

Available online at [GSC Online Press Directory](http://www.gsonlinepress.com)

GSC Biological and Pharmaceutical Sciences

e-ISSN: 2581-3250, CODEN (USA): GBPSC2

Journal homepage: <https://www.gsonlinepress.com/journals/gscbps>

(RESEARCH ARTICLE)



Larvicidal activity of *Ageratum conyzoides* L. extracts on *Anopheles gambiae* complex

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Publication history: Received on 06 April 2018; revised on 26 May 2018; accepted on 28 May 2018

Article DOI: <https://doi.org/10.30574/gscbps.2018.3.3.0027>

Abstract

Larviciding is a useful approach in the control of *Anopheles* species the vector for Plasmodium and the extensive uses of synthetic organic insecticides during the past decades have resulted into environmental pollution and development of physiological resistance in major vector species, the search for compounds that are ecofriendly with improved mode of action is an area of study. The larvicidal potentials of leave, flower, stem and root of *Ageratum conyzoides* (goat weed plant) extracts against 3rd- 4th instar larvae of *Anopheles gambiae* complex was investigated. The n-hexane, ethyl-acetate and methanol Fractions of the different plant parts were obtained using Soxlet technique. These extracts were tested against 3rd- 4th instar larvae of *A. gambiae* complex with different concentrations in increasing order 100 ppm-500 ppm Using WHO procedure with slight modification. To observe the larvicidal efficacy, extracts of different plant parts were mixed at different concentration; four replications each with a control were set. The 24 hr. and 48 hr. LC₅₀ values of individual Plant part extracts were determine using Probit analysis. All the plant parts after 24 hr. showed moderate toxic effect on the larvae with relatively moderate LC₅₀ of leaf, 423.520 ppm (Methanol), and the lowest LC₅₀ in leaf (n-hexane) 627.904 ppm respectively. Highest LC₅₀ at 48 hr. were found in leaf extracts with LC₅₀ of 53.742 ppm (Methanol), 73.524 ppm (ethyl-acetate), and stem (n-hexane) were found to be least effective with LC₅₀ of 149.875 ppm respectively. The results demonstrate that plant extracts may serve as larvicidal agent in insect vector control and further research need to be done on the mode of the action of this plant extract.

Keywords: Larvicidal; Methanol; *Ageratum conyzoides*; *Anopheles gambiae* complex

1. Introduction

Mosquitoes are among the vectors responsible for the spread of some of the world's deadliest diseases. Malaria a mosquito-borne infectious disease is endemic in 117 countries with some 3.2 billion people living in risk areas all over the world [1]. *Anopheles gambiae species* is the most efficient vector of human malaria in the Afrotropical Region [2]. Thus, it is commonly called the African malaria mosquito. The Integrated Vector Management amongst other strategies; larviciding as a useful approach in vector control. Larviciding is a preferred option in vector control because larvae occur in specific areas and can thus be more easily controlled [3].

According to Govindarajan *et al.*, (2011) extracts and essential oils from plants may be alternative sources of mosquito control agent, since they constitute potentially suitable bioactive compounds that are biodegradable and contain nontoxic products that are effective control agents against mosquitoes [4]. Plants have revolutionized the fields of vector control as they possess different bioactive components that may be used as general toxicants against various developmental stages of the mosquito [5].

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Ageratum conyzoides is among such medicinal plants that are effective against diseases and contain these biologically active compounds, which are effective against diseases. It is native to Central America, Southeast Asia, South China, India and West Africa. [6-7]. This study is aimed at evaluating bio efficacy of the Leaf, Stem, Root and Flower of *Ageratum conyzoides* on malaria vector.

2. Material and methods

2.1. Description of the study area

Bauchi State occupies a total land area of 49,119 km² representing about 5.3% of Nigeria's total land mass and is located between latitudes 9° 3' and 12° 3' north and longitudes 8° 50' and 11° east. Bauchi was until 1976 a province in the then North-Eastern State of Nigeria. According to the 2006 census, the State has a population of 4,653,066. Bauchi state is one of the states in the northern part of Nigeria that span two distinctive vegetation zones, namely, the Sudan savannah and the Sahel savannah.

2.2. Collection and rearing of *Anopheles gambiae*

The *Anopheles gambiae* L larvae were collected in naturally infested water bodies in and around Bauchi town; in a well labelled plastic buckets and transported to the laboratory. The larvae are fed with larval food (Horse biscuit and yeast tablets). 3rd-4th instar larvae will then be removed/ picked for larvicidal bioassay.

2.3. Collection of plant sample

The *Ageratum conyzoides* plant was collected and identified by experts from Abubakar Tafawa Balewa University Bauchi, Yelwa Campus Area.

2.4. Sample preparation and processing

The plant materials were separated into (Leaves, Flowers, Stem, and Root) and spread out on a clean surface to air-dry under shade at room temperature (27 ± 1 °C) for about one week. After air-dried, the samples were grinded into powdered form. The extracted content was then subjected to rotary evaporator until solvents (methanol, ethyl-acetate and n-hexane) were completely evaporated to get the solidified crude extracts and stored in sterilized bottles and maintained at 4 °C in a refrigerator.

2.5. Larvicidal bioassay

The larvicidal bioactivity of the different parts of *A.conyzoides* (leaves, stem, flower, and roots) Extracts on the 3rd - 4th larval forms of *Anopheles gambiae* s.l were evaluated as per the method recommended by(WHO, 2005)separately. Larval mortality was recorded after 24 and 48 hours in each of the treatments and the control mortality were corrected using Abbott's formula [8] when it ranged between 5 – 20% as follows:

$$\% \text{ mortality} = \frac{\text{no. of dead larval}}{\text{no. of larvae introduced}} \times 100$$

$$\text{Corrected \% mortality} = \frac{\% \text{ mortality in treated} - \% \text{ mortality in control}}{100 - \% \text{ mortality in control}}$$

Five replicates were set up for each concentration and an equal number of control were set up simultaneously using distilled water with 1ml acetone.

3. Results

3.1. Mortality rate against log concentration of plant part extracts

Figure 1- 4 shows a graphical representation of mortality rate at 24 and 48 hours against log concentration of plant part extracts of *Ageratum conyzoides* using methanol, ethyl- acetate and n-hexane solvents on *A. gambiae* s.l

Probit analysis at 24 hours, leaf extracts of methanol had high efficacy at 423.52 ppm, followed by ethyl-acetate at 460.41 ppm and n-hexane at 627.90 ppm. However, at 48 hours showed leaf extract of methanol having high efficacy at 53.74 ppm compared to ethyl-acetate and n-hexane at 73.524 ppm and 128.51 ppm respectively.

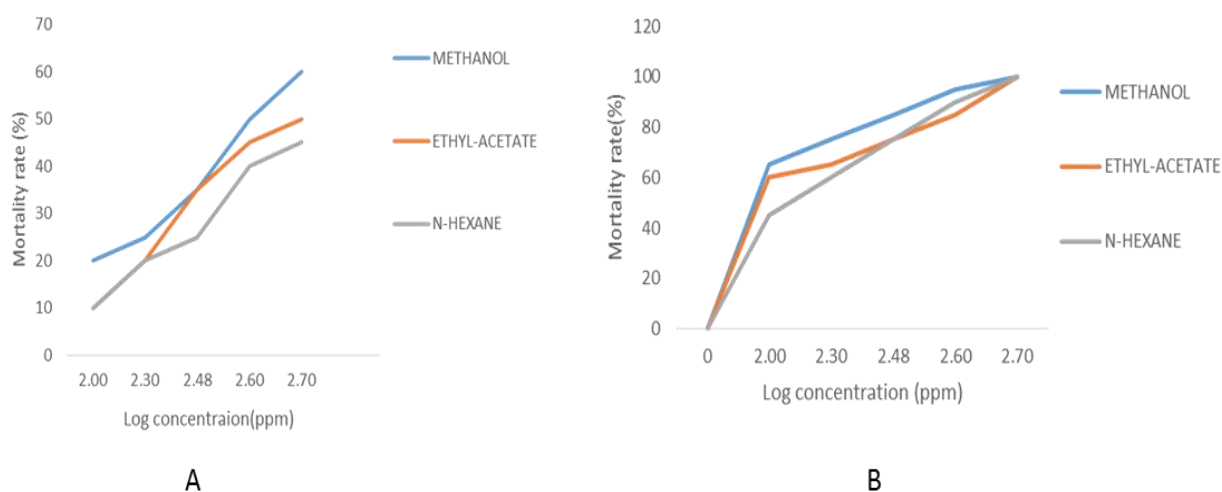


Figure 1 Mortality rate against log concentration of treatments of leaf extract using methanol, ethyl-acetate and n-hexane solvent at A- 24 hours, B- 48 hours

Probit analysis at 24 hours, flower extracts of methanol had high efficacy at 487.33 ppm, followed by ethyl-acetate at 512.01 ppm and n-hexane at 617.10 ppm. However, at 48 hours showed flower extract of ethyl-acetate having high efficacy at 116.92 ppm compared to n-hexane and methanol at 126.95 ppm and 130.97 ppm respectively. Flower extracts of ethyl-acetate at 48 hours had more efficacy than other solvents.

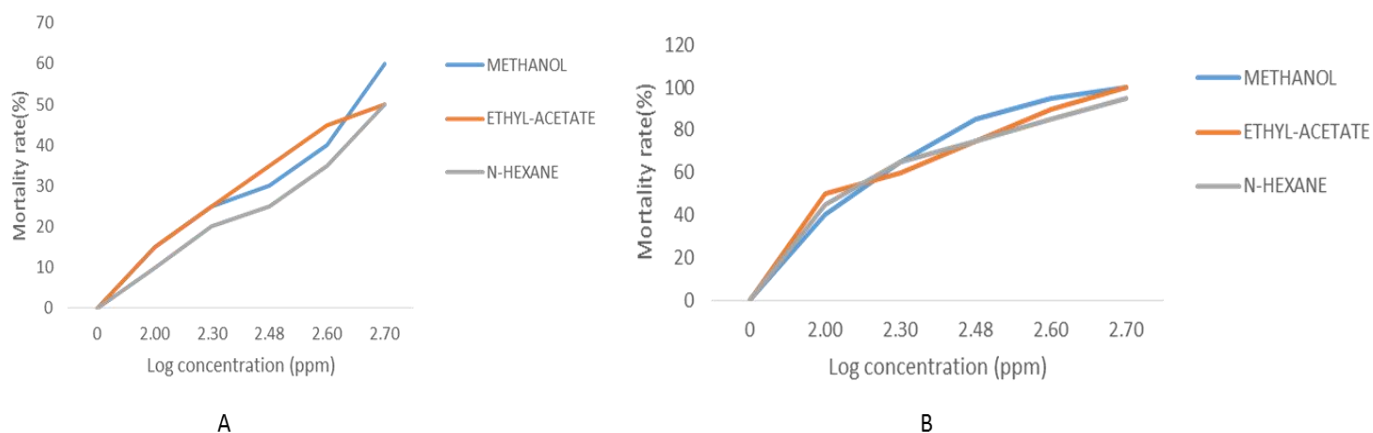


Figure 2 Mortality rate against log concentration of treatments of flower extract using methanol, ethyl-acetate and n-hexane solvent at A- 24 hours, B- 48 hours

Probit analysis at 24 hours, root extracts of methanol had high efficacy at 414.25 ppm, followed by ethyl-acetate at 460.41 ppm and n-hexane at 590.20 ppm. However, at 48 hours showed root extract of n-hexane having high efficacy at 126.80 ppm compared to methanol and ethyl-acetate at 150.15 ppm and 151.27 ppm respectively. Root extracts of n-hexane at 48 hours had the highest efficacy on *Anopheles gambiae* complex.

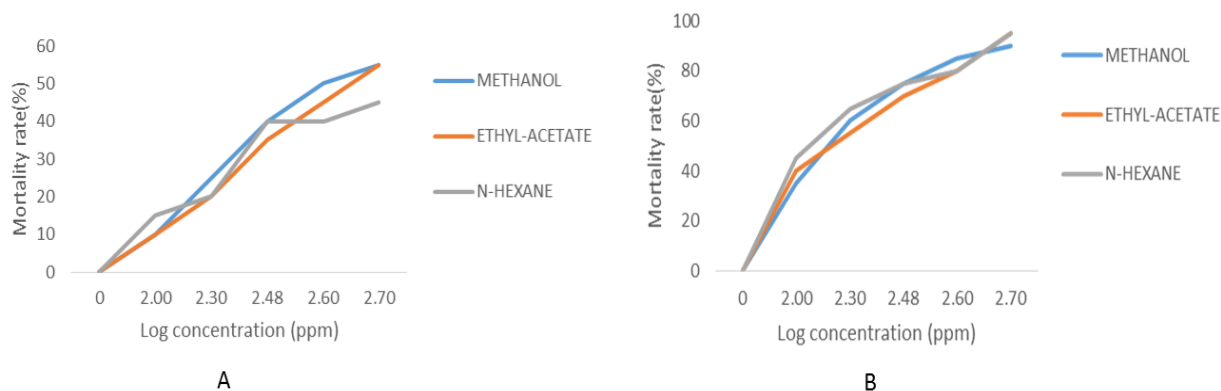


Figure 3 Mortality rate against log concentration of treatments of root extract using methanol, ethyl-acetate and n-hexane solvent at A- 24 hours, B- 48 hours

Probit analysis at 24 hours, stem extracts of methanol had high efficacy at 470.90 ppm, followed by n-hexane at 503.00 ppm and ethyl-acetate at 552.35 ppm. However, at 48 hours showed stem extract of methanol having high efficacy at 106.74 ppm compared to n-hexane and ethyl-acetate at 149.88 ppm and 153.66 ppm respectively. Stem extracts of methanol at 48 hours had the highest efficacy, followed by n-hexane and ethyl-acetate.

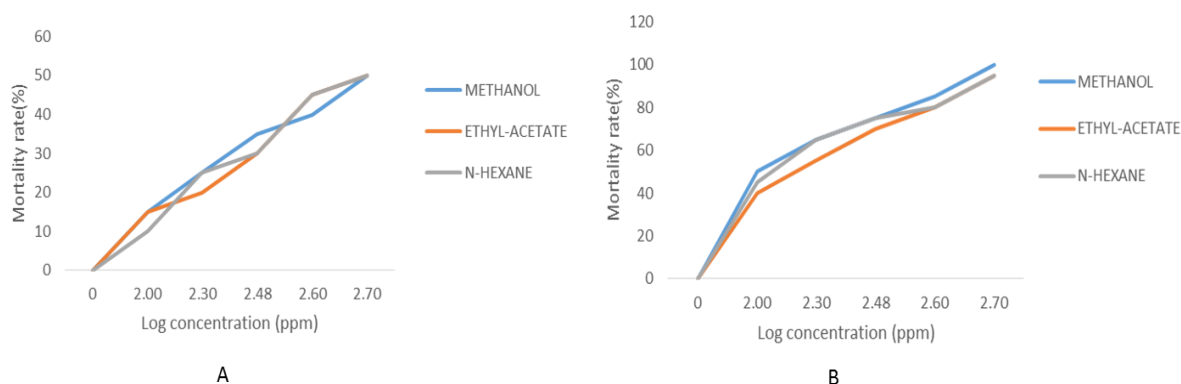


Figure 4 Mortality rate against log concentration of treatments of stem extract using methanol, ethyl-acetate and n-hexane solvent at A- 24 hours, B- 48 hours

Leaf extract using methanol and ethyl- acetate solvent at 48 hours had the highest mortality rate at 53.74 ppm and 73.524 ppm respectively compared to other plant parts of *Ageratum conyzoides*. This could be as a result of the weak polarity of methanol and ethyl-acetate solvent; making it more miscible and given rise to more yield than n-hexane. The effectiveness of the flower extract of *Ageratum conyzoides* on the larvae of *Anopheles gambiae* s.l could be attributed to the presence of active ingredients of the plant parts like chromene which agrees with Usman et al., (2013) on the chemical constituents of flower oil of *Ageratum conyzoides* growing in Nigeria [9]. Leaf extract of *A. conyzoides* can be utilized as a highly potential and eco-friendly larvicide for controlling important species of mosquitoes *Anopheles gambiae* s.l as recommended by [10].

4. Conclusion

The present study evaluates the bioactivity of *Ageratum conyzoides* against Adult, third and fourth instar larvae of *Anopheles gambiae*. As a biocontrol approach in malaria vector control. Plant materials have advantages over broad-spectrum conventional insecticides. It targets insects and closely related organisms, equally effective in very small quantities, decomposed quickly, and provide residue free food and are safe to environment.

Compliance with ethical standards

Acknowledgments

We wish to thank laboratory staffs of Department of Biological Sciences for their contribution to the success of this research.

Disclosure of conflict of interest

There's no what so ever any conflict of interest we are giving the outfit full right to publication of this work.

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How to cite this article

Hussaini, S, Alhassan, AB, Panda SM and Omar AA. (2018). Larvicidal activity of *Ageratum conyzoides* L. extracts on *Anopheles gambiae* complex. GSC Biological and Pharmaceutical Sciences, 3(3), 01-05.
