Larvicidal effect of *Cymbopogon citratus* root and leaf on the first instar larval stage of *Anopheles gambiae, Culex quinquefasciatus* and *Aedes aegypti*

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**ABSTRACT**

Larvicidal effect of lemongrass root and leaf was carried out with three different species of mosquito (*Anopheles gambiae, Culex quinquefasciatus* and *Aedes aegypti*) at the first instar stage of development. Soxhlet apparatus was used to extract the pulverized plant parts using petroleum ether and aqueous extraction solvents and the different extracts were used for the analysis. The result showed that the mean death of *Anopheles gambiae* recorded highest (13.995); this is followed by *Aedes aegypti* (12.641) and *Culex quinquefasciatus* (11.426). Also lemongrass leaf showed higher larvicidal effect than the root. Furthermore, petroleum ether extraction solvent was found to be more effective than the aqueous extraction solvent.

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**Keywords:** larvicidal, *Anopheles gambiae, Culex quinquefasciatus, Aedes aegypti*, petroleum ether, aqueous extract

1. **INTRODUCTION**

Mosquitoes in the family Culicidae, comprise three Sub-families within the order Diptera, (the two winged flies). These three sub-families are the: Toxorhynchitinae, Anophelininae and Culicinae [1]. Mosquitoes belong to several genera e.g. *Anopheles, Aedes, Psorophora* and *Culex* [2]. Besides, not all the culicinae concern the parasitologist, for one group, referred to as the tribe Megarhini, are exclusively plant feeders and have a proboscis so modified as to be incapable of piercing skin [3].

Mosquitoes are found throughout the world except in places that are frozen and occur throughout the year with highest population in August and September [4], peak raining season in Nigeria. Ecological changes caused by drainage system, dam, roads, dykes, canals etc., create breeding sites for mosquitoes and consequently tend to boost area of stagnant water in which they breed and by extending the periods during which stagnant water is present.

*Cymbopogon citratus* (Lemongrass) is a native herb from India and is cultivated in other tropical and subtropical countries [5]. It is used as traditional medicine in the treatment of nervous, gastrointestinal disturbances, fever and hypertension, malaria etc. As a medicinal plant, Lemongrass has been considered as an insect repellent [5].

Its common name is Lemongrass, locally it is called "Kooko-oba" by the Yoruba, “Isauri” by the Hausa, “Achara ehi” by the Igbos, “Ikon” by the Efik.

Due to the severe effects of synthetic pesticides, there is serious need to emphasis on natural, economical, biodegradable and environmental friendly pesticide in the control of pest especially mosquitoes.
2. METHODOLOGY

2.1 Collection of mosquito species

The eggs of the different species of Mosquito (Aedes aegypti, Anopheles gambiae and Culex quinquefasciatus) were collected from the egg colony at the National Arbovirus and Vector Research Centre, Enugu, Enugu State, Nigeria, and were reared in the laboratory.

2.2 Collection of plant parts

Fresh plant parts were collected at Amudi in Ezinihitte Mbaise Local Government Area of Imo State and identified by a botanist in Forestry and Wild Life Department of Federal University of Technology, Owerri. Dead leaves were removed together with insect larvae from the twigs. The plant part was carefully washed, rinsed with tap water and air dried at room temperature of 28±1°C for five days and stored in air tight glass containers for further use [6].

2.3 Preparation of plant extract

The completely dried plant part was ground with Binatone Mx10 blender and sieved to obtain a fine powder of the plant part. 150 grams of each pulverised plant part was placed in a plain sheet of white paper, then placed in the timbel of the soxhlet apparatus compartment using petroleum ether extraction solvent [6].

2.4 Preparation of test material

Stock solution was prepared by dissolving 5g of the extract in 150mls of water into which three drops of acetone was added to emulsify the extract in 150mls of water into which three drops of acetone was added to emulsify the extract in 150mls of water into which three drops of acetone was added to emulsify the extract into 240 ml, 235 ml to 195 ml of distilled water respectively in separate labeled 500 ml bowls making it up to 245 ml in volume[7].

2.5 Susceptibility test

Twenty specimens of the different mosquito were picked using rubber pipette and placed in small separate specimen bottles containing 5ml of water and then exposed to each of the concentrations of the extract giving a final volume of 250 ml in the bowls.

Quaker oat powder was used to feed the larvae every twenty-four hours. Three replicates for each of the test concentration and control (without plant extracts) were tested for anti-larval effects. The larval mortalities were recorded at intervals of 8 hours for 48 hours exposure. All the mortalities were counted and recorded [8].

3. RESULTS AND DISCUSSION

Table shows that the mean death of each species of mosquito is statistically different. This is evident in Table 2 as the mean death of Anopheles gambiae is higher than Aedes aegypti which in turn is higher than Culex quinquefasciatus. This is because Anopheles gambiae breed and thrive well in fresh water unlike the Culex quinquefasciatus that thrives in polluted water and thereby having more resistance to the extracts used [9]. Also, [10] reported that lethality varied by type of mosquito and extract.

The mean effect of each plant extract is significantly different on the death of the mosquitoes with the lemongrass leaf more effective than the root. This is in line with the result of [11] who reported that exposure of Anopheles mosquito larvae to undiluted extracts of A. indica leaf and stem for 12 hours led to 98 and 48% mortality respectively. In general, the mean death of each mosquito in different solvent types and in each plant part type is significantly different. Petroleum ether extract was found to be better than aqueous extracts. This is because the active ingredients in the plant are soluble in petroleum ether than aqueous solvent. This observation is consistent with [12] who found ethanol extracts from various plant part more toxic than aqueous extracts of the same plant parts. The result is comparable to results of [13] using Cardiospermum halicocabum extracts against Culex pipiens larvae, [14] using the A. indica extract against C. p. larvae.

Furthermore, [6] also reported that petroleum ether leaf extracts of A. indica and O. gratissimum were very effective as mosquito larvicides.

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
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</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>56473.350</td>
<td>47</td>
<td>1180.284</td>
<td>35.959</td>
<td>.000</td>
</tr>
<tr>
<td>Intercept</td>
<td>463575.875</td>
<td>1</td>
<td>463575.875</td>
<td>15301.821</td>
<td>.000</td>
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<tr>
<td>x1</td>
<td>47975.659</td>
<td>7</td>
<td>6853.666</td>
<td>226.227</td>
<td>.000</td>
</tr>
<tr>
<td>x2(x3(x1))</td>
<td>5095.125</td>
<td>32</td>
<td>159.223</td>
<td>5.256</td>
<td>.000</td>
</tr>
<tr>
<td>x3(x1)</td>
<td>2402.565</td>
<td>8</td>
<td>300.321</td>
<td>9.913</td>
<td>.000</td>
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<tr>
<td>Error</td>
<td>85796.775</td>
<td>2832</td>
<td>30.295</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>604846.000</td>
<td>2880</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>141270.125</td>
<td>2879</td>
<td></td>
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</table>

a. R Squared = .393 (Adjusted R Squared = .383)

x1 = plant part extract; x2 = mosquito type; x3 = solvent type

Table 1: Anova table to determine the effect of plant extracts on different mosquito species at the first instar stage
In conclusion, it was observed that larvicidal effect of the plant extracts depends on the mosquito species, the extraction solvent and the plant part used.

ACKNOWLEDGEMENT

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REFERENCES

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TABLE 2. Multiple comparison of estimated mean death of the different mosquito species at the first instar stage

<table>
<thead>
<tr>
<th>Mosquito Type</th>
<th>Mean</th>
<th>Std. Error</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aedes</td>
<td>12.641</td>
<td>.178</td>
<td>12.292 - 12.899</td>
</tr>
</tbody>
</table>

TABLE 3. Pairwise comparisons mean difference of the different mosquito species at the first instar stage

<table>
<thead>
<tr>
<th>(I) Mosquito Type</th>
<th>(J) Mosquito Type</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.*</th>
<th>95% Confidence Interval for Difference*</th>
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</thead>
<tbody>
<tr>
<td>Aedes</td>
<td>Anopheles</td>
<td>-1.354</td>
<td>.251</td>
<td>.000</td>
<td>-1.847 - .862</td>
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<tr>
<td></td>
<td>Culex</td>
<td>1.215</td>
<td>.251</td>
<td>.000</td>
<td>.722 - 1.707</td>
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<tr>
<td>Anopheles</td>
<td>Aedes</td>
<td>1.354</td>
<td>.251</td>
<td>.000</td>
<td>.862 - 1.847</td>
</tr>
<tr>
<td></td>
<td>Culex</td>
<td>2.569</td>
<td>.251</td>
<td>.000</td>
<td>2.076 - 3.061</td>
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<tr>
<td>Culex</td>
<td>Aedes</td>
<td>-1.215</td>
<td>.251</td>
<td>.000</td>
<td>-1.707 - .722</td>
</tr>
<tr>
<td></td>
<td>Anopheles</td>
<td>-2.569</td>
<td>.251</td>
<td>.000</td>
<td>-3.061 - 2.076</td>
</tr>
</tbody>
</table>

* Based on estimated marginal means
a. The mean difference is significant at the .05 level.

Based on estimated marginal means

In conclusion, it was observed that larvicidal effect of the plant extracts depends on the mosquito species, the extraction solvent and the plant part used.