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Research Paper

Larvicidal Effects of *Termanalia Catappa* Leaves Extract on Mosquito Larvae

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Abstract
There is an emergence of vector resistance to the four commonly used mosquito insecticides in over 28 countries. Therefore, it has become necessary to seek for more effective alternatives. This present study aims to evaluate the larvicidal properties of the leaf extracts of Termanalia catappa on Culex quiquefasciatus and Aedes aegypti mosquito larvae. The plant leaves were collected locally and extracted using petroleum ether as solvent. Four varying concentrations were made using dilution method to test larvicidal activity on 4th instar larva of the aforementioned species of mosquito. It was observed that the plant extract was lethal against both species of mosquito. The results also showed that mortality of the mosquito larvae increased as the concentration of the extract increases. Furthermore, probit analysis of the results shows that the median lethal concentration LC_{50} of Termanalia catappa extract on Aedes aegypti and Culex quinquefasciatus are 0.5166ppm and 0.465ppm respectively. This means that Culex quinquefasciatus is more susceptible to the plant extracts. It is evident from this study that Termanalia catappa has larvicidal properties that can be considered in the production of an environmentally-friendly plant based larvicide. Since Termanalia catappa is known to naturally grow in the wild; it will therefore require lesser resources to be cultivated domestically. We recommend that further studies should be conducted on the plant to explore its full potential.

Key words: *Terminalia catappa, mosquito, larva, Culex quinquefasciatus, Aedes aegypti*

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I. Introduction

Mosquitoes are members of a group of about 3,500 species of small flies within the family Culicidae. They have a slender segmented body, one pair of wings, one pair of halters, three pair's long hair-like legs, and elongated mouthparts. The mosquito life cycle consist of egg, larva, pupa and adult stages. Eggs are laid on water surface; they hatch into motile larvae that feed on aquatic algae and organic material. The adult female mosquitoes of most species have tube-like mouth parts (proboscis) that can penetrate the skin of the host and take blood meal for their nourishment needed to produce eggs. Many mosquito species are known to feed on the blood of various vertebrate and invertebrate hosts, including mammals, birds, amphibians, fishes, and arthropods. Mosquito saliva is transferred to the host during the bite and can cause itchy rash. In addition, many species can ingest pathogens during blood meal, and transmit them to future hosts. This makes mosquitos' important vectors of diseases such as malaria, filariasis, yellow fever, Chingkunguya, west nile, dengue fever and Zika virus (Bates, 2016).

Terminalia catappa belongs to the family Combretaceae. It is commonly found in the tropics and a native to Asia, Pacific, Australia and Madagascar. In English, the plant is has many common names such as; beach almond, sea almond, tropical almond, false kamani, indian almond and country almond. The plant can reach a height of about 35m tall. The edible fruits are light in weight and corky in nature. The leaves are good sources of tannins, flavonoids, saponins and Physterols. Extracts of the plant have been reported to contain anti-parasitic and anti-diarrheal properties.

According to Singha *et al*. (2011), to reduce the incidence of different mosquito borne diseases, regulation of mosquito population is very important. The approach for control of mosquito-borne diseases largely relies on the interruption of disease transmission cycle by preventing mosquitoes from biting humans, using

insecticides and causing larval mortality in a large scale at breeding sites with larvicides (Rajmohan and Ramaswamy, 2007). Proper control of mosquitoes is based on personal protection and public awareness for eradicating breeding sites (Corbel *et al*., 2004). Larviciding is a successful way of reducing mosquito densities in their breeding places before they emerge into adults. Larviciding largely depends on the use of synthetic chemical insecticides-organophosphates and insect growth regulators. Although effective, their repeated use has disrupted natural biological control systems and sometimes resulting in undesirable effects on non-target organisms (Tiwary *et al*., 2007). This also fostered environmental and human health concern that initiates a search for alternative control measures (Prabhu *et al*., 2011). Many plants produce secondary components that have insect growth inhibitory activities. Besides the use of such compounds as agricultural insect pest control agents, their use in mosquito larval control is an interesting perspective (Markouk *et al*., 2000). Plant derived products are being investigated for their larvicidal prospects to the extent that more than 2000 plant species are already known to have insecticidal properties (Nazar *et al.*, 2009). The aim of the present study is to determine mosquito larvicidal potentials of extracts from leaves of *Terminalia catappa.*

II. METHODOLOGY

Larval Sampling Area

The Mosquito larvae were collected from different prospective larval breeding sites which include; stagnant ponds, domestic water containers, small water pools, broken soak away pipes, tins and used tyres, flower pots and wells within Federal Polytechnic Mubi main campus. The Collections were made with dipper, while the contents of small containers were directly transferred into collecting vessels (Kiseleu *et al*., 2007)

Identification and Rearing of the Larvae

The collected larvae were transported to the laboratory and subsequently sorted. They were further identified to species level using the keys of Evans (1983) and illustrations of (Harrison, 2005). The larvae for each species identified was sorted and counted. After counting, larvae of same species were each combined in the same labeled beakers containing 0.5 liters of breeding site water respectively.

Collection and Identification of Plant Materials

Leaves of *Taminalia catappa* was collected from fruiting trees within the main campus of Federal Polytechnic Mubi, Adamawa, Nigeria, during the months of April to June (raining season). The leaves were taken to the herbarium unit of the Department of Biological Sciences of the Polytechnic for Identification and were assigned voucher numbers.

Preparation of Plant Extracts

The leave samples of the plant were dried using cabinet dryer set at 40^0C for one hour. The dried leaves were pulverized into fine powder using pestle and mortar and stored in separate labeled polythene bags prior to extraction.

Extraction of Plant Materials

Soxhlet extraction method using petroleum ether (60^0C-80^0C) as solvent was used to extract each of the powders already prepared.

Formulation of Concentration

Four (4) varying concentrations were prepared in accordance with Finney (1971) protocol using dilution formula to test the larvicidal activity.

Larvicidal bioassay

Larvicidal activity of the plant extracts was tested against 4th instar larvae of *Aedes aegyti* and *Culex quinquefasciatus* mosquito collected within the sample area.

Determination of Lethal Concentration (LC50) of Leaf Extract against Mosquito Larvae

The LC50 for each extract under laboratory and outdoor conditions was computed by transforming the various concentrations.

Statistical Analysis of Data

Data obtained from the study was analyzed using Percentage mortality of the larvae in the different doses of the leave extracts was determined. Treatment mortality means were compared using Analysis of Variance (ANOVA). Probit analysis of mortality data were done to determine the median lethal concentrations (LC50) of the extracts against the treated mosquito species after 48 hours of treatment (Finney, 1971). Logarithms of the concentrations of extracts used was plotted against the empirical probit of the killed larvae to obtain regression equations and coefficients of determination (R2) for the extract type against each mosquito species.

Table 1. Lavicidal activity of *Taminalia catappa* Extract on *Aedes* larvae.

Concentration of Extract (mg/ml)	Percentage of Mortality (%)	Logarithm of Concentration	Empirical Probit of Mortality
3.0	78.7	0.48	5.81
2.0	73.3	0.30	5.61
1.0	61.1	0.00	5.28
0.5	49.6	-0.30	5.00

$Y=1.042x+5.299$, $R^2=0.998$, $LC_{50}=0.516$

Table 2. Lavicidal activity of *Taminalia catappa* Extract on *Culex quinquefasciatus* larvae

Concentration of Extract (mg/ml)	Percentage of Mortality (%)	Logarithm of Concentration	Empirical Probit of Mortality
3.0	84.0	0.48	5.99
2.0	74.9	0.30	5.67
1.0	64.8	0.00	5.39
0.5	52.3	-0.30	5.05

$Y=1.159x+5.385$, $R^2=0.986$, $LC_{50}=0.465$

III. Results

The larvicidal activity of *Taminalia catappa* extracts *on Aedes aegyti* is presented in table 1. The plant extract displayed a very high potency with an LC_{50} value of 0.516mg/ml. probit analysis of the results revealed that *T. catappa* extracts eliminated 78.7% of *Aedes aegyti* larvae at a concentration of 3.0mg/ml. it was further observed that mortality rates subsequently decreased with concentration to 73.3%(2.0 mg/ml), 61.1%(1.0mg/ml) and 49.6 (0.5mg/ml) respectively. The results obtained in table 2 shows that Median Lethal Concentration of LC_{50} value of *T. catappa* was 0.465mg/ml, this means that comparably the plant extract is more effective against *Culex quinquefasciatus* than *Aedes aegyti* larvae. Similarly, the probit analysis revealed that percentage mortalities induced by *T. catappa* on *Culex quinquefasciatus* were also dose dependent. Mortality rate was highest at the concentration of 3.0mg/ml (84.0%), followed by 2.0mg/ml (74.9), 1.0mg/ml (64.8) and the least was 0.0mg/ml (52.3).

IV. Discussion

Malaria vector resistances to the four commonly used insecticides have been reported in 28 countries (WHO, 2020). Therefore, there is an urgent need to search for more effective alternatives. *T. catappa* is an important deciduous plant with so many medicinal, culinary and ornamental uses. The plant is known to contain high amount of Tanins in most of its parts. Medicinally it has been reported to be effective in treating dysentery, jaundice, yaws, absences, leprosy, diabetes etc. In this present study the petroleum ether leave extracts of *T. catappa* was found to be lethal against the larvae of *Aedes aegyti* and *Culex quiquefasciatus*. This is similar with the findings of Dawudu (2016), who reported that extracts of *T. catappa* seed oil caused 81% and 99% mortality on *Aedes aegyti* and *Culex quinquefasciatus* larvae respectively. Redo *et al*, (2019) also reported that water-ethanol extract of leaves of the same plant recorded 96.67% mortality rate on *Aedes aegyti* larvae at a concentration of 2000ppm. These findings are also in partial agreement with that of Geetha (2014), who reported that ethanol extract of *T. catappa* had the highest larvicidal activity on *Aedes aegyti* 3rd instar larva when compared to acetone and aqueous extracts respectively. In this present study larvicidal activity of the plant extract on both mosquito larvae species were observed to increase with concentration, which is in conformity with the findings of Dawudu (2016), Redo *et al* (2019) and Geetha (2014). In a related study conducted by Yakubu *et al* (2021), petroleum ether extracts of leaves of *Calotropis procera* caused 75.1% and 90% mortality on mosquito larvae on *Aedes agypti* and *Culex quiquefasciatus* at 3mg/ml concentration respectively. In this present study, *Culex quiquefasciatus* was found to be more susceptible than *Aedes agypti* to *T. catappa* leaves extract, which is in conformity with the findings of Singh *et al* (2005).

V. Conclusion

T. catappa leaves extract has proven to be lethal against mosquito larvae of *Aedes agypti* and *Culex quiquefasciatus species.* Therefore, it will make a good substitute for the common insecticides that have been reported to experience mosquito-vector resistance in endemic regions.

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