International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 20-04-2026, Accepted: 21-05-2026, Published: 05-06-2026
Volume 11, Issue 2, 2026, Page No. 373-377

Comparative study of essential oils for the management of *Myzus persicae* (Hemiptera: Aphididae) in *Euryops pectinatus*

Sidra Mehfooz, Barish E James
Department of Zoology, Isabella Thoburn College, Faizabad road, Lucknow, India
Corresponding Author: Barish E James
DOI: https://doi.org/10.66856/ijer.2026.11.2.11187

Abstract
The goal of the current study was to assess the toxicity and effectiveness of three essential oils against the green peach aphid, *Myzus persicae (*Sulzer), which infest yellow daisy plants (*Euryops pectinatus*). These oils are neem oil (*Azadirachta indica*), clove oil *(Syzygium aromaticum*), and lemongrass oil (*Cymbopogon citratus*). Three replications of each treatment were used in the Completely Randomized Design (CRD) experiment, which was conducted in a controlled laboratory setting. Aphid mortality was measured 24, 48, and 72 hours after treatment (HAT), and essential oils were examined at three doses (1%, 2%, and 5%). Clove oil showed the highest toxicity among all treatments, recording a mean mortality of 43.44 ± 3.87% at 5% concentration after 72 hours, followed by lemongrass oil (39.33 ± 4.41%) and neem oil (36.33 ± 4.03%). The control treatment showed minimal mortality. ANOVA statistical analysis revealed highly significant differences among treatments and exposure periods ($P < 0.05$), confirming the efficacy of essential oils in aphid management. According to the study, plant-derived essential oils, particularly clove oil, have strong insecticidal properties against *M. persicae* and could be used as eco-friendly alternatives to synthetic chemical pesticides. Botanical oils can help to promote sustainable and environmentally friendly pest management in ornamental and crop plants.

Keywords: *Myzus persicae*, essential oils, HAT

Introduction

The Asteraceae family's *Euryops pectinatus "*Viridae" is a weed that thrives in full sun and well-drained soil because it tends to spread; it uses the available nutrients and space to impact the growth of other crops.

However, special attention is devoted nowadays to undesired weeds as they exhibit some special features that make them grow quickly under abiotic stress circumstances. Phytoconstituents, which are abundant in plants, offer countless possibilities for the creation of novel therapeutic candidates.

In South Africa's Western Cape, *Euryops pectinatus* is native to rocky, sandstone hillsides. According to research of weed flora of dry land crops in the Chunkatta and Bhilai regions, Asteraceae was discovered to have the second biggest species distribution in Chhattisgarh, often known as the "bowl of rice." The majority of these plants may have beneficial qualities (Anju Meshram,2018).

Aphids are important pests of many vegetables and fruits as they suck the sap of plants that is followed by the development of sooty mold on damaged plants (Tang *et al*. 2017). Among the most damaging and common species of aphids are the green peach aphid, *Myzus persicae* Sulzer; the cabbage aphid, *Brevicoryne brassicae* L.; the potato aphid, *Macrosiphum euphorbiae* Thomas; and the melon (or cotton) aphid, Aphis gossypii Glover (Homoptera: Aphididae). Aphids are serious pests as they are known to disseminate the viruses among healthy plants (Javed *et al*. 2019) [12]

Aphids are tiny, soft-bodied insects that feed by sticking their thin mouthparts into plant food tubes called phloem cells. Closely related aphid species typically feed on closely related plant species, and the majority of aphid species only eat one type of plant. Aphids feed and reproduce at the same time after identifying the right plant species. Large colonies are created when offspring settle near their mothers. During their four molts, newborn nymphs grow larger but generally resemble their prior incarnation (Stern, David L.2008)

Aphids are found in around 4000 species, 250 of which are plant pests. Aphids are distributed across the planet, and because they can establish colonies quickly, their population grows to a very big size very quickly. Numerous ornamental and vegetable plants are harmed by them. Aphids typically consume plant sap, and they have been shown to curl and deform leaves, especially in populations that are high (Aly *et al*., 2022).

The green peach aphid *Myzus persicae*, Sulzer (1776) (Hemiptera: Aphididae) is the most economically important aphid crop pest worldwide (Van Emden and Harrington,2007). Several factors have enhanced the status of this species as a pest, including its distribution, host range, mechanisms of plant damage, life cycle, capacity to disperse, and ability to evolve resistance to insecticides (Chris Bass *et al*.,2014) [3]

The management of aphids has been difficult, and their presence in the golden daisy bush crop affects the quality and growth of the plant. The population build-up of aphids is mainly influenced by the weather parameters. In India, several workers have studied the behaviour and reproduction rate of aphids on golden daisy bush in different agro-climatic zones of the country (Trivedi and Gadewar 1990, Verma *et al*., 1989, and Venna *et al*. 1982).

Myzus persicae (Sulzer), the green peach aphid, is a significant pest of numerous cultivated plants across the globe. losses in horticulture and crops by feeding on over 40 plant families.

This insect causes direct crop damage by phloem feeding and indirect crop loss through plant virus transmission. It has been demonstrated that *Myzus persicae* is one of the most

common aphid viral vectors capable of spreading more than 100 distinct phyto-viruses (P. Czerniewcz *et al*.,2018).
Aphids constantly infest greenhouses, making it difficult to control their populations; despite various methods, these tiny pests persist, challenging gardeners and requiring persistent management strategies. In addition to causing direct damage during feeding, they also transmit hazardous viruses (Grigorov,1980). Chemical products can be ineffective and have negative long-term effects when used frequently.
Controlling *M.persicae* and restricting virus -infected plants are made possible by mineral or essential oils. This is an alternate chance to lessen chemical treatments in order to achieve a healthy and pesticide-free environment (V. Yankova *et al*.,2006-2007).
So, the goal of the current study was to determine how well three different essential oil concentrations of neem, lemon grass, and clove could control green peach aphid (*Myzus persicae)* on the yellow daisy plant.

Material and methodology

Design of Experiments

A completely randomized design (CRD) was used for the experiment. Three replications of each of the three essential oil treatments were assessed. The experiment's goal was to evaluate, under controlled circumstances, the impact of several essential oils on the aphid population.

Host Plant Raising

- Aphids were raised using 40 yellow daisies (*Euryops pactinatus*) seeds as host plants. The seeds were first sown in 1-liter plastic bottles, each containing two seeds.
- A total of twenty plastic bottles were utilized. To keep each bottle moist, a layer of cotton was positioned at the bottom.
- To aid in germination, two daisy seeds were put on the cotton surface and softly misted with water.
- Each bottle's mouth was covered with muslin material that was fastened with rubber bands to let air in while keeping insects out. Only when watering was necessary was the cloth opened.
- For ten days following seeding, the seedlings were kept at (25.0 °C).
- When the seedlings reached the top of the bottles after ten days, they were moved into plastic polythene bags infused with seeds and filled with garden soil to supply enough nutrients for continued growth.
- To ensure adequate establishment, the transplanted plants were cared for and monitored for 15 days following transfer.
- The host plants were not treated with any pesticides during the whole growing period.

Fig 1: Materials required during experiment

Fig 2: Seed germination in plastic bottles with yellow daisy seeds inside fixed with muslin cloth

Fig 3: Aphid introduced in yellow daisy plants covered with plastic polythene after application of treatment with essential oil

Fig 4: Newly hatched green peach aphid after being transferred to experimental yellow daisy plant (50 in each plant):

Aphid Culture and Rearing

- Aphid species colonies from a local farm; naturally afflicted daisy plants were used to gather *Myzus persicae*. Aphid colonies on infested plant portions were sent to the lab.
- A fine paintbrush was used to carefully transfer newly hatched aphids on yellow daisy twigs that were kept in plastic polythene bags that had been infused with seeds. To keep insects from escaping while allowing air to circulate, these plants were placed inside clear plastic polythene secured with cello tape on top.

- The aphid culture was kept in a controlled atmosphere with a temperature of (32.56 °C & 45.56 % R. H).
- Each fresh yellow daisy plant cultivated in polythene bags received 50 newly hatched aphids for the experiment. To ensure consistent experimental settings, each plant was once more covered with polythene in the same way as previously mentioned.

The Experiment's Essential Oils

Based on their accessibility and documented insecticidal effectiveness against aphids, three essential oils were chosen for the investigation.

The following oils were utilized in the experiment:

- Neem oil derived from *Azadirachta indica*
- *Syzgium aromaticum* is the source of clove oil.
- *Cymbopogon citratus* is the source of lemongrass oil.
- All three oils were purchased from the Lucknow local market.
- The toxicity and efficacy of these oils as therapies against aphid populations on yellow daisy plants were assessed.
- Each oil was produced in three different v|/v concentrations (1.0, 2.0,5.0 %). For the preparation of concentration 1.0, 2.0, 5.0 ml of neem, clove, and lemongrass oils were taken in a conical flask (10ml) separately, and 1000 ml of distilled water was added for 1% concentration,(20ml) oil and 1000ml distilled water for 2% conc. and for 5 % conc. add (50ml) oil in 1000ml distilled water

- A similar approach was used (Hossain, Yasmin, Bachchu, & Alim, 2021). As an emulsifier, one drop of detergent was added. One drop of detergent and distilled water was utilized as a comparison positive control group (A. Pandey & B.E.James,2023) [17].

Method of application (Spraying)

- For every concentration, three concentrations and three replicas were used for each treatment.
- For every replicate, fifty *M.persicae* individuals (adult and nymph) received treatment. Using a hand-held sprayer, the essential oil solutions were applied to the plants until the leaves were fully moistened.
- To stop aphids and treated oils from escaping, the complete experiment setup was covered with plastic polythene, and the top of the polythene was taped shut.
- The entire experiment was carried out over the course of three time windows (24 hours, 48 hours, and 72 hours).
- By using a tiny brush to delicately contact the bug and observing any movement of its legs or antennae, dead aphids were found. (Methodology followed by A. Pandey & B.E. James.

Table 1: List of treatment oils

S.No.	Essential oils	Scientific name
T1	Neem	Azadirachta indica
T2	Clove	*Syzgium aromaticum*
T3	Lemon grass	*Cymbopogon citratus*
T4	control	Distilled water and detergent

The relative efficiency of essential oils is shown in Table 2. The average mortality rate has increased with increasing concentration and duration. It was clearly shown that in all treatment 5% concentration resulted in the highest mortality % at a duration period of 72 hours (3Days).

Results

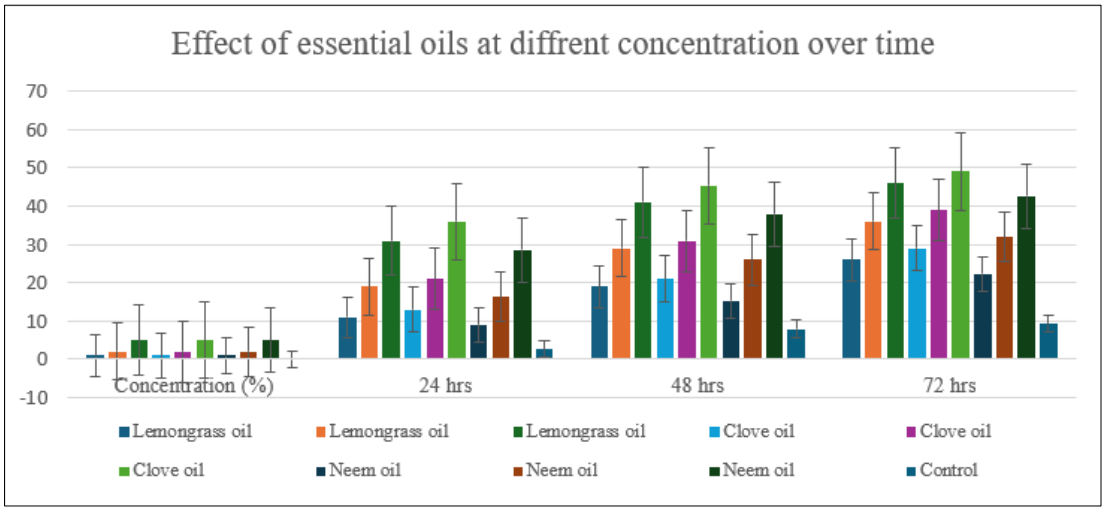
Table 2: Toxicity effects of different dosages of essential oils against *M. persicae* at different HATs (Interaction of oils, doses, and periods)

S. No.	Essential oils	No. of Aphids	Dose (%)	24 hrs	48 hrs	72 hrs	Mean Mortality (% ± SE)
1	Neem oil	50	1	9	15.33	22.33	15.55 ± 3.85
		50	2	16.33	26	29	23.78 ± 3.82
		50	5	28.67	38	42.33	36.33 ± 4.03
2	Clove oil	50	1	13	21	29	21.00 ± 4.62
		50	2	21	31	39	30.33 ± 5.21
		50	5	36	45.33	49	43.44 ± 3.87
3	Lemongrass oil	50	1	11	19	26	18.67 ± 4.33
		50	2	19	29	36	28.00 ± 4.93
		50	5	31	41	46	39.33 ± 4.41
4	Control	50	0	2.67	8	9.33	6.67 ± 2.04

The results of the analysis showed that both types of oil and the time of exposure significantly affected the response values. Among the oils tested, clove oil possessed the highest activity, followed by lemongrass oil, whereas neem oil exhibited comparatively low effects. Moreover, the response increased gradually with increasing exposure time from 24 to 72 h. ANOVA revealed that aphid mortality varied significantly between treatments and exposure times ($P < 0.05$). The computed F-values for rows (416.71) and columns (958.29) were higher than the corresponding F-critical values (2.59 and 3.63), suggesting that exposure duration and essential oils had a significant impact on aphid mortality.

Statistical Analysis

Microsoft Excel and SPSS were used to perform the ANOVA analysis. Because the computed F-values were higher than the critical F-values with p-values less than 0.05, the results demonstrated highly significant differences between both rows and columns. The column factor displayed an F-value of 28.08365, whilst the row factor recorded an F-value of 10.23659. To evaluate treatment means and find significant variations across treatments, Duncan's Multiple Range Test (DMRT) was utilized.



Graph 1: Mean mortality % of *Myzus persicae* due to contact toxicity of different essential oils

Discussion

In view of the broad range of bioactivities of plant essential oils, such as fungicidal, medicinal, and aromatic effects, they have been studied by many disciplines. In this review, we found that clove oil and neem oils were most effective against green peach aphids, as shown by the results. The reason for the higher efficiency of such oil compared to other oils is due to the presence of a higher amount of effective monoterpenes (Prayash Pathak *et al*. 2019).

The results showed that Clove essential oil is a potential plant-based insecticide based on the constituents identified by GC-MS, such as eugenol (88.61%), eugenol acetate (8.89%), and β-caryophyllene. This makes up 99.89% of its components and is also known for its insecticidal properties (Ahmed&Ren,2023; Raedetal.,2022; Tianetal.,2015).

Commercial neem seed extracts have a broad spectrum of pest control properties, affecting insect growth, fertility, and metamorphosis in addition to direct toxicity and antifeedant and oviposition- deterrent effects (Naqvi, 1996). The pharmacological actions that *Cymbopogon citratus* has anti-inflammatory, antibacterial, and antifungal properties. Numerous other consequences have also been examined, such as antimalarial, hypoglycemic, and antioxidant (Shah *et al*., 2011).

Conclusion

The current study unequivocally showed that essential oils had strong insecticidal action against Myzus persicae, the green peach aphid, on yellow daisy plants (Euryops pectinatus). Clove oil, followed by lemongrass and neem oils, was found to be the most effective treatment out of the three essential oils that were tested. Higher concentrations and longer exposure times led to a steady increase in aphid mortality; after 72 hours of treatment, the maximum mortality was recorded at 5% concentration. The results show that essential oils are a promising botanical substitute for synthetic insecticides in the control of aphids. They are appropriate for integrated pest management (IPM) and organic farming systems due to their natural origin, biodegradability, and relatively safer environmental profile. Clove oil, in particular, has shown exceptional toxicity, probably because it contains bioactive substances like eugenol and β-caryophyllene.

Overall, this study emphasizes how essential oils may be used to promote sustainable farming methods and lessen reliance on chemical pesticides. To increase the practical application and long-term efficacy of these botanical insecticides, more field research and formulation changes are advised**.**

Acknowledgement

To everyone who helped me finish this research paper successfully, I would like to extend my profound gratitude. First of all, I would like to express my gratitude to Isabella Thoburn College Principal Dr. Neerja Masih for helping to facilitate the study process. I also want to express my gratitude to Professor Chitra Singh, Head of Department (H. O. D.), for her insightful conversations and crucial assistance during the project. Then, I would like to express my sincere gratitude to Professor Barish James (the supervisor) for her helpful advice and knowledge over the course of the research. Her astute advice and perceptive criticism had a significant impact on the results of my study and made it possible to obtain the necessary tools and supplies needed for the setup of the experiment. Finally, I would want to express my gratitude to my friends for their encouragement and moral support during the study process.

References

1. Milner RJ. Prospects for biopesticides for aphid control. BioControl,1997:42(1):227-239.
2. Florencio-Ortiz V, Sellés-Marchart S, Zubcoff-Vallejo J, Jander G, Casas JL. Changes in the free amino acid composition of *Capsicum annuum* leaves in response to *Myzus persicae* infestation. A comparison with water stress. PLoS One,2018:13(6):e0198093.
3. Bass C, Puinean AM, Zimmer CT, Denholm I, Field LM, Foster SP, *et al*. The evolution of insecticide resistance in the peach potato aphid, *Myzus persicae*. Insect Biochemistry and Molecular Biology,2014:51:41-51.
4. Ali J. The Peach Potato Aphid (*Myzus persicae*): Ecology and Management. CRC Press, 2023.
5. Pan M, Wei Y, Wang F, Liu T. Influence of plant species on the biological control effectiveness of *Myzus persicae* by *Aphidius gifuensis*. Crop Protection,2020:135:105223.
6. Meshram A, Bhagyawant SS, Srivastava N. International Journal of Bioscience and Biochemistry.

7. Czerniewicz P, Chrzanowski G, Sprawka I, Sytykiewicz H. Aphicidal activity of selected Asteraceae essential oils and their effect on enzyme activities of the green peach aphid, *Myzus persicae* (Sulzer). Pesticide Biochemistry and Physiology,2018:145:84-92.
8. Yankova V, Markova D, Todorova V, Velichkov G. Biological activity of certain oils in the control of green peach aphid (*Myzus persicae* Sulz.) on pepper. In: IV Balkan Symposium on Vegetables and Potatoes,2008:830:619-626.
9. Castresana J, Puhl L. Botanical formulations for the ecological management of *Myzus persicae* (Sulzer) and *Aphis gossypii* (Clover) (Hemiptera: Aphididae) and their side effects on parasitoids. Revista de Ciencias Agrícolas,2021:38(1):50-61.
10. Golijan-Pantović J, Popović V, Jovanović S, Šarčević-Todosijević L, Popović A, Lakić Ž, *et al*. Essential oils as bioinsecticides and their application in organic agriculture. Lekovite Sirovine,2025:45(1):e337.
11. Costa AV, Pinheiro PF, Rondelli VM, de Queiroz VT, Tuler AC, Brito KB, *et al*. *Cymbopogon citratus* (Poaceae) essential oil on *Frankliniella schultzei* (Thysanoptera: Thripidae) and *Myzus persicae* (Hemiptera: Aphididae). Bioscience Journal,2013:29(6):1840-1847.
12. Javed K, Javed H, Mukhtar T, Qiu D. Pathogenicity of some entomopathogenic fungal strains to green peach aphid, *Myzus persicae* Sulzer (Homoptera: Aphididae). Egyptian Journal of Biological Pest Control,2019:29(1):92.
13. Landge AD, Dwivedi SA, Landge SA. A review on application of integrated pest management tactics for the aphid complex on the crop ecosystem. International Journal of Advanced Biochemistry Research,2024:8(7):458-468.
14. Shannag HS, Capinera JL, Freihat NM. Efficacy of different neem-based biopesticides against green peach aphid, *Myzus persicae* (Hemiptera: Aphididae).
15. Salim A, Ahmed Q. Evaluation of six essential oils for controlling cotton aphid and potential use in the organic agriculture. Iraqi Journal of Agricultural Sciences,2026:57(4):1124-1033.
16. Riyaz T, Riat AK. Effects of *Hibiscus rosa-sinensis* and *Cymbopogon citratus* against aphids: a review. Plant Archives,2021:21(1):2317-2322.
17. Pandey A, James BE. Potency of three essential oils against *Aphis craccivora* Koch (Homoptera: Aphididae) in bean plant. International Journal of Science and Research,2023:12(6):287-291.