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Phytochemical Screening and Larvicidal Activity of *Croton hirtus* L'Her Leaves against *Culex quinquefasciatus* Say

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Abstract: ***Mosquitoes, the public enemy number one transmit malaria, filariasis, dengue fever, Japanese encephalitis, yellow fever, chikun guniya etc. The control of mosquito at the larval stage is necessary and efficient in integrated mosquito management. To reduce the environment pollution and the development of resistance, plant products were used as an alternative for chemical insecticides. The present study aims to evaluate the larvicidal efficacy of Croton hirtus L'Her against Culex quinquefasciatus Say. Acetone and methanol extracts were used for the bio assay against 3rd instar larvae of Cx. quinquefasciaus and the LC_{50} values were 49.81 and 57.32 respectively. Phytochemical screening reveals the presence of alkaloids, tannins, flavonoids, steroids, phenols, glycosides, terpenoids, anthroquinone and saponins Hence, it is a potential and ecofriendly approach for the control of mosquitoes.***

Keywords: Mosquitoes, larvicidal bioassay, *Croton hirtus* L'Her., phytochemicals

1. Introduction

The control of mosquito at the larval stage is necessary and efficient in integrated mosquito management [1]. Excessive application of synthetic organochlorides, organophophates and carbamates has resulted in the selection of genetically resistant mosquitoes in the environment [2]. From the socio-ecological point of view, the environmental safety of an insecticide is a paramount importance Plant products have been used traditionally by human communities. Mosquito larvicides from plant origin have been reported to overcome the environmental hazards associated with using synthetic chemicals in mosquito control programmes [3].

Extracts or essential oils from plants may be alternatives for mosquito control agents as they constitute a rich source of bioactive compounds that are biodegradable into non-toxic products and potentially suitable for use in the control of mosquito larvae. In fact, many researchers have reported on the effectiveness of plant extracts or essential oils against mosquito larvae [4].

The present study aims to find out the larvicidal and adulticidal properties of leaf extracts of *Croton hirtus* L'Her. The phyto-chemical screening was conducted to identify the components present in the plant extract.

2. Materials and Methods

The leaves of the selected weed plant were collected from in and around the Calicut University Campus and were identified from the Department of Botany, University of Calicut.

Croton hirtus L'Her. is a common annual weed belongs to the family Euphorbiaceae. It is commonly known as Hairy croton in English. Croton oil has been used in traditional Chinese medicine to treat severe constipation, since the seed of the plant can cause diarrhea. It is a source of the organic compound phorbol and its tumor-promoting esters such as 12-0-tetradecanoyl phorbol-13-acetate. In the Amazon the red latex from the species *Croton lechleri*, known as sangre de Drago (Dragon's blood) is used as a "liquid bandage," as well for other medicinal purposes, by native peoples.
Fresh leaves of selected plants were thoroughly washed with water and shade dried at the room temperature. The dried materials were powdered using a mixer grinder and sieved through a fine mesh. The extracts were taken using different solvents such as acetone and methanol.

Bioassay: were conducted using the third instar larvae of *Cx. quinquefasciatus* belongs to the family Culicidae and order Diptera according to WHO protocol [5] and % mortality were calculated using Abbots formula [6] and lethal concentration were calculated using the probit analysis developed by Finney [7] .

Phytochemical analysis: Qualitative analysis was done to identify the presence of different secondary metabolites in the leaf extracts of *C. hirtus* according to the methods proposed by Trease and Evans [8].

3. Results and Discussion

Vector control is facing a threat due to the emergence of resistance in vector mosquitoes to conventional synthetic insecticides. Botanical insecticides may serve as suitable alternative to synthetic insecticides in future as they are relatively safe and easily degradable. To find new model of action and to develop active agents based on natural plant products, efforts are being made to test selected ethno botanicals possessing insecticidal activity.

Table 1: Physico-chemical characterization of the different extracts of *C. hirtus*

S. No.	Solvent	Yield (%)	Color	Consistency
1	Acetone	24.5	Greenish brown	Powder
2	Methanol	22	Greenish brown	Powder

The % yield for acetone extract was 24.5 and that for methanol was 22. In both extracts the color was greenish brown and it appeared in powder form. The extracts completely dissolve in water.

Table 2: 24, 48 & 72 hour LC_{50} (ppm) values of the different extracts of *C. hirtus* against III instar of *Cx. quinquefasciatus*

S. No.	Solvent	LC_{50} (Lower limit- Upper limit)		
		24hr	48hr	72hr
1	Acetone	49.81 (24.8 – 65.1)	35.06 (24.43- 43.65)	29.76 (16.57-38.16)
2	Methanol	57.32 (34.7 – 77.9)	40.95 (35.59-48.36)	32.98 (28.31-35.34)

C. hirtus acetone extracts shows more activity than methanol extracts. The larvicidal activity increases with the concentration and time of exposure in every case. The 72 hour LC_{50} value is less as compared with the 24 hour LC_{50} value and in every reaction. The control did not show any mortality. As the concentration and time of exposure increases the activity also increases.

Table 3: Phyto-chemicals present in the different extracts of *C. hirtus*

Sl. No.	Tests	Acetone	Methanol
1)	Alkaloids	-	+
2)	Tannins	+	+
3)	Flavonoids	+	+
4)	Steroids	+	+
5)	Phenols	+	+
6)	Glycosides	+	+
7)	Terpenoids	+	-
8)	Anthroquinones	-	+
9)	Saponins	-	-
+ sign represents presence and - sign represents absence			

The screening of acetone extracts of *C. hirtus* showed presence of constituents like tannins, flavonoids, steroids, phenols, glycosides and terpenoids. Alkaloids, tannins, flavonoids, steroids, phenols, glycosides and anthroquinones were present in methanol extract.

The findings here reveals that *C. hirtus* is significantly efficacious as larvicides. *Culex* larvae mortality increased significantly as the concentration of *Croton* extract and exposure period increased.

Croton have been documented in other studies to be highly effective and potent against all species mosquitoes at different developmental stages in general [9,10,11]. In the present study the acetone extracts shows higher activity as compared with methanol extracts. This could be due to the presence of alkaloid which is in high abundance in the Croton leaves. The active phytochemicals present in the leaves of *C. hirtus* may be he rason for its more activity against mosquitoes. Studies have shown the leaves and shoots of Croton to be rich in alkaloids, cardiac glycosides, saponins, tannins, cardenolides, flavenoids, steroids and phyllates [12].

The results obtained from the present study showed that acetone extract of *C. hirtus* has good larvicidal properties and may serve as an alternative to synthetic insecticides in the control of *Culex* mosquito. Phytochemicals are environmentally friendly, species specific, readily available and hence could serve as a more favourable option in the control of mosquitoes from our environment [13]. While this plant is using for medicinal and nutritional purposes it has no side effect on human beings or non target organisms. Further purification and isolation of compounds from this plant will serve as suitable and promising larvicidal agent.

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