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# Investigation of Ovicidal Activity of Artocarpus Heterophyllus Lam. Leaves.

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**ABSTRACT**
Insect-transmitted diseases remain a significant public health issue globally, highlighting the urgent need for innovative and environmentally sustainable insect control methods. While chemical insecticides are effective, they carry risks to both health and the environment due to their persistence and toxicity. This research assesses the ovicidal properties of the ethanolic extract derived from the leaves of Artocarpus heterophyllus Lam. to explore its viability as a natural insect control alternative. The study adhered to the established protocol by Su and Mulla (1998), wherein insect eggs were categorized into eleven groups, including a negative control, a positive control, and various test groups subjected to different concentrations of the ethanolic extract. The eggs were placed in small test containers with 100 ml of water, followed by the introduction of the test solutions. Observations were made after 18 hours to evaluate hatching rates, and the median lethal dose (LD50) and the lethal dose required to eliminate 90% of the eggs (LD90) were determined. The findings indicated a significant dose-dependent ovicidal effect, with higher concentrations (22.5 mg/ml) demonstrating markedly greater inhibition of egg hatching compared to lower concentrations (2.5 mg/ml). The standard ovicidal agent also exhibited considerable suppression of hatching. Phytochemical analysis of Artocarpus heterophyllus Lam. leaves identified the presence of bioactive compounds, including flavonoids, tannins, saponins, and alkaloids, which may play a role in ovicidal activity by interfering with embryonic development and weakening eggshell structure. These results imply that the leaf extract of Artocarpus heterophyllus Lam. holds significant promise as a natural ovicidal agent, presenting an environmentally friendly alternative to synthetic insecticides. Additional research is required to clarify the precise mechanisms of action, refine dosage formulations, and assess its environmental safety and impact on non-target organismsprior to extensive utilization.

**Keywords:** Oviposition inhibition, Artocarpus heterophyllus Lam., pest management, phytochemicals, natural insecticide, embryonic development suppression, sustainable pest control, public health.

## I. INTRODUCTION

Herbal medicine has served as a fundamental aspect of healthcare for centuries, with the World Health Organization (WHO) indicating that more than 80% of the global population depends on plant-derived remedies for their primary health needs.[1] India, often referred to as the "Botanical Garden of the World," boasts a vast array of medicinal plants and traditional medical practices, including Ayurveda, Siddha, and Unani.[5-6] With an estimated 15,000 to 18,000 species of flowering plants and over 15,000 recognized for their medicinal properties, India is integral to the global herbal medicine industry.[9] These traditional remedies, grounded in historical practices, provide safe, effective, and environmentally sustainable alternatives to synthetic pharmaceuticals, leading to their growing popularity worldwide. The assessment of quality and standardization of herbal medicines is essential for ensuring their safety and effectiveness.[2] The WHO underscores the necessity of establishing dependable methods for evaluating raw materials, intermediate products, and final formulations through contemporary analytical techniques.[3] Despite the progress in synthetic pharmaceuticals, herbal medicines continue to excel in safety and therapeutic advantages, particularly in the treatment of resistant diseases and the enhancement of immune function.[4-8]

Vector-borne diseases, including malaria, dengue, Zika, and yellow fever, remain significant public health concerns globally. These illnesses impact over 700 million individuals each year, resulting in considerable mortality and economic losses, particularly in tropical and subtropical areas. The life cycle of mosquitoes, such as Aedes aegypti, is completed in a mere 7 to 10 days, with eggs deposited in small reservoirs of stagnant water.[10]Common objects such as bowls, tires, and barrels act as breeding sites, highlighting the urgent necessity for mosquito control. It is essential to

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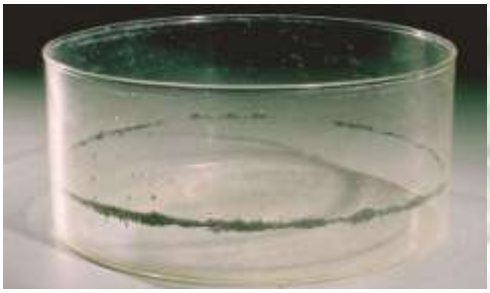
develop safe, effective, and sustainable strategies for managing mosquitoes to mitigate the transmission of these diseases. Plant-derived insecticides are increasingly recognized as environmentally friendly substitutes for chemical pesticides. Investigating medicinal plants for their ovicidal and larvicidal characteristics presents promising opportunities for managing mosquito populations and decreasing the prevalence of vector-borne diseases.[11]



**Photograph showing female Mosquitoes lay eggs on the innerwalls.**


**Photograph showing microsopic image of mosiquito eggs.**

Artocarpus heterophyllus Lam. (Jackfruit) leaves are known to possess bioactive compounds that exhibit insecticidal properties, which include anti-feeding effects, growth regulation, oviposition deterrence, and enzyme inhibition. These properties have been documented across various insect species, notably resulting in the suppression of egg hatching. Research indicates a significant ovicidal effect, with egg hatch rates ranging from 1.3% to 40% following extended exposure.[13]

Given that mosquitoes serve as vectors for numerous diseases and have developed resistance to chemical insecticides, there is an increasing demand for safer and more cost-effective alternatives. Plant-derived compounds that inhibit insect growth are receiving considerable attention for their potential in mosquito control. This study emphasizes the efficacy of A. heterophyllus leaf extract as a natural ovicidal agent against Aedes aegypti.[15]

## II. MATERIALS AND METHODS:

**Equipment:**

• Soxhlet extractor, Evaporator, Beakers, Micropipette.

**Chemicals:**

• Ethanol, Confidor (standard drug), Methanol, Distilled water.

**Collection of Plant Material:**

The leaves of Artocarpus heterophyllus Lam. were sourced from a local garden for this study.

**Preparation of Plant Extract:**

The leaves were shade-dried, ground into a powder, and subjected to continuous hot extraction with 70% ethanol in a Soxhlet apparatus until the extract was clear. The resulting ethanol extract was concentrated using a rotary evaporator, producing a brown, sticky semi-solid residue, which was then stored at -20°C for subsequent experimental applications.

**Mosquito Cultivation**

Aedes aegypti eggs were sourced from stagnant water in Chitradurga. They were kept under controlled conditions, with experiments conducted at a temperature of 27 ± 2°C and relative humidity levels ranging from 75% to 85%, following a light and dark cycle of 14:10 hours.

## III. METHODOLOGY:

The ethanol extract of Artocarpus heterophyllus Lam.was evaluated for its ovicidal properties against Aedes aegypti eggs, adhering to WHO guidelines with minor adjustments. A uniform batch of eggs was placed in test cups containing approximately 7.5 cm of water. Due to the extract's insolubility in water, it was first dissolved in Tween 80 to create stock solutions with concentrations between 2.5 and 22.5 mg/ml. These stock solutions were then diluted in lukewarm water, with 100 ml introduced into each test cup. Homogeneous mixtures were obtained by gentle shaking or stirring.

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**Ovicidal Bioassay:**

The assessment of ovicidal activity was conducted using the methodology established by Su and Mulla (1998). Initial tests revealed that the extract from the leaves of Artocarpus heterophyllus Lam. exhibited ovicidal properties. To further investigate this relationship, eggs from the Aedes aegypti mosquito were collected and distributed evenly into 11 cups, with each cup containing 10 eggs. Nine of these cups were filled with leaf extract at varying concentrations of 2.5mg, 5mg, 7.5mg, 10mg, 12.5mg, 15mg, 17.5mg, and 20mg, while the control cup contained 100ml of water. Additionally, one cup was filled with 2ml of a standard drug solution in water, serving as a reference. Following the treatment, the egg rafts or individual eggs from each concentration were transferred to cups containing distilled water for hatching evaluation, with the eggs being counted under a microscope. This experiment was replicated six times. The hatch rate was determined 120 hours post-treatment using the following formula:[13]

$$x = \frac{\text{Number of the hatched eggs}}{\text{Total number of eggs}} \times 100$$

## IV. RESULTS

**Preparation of ethanolic extract of Artocarpus heterophyllus Lam.Leaves.**

Artocarpus heterophyllus Lam. Leaves was dried at room temperature for 5 days and pulverized. The obtained powder was subjected to Soxhlet extraction with ethanol as solvent. The extract was concentrated using rotary extraction with ethanol as solvent. The solvent was removed completely over a water bath and the obtained product was dried in a desiccator. The extract was weighed and labelled. The yield was calculated in terms of gram percent of the weight of power.

The percentage yield of ethanolic extract of Artocarpus heterophyllus Lam, Leaves was found to be 12.87%.

Percentage yield of ethanolic extract of Artocarpus heterophyllus Lam, leaves.

| SI.no | Solvent | Colour and consistency | Percentage yield |
|---|---|---|---|
| 1 | Ethanol | Dark green-brown, sticky, and slurry consistency | 12.87% |

Preliminary phytochemical screening of leaves of Artocarpus heterophyllus Lam.

It is observed from the preliminary Phyto-chemical screening of the leaf of Artocarpus heterophyllus Lam, Leaf that alkaloid, glycosides, flavonoids, tannins, triterpenoids, phenols.

**Preliminary Phytochemical screening**

Present (+)
Negative (-)

| SI.no | Phytoconstituents | Alcohol extract |
|---|---|---|
| 1 | Alkaloids | + |
| 2 | Tannins | + |
| 3 | Glycosides | + |
| 4 | Flavonoids | + |
| 5 | Phenols | + |
| 6 | Triterpenoids | + |
| 7 | Saponin | + |
| 8 | Carbohydrates | + |
| 9 | Resins | - |
| 10 | Steroids | - |

Investigation of ovicidal activity of Artocarpus heterophyllus Lam. Leaves.
Test group: 9 groups, each group containing 10 eggs.
Concentration of drugs: different groups treated with differentconcentration;the concentration are as follows.

**Test drug concentration**

| Groups | Concentration(mg/ml) |
|---|---|
| A | 2.5mg/ml |
| B | 5mg/ml |
| C | 7.5mg/ml |
| D | 10mg/ml |
| E | 12.5mg/ml |
| F | 15mg/ml |
| G | 17.5mg/ml |
| H | 20mg/ml |
| I | 22.5mg/ml |

Standard drug: Confidor
Positive control: Confidor
Negative control: Methanol

**Observation ovicidal activity of Artocarpus heterophyllus Lam.Leaves on mosquito eggs.**

| Groups | Treatment(test extract) | Hatched of eggs |
|---|---|---|
| A | 2.5mg/ml | 5 |
| B | 5mg/ml | 4 |
| C | 7.5mg/ml | 4 |

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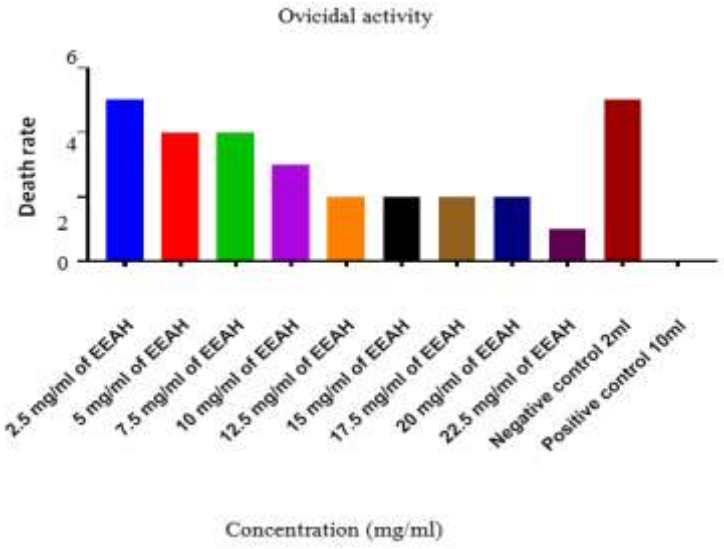
| | | |
|---|---|---|
| D | 10mg/ml | 3 |
| E | 12.5mg/ml | 2 |
| F | 15mg/ml | 2 |
| G | 17.5mg/ml | 2 |
| H | 20mg/ml | 2 |
| I | 22.5mg/ml | 1 |
| Negative control | 10ml | 5 |
| Positive control | 2ml | 0 |

The observation mentioned above demonstrate that our test medication has strong ovicidal action and is dose dependent. By graphing the death rate varies drug concentration using the information from the above data, we can get LD50 and LD90.

DETERMINATION OF LC50 AND LC90

Determination of LC50 and LC90 by plotting a graph death rate v/s concentration.




**Photograph showing graph death rate v/s concentration.**

## V. DISCUSSION:

Medicinal plants represent a crucial resource with both economic and therapeutic significance globally. Among these, Artocarpus heterophyllus Lam.(commonly referred to as jackfruit) stands out due to its rich phytochemical composition, which includes alkaloids, glycosides, flavonoids, tannins, triterpenoids, and phenolic compounds. These constituents are associated with a range of bioactivities, such as anti-inflammatory, antimicrobial, antioxidant, antifungal, antibacterial, antidiabetic, immunomodulatory, and anthelmintic properties.

This research investigates the ovicidal properties of the leaf extract of Artocarpus heterophyllus Lam. against mosquito eggs. Leaves were sourced from a local garden in Chitradurga, and the experimental design aimed to assess the extract's effectiveness. Mosquito eggs were categorized into nine test groups, alongside positive and negative controls. Each group contained 10 eggs, with the extract applied at varying concentrations. Observations were conducted over an 18-hour period to monitor egg hatching, and the lethal concentrations (LC50 and LC90) were calculated.

The results indicated a significant ovicidal effect of the leaf extract, highlighting its potential as an environmentally friendly method for mosquito control. Furthermore, these findings underscore the necessity of investigating plant-derived alternatives that are safe for the ecosystem and non-target species, thereby providing a sustainable approach to vector management.

**Summary:**

This study examines the ethanolic extract derived from the leaves of Artocarpus heterophyllus Lam. for its preliminary phytochemical profile and its ovicidal effects on Aedes aegypti mosquito eggs. The leaves were sourced from Chitradurga, Karnataka, India, authenticated by a botanist, then dried, ground into a powder, and extracted using the Soxhlet method with ethanol.

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The preliminary phytochemical analysis revealed the presence of tannins, flavonoids, alkaloids, saponins, and glycosides. Aedes aegypti eggs were collected from freshwater sources in Chitradurga and maintained under controlled laboratory conditions (27°C, 75–85% relative humidity, and a 14:10 light-dark cycle). For the experimental procedure, ten eggs were placed in beakers containing tap water with varying concentrations of the extract (ranging from 2.5 to 22.5 mg/ml). Both positive and negative controls were established for comparison. The observations were conducted over 18 hours.

The results indicated that at higher concentrations (20–22.5 mg/ml), up to 90% of the eggs were rendered non-viable, while lower concentrations (2.5–17.5 mg/ml) resulted in 40–50% ovicidal activity. The ovicidal effect was found to be dose-dependent, with increased concentrations demonstrating significant activity comparable to the standard reference, Confidor.These results suggest that the ethanolic extract of Artocarpus heterophyllus Lam. leaves possesses notable ovicidal properties, indicating its potential as an environmentally friendly alternative for mosquito management.

## VI. CONCLUSION:

The investigation into the ovicidal properties of Artocarpus heterophyllus Lam. leaves demonstrates that the ethanolic extract of this plant exhibits significant ovicidal activity, which is dependent on dosage. Higher concentrations result in increased mortality rates, while lower concentrations yield reduced effects. The study utilized the ethanolic extract of Artocarpus heterophyllus Lam. leaves, which are known to contain active compounds that effectively target mosquito eggs.

In contemporary discussions, environmental safety is of utmost importance. An effective ovicide must achieve a high mortality rate in target organisms while remaining environmentally friendly. Phytochemicals present a viable solution, as they are generally safe, cost-effective, and widely accessible across various regions. Numerous plants have been traditionally employed in different cultures for their mosquito ovicidal properties.

As noted by Bowers et al., the exploration of locally sourced medicinal plants for mosquito control can foster local employment, decrease reliance on costly imported alternatives, and bolster community initiatives aimed at improving public health systems.

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