A study on *Nerium oleander* extract as a potential mosquito larvicide

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Abstract

Mosquitoes transmit serious diseases like malaria, dengue, chikungunya, and yellow fever. Plant extracts, including *Nerium oleander* leaf and flower extracts, offer a promising alternative to chemical insecticides. This study assessed their larvicidal effects on *Culex* mosquitoes. Flowers and leaves were collected, shade-dried, powdered, and then extracted using methanol, ethanol, hexane, and water. Vials with 5 ml of water and 1 ml of extracts were tested with fourth-instar larvae. The study found that polar solvents (ethanol and methanol) and hexane were more effective than aqueous extracts, with hexane showing the quickest action. *Nerium oleander* extracts demonstrate potential as eco-friendly larvicides, useful for controlling mosquito larvae, managing stored grain pests, and addressing other harmful larvae.

Keywords: Insecticide, eco-friendly, *Nerium oleander*, *Culex mosquito*, fourth-instar larvae, Flower and Leaf extract.

Introduction

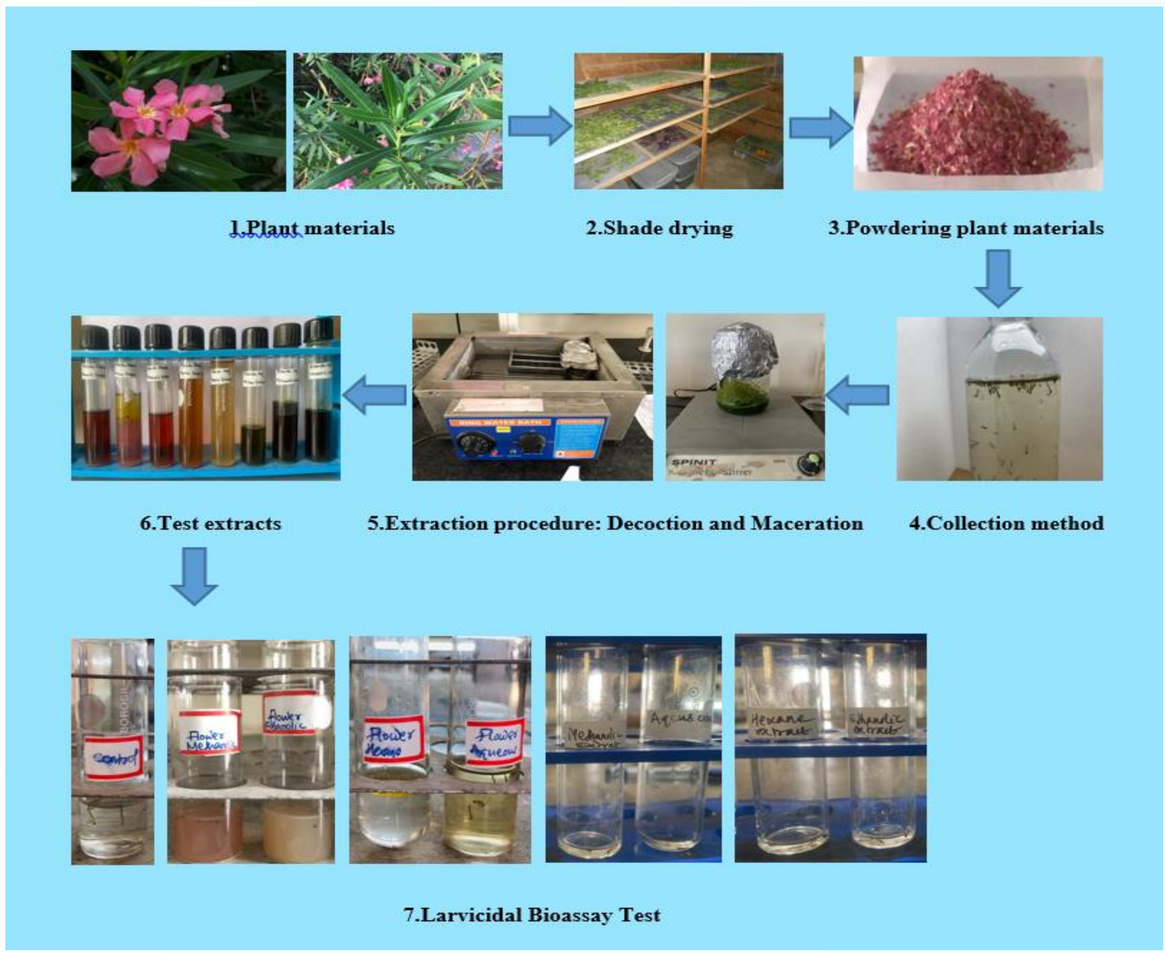
Nerium oleander is a striking flowering shrub celebrated for its vibrant blooms and lush evergreen leaves. This plant can reach heights of 20-25 feet in summer, characterized by its green foliage and thick sap. While native to the Mediterranean, Asia, and North America, oleander is commonly found in the southern United States and other regions worldwide. However, it's important to note that all parts of the plant are toxic, containing cardiac glycosides, which can lead to serious poisoning.

Recently, India has seen a rise in dengue cases, primarily spread by *Culex* mosquitoes. These mosquitoes are known vectors for various diseases affecting birds, humans, and other animals, including West Nile virus, Japanese encephalitis, and filariasis. Factors such as climate change, global trade, habitat alteration, and urbanization are contributing to the expansion of *Culex* mosquitoes into new areas.

To combat the transmission of these diseases, *Nerium oleander* offers a potential solution as an environmentally friendly insecticide. By targeting mosquito larvae, oleander presents a sustainable option for reducing mosquito populations and mitigating disease spread.

Methodology

1.Plant materials: The use of both fresh and dried plant samples.
2.Shade drying: Shade drying in a well-ventilated area at room temperature.
3.Powdering plant materials: Using a mixer, both the flowers and leaves of *Nerium oleander* are ground into a powder.
4.Collection method:
-The flowers and leaves of N. oleander were collected from residential areas in HSR Layout and Thirumagondanahalli and carefully placed in paper bags.
-*Culex* mosquito larvae are collected from locations like Ramamurthy Nagar and Vimanapura in separate plastic bottles filled with stagnant or pond water, covered with cotton for airflow.
NOTE: The collection process follows strict protocols, with collectors wearing gloves for safety.
5.Extraction Procedure:
-Decoction: Boil 20.55 g of *Nerium oleander* flowers and leaves in 100 ml of water for 15 to 60 minutes to extract plant compounds. After boiling, cool, strain, and filter the mixture.
-Maceration: To extract plant compounds, soak 4.8 g of flower powder and 1.8 g of leaf powder in a closed containers with Methanol, Ethanol, and Hexane respectively. Let the mixture sit at room temperature overnight, stirring regularly with a magnetic stirrer, while a sealed extractor prevents solvent evaporation. The next day, press or strain the mixture through filtration or decantation.
6.Test Extracts: Extracts from *Nerium oleander* leaves and flowers were obtained using solvents including methanol, ethanol, hexane, and water.
7.Larvicidal Bioassay Test: Four vials were prepared with 5000 µl (5 ml) of stagnant water, labeled Methanol, Ethanol, Hexane, and Water. Five fourth instar larvae were added to each vial, followed by 1000 µl (1 ml) of the corresponding flower extracts. Additionally, four more vials received 1000 µl (1 ml) of distinct leaf extracts, with five larvae added to each for observation.



Results

A comprehensive study was conducted to assess the toxicity of methanolic, ethanolic, hexane, and aqueous extracts from the flowers and leaves of *Nerium oleander* on the IV instar larvae of *Culex* mosquitoes through bioassay tests. The findings revealed significant differences in larvicidal activity based on the type of extract used. The methanolic flower extract was the most effective, killing larvae in approximately 25 minutes, while the methanolic leaf extract resulted in a longer survival time of around 35 minutes. In contrast, both the ethanolic flower and leaf extracts also led to mortality in about 25 minutes, but the ethanolic leaf extract showed a shorter survival duration of 12 to 14 minutes. The hexane flower extract proved even more lethal, with larvae succumbing in just 8 minutes, although the hexane leaf extract allowed for a slightly longer survival of 10 to 12 minutes. The aqueous extract, however, resulted in the longest survival time of 1 hour for both flower and leaf extracts. Overall, the study indicated that polar solvents like ethanol and methanol, along with the non-polar solvent hexane, exhibited significantly higher larvicidal activity compared to the aqueous extract, as summarized in Tables 1 and 2.

Solvent	Time taken for the larvicidal activity
Methanol	25 minutes
Ethanol	25 minutes
Hexane	8 minutes
Aqueous (water)	1 hour

Table 1: Larval mortality of *Culex* against *Nerium oleander* flower extract.

Solvent	Time taken for the larvicidal activity
Methanol	35 minutes
Ethanol	12 to 14 minutes
Hexane	10 to 12 minutes
Aqueous (water)	1 hour

Table 2: Larval mortality of *Culex* against *Nerium oleander* leaf extract.

Discussion

Plants have developed various protective mechanisms against insects, making this an important research area. Our study examined the larvicidal properties of *Nerium oleander* against mosquito larvae, showcasing its potential as a natural control for mosquito-borne diseases. Plants contain bioactive compounds in various parts, with effectiveness differing among mosquito species, and solvent choice significantly impacts extraction.

Our findings indicate that *Nerium oleander* leaf and flower extracts could serve as an eco-friendly larvicide. Further research is essential to explore their efficacy against other harmful larvae that affect crop yields, as well as housefly larvae, which are known vectors for multiple pathogens.

Conclusion

The leaf and flower extract of *Nerium oleander* shows promise as an eco-friendly larvicide, paving the way for further research into its effectiveness against other harmful larvae that threaten crop yields, as well as housefly larvae, which are known carriers of multiple pathogens associated with various diseases.

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