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Larvicidal activity of *Monstera adansonii* plant extracts against *Culex quinequefaciatus*

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Abstract
Mosquitoes transmit serious human diseases, causing millions of deaths every year and the development of resistance to chemical insecticides resulting in rebounding vectorial capacity. Controlling mosquitoes at the larval stage is easy as target specificity of the larvicide used can be ensured. Plants may be alternative source of mosquito control agents. The Present study assessed the role of larvicidal activities of methonal, chloroform, petroleum ether, (25, 50, 75, 100 mg) extracts of *Monstera adansonii* against early 4th instar larva of *Culex quinequefaciatus*. The larval mortality was observed after 12 h of exposure, The larvicidal effect of methanol and chloroform extracts was moderately less. However, the highest larval mortality rate was found in petroleum ether extract, This study indicates that *Monstera adansonii* plant possesses larvicidal activity against *Culex quinequefaciatus* and may be a possible source of mosquito larvicides.

Keywords: *Culex quinquefasciatus* larvae, *Monstera adansonii* extracts, larvicidal activity.

1. Introduction
Mosquitoes are vectors responsible for the transmission of various diseases, such as malaria, yellow fever, dengue fever and other infections. Many approaches have been developed to control mosquito menace. One such approach to prevent mosquito borne disease is by killing mosquito at larval stage. The current mosquito control approach is based on synthetic insecticides. Even though they are effective, they created many problems like insecticide resistance, pollution, toxic side effect on human begins. One of the most effective alternative approaches under the biological control programme is to explore the floral biodiversity and enter the field of using safer insecticides of biological origin as a simple and sustainable method of mosquito control. The effects of botanical derivatives against mosquito have been reviewed by (Sukumar *et al*. 1991) [1]. A wide selection of plants from herbs, shrubs and large trees were used for extraction of mosquito toxins. Phytochemicals were extracted either from the whole plant or from various parts like fruits, leaves, stem, bark, roots etc of trees.
Monstera adansonii schott. Adanson's monster, is an evergreen root climbing hemi-epiphyte. The stem, branched, cylindrical, aerial elongated axis with extended internodes, and climbing hemi epiphytes. Leaves simple, large, thick, distichous, juvenile, stricking of heteroblasty. Inflorescence in each floral sympodium. Flowers bisexual. Gynoecium obovoid to ellipsoid, prismatic, ovary 2-locular, ovules 2 per locule, anatropous, stigma oblong elliptic to linear and longitudinal or round.
Human beings have used plant products and secondary metabolites of plant origin in pest control. Since early historical time vector control has been practiced till 20th century. The present investigation assessed the larvicidal effects of *Monstera adansonii* against early 4th instar larvae of *Culex quinquefasciatus.*

2. Materials and methods
2.1 Sample Preparation
Fresh samples of the *Monstera adansonii* leaves and stem were collected in Tamil Nadu Agriculture Society, Chennai - 04, shade dried, powdered and 25 g was extracted with 100 ml of each solvent namely Petroleum Ether, Chloroform and Methanol separately and kept overnight in shaker. The extract was filtered using Whatman No.1 filter paper, the solvent evaporated and the residue redissolved.

2.2 Larvicidal Assay

In the larvicidal assay, fourth instar larvae of *Culex quinquefasciatus* were exposed to test concentrations of 25, 50, 75, 100 mg of methanol, Chloroform and petroleum ether extracts of *Monstera adansonii* in 100 ml of water. 100 ml of tap water was taken in a series of 250 ml glass beakers. The measured amount of extracts was dissolved in 1ml of the solvent. A control was also maintained by adding 1ml of solvent to 100 ml water. 25 larvae per concentration were used for all the experiments. The number of dead larvae at the end of 24 h was recorded and the mortality percentage was calculated. This experiment was repeated three times.

The phytochemical screening of plant extract for saponin, flavonoids, tannin, steroids and carbohydrates were also carried out by the standard method (Trease and Evans, 2002).

3. Results and discussion

The extracts of *M. adansonii* showed a marked inhibitory effect on the larve of mosquitoes, which was visibly noted by its movement. In the present study, the plant extracts exhibited the presence of larvicidal activity (Table 1) which was a dose dependent effect.

Table 1: Effect of *Monstera adansonii* on 4th instar larvae of *Culex quinquefasciatus*

Larvae	Extract	Concentration (mg/ml)			
		0.25	0.50	0.75	1.00
4th Instar larvae Mortality %	Methanol	10	26	88	94
	Chloroform	0	16	52	56
	Petroleum Ether	20	49	92	100

The petroleum ether and methanol extract of *Monstera adansonii* showed mortality in the 4th instar larvae of *Culex quinquefasciatus*. 0.75 and 1.00 mg/ml concentration of petroleum ether extract of *M. adansonii* showed maximum inhibitory effect on the 4th instar larvae of *C. quinquefasciatus*. Petroleum ether extracts showed 100% mortality at a concentration of 1.00 mg/ml in 4th instar larvae. Methanol extracts showed 94% mortality and chloroform extracts showed 56% mortality at a concentration of 1.00 mg/ml in 4th instar larvae. The LC50 value for petroleum ether extract was 52 mg/ml and for methanol was 64 mg/ml, while for chloroform it was 73 mg/ml.

The phytochemicals present in various extracts of *Monstera adansonii* were represented in table 2. Flavonoids, steroids, tannins, carbohydrates were present in methanol extracts. Saponins, carbohydrates, Flavonoids were present in petroleum ether extracts. Saponins and carbohydrates were present in chloroform extracts.

Mosquito borne diseases are one of the most public health problems in the developing countries. It can be controlled by preventing mosquito bite using repellent, but eradicating at the larval stage of mosquitoes is most reasonable. The effects of various extracts were studied in a dose dependent manner. The petroleum ether extracts of *Monster adenosine* were found to have higher rate of parricidal rates against *Culex quinquefasciatus* and the concentration of extracts have to be increased for better larvicidal effect.

Today, the environmental safety of an insecticide is considered to be of paramount importance. An insecticide does not have to cause high mortality on target organisms in order to be acceptable (Kabaru and Gichia, 2001) [2]. Phytochemicals may serve as suitable alternatives to synthetic insecticides in future as they are relatively safe and inexpensive and are readily available in many parts of the world. According to (Bowers *et al*, 1995) [3], the screening of locally available medicinal plants for mosquito control would generate local employment, reduce dependence on expensive imported products, and stimulate local efforts to enhance public health. Different parts of plants contain a complex of chemicals with unique biological activity [4, 5, 6, 7] which is thought to be due to toxins and secondary metabolites which act as larvicidal agent [7]. Plant based insecticides provide an alternative to synthetic insecticides because they are generally considered safe, are biodegradable, and can often be obtained from local sources [8] .

This result is also comparable to earlier reports of Singh *et al.* (2003) who observed the larvicidal activity of *Ocimum canum* oil and *Culex quinquefasciatus* and *Anopheles stephensi*. The methanol extract of *Citrus sinensis* peel and the leaf and flower ethyl acetate extracts of *Ocimum canum* were tested against the larvae of *Anopheles stephensi* respectively (Kamaraj *et al*., 2008a) [10] Karunamoorthi *et al*. (2008) [11] reported the petroleum ether extracts of the leaves of *Vitex negundo* were evaluated for larvicidal activity against larval stage of *Culex tritaeniorhynchus*.

Amer And Mehlhorn (2006a) [12] has reported that the most effective oils were those of Litsea (*Litsea cubeba*), Cajeput (*Melaleuca leucadendron*), Niaouli (*Melaleuca quinquenervia*),Violet (*Viola odorata*) and Catnip (*Nepeta cataria*), which induced a protection time of 8 h at the maximum and a 100% repellency against *Aedes aegypti*, *Anopheles stephensi*, and *Culex quinquefasciatus*. (Gopieshkhanna and Kannabiran 2007) [16] have observed the presence of carbohydrates, saponins, phytosterols, phenols, flavonoids, and tannins in the plant extract having mosquito larvicidal activity. (Pelah *et al*., 2002) [17] reported the use of commercial saponin from *Quillaja saponaria* bark as a natural larvicidal against *Aedes aegypti* and *Culex pipiens*. (Rajkumar and Jebanesan 2004) [18] studied ovicidal activity of *Moschosma polystachyum* leaf extract against *Culex quinquefasciatus* and observed 100% egg mortality at 100 ml/l.

We can conclude from this study that the presence of these phytochemical in *Monstera adansonii* might be the reason for its larvicidal activity. The results of this experiment indicate that the extract of the plant *Monstera adansonii* can be used as potential larvicides in vector control programmes as field application of these extracts can be done.

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