International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 01-11-2025, Accepted: 01-12-2025, Published: 16-12-2025
Volume 10, Issue 12, 2025, Page No. 68-70

Formulation and Comparative Bioefficacy Assessment of a Herbal Mosquito and Insect Repellent Vaporizer Incorporating *Ocimum tenuiflorum* and Selected Essential Oils

Pravin V. Gomase*
Department of Pharmacognosy, JES's College of Pharmacy, Nandurbar, Waghode, Maharashtra, India

Abstract
The life-threatening pathogenic organisms and associated human diseases including malaria, dengue, filariasis, chikungunya, Japanese encephalitis, etc. are spread by mosquitoes, which are hostile dipteran insects. The female mosquito bite, by piercing and sucking type mouth parts, creates localized skin irritation and injects infectious organism in to the skin through its saliva. The development of effective and safe insect repellents is vital since there are at present no viable vaccinations against parasitic and viral infections carried by arthropods. Many chemical-based mosquito repellents are available in the market, but they can be toxic to individuals and the environment, and have been related with many bad effects. Conversely, the mosquitoes became resistant to them. Additionally, a spectrum of recognized and undiscovered undesirable side effects are being reported by consumers. The researcher had to develop and evaluate a herbal insect repellent vaporizer that included several essential oils and plant extract in order to mitigate the adverse effects of existing commercially available mosquito repellents. This research focuses on the formulation and evaluation of a herbal mosquito and insect repellent vaporizer incorporating neem oil, Lavender essential oil, Lemongrass essential oil, Cedarwood essential oil, Clove oil, Citronella oil, camphor and *Ocimum tenuiflorum* extract.

Keywords: *Ocimum tenuiflorum*, Mosquito Repellent Vaporizer, herbal, essential oils

Introduction

Malaria, arboviral encephalitis, dengue fever, chikungunya fever, West Nile virus, and yel-minimal fever are all serious and popular diseases transmitted by insects. These illnesses cause major morbidity and mortality among humans and animals around the world. Insect-transmitted diseases continue to be a primary cause of illness and death worldwide. Diseases caused by viral transmission from insects to humans are becoming more common in tropical and subtropical climates. Malaria and dengue fever are among the world's most common arboviral infections. Because it contains species that can transmit serious diseases such as filariasis [1]. Mosquitoes pose a threat to human health by transmitting pathogenic agents that cause diseases such as malaria, filariasis, dengue, chikungunya, Japanese encephalitis, yellow fever, and others. They are also poisonous to humans due to their biting activities, which cause itching and irritations at the skin's surface, whether at night or during the day [2].

Vectors are organisms that spread parasites or viruses from asymptomatic individuals to another, causing devastating diseases. According to the World Health Organization, vector-borne diseases account for more than 17% of all deaths each year, with over one billion cases and one million deaths. Malaria, dengue, chikungunya, filariasis, encephalitis, and kala-azar are all major public health concerns in India. According to 2012 data from the National Vector-Borne Disease Control Program, Plasmodium falciparum causes 50% of all malaria cases. According to the Lancet, India's malaria toll is 40 times higher than the official figure [3]. Mosquitoes from the Anopheles, Culex, and Aedes genera carry viruses that cause diseases like dengue fever, malaria, yellow fever, Japanese encephalitis, and others. Malaria, with around two to three million new cases each year, is one of the leading causes of baby, child, and adult mortality in India [4].

In the first five months of 2016, there were 50,000 instances of dengue fever, making it the most quickly spreading insectborne illness. In Malaysia, dengue fever seem to be the most worrisome vector-borne disease among all. This is because of the startlingly high number of cases that are reported each year; according to data given by the Ministry of Health (MOH), Malaysia had 20,000 dengue cases in 2016, which is consistent with 2015. There is now no simple therapy available, and while a dengue vaccine, called Dengvaxia, has been discovered, its status is still unknown and the WHO has not yet approved it [5].

More over 40% of the world's population, or over 2.5 billion individuals, are susceptible to dengue fever, which is spread by the *Aedes aegypti* mosquito and causes over 100 million infections annually worldwide, resulting in thousands of deaths. In Sri Lanka, major cyclical Dengue epidemics have occurred at regular intervals and in 2014, over 47,000 cases were reported. Therefore, the management of mosquitoes is a significant public health priority around the world. One of the ways for prevention of these mosquito-borne diseases is the interruption of disease transmission by either killing the mosquitoes or preventing them from biting individuals [6].

Since ancient times, traditional medicine has incorporated plants with healing powers. A range of ailments and problems have been treated organically with an extract prepared from the leaves, stems, and roots of different medicinal plants. Although many herbal treatments have been superseded by synthetic drugs, the safety and efficacy of Ayurvedic remedies have established standards [7]. Numerous behavioral, pharmacological, biological, and mechanical approaches are applied in the control of diseases spread by mosquitoes. The success rates that have been attained have been constrained by a lack of effective vaccinations and delays in the discovery of antiviral medications for the majority of arboviruses. The rising pesticide resistance in the mosquito vectors, delaying the

development of new medications and vaccines, curtails these attempts. The failing vector control efforts, the proliferation of invasive mosquitoes as well as increased contact between people and these vectors have led to the ongoing re-emergence of arboviruses. As a result, mosquito control programs face substantial and quickly evolving issues that call for the creation of novel methods for disease identification and management as a new public health requirement [8].

Children, the elderly, and pregnant women should avoid using commercially available mosquito repellents for an extended period of time since they contain harmful synthetic chemicals that can cause skin/eye irritation, coughing, and asthma [9]. The literature review mentioned several plants and essential oils that have mosquito-repellent properties, including lavender essential oil, mint, rosemary, basil, lemongrass essential oil, cedar, eucalyptus, cedarwood essential oil, geranium, chamomile, peppermint, neem, clove oil, citronella oil, and pyrethrum [10].

Plant Profile

1. *Ocimum tenuiflorum*

Fig 1: *Ocimum tenuiflorum*

The mint family contains the annual herb *Ocimum tenuiflorum* L., which has at least 150 varieties. Because of its alleged medical properties, at least two species of *Ocimum tenuiflorum*, also known as Ocimum sanctum, Tulsi, or Holy Basil from the Lamiaceae family, have been dubbed the "Queen of Plants" and the "Mother Medicine of Nature." The annual plant is erect, herbaceous, and slightly hairy, with numerous branches. The flowers are in closely spaced, whorled racemes that are either purplish or crimson. The leaves are elliptic-oblong, acute or obtuse, entire or serrate, hairy on both sides, and minutely gland-dotted [11].

Many distinct active phytochemicals work in concert to produce the nutritional and medicinal qualities of the entire herb in its natural state, as it has been used traditionally.

According to reports, Ocimum sanctum leaves are a rich source of volatile oil that contains 20% methyl eugenol and 71% eugenol. The volatile oil also contains the sesquiterpine hydrocarbon caryophyllene and carvacrol. Terpenoids, phenolics, flavonoids, and fatty acids are the other chemical components. Ocimum sanctum's aqueous leaf extract has yielded two flavonoids, orientin and andvicenin. The leaf extract has also been used to isolate ursolic acid, apigenin, luteolin, apigenin-7 O-glucuronide, luteolin-7-O glucuronide, orientin, and molludistin [12].

Material and Methods

Procurement and identification

The raw drugs *Ocimum tenuiflorum leaves*, was collected from botanical garden of JES College of Pharmacy, Nandurbar and get authenticated by Botany department of Jijamata Science college, Nandurbar. Essential oils of *Azadirachta indica* (Neem oil), *Lavandula angustifolia* (Lavender), *Cymbopogon citratus* (Lemongrass), *Juniperus barbadensis* (cedarwood), *Eugenia caryophyllata* (Clove oil) and Cymbopogon nardus (Citronella), Camphor were procured from Sahyadri Scientific Suppliers, Satara. India. Every chemical and solvent utilized was of analytical quality.

Chemicals required

Tween 80 and ethanol were procured from Thermosil Fine Chem Industries, Pune, India. Every chemical and solvent utilized was of analytical quality.

Preparation of extract

The extractions are prepared according the standard guidelines of IP and Khandelwal KR. Initially the fresh juices of *Ocimum tenuiflorum leaves* was prepared and taken in equal quantity [13, 14].

Preparation of Herbal Mosquito and insect repellent Vaporizer [3, 5]

The plug-in device's liquid was created by mixing *Ocimum tenuiflorum* juice extracts with essential oils of neem, lavender, lemongrass, cedarwood, clove, citronella, and camphor, as well as ethanol. To create an aqueous phase, mix Tween 80 and a tiny amount of distilled water. A solution of oils in ethanol was introduced to an aquatic phase that included tween 80. Magnetic stirring was used for 30 minutes to accomplish emulsification. (Table 1)

Table 1: Composition of Nasal vaporizer

Sr. No	Name of Ingredients	Quantity (%)
01	*Ocimum tenuiflorum* Juice	10 %
02	Neem oil	10 %
03	Lavender oil	2 %
04	Lemongrass oil	2 %
05	Cedarwood oil	1 %
06	Clove oil	1 %
07	Citronella oil	1 %
08	Camphor	5 gm
09	Ethanol	30 ml
10	Tween 80	7 %
11	Distilled water (gm^2)	Up to 100 ml

Evaluation of Herbal Mosquito and Insect Repellent Vaporizer [3, 15]

Separation of phases

The overall stability of the solution was assessed by observing the liquid's phase separation.

Organoleptic characteristics

Using visual inspection, determine color, smell, and look.

Mosquito Landing Test

This test consists of monitoring the number of mosquitos who land on a person's skin that is contact while they are near a liquid. To perform this test, have an individual sit in an area with the liquid blazing and quantify the number of

of mosquitos which land on their body over a set time period, such as five minutes.

Fume Test
A fume test identifies the color and smell of fumes emitted when a product is burned, as well as the presence of specific components.

Irritability Test
The irritability test is performed to see if the produced liquid causes any skin irritation.

Mosquito Killing Time
This test is used to assess the effectiveness of mosquito killing, whether slow or fast.

Burning for Users
The test was carried out by administering mosquito liquid to residents of the area and investigating the effects, which included coughing and tears.

Table 2: Evaluation of herbal mosquito and insect repellent vaporizer

Sr. No	Evaluation Parameter	Observation
01	Separation of phases	No phase separation in 24 hours.
02	Mosquito Landing Test	10 min
03	Fume Test	Good
04	Irritability Test	No irritation
05	Mosquito Killing Time	Effective
06	Burning for Users	No adverse effects on the user.

Results and discussion
This mosquito and bug repellent solution, made from natural chemicals, is extremely effective in controlling mosquitoes, housefly larvae, and other insects that carry vectors. During 24 hours, the solution forms a single phase with no phase separation seen, the repellent vaporizer exhibits quick mosquito landing properties, there is no discomfort from the liquid fumes, and it is a very effective formulation. (Table 2).

Conclusion
The research was undertaken with the aim to design mosquito and insect repellent vaporizer formulation with some essential oil like neem oil, Lavender essential oil, Lemongrass essential oil, Cedarwood essential oil, Clove oil, Citronella oil, camphor and *Ocimum tenuiflorum* extract. Based on the findings of the investigational study, the mosquito and insect repellent vaporizer preparation with essential oil has mosquito-repellent activity and showed good results as formulation.

Acknowledgment
The researchers are thankful to the Management and Principal of JES's College of Pharmacy, Nandurbar for granting assistance to carry out the research work.

References
1. Ubale AT, Patil SJ, Shinde SS, Paloji SS, Parab AT, Raul SA. Review on Herbal Insect Repellent Vaporizer Containing Tamarindus indica Leaves, Calotropis procera Extract. International Journal of Pharmaceutical Research & Allied Sciences,2025:14(1):1–7.
2. Chand S. Efficacy of certain plant essential oils as larvicides and repellents on mosquitoes. Journal of Entomology and Zoology Studies,2024:12(4):01–07.
3. Prasuna Sundari PJ, Sushma C, Srija T. Development of herbal mosquito-repellent formulations and their comparative evaluation. Asian Journal of Pharmaceutical and Clinical Research,2023:16960:127–132.
4. Hangargekar P, Birajdar A, Joshi A, Jha D, Yawalkar D. Formulation and Evaluation of Safe Herbal Mosquito Repellent Roll-On and Liquid Spray. Acta Scientific Pharmaceutical Sciences,2023:7(8):08–14.
5. Mahendran Sekar, Farah Nurliyana Abd Rahim. Formulation and Evaluation of Novel and Natural Mosquito Repellent Liquid to Prevent Dengue Mosquitoes. Annual Research & Review in Biology,2017:18(1):1–6.
6. Ranasinghe MSN, Arambewela L, Samarasinghe S. Development of Herbal Mosquito Repellent Formulations. International Journal of Collaborative Research on Internal Medicine & Public Health,2016:8(6):341–380.
7. Gomase PV. Development and Evaluation of herbal bath soap containing some Ayurvedic Varnya herbs. International Journal of Biological and Pharmaceutical Analysis and Science,2023:12(10):4619–4625.
8. Hudson Onen, Miryam M. Luzala, Stephen Kigozi, Rebecca M. Sikumbili, Claude-Josué K. Muanga, Eunice N. Zola, et al. Mosquito-Borne Diseases and Their Control Strategies: An Overview Focused on Green Synthesized Plant-Based Metallic Nanoparticles. Insects,2023:14:221. doi.org/10.3390/insects14030221.
9. Da Silva MR, Ricci-Junior E. An approach to natural insect repellent formulations: From basic research to technological development. Acta Tropica,2020:212:105 419.
10. Reegan AD, Kannan RV, Paulraj MG, Ignacimuthu S. Synergistic effects of essential oil-based cream formulations against Culex quinquefasciatus Say and *Aedes aegypti* L. Journal of Asia-Pacific Entomology,2014:17:327–331. doi:10.1016/j.aspen.2014.02.008.
11. Ashwini A, Kavitha C Sagar, Vijay Danapur. Pharmacognostic and Phytochemical studies on a religious herb *Ocimum tenuiflorum* L. International Journal of Pharmaceutical Sciences and Research,2021:12(3):1624–1629.
12. Amisha Ambolkar, Ankita Raut, Vrushali Vayeda. To Study Pharmacognosy and Phytochemistry of Holy Basil (*Ocimum tenuiflorum*). International Journal of Novel Research and Development,2023:8(1):164–171.
13. Khandelwal KR. Practical Pharmacognosy. Techniques and Experiments. 19th edition. Pune, Nirali Prakashan, 2005.
14. Gomase PV. In vitro Antibacterial activity of the crude methanol extract of fruit of Carissa carandas. International Journal of Biological and Pharmaceutical Analysis and Science,2024:13(2):531–538.
15. Mukund BA, Waghmare KP, Garje SY, Sayyed GA. Formulation of Herbal mosquito repellent liquid vaporizer of cinnamon and clove. International Journal of Research Publication and Reviews,2024:5(5):11690–11698.