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## Analysis of Macroscopic, Microscopic and TLC based Phytochemical characteristics of *Melia azedarach L.*

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### ARTICLE INFO

### ABSTRACT

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The study investigates the medicinal potential of *Melia azedarach* through a comprehensive analysis of its phytochemical composition and genetic characteristics. Phytochemical analysis of plant extracts revealed the presence of alkaloids, flavonoids, saponins, tannins, and carbohydrates, while extraction with methanol yielded a 13.5% dark green methanolic extract. Macroscopic and microscopic examinations provided insights into leaf morphology. Further confirmation of phytochemical constituents through qualitative analysis, thin layer chromatography, and UV-VIS spectrophotometry underscored the plant's diverse chemical profile. Successful DNA extraction using cTAB procedure for molecular genetic studies validated the authenticity of the genetic material. Overall, these findings emphasize the medicinal significance of *Melia azedarach* and suggest its potential for the development of novel therapeutic agents.

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## INTRODUCTION

*Melia azedarach L.*, commonly referred to as the bead tree or chinaberry, is a plant species of considerable ethnopharmacological significance owing to its extensive traditional uses in various medicinal practices. Classified within the family Meliaceae, this species is primarily indigenous to Persia and Arabia but has also been observed in regions extending to the low-lying areas of the Himalayas in India (Vekariya *et.al.*, 2016).

The plant is visually characterized by its straight, medium-sized trees, which typically reach heights ranging from 20 to 40 feet, resembling the stature of neem trees. Throughout the months of Phagun and Chaitra, a milky juice is known to exude from this tree, an attribute that underscores its seasonal importance in traditional medicine. However, it is imperative to exercise caution during this period, as the plant exhibits a degree of toxicity. Notably, this toxicity is

more pronounced in certain parts of the plant, with the seeds being identified as particularly hazardous. Consequently, meticulous attention to dosage and administration is recommended to mitigate potential adverse effects (Jafari *et.al.*, 2013).

Despite these considerations, the medicinal potential of *Melia azedarach L.* is vast, with various parts of the plant being utilized to address a diverse array of health concerns. Traditional remedies harness the therapeutic properties found in its bark, leaves, flowers, fruits, and seeds to combat numerous ailments. For instance, preparations derived from the plant are commonly employed in the treatment of mouth sores, goiter, eye diseases, hemorrhoids, colic, intestinal worms, gout, inflammation, itching, leprosy, fever, ulcers, tumors, and abdominal worms. These remedies often involve different modes of administration, including ingestion, topical

application, or infusion, each tailored to suit the specific ailment being addressed (Naseer *et.al.*, 2020).

Furthermore, ongoing research into the chemical composition and pharmacological properties of *Melia azedarach* L. holds significant promise for expanding our understanding of its therapeutic potential. Insights gleaned from such studies could potentially pave the way for the development of novel treatments in modern medicine, offering new avenues for addressing various health conditions. However, alongside these endeavours, it remains crucial to continue exploring the plant's toxicity profile to ensure the safe and effective utilization of its medicinal properties. By striking a balance between harnessing its therapeutic benefits and mitigating potential risks, *Melia azedarach* L. stands as a compelling subject for further investigation in the realm of ethnopharmacology (Malar *et.al.*, 2020).

## MATERIALS AND METHOD

The Materials and Methods section outlines the procedures followed in a research project involving the phytochemical analysis of *Melia azedarach*, commonly known as the chinaberry tree. Below is a detailed elaboration of the key steps described in the section:

**Plant Selection:** The selection of *Melia azedarach* for the research was based on existing literature indicating significant chemical investigation, particularly focusing on its leaves.

**Plant Collection:** Leaves of *Melia azedarach* was collected from the college grounds.

**Plant Identification:** Field identification of the collected samples was attempted to confirm the plant species.

**Drying of Plant Sample:** The collected plant material was dried at a temperature below 30°C to prevent decomposition of thermolabile compounds. Sun drying was used, although it poses a risk of microbial growth due to water absorption.

**Grinding of Dried Samples:** The dried samples were ground into coarse powder using a mechanical grinder (blender). Grinding increases surface area, improving extraction efficiency, and decreases solvent requirement.

**Preparation of Plant Extracts:** 5g of shade-dried *Melia azedarach* samples were ground and extracted with methanol using a rotary shaker. The resulting extract was filtered, evaporated, and diluted for further investigation.

**Preliminary Phytochemical Screening:** Various qualitative tests were conducted to screen for the presence of alkaloids, saponins, carbohydrates, resins, phenols, tannins, diterpenes, and fixed oils in the plant extract.

**Qualitative Physiochemical Examination of Extract:** Physiochemical tests were performed to identify secondary metabolites and observe colour changes when treated with different reagents. (Table.2)

**Thin Layer Chromatography (TLC):** The plant extract was subjected to TLC using different solvent systems to confirm the presence of major groups of compounds like alkaloids, flavonoids, and saponins. TLC plates were prepared, spotted, developed, and visualized using appropriate methods.

**Standardization:** Macroscopic and microscopic examinations were conducted to assess the physical and structural characteristics of the plant material. DNA extraction and quantification were also performed for molecular genetic studies.

Overall, these methods provide a comprehensive approach to investigate the phytochemical composition and genetic characteristics of *Melia azedarach*.

## RESULTS AND DISCUSSION

The results obtained from various experiments demonstrate the potential of *Melia azedarach* as a medicinal plant with antisciatia components. The phytochemical analysis revealed the presence of alkaloids, flavonoids, saponins, tannins, and carbohydrates in the plant extracts. (Fig.1)

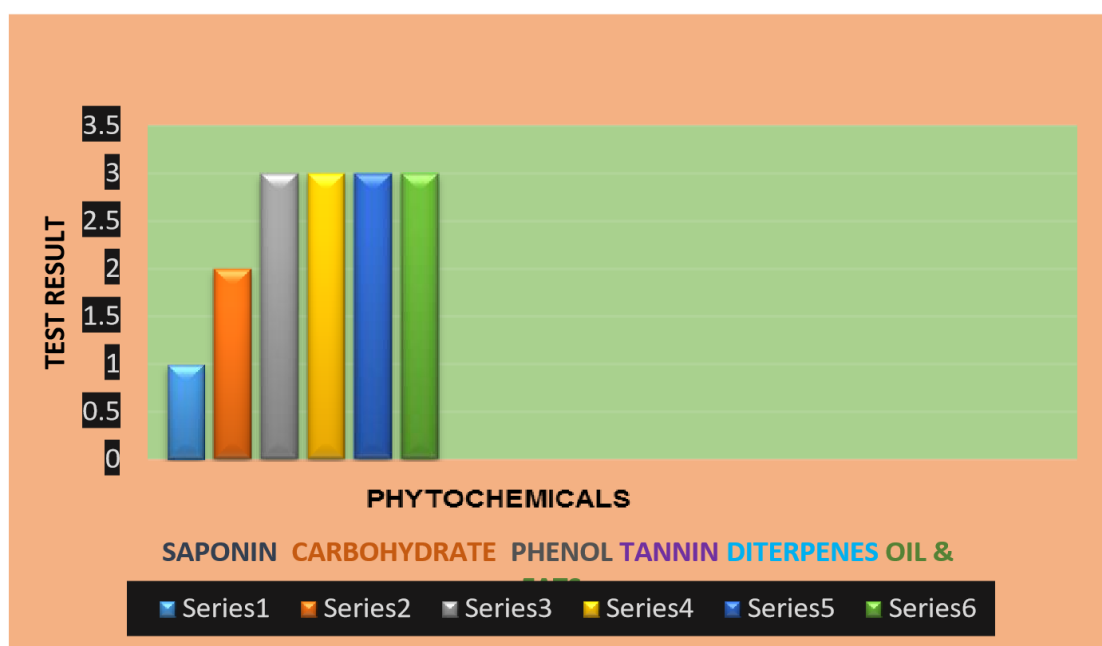
However, anthraquinone was found to be absent. The extraction process using methanol resulted in a 13.5% yield of dark green methanolic extract. Macroscopic examination of the leaves showed characteristics such as a bitter taste, green color, and strong odor, while microscopic examination revealed wavy epidermal cells, stomata, trichomes, phloem fibers, and xylem vessels. Qualitative phytochemical analysis using various reagents confirmed the presence of alkaloids, saponins, carbohydrates, resins, phenols, tannins, diterpenes, and oil/fats in the plant extracts. Thin layer chromatography (TLC) further confirmed the presence of multiple compounds with different R<sub>f</sub> values (Table.1).

UV-VIS spectrophotometry provided additional qualitative screening data, showing

absorbance peaks at different wavelengths, indicating the presence of various phytochemicals (Fig.2).

Finally, molecular genetic studies using DNA isolation techniques demonstrated successful DNA extraction from *Melia azedarach* leaves. The cTAB procedure was effective in overcoming challenges such as low yield and degradation due to the presence of plant chemicals. PCR amplification confirmed the authenticity of the extracted DNA.

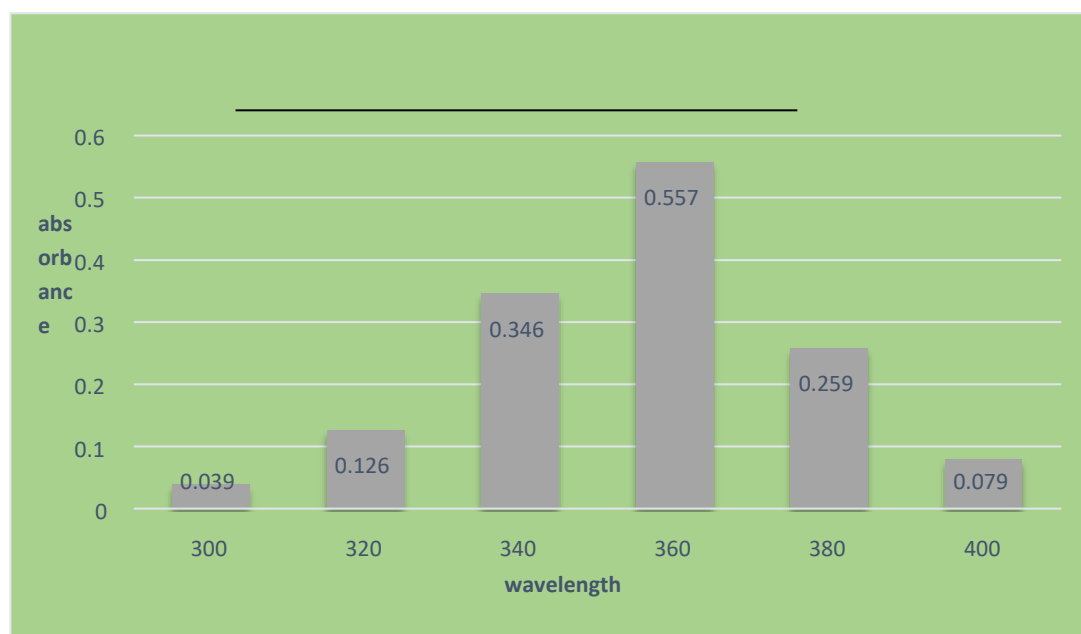
Overall, these results highlight the medicinal potential of *Melia azedarach* and provide valuable insights into its phytochemical composition and genetic characteristics. Further research in this area could lead to the development of novel therapeutic agents.



**Fig.1: Qualitative Phytochemical tests**

**Table.1: TLC with solvent system Chloroform: Methanol: n Butanol: Water (10:10:1:6)**

Plant species	Extract	Distance travelled by solute	Distance travelled by solvent	Colour	R <sub>f</sub> value %
<i>Melia azedarach</i>	Methanol	0.6	5	Light	0.1
				Orange	
		1.7	5	Light green	0.3
		2.8	5	Light brown	0.5
		4.6	5	Dark brown	0.9

**Fig.2: Qualitative phytochemical screening of UV-VIS spectrophotometer****Table.2: Qualitative physiochemical analysis of *Melia azedarach***

S. No	Reagents	Color observed	Result
1	Powder + conc HCL	Brownish black	Negative
2	Powder + conc HNO <sub>3</sub>	light brownish	Positive
3	Powder + conc H <sub>2</sub> SO <sub>4</sub>	light brick red	Negative
4	Powder + Glacial acetic acid	light brownish	Negative
5	Powder + 5% NaOH	light brownish	Negative

6	Powder + 5% KOH	light brownish	Negative
7	Powder + 5% Ferric chloride	yellow brownish	Positive
8	Powder + Picric acid	yellow brownish	Positive
9	Powder + Ammonia solution	light brownish	Negative

## CONCLUSION

In conclusion, the findings of this study underscore the significant medicinal potential of *Melia azedarach*, supported by its rich phytochemical composition and genetic characteristics. The presence of alkaloids, flavonoids, saponins, tannins, and carbohydrates in the plant extracts, along with the absence of anthraquinone, highlights its pharmacological promise. The successful extraction of DNA using the cTAB procedure further validates its genetic authenticity, facilitating future research into its molecular profile. These results collectively provide valuable insights into the therapeutic applications of *Melia azedarach* and lay the groundwork for further exploration and development of novel pharmaceuticals derived from this plant.

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