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# Pharmacognostic Standardisation and Monograph Development of *Simarouba Glauca* DC Leaves

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**A B S T R A C T**

Pharmacognostic standardization and Monograph development of the leaves of Simarouba glauca DC are essential for ensuring the quality, safety and efficacy of herbal formulations derived from this plant. Simarouba glauca DC, commonly known as the paradise tree, has gained interest due to its broad therapeutic applications in traditional medicine, including its anti-inflammatory, antimalarial and anticancer properties. This study focuses on establishing comprehensive pharmacognostic standards through a systematic analysis of macroscopic, microscopic, physicochemical, and phytochemical parameters. Microscopic examination reveals distinct characteristics, including the presence of specific cellular structures, stomatal patterns and trichome types, aiding in the correct identification of Simarouba glauca DC leaves. Physicochemical parameters, such as moisture content, ash values and extractive values were evaluated to establish quality benchmarks. Phytochemical screening of the leaves revealed the presence of bioactive compounds like alkaloids, terpenoids, flavonoids and tannins contributing to its pharmacological potential. This monograph serves as a standardized reference, providing essential information for the identification, quality control, and therapeutic application of Simarouba glauca DC, thereby facilitating its safe incorporation into herbal and pharmaceutical products.

Keywords: *Simarouba glauca* DC, Pharmacognostic, Standardisation, Monograph, Herbal formulations.

Figure 1: Healthy leaves of Simarouba glauca DC

Figure 2: Simarouba glauca DC tree bearing seeds

## Introduction

Herbal remedies have been used by humans for thousands of years, tapping into the natural healing properties of plants for the treatment of various ailments.[1] Ancient civilizations, including the Egyptians, Chinese, and Greeks, documented the medicinal uses of herbs, relying on them for everything from pain relief to immune support. [2] Plants contain bioactive compounds that can offer therapeutic effects, such as anti-inflammatory, antibacterial, and antioxidant properties. [3] Today, interest in herbal medicine is rising as people seek natural alternatives or complements to conventional treatments, bridging the gap between traditional knowledge and modern science. [4] Phytoconstituents are the bioactive compounds found in plants, play a crucial role

in the treatment and prevention of diseases. [5] These natural compounds, including alkaloids, flavonoids, terpenes, tannins, and phenolic acids, exhibit a variety of therapeutic effects.

Their significance lies not only in their diverse pharmacological actions but also in offering a gentler alternative to synthetic drugs, often with fewer side effects, making them a valuable resource in modern and traditional medicine. [6] *Simarouba glauca* DC, commonly known as the paradise tree or Lakshmi Taru, is a medicinal plant traditionally used in treating conditions like fever, malaria, and digestive disorders. [7] Given its therapeutic potential, pharmacognostic standardization of *Simarouba glauca* DC is essential to ensure its efficacy, safety, and quality in medicinal use. [8] Standardization involves a thorough examination of its morphological, microscopic, and chemical characteristics to establish reliable identification markers. [9] This is particularly important due to the potential for adulteration and variation in plant composition caused by different environmental factors. [10] By developing a standardized profile for *Simarouba glauca* DC, researchers and healthcare practitioners can maintain consistency in its medicinal applications, supporting its integration into modern herbal medicine with scientific backing. [11]

## Materials and methods

The leaves of *Simarouba glauca* DC were collected from the healthy plants at medicinal garden "Sarada Vilasa Aushadhi Sasya Vatika" of Sarada Vilas College of Pharmacy, Mysuru and the plant was authenticated at Central Ayurveda Research Institute, Bengaluru, India. The leaves were rinsed gently with distilled water to remove any dirt or debris. Pat dried wet leaves with a clean cloth. Used a magnifying glass to closely observe and record the morphological characteristics of the leaves. [12] Prepared thin transverse (cross) sections of the leaves using a sharp blade. Cleared the sections by soaking them in a solution of chloral hydrate to remove chlorophyll and other pigments. Stained the sections with suitable dyes to highlight different cellular structures. Placed the stained sections on a clean glass slide and added a drop of glycerine and observed under microscope. [13] This study was carried out in the laboratory of Pharmacognosy and Phytochemistry at Sarada Vilas College of Pharmacy, Mysuru. The physicochemical studies such as loss on drying, foreign matter, total ash, acid insoluble ash and acid insoluble ash were carried out according to the standard procedures as per the API. [14, 15] The ethanolic extract of the powdered leaf was subjected to qualitative analysis to estimate the presence of different phytochemical ingredients in the leaf, Preliminary phytochemical studies were carried out by following the Mayer's test for alkaloids, Molisch's test for carbohydrates, Keller Kiliane test for cardiac glycosides, Shinoda test for flavonoids, ferric chloride test for phenols and tannins, froth test for saponins, Salkowski's test for triterpenoids (according to API). [15]TLC plate is prepared and the drug is loaded on plates as per the standard procedure. Ethyl acetate, Methanol and water in a ratio of 10:1.35:1are used as a mobile phase. Spots are observed under short and long wave lengths. $R_f$ value was calculated by dividing the distance travelled by the spot and the distance travelled by the mobile phase. [15]

## Results

### Macroscopic studies

Leaf size is medium to large, typically ranging from 5 to 25 cm in length. Leaf shape is pinnately compound with 10-20 leaflets per leaf and leaflets are lanceolate to ovate. Leaf Apex is Acute (pointed end). Leaf Base is asymmetrical or obtuse (rounded base). Leaf Venation is Pinnate, with a prominent central vein and secondary veins branching out. Leaf Texture is Smooth and glossy with a leathery feel. Leaf Arrangement is alternate on the stem. Petiole is Short and sturdy, connecting the compound leaf to the branch.

Figure 3: Measurement of length and width of the leaflet

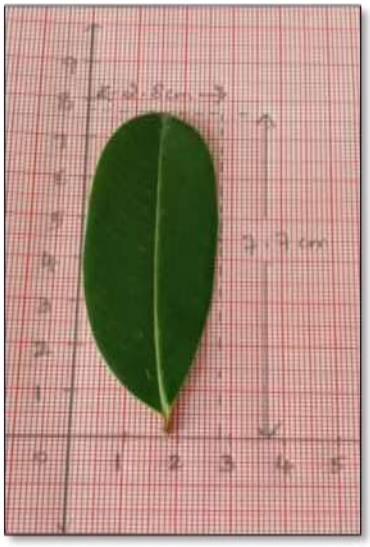

Figure 4: Measurement of the length and width of the leaf

### Microscopic studies

The leaf has a single-layered epidermis on both the upper (adaxial) and lower (abaxial) surfaces. The cells are rectangular and covered with a thick cuticle, which provides protection. Non-glandular, multicellular trichomes are occasionally present on both surfaces. Mesophyll is differentiated into two distinct layers, Palisade Parenchyma is located beneath the upper epidermis, it consists of elongated, columnar cells with dense chloroplasts, Spongy Parenchyma is found below the palisade layer, composed of loosely arranged, irregularly shaped cells with large intercellular spaces. The vascular bundles are collateral and enclosed by a bundle sheath. They consist of xylem (towards the upper side) and phloem (towards the lower side), which are well-developed. Bundle Sheath is composed of parenchymatous cells that surround the vascular bundles. The midrib region is prominent with larger vascular bundles, reinforced by collenchyma cells on both adaxial and abaxial sides. Secretory Cells, Calcium oxalate crystals and Resin Ducts are present within the mesophyll.

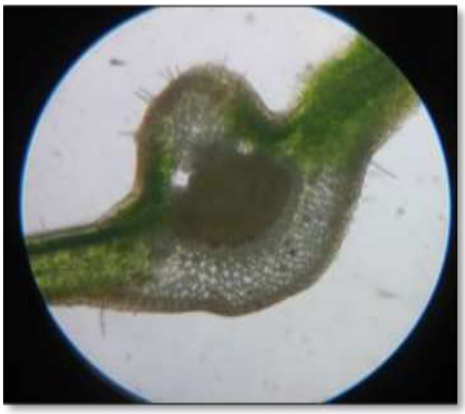

Fig 5: Transverse section of leaves of Simarouba glauca DC

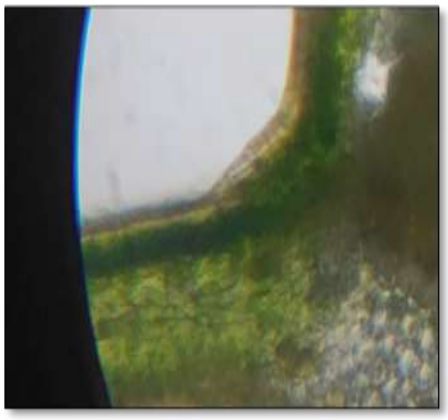

Fig 6: Upper epidermis

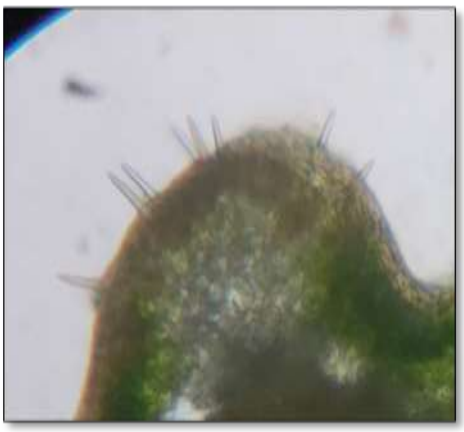

Fig 7: Trichonmes

Fig 8: lower epidermis

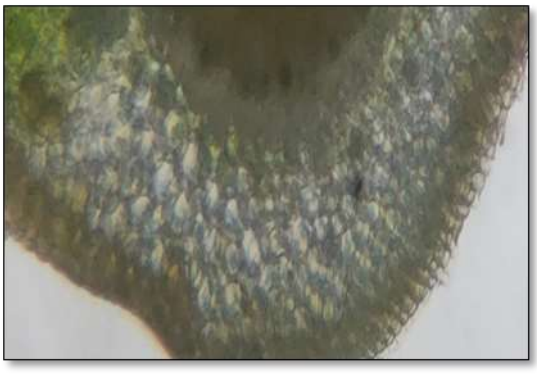

**Fig 24: Spongy Parenchyma cells**

**Physicochemical parameters studies**

The estimation of foreign matter, Loss on drying, Total ash, Acid insoluble ash, Sulphated ash, Water soluble extractives, Ethanol soluble extractives of *Simarouba glauca* DC leaves was found to be 2%, 9%, 5%, 1.5%, 4%, 12% and 9% respectively.

**Table 1: Results of Physicochemical parameters**

| Sl.No | Parameters | Result |
|---|---|---|
| 1. | Determination of foreign matter | 2% |
| 2. | Loss on drying | 9% |
| 3. | Total Ash | 5% |
| 4. | Acid insoluble ash | 1.5% |
| 5. | Sulphated ash | 4% |
| 6. | Water soluble extractive | 12% |
| 7. | Ethanol Soluble extractive | 9% |

**Qualitative Estimation Studies:**

**Table 2: Results of Qualitatative Estimation**

| Sl.No | Phytochemicals | Test | Observation | Inference |
|---|---|---|---|---|
| 1. | Alkaloids | Mayer's test | Pale green precipitate | Present |
| 2. | Glycosides | Modified borntrager's test | No pink/red colour | Absent |
| 3. | Flavonoids | Shinoda test | Reddish brown colour | Present |
| 4. | Phenols | Ferric chloride test | blue colour | Present |
| 5. | Anthraquinones | Borntrager's test | Rose pink colour | Present |
| 6. | Sterols | Liebermann's test | Bluish-green colour | Present |
| 7. | Saponins | Frothing test | Stable froth | Present |
| 8. | Tannins | Ferric chloride test | No blue-green or blue-black colour | Absent |
| 9. | Triterpenoids | Salkowski test | Reddish brown colour | Present |
| 10. | Carbohydrates | Molisch test | Reddish violet ring | Present |
| 11. | Oils and fats | Grease spot test | A greasy spot | Present |

**TLC studies:**

**Table 3: Results of TLC of the leaf extract**

| Sl.No | Band | Distance travelled by the solvent (in cm) | Distance travelled by the components (in cm) | $R_f$ value |
|---|---|---|---|---|
| 1. | 1 | 6.5 | 3.6 | 0.55 |
| 2. | 2 | 6.5 | 4.1 | 0.63 |
| 3. | 3 | 6.5 | 4.6 | 0.71 |
| 4. | 4 | 6.5 | 5.2 | 0.80 |

***Monograph of Simarouba glauca DC leaves***

**Lakshmitharu leaves**

*Simarouba glauca* DC belonging to family Simaroubaceae, is generally known as paradise tree. Simaroubacece family includes 32 genera and further 170 species of trees. It is a medium sized evergreen tree

**Synonyms:** Paradise Tree, dysentery bark, Lakshmitharu and Bitter wood

**Category:** Antioxidant, Anti-inflammatory, Anticancer Antimicrobial

**Description**: The mature tree attains a height of (25- 27 m) and a stem periphery of (40- 50 cm)

**Identification**: Leaves are dark green above, oblong and frequently notched, smooth and acute at the apex. Pinnate venation, with a prominent central vein and secondary veins branching out. Leaf texture is Smooth and glossy with a leathery feel

**Powder microscopy**: paracytic stomata, glabrous **microscopy** epidermal cells, presence of sclereids, fibers and calcium oxalate crystals

**TLC analysis**: coating the plate with chromatography grade silica gel GF254

**Mobile phase**: (Ethyl acetate: Methanol: Water in a ratio of 10:1.35:1)

**Test solution**: Ethanolic extract of the leaves

**Physicochemical parametes:**

**Foreign organic matter**: 2%

**Loss on Drying**: 9%

**Total ash:** 5%

**Acid insoluble ash**: 1.5%

**Water soluble extractives**: 12%

**Ethanol soluble extractives**: 9%

**Storage:** store away from sunlight and moisture

## Discussion

The morphological features of *Simarouba glauca* DC leaves suggest a well-adapted plant for tropical and subtropical environments. The leaf's large surface area, combined with its compound structure, enables efficient photosynthesis. The colour variation between the upper and lower surfaces, along with the smooth texture and entire margins, suggests adaptations for water conservation and sunlight management. The pinnate venation supports structural integrity, while the acute apex and smooth margins facilitate water runoff, reducing risks of waterlogging and fungal infections. The alternate leaf arrangement ensures efficient light capture and airflow, promoting healthy growth in a competitive canopy environment.

The microscopic features of *Simarouba glauca* DC leaves reveal a well-differentiated epidermis, along with a thick cuticle, provides protection against water loss, while amphistomatic leaf structure ensures efficient gas exchange even in a dry environment. The mesophyll, with its distinct palisade and spongy parenchyma, reflects a structure optimized for photosynthesis and gas exchange, critical for growth in tropical and subtropical conditions. The vascular bundles are highly developed, ensuring efficient transport of water and nutrients, while the bundle sheath provides additional protection and

regulates material flow. The presence of secretory cells and calcium oxalate crystals reflects biochemical defenses and physiological adaptations for managing environmental stress and herbivore.

The low content of foreign matter indicated proper handling and collection practices, which were essential for maintaining the quality of the plant material. The moisture content was within acceptable limits, ensuring that the leaves are properly dried and stable for storage and use. The total ash value and acid insoluble value were within the normal range, confirming the plant material's purity and minimal contamination with inorganic or extraneous matter. The sulphated ash content reflects the presence of inorganic elements, including important minerals, and was within acceptable limits for medicinal plants. The high extractive values suggested the presence of bioactive compounds that can be extracted using either water or ethanol, making the plant versatile for various herbal preparations.

TLC findings align with the known phytochemical profile of *Simarouba glauca* DC which includes flavonoids, terpenoids, alkaloids, saponins, and phenolic compounds. The separation of these compounds using TLC provides further evidence of the plant's diverse bioactive constituents and supports its potential for therapeutic application.

## Conclusion

The pharmacognostic standardization and monograph development of *Simarouba glauca* DC provide essential insights into the plant's morphology, anatomy, physicochemical properties, and phytochemical profile. This comprehensive characterization forms a critical foundation for the plant's identification, authentication, and quality assessment, which are necessary for its medicinal use. Establishing these standards ensures that herbal formulations derived from *Simarouba glauca* DC are consistent, safe, and effective. Additionally, the detailed monograph contributes to future research, supporting traditional medicine validation and potential pharmaceutical applications. This work lays the groundwork for the plant's broader acceptance and integration into standardized herbal pharmacopoeias worldwide

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