

**A REVIEW ON MOSQUITO REPELLANT CREAM FROM LEMONGRASS PLANT: A
NATURAL ALTERNATIVE TO SYNTHETIC REPELLENT CREM**

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ABSTRACT

The growing awareness of the harmful effects associated with synthetic chemical repellents has led to a heightened demand for herbal and natural alternatives to control mosquito-borne diseases. According to the World Health Organization (WHO), there were 19,404 reported cases of dengue in the Philippines as of February 2023. Malaria also remains a major global concern, with the African continent, particularly Nigeria, bearing the highest mortality burden. Mosquito-borne diseases continue to be a significant public health challenge worldwide. Mosquito repellents play a crucial role in minimizing mosquito bites, thereby reducing the risk of disease transmission. In response to this need, a herbal mosquito repellent cream was developed using plant-based ingredients such as neem (*Azadirachta indica*), tulsi (*Ocimum sanctum*), clove (*Eugenia caryophyllus*), and lemongrass (*Cymbopogon citratus*), all known for their insecticidal and repellent properties. The objective of the study was to evaluate the physical characteristics, stability, skin safety, and repellency efficacy of the formulated cream. The cream was prepared via the water-in-oil (W/O) emulsion method, employing beeswax, liquid paraffin, and coconut oil as the oil phase, and glycerine, borax, and rose water as the aqueous phase. The final product demonstrated an optimal skin-compatible pH range of 5.0 to 6.0. Skin irritation tests conducted on human volunteers showed no signs of redness, discomfort, or irritation, confirming the cream's safety for topical application. Additionally, the formulation exhibited excellent stability, with no phase separation observed. Overall, this study highlights the potential of herbal-based mosquito repellents as a natural, safe, cost-effective, and environmentally friendly alternative to conventional synthetic repellents. The successful formulation and testing indicate promising scope for wider application and further enhancement of plant-derived mosquito repellent product.^{[5][6][7]}

KEYWORDS: Mosquito repellent, *Cymbopogon citratus*, *Azadirachta indica*, *Eugenia Caryophyllus*, *Ocimum Sanctum*, Cream, Repellent action.

INTRODUCTION

Herbal preparations are often considered more effective and safer compared to synthetic chemical formulations because they are derived from natural biological sources. Insect-transmitted diseases remain one of the leading causes of illness and death worldwide. Mosquitoes, in particular, play a major role in spreading such diseases once their larvae develop into adults. These insects transmit a variety of pathogens, including viruses, bacteria, and protozoa, responsible for life-threatening diseases such as dengue, chikungunya, malaria, yellow fever, and Japanese encephalitis. Annually, mosquito-

borne diseases affect over 700 million people, with malaria alone accounting for about 3 million deaths each year, including one child every 30 seconds. Using insect repellents is one of the most effective ways to protect against arthropod bites. Repellents can be applied directly to the skin to prevent bites from mosquitoes, mites, ticks, and lice. However, chemical-based repellents can sometimes cause adverse skin reactions, such as irritation, erythema, desquamation, or bullae formation. Therefore, selecting a suitable repellent that provides protection while being gentle on the skin is crucial.

Commercial insect repellents fall into two categories: synthetic chemical repellents and plant oil-based repellents. The most widely used synthetic repellent is N,N-diethyl-m-toluamide (DEET), also known as N,N-diethyl-3-methylbenzamide. In contrast, plant-derived repellents are gaining popularity due to their effectiveness and lower toxicity. Certain plant extracts possess strong mosquitocidal properties and can be used as eco-friendly alternatives for mosquito egg and larval control.

Neem extract, for instance, effectively suppresses mosquito populations. Similarly, lemongrass (*Cymbopogon citratus*) from the family Poaceae is commonly used for its medicinal, culinary, and insect-repelling properties. Clove oil also demonstrates strong insecticidal and repellent activity against various pest species. As a result, tulsi, lemongrass, and neem leaves have been selected in this study as the most effective natural repellents.

A mosquito repellent is something you put on your skin, clothes, or other surfaces to keep mosquitoes away and protect yourself from bites and the diseases they may carry.^{[5][6][7]}

How the Herbal Cream Works ?

Lemongrass, neem, tulsi, and clove oil are all known for their ability to repel insects, especially mosquitoes.

The cream is made by extracting the active parts (usually the oils) from these herbs, which are then mixed carefully into a smooth, skin-friendly base.

When applied to the skin, this cream creates a subtle barrier filled with natural scents and compounds that mosquitoes find unpleasant or confusing. This means mosquitoes are much less likely to land on you or bite you.

Safety and Benefits

The herbal cream is gentle—tests showed that it didn’t cause irritation, redness, or discomfort in users, making it safe for regular use, even for people with sensitive skin. It has a pleasant, natural aroma thanks to the combination of essential oils.

The protection it offers is strong: studies found that the best formulations can provide up to 90% protection against mosquitoes, which is very close to the level of protection offered by leading chemical repellents like DEET.

Why Choose Herbal ?

This kind of herbal mosquito repellent is much safer for both people and the environment than many chemical-based repellents. There’s no worry about toxic ingredients, and it’s biodegradable.

Herbal creams offer a sustainable, natural approach to staying safe from mosquitoes, letting you enjoy the outdoors with peace of mind.

HARMFUL EFFECTS OF CHEMICALS BY MOSQUITO REPELLENT.

| CHEMICALS | PROBLEMS ASSOCIATED |
|-------------------|--|
| DEET | Neurological issues, Scarring in adults |
| PICARDIN | Inhalation toxicity, Eye Irritation |
| SCOURGE | Liver and Thyroid Problems |
| ANVIL | Boost tumor growth in Cancer |
| MALATION | Acute and Chronic Neurological Problems |
| IR3535 | Toxicity on oral, dermal, inhalational exposure |
| PARA-METHANE-DIOL | Eye and face irritation |
| METOFLUTHRIN | Neurotoxicity |
| PERMTHRIN | Irritation to (Nose, lungs, throat), Headache, Fatigue, Excessive Salivation, Dizziness. |

Mosquitoes are responsible for spreading serious diseases like malaria, dengue, chikungunya, lymphatic filariasis, and zika, all of which can have dangerous effects on human health.

Key Mosquito-Borne Diseases

- **Malaria:** Malaria is a potentially fatal disease caused by the plasmodium parasite, primarily transmitted through the bite of infected female *Anopheles* mosquitoes.

Symptoms typically appear 10–15 days after exposure and include fever, headache, chills, and nausea. Severe malaria can lead to life-threatening complications such as cerebral malaria, anemia, and kidney failure.

Diagnostic methods include blood smear, rapid tests, and PCR. High-risk groups include children under five, pregnant women, travellers, and people with weakened immunity. Early treatment helps prevent serious illness.

- **Dengue:** Caused by the dengue virus, this disease is spread by *Aedes aegypti* and *Aedes albopictus* mosquitoes. While many infections are mild, severe dengue can cause dangerously high fever, severe headaches, rashes, and even death. Symptoms begin 4–10 days after infection.
- **Chikungunya:** This viral disease is also spread by *Aedes* mosquitoes. Symptoms include fever, joint pain, and rash. There is no specific medication, but vaccines for at-risk populations are available.

- **Lymphatic Filariasis:** Known as elephantiasis, this disease is caused by filarial roundworms and transmitted by Anopheles, Culex, and Aedes mosquitoes. It can cause swelling, disability, and social stigma. Prevention includes mass drug administration.
- **Zika Virus:** Transmitted mostly by Aedes mosquitoes, Zika can cause birth defects such as microcephaly if contracted during pregnancy. Other symptoms may include fever, rash, joint pain, and conjunctivitis. There is currently no specific antiviral treatment.

Prevention and Control Strategies

- Use mosquito repellents: EPA-approved mosquito repellents should be used on exposed skin and clothing.
- Wear long-sleeved clothing: Protective clothing reduces the chance of bites, especially during peak mosquito hours like dawn and dusk.

- Eliminate stagnant water: Mosquitoes breed in standing water, so remove water from flower pots, gutters, birdbaths, and containers.
- Install screens and use nets: Window and door screens, as well as bed nets, prevent mosquitoes from entering homes and protect sleeping children.
- Community and environmental control: Community involvement and public education are essential for eliminating breeding sites and reducing overall transmission.
- Medical interventions: Early diagnosis and treatment of illness, as well as mass drug administration for diseases like lymphatic filariasis, help reduce the impact of mosquito-borne diseases.

Importance of Early Action

Prompt medical attention and preventive measures greatly reduce the risk of severe complications and help protect vulnerable populations like children, pregnant women, and those with compromised immunity.

➤ **MOSQUITO LIFE CYCLE**

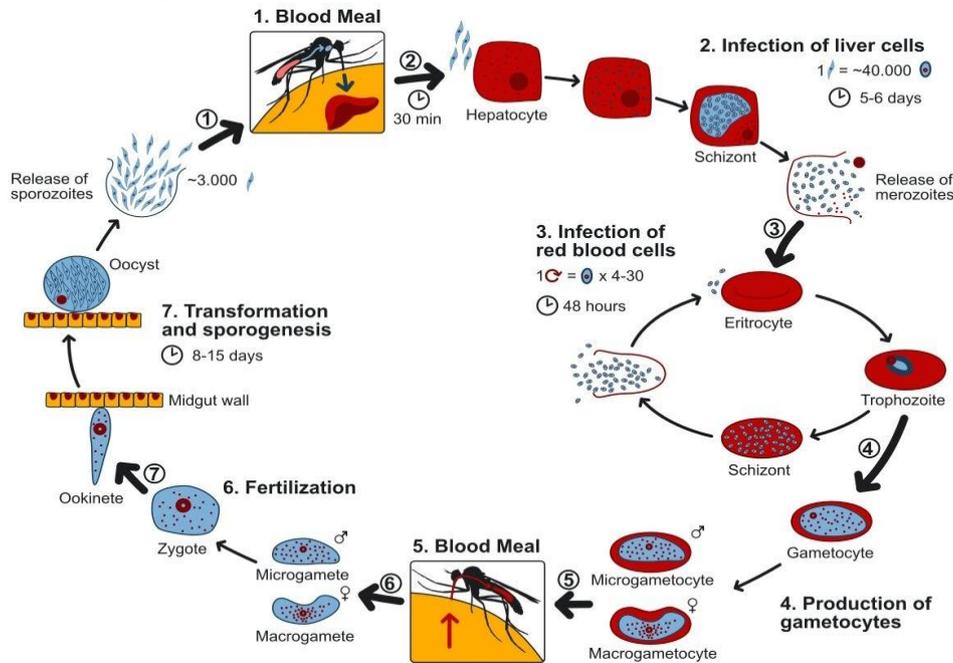


FIG.1: MOSQUITO LIFE CYCLE.

<https://share.google/Z9lzqAx1YW0EsMN1V>

Many people use mosquito repellents containing DEET because they are effective, but some users have experienced negative reactions. While DEET is generally considered safe when used as directed, there have been reports of dermatitis, rashes, and irritation, particularly in sensitive individuals and children. Rare cases of more serious effects, such as neurologic symptoms (tremors, slurred speech, seizures, or even encephalopathy and coma), have also been documented, especially when the product is misused or ingested.

Because of these risks, some people are seeking safer, plant-based alternatives like herbal mosquito repellents.

Natural ingredients are less likely to cause skin irritation or severe side effects, making them a gentler choice for families and anyone concerned about long-term exposure or possible toxic effects from chemical repellents.

TAXONOMICAL AND BOTANICAL DESCRIPTION

1. LEMONGRASS (Cymbopogon citratus)

Lemongrass, also known as Cymbopogon citratus, is a tall, perennial grass that can grow up to 6 feet in height and around 4 feet wide. It is widely recognized for its pleasant, lemon-like aroma and is commonly found in tropical and subtropical regions, especially in Southeast

Asia. This plant grows in dense clusters, with long, slender leaves that are about 1.3 to 2.5 cm wide and can reach up to 3 feet in length. Its leaves are green and linear, tapering at the tips, with a fragrant aroma that's richer than actual citrus and hints of mint and camphor. The plant produces small flowers at the tips of its leaves in long inflorescences, adding to its visual appeal and usefulness.

Uses and Benefits

Lemongrass is not just a culinary herb but also holds medicinal and aromatic significance. It is used in cooking to add a bright, citrus flavour to dishes and soups, especially in Southeast Asian cuisines. The plant is also valued for its essential oil, which is used for its anti-inflammatory, antimicrobial, and mood-boosting properties. It acts as a natural insect repellent, especially against mosquitoes, and is used in aromatherapy and household cleaners.

Traditional and Medicinal Uses

In various traditional medicines, lemongrass has been used for its calming effects, to aid digestion, and to help treat urinary tract issues. It is believed to have anti-inflammatory, antispasmodic, and antibacterial properties that may help protect against infections and reduce fever.

Cultivation

Lemongrass is cultivated in many tropical countries, including India, Sri Lanka, Thailand, Vietnam, and the Pacific Islands. It thrives in warm, moist climates and is

often grown as a perennial crop, with the oil extracted from its leaves and flowering tops.

Overall, lemongrass is a versatile, fragrant herb with a rich history of culinary, medicinal, and aromatic uses, making it a valuable plant both locally and globally.

BIOACTIVE COMPONENTS

The main chemical constituent of lemongrass useful as an insect repellent is citral, which is a mixture of geranial (α -citral) and neral (β -citral), and geraniol. Other compounds like limonene and citronellal also contribute to the repellent action. Even minor components like eucalyptol play a role in the overall efficacy.

Lemongrass is a wonderfully versatile plant that's beloved around the world for many reasons. In the kitchen, its long, slender leaves with a sharp edge add a fresh, citrusy flavour to soups, curries, and teas, bringing a bright and fragrant twist to these dishes. Beyond cooking, lemongrass is treasured for its essential oil, which is commonly used in perfumes, soaps, and cosmetics because of its clean, pleasant aroma.

But lemongrass isn't just about its scent or taste—it also has some impressive health benefits. Its oil has natural antibacterial, antifungal, and anti-inflammatory properties, making it valuable for soothing minor infections and reducing inflammation. Many people use lemongrass oil in aromatherapy to relax, relieve stress, and uplift their mood.^[4]



Fig. 2: Lemongrass Plant.

<https://cdn.mos.cms.futurecdn.net/4uQu8qW3Ky5ZVkwEjU2ffH-1600-80.jpg>

- **Kingdom:** Plantae
- **Division:** Magnoliophytes
- **Class:** Liliopsida
- **Family:** Poaceae
- **Genus:** Cymbopogon
- **Species:** Cymbopogon citratus

Lemongrass has a strong lemon fragrance due essentially to its high contents of essential oils. It is also a raw material in the manufacture of ionones, which are applied in the manufacture of Vitamin. It contains several bioactive components that gives it a medicinal value. There is substantial evidence supporting ethnopharmacological uses. According to the World Health Organization, herbal medicine is an important

part of healthcare for more than two-thirds of the population in developing countries. In Algeria, rose-scented geranium and lemongrass are traditionally used to treat bacterial and fungal infections, as well as stomach pain and toothache.^[4]

Lemongrass essential oil is highly sought after worldwide for its many health benefits. It's made by steam distilling dried or fresh lemongrass leaves, producing both the essential oil and aromatic waters called hydrosols. These natural extracts have been traditionally used to help with various health issues, especially inflammatory diseases and infections caused by microbes.

Medicinally, lemongrass oil works as an antiseptic, helps suppress coughs, and has anti-rheumatic properties, meaning it can relieve joint pain and inflammation. It's also used to ease back pain, sprains, and even bleeding from the lungs. Folk medicine often uses infusions of lemongrass leaves as sedatives, antimicrobials, and anti-inflammatory agents. In some African countries, lemongrass has been part of managing diabetes as well.^[4] Overall, lemongrass essential oil combines natural healing power with a refreshing aroma, making it a valuable remedy for a range of ailments while also offering soothing and relaxing effects.

2. NEEM (*Azadirachta indica*)

Neem, also known as the nim tree or Indian lilac, is a remarkable plant with a wide range of health benefits. It has natural antibacterial, antifungal, antiviral, anti-inflammatory, and antioxidant properties, making it effective in fighting various infections and soothing inflammation. Traditionally, neem has been used to treat skin disorders, heal wounds, reduce fever, and address dental problems like toothaches.

Neem oil and leaf extracts are commonly used to make herbal remedies, cosmetics, and natural insect repellents. Thanks to its powerful healing qualities, neem is often called a "green treasure" and has been prized in traditional medicine for centuries. Its gentle but effective nature makes it a popular choice for promoting healthy skin and protecting against harmful microbes.^[4]

BIOACTIVE COMPONENTS

Neem is a remarkable plant rich in diverse phytochemicals. Its fruits, seeds, leaves, stems, and bark all contain valuable compounds such as limonoids. The seed oil, which is yellow, bitter, and has a distinct garlic-like smell, is composed of glycerides, polyphenols, nimbolide, triterpenes, and beta-sitosterol, with about 2% limonoid content. Neem leaves are packed with beneficial nutrients like quercetin, catechins, carotenes, and vitamin C, making them an important source of natural antioxidants.

Azadirachtin is one of the most important chemical compounds found in neem, known for its powerful

mosquito-repelling properties. Extracted mainly from neem seeds, it is considered one of the most effective natural substances for combating insects. Along with azadirachtin, other limonoids—belonging to the triterpene class—also play a significant role in enhancing neem's insect-repellent activity.

- Meliantriol :- Potent feeding inhibitor that stops insect from eating.
- Salannin :- Potent feeding inhibitor.
- Nimbin and nimbidin :- It has antiviral activity and also have pesticidal effect.



Fig.3: Neem Plant.

https://live.staticflickr.com/4096/4941518502_75554b68bc_b.jpg

- Kingdom: Plantae
- Division: Magnoliophyta (Angiosperms)
- Class: Magnoliopsida (Dicotyledons)
- Order: Sapindales
- Family: Meliaceae
- Genus: *Azadirachta*
- Species: *Azadirachta indica* A. Juss.

3. TULSI (*Ocimum tenuiflorum*)

Ocimum tenuiflorum, commonly known as holy basil or tulsi, is an aromatic perennial herb from the Lamiaceae family. It holds a special place in traditional Ayurvedic medicine and is widely used in various herbal preparations. Tulsi contains several bioactive compounds such as eugenol, carvacrol, flavonoids, caryophyllenes, camphor, cinnamyl acetate, and eugenol-methyl-ether, which give it its unique fragrance and therapeutic properties. It is valued for its antimicrobial, anti-inflammatory, antioxidant, and immunity-boosting effects, making it one of the most revered medicinal plants in India.^[4]

BIOACTIVE COMPONENTS

The main active compound in tulsi is eugenol, which plays a key role in its mosquito-repelling properties. Another important component, methyl eugenol, makes up about 20 percent of the plant's volatile oil. Linalool and carvacrol also contribute significantly to tulsi's overall insect-repellent and insecticidal effects. In addition, sesquiterpene hydrocarbons such as

caryophyllene are present and further enhance these protective properties.

Beyond its insect-repelling ability, tulsi contains a variety of bioactive compounds like flavonoids, phenolic acids, and tannins that offer antioxidant, anti-inflammatory, and antimicrobial benefits. These compounds help neutralize free radicals, support immune function, and promote general health, making tulsi not only a natural insect repellent but also a powerful medicinal herb.^[4]



Fig. 4: Tulsi Plant.

https://upload.wikimedia.org/wikipedia/commons/a/a7/Ocimum_tenuiflorum2.jpg

- Kingdom: Plantae
- Division: Angiospermae (Magnoliophyta)
- Class: Dicotyledonae (Magnoliopsida)
- Order: Lamiales
- Family: Lamiaceae (Labiatae)
- Genus: Ocimum
- Species: Ocimum sanctum.

4. CLOVE (*Syzygium aromaticum*)

Cloves contain approximately 14 to 21 percent of volatile oil, with eugenol being the major active compound, accounting for nearly 70 to 90 percent. Other important constituents include acetyl eugenol, gallotannic acid, alpha- and beta-caryophyllenes, methyl furfural, gum, resin, and fiber. Clove oil is recognized as one of the most effective natural mosquito repellents because of its high eugenol content. The compound emits a sharp, peppery, and woody smell that mosquitoes find irritating and unpleasant. This strong aroma disrupts the sensory receptors on their antennae, preventing them from detecting human cues such as carbon dioxide, body heat, perspiration, and odour, and thereby keeping them away from humans.

Beyond its insect-repelling property, cloves also possess several medicinal qualities. The bioactive compounds in clove oil exhibit strong antimicrobial, antifungal,

antioxidant, and analgesic activities. Eugenol, in particular, is known for its ability to inhibit bacterial growth, reduce inflammation, and relieve dental pain. The antioxidant components help neutralize harmful free radicals, supporting overall health and enhancing tissue protection. These combined effects make clove not only a powerful mosquito repellent but also a versatile medicinal spice widely valued in both traditional and modern medicine.^[4]

When eugenol is combined with synergistic compounds, its mosquito-repelling power increases significantly, and it can also lead to higher mosquito larval mortality. Beta-caryophyllene, which is present in high concentrations in clove oil, further enhances its overall repellent and insecticidal activity. Another important component, eugenyl acetate, also plays a key role in strengthening the repellent properties of clove oil. Together, these bioactive compounds make clove oil a highly effective natural alternative for mosquito control.^[4]



FIG.5: Clove Buds

https://as2.ftcdn.net/jpg/01/89/84/29/220_F_189842916_CaMMxSX3KzASB4lpEDPFe5mHhTxHLMUO.jpg

- Kingdom: Plantae
- Division: Angiospermae (Magnoliophyta)
- Class: Dicotyledonae (Magnoliopsida)
- Order: Myrtales
- Family: Myrtaceae
- Genus: Syzygium
- Species: Syzygium aromaticum

➤ Mechanism of Mosquito Repellency

Herbal mosquito repellent creams protect the skin by combining chemical, scent-based, and behavioral mechanisms that keep mosquitoes from landing, probing, or feeding. Unlike synthetic repellents such as DEET or picaridin, which act mainly on smell receptors, herbal repellents use natural volatile compounds from plant essential oils. These phytochemicals disrupt the mosquitoes' sense of smell and other sensory receptors, making it harder for them to detect and target humans.

Lemongrass oil is an essential oil extracted from the aerial parts of *Cymbopogon citratus* (DC.) Stapf., a

member of the Poaceae family. The major active compounds in lemongrass oil are geranial (α -citral) and neral (β -citral), which together form citral, responsible for its strong lemon-like aroma and powerful biological activity. Smaller quantities of geraniol and citronellol, both known for their insect-repelling properties, also contribute to its effectiveness.

Lemongrass essential oil has shown strong repellent action, both individually and in combination with other plant oils, against a wide range of disease-transmitting mosquitoes (Diptera: Culicidae) and houseflies (*Musca domestica*). The oil works by masking human odours and

interfering with the mosquito's olfactory system, making it difficult for them to locate hosts.^[12]

In addition to its repellent properties, lemongrass oil also exhibits antibacterial, antifungal, antioxidant, and anti-inflammatory effects. It is commonly used in aromatherapy, cosmetics, and natural household products due to its fresh scent and therapeutic benefits. Because it is biodegradable and non-toxic, lemongrass oil is considered an eco-friendly alternative to synthetic repellents like DEET.^[13]

Comparison table:- Natural vs Chemical Repellents^[8]

| FEATURES | NATURAL REPELLENTS (e.g. lemongrass oil) | CHEMICAL REPELLENT(e.g. DEET) |
|--------------------|--|--|
| Active ingredients | Plant based compounds (e.g. citronella) | Synthetic chemicals (e.g. DEET, Picaridin) |
| Scent | Pleasant, refreshing(often citrusy, herbal) | Strong, often chemical or pungent |
| Environmental | Biodegradable, sustainable, low environmental impact | Can be harmful to ecosystem, water, wildlife |
| Cost | Slightly costlier due to natural extraction processes and limited shelf life due to volatility | Low cost per unit widely available in commercial markets |
| Safety concern | Proper dilution and patch testing required | Potential for skin reactions, strong chemical exposure |
| Logevity | May required more frequent reapplications | Generally longer lasting, fewer reapplications |
| Skin impact | Generally gentle less likely to cause irritancy(when diluted) | Can cause irritancy, dryness, allergic reactions |

➤ CONCLUSION

After reviewing various studies and research papers on herbal mosquito repellent creams, we found that natural formulations made from ingredients like lemongrass, neem, tulsi, and clove show great potential as alternatives to synthetic repellents. Although their protection time may be shorter than that of chemical-based creams, their safety, biodegradability, and pleasant aroma make them a healthier and more eco-friendly option for regular use.

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