Pharmacognostic study of Gambhari phala and Patra (Gmelina arborea. Linn)

Dixit Renu, P Kumar Dileep and Reddy KV Vijaya Bhaskara

Abstract
Gmelina arborea. Linn is one of the important medicinal plants most widely propagated and cultivated species of the family Verbenaceae. It is commonly known as “Kashmarya” and one of the herbs mentioned in all ancient scriptures of Ayurveda. It is a beautiful fast growing avenue tree that grows throughout India. This medicinal plant is highly valued from time immemorial because of its vast medicinal properties. Gambhari an essential component of Dashamuala. The Rasayana (rejuvenative), Medhya (Memory enhancer) and Vrishya (Aphrodisiac) activities have been related to its fruits, which are edible in nature. The leaf of Gambhari has been mentioned in the diseases like Vran(Wounds) and Kushta (Skin diseases). The classical part of plant Gambhari is root. It is extensively used traditionally as antihelmintic, antimicrobial, antidiabetic, diuretic, hepatoprotective and antiepileptic agent. The present article provides insight on the Pharmacognostic study of fruit and leaf Gambhari.

Objective: To investigate Macroscopic, Microscopic structures, Powder analysis of Gambhari (Gmelina arborea. Linn) Phala (Fruit) and Patra (Leaves). Which is well mentioned plant in all Ayurvedic classics.

Methods: The Pharmacognostic study was done based on the principles mentioned in Pharmacognosy of Kokate.

Results: Macroscopic and Microscopic study showed distinct characteristics in the Fruits of Gambhari like Epicarp, Mesocarp and Endocarp and Leaves of Gambhari like Epidermis, Mesophyll and Vascular bundles. Powder analysis of Gambhari Fruit revealed the presence of Stone cells, Oil globules, Fragments of lignified fibers and Powder analysis of Gambhari Leaf showed the multi cellular, uniseriate trichomes, glandular trichomes and starch grains.

Conclusion: In the standardization of the drug and identification and to ensure quality and purity standards.

Keywords: Kashmarya, dashamula, gambhari, Gmelina arborea. Linn, verbenaceae

Introduction
Gambhari (Gmelina arborea. Linn) belongs to the family Verbenaceae. It is found throughout greater part of India, Western Ghats, and from foot of North-West Himalaya to Chittagong and throughout Deccan Peninsula. It is a medium sized to rarely large deciduous tree attaining a height of 15-20m. This plant is planted in gardens and also as an avenue tree. Gmelina arborea. Linn is one of the ingredients of most famous group Dashamoola and in particular Brihat panchamula. It is popularly known as Coomb teak, Cashmeri tree, Candhar tree i arborea Linn. This plant is planted in gardens and also as an avenue tree. Gmelina arborea. Linn is one of the ingredients of most famous group Dashamoola and in particular Brihat panchamula. It is popularly known as Coomb teak, Cashmeri tree, Candhar tree (Kashmarya, Kashmeeri, Gambhari in Sanskrit. Different parts of the plant can be used medicinally like root, fruit, leaf, flower, bark. The family Verbenaceae consists of 2,600 species, among them 107 species are found in India. The present study deals pharmacological activities carried on Gmelina arborea. Linn.

Taxonomical Classification
Taxonomy is the science of systematically naming and organizing organisms in to similar groups. Plant taxonomy is an old science that uses the gross morphology (flower form, leaf shape, fruit form etc.) of plants to separate them in to similar groups. Taxonomical classification of plant Gmelina arborea. Linn (Gambhari), is tabulated.

Taxonomical Profile
Kingdom : Plantae
Division : Magnoliophyta
Class : Magnoliopsida
Order : Lamiales
Family : Verbenaceae
Genus : Gmelina
Species : Gmelina arborea Linn.
Common names (Vernacular names)

Burmese: Yemane, Yemani, Yemari
English: Beechwood, Melina, Goomar teak, Kashmir tree.
French: Melina, Melina, Peuplier d’Afrique
German: Gumlar-Teak
Nepali: Gamari, Gambari, Gunhari.
Bengali: Gamari, Gambar, Gunbar
Gujarati: Shewan, Sivan.
Hindi: Gamhar, Khamara, Khumbhari.
Kannada: Kulimavu, Kumbuda, Kumulu
Kasimir: Mara, Shivani
Malayalam: Kumbil, Kumbulu, Kumil, Kumiska.
Marathi: Shivam, Siwan
Oriya: Bhodroporni, Gambari, Kumar
Punjabi: Gunhar, Khumbar
Sanskrit: Gambhari, Sindhuparni, Bhdraparni, Kasmari.
Tamil: Kulama, Kunalamaram, Kulum, Unmithekku
Telugu: Gumtek, Gummadi, Summadi

Paryaaya Naama (Synonyms)
A single name is given to, many drugs and also a drug may have many names which are called as Paryaayas. Names and synonyms are the tools to specify the salient features of the plants. Likewise Gambhari also have paryaayas.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Synonym</th>
<th>Nirukti</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kashmiri</td>
<td>It is a beautiful tree</td>
</tr>
<tr>
<td>2</td>
<td>Kashmire</td>
<td>It is found Kashmir</td>
</tr>
<tr>
<td>3</td>
<td>Krishnavrnta</td>
<td>It has blackish petiole</td>
</tr>
<tr>
<td>4</td>
<td>Pitrohini</td>
<td>It has yellowish bark</td>
</tr>
<tr>
<td>5</td>
<td>Bhdraparni</td>
<td>It has beautiful leaves</td>
</tr>
<tr>
<td>6</td>
<td>Mahakusumaka</td>
<td>It has long inflorescence</td>
</tr>
<tr>
<td>7</td>
<td>Vatahrit</td>
<td>It is good remedy for vatiya disorders</td>
</tr>
<tr>
<td>8</td>
<td>Shrirpi</td>
<td>It has beautiful leaves</td>
</tr>
<tr>
<td>9</td>
<td>Sarvatobadhra</td>
<td>Each part of this tree has medicinal values</td>
</tr>
<tr>
<td>10</td>
<td>Suphala</td>
<td>Fruits are wholesome</td>
</tr>
<tr>
<td>11</td>
<td>Shulatvaca</td>
<td>It has thick stem bark</td>
</tr>
<tr>
<td>12</td>
<td>Hira</td>
<td>Fruits are used as Rasayana</td>
</tr>
<tr>
<td>13</td>
<td>Madhuparni</td>
<td>Its leaves are sweet as honey or its leaves are glabrous, shining like honey</td>
</tr>
</tbody>
</table>

Distribution
Found throughout India, from north-west Himalaya to Chittagong and throughout Deccan peninsula.

Family Features
Over 2,600 species, 107 species are found in India. Herbs, shrubs, trees or climbers. Often prickly and some are xerophytic in habit. They are usually strong smelling. The stem is sometimes 4- angled.
Leaves: simple, opposite or whorled and sometimes pinnately or palmately compound.
Inflorescence: Raceme, panicle or spike (long or condensed), or a dichasial cyme.
Flowers: Bisexual, medianly zigymorphic, hypogynous and pentameros. Bracts are sometimes in the form of involucres, as in Lantana.
Calyx: Sepals usually 5, rarely 4 or more andเกมสิapoepalos. The calyx is persistent.
Corolla: Petals usually 5, gamopetalous. They are initially 2 lipped and later 5 lobed. The tube may be long or short and the limb oblique is aestivation imbricate.
Androecium: Stamens are 4, didynamous and epipetalous (rarely 2 or 5). Often inserted or sometimes exerted and alternate with corolla lobes.

Gynoecium: Carpels are 2, rarely 4 and syncarpous. Superior ovary, entire or lobed, 2-locular with 1 or 2 ovules in each chamber or 4-locular with 1 ovule in each chamber. Terminal style.
Fruit: Drupe (2 or 4 pyrenes) and rarely capsule.
Seed: Exalbuminous seed.
Floral Formula: 1.25K(5)C(5)A4G(2)
Part Used - Root, bark, leaf, flower, and fruit.

Table 2: Showing Classical Categorization / Gana of Gambhari in different Ayurvedic texts

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Reference</th>
<th>Varga</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Caraka Samhita</td>
<td>Sothahara, Dahaprassamana, Virecanopaga</td>
</tr>
<tr>
<td>2</td>
<td>Susruta Samhita</td>
<td>Sarivadi, Brhat pancamula</td>
</tr>
<tr>
<td>3</td>
<td>Astanga Hrdaya</td>
<td>Sarivadi</td>
</tr>
<tr>
<td>4</td>
<td>Bhavaprakash Nighantu</td>
<td>Guduchayadi</td>
</tr>
<tr>
<td>5</td>
<td>Kalyadeva Nighantu</td>
<td>Aushadhi</td>
</tr>
<tr>
<td>6</td>
<td>Raja Nighantu</td>
<td>Prabhadri</td>
</tr>
<tr>
<td>7</td>
<td>Mahasudha Nighantu</td>
<td>Bilvadi</td>
</tr>
<tr>
<td>8</td>
<td>Dhanvantari Nighantu</td>
<td>Guduchayadi</td>
</tr>
<tr>
<td>9</td>
<td>Shodala Nighantu</td>
<td>Guduchayadi</td>
</tr>
<tr>
<td>10</td>
<td>Madanpala Nighantu</td>
<td>Abbayadi</td>
</tr>
</tbody>
</table>

Table 3: Rasa Panchaka of Gambhari parts

<table>
<thead>
<tr>
<th>Part</th>
<th>Rasa</th>
<th>Guna</th>
<th>Virya</th>
<th>Vipaka</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root</td>
<td>Tikta, Kashaya, Madhura</td>
<td>Guru</td>
<td>Ushna</td>
<td>Katu</td>
</tr>
<tr>
<td>Fruit</td>
<td>Kashay Amla, Madhura</td>
<td>Snigdha, Guru</td>
<td>Sita</td>
<td>Madhura</td>
</tr>
<tr>
<td>Flower</td>
<td>Kashaya, Madhura, Tikata</td>
<td>Snigdha</td>
<td>Sita</td>
<td>Madhura</td>
</tr>
<tr>
<td>Leaf</td>
<td>Madhura, Kashaya</td>
<td>Snigdha</td>
<td>Sita</td>
<td>Madhura</td>
</tr>
</tbody>
</table>

Chemical Constituents
Gmelin furan-a furanosquiterpenoid, sessquiterpene, cerylalcohol, hentriacontanol-1, β-sitosterol, n-octacosanol, gmelinol, apiosylskimmin-a apiofuranosy1-(1-6)-β-D-glucopyranosyl (1.0.7)-umbelliferone.
Root: cluytylferulate, n-octacosanol, gmelinol, arboreol, 2-0-methyl arboareol, 2-0-ethylarboreol, isoarboreol, gmelanone,β-sitosterol, paulownin, 6'-bromoisoarboreol, 4-hydroxysemasin, 4,8-dihydroxysemasin, 4,14-dihydroxysemasin(gumadiol), 2-piperonyl-3-(hydroxymethyl)-4(α-hydroxy-3,4-methylenedioxybenzyl)-4-hydroxy tetrahydro furan (1), 4-epigumadiol-4-0-glucoside, 1,4-dihydroxy-2,6-dipiperonyl-3,7-dioxabicyclo[3.3.0]-octane, gmelanone, palmitic, oleic and linoleic acids, stigmasterol, stigmastanol, campesterol, α-2-sitosterol, butulolin.
Leaf: luteolin, apigenin, quercetin, hentriacontanol, β-sitosterol, quercetogenin and other flavons.
Fruits: Butyric and tartaric acids, saccharine substances and little tannin, β-sitosterol, ceryl alcohol, gmelinol, arboreol, arboreol, luteolin, apigenin, quercetin, hentriacontanol, quercetogenin.

Pharmacognostic Study of Gambhari phala and Patra
Aims and Objectives
To study the Macroscopic, Microscopic study and Powder Analysis of Gmelina arborea. Linn Fruits and Leaves.

Materials and Methods
Drug Collection and Authentication
The Fruits and fresh leaves of Gambhari (Gmelina arborea. Linn) were collected from S.V. Ayurvedic College, Tirupati, Andhra Pradesh. Authenticated by Botanist S. Koteswara

http://www.phytojournal.com
Rao, Post graduate teacher in Botany, A.P.Model School and Junior College, Madanapalli, Chittoor Dist. Tirupati.

Observation and Results
Pharmacognosy of *Gmelina arborea* Linn (Fruit Pericarp)

**Drug description:** Dried, Dark-black colour, pyriform or ob-ovoid - oblong fruits with wrinkled surface

**Macroscopic Properties**
Size: Length: 2 to 3 cm (Ref: 1.5- 2 cm);
Width: 15 to 30 mm (Ref: 13-25 mm)
Shape: Ovoid
Colour: Black
Odour: Not characteristic
Taste: Sweetish sour

Fruits is a Drupe ovoid in shape, black in colour, externally exhibiting crinkled surface, some are attached with a portion of pedicel, generally two seeded some times one seeded; seeds ovate 0.5 to 1 cm long and 0.3 to 0.6 cm wide, light yellow with smooth surface, seed coat thin papery and oily in taste.

**Microscopic Properties**

**T.S. of Pericarp:** Transverse Section of Pericarp is done by Free hand Section cutting and Simple staining procedure and findings are as mentioned below.
Transverse section of Pericarp shows mainly three parts (A). Epicarp (B.) Mesocarp (C). Endocarp

A. **Epicarp**
- Pericarp externally covered by a layer of Epicarp
- Epicarp represented by a single layer of thin walled cells

B. **Mesocarp**
- Inner to the Epicarp, Mesocarp is present
- Mesocarp is represented by a multi layered wide zone of isodiametric, thin-walled, parenchymatous cells arranged loosely.

C. **Endocarp**
- Mesocarp followed by Endocarp
- Endocarp composed of several layers of Sclerenchymatous cells
- Cells are filled with darkly stained colouring matter

**Powder Analysis:** Powder Analysis is carried out by clarifying the powder in chloral hydrate solution and prepared Glycerin mount, Iodine solution mount and Saffranin solution mount and the following characters are identified.

**Organoleptic properties**
**Colour:** Blackish Brown
**Odour:** Not characteristic
**Taste:** Astringent
**Texture:** Fine Powder

**Microscopic Characters**
- Stonecells
- Fragments of lignified fibres
- Oil globules
- Aleurone grains
- Fragments pericarp tissue filled with colouring matter

*Microscopic images of Gambhari fruit powder*
Pharmacognosy of Gmelina arborea. Linn (Leaf)

**Drug description:** freshly collected green colour raw leaves, Leathery in touch with green color, slightly sweet and bitter in taste.

**Macroscopic Properties**
- **Size:** Length: Up to 15 to 20 cm
- **Width:** up to 7 to 15 cm
- **Shape:** Broadly Ovate or oblong
- **Colour:** Dark Green
- **Odour:** Not specific
- **Taste:** Slightly sweet and bitter

The leaves are simple, opposite, Broadly ovate or oblong, apex acuminate, Leaf margin is entire, upper surface glabrous, lower surface is covered with numerous hairs. Base is subcordate, some times truncate and shortly cuneate. Petiole: long measures up to 10 to 15cm in length, cylindrical in shape and with glandular surface

**Microscopic Properties**

**T.S. of Leaf:** Transverse Section of Leaf is done by Free hand Section cutting and simple staining procedure and findings are as mentioned below.

**A. Epidermis**
- Leaf on either sides covered with Epidermal layers i.e Upper Epidermis and Lower Epidermis.
- Epidermal Layers composed of a single row of rectangular tangentially elongated cells
- Externally both epidermal layers are covered by a thick cuticle
- Lower epidermal layer externally covered with several elongated multicellular, uni -seriate covering trichomes with blunt ends, which make the lower surface pubescent.
- On the Lower epidermis several Gladular Trichomes with short stalk are also visible
- On the lower epidermal layer few stomata are present here and there.

**B. Mesophyll**
- In between upper and Lower epidermal layers mesophyll region is present
- Mesophyll is distinguished in to 1 to 2 layers of Palisade parenchyma and 5 to 6 layers of spongy parenchyma.
- Palisade parenchyma cells are radially elongated, arranged compactly without any intercellular spaces and filled with dense chlorophyll pigment
- Cells of spongy parenchyma are oval to circular in shape, loosely arranged with intercellular spaces and filled with chlorophyll pigment comparatively less than palisade parenchyma.
- At the region of midrib the upper epidermis is followed by 10 to 12 layers of collenchymatous hypodermis.
- Below the vascular bundle towards lower epidermis few layers of compactly arranged collenchymatous tissue is present.

**C. Vascular Bundle**
- The vascular strand is single, broadly cup or bowl shaped with conjoint collateral vascular bundle
- vascular bundle composed of xylem towards Lower epidermis and Phloem towards upper epidermis
- The xylem elements are wide, angular, thick walled and arranged compactly in parallel lines.
- Phloem consists of narrow, thick walled sieve elements and phloem parenchyma.
- A discontinuous ring of sclerechymatous, pericyclic fibre bundle sheath covers the vascular bundle.

**Powder Analysis:** Powder Analysis is carried out by clarifying the powder in chloral hydrate solution and prepared Glycerin mount, Iodine solution mount and Saffranin solution mount and the following characters are identified.

**Organoleptic properties**
- **Colour:** Green
- **Odour:** Not specific
- **Taste:** Slightly bitter and astringent
- **Texture:** Fine Powder

**Microscopic Characters**
- Numerous elongated, multi cellular, uni-seriate covering trichomes
- Glandular Trichomes without stalk
- fragments of wavy thin walled epidermal cells in surface view
- Starch grains of various shapes and sizes
- Fragments of Xylem elements isolated and in bundles with annular thickenings.
- Lignified xylem fibres in bundles and also isolated.
Image 7: Transverse section of Gambhari Leaf

Image 8: Transverse section of Gambhari Leaf

Microscopic images of Gambhari Leaf powder

Image 9: Transverse section of Gambhari Leaf (Lamina enlarged)

Image 10: Multicellular Trichome, Glandular Trichome, Fragments vessels of Gambhari leaf powder
Discussion

Under Pharmacognostical studies Macroscopic structures of fruit was observed as drupe, ovoid, black in color, externally wrinkled surface, generally two seeded. Seeds are ovate, light yellow with smooth surface, seed coat is thin pappery on touch. The taste is slightly sweet and bitter. Microscopic structures of fruit are Epicarp, Mesocarp, Endocarp. The Epicarp is single layer thin walled cells. Mesocarp is multilayerd with isodiametric, thin walled, parenchymatous are loosely arranged. Endocarp with several layers of sclerenchymatous cells which are darkly stained. Macroscopic structures of leaf shape is broadly ovate and oblong, dark green in colour and taste is slightly sweet and bitter. Microscopic structures of leaf is Epidermis, Mesophyll and Vascular bundle. The Epidermis is with of upper and lower epidermis and upper is covered with thick cuticle and lower is covered with several elongated multicellular, uni-seriate covering trichomes with blunt ends. Mesophyll is in between upper and lower epidermal layers. Mesophyll is distinguished into 1 to 2 layers of palisade parenchyma and 5 to 6 layers of spongy parenchyma. Vascular bundle is single, broadly cup or bowl shaped with conjoint collateral vascular bundle. Vascular bundle is composed of xylem towards lower epidermis and phloem is towards upper epidermis. Powder analysis of Gambhari phala shows the presence of Stonecells Fragments of lignified fibres, Oil globules, Aleurone grains, Fragments pericarp tissue filled with colouring matter, Few prismatic crystals of calcium oxalate. Powder analysis of Gambhari Patra shows the presence of numerous elongated, multi cellular, uni-seriate covering trichomes, Glandular Trichomes without stalk, fragments of wavy thin walled epidermal cells in surface view. Starch grains of various shapes and sizes. Fragments of Xylem elements isolated and in bundles with annular thickenings. Lignified xylem fibres in bundles and also isolated.

Conclusion
The Pharmacognostic study provided the data helpful for the correct identification and authentication of raw drug.

Acknowledgement
Authors express their heartfelt thanks to Botanist S. Koteswara Rao, Post graduate teacher in Botany, A.P. Model School and Junior College, Madanapalli, Chitoor Dist. Tirupati for their timely support in providing us the necessary facilities for carrying out Pharmacognostic study for the research work.

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