
A Review: Herbal Mosquito Repellent Candle

Suvarna S.Dhanave *, Yogesh B. Raut, Sanjay K. Bais
Fabtech College of Pharmacy, Sangola, Solapur, Maharashtra, India
*Corresponding Author: suvarnadhanave06@gmail.com

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Abstract

Modern and conventional herbal therapy for illness prevention primarily derives from herbal plants, which contain a variety of biologically active substances that are beneficial for enhancing one's quality of life. as an environmentally responsible substitute for chemical repellents. Combining a suitable wax base for maximum burning, the candle contains a blend of natural essential oils, such as lemon, lavender, and rosemary, that are known for their ability to repel insects. The number of illnesses brought on by mosquitoes is increasing day by day. Yellow fever, dengue, zika virus, filariasis, malaria, and chicken-gunya are among the illnesses that are frequently brought on by mosquitoes. The created candle was tested at room temperature in the lab. The created candle is assessed for Organoleptic Character colour, Fragrance, texture, testing for irritability, flammable Test. humans health and insects can benefit from the use of herbal mosquito repellent candles. To ensure safety for indoor usage while optimising efficacy, the formulation process required figuring out the perfect concentrations for each essential oil. Through field testing in controlled circumstances, the duration and efficacy of mosquito deterrent were measured in order to assess the candles' repellent ability. The assessment also included physical attributes including stability, scent throw, and burn time. The outcomes demonstrated that the polyherbal composition considerably decreased mosquito attraction; an ideal mix demonstrated improved efficacy.

Keywords - Type of Mosquito Species, Life cycle of Mosquito, disease and treatment, mode of action, Herb selection

INTRODUCTION

The most terrifying blood-sucking bug that affects people is probably the mosquito. Anopheles, Culex, and Aedes fly species are known to act as carriers of a number of illnesses, including malaria, dengue fever, and yellow fever. Mosquitoes can also transmit the Zika virus, Chikungunya, Japanese encephalitis, Rift Valley disease, West Nile virus, and lymphatic filariasis. When mosquitoes inject their saliva into a host's bloodstream, the antigens attach to IgG and IgE antibodies, triggering an immunological reaction. In addition to causing discomfort, itching, and redness, the reactions frequently result in bumps. Additionally, the saliva of the mosquito causes a very irritating, itchy rash. When humans come into contact with mosquitoes and develop an allergic reaction to their saliva, mosquito bites can also result in extremely painful skin inflammation.^[1] Scientists who treat patients in the field of medicine rely on the significant logical method of this polyherbal mixture. Using experimental methodologies to demonstrate the effectiveness of herbal extracts was the systematic goal of polyherbal formulations.^[2] Significant efforts were made in the past to prevent diseases spread by mosquitoes by the use of polyherbal

formulations.^[3] Natural repellents: While the majority of repellents on the market today are effective in keeping mosquitoes away rapidly, they are not the best option for safety because they contain the hazardous chemical N,N-diethyl-meta-toluamide (DEET). In the US, citronella oil-based candles that ward off mosquitoes are widely available.^[4] Over 700 million people are infected by mosquitoes every year, which leads to over one million fatalities globally.^[5,6]

To produce a safe and non-toxic composition, we try to incorporate natural herbal substances and essential oils with proven mosquito-repelling characteristics, such as Beeswax, Camphor, Tulsi, Neem, Orange, Lemongrass, Marigold, Rosemary oil, Lavender Oil, Lemon Oil. The following sensors are carried by mosquitoes and allow them to monitor the presence of their prey:

Chemical sensors

Heat sensor

Visual sensor

The following list includes the various mosquito species and the illnesses they can spread:

Aedes mosquito

Zika virus, yellow fever, dengue fever, and West Nile fever are among the illnesses spread by the Aedes mosquito. The primary way to identify them is by looking for black and white marks on their bodies and legs.

Aedes albopictus

Aedes albopictus also called Asian tiger. In addition to some filarial worms like *Dirofilaria immitis*, it is the cause of other viral infections like Dengue fever, Zika fever, and yellow fever virus. Southeast Asian regions that are tropical or subtropical are home to them.

Anopheles mosquito

Anopheles mosquitoes are known to cause malaria, brain tremors, and *dirofilaria immitis*. They are typically found in tropical and colder climates, particularly in sub-Saharan Africa.

Yellow Fever mosquito

Dengue fever, Zika fever, yellow fever, and other illnesses are spread by the yellow fever mosquito. Originally found in African nations, this mosquito is now found throughout the world's tropical and subtropical zones.

Written 5000 years ago in India, the Rig-Veda is the oldest literature in Hindu civilisation. The Atharvana Veda makes far more extensive and altered use of plant material. An Upaveda named Ayurveda was a part of Atharvana Veda. Ayurvedic treatises such as Sushruta and Charaka Samhita are well-known. The Charaka Samhita lists 64 minerals, 57 medications derived from animals, and 395 medicinal plants as therapeutic agents.^[7] The main insecticides used in the Americas, according to the WHO pesticide review, are pyrethroids and organophosphates. Examples of chemical-based insect repellents used on mosquitoes include DEET.^[8] Although this insecticide is registered, there are potential adverse effects and cautions, such as irritation of the skin and eyes and insomnia. Synthetic pyrethroids such as sumithrin, resmethrin, and permethrin are used to kill adult mosquitoes. In insect repellents, a variety of plant extracts are also utilised. Researchers are discovering that several plant-based insect repellents, such as eucalyptus and neem powders, are just as effective as DEET.^[9] Various repellents contain butylated hydroxy toluene (B.H.T.), an antioxidant that can be harmful to the liver or kidneys when consumed or inhaled. Due to their insecticidal or repellent properties, plant-based repellents are becoming more and more used as a mosquito control strategy. Plant powders can be found naturally and have a potent smell. Fine particles and a green colour are typical characteristics of plant powder.^[10]

Life Cycle of Mosquito

The life cycle of a mosquito consists of four stages: the egg, larva, pupa, and adult.^[11]

Egg

Egg close to water's surface, female mosquitoes deposit their eggs. Either group egg laying is possible. Depending on the surroundings, it may take a few days or several weeks for the eggs to hatch because they need water.

Larva

Larva also Known as “wigglers” after they hatch, The larvae are aquatic organisms.

They experience four growth phases, or “instars.” Bacteria and algae are among the organic elements that larvae eat from the water. Through a syphon at the water's surface, they breathe air.

Pupa

Following the larval stage, mosquitoes transition into the pupal stage, which they refer to as “tumblers” due to their tendency to move in the water. The mosquito changes into its adult form during this phase, which is devoid of eating. Depending on the species and 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 its wings and body on the water's surface before taking off. Depending on the species and the habitat, adult mosquitoes normally have a lifespan of a few weeks to a few months. While male mosquitoes often feed on nectar and other plant liquids, female mosquitoes prefer blood meals in order to grow their eggs.

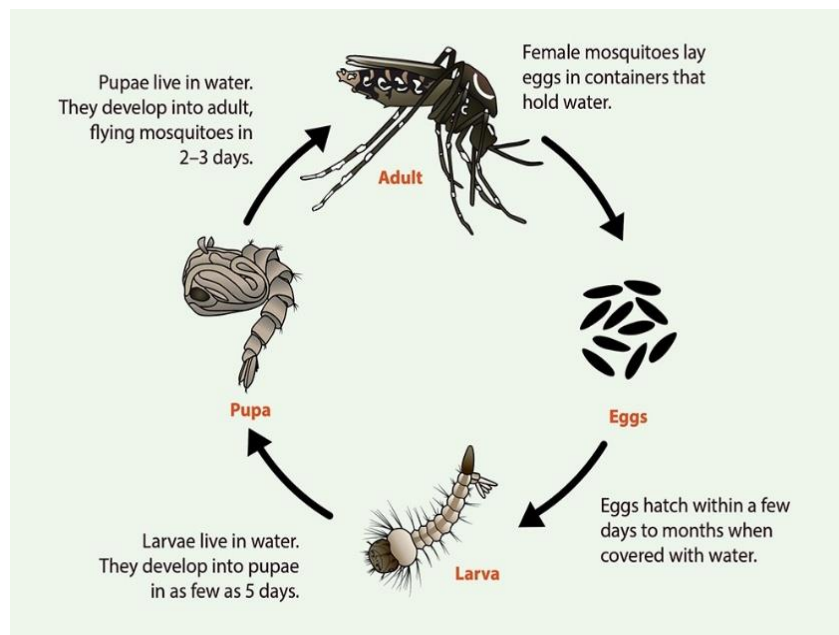


Figure 1: Life Cycle of Mosquito

Mosquito Borne Diseases

Diseases that human's contract from mosquito bites are known as mosquito-borne diseases. The following are a few of the most important:

Malaria

Largely spread by Anopheles mosquitoes, it is caused by Plasmodium parasites. Flu-like symptoms include chills, fever, and body aches.

Dengue virus

Aedes aegypti mosquitoes are the primary vectors of dengue fever, which is caused by the dengue virus. Severe headache, joint/muscle discomfort, eye pain, and high temperature are among the signs and symptoms.

Zika Virus

This virus, which is also carried by Aedes mosquitoes, is usually asymptomatic but can cause severe birth defects if contracted during pregnancy.

West Nile virus

Culex mosquitoes are the primary vectors of the West Nile virus. The majority of infections are mild, but severe ones have the potential to lead to neurological conditions.

Chikungunya

Caused by fever and excruciating joint agony, this disease is spread by Aedes mosquitoes.

Yellow fever

Spread by Aedes and Haemagogus mosquitoes, the yellow fever virus can cause severe liver damage and haemorrhage.

Japanese encephalitis

A viral disease that can inflame the brain that is transmitted by Culex mosquitoes.

Using insect repellent, donning protective clothes, and removing standing water—a breeding ground for mosquitoes—are examples of preventative actions. Certain diseases, like Japanese encephalitis and yellow fever, have vaccines available.

Prevention And Control of Mosquito Born Diseases**Individual Safety Steps****Apply repellents**

Make use of EPA-registered products that contain active chemicals such as IR3535, picaridin, or DEET.

Wearing protective clothes

Put on loose-fitting, light-colored clothing. For further protection, think about applying permethrin to clothing.

Avert Peak Activity

Remain inside between the hours of early morning and late afternoon, when mosquito activity is at its highest.

Management of Environment**Eliminate Any Standing Water**

Check and empty water-collecting objects on a regular basis (e.g., flower pots, bird baths, tires).

Landscaping

To lessen mosquito habitats, prune vegetation and control water features.

Water Treatment

In bigger, non-drainable pools of standing water, apply larvicides.

Immunisations and Therapeutic Measures Vaccines

When appropriate, promote immunisation against diseases like dengue and yellow fever. Fast Medical Attention: Teach patients how to identify symptoms early and get help to prevent worsening of the disease.

Innovation and Research Genetic Control

Look into genetic engineering methods to lower mosquito populations or stop the spread of disease.

Community-Oriented Methods

Engage local populations in data collection and research to customise strategies for certain regions.

Mosquito repellent

To keep mosquitoes from flying into or staying on areas, especially human skin, is the aim of insect repellents.^[12] These are substances that are used on skin, clothing, and other surfaces. They work by making the treated area repellent or uninviting to mosquitoes, so reducing the likelihood of mosquito bites and the transmission of diseases including dengue fever, malaria, and the Zika virus. There are several ways to repel mosquitoes: sprays, lotions, creams, coils, and electrical gadgets.

Type of mosquito repellent

Chemical repellents

In which include picaridin, ethyl butyl acetyl aminopropionate, and DEET.

Natural repellent

Citronella, lavender, rosemary, and neem oils, as well as lime Eucalyptus oil.

Wearable repellent

Repellent bracelets and clip-on devices are examples of wearable repellents.

Globally repulsive

Candles, coils, dhoops, plug-ins, electric diffusers, and sticks are examples of globally repulsive.

Mosquito Repellent clothing

Clothes coated with permethrin is considered mosquito repellent.

Ultrasonic Devices

Ultrasonic Repellents.^[13]

Mosquito repellent mode of action

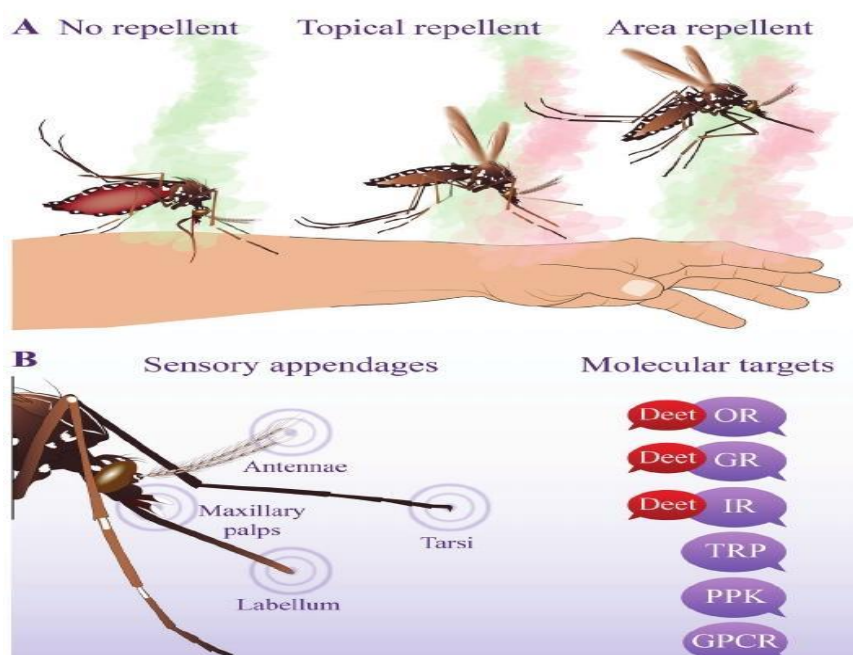


Figure 2: Mosquito repellent Mode of action

It is frequently noted that behaviours that fall under the category of repellence might result from a variety of physiological or metabolic processes. It is thought that the lactic acid receptor blockage and subsequent elimination of upwind flight, which causes the host to be “lost” by the bug, are the

causes of the repellent effect that DEET has on mosquitoes. Furthermore, research has produced how lactic acid functions in host searches analysing the biology of mosquitoes following their blood meal. After a blood meal, *Aedes aegypti* stops seeking hosts. Host-seeking behaviour also ends at the same time that receptive neurones sensitivity to lactic acid diminishes. Lactic acid immunity returns to normal after oviposition.

Mosquito repellents function by disguising the smell of humans or by employing an odour that insects naturally dislike.^[14] Insect repellents target mosquitoes' sensory receptors and odour receptors. Mosquitoes find it more difficult to bite people when they are wearing repellents. In order to find their hosts, mosquitoes use their sense of smell to identify carbon dioxide (CO₂) and other human scents. Mosquitoes employ heat sensors to detect the body heat emitted by hosts with blood to warm up. Irritants for skin contact as a means of preventing biting and landing.^[15]

Herbs Selection

A kind of candle used to repel insects using natural components is called a polyherbal mosquito repellent candle. Typically, natural herbs derived from plants are used, together with their essential oils, which have the ability to repel mosquitoes. Mosquito control treatments with a chemical base are frequently utilised, however because of their synthetic ingredients, they are harmful to humans. There is a rising need in the market for the creation of herbal-based insect repellents as a result of these toxicity issues.^[16]

Advantage of Natural Insect Repellent Candle

Natural Insect Repellent Candles are portable, lightweight, and simple to use.

They are eco- friendly as well as biodegradable.

In which contain the essential oil show the repellent activity.

They are non-irritating, non-poisonous, simple to produce, and have insect-repelling properties.

Beeswax

Synonym: Yellow wax, Cera alba

Biological source: Honeycomb of the honey bee, *Apis mellifera* Linn and other species of *Apis*

Family: Apidae.

Chemical constituents: Ester of fatty acids and long – chain alcohols.



Figure 3: Beeswax

Uses

Candles, cosmetics, lubricants, waterproofing agent, polish, lost wax casting, encaustic painting. Beeswax is an inexpensive, naturally occurring biological polymer made up of a variety of

inexpensive, non-toxic ingredients. Additionally, it is often utilised in the manufacturing of medicinal formulations with controlled release. It is an organic insecticide that is also present in candles that ward off mosquitoes. One extremely crystalline natural substance is beeswax.

Camphor

Synonym: Camphora, Gum camphor

Biological source: wood of the camphor Laurel tree (*Cinnamomum camphora*).

Family: Lauraceae

Chemical Constituent: 1% essential oil (cineol, pinene, thymol, menthol), wood contains around 3%.



Figure 4: Camphor

Uses

Camphor is used for itchy skin, pain, and cough. Insect bites, acne, and numerous other ailments are also treated with it.

A powerful sense of smell is possessed by mosquitoes. They use the scent of carbon dioxide emissions from human bodies to locate them. Thus, while burning camphor in a space, the mosquitoes are repelled from it by its potent scent, which also disorients them with their own odour. Your house will release them from their hiding places as soon as they scent it.

Tulsi

Synonym: *Ocimum sanctum*, *Ocimum tomentosum*

Common Name: Holy Basil, Sacred Basil.

Biological source: It consists of fresh and dried leaves of *Ocimum* species like *Ocimum sanctum* L. and *Ocimum basilicum* L.

Family: Lamiaceae

Chemical Composition: Volatile Oil (linolol, eugenol, ocimemene, citral, thymol), vitamins and mineral, other compound.

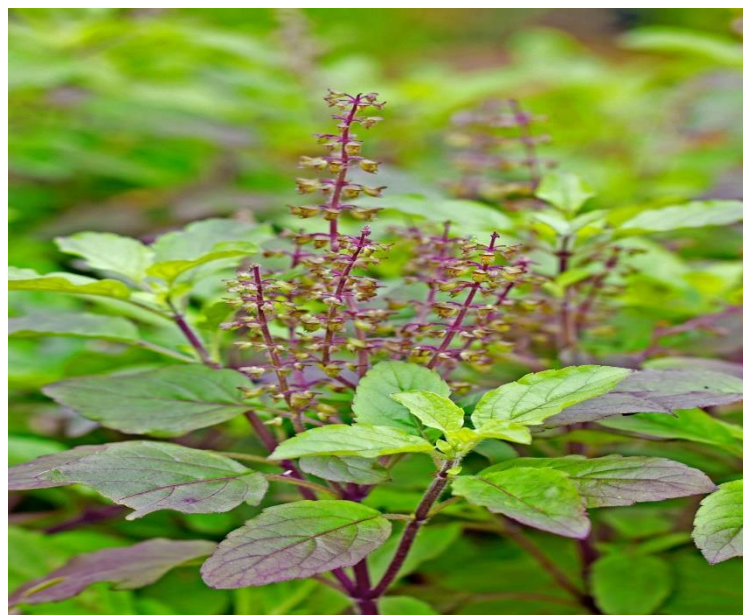


Figure 5: *Tulsi*

Uses

All sections of the plant, including the stem, leaves, seeds, roots, and flowers, are medicinal. Numerous ailments, including sore throats, kidney stones, eye conditions, respiratory issues, coughs, and stress, are treated with it. It is also used by people as a mosquito repellent. It can assist in calming, repairing, and revitalizing the skin.^[17] Help to prevent hairfall, minimize the gray hair, help in thickness.^[18]

Neem

Synonym: Nimba, Margosa.

Biological source: Neem is fresh or dry leaves and seed oil of *Azadirachta Indica*.

Family: Meliaceae.

Chemical Constituents: Azadirachtin, Nimbin, Nimbidin, Nimbidol, Gednin, Sodium Nimbinat.



Figure 6: *Neem*

Uses

Neem leaves extract can be used as an insecticide or mosquito repellent in herbal mosquito repellent candles. In which Active Ingredient is Azadirachtin. It has been demonstrated to prevent the reproduction of aquatic larvae like mosquitoes and plant-feeding larvae as well as their larval, pupal, and adult moults. Neem is among the safest ways to prevent mosquitoes from biting your body. Neem's efficacy lasts for around three hours and can repel 70% of mosquitoes.^[14] Neem is helpful in the treatment of a variety of skin disorders, wounds, and infections due to its inherent antibacterial and antifungal qualities. Also helpful in Antipyretic.^[19]

Orange

Synonym: Cortrex Limonis.

Biological source: Lemon peel is outer part of pericarp of the ripe fruit of citrus Limonis Burm.

Family: Rutaceae.

Chemical Constituents: 23% sugar, 22% cellulose, 25% pectins, 11% hemicellulose, Vitamin C, Flavonoid.



Figure 7: Orange

Uses

Orange used to help prevent chronic diseases such as cancer and heart diseases. Mosquitoes are repelled by the smell of orange peels because they dislike perfumes. It has been discovered that orange peel works well to keep mosquitoes away. It contains essential oils with mosquito-repelling properties, like limonene.^[20]

Powdered orange peel is excellent for cooling hair. Lowering dandruff as well.^[21]

Lemon grass

Synonym: Fever grass, Cochin grass, Malabar grass, soft heads, oily heads.

Biological source: It obtained from fresh Aerial part of *Cymbopogon citratus*.

Family: Poaceae.

Chemical Constituents: Citral, Isoneral, Citonellal, Citronellol, Gerniol, Isogeranial, Geranyl acetate, Germacrene-D



Figure 8: Lemon Grass

Uses

Perfumery Soap and cosmetic, also used as repellent. It contains scents associated with musk, including human carbon dioxide and lactic acid, as well as citronella oil, which is known to draw mosquito. Put another way, using repellent that contains citronella oil actually prevents mosquitoes from detecting certain scents.^[22]

Marigold

Synonym: Calendula, geranium, anemone.

Biological source: Its genus of about 50 species of annual herbs of Calendula Officinalis.

Family: Daisy.

Chemical Constituent: Limonene, Terpinolene, (Z)- myroxide, Piperitone, Piperitenone, Piperitenone oxide and β -caryophyllene



Figure 9: Marigold

Uses

Soothes rashes and soreness, great for dry and damaged skin, The extract from marigold flower petals has 100% mortality rate of mosquito larvae and acts as a repellent, α -terphenyl and

linalool. Excellent mosquito-repelling properties of French marigold flowers have been demonstrated.^[22]

Rosemary Oil

Synonym: Romero, polar plant, Hoja de romeo.

Biological Source: It consists fresh and dry flower of *rosmarinus officinalis*.

Family: Lamiaceae.

Chemical Constituent: 1,8 cineole (46.4%), Camphor (11.4%), Camphene (5.2%).



Figure 10: Rosemary Oil

Uses

It has been used to treat depression, emotional disturbance, intercostal neuralgia, headaches, migraines, and sleeplessness in addition to being a moderate analgesic. The main reasons rosemary oil works so well as a mosquito repellent are its active ingredients, namely camphor and 1,8-cineole, sometimes referred to as eucalyptol. These substances have the ability to repel insects.^[20]

Levender Oil

Synonym: Levenda, Foreign oil, Espliego.

Biological Source: It consists of fresh Flowering tops *Levendula Officinalis*, *L. augustifolia*.

Family: Lamiaceae.

Chemical Constituent: It consists of Volatile Oil contain linalyl acetate, linolool, cineol, terpin-4-ol.



Figure 11: Levender Oil

Uses

Lavender is used in aroma by aromatic therapists to relieve fatigue, headaches, and nervous illnesses. For the treatment of joint and muscle discomfort, it is frequently added to a therapeutic bath. Linalool and linalyl acetate are the active ingredients in Lavender Oil, it is well known for its ability to repel mosquitoes. Its ability to discourage insects is aided by these chemicals.^[23] Antioxidant-property chemicals including linalyl acetate and linalool are found in lavender oil.^[24]

Lemon Oil

Synonym: Citrus, Citrus Fruit, Cortex limonis, lemon peel.

Biological Source: It consists of fresh peel of ripe fruit Citrus Limonis.

Family: Rutaceae

Chemical Constituent: It consists of Lemon oil contains terpenes, Sesquiterpenes, aldehydes, esters.



Figure 12: Lemon oil

Uses

Chemicals found in lemon eucalyptus destroy fungus and deter insects. Mosquito repellent made with lemon eucalyptus oil is used by people.^[16]

Formulation of Poly Herbal Mosquito Repellent Candle

Sr No.	Ingredient Name	Quantity	Uses
1.	Beeswax	50gm	Insect repellent
2.	Camphor	2gm	Burning, Room Freshener.
3.	Tulsi	2gm	Anti-inflammatory, Antioxidant
4.	Neem	4gm	Insecticide
5.	Orange	2gm	Fragrance
6.	Lemon grass	4ml	Insect repellent
7.	Marigold	4ml	Insect repellent
8.	Rosemary Oil	8-10 drop	Flavouring agent
9.	Lavender Oil	8-10 drop	Insect repellent
10.	Lemon Oil	5-7 drop	Aroma

Table 1: Formulation of poly Herbal Mosquito Repellent Candle

Process

Measure out a Beeswax piece and weigh it precisely.

Make tiny slices in the beeswax and use a heating mantle to melt it in a beaker.

After the ingredients have melted sufficiently, begin combining the camphor, orange peel powder, and tulsi powder in a beaker, stirring continuously.

In the beaker, mix the juice of the marigold and lemongrass.

After that, add the rosemary, lavender, and lemon oils. After adding each item, whisk for a full fifteen minutes.

Pour the mixture into the size mould above.

The mould allowed to cool to room temperature.

After three to five hours, take the candle out of the mould.^[25]



Figure 13: Formulation of multiple herbal insects repels candle

An evaluation of the candle that repels insects using multiple herbs**Organoleptic Character**

To evaluate the aroma, shade, and texture of the formulation, visual inspection of the mixture was used in this test.

Colour

Green

Fragrance

It was discovered that the formulation's fragrance was pleased.

Texture

A homogeneous formulation was discovered.^[25]

Testing for irritability

It was found that there was no skin discomfort when a prepared insect repellent candle was lit.

Flammable Test

The created candle was evaluated for flammability to find out more about the behaviours that repel insects. It also burned well in terms of burning time. Finally, a flammability test was performed to confirm the candle's apparent flammability in the lab using the spotting technique.^[26]

CONCLUSION

Neem extract has an active component called azadirachtin, which may have the potential to function as a natural insecticide. Azadirachtin has been shown to directly harm a mosquito's reproductive cycle, feeding habits, and body development in addition to functioning as a poison when consumed by the insect. A candle can serve as an effective, reasonably price, and conveniently accessible means of preventing mosquito-borne illnesses including dengue and malaria. It is made a natural insect repellent candle is manufactured with natural ingredients, it won't irritate skin or trigger an allergic response. Because the herbal mosquito repellent candle is lightweight, it is really simple to use and carry. Both human health and mosquitoes can be protected by using a herbal mosquito repellent candle. It is concluded that using herbs and essential oils as a mosquito repellent was extremely safe and efficient. The market's mosquito coils produce a lot of smoke, which can cause respiratory issues, particularly for those with COPD, asthma, and other respiratory conditions. In this research investigation, a natural base mosquito repellent was effectively developed. The Candle has proven to be both extremely safe and effective. The composition offers maximum mosquito repellent power and is inexpensive, safe, eco-friendly, and simple to use making this organic repellent.

REFERENCE

1. Mudrigal R.V., Knapp F. E., Sigafus R., Smith C. R., Fraction of Extraction of Vitex Negundol and Their Activity Against Mosquito Laevae, *International Journal of Pharmaceutical, Chemistry and Biological Sciences*,1979:39(1):536-540.
2. Jacobson M., Crosby B. G., Naturally Occurring Insecticides, *Journal of Pesticide Science*,1971:6(6):210.
3. Dutta S. C., *Medicinal Plants New*, National Council for Education Research and Training,973:2(8):2347.
4. Patel E. k., Gupta A., Oswal R. j., A Review on Mosquito Repellent Methods, *International Journal of Pharmaceutical, Chemical and Biological Sciences*,2012:2(3):310-317.
5. Ranasinghe., Arambewela L., Samarasinghe S., Development of Herbal Mosquito Repellent Formulations, *International Journal of Collaborative Research on Internal Medicine and Public Health*,2016:8(6):341-342.
6. Deepak K. G., Revathi A. G., Formulation and Evaluation of Poly Herbal Mosquito Repellent Candle, *Journal of the Gujarat Research Society*,2019:21(14):2144-2145.
7. Frandin M. S., Day J. F., Comparative Efficacy of Insect Repellents Against Mosquito Bites, *New England Journal of Medicine*,2002:34(7):13-18.
8. Braverman Y., Chizov-Ginzburg A., Mullens, B. A., Mosquito Repellent Attracts *Culicoides Imicol*, *Journal of Medical Entomology*,1999:36(1):113-115.
9. Chaiyakunapruk N., Kongkaew C., Sakunrag I., Tawatsin., Effectiveness of Citronella Preparations in Preventing Mosquito Bites Systematic Review of Controlled Laboratory Experimental Studies,*Tropical Medical International Health*,2011:16(7):802-810.
10. Mohomed A. A., Tarek I. A., Zarrag I. A., Extracts Against the Dengue Fever Mosquito, *Journal Saudi Soc*,2012:20(1):13-16.
11. Megha T. S., Ganesh B. P., Tejas S. S., Nandkishor R. R., Formulation of Herbal Mosquito Repellent from *Laurus Nobile*, *International Journal of Innovative Science and Research Technology*,2020:5(4):771-772.

12. Sneha A., Nidhi H., Aniket J., Formulation of Natural Mosquito Repellent, *International Journal of Advance Research Ideas and Innovations in Technology*,2018;4(1):11-17.
13. Patel E. K., Gupta A., Oswal R. J., A Review on Mosquito Repellent Methods, *International Journal of Pharmaceutical Chemical and Biological Sciences*,2012;2(3):310-317.
14. Priyanka S., Sandhya G., Nandu K., Development and Evaluation of Herbal Mosquito Incense Repellent, *International Journal of Research Publication and Reviews*, 2023;4(3):4714-4718.
15. Sanjay T. S., Santosh J., Waghmare D. M., Formulation and Evaluation of Herbal Mosquito Repellent Candle, *International Journal of Relative Research Thoughts*,2023;11(6):93-104.
16. Dhanashree A. P., Vaibhav V. D., Ankit C. R., Vaishnavi S. C., Preparation of Mosquito Repellent Dhoop from Orange Peels, *International Journal for Multidisciplinary Research*,2023;5(2):1-9.
17. Yogesh B. Raut., Sanjay K. Bais., Sahara Chavan., Review on Significance of Moisturizing Activity of Herbal Cold Cream for Skin Dryness, *International Journal of Pharmacy and Herbal Technology*,2024;2(1):407-417.
18. Yogesh B. Raut., Sanjay K. Bais., Shivani Arve, A Review on Herbal Tonic, *International Journal of Pharmacy and Herbal Technology*,2024;2(1):1218-1236.
19. Suvarna S. Dhanave., Nishigandha R. Mane., Pallavi D. Shitole., Amol V. Pore., S. K. Bais., Current Scenario of Pharmaceutical and Herbal Medicine, *International Journal of Pharmacy and Herbal Technology*,2024;2(2):1650-1656.
20. Gushit J. S., Shimuan J. T., Idoko J. E., Formulation and Evaluation of Bio-Mosquito Repellent Air Freshener Gel from oil Extract of Cymbopogon Citrus, Stapf Plant, *Word Journal of Advance Research and Reviews*,2023;19(1):496-507.
21. Yogesh B. Raut., Sanjay K. Bais., Sweta Badure., A Review an Analysis and Formulation of Herbal Shampoo, *International Journal of Pharmacy and Herbal Technology*,2023;1(3):132-140.
22. Megha T. S., Ganesh B. P., Tejas S. S., Nandkishor R. R., Formulation of Herbal Mosquito Repellent from Laurus Nobilis, *International Journal of Innovative Science and Research Technology*,2020;5(4):771-772.
23. Shaily S., Hansika V., Anshika S., Formulation and Evaluation of Mosquito Repellent Candles, *International Journal of Pharmaceutical Sciences*,2024;2(4):684-688.
24. Yogesh B. Raut. Sanjay K. Bais., Kunal Ghodake., Review on Herbal Plant Used in the Sunscreen, *International Journal of Pharmacy and Herbal Technology*,2023;2(1):574-584.
25. Apurva S., Yash M., Arpit M., Nikita M., Hridaya N., Formulation and Evaluation of Mosquito Repellent Candles using Dried Catnip Leaves, *Journal of Emerging Technologies and Innovative Research*,2024;11(5):237- 246.
26. Kuntal D., Vasudeva C., Raman D., Economical Novel Formulation and Evaluation of Herbal Oils for Mosquito and House Fly Repellent Activities, *Annals of Phytomedicine an International Journal*,2016;5(2):91-96.