

## Efficacy of horticultural mineral oil and its combinations against leafhopper *Amrasca biguttula biguttula* (Ishida) in brinjal and whitefly *Aleurodicus dispersus* Russell in chilli, Kerala, India

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**ABSTRACT:** Horticultural mineral oils (HMO) and its combinations were evaluated against leafhopper *Amrasca biguttula biguttula* (Ishida) in brinjal and whitefly *Aleurodicus dispersus* Russell in chilli. HMO (3%) in combination with thiamethoxam (25WG 0.1g L<sup>-1</sup>), was significantly effective in control the leaf hopper on brinjal. While in the case of white fly on chilli HMO (3%) with thiomethoxam (25WG 0.2g l<sup>-1</sup>) was effective. The results show a reduction in pesticide load to half without compromising pesticide efficacy. © 2026 Association for Advancement of Entomology

**KEY WORDS:** Sucking pests, integrated pest management, population reduction

Horticultural mineral oils (HMOs) act as contact insecticides, disrupting insect respiration through physical means rather than chemical action (Johnson, 1980). HMOs suffocate insects by forming an oil coating that blocks the spiracles. They deter oviposition on the treated surface. They pose minimal risk to groundwater or soil, and no pest resistance has been recorded so far (Helmy *et al.*, 2012). HMO could effectively combine with abamectin and exhibited a synergistic effect against *Helicoverpa armigera* (Wang *et al.*, 2005). Leaf hopper *Amrasca biguttula biguttula* (Ishida) and whitefly *Aleurodicus dispersus* Russell are major sucking pests of brinjal and chilli respectively. Leaf hoppers cause more than 50 per cent of economic losses due to their continuous feeding of leaves, that ultimately leads to necrosis (Ramzan *et al.*,

2020); on the other hand, whiteflies can potentially lead the chilli crop to low productivity with considerable economic loss (Aswathanarayanareddy *et al.*, 2006). The issues that arise due to the use of chemical pesticides, viz., target pest resistance, residues in the harvested products, minor pest resurgence, mortality of beneficial organisms, and ecosystem disruption, are always a concern among farmers (Halder *et al.*, 2014). Brinjal and chilli crops have to be harvested very frequently, wherein adopting a longer waiting period is not possible once yielding starts. This makes the research community inquisitive about safe alternative methods. It was reported that HMOs are safe for mammals (including humans), some birds, and reptiles with low phytotoxicity (Sridharan *et al.*, 2015a). In this backdrop, the

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present research has been undertaken to evaluate the efficacy of HMO against the leaf hopper in brinjal and whitefly in chilli.

Field experiments were carried out on brinjal and chilli at the instructional farm of College of Agriculture, Padannakkad from November 2023 to April 2024. Seeds of brinjal variety Surya and chilli variety Vellayani Athulya were sown in pot trays and transplanted to the main field. Crops were raised as per the recommendations (KAU, 2016). The experiment was performed under the layout Randomized Block Design with eight treatments (Table 1 for brinjal experiment, Table 2 for chilli experiment) and three replications. Cristol TSO, commercial horticultural mineral oil obtained from Krishna Antioxidants Pvt. Ltd. Mumbai, which meets NPOP and USDA standards, was used. Treatments were applied at vegetative and reproductive stages as soon as the pest infestation was seen. Observations on the population density of leafhoppers and whiteflies were made a day prior to spraying and post treatment population density at 1, 3, 5, 7 and 14 DAT from six leaves (two top, two middle, and two lower) of tagged plants. The data were analysed using analysis of variance after square root transformation, and significant means were separated by Duncan Multiple Range Test at 5 per cent level of significance. Grapes version 1.1.0 software (Gopinath *et al.*, 2021) was used to compare the significance of each treatment.

***Amrasca biguttula biguttula* in brinjal:** The pest population (mean of 15 plants) on the seventh DAS was only discussed, as the data showed the consistency of population reduction after the treatments (Table 1). On the seventh day of first application, the treatment T<sub>4</sub> [HMO 3% + Thiamethoxam 25WG 0.1g L<sup>-1</sup>] recorded the lowest leafhopper population (0.00), which was statistically on par with T<sub>5</sub> [Thiamethoxam 25WG 0.2g L<sup>-1</sup>] and T<sub>2</sub> [HMO 3% + Azadirachtin formulation 1%, 1ml L<sup>-1</sup>] both recording 0.13, whereas the population of leafhoppers was maximum in T<sub>8</sub> [Absolute control] (8.60). T<sub>1</sub> [HMO 3%], was statistically on par with T<sub>6</sub> [HMO 3% + Chlorantraniliprole 18.5SC 0.15ml L<sup>-1</sup>] both recording 0.27 and T<sub>7</sub> [Chlorantraniliprole 18.5SC

0.3ml L<sup>-1</sup>] with 0.33. All treatments were significantly different from the control after the first application. After the second application, on the seventh day after treatment, T<sub>4</sub> recorded the lowest leafhopper population (0.80), which was on par with T<sub>5</sub> (1.40) and T<sub>6</sub> (1.47). T<sub>1</sub> (2.27) was statistically on par with treatments with T<sub>2</sub> (1.60) and T<sub>7</sub> (1.80). The population of leafhoppers was highest in T<sub>8</sub> (9.53). All treatments were significantly different from the control after the second application. The data on the leaf hopper population after the third application, on the seventh day, all treatments were significantly different from the control. The population was highest in T<sub>8</sub> (9.67). T<sub>4</sub> (1.07) exhibited the lowest leafhopper population which was on par with T<sub>5</sub> (1.40), T<sub>2</sub> (1.67) and T<sub>6</sub> (1.80). T<sub>1</sub> (2.47) was statistically on par with T<sub>3</sub> [Azadirachtin formulation 1%, 2ml L<sup>-1</sup>] (2.27) and T<sub>7</sub> (1.87).

From the data of the leaf hopper *A. biguttula biguttula* population, it is clear that, there is a significant reduction under different treatments of HMO and its combinations compared to the control. HMO at 3 per cent concentration also can effectively control leaf hoppers compared to control. This finding is in line with the observation of Sridharan *et al.* (2015a), who found that HMO at 1 per cent and 2 per cent could effectively reduce the leaf hopper *A. biguttula biguttula* population in bhindi. In the present study, treatment HMO at 3 per cent + thiamethoxam 25WG 0.1g/L (half the recommended dose) combination was superior among all other treatments against leaf hoppers, which was on par with treatment with thiamethoxam alone (full recommended dose). This indicates that, HMO can be effectively used in combination with chemical pesticides, which improves its efficiency. Similar findings were recorded by Malik *et al.* (2020), who found that the combination of HMO @ 50ml/10l + thiacloprid 240SC @ 4ml/10l significantly reduced the leaf hopper *A. biguttula biguttula* population (0.49 leaf hoppers/plant) in potato. It was also found that mineral oil in combinations with karanj oil or neem oil effectively controlled leaf hoppers *A. biguttula biguttula* in bhindi (Sridharan *et al.*, 2015a). According to Fernandez *et al.* (2005), the apple

**Table 1. Effect of treatments on *Amrasca biguttula biguttula* population in brinjal (mean of 15 plants)**

| Treatment                                                                   | First application            |                              | Second application           |                              | Third application             |                              |
|-----------------------------------------------------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|-------------------------------|------------------------------|
|                                                                             | 7DAS                         | 14 DAS                       | 7DAS                         | 14 DAS                       | 7DAS                          | 14 DAS                       |
| T <sub>1</sub> - HMO 3%                                                     | 0.27<br>(1.13) <sup>b</sup>  | 0.87<br>(1.37) <sup>b</sup>  | 2.27<br>(1.78) <sup>b</sup>  | 2.40<br>(1.83) <sup>b</sup>  | 2.47<br>(1.85) <sup>b</sup>   | 3.47<br>(2.11) <sup>b</sup>  |
| T <sub>2</sub> - HMO 3% + Azadirachtin formulation 1%, 1ml L <sup>-1</sup>  | 0.13<br>(1.06) <sup>bc</sup> | 0.60<br>(1.26) <sup>c</sup>  | 1.60<br>(1.61) <sup>b</sup>  | 1.87<br>(1.69) <sup>b</sup>  | 1.67<br>(1.63) <sup>bcd</sup> | 2.27<br>(1.81) <sup>cd</sup> |
| T <sub>3</sub> - Azadirachtin formulation 1%, 2ml L <sup>-1</sup>           | 0.33<br>(1.15) <sup>b</sup>  | 0.53<br>(1.24) <sup>cd</sup> | 1.60<br>(1.61) <sup>b</sup>  | 1.80<br>(1.67) <sup>b</sup>  | 2.27<br>(1.79) <sup>bc</sup>  | 2.87<br>(1.96) <sup>bc</sup> |
| T <sub>4</sub> - HMO 3% + Thiamethoxam 25WG 0.1g L <sup>-1</sup>            | 0.00<br>(1.00) <sup>c</sup>  | 0.47<br>(1.21) <sup>cd</sup> | 0.80<br>(1.34) <sup>c</sup>  | 1.53<br>(1.59) <sup>b</sup>  | 1.07<br>(1.44) <sup>d</sup>   | 1.27<br>(1.50) <sup>e</sup>  |
| T <sub>5</sub> - Thiamethoxam 25WG 0.2g L <sup>-1</sup>                     | 0.13<br>(1.06) <sup>bc</sup> | 0.33<br>(1.15) <sup>d</sup>  | 1.40<br>(1.55) <sup>bc</sup> | 2.07<br>(1.75) <sup>b</sup>  | 1.40<br>(1.55) <sup>cd</sup>  | 1.67<br>(1.63) <sup>de</sup> |
| T <sub>6</sub> - HMO 3% + Chlorantraniliprole 18.5SC 0.15ml L <sup>-1</sup> | 0.27<br>(1.13) <sup>b</sup>  | 0.47<br>(1.21) <sup>cd</sup> | 1.47<br>(1.57) <sup>bc</sup> | 2.13<br>(1.77) <sup>b</sup>  | 1.80<br>(1.67) <sup>bcd</sup> | 2.40<br>(1.84) <sup>cd</sup> |
| T <sub>7</sub> - Chlorantraniliprole 18.5SC 0.3ml L <sup>-1</sup>           | 0.33<br>(1.15) <sup>b</sup>  | 0.53<br>(1.24) <sup>cd</sup> | 1.80<br>(1.67) <sup>b</sup>  | 2.53<br>(1.88) <sup>b</sup>  | 1.87<br>(1.69) <sup>bcd</sup> | 2.47<br>(1.86) <sup>c</sup>  |
| T <sub>8</sub> - Absolute control                                           | 8.60<br>(3.09) <sup>a</sup>  | 8.80<br>(3.13) <sup>a</sup>  | 9.53<br>(3.25) <sup>a</sup>  | 10.33<br>(3.36) <sup>a</sup> | 9.67<br>(3.27) <sup>a</sup>   | 10.87<br>(3.44) <sup>a</sup> |

leaf hopper *Typhlocyba pomea* population considerably reduced through a higher number of applications of mineral oil in a three-year duration pest management programme.

#### Whitefly *Aleurodicus dispersus* in chilli:

There was no infestation of whiteflies in chilli during the first application of treatments. From the second application only, the observations were taken. The pest population (mean of 18 plants) on the seventh DAS was only discussed, as the data showed the consistency of population reduction after the treatments (Table 2). On the seventh day, the population was lowest in T<sub>4</sub> (0.67), which was on par with T<sub>5</sub> (0.78). T<sub>1</sub> (2.50) was statistically on par with T<sub>2</sub> (2.33), T<sub>6</sub> (1.94) and T<sub>7</sub> (2.00). The population of whiteflies was highest in T<sub>8</sub> (7.78). All treatments were significantly different from the

control. The data on the whitefly population after the third application on the seventh day after application, showed the lowest whitefly population in T<sub>4</sub> (0.06), which was on par with T<sub>5</sub> (0.11). T<sub>1</sub> (1.89) was statistically on par with T<sub>3</sub> (1.94), T<sub>6</sub> (1.78) and T<sub>7</sub> (1.83). The population of whiteflies was highest in T<sub>8</sub> (7.94). All treatments were significantly different from the control after the third application.

There was a significant reduction in the whitefly population in HMO and its combination treatments in chilli compared to the control after two sprays (Table 2). In the present study, treatment HMO at 3 per cent + thiamethoxam 25WG 0.1g/L (half the recommendation dose) combination gave the best results among all other treatments against whiteflies, which was on par with treatment with thiamethoxam 25WG 0.2g/L (full recommended dose). So, the

Table 2. Effect of treatments on whitefly *Aleurodicus dispersus* population in chilli (mean of 18 plants)

| Treatments                                                               | Second application          |                              | Third application           |                              |
|--------------------------------------------------------------------------|-----------------------------|------------------------------|-----------------------------|------------------------------|
|                                                                          | 7DAS                        | 14 DAS                       | 7DAS                        | 14 DAS                       |
| T <sub>1</sub> HMO 3%                                                    | 2.50<br>(1.87) <sup>b</sup> | 2.11<br>(1.76) <sup>b</sup>  | 1.89<br>(1.69) <sup>b</sup> | 2.56<br>(1.88) <sup>b</sup>  |
| T <sub>2</sub> HMO 3% + Azadirachtin formulation 1%, 1ml L <sup>-1</sup> | 2.33<br>(1.82) <sup>b</sup> | 2.00<br>(1.73) <sup>bc</sup> | 1.89<br>(1.69) <sup>b</sup> | 2.33<br>(1.82) <sup>b</sup>  |
| T <sub>3</sub> Azadirachtin formulation 1%, 2ml L <sup>-1</sup>          | 2.22<br>(1.79) <sup>b</sup> | 2.17<br>(1.78) <sup>b</sup>  | 1.94<br>(1.72) <sup>b</sup> | 2.72<br>(1.93) <sup>b</sup>  |
| T <sub>4</sub> HMO 3% + Thiamethoxam 25WG 0.2g L <sup>-1</sup>           | 0.67<br>(1.29) <sup>c</sup> | 1.33<br>(1.53) <sup>d</sup>  | 0.06<br>(1.03) <sup>c</sup> | 1.06<br>(1.43) <sup>c</sup>  |
| T <sub>5</sub> Thiamethoxam 25WG 0.4g L <sup>-1</sup>                    | 0.78<br>(1.33) <sup>c</sup> | 1.44<br>(1.56) <sup>d</sup>  | 0.11<br>(1.05) <sup>c</sup> | 1.33<br>(1.53) <sup>c</sup>  |
| T <sub>6</sub> HMO 3% + Fenpyroximate 5EC 0.3ml L <sup>-1</sup>          | 1.94<br>(1.69) <sup>b</sup> | 1.50<br>(1.58) <sup>d</sup>  | 1.78<br>(1.67) <sup>b</sup> | 2.00<br>(1.73) <sup>b</sup>  |
| T <sub>7</sub> Fenpyroximate 5EC 0.6ml L <sup>-1</sup>                   | 2.00<br>(1.71) <sup>b</sup> | 1.56<br>(1.59) <sup>cd</sup> | 1.83<br>(1.68) <sup>b</sup> | 2.11<br>(1.76) <sup>b</sup>  |
| T <sub>8</sub> Absolute control                                          | 7.78<br>(2.96) <sup>a</sup> | 8.00<br>(3.00) <sup>a</sup>  | 7.94<br>(2.99) <sup>a</sup> | 10.61<br>(3.41) <sup>a</sup> |

combination effect of HMO is clearly evident. This result is concordant with the findings of Horowitz *et al.* (1997), who observed that the combination having 1 per cent mineral oil with abamectin 18 g a.i./ha reduced the larval population of sweet potato whitefly *Bemisia tabaci* significantly better than the abamectin applied alone. Mineral oil in combination with pongamia oil and neem oil exhibited higher efficacy in checking *Bemisia tabaci* population in bhindi (Sridharan *et al.*, 2015b). In current study, HMO at 3 per cent concentration alone can also effectively manage whiteflies which concur with the results of Stansly and Conner (2005) who reported the considerable reduction of silverleaf whitefly *Bemisia argentifolii* by the application of HMO concentrations ranging from

0.5 per cent to 2 per cent in tomato. It was reported that, the effective reduction in oviposition of greenhouse whitefly *Trialeurodes vaporariorum* was achieved by nC24 horticultural mineral oil in tomato (Xue *et al.*, 2002). Laboratory studies of silverleaf whitefly *Bemisia argentifolii* on melon leaves proved that mineral oil 1 per cent could successfully repel whitefly adults and significantly reduce the population (Liang and Liu, 2002). HMO in combination with half the recommended dose of thiamethoxam, azadirachtin and chlorantraniliprole were on par with the full dose of respective chemical pesticides in managing leaf hoppers on brinjal and HMO in combination with a half-recommended dose of thiamethoxam, azadirachtin and fenpyroximate were on par with the full dose

of respective chemical pesticides in managing whiteflies on chilli. This indicates the reduction in the chemical pesticide load in both crops without compromising the efficiency. Similar findings were reported by Shilpa (2024), who found that HMO in combination with half recommended dose of chemical pesticides lambda cyhalothrin 25EC 0.0015 per cent and quinalphos 25 EC 0.025 per cent were on par with the full dose of respective chemical pesticides in managing tea mosquito bug on cashew. The combination effect of HMO with half the recommended dose of the chemical pesticides showed the same efficiency on the leafhopper and the whitefly, when the same chemical pesticides were applied alone in the full recommended dose.

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