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Review On API (Lemon Grass) Citronella As A Herbal Mosquito Repellent

Krushna Mhase V[1], Saurav Barde S[2], Digvijay Tikkal S[3], Sanket Vidhate V[4], Asst Prof. Sabale K[5]
Students, Department of Pharmacy[1,2,3,4]
Guide, Department of Pharmacy[5]
Mrs. Saraswati Wani College of Pharmacy, Ganegaon, Maharashtra
Affiliated to Dr Babasaheb Aambedkar Technological University, Lonore, Raigad

Abstract: *Citronella oil is a well-known natural mosquito repellent obtained from the leaves and stems of Cymbopogon species, mainly Cymbopogon nardus and Cymbopogon winterianus. For many years, it has been used as an ingredient in natural insect repellent products. Citronella is recognized for its pleasant lemon-like fragrance and its ability to repel mosquitoes by masking human odors that attract them.*

This review paper presents a detailed summary of citronella oil, including its sources, chemical composition, mechanism of action, various formulations, advantages, disadvantages, and future research possibilities. It also compares citronella with synthetic repellents such as DEET and discusses how natural alternatives can be made more effective through new technologies like nanoencapsulation and controlled release systems. Although citronella oil is less long-lasting than synthetic repellents, its safety, eco-friendliness, and potential for improvement make it a promising herbal solution against mosquito-borne diseases

Keywords: Citronella, Cymbopogon, mosquito repellent, herbal oil, DEET alternative nanoformulation

I. INTRODUCTION

Mosquitoes are among the most common insects responsible for spreading many harmful diseases such as malaria, dengue, chikungunya, Zika virus, and yellow fever. These diseases affect millions of people worldwide, especially in tropical and subtropical countries. Preventing mosquito bites is one of the most effective ways to control the spread of these diseases.

Chemical repellents like DEET (N, N-diethyl-meta-toluamide) have been widely used for mosquito control. Though effective, they often cause side effects such as skin irritation, unpleasant odor, and environmental toxicity. Due to these drawbacks, people have become more interested in herbal and natural repellents.

Citronella oil, derived from Cymbopogon species, has been used for hundreds of years as a safe and natural repellent. It is considered one of the best-known plant-based repellents available today. This paper discusses in detail how citronella oil works, what it contains, how it is used, and what improvements can make it more effective.

2. Origin and Source of Citronella Oil

The two main types of citronella oil are:

1. Ceylon Citronella Oil – Extracted from Cymbopogon nardus, mainly grown in Sri Lanka.
2. Java Citronella Oil – Extracted from Cymbopogon winterianus, found in Indonesia and India.

Both types contain citronellal, citronellol, and geraniol as the main components, but the percentage of each varies depending on the species, climate, soil, and distillation method.

perfumes, soaps, candles, and cosmetics in addition to its use as an insect repellent.

3. Chemical Composition of Citronella Oil

The major chemical compounds responsible for the repellent properties of citronella oil are:

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Citronellal (32–45%) – Main component providing the lemon aroma and repelling effect.
Citronellol (10–20%) – Contributes to fragrance and repellent activity.
Geraniol (18–25%) – Known for its antimicrobial and insect repellent properties.
Limonene, Borneol, and Methyl Eugenol – Minor components that enhance the overall effect.
The exact chemical composition depends on plant variety, growing conditions, and distillation temperature. Studies show that the synergistic effect of these compounds provides citronella oil with its mosquito-repelling characteristics.

4. Mechanism of Action

Mosquitoes locate humans mainly by sensing body odor, sweat components, and the carbon dioxide we exhale. Citronella oil works by interfering with these signals. The volatile compounds of citronella mask or confuse the mosquito's olfactory (smell) receptors, making it harder for them to identify a human host.
Research shows that citronella oil acts as an olfactory camouflage, blocking the mosquito's ability to detect lactic acid and CO_2. However, because citronella evaporates quickly, its effect usually lasts for 30 minutes to 2 hours, depending on environmental factors like humidity, wind, and body temperature.

5. Citronella-Based Products

Citronella is used in many commercial mosquito repellent products. Common forms include:
Sprays and Aerosols: Easy to apply but require reapplication every few hours.
Lotions and Creams: Provide a protective layer on the skin and last longer.
Candles and Coils: Release citronella vapor into the air; effective for outdoor areas.
Essential Oil Diffusers: Spread fragrance indoors to repel insects.
Nanoformulations: Advanced technology encapsulating citronella molecules in nanoparticles for slow and controlled release. These can last up to 6–8 hours.
Combining citronella with other herbal oils like neem, eucalyptus, or peppermint can enhance its repellent effect and extend its protection time.

6. Studies on Effectiveness

Several scientific studies have evaluated the effectiveness of citronella oil:
Trongtokit et al. (2005) compared 38 essential oils and found that citronella provided 30–180 minutes of protection, depending on formulation.
Nerio et al. (2010) confirmed that citronella oil has a significant repellent effect but requires frequent reapplication.
Maia and Moore (2011) concluded that when citronella is combined with vanillin or encapsulated in polymers, its duration increases up to 6 hours.
Although citronella offers short-term protection, it is considered safe for all age groups. Mild skin irritation may occur in sensitive individuals, but no serious toxicity has been reported.

7. Advantages of Citronella Oil

1. Natural and Non-Toxic: Derived from plants; safe for humans and pets.
2. Eco-Friendly: Does not pollute soil or water like chemical repellents.
3. Pleasant Smell: Lemon-like fragrance is refreshing.
4. Affordable and Easily Available: Can be cultivated and distilled locally.
5. Multi-purpose Use: Also used in perfumes, candles, soaps, and aromatherapy.

8. Limitations

1. Short Duration of Action: Needs frequent reapplication due to volatility.
2. Sensitivity to Sunlight: Rapidly evaporates under high temperature or UV light.
3. Mild Skin Irritation: May occur if applied undiluted.
4. Less Effective than DEET: Chemical repellents last longer in harsh conditions.

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To overcome these issues, scientists are focusing on improved formulations like microencapsulation and nanotechnology that can release citronella slowly and increase its longevity.

9. Future Research and Possibilities

Future research should focus on the following areas:

Nano and Microencapsulation: To prolong the release and maintain repellent effect for 8–10 hours.

Combination Formulas: Mixing citronella with neem, clove, or lemongrass oil for stronger effect.

Eco-Friendly Carriers: Using biodegradable polymers for controlled release.

Clinical Studies: More human-based trials for standardization and approval by health authorities.

Awareness Programs: Educating people about safe and effective use of herbal repellents.

With proper scientific development, citronella oil can become a major sustainable solution for mosquito control, especially in rural and developing areas.

II. CONCLUSION

Citronella oil is a promising natural mosquito repellent that offers a safer alternative to synthetic chemicals like DEET. While its effect is short-lived, new research on nano-based and slow-release formulations can improve its performance. Because it is safe, eco-friendly, and affordable, citronella remains one of the most valuable herbal repellents available today.

Encouraging the use of such natural products not only reduces chemical exposure but also supports sustainable environmental practices. With more research and innovation, citronella can continue to play an important role in protecting human health from mosquito-borne diseases.

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