Rebellant

PROPOSAL

By Fatima Farrukh, Dua Zafar, Amna Naz, Hafsah Khalid

DOW College of Biotechnology

Introduction

Mosquito-borne diseases pose a significant threat to human and animal well-being in tropical and subtropical regions worldwide. Common ailments such as malaria, filariasis, yellow fever, Japanese encephalitis, and dengue fever are predominantly caused by mosquitoes. In Pakistan, malaria and dengue fever are the most prevalent mosquito-borne diseases. Almost every year or every other year, Pakistan experiences severe dengue epidemics with increasing fatalities. Malaria is also endemic in the country, occurring seasonally and peaking twice a year.

Over time, numerous approaches have been explored to combat mosquito-borne diseases. However, the use of synthetic chemicals like DEET (N, N-diethyl-meta-toluamide) for insect and arthropod management raises concerns for the environment and human health. To address these concerns, an organic mosquito repellent called "Rebellant" has been developed. Unlike DEET-based repellents, Rebellant does not contain any synthetic chemicals. It is available in liquid spray and candle forms, both of which contain a combination of essential oils derived from citronella grass (*Cymbopogon nardus*), peppermint (*Mentha piperita*), eucalyptus (*Eucalyptus globulus*), tea tree (*Melaleuca alternifolia*), and lavender (*Lavandula angustifolia*). Essential oils are complex mixtures of volatile organic compounds extracted from plants. They primarily consist of terpenoids and related aromatic chemicals, which are secondary metabolites of plants. Essential oils possess various properties, including antioxidant, antibacterial, and medicinal effects, as well as repellent and insecticidal properties due to their chemical constituents.

Problems to be solved

The threat of mosquito-borne diseases are a substantial risk to public health on a global scale, with a staggering number of cases and fatalities each year. Approximately 700 million people worldwide suffer from mosquito-borne infections, leading to over one million deaths annually. These diseases are caused by bacteria, viruses, and parasites carried by mosquitoes, primarily the *Aedes* and *Anopheles* species. The range of illnesses transmitted by these mosquitoes is extensive and includes malaria, dengue fever, West Nile virus, chikungunya, yellow fever, filariasis, tularemia, dirofilariasis, Zika fever, Keystone virus, Rift Valley fever, and many others. Every year in Pakistan there are numerous cases and fatalities due to dengue virus and malaria causing a major burden on the healthcare system. According to the World Health Organization (WHO), South Asia has experienced a significant impact from dengue. In 2021, WHO documented 48,906 cases, including 183 fatalities, in Pakistan, indicating a concerning rise in cases. Since October 2022 in Karachi alone 1255 cases have been reported, attributed to weather fluctuations, flood and rainfall. Recent reports indicate that a total of 7808 cases have been reported across Sindh, as stated by health officials. As per the World Health Organization (WHO), Pakistan is among the seven countries in the Eastern Mediterranean Region that bear the brunt of malaria, representing 98% of the overall malaria burden in the region. A significant number of people in Pakistan, approximately 217 million, face a moderate risk of contracting malaria, while 63 million individuals are at high risk. In the year 2020, around 0.47 million cases of malaria and 800 deaths were reported in the country.

Efforts to combat mosquito-borne diseases have been ongoing for years, with various approaches being employed, including the use of synthetic mosquito repellants. Among these, DEET has emerged as the most commonly used active ingredient in synthetic insect repellants. However, the use of DEET, specifically N, N-diethyl-meta-toluamide, raises significant concerns for both the environment and human health. Excessive use of DEET-based repellants has been associated with adverse reactions reported by individuals, including seizures, uncoordinated movements, agitation, aggressive behavior, low blood pressure and skin irritation. Furthermore, research has demonstrated that DEET can be detrimental to the central nervous system. These concerns surrounding DEET-containing synthetic repellants have sparked considerable discussions about the potential risks and safety issues for both the environment and human health. Moreover majority of insect repellants currently in the market are being imported amounting to millions of rupees thus causing a major setback to our economy.

Solution to the problems

Our product offers an effective solution to repel mosquitoes without the use of DEET, relying instead on a blend of plant-based essential oils. We provide a mosquito repellent spray designed for topical application, as well as a mosquito repellent candle. The key ingredients in our spray and candle include a mixture of citronella, eucalyptus, peppermint, tea tree, and lavender oils.

When these essential oils are combined with rubbing alcohol, they create a potent combination that effectively repels insects. Additionally, the rubbing alcohol in our spray also has the added benefit of soothing mosquito bites. To further enhance the skin-soothing properties of our spray, we have included Aloe Vera gel. Moreover, the spray possesses anti-bacterial properties, providing an additional layer of protection. In the case of our mosquito repellent candle, the mixture of essential oils is combined with paraffin wax, ensuring a slow and consistent release of the repellent properties. For aesthetic purposes, we have also added color to the candle.

Our product aims to control mosquito exposure and minimize disease transmission, ultimately reducing hospital burden and improving the overall quality of life and well-being of individuals. Moreover, by offering an alternative to DEET-based repellents, we also aim to reduce the risks associated with DEET exposure and contribute to the health and safety of the people. Our product will also remove the need to import mosquito repellant and have a positive impact on the economy of our country.

Cost

For 100 Spray Bottles

Materials	Manufacturing Cost (for 100 units)	Total
Spray Bottles	Rs 6000/-	Rs 16000/- (for 100 spray bottles) Rs. 160/- per unit
Labels	Rs 1000/-	
Essential Oils	Rs 5000/-	
Isopropyl Alcohol	Rs 2000/-	
Glycerol	Rs 1000/-	
Aloe Vera	Rs 1000/-	

For 100 Candles

Materials	Manufacturing Cost (for 100 units)	Total
Candle Jars	Rs 6000/-	Rs 15000/- (for 100 candles) Rs. 150/- per unit
Labels	Rs 1000/-	
Essential Oils	Rs 5000/-	
Wax	Rs 2000/-	
Wicks	Rs 1000/-	

Summary

Mosquito-borne diseases like malaria and dengue fever pose a significant threat to human and animal health in tropical and subtropical regions, including Pakistan. Synthetic chemicals such as DEET, commonly used in insect repellents, raise concerns for the environment and human health. To address these concerns, an organic mosquito repellent called "Rebellant" has been developed. Rebellant is a DEET-free repellent available as a liquid spray and candle, containing a blend of essential oils derived from plants like citronella, eucalyptus, peppermint, tea tree, and lavender.

Essential oils, rich in terpenoids and aromatic compounds, possess various properties including repellent effects due to their chemical constituents. Mosquito-borne diseases cause a significant

number of cases and deaths globally each year, transmitted by mosquitoes such as *Aedes* and *Anopheles* species. Synthetic repellents with DEET have been widely used, but their potential risks and adverse reactions have raised concerns for human health and the environment.

Rebellant offers an alternative by using essential oils instead of DEET. The spray combines essential oils with rubbing alcohol, creating a potent insect repellent that also soothes mosquito bites. Aloe Vera gel is included to enhance skin-soothing properties, and the spray exhibits antibacterial effects. The candle releases the repellent properties slowly by combining essential oils with paraffin wax. The product aims to control mosquito exposure, reduce disease transmission, and improve well-being while minimizing risks associated with DEET exposure.

Overall, Rebellant provides an effective solution to repel mosquitoes naturally and contribute to the health and safety of users.