

AREVIEW ON MOSQUITO REPELLENT CANDLE

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ABSTRACT

Creation and Assessment of Poly Herbal Mosquito Repellent Candle: The goal of the study is to create an environmentally friendly and potent herbal mosquito repellent candle that works better than those made of chemicals. Choosing appropriate herbal ingredients, creating candles with oils of neem, clove, orange peel, lemongrass, marigold, rosemary, and lavender all of which are known to repel mosquitoes and assessing their effectiveness are all part of the study. The candles are non-toxic, harmless, and designed to guard against diseases like dengue, chikungunya, zika virus, malaria, and yellow fever that are spread by mosquitoes. Melted wax is mixed with oils and herbal components to make a cure for diseases spread by mosquitoes. The efficacy and safety of the candles are demonstrated by tests of their colour, scent, appearance, flammability, burning time, irritancy, stability, and repelling activity. The benefits of polyherbal mosquito repellent candles are also emphasized, such as their low toxicity to non-target creatures, safety, lightweight nature, and environmental friendliness. Melting beeswax, combining powdered components, adding oils and juices, filling molds and cooling the candles are all steps in the formulation process. The candles successfully repel and kill mosquitoes while being safe for human usage, according to tests including organoleptic evaluation, irritancy, uniformity of mass, burning time, and mosquito repellent action. All things considered, the herbal mosquito repellent candle provides a sustainable and natural way to fight diseases spread by mosquitoes, with possible advantages for the environment and public health.

Keywords: Mosquito, Candle, Herbal, Neem.

I. INTRODUCTION

A practical method of protecting yourself from annoying mosquito bites that may transmit diseases such as the Zika virus, chikungunya virus, dengue virus, and plasmodia is to apply repellents. There are a lot of commercially available items available right now; some of them work well, while others don't. Access to effective repellent products might occasionally be limited in developing countries. Self-defence systems are often absent or insufficient in those who are at a higher risk of catching diseases spread by vectors. People all across the world use mosquito repellent as a traditional practice and widespread home medicine. Some of these remedies, such as DEET, are expensive and difficult to locate, while others are most likely highly successful. Furthermore, because they are impracticable in some situations, several tried-and-true methods such as the usage of mosquito nets are not regularly used by community members. [1]



Figure No.1:- Mosquito^[2]

One of the most upsetting bloodsucking insects that humans have to deal with is the mosquito. Many diseases, including Dengue fever, malaria, yellow fever, and others, are spread by mosquito species from the Anopheles, Culex, and Aedes genera.^[3] Because the antibodies IgG and IgE attach to the antigens, the saliva that the mosquitoes release into the host's blood triggers an immune reaction. Irritations, itching, redness, and occasionally pimples are the results of the reactions. An unpleasant rash that is a major annoyance is frequently

caused by mosquito saliva. Furthermore, human-mosquito interaction might result in an allergic reaction to the mosquito's saliva, which can cause extreme skin irritation.^[4]

Mosquitoes bear set of sensors that have the capability to track their prey's presence, these include:

A. Chemical Sensors: Research has shown that mosquitoes can detect lactic acid, carbon dioxide, and propen-3-ol at a distance of several yards. Both people and animals emit these chemicals when they breathe or perspire. Because of this, the species targets those who perspire more, whereas those who perspire less are less likely to be bitten.^[5]

Mosquito-Borne Diseases:

Malaria: Plasmodium parasites, which cause malaria, are spread via female Anopheles mosquito bites.^[6] Malaria is still a major problem worldwide; in 2022, there were roughly 249 million cases, which resulted in nearly 619,000 fatalities. Children under five and pregnant women are more vulnerable. Severe anemia can result from malaria.

Dengue: The mosquitoes *Aedes aegypti* and *Aedes albopictus* are the culprits behind dengue. Dengue fever is widespread, especially in portions of Africa and the Americas. About 4.1 million suspected dengue cases were reported in the Americas in 2023, with 2,049 fatalities and 6,710 severe cases. With more than 2.9 million suspected cases, Brazil had the most. There was a major dengue outbreak in Africa, with 688 fatalities and 146,878 probable cases. Hospitalization and even death are possible outcomes of severe dengue, especially in youngsters and people with weakened immune systems.^[7]

Chikungunya: The *Aedes aegypti* and *Aedes albopictus* mosquitoes are the cause of chikungunya. Chikungunya cases have significantly increased across the Americas as of 2023; in the first few months alone, nearly 214,000 cases were documented. Particularly hard hit is Paraguay, which has 138,730 cases, the most in its history. Bolivia has had high levels of dengue and chikungunya transmission, while other nations such as Uruguay and Argentina have also recorded local transmission for the first time. Severe joint pain and a sudden onset of fever are hallmarks of chikungunya. Usually lasting a few days, this joint pain can sometimes linger for weeks, months, or even years.^[8]

Life cycle of Mosquitoes:

There are four unique phases in a mosquito's life cycle: egg, larva, pupa, and adult.

Egg: On or close to water surfaces, female mosquitoes deposit their eggs. Both single and clustered eggs can be deposited. The time it takes for the eggs to hatch which depends on the environment can range from a few days to many weeks.^[9]

Larva: The larvae, also referred to as "wigglers," reside in the water after hatching. Known as "in stars," they go through four stages of growth. Larvae consume aquatic organic materials, such as bacteria and algae. They use a siphon at the water's surface to breathe air.

Pupa: Mosquitoes transition from the larval to the pupal stage, which is referred known as "tumblers" because to their aquatic mobility. The mosquito transforms into its adult form during this non-feeding stage. Depending on the species and the climate, the pupal stage might last anywhere from a few days to a week.

Adult: After emerging from the pupal case, the adult mosquito lays on the water's surface to dry its body and wings before taking off. Depending on their species and the habitat, adult mosquitoes can live anywhere from a few weeks to many months. In order to grow their eggs, female mosquitoes look for blood meals, but males typically consume nectar and other plant fluids.

Under ideal circumstances, the entire life cycle from egg to adult can be completed in as little as 8–10 days, but environmental considerations may cause it to take longer.

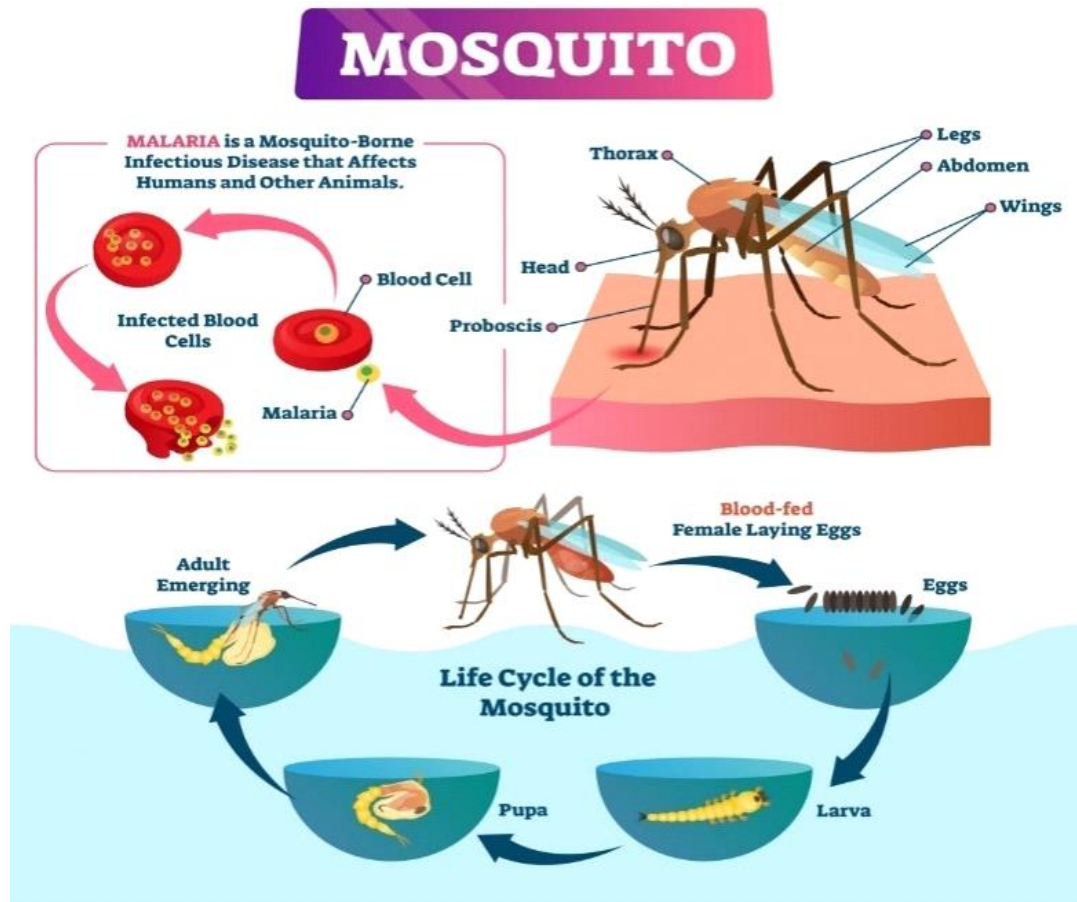


Figure No.2- Life Cycle Of The Mosquito^[10]

Mechanism of Action of Mosquito Repellence:

Mosquito repellents usually operate by either utilizing a scent that mosquitoes naturally shun and find unpleasant or by disguising the scent of humans.^[11] The olfactory receptors (ORs) and gustatory receptors (GRs) of mosquitoes are the targets of mosquito repellents. Repellants work by interfering with these receptors, which makes it harder for mosquitoes to locate and attack people. Mosquitoes locate their hosts by using their olfactory apparatus to detect carbon dioxide [CO₂] and other human scents. Heat sensors are used by mosquitoes to identify body heat released by warm-blooded hosts. In order to prevent landing and biting, repellents that function as contact irritants.^[12]

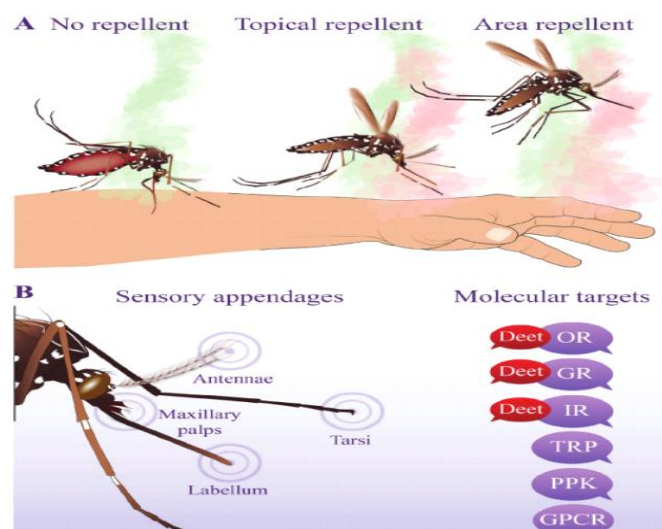


Figure No. 3- Mode of action of Mosquito Repellence^[13]

Herbs Selection:

❖ **Neem**

Biological Name: Azadirachta indica

Family: Meliaceae

Uses: Neem is utilized because it repels mosquitoes. Azadirachtin is Neem's primary active component. Azadirachtin has been demonstrated to prevent aquatic larvae, such as mosquitoes, from feeding on plants and to prevent larval, pupal, and adult moults and reproduction. One of the safest ways to keep mosquitoes away from your body is to use neem. Neem repels 70% of mosquitoes and has a roughly 3-hour half-life. [14]

❖ **Lemongrass**

Biological Name: Cymbopogon citratus.

Family: Poaceae.

Uses: Lemongrass, also called Cymbopogon citratus, has musk odors that draw mosquitoes, such as carbon dioxide and lactic acid, as well as citronella oil. To put it another way, a repellent that contains citronella oil actually prevents mosquitoes from detecting certain scents. [15]

Polyherbal Mosquito Repellent Candle:

A polyherbal mosquito repellent candle is a kind of candle made with natural substances to keep insects away. Usually, plant-based natural herbs and their essential oils which are known to have mosquito-repelling qualities are used to make it. Natural waxes like soy, beeswax, or palm wax are also frequently used in these candles. This has gained popularity as an environmentally friendly substitute for chemical repellents. Although chemical-based solutions are frequently used to control mosquitoes, they are hazardous to humans due to their synthetic components. The market is seeing an increase in demand for the creation of herbal-based insect repellents as a result of these toxicity issues. [16]

Advantages of herbal mosquito repellent candles:

- Because herbal mosquito repellent candles are smaller in height and weight, they are portable and easy to use anywhere.
- They have repelling essential oils that give off a nice scent instead of a harsh one.
- They are safe and less prone to cause allergic reactions or skin irritation because they contain natural ingredients and essential oils.
- Because they are biodegradable, they are environmentally beneficial.
- In general, herbal mosquito repellents are less harmful to species that are not their intended target.

II. LITERATURE REVIEW

1. Saini S. et. al. (2024):

Effective mosquito control techniques are required due to the concerning increase in diseases spread by mosquitoes. A potential remedy is the use of repellents, which prevent mosquitoes from landing or crawling on human skin, clothing, or surfaces. The purpose of this project is to look at the creation of innovative mosquito repellents as a vital method of stopping the spread of disease. This research attempts to create a safe and effective way to reduce the transmission of diseases brought on by mosquitoes by identifying and creating effective repellents. The study's conclusions have important ramifications for public health since they demonstrate how effective insect repellents may be in the battle against diseases spread by mosquitoes.

2. Chogule A.G . et.al. (2024):

Choosing appropriate herbal ingredients, creating candles with oils of neem, clove, orange peel, lemongrass, marigold, rosemary, and lavender all of which are known to repel mosquitoes and assessing their effectiveness are all part of the study. The candles are non-toxic, harmless, and designed to guard against diseases like dengue, chikungunya, zika virus, malaria, and yellow fever that are spread by mosquitoes.

3. Shelake S. T. et.al. (2023):

The goal of the study was to create a herbal mosquito repellent candle that contained neem leaf essential oil. Its foundation is a blend of eucalyptus species, and beeswax. The formulation had the highest level of mosquito

repellency and was safe, inexpensive, eco-friendly, and simple to apply. According to the test, the created poly herbal candle was no longer harmful, more effective, and less expensive. To confirm the candle's apparent combustibility in the lab, an inflammability test was performed.

4. Chandra E. et.al. (2023):

In Indonesia, Dengue Hemorrhagic Fever (DHF) has emerged as a major health concern. The design of this study is entirely randomized, making it an experimental investigation. Duku bark extract wax was created by adjusting the wax's duku peel extract content. With the greatest number of mosquito deaths, the concentration of dead mosquitoes reached 3%. It was examined how well Duku Kumpeh skin extract aromatherapy candles repelled DHF. The findings demonstrated that DHF continues to have a high incidence rate.

5. Gupta D. K. et. al. (2022)

The best way to protect yourself from insects is to use repellents that help keep mosquitoes away. Eight distinct formulations of mosquito repellent gel and candle based on essential oils were found to have an effective insecticidal or repellent effect in this investigation. Stearic acid and hard paraffin were combined to create the formulations, which served as the hydrocarbon foundation for the candles. The optimized formulation was put through a 90-day accelerated stability test at 40 °C. The developed mixture was evaluated based on laboratory results for a field-dwelling human sample. The F2 and commercial formulations exhibited the highest mosquito repellent activity in the first and second hours of the experiment, whereas the F3 formula showed the highest 90.45 % repellency in the 0th hour. When compared to the F2, F3, and commercially available formula F1, the F1 showed the strongest mosquito-repelling effectiveness. On test day, there were no rashes or skin irritations either the F1 or F2 formulations.

6. Okorie Angela nkeiruka et. al. (2020)

The plant *Ocimum gratissimum* (L.) has the ability to both repel and kill mosquitoes. The purpose of this project is to use several *Ocimum gratissimum* extractives to create mosquito repellent candles. The knockdown effect was used to assess the created candles' ability to repel *Aedes aegypti* L. mosquitoes and determine their effectiveness in a lab setting. The findings indicated that ethanolic extracts outperformed methanol and ethyl acetate extracts as mosquito repellents. Candles made with cold water extract showed a knockdown effect. It was discovered that the candles worked well to shorten the time that humans and mosquitoes spent in contact.

7. Dr. Agarwal S. et.al. (2018):

As the number of diseases caused by mosquitoes rises, mosquito control has become more and more crucial. A sizable market for "natural" DEET-free repellents with a variety of active components has emerged in recent years. However, the use of natural DEET products has decreased as a result of worries about possible negative consequences of DEET. As a result, several safe, nontoxic, and natural repellents for adults and kids older than two months have been created.

8. Muller G. C. et.al. (2008)

This study aimed to assess how well terpene alcohols and products based on essential oils repel mosquitoes and diseases spread by sand flies. Professional entomologists and the study's authors requested four volunteers two men and two women to test the repellent qualities of citronella, linalool, geraniol, geranium, and essential oils. The findings demonstrated that, both indoors and out, area repellent offered volunteers noticeably greater protection. Outside, citronella repelled mosquitoes less effectively than geranyl (P, 0.001, p0.001, resp.), although geranic acid repelled mosquitoes considerably more effectively than citronella (P = 0.001; p=0.003, resp.). Geranyl offered considerably less protection from sander flies (P=0.03, p>0.05), although linalool offered significantly more indoor protection than citronic acid (P > 0.05, p = 0.04, resp.) (P0.05, resp.).

9. Muller G.C. et.al. (2008)

A cost-effective biting repellent has been developed as a result of the creation of cost-effective insect repellents. Nevertheless, there aren't enough quantitative research on their impact. This essay examines the most recent research on linalool's effects on sand flies and mosquitoes.

Table 1- Summerizing research paper of herbal mosquito repellent candle.

Author	Ingredients	Quantity	Test
Chaugule A G et.al (2024)	<ul style="list-style-type: none"> • Neem powder • Orange peel powder 	4gm 2gm	Organoleptic test, Irritancy test, Uniformity of mass.
Shaily Saini et.al (2024)	<ul style="list-style-type: none"> • Lemongrass extract • Marigold leaves extract • Camphor oil 	2ml	Melting point, Burning rate, Flame test.
		4ml	
Shelake S T et.al (2023)	<ul style="list-style-type: none"> • Neem extract • Cowdung • Marigold extract 	8ml 3ml 1ml	-

III. CONCLUSION

The natural herbal ingredients used to make the herbal mosquito repellent candle don't irritate skin or trigger allergic reactions. Because it is lightweight, the herbal mosquito repellent candle is very simple to use and carry. In addition to protecting human health, herbal insect repellent candles are effective at keeping mosquitoes away. The use of essential oils and plants as mosquito repellents was found to be both safe and efficient.

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