

Larvicidal Activity of Some Medicinal Plant Crude Aqueous Extracts Against the Bancroftian Filariasis Vector, *Culex quinquefasciatus*

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Abstract

Original Research Article

Aqueous extracts of dried *Conyza aegyptiaca* (Asteraceae) aerial parts, *Morettia phillaeana* (Del.) DC. (Brassicaceae) aerial parts, *Acacia mellifera* (Vahl.) Benth. (Mimosaceae) stem bark and *Fagonia cretica* L. (Zygophyllaceae) aerial parts were tested for larvicidal activity against the third instar larvae of the mosquito *Culex quinquefasciatus* Say. Extracts of *C. aegyptiaca* (LC₅₀ = 1.55 mg/ml), *M. phillaeana* (LC₅₀ = 5.50 mg/ml), *A. mellifera* (LC₅₀ = 4.79 mg/ml) and *F. cretica* (LC₅₀ = 13.80 mg/ml) were all promising as larvicides.

Keywords: *Culex quinquefasciatus*, larvicide, medicinal plants, Sudan.

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INTRODUCTION

The selective pressure of conventional insecticides is enhancing resistance of mosquito populations at an alarming rate [1], increasing the demand for new products that are environmentally safe, target-specific and degradable. Although several plants have been reported for mosquitocidal activity, only new botanicals have moved from the laboratory to field use, because they are poorly characterized, in most cases active components are not determined and most of the works are restricted to preliminary screening.

Recently, the discovery of insecticide activity of phototoxins present in Asteraceae species has stimulated the interest in this plant family as part of the search for new plant derived insecticides [2].

The interest in the study of medicinal plants as a source of biologically active compounds has increased worldwide. In Sudan, extracts from several plants, including *Acacia nilotica*, *Azadirachta indica*, *Balanites aegyptiaca*, *Calotropis procera*, *Citrullus colocynthis*, *Euphorbia acalyphoides*, *Gardenia lutea*, *Solanum incanum* and *Solenostemma argel* show a potential activity against the mosquito larvae *C. quinquefasciatus* [3- 6].

The objective of the present study was to evaluate larvicidal activity of selected Sudanese medicinal plants against mosquito larvae of

C. quinquefasciatus, the vector of Bancroftian filariasis in Sudan.

MATERIALS AND METHODS

Plant material

Conyza aegyptiaca (Asteraceae) aerial parts, *Morettia phillaeana* (Del.) DC. (Brassicaceae) aerial parts, *Acacia mellifera* (Vahl.) Benth. (Mimosaceae) stem bark and *Fagonia cretica* L. (Zygophyllaceae) aerial parts were collected from different localities in Omdurman South, Khartoum State, and Central Sudan and identified by one author (Prof. H.H. EL-Kamali). A voucher specimen has been deposited at Department of Botany, Faculty of Science and Technology, Omdurman Islamic University, Sudan. After collection, the samples were washed with tap water and shade-dried.

For preparation of extracts, 20 g of each plant sample were separately macerated in distilled water for 24 h at room temperature (30 °C). The extracts were subsequently filtered through cotton and the volume was adjusted to 1000 ml with distilled water for a stock concentration of 20 mg/ml. Serial dilutions (20 mg/ml to 1.5 mg/ml) were made from the stock solution. Tap water without extract was used as a control solution.

Test organisms

Larvae of the mosquito *Culex quinquefasciatus* Say were collected from breeding sites on the University Campus in AL-Fettaehab, South Omdurman. After

pipetting all larvae into a Petri dish, those larvae with late three instar characteristics were separated from the collection by examining under a binocular microscope. After separation, 25 of the larvae were released into 500 ml beakers containing 250 ml of the test or control solution [6].

Bioassays and larval mortality

Mortality counts of larvae were made after 24 h of treatment in the test solution. Larvae were considered dead if they settled and remained motionless at the bottom of the test beaker, did not respond to either light stimulation or mechanical stimulation (taps on the beaker with a pencil), and did not recover life functions if washed and transferred to a control water solution. The

lethal concentrations: LC_{50} and LC_{90} values were calculated following the method of Finney, 1971.

Mortality was determined according to Abbot s, (1925) formula:

$$\frac{\text{Treatment mortality \%} - \text{Control mortality \%}}{100 - \text{Mortality \% control}}$$

RESULTS AND DISCUSSION

The lethality of *Conyza aegyptiaca* aerial parts, *Morettia phillaeana* (Del.) DC. aerial parts, *Acacia mellifera* (Vahl.) Benth. stem bark and *Fagonia cretica* L. aerial parts on mosquito larvae at different concentrations under laboratory conditions are presented in Tables 1-5 and Figures 1-2.

Table-1: The lethality of *Conyza aegyptiaca* extracts on mosquito larvae

Concentration (mg/ml)	Mortality (%)	Log concentration (X)	Probit (Y)
20	100	1.30	7.33
10	96	1.0	6.75
7	93	0.85	6.48
6	83	0.78	5.95
5	73	0.70	5.61
2.5	63	0.40	5.33
1.5	60	0.18	5.25

Table-2: The lethality of *Morettia phillaeana* extracts on mosquito larvae

Concentration (mg/ml)	Mortality (%)	Log concentration (X)	Probit (Y)
20	96	1.30	6.75
10	70	1.0	5.52
7	56	0.85	5.15
6	43	0.78	4.82
5	30	0.70	4.48
2.5	26	0.40	4.36
1.5	13	0.18	3.87

Table-3: The lethality of *Fagonia cretica* extracts on mosquito larvae

Concentration (mg/ml)	Mortality (%)	Log concentration (X)	Probit (Y)
20	66	1.30	5.41
10	36	1.0	4.64
7	30	0.85	4.48
6	26	0.78	4.36
5	26	0.70	4.36
2.5	13	0.40	3.87
1.5	10	0.18	3.72

Table-4: The lethality of *Acacia mellifera* extracts on mosquito larvae

Concentration (mg/ml)	Mortality (%)	Log concentration (X)	Probit (Y)
20	93	1.30	6.48
10	70	1.0	5.52
7	63	0.85	5.33
6	56	0.78	5.15
5	46	0.70	4.90
2.5	30	0.40	4.48
1.5	16	0.18	4.01

Table-5: Lethal concentration of studied plants

Plant	Lethal concentration (mg/ml)	
	LC ₅₀	LC ₉₀
<i>Conyza aegyptiaca</i>	1.55	6.76
<i>Morettia phillaeana</i>	5.50	18.62
<i>Acacia mellifera</i>	4.79	19.50
<i>Fagonia cretica</i>	13.80	30.90

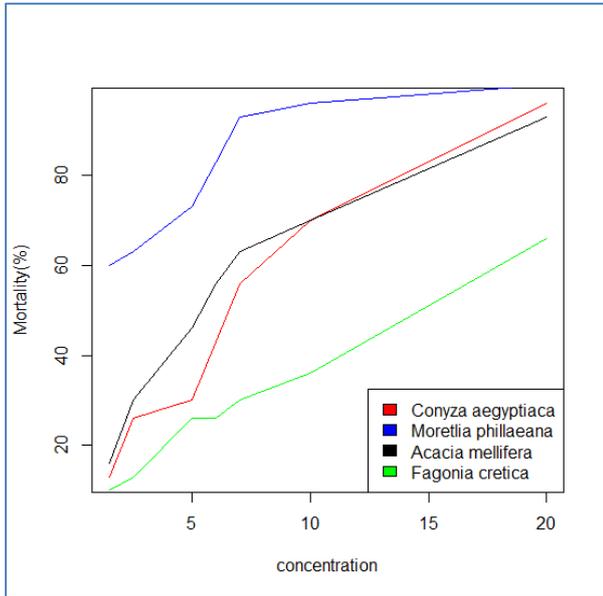


Fig-1: Dose response relationship for selected plant aqueous crude extract applied for 24 hours on *Culex quinquefasciatus* Say

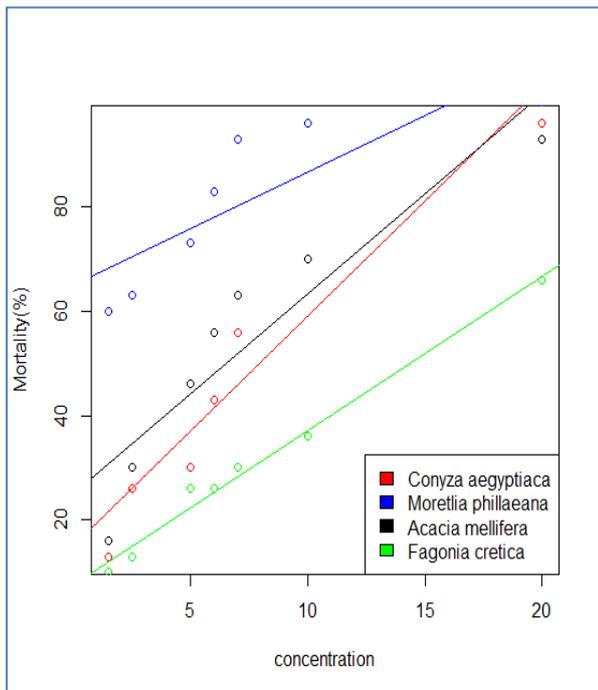


Fig-2: Probit mortality regression index of third instar of *Culex quinquefasciatus* after treatment with crude aqueous extracts

The toxicity data indicate that the crude aqueous extracts of these plants has high larvicidal activity. Based on the percentage of mortality demonstrated by the mosquito larvae, the lethality of the investigated plant species can broadly classified as highly toxic and moderately toxic. The first category (highly toxic: a dose of < 1.5 mg/ml to effect 50 % larval mortality) on *C.aegyptiaca*. The second category (moderately toxic: a dose of > 6 mg/ml to effect 50 % larval mortality) on *M.phillaeana* and a dose of > 10 mg/ml to effect 50 % larval mortality on *Fagonia cretica*. The observed toxicities were also found to be concentration dependent.

Saponins are freely soluble in water and they work by interacting with the cuticle membrane of the larvae, ultimately disarranging the membrane, probable reason for larval death [7]. All investigated plants in this work were contains saponins [8, 6, 9, 10]. Wiesman and Chapagin [1] reported that saponin extracted from *Balanites aegyptiaca* showed 100% mortality against larvae of *Culex pipiens*. The larvicidal property of saponin isolated from *Cestrum diurnum* was also evaluated against *Anopheles stephensi* mosquito by Gosh and Chandra [12]. EL-Kamali [6] reported that crude aqueous extracts of dried fruit pericarp, flowers, root and stem of *Solenostemma argel*, Sudanese herb rich with saponins, were showed larvicidal activity against *Culex quinquefasciatus*. Isoflavonoids from tubers of *Neoeautanenia mitis* had a larvicidal effect against the malarial transmitting mosquitoes, *Anopheles gambiae* and *Culex quinquefasciatus*, respectively [13]. Studies with caraway, celery, fennel, mullilam and zedoary essential oils suggested that they are a biocontrol agent against mosquito vectors [14].

Our results relate to crude plant extracts and not to the purified active components, which, when isolated, would be expected to show much lower LC₅₀ values than those reported here for the extracts. Identification of the active components for the larvicidal activity against *Culex quinquefasciatus* will be an important next step in the development of a verifiable application of these materials for the field control of the insect vector.

CONCLUSION

In conclusion, *Conyza aegyptiaca* offers promised as a potential biocontrol agent against *Culex quinquefasciatus* larvae.

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