duration	8.24	4.02

Table 4. Effect of ecofriendly approaches against leafhopper population on leaves

Treatments	No.of Leafhopper /leaf				
	On 5th day	On 10th day	On 15th day	Pooled Mean	Reduction from untreated control (%)
Fish oil rosin soap 0.2%	5.13 (2.37)	4.87 (2.32)	4.91 (2.32)	4.97 (2.34)[c]	7.96
Neem oil 0.2%	4.29 (2.19)	3.96 (2.11)	4.09 (2.14)	4.11 (2.15)[b]	23.89
Yellow sticky trap	5.23 (2.39)	4.96 (2.33)	4.98 (2.34)	5.06 (2.36)[d]	6.30
Imidacloprid 0.06%	3.62 (2.02)	3.29 (1.94)	3.33 (1.95)	3.41 (1.98)[a]	36.85
Control	5.43 (2.43)	5.51 (2.45)	5.26 (2.40)	5.40 (2.43)[e]	-
Mean	4.74 (2.28)	4.52 (2.23)	4.51 (2.23)	4.59 (2.25)	-

	CD (P=0.05)	SEd
Treatment	4.76	2.32
Duration	3.68	1.80
Treatment x Duration	8.24	4.02

neem oil was effective than other botanical pesticides (Trooh and tobacco) for the control of leafhoppers. Halder et al. (2022) suggested that neonicotinoids like imidacloprid, thiamethoxam and diamide insecticide like cyantraniliprole were found effective against leaf hopper infesting bitter gourd. According to Stanley et al. (2014), many chemical insecticides have shown to be effective in managing cardamom pests, they cannot be sprayed continuously throughout the year and control measures cannot be stopped since thrips will begin to infest the crop as soon as the treatment is stopped. Therefore, an effective botanical can be sprayed in between chemical sprays to reduce pesticide load against thrips. Jeena and Kumar. (2024) concluded that combining neem oil 5% with imidacloprid 17.8 SL produced better effects than single treatment. The installation of yellow sticky traps against sucking pests was highly effective by trapping a large number of whiteflies and leaf hoppers (Halder et al*.,* 2022).

4. CONCLUSION

Based on the findings, it was indicated that imidacloprid neem oil, FORS and yellow sticky trap might be used as part of integrated pests management for the control of sucking pests.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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