

INVESTIGATING THE EFFICACY OF *Ocimumgratissimum* AS A NATURAL MOSQUITO REPELLENT

By

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ABSTRACT

The study investigated the efficacy of Ocimumgratissimum as a natural mosquito repellent. The study was conducted in Enugu, Nigeria between April-May 2024. Bred Aedes aegypti mosquitoes were exposed to candles infused with different concentrations of Ocimumgratissimum extracts. The findings from this study demonstrated a positive correlation between increased extract concentration and mosquito repellence, with a knockdown rate of 11.6% (0.5g extract), 17.1% (1.0g extract), 26.3% (1.5g extract) and 42.3% (2.0g) as the highest test concentration. The findings show strong potentials of Ocimumgratissimum as a mosquito repellent with environmental benefits, offering both a healthy and eco-friendly alternative to synthetic mosquito repellents. Recommendations would be to conduct a long-term field trials to validate laboratory findings, explore commercial production of Ocimumgratissimum based repellents and advocate for the integration of natural repellents in public health strategies.

Key words: Candles, Malaria, Mosquitoes, Ocimumgratissimum, Repellence.

1. INTRODUCTION

Mosquito-borne diseases, including malaria, dengue fever, and Zika virus, pose significant global health challenges. *Ocimumgratissimum*, 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 *Ocimumgratissimum* 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 *Ocimumgratissimum* as a natural repellent, promoting environmental sustainability and public health.

2. MATERIALS AND METHODS

2.1 Study Area

The 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 the 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. Samples were divided into two and used for laboratory extraction of active ingredients and qualitative phytochemical analysis.

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 pupae 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 on one side used to introduce and retrieve materials.

2.4 Mosquito Identification

Hand lens was used to distinguish the mosquitoes from 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 holding a regular candle of pure paraffin wax. The sugar solution was used as food or nutrition for the mosquitoes' survival before the processing took place.

2.6 Extraction preparation (soxhlet method)

Extraction was done using a 500ml 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 °C for 2 hours so that it could be miscible with paraffin wax. It was eventually cooled and stored in an 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 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.

2.9 Statistical analysis

Data were presented as mean \pm 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. RESULT **Table 1:** The qualitative analysis of *Ocimum gratissimum* (scent leaf) using aqueous and ethyl acetate solvents.

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

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

TEST	CONCENTRATIONS					
	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	
TEST 4	3	6	10	15	24	
TEST 5	1	7	10	17	25	
$\Sigma \mu$	8	34	50	77	124	293

4. DISCUSSION

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 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 show 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.

5. CONCLUSION

The results from the 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.

In conclusion, *Ocimum gratissimum* demonstrated an effective mosquito repellent activity, indicating a significant potential and suitability for sustainable vector control. It is therefore recommended that:

- i. A long-term field trials should be conducted to validate laboratory findings;
- ii. Commercial production of *Ocimum gratissimum* based repellents should be explored;
- iii. The integration of natural repellents in public health strategies should be advocated.

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