



E-ISSN: 2278-4136
 P-ISSN: 2349-8234
www.phytojournal.com
 JPP 2021; 10(1): 17-22
 Received: 06-11-2020
 Accepted: 12-12-2020

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

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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 Dashamoola. 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 Vrana(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, uni – seriate 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 in English. 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	:	<i>Gmelina</i>
Species	:	<i>Gmelina arborea</i> Linn.

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Common names (Vernacular names)**Burmese:** Yemane, Yemani, Yemari**English:** Beechwood, Gmelina, Goomar teak, Kashmir tree.**French:** Gmelina, Melina, Peuplier d Afrique**German:** Gumar-Teak**Nepali:** Gamari, Gambari, Gumhari.**Bengali:** Gamari, Gambar, Gumbar**Gujarati:** Shewan, Sivan.**Hindi:** Gamhar, Khamara, Khumbhari.**Kannada:** Kulimavu, Kumbuda, Kumulu**Kasmiri:** Mara, Shivani**Malayalam:** Kumbil, Kumbulu, Kumilu, Kumiska.**Marathi:** Shivan, Siwan**Oriya:** Bhodroporni, Gambari, Kumar**Punjabi:** Gumhar, Kumhar**Sanskrit:** Gambhari, Sindhuparni, Bhadruparni, Kasmari.**Tamil:** Kumla, Kumalamaram, Kumil, Ummithekku**Telugu:** Gumartek, 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 1: Showing *Paryaaya naama* (Synonyms)

S. No.	Synonym	Nirukti
1	Kashmari	It is a beautiful tree
2	Kashmiri	It is found Kashmir
3	Krishnavrinta	It has blackish petiole
4	Pitarohini	It has yellowish bark
5	Bhadruparni	It has beautiful leaves
6	Mahakusumaka	It has long inflorescence
7	Vatahrit	It is good remedy for vatika disorders
8	Shriparni	It has beautiful leaves
9	Sarvatobadhra	Each part of this tree has medicinal values
10	Suphala	Fruits are wholesome
11	Sthulatvaca	It has thick stem bark
12	Hira	Fruits are used as Rasayana
13	Madhuparni	Its leaves are sweet as honey or its leaves are glabrous, shining like honey

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 zygomorphic, hypogynous and pentamerous. Bracts are sometimes in the form of involucre, as in Lantana.

Calyx: Sepals usually 5, rarely 4 or more and gamosepalous. 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 exserted 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: $\cdot \downarrow \cdot \text{♀} \text{♂} \text{K} (5) \text{C} (5) \text{A}4 \underline{\text{G}} (2)$

Part Used - Root, bark, leaf, flower, and fruit.

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

S. No.	Reference	Varga
1	Caraka Samhita	Sothahara, Dahaprasamana, Virecanopaga
2	Susruta Samhita	Sarivadi, Brhat pancamula
3	Astanga Hridaya	Sarivadi
4	Bhavaprakash Nighantu	Guduchayadi
5	Kaiyaideva Nighantu	Aushadhi
6	Raja Nighantu	Prabhadradi
7	Mahausadha Nighantu	Bilvadi
8	Dhanvantari Nighantu	Guduchayadi
9	Shodala Nighantu	Guduchayadi
10	Madanpala Nighantu	Abhayadi

Table 3: Rasa Panchaka of Gambhari parts

Gambhari	Rasa	Guna	Virya	Vipaka
Root	Tikta, Kashaya, Madhura	Guru	Ushna	Katu
Fruit	Kashay Amla, Madhura	Snigdha, Guru	Sita	Madhura
Flower	Kashaya, Madhura, Tikata	Snigdha	Sita	Madhura
Leaf	Madhura, Kashaya	Snigdha	Sita	Madhura

Chemical Constituents

Gmelo furan-a furanosesquiterpenoid, sesquiterpene, cerylalcohol, hentriacontanol-1, β -sitosterol, n-octacosanol, gmelinol, apiosylskimmim-a apiofuranosyl-(1-6)- β -D-glucopyranosyl (1.0.7)-umbelliferone.

Root: cluetylferulate, n-octacosanol, gmelinol, arboreol, 2-0-methyl arboreal, 2-0-ethylarboreol, isoarboreol, gmelanone, β -sitosterol, paulownin, 6''-bromoisoarboreol, 4-hydroxysesamin, 4,8-dihydroxysesamin, 1,4-dihydroxysesamin(gummadiol), 2-piperonyl-3-(hydroxymethyl)-4(α -hydroxy-3-, 4-methylenedioxybenzyl)-4-hydroxy tetrahydro furan (1), 4-epigummadiol-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, butulinol.

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, 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

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

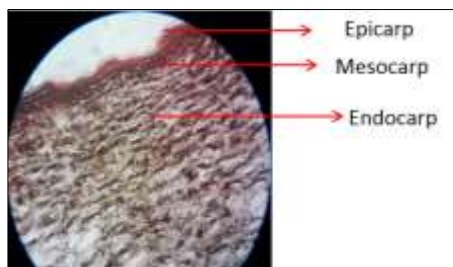


Image 1: Transverse Section of Gambhari Fruit

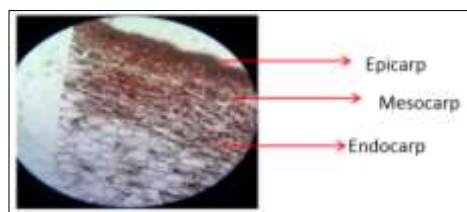


Image 2: Transverse Section of Gambhari Fruit

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



Image 3: Fibers and Stone cells of Gambhari fruit



Image 4: Showing Fibers of Gambhari fruit



Image 5: Sclerenchymatous cells of Endocarp of Gambhari fruit



Image 6: Prismatic crystals of Gambhari fruit

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 speciic

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 lenth, 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 sclerenchymatous, 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.

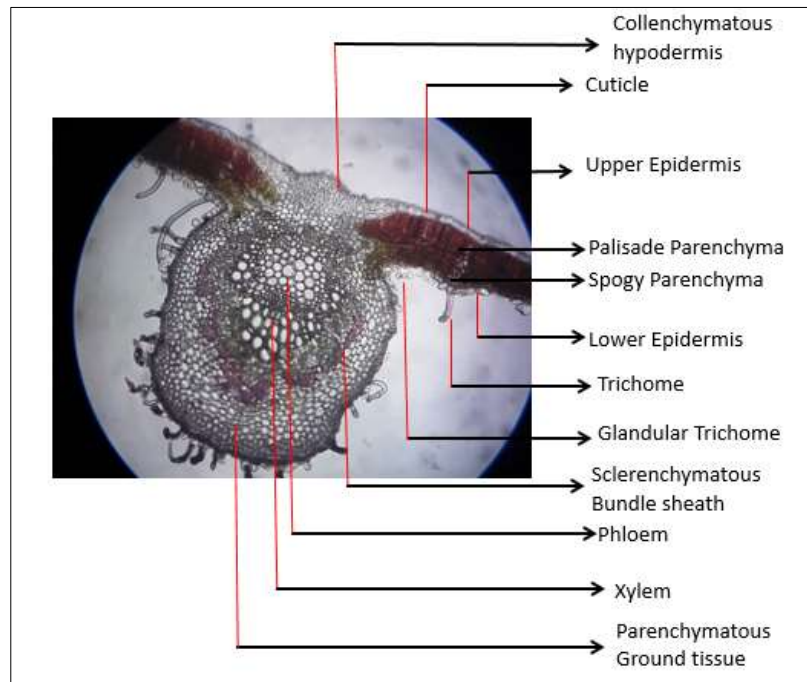


Image 7: Transverse section of Gambhari Leaf

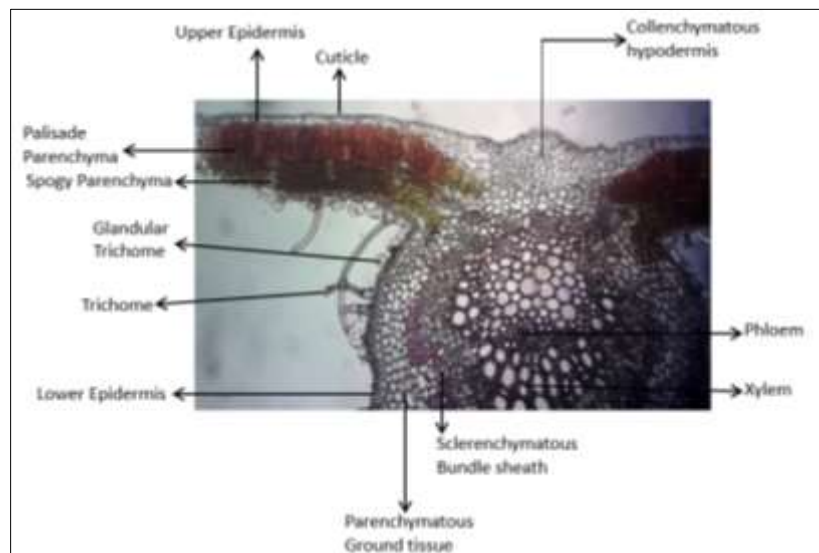


Image 8: Transverse section of Gambhari Leaf



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

Microscopic images of Gambhari Leaf powder



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



Image 11: Fragments of epidermis, Starch grain, Multicellular Trichome 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 multilayered 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, Chittoor 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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