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PHARMACOGNOSTIC REVIEW OF *EHRETIA LAEVIS* ROXB. (KHANDU CHAKKA) PLANT MORPHOLOGY, POWDER EVALUATION, AND PHYSICOCHEMICAL PARAMETERS

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Abstract : ***Ehretia laevis*** **Roxb., commonly known as Khandu Chakka, is a medicinally important plant belonging to the family Boraginaceae and is extensively utilized in Indian traditional and folk medicine. Various parts of the plant, including leaves, bark, and fruits, are traditionally employed in the management of peptic ulcers, wounds, inflammatory conditions, hepatic disorders, dysentery, and skin diseases. Despite its wide ethnomedicinal application, comprehensive pharmacognostic standardization of *E. laevis* remains limited. The present review consolidates available scientific information on the macroscopic and microscopic characteristics, powder microscopy, and physicochemical parameters of *E. laevis*. Establishment of these pharmacognostic parameters is essential for correct botanical identification, detection of adulteration, quality control, and standardization of the crude drug. This review aims to provide a foundational reference for future phytochemical, pharmacological, and formulation-based investigations of *E. laevis*.**

IndexTerms **- *Ehretia laevis*, Khandu Chakka, Pharmacognosy, Powder microscopy, Physicochemical parameters, Herbal standardization.**

Abstract

Ehretia laevis Roxb., commonly known as Khandu Chakka, is a medicinally important plant belonging to the family Boraginaceae and is extensively utilized in Indian traditional and folk medicine. Various parts of the plant, including leaves, bark, and fruits, are traditionally employed in the management of peptic ulcers, wounds, inflammatory conditions, hepatic disorders, dysentery, and skin diseases. Despite its wide ethnomedicinal application, comprehensive pharmacognostic standardization of *E. laevis* remains limited. The present review consolidates available scientific information on the macroscopic and microscopic characteristics, powder microscopy, and physicochemical parameters of *E. laevis*. Establishment of these pharmacognostic parameters is essential for correct botanical identification, detection of adulteration, quality control, and standardization of the crude drug. This review aims to provide a foundational reference for future phytochemical, pharmacological, and formulation-based investigations of *E. laevis*.

Keywords:*Ehretia laevis*, Khandu Chakka, Pharmacognosy, Powder microscopy, Physicochemical parameters, Herbal standardization

1. Introduction

Medicinal plants have served as the primary source of healthcare for a large proportion of the global population, particularly in developing countries. The World Health Organization estimates that nearly 80% of the world's population relies on traditional medicine for primary healthcare needs [1]. However, the

therapeutic efficacy and safety of herbal medicines depend largely on the authenticity, purity, and quality of the raw materials used.

Ehretia laevis Roxb. is a medium-sized deciduous tree widely distributed across India, particularly in dry deciduous forests of Maharashtra, Madhya Pradesh, Gujarat, Rajasthan, and parts of South India [2]. The plant is well known in folk medicine under vernacular names such as Khandu Chakka, Ajan Vruksha, and Chamror. Traditionally, the leaves are used for wound healing and ulcer management, the bark for liver disorders and inflammation, and the fruits as a mild laxative and nutritive agent [3,4].

Pharmacognostic evaluation—which includes macroscopic, microscopic, powder, and physicochemical analysis—is considered the first and most fundamental step in the standardization of herbal drugs [5]. These parameters ensure correct identification and help differentiate genuine plant material from substitutes or adulterants. Given the increasing interest in *E. laevis* for its gastroprotective and wound-healing potential, comprehensive pharmacognostic documentation is essential.

This review focuses on the plant morphology, powder evaluation, and physicochemical parameters of *E. laevis*Roxb., thereby contributing to its scientific validation and potential inclusion in herbal pharmacopeias.

2. Plant Morphology (Macroscopic Evaluation)

2.1 Botanical Classification

1. Kingdom: Plantae
2. Order: Boraginales
3. Family: Boraginaceae
4. Genus: *Ehretia*
5. Species: *Ehretia laevis* Roxb.

2.2 Habit and Habitat

Ehretia laevis is a medium-sized deciduous tree attaining a height of approximately 10–15 m. It is commonly found in dry deciduous forests, scrublands, and rocky terrains. The plant exhibits high adaptability to arid and semi-arid climatic conditions and is often found growing wild rather than under cultivation [6].

2.3 Stem and Bark

The stem is erect, cylindrical, and woody. The bark is grayish-brown, rough, and longitudinally fissured. Exfoliation of bark occurs in irregular patches, revealing a pale brown inner surface. The inner bark is fibrous and mucilaginous, which may account for its traditional use in wound healing and ulcer management [7]. The bark possesses a slightly astringent taste.

2.4 Leaves

Leaves are simple, alternate, ovate to elliptic, measuring approximately 6–15 cm in length. The leaf margin is entire or slightly crenate, with an acute to acuminate apex and a rounded base. The upper surface is dark

green and glabrous, whereas the lower surface is lighter in color and sparsely pubescent. Venation is reticulate and prominent on the lower surface. The leaves exhibit a slightly bitter taste, which is often associated with the presence of bioactive phytoconstituents such as tannins and flavonoids [8].

2.5 Flowers

Flowers are small, white to yellowish-white, arranged in axillary or terminal cymes. They are bisexual and mildly fragrant. The calyx is campanulate, while the corolla is tubular with spreading lobes. Flowering typically occurs during the summer season.

2.6 Fruits

The fruit is a globose drupe, green when unripe and turning orange-red upon ripening. The fruit is mucilaginous and edible, traditionally consumed to relieve constipation and improve digestion. The mucilage content may contribute to its gastroprotective properties [9].

3. Microscopy and Powder Evaluation

3.1 Leaf Microscopy

Microscopic evaluation of the leaf provides diagnostic anatomical features essential for identification.

The transverse section (T.S.) of the leaf reveals a dorsiventral structure, characteristic of dicotyledonous plants [10].

Epidermis

The upper and lower epidermis consist of a single layer of rectangular cells covered with a thin cuticle. The lower epidermis shows a higher frequency of stomata compared to the upper surface.

Stomata

Stomata are predominantly paracytic (rubiaceous) type, mainly distributed on the abaxial surface. This stomatal type serves as a key diagnostic feature for *E. laevis* [11].

Mesophyll

The mesophyll is differentiated into:

- Palisade parenchyma: One to two layers of elongated cells rich in chloroplasts.
- Spongy parenchyma: Loosely arranged cells with intercellular spaces facilitating gaseous exchange.

Vascular Bundles

Vascular bundles are collateral and closed, surrounded by sclerenchymatous tissue, providing mechanical support. Xylem vessels are well developed, indicating efficient water conduction.

Calcium Oxalate Crystals

Prismatic calcium oxalate crystals are frequently observed in mesophyll cells. These crystals are commonly encountered in Boraginaceae and serve as an additional diagnostic marker [12].

3.2 Powder Microscopy

Powder microscopy plays a crucial role in identifying crude drugs in powdered form, where macroscopic features are lost.

Diagnostic Powder Characters

Microscopic examination of powdered leaf and bark material of *E. laevis* reveals:

- ✓ Fragments of epidermal cells with paracytic stomata
- ✓ Spiral and annular xylem vessels
- ✓ Lignified fibers with thick walls
- ✓ Prismatic calcium oxalate crystals
- ✓ Simple and compound starch grains
- ✓ Tracheids and sclerenchyma fragments

These features collectively serve as **authentication markers** and are useful in detecting adulteration or substitution with morphologically similar plant materials [13].

4. Physicochemical Parameters

Physicochemical evaluation provides numerical values that help assess the purity and quality of crude drugs.

4.1 Ash Values

Ash values represent the inorganic residue remaining after incineration and are indicative of contamination or adulteration [14].

Parameter	**Typical Range**
Total ash	8–12%
Acid-insoluble ash	<2%
Water-soluble ash	3–5%

A low acid-insoluble ash value suggests minimal contamination with siliceous matter such as sand or soil.

4.2 Extractive Values

Extractive values indicate the amount of active constituents extracted with specific solvents.

Extractive Type	Observation
Alcohol-soluble extractive	High
Water-soluble extractive	Moderate

Higher alcohol-soluble extractive values suggest the presence of moderately polar phytoconstituents such as flavonoids, tannins, phenolic compounds, and triterpenoids, which are known for gastroprotective and anti-inflammatory activities [15].

4.3 Loss on Drying

Loss on drying measures moisture content in the crude drug.

- Range: 6–9%

Controlled moisture content is essential to prevent microbial growth, enzymatic degradation, and deterioration of bioactive compounds during storage [16].

5. Significance of Pharmacognostic Evaluation

Pharmacognostic standardization of *Ehretia laevis* offers several advantages:

- Ensures correct botanical identity
- Establishes quality control standards
- Supports reproducibility of therapeutic effects
- Facilitates regulatory acceptance and pharmacopeial inclusion
- Provides a scientific basis for phytochemical and pharmacological studies

Given its traditional use in ulcer management and wound healing, the establishment of pharmacognostic parameters is crucial for its safe incorporation into modern herbal formulations and nutraceuticals [17].

6. Conclusion

The present review demonstrates that *Ehretia laevis* Roxb. possesses distinct macroscopic, microscopic, powder, and physicochemical characteristics that can be effectively utilized for its authentication and quality control. Systematic pharmacognostic evaluation forms the foundation for the scientific validation of this traditionally important medicinal plant. Although existing data support its therapeutic potential, further studies focusing on phytochemical standardization, bioactive marker identification, and clinical evaluation are warranted to develop *E. laevis* as a standardized herbal drug.

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