



## NATURAL CHEMICAL LEAF EXTRACTS OF *Calotropis*, *Lemongrass*, *Mint*, and *Marigold* AS LARVICIDE AGAINST *Culex pipines*.

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### Abstract:

Mosquitoes can transmit various diseases including malaria, filariasis, yellow fever, and dengue. However, resistance to synthetic chemicals has been increasing, so scientists are exploring the use of plant extracts as alternative sources for mosquito control agents. In this study, four different plant extracts - *Calotropis*, Lemongrass, Mint, and Marigold - were tested as potential larvicides against *Culex pipiens*. These plant extracts were applied to 4th instar mosquito larvae at different concentrations of 3ml, 6ml, and 9ml, with a control group as well, and the mortality rate was recorded after 24, 48, and 72 hours. The effectiveness of the plant extracts was determined by calculating the percentage of mortality. *Calotropis* resulted in 100% mortality, while mint resulted in 98% mortality after 72 hours of application.

### Introduction:

Mosquitoes are small flying insects that belong to the family Culicidae.

They are a diverse group of insects with over 3,500 species distributed worldwide. Mosquitoes are known to transmit various diseases, such as dengue, encephalitis, chikungunya, filariasis, yellow fever, malaria, and can cause death. Only 10% of mosquito species have medicinal and veterinary relevance (Reiter, 2001). Mosquitoes can be found in almost every habitat on earth, from tropical rainforests to arctic tundra. They play essential roles in ecosystems as pollinators and as a food source for other animals. Mosquitoes lay eggs in standing water or show little movement. The larvae and pupae of mosquitoes nourish in water and feed on either dead or living fauna present in water. *Aedes*, *Anopheles*, and *Culex* are the three blood-feeding genera that breed in stagnant water in our surroundings like tires and tree holes (Zia Ullah, 2018). It is very tough to inhibit the mosquito population as all the mosquitoes have developed resistance power against chemical insecticides, which results in the rebounding vectorial capability. The most appropriate way to control mosquitoes is to remove their breeding sites by applying environment-friendly larvicides. Larval treatment is more effective in controlling this notorious insect due to its localization and low mobility.

The use of natural products derived from plants for vector control has many attractive characteristics. These include affordability, biodegradability, lower toxicity, and broad-spectrum target-specific activities against various mosquito species. Several studies have reported the effectiveness of these natural products in controlling mosquito populations (Ghosh, 2012; Varun, 2013; Wilke & Marrelli, 2015). According to the US Centre for Disease Control and Prevention (CDC), by the end of 2012, there were nearly 250 deaths related to the West Nile virus in the United States.

Health officials strongly advise individuals to take precautions against mosquito bites. In 2012, over 5,300 cases were reported, the highest figure in nearly a decade.

There are many chemical insecticides, larvicides, and adulticides used to control mosquitoes. However, their use has harmful effects such as resurgence and resistance in insect populations, mammalian toxicity, residual effects, and non-specificity in action which can kill all insects, both beneficial and harmful. Therefore, it is important to choose an alternative option. Overuse of synthetic insecticides in agriculture and public health has resulted in many problems such as environmental pollution, toxic hazards to humans and non-target organisms. As a result, the World Health Organization (W.H.O.) has developed standards for the use and registration of bacterial and phytochemicals as alternatives to traditional insecticides. Plants contain many biochemicals which can act as insect feeding deterrents, disturb adult emergence capacities, and can be repelled by plant extracts such as *Calotropis procera*. Additionally, the pesticidal effect of *Mentha* can kill insect pests by feeding on limonoids (Zia Ullah, 2018).

## Material and methods:

### Collection of larvae

The larvae were obtained from the cultural methods.

### Plant material collection and extraction

Collection of fresh and healthy leaves and stem branches of *Calotropis*, lemongrass, mint and marigold were collected from my society and Department of zoology Isabella Thoburn college India. Leaves were washed thoroughly using tap water then dried for 1 day and the leaves were mashed and soaked into the water for 1 day, and the liquid was filtered using filter paper, the juice obtained is 100% natural extract with no added chemical/ synthetics.

### Preparation of concentration of plant extracts

The 20 *Culex pipiens* larvae were transferred into the container and three replicas were made for each leaf extract. 15 min were given to the larvae to get stable and adjust into the environment. Then in each container 3, 6, 9ml of each leaf extract were transferred with the help of dropper and the death of the larvae were counted and effectiveness of the leaf extract was noted. Control was taken in each.

To check the accuracy of results of experiment, three replicates of three different concentration were made.

### Percentage mortality of larvae

Mortality of the larvae was checked after 24, 48 and 72 hours.

### Mortality rate

No. of total tested larvae – no. of dead larvae/ no. of total tested larvae x 100

## Pictures of air-dried leaves



Marigold leaves



Calotropis leaves



**Mint leaves**



**Lemongrass leaves**

**Leaves soaked in water**



**Prepare extracts**



### Experimental set-up





## Result:

### Statistical analysis

The purpose of the present study was to manage *Culex pipiens* mosquitoes. The number of *Culex pipiens* larvae that died after exposure was recorded and shown in Table 1.

This data was then compared to a control to determine the correct mortality rate of *Culex pipiens* larvae. The second table shows the percentage of mean mortality expressed in Calotropis. Both tables were created using an Excel spreadsheet.

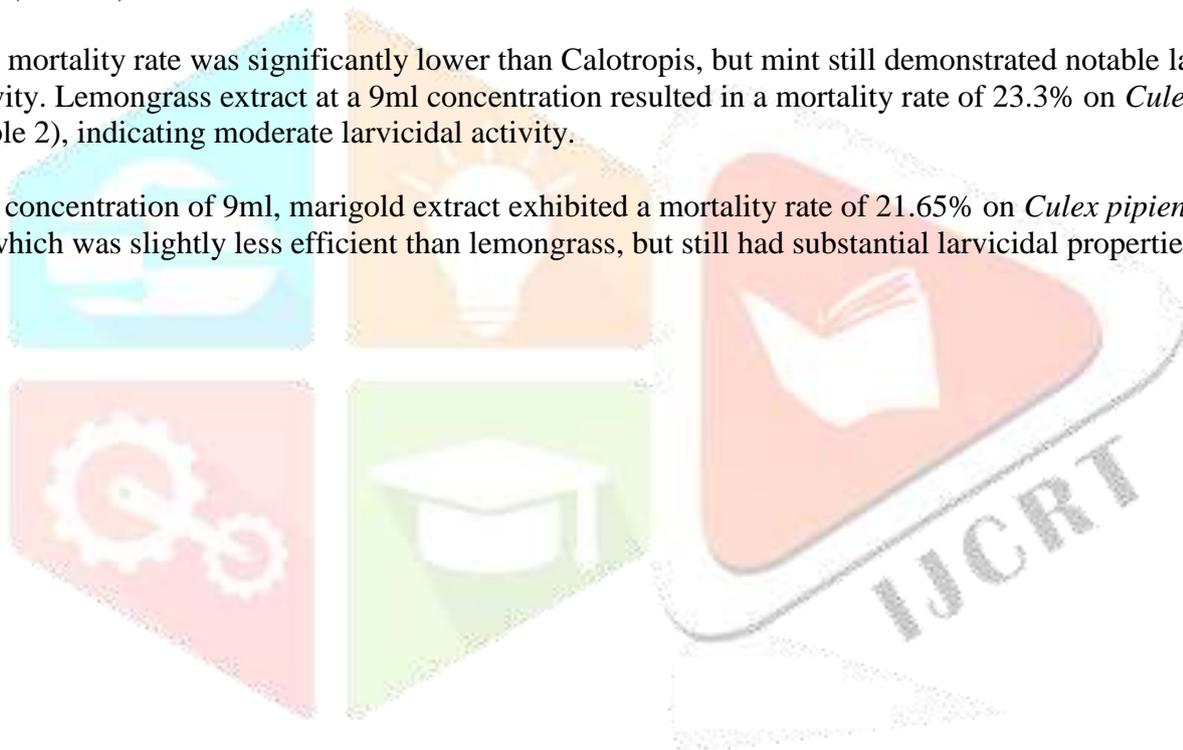
The data was analysed using SPSS software to perform a one-way analysis of variance (ANOVA) statistics were significant ( $p < .001$ ). Overall, the experiment found that the Calotropis extract had a mortality rate of 100% on *Culex pipiens* larvae exposed to a concentration of 9ml.

This indicates that Calotropis has a strong larvicidal effect on *Culex pipiens* larvae, completely eradicating Table 2.

Meanwhile, when exposed to a 9ml concentration of mint, *Culex pipiens* larvae had a mortality rate of 28% (Table 2).

This mortality rate was significantly lower than Calotropis, but mint still demonstrated notable larvicidal activity. Lemongrass extract at a 9ml concentration resulted in a mortality rate of 23.3% on *Culex pipiens* (Table 2), indicating moderate larvicidal activity.

At a concentration of 9ml, marigold extract exhibited a mortality rate of 21.65% on *Culex pipiens* (Table 2), which was slightly less efficient than lemongrass, but still had substantial larvicidal properties.



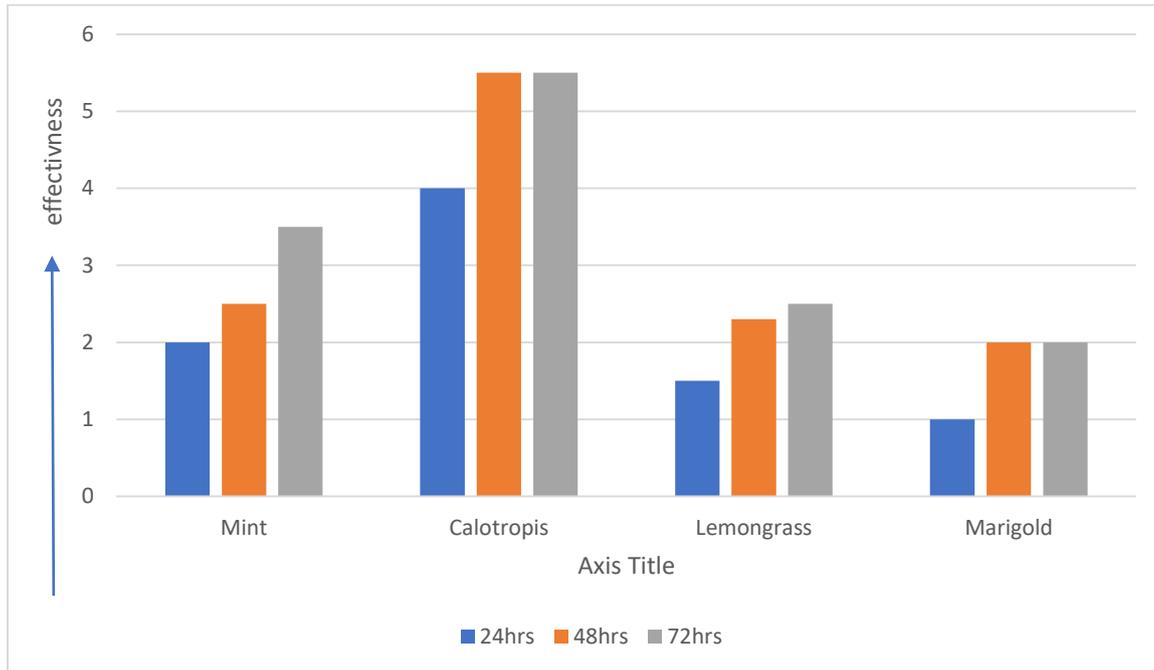
**Table: 1****Culex pipiens larva mortality after exposure to leaf extract**

Mortality (Mean±S.E) after exposure to plant extract												
	Calotropis			Mint			Lemongrass			Marigold		
Conc	Day1	Day2	Day3	Day1	Day2	Day3	Day1	Day2	Day3	Day1	Day2	Day3
3ml	11.66±.33	14.66±1.77	14.66±.88	2.00±.00	1.33±.33	1.66±.33	1.33±.33	2.00±.57	1.66±.33	1.00±.00	1.66±.33	1.33±.33
6ml	20.00±.00	20.00±.00	20.00±.00	2.66±.66	2.66±.33	3.00±.57	3.66±.33	3.33±.66	3.66±.33	2.66±.33	2.00±.57	3.00±.00
9ml	20.00±.00	20.00±.00	20.00±.00	4.66±.88	5.66±.33	5.66±.57	3.66±.57	4.66±.88	4.00±.57	3.33±.33	3.00±.57	4.33±.33
control	1.00±.00	1.00±.00	1.00±.00	1.00±.00	1.00±.00	1.00±.00	1.00±.00	1.00±.00	1.00±.00	1.00±.00	1.00±.00	1.00±.00

**Table: 2****Table Showing %Mean mortality of Culex pipiens larvae after exposure to plant extracts****%Mean mortality of Culex pipiens larvae after exposure to plant extract**

	Mint			Calotropis			Lemongrass			Marigold		
Conc.	Day1	Day2	Day3	Day1	Day2	Day3	Day1	Day2	Day3	Day1	Day2	Day3
3ml	10%	6.65%	8.3%	58%	73.3%	73.3%	6.65%	48%	8.3%	5%	8.3%	6.65%
6ml	13.3%	13.3%	15%	100%	100%	100%	18.3%	16.65%	18.3%	13.3%	10%	15%
9ml	23%	28%	28%	100%	100%	100%	18.3%	23.3%	20%	16.65%	15%	21.65%
Control	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%

## Graph



### Concentration of doses

**This graph shows the mortality of culex pipiens after exposure to the leaf extracts.**

### Discussion: -

The use of natural products is an effective way to control mosquito larvae. Researchers have tested different plant extracts against mosquito larvae and found that the leaf extract of *Calotropis procera* has larvicidal properties against three mosquito species: *Anopheles stephensi*, *Culex quinquefasciatus*, and *Aedes aegypti* (Singh, et. al., 2005).

The latex of the *Calotropis* plant contains toxic properties that are specifically targeted toward mosquitoes, making it effective in controlling mosquito larvae (Giridhar et al., 1984).

Mentha oil has also been tested and developed as an insecticide against various insects and pests. The ketone monoterpenes found in Mentha species, including pulegone, carvone, and menthone, exhibit insect toxicity.

Lemongrass is another natural plant that is effective in controlling mosquito larvae. It contains citronella oil, a natural insecticide, which can be extracted from the leaf. The dried lemongrass extract has been shown to be particularly effective, with all larvae dead within two hours of usage. A previous study, (Sosan, 2013) also found that *Cymbopogon citratus* and *Tagetes erecta* resulted in 100% mortality rates of *Culex pipiens* mosquitoes at concentrations of 120, 200, and 300mg/L, respectively.

## Conclusion: -

Plant extracts can be a useful tool in managing mosquitoes, as they have fewer harmful effects on human health.

Our study found that *Calotropis procera* and *Mentha* extracts were the most effective in killing *Culex pipiens* larvae, with mortality rates of 100% and 28%, respectively, compared to other extracts. Based on our findings, we recommend adding these extracts to mosquito control programs to achieve safe and effective results.

## Reference: -

1. Aouinty, B., Chennaoui, M., Mahari, S., Rihane, A. and Mellouki, F., 2018. Larvicidal effects of aqueous extract from *Ricinus communis* L. leaves against mosquito *Culex pipiens*: mortality and histopathology of treated larvae. *Journal of Materials and Environmental Sciences*, 9(2), pp.619-623.
2. Dahchar, Zineb, Fatiha Bendali-Saoudi, and Nouredine Soltani. "Larvicidal activity of some plant extracts against two mosquito species *Culex pipiens* and *Culiseta longiareolata*." *Journal of Entomology and Zoology Studies* 4, no. 4 (2016): 346-350.
3. Baz, Mohamed M., Maysa M. Hegazy, Hanem F. Khater, and Yasser A. El-Sayed. "Comparative Evaluation of Five Oil-Resin Plant Extracts against The Mosquito Larvae, *Culex pipiens* Say (Diptera: Culicidae)." *Pakistan Veterinary Journal* 41, no. 2 (2021).
4. El Hag, E. A., A. H. El Nadi, and A. A. Zaitoon. "Toxic and growth retarding effects of three plant extracts on *Culex pipiens* larvae (Diptera: Culicidae)." *Phytotherapy Research* 13, no. 5 (1999): 388-392.
5. Rashid, M. I. S. B. A. H., and A. F. T. A. B. Ahmad. "The effect of neem (*Azadirachta indica*) leaves extract on the ecdysis and mortality of immature stages of common house mosquito *Culex pipiens fatigans*." *Biologia (Pakistan)* 59, no. 2 (2013): 213-19
6. Upadhyay, Ravi Kant, and R. K. Jauhari. "International Journal of Zoological Investigations."
7. Kaushik, M., Yadav, J., Singh, A., & Dubey, M. K. (2023). A systematic review of plant-based mosquito repellents and their activity.