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Lagenaria Siceraria as a Natural Mosquito Repellant

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Abstract

Lagenaria siceraria (Molina) Standley (Family: Cucurbitaceae) are commonly known as Bottle gourd, an excellent fruit in the nature having composition of all the essential constituents that are required for normal and good health of humans. The present study had truly proved that botanical origin have the potential to be used successfully as larvicides. The larvicidal activity of crude methonal and petroleum ether extracts of *L. siceraria* fruit, which were assayed for their toxicity against the larvae of *Culex quinquefasciatus* (Dipteria: Culicidae). The Larval mortality was observed after 24h exposure and highest larval mortality was found in petroleum ether fruit extract as compare to methonal fruit extract of *L. siceraria*. In the present study linoleic acids were identified with the help of HPTLC method, which is used as mosquito larvicidal compounds.

Keywords: *Lagenaria siceraria,* petroleum ether extracts, *Culex quinquefasciatus,* linoleic acids, larvicides

Introduction

Mosquitoes may be nature's most effective bioterrorist because they transmit some of the world's most life threatening and debilitating parasitic and viral diseases including malaria (*Anopheles*) Filariasis (*Culex, Manosonia* and some *Anopheles* sp.) and dengue and chickungunya fever (principally *Aedes aegypti*) (Jebanesan 2007). Most people dislike mosquitoes and are aware of the diseases and discomfort that they cause. Chemical controls are typically very effective against mosquitoes. However if the same chemicals are used against many generations of mosquitoes over a large area, the mosquitoes have genes that make them less sensitive to the toxin (Lawler and Lanzaro 2005). Mosquito borne diseases have an economic impact, including loss in commercial and labor outputs, particularly in countries with tropical and subtropical climates; however, no part of the world is free from vector-borne diseases (Fradin and Day 2002).

Mosquitoes are the most important single group of insects in terms of public health importance, which transmit a number of diseases, such as malaria, filarasis, dengue, Japanese

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encephalitis, etc. causing millions of deaths every year. *Aedes aegypti*, a vector of dengue is widely distributed in the tropical and subtropical zones. Dengue fever incidence has increased fourfold since 1970 and nearly half the worlds population is now at risk. In 1990, almost 30% of the world population, 1.5 billion people, lived in regions where the estimated risk of dengue transmission was greater than 50% (Hales *et al.* 2002). *Anopheles stephensi* is the major malaria vectors in India. With an annual incidence of 300-500 million; malaria is still one of the most important communicable diseases. Currently about 40% of the world's population lives in areas where malaria is endemic (Wernsdorfer and Wernsdorfer 2003). *Culex quinquefasciatus* a vector of lymphatic filariasis and its widely distributed tropical diseases with around 120 million people infected worldwide and 44 million people have common chronic manifestation (Bernhard *et al*. 2003). Use of chemical agent however results in environmental degradation in addition to accumulation of toxicants as residual deposits in non-target species.

Natural products' of plant origin with insecticidal properties have been tried in the resent past for control of variety of insects pest and vectors. Plants are considered as a rich source of bioactive chemicals (Wink 1993) and they may be an alternative source of mosquito control agents. Natural products are generally preferred because of their less harmful nature to non-target organisms and due to their innate biodegradability.

Botanicals offer an advantage over synthetic pesticides as they are less toxic, less prone to the development of resistance and easily biodegradable. Some of the plant species may possesses substances with a wide range of activities like anti-feedant, anti-oviposition, repellent and growth regulating activity (Schmutterer1990). Beerenbaum(1989) envisaged over 20,000 species of North America plant especially belonging to Rutaceae, Solanaceae, Verbinaceae, and Cucurbitaceae as having potential insecticidal activity. Various active principle have been localized in different plant which caused deleterious effect on the development stages of mosquito. In general, the solanaceous and cucurbitaceous plants are reported to contain the secondary metabolites such as solanin, cucurbitacin, and luffin which may cause the mortality of the mosquitoes (Renugadevi and Thangaraj 2006).

In the present study, the fruit of *Lagenaria siceraria* (Molina) Standley syn. *L. leucantha* Rusby; *L. Vulgaris* Ser. (Family: Cucurbitaceae) are commonly known as Bottle gourd, was selected in order to find out a new mosquitocidal compound against the mosquito *Culex*

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quinquefasciatus Say. Because of bitter taste of the fruit of *Lagenaria siceraria*, this plant fruit was used to study the larvicidal activity of mosquito *Culex quinquefasciatus* Say.

Culex is a genus of mosquito, and is important in that several species serve as vectors of important diseases, such as West Nile virus, filariasis, Japanese encephalitis, St. Louis encephalitis and avian malaria

Scientific name: *Culex quinquefasciatus* Say.

Common name: Southern house mosquito

Culex quinquefasciatus (earlier known as *Culex fatigans*) (Dipteria: Culicidae) is the vector of lymphatic filariasis caused by the nematode *Wuchereria bancrofti* in the tropics and sub tropics.

To produce natural mosquito repellant fruit of *L. siceraria* was used to show the mortality activity of Mosquito i.e. *Culex quinquefasciatus*. This Natural mosquito repellant may be less harmful to non-target organisms. The results of the present study would be useful in promoting research aiming at the development of new agent for mosquito control based on bioactive chemical compounds from indigenous plant source.

Methodology

Plant material: The fruit of *Lagenaria siceraria* (Molina) Standley (Cucurbitaceae). Collect from the Tal. Wai, Dist. Satara, State Maharashtra and identified from the Botanical survey of India, Pune, M.S., India.

Mosquito: Larvae of *Culex quinquefasciatus* Collect from the stagnant water near Chinchwad, Dist. Pune, M.S., India and identified from the Zoological Survey of India, Pune, M.S., India.

Preparation of Plant Extract: The collected fruits are peeled to separate the epicarp and immediately dried under the shade. The dried fruit (500gm) were made into fine powdered mechanically using commercial stainless steel blender and extracted with methanol (1000ml) and petroleum ether (1500ml at 60 to 80ºc) in a soxhlet apparatus separately until exhaustion. The extract was concentrated under reduced pressure 22-26 mm Hg at 45°C and the residue obtained was stored at 4°C.

Larvicidal Bioassay: Early fourth stage larvae of *C. quinquefasciatus* were used for the bioassay test. Experiment was conducted in a glass jar for 24 hrs at (28$\pm$2ºC). A total of 30 larvae were exposed in three concentrations at triplicate form of 10 larvae each. This bioassay was divided

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into three concentrations of 5ml, 10ml and 15ml, of crude extract in glass jar containing water and made the volume upto 500ml in each jar. After 24 hr the numbers of dead larvae and the percentage mortality was reported comparing with the control. The experimental media, in which 100% mortality of larvae occurs alone, were selected for isolation and purification of crude extracts. Among the crude extracts tested for larvicidal activity, petroleum ether fruit extract of *L. siceraria* showed maximum activity and it was selected for the purpose of isolation and purification of compounds by High performance thin layer chromatography method.

High Performance Thin Layer Chromatography: HPTLC techniques was followed for the qualitative analysis and confirmation of larvicidal activity present in the petroleum ether fruit extract of studied plant (Passera, *et al*, 1964).

Statistical Analysis : Data were analyzed by one-way ANOVA: Duncan Multiple Range Test (DMRT) using SPSS software Data were expressed Mean $\pm$ SE (n=3). Values followed by the same letter (a,b,c,d & e) were not significantly different at 5% level.

Results

In the present investigation fruit of *L. siceraria* was used to study the mortality of the mosquito *C. quinquefasciatus* Larvicidal Bioassay method was used, these extract was divided into two parts i.e. Methonal Fruit Extract (MFE) & Petroleum Ether Fruit Extract (PEFE) was prepared. After 24 hr the numbers of dead larvae and the percentage mortality was reported comparing with the control.

In this method effect of MFE and PEFE of *L. siceraria* against early fourth instar larvae of *C. quinquefasciatus* was recorded (Table 1). As compare to 5ml, 10ml, 15ml & control, the mortality percentage was greater in 15ml (50%). In control the mortality percentage was nil.

Comparison data was prepared between MFE and PEFE. In these comparison data MFE shows mortality percentage (50%) in 15ml as compare to PEFE shows greater mortality percentage in 10ml (76.66%) & 15ml (100%).

Thus in the present investigation PEFE shows greater mortality, to find out the chemical present in the PEFE of studied plant qualitative analysis was done with the help of High Performance Thin Layer Chromatography (HPTLC) techniques. Lenoleic acid was identified and confirmed.

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Table 1: Effect of *L. siceraria* fruit extract against early fourth instar larvae *C. quinquefasciatus*

Sr. No.	Extract concentration in 500ml vol. of water	Petroleum ether Fruit Extract (PEFE)		Methanol Fruit Extract (MFE)	
		Mortality of Larvae Mean ± SE	% Mortality	Mortality of Larvae Mean ± SE	% Mortality
1.	5ml	2.3+0.04a	23.33%	0.60+0.02a	6.66%
2.	10ml	7.6+0.03b	76.66%	2.60+0.03b	26.66%
3.	15ml	10+0.02b	100%	5.00+0.03a	50%
4.	Control	Nil	Nil	Nil	Nil

Data were analyzed by one-way ANOVA: Duncan Multiple Range Test (DMRT) using SPSS software Data of mortality were expressed by Mean ± SE (n=3). Values followed by the same letter (a,b,c,d & e) were not significantly different at 5% level.

Discussion and Conclusion

The plant-isolated compound revealed that the compound under investigation could be lenoleic acid. The physical and spectral data of the present compound were in agreement with those of the values reported in the literature (Roberts *et al*. 2006; Leon *et al*. 2004; Sun *et al*. 1994; Dilika *et al.* 2000). However HPTLC analysis with the standard lenoleic acid confirmed the identity of compounds.

MFE fruit extract showed moderate larvicidal effects however the highest larval mortality was found in PEFE. Among the crude extracts tested, the PEFE showed 100% larval mortality at 15 ml. The PEFE of *L. siceraria* may have potential to develop as natural larvicidal agent. In this context, the highly bioactive compounds of *L. siceraria* which is being grown widely in most areas of India, offer an opportunity for developing alternatives to rather expansive and environmentally hazardous organic insecticide. This plant can be used as natural mosquito repellent, which may be useful in the household to kill mosquitoes, mice, etc.

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