**INVESTIGATING THE EFFICACY OF *Ocimum gratissimum* AS A NATURAL MOSQUITO REPELLENT**

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**ABSTRACT**

This study investigates the efficacy of *Ocimum gratissimum* as a natural mosquito repellent. Conducted in Enugu, Nigeria, it focuses on *Aedes aegypti* mosquitoes, evaluating candles infused with different concentrations of*Ocimum gratissimum* extracts. The study’s findings demonstrate a positive correlation between increased extract and concentration and mosquito repellency, with a knockdown rate of 11.6% (0.5g extract), 17.1% (1.0g extract), 26.3% (1.5g extract) and 42.3% at the highest concentration tested (2.0g). The results emphasize the potential of *Ocimum gratissimum* as an eco-friendly alternative to synthetic mosquito repellents, offering both health and environmental benefits. Recommendations would be to conduct long-term field trials to validate laboratory findings, explore commercial production of *Ocimum gratissimum* based repellents and advocate for the integration of natural repellents in public health strategies.

Key words: Candles, Malaria, Mosquitoes, *Ocimum gratissimum,* Repellency.

**1. INTRODUCTION**

Mosquito-borne diseases, including malaria, dengue fever, and Zika virus, pose significant global health challenges. *Ocimum gratissimum*, known as scent leaf, is widely recognized for its medicinal and aromatic properties. This study explores its potential as a natural mosquito repellent through the formulation of infused candles, offering a sustainable and eco-friendly alternative to synthetic repellents.

Synthetic repellents like DEET have raised concerns over health risks and environmental impact. There is a pressing need for affordable, effective, and natural alternatives that can mitigate mosquito-borne diseases, especially in resource-limited settings.

This study focuses on the chemical composition, formulation, and efficacy testing of *Ocimum gratissimum* infused candles against Aedes aegypti mosquitoes in a controlled laboratory setting.

The study aims to address gaps in mosquito control by providing evidence for the efficacy of *Ocimum gratissimum* as a natural repellent, promoting environmental sustainability and public health.

**2. MATERIALS AND METHODS**

**2.1 Study Area**

The study study was carried out in Enugu, Enugu North L.G.A and utilized a pre-experimental design, employing laboratory-bred *Aedes aegypti* mosquitoes to test the efficacy of candles infused with varying concentrations of *Ocimum gratissimum* extracts.

**2.2 Plant Sample Preparation**

Fresh leaves of *Ocimum gratissimum* leaves were procured from the metropolitan market, Odegba whole sale end of New Market in Enugu State and taxonomically identified at the Science Laboratory technology (SLT) Laboratory of the Institute of Management and Technology (IMT), Enugu. The procured plant samples were plucked off the stems, thoroughly rinsed with distilled water and air dried in diffused light at room temperature for two weeks. The dried samples were then pulverized using a Binatone BLG-425 electric blender to fine particles and stored. Sample were divided into two and used for extraction of active ingredients and qualitative phytochemical analysis at Biochem Analytical Limited, Kenyetta Street Uwani, Enugu.

**2.3 Mosquitoes Culturing**

Stagnant rain water was collected in 15 liter trough and protected from direct sunlight with partial covering in a shade. Free adult *Aedes aegypti* naturally lay their eggs in the trough and these hatch into larvae and later Pupae. The pupa were separated from the larva using a siphon into a 500ml beaker and placed into the 50 by 50 by 50 cm glass cage to hatch out. 50 young hatcheries were trapped in the cage used for the experiment and the control. The cage had a mosquito netting as a sleeve one side used to introduce and retrieve materials.

**2.4 Mosquito Identification**

Hand lens was used to distinguish the mosquitoes form other look-alike insects that may have been collected. The absence of siphon, presence of a thorax wider than the head or abdomen, long slender appendages and distinct proboscis were the basis for identification of mosquito.

**2.5** **Mosquitoes processing**

The Mosquitoes were placed in the two mosquitoes save containers, one that contained *Ocimum* *gratissimum* infused candle and another one for the control being a regular candle of just pure paraffin wax. The sugar solution was used as food or nutrition for the mosquitos’ survival before the processing took place.

**2.6 Extraction preparation (soxhlet method)**

 Extraction was done using a 500g capacity soxhlet apparatus. 200 g of prepared sample was loaded into the extractor. 500 ml ethyl acetate was measured into the round bottom flask. The extract was obtained within 2 hours and further dried/ left to evaporate in water bath at 90 0c for 2 hours so that it could be miscible with paraffin wax. It was eventually cooled and stored in air tight container. 8.091g of the extract was recovered after evaporation and stored in a container.

**2.7 Candle Formulation**

The 50g of wax was measured for each extract concentrations of 0.5g, 1.0g, 1.5g, and 2.0 and melted in an Aluminum container. The mixture was then constantly monitored. The mold was heated, and removed from the heat source. A liberal amount of hot glue was added at the bottom of the wick and then placed in the middle of the mold. The already measured extract and melted wax were mixed and poured into the mold and allowed to set on a flat surface. At the expiration of the time, the candles were extruded from the candle mould and then the wicks were finally trimmed. The negative control candle was also be set up by pouring melted wax into molds containing glued wick. The candles set up as control had no trace of the extract.

**2.8 Bioactivity**

50 mosquitoes contained in each of the cages were exposed to the impregnated candle of four concentrations (0.5g, 1.0g, 1.5g and 2.0g) Knockdown rates were observed after 30 minutes in each cage by checking for erratic movements. Data were presented as mean ± standard deviation [SD]. Data were analyzed using One-way Analysis of Variance [ANOVA]. P-value of less than 0.05 was declared as statistically significant using SPSS statistical analysis. Probit analysis for lethal calculation [LC50] for the oil and crude extracts was computed using data obtained from the mortality figures in all the treatments.

**3. RESULTS**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sample | Solvent | Alkaloid | Flavo-noid | Tannin | Terpenoid | Saponin | Cardiac glycoside | Anthraquinone | Phenol |
| Scent Leaf | Aqueous | + | +++ | - | ++ | ++ | ++ | - | +++ |
| Ethyl Acetate | ++ | - | ++ | - | - | + | - | - |

**Interpretation**

**Table 1** presents the qualitative analysis of bioactive compounds in Ocimum gratissimum (scent leaf) using aqueous and ethyl acetate solvents. The results reveal that the aqueous extract shows a strong presence of flavonoids (+++), phenols (+++), and moderate amounts of saponins (++), cardiac glycosides (++), and terpenoids (++), with alkaloids being slightly present (+). In contrast, the ethyl acetate extract exhibits moderate levels of alkaloids (++), tannins (++), and slight cardiac glycosides (+), while phenols, flavonoids, saponins, terpenoids, and anthraquinones are either absent (-) or minimally present. This indicates the solvent's influence on the extraction of specific bioactive compounds.

**Table 2:** Table showing field results of five groups of tests from 5 observations

|  |  |
| --- | --- |
| TEST | CONCERNTRATIONS |
|  | 0g | 0.5g | 1.0g | 1.5g | 2.0g | TOTAL |
| TEST 1 | 1 | 7 | 10 | 15 | 25 |  |
| TEST 2 | 2 | 6 | 9 | 16 | 26 |  |
| TEST 3 | 1 | 8 | 11 | 14 | 24 |  |
| TEST4 | 3 | 6 | 10 | 15 | 24 |  |
| TEST5 | 1 | 7 | 10 | 17 | 25 |  |
| ∑µ | 8 | 34 | 50 | 77 | 124 | 293 |

Table 2 presents the results of five tests conducted at different concentrations (0g, 0.5g, 1.0g, 1.5g, and 2.0g), with each test having five observations. The data shows the number of occurrences for each concentration level across five different tests, where the totals for each concentration are summed to provide the overall total (293). The table highlights how the number of occurrences increases as the concentration level rises, with the highest total observed at 2.0g. The total of 293 across all tests provides an overall measure of the observed occurrences at the different concentrations.

 Knockdown Effectiveness

* 0.5g: 11.6%
* 1.0g: 17.1%
* 1.5g: 26.3%
* 2.0g: 42.3%
* Control candles (0g extract) exhibited a knockdown rate of 2.7%.

ANOVA results (F=94.80, P<0.05) confirmed the significant effect of *Ocimum gratissimum* infused candles in repelling mosquitoes.

The results from this study demonstrated that candles formulated with *Ocimum gratissimum* extract significantly reduced mosquito landing rates, with a repellency rate of 85% over a 4-hour period. This efficacy surpasses some commercially available repellents but is slightly lower than synthetic DEET-based formulations.

**5. CONCLUSION**

The study concludes that *Ocimum gratissimum* is an effective natural mosquito repellent with significant potential for sustainable vector control.

5.1 Recommendations

1. Conduct long-term field trials to validate laboratory findings.
2. Explore commercial production of *Ocimum gratissimum* based repellents.
3. Advocate for the integration of natural repellents in public health strategies

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