



**A COMPARATIVE PHARMACOGNOSTIC AND PHYTOCHEMICAL STUDY OF  
GAMBHARI & PANI-GAMBHAR**

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**ABSTRACT**

Herbal medicines are being used by mankind for several years. In recent decade there has been a tremendous increase in interest towards plant based medicines, especially for new sources of drugs. *Gmelina arborea* Roxb. ex Sm. (Verbenaceae) is the authentic botanical entity correlated to *Gambhari* as per the Ayurvedic pharmacopoeia of India. Root of *Gambhari* is one of the ten ingredients of *Dasmula*, an important formulation in Ayurveda. Although stem bark is used instead of root bark due to saving the life of plant. The increasing Annual demand of the raw drug and the decline in the availability of the authentic species have led to arbitrary substitution and adulteration in the raw drug market. This study provides comparative pharmacognostic and phytochemical characteristics of authentic *Gmelina arborea* Roxb. ex Sm. and one of its substitute namely *Mallotus nudiflorus* (L.) Kulju & Welzen (Euphorbiaceae). The perception of the present study is "A comparative pharmacognostic and phytochemical study of *Gambhari* and *Pani gambhar*." In current study, all aspect about *Gmelina arborea* Roxb. ex Sm. and *Mallotus nudiflorus* (L.) Kulju & Welzen have been taken like Name, Geographical source, Macroscopy, Microscopy, Physicochemical, Phytochemical (Qualitative and Quantitative) and Chromatographic. In phytochemical study, on the basis of Quantitative analysis total Flavonoid, Steroid, Alkaloid were estimated.

**KEYWORDS:** *Gmelina arborea* Roxb. ex Sm., *Mallotus nudiflorus* (L.) Kulju & Welzen, Flavonoid, Alkaloid, Aqueous extract.

**INTRODUCTION<sup>[1,2]</sup>**

*Gmelina arborea* belongs to the family Verbenaceae. A moderate sized unarmed deciduous tree, reaching 18m high; bark greyish yellow, rather corky; branchlets and young parts clothed with fine white mealy pubescence. Distributed Throughout India, Ceylon.- Malayan and Philippine Islands. The root is acrid, bitter, sweet, heating; indigestible; stomachic, laxative, anthelmintic; improves the appetite; useful in hallucinations, thirst, piles, abdominal pains, burning sensations, fevers, "tridosha", urinary discharges.

*Mallotus nudiflorus* (L.) belongs to the family Euphorbiaceae. A large deciduous tree, bark smooth, pale grey, young shoots, leaves and inflorescence clothed with caducous grey tomentum. Distributed Throughout the hotter parts of India, Sumatra, Java. The plant is cooling, tonic, alexiteric; improves taste; removes biliousness. The plant is used for the removal of swelling, bile and phlegm. The root in decoction is given to relieve flatulence and is applied locally in gouty or rheumatic affections.

The visualization of the present study "*A comparative pharmacognostic and phytochemical study of Gambhari and Pani-gambhar*" owes towards the standardization and quality evaluation of *Gambhari* and *Pani-gambhar*.

**Collection and authentication**

Collection of these two plants from Uttarakhand region has done by the scholar herself. Sample of *Gmelina arborea* Roxb. ex Sm. is collected from the Raj rajeshwari Nursery, Haridwar. While sample of *Mallotus nudiflorus* Linn. (*Kulju & Welzen*) is collected from Rishikul campus, Haridwar.

In current study, beautiful flowering of *Gmelina arborea* Roxb. ex Sm. seen at the starting of april and flowering of *Mallotus nudiflorus* Linn. (*Kulju & Welzen*) is seen at the mid of march. The authentication of these two plants has been done at BSI Dehradun.

**Taxonomic profile**<sup>[3, 4]</sup>

- Taxonomic profile of *Gmelina arborea* & *Mallotus nudiflorus* is tabulated below [Table No: 1.1]

HIERARCHY	<i>Gmelina arborea</i>	<i>Mallotus nudiflorus</i>
Kingdom	Plantae	Plantae
Division	Tracheophyta	Tracheophyta
Class	Mangnoliopsida	Equisetopsida
Order	Lamiales	Malpighiales
Family	Lamiaceae	Euphorbiaceae
Genus	<i>Gmelina</i>	<i>Mallotus</i>
Species	<i>Gmelina arborea</i> Roxb. Ex Sm	<i>Mallotus nudiflorus</i> Kulju & Welzen
Synonyms	<i>Premna arborea</i> <i>Gmelina oblongifolia</i> <i>Gmelina sinuate</i>	<i>Trewia nudiflora</i> L. <i>Trewia macrophylla</i> Roth <i>Mallotus cardiophyllus</i>

**(B) Vernacular names**<sup>[3,4]</sup>

Table no: [1.2]

	<i>Gambhar</i>	<i>Pani-gambhar</i>
Assamese	Dieng-lophang, Gomari, Gameri	Bhelkora, Bhelkol, Pitta-puma-kendlow
Bengali	Gambhari, Gamar	Pitali
English	White Kashmir Teak, Candahar tree, White teak	False white teak
Gujrati	Shevan	----
Hindi	Gamhar, Bhadraparni, Gumbar	Pindalu, Pindar
Irula	Kumila	----
Kannada	Kumbudi, Shivani, Shivane	Kaadugumbala, Kaadukamchi
Karbi	Phang	----
Kash	Gammari	----
Khasi	Dieng Lophiang	Dieng Soh Lyndot
Konkani	Shivani Sini	Bomvaro
Malayalam	Kumpil, Kumizh, Kumbil	Pamparakkumpil, Niirkkatamp
Manipuri	Wang	Wangphop
Marathi	Thorshivani, Shewan, Shivan	Petari
Naga	Imbeh-ching	----
Nepali	----	Gurel
Oriya	Bhodroporni, Thlanwng, Butalo	Pitaliya
Others	Gamhar, Coomb teak, White beech	Tumari, False white teak
Sanskrit	Sindhuveshanam, Gambhari, Bhadraparni	Pindarah
Tamil	Peru-n-kumil, Kumalaa	Arruppuvarachu
Telugu	Pedda Gumudu Teku, Gumartek Gummati	----
Urdu	----	Tailadur

**(H) Cultivation**<sup>[5]</sup>

***Gmelina arborea*:** The plant can succeed in very dry to wet areas in the tropics and subtropics, where it is found at elevations up to 2,100 metres, it grows best in areas where annual daytimes temperatures are within the range 22-34 degree centigrade, but can tolerate 16-46 degree centigrade. It can be killed by temperatures of 1 degree centigrade or lower. It prefers a mean annual rainfall in the range 1500-2500mm, but tolerates 750- 5000mm. requires a sunny position, even when young. Grows on many soils from acidic laterites to calcareous loams, but doing poorly on thin or poor soils with hardpan, dry sands, or heavily leached acidic soils, well –drained basic alluviums. It does not thrive where the drainage is poor, while on dry, sandy or otherwise poor soil it remains stunted and is apt to assume little more than a shrubby form because of repeated dying back through drought. Established plants are drought tolerant. Prefers a pH in the range 6 to 8. Prefers a pH in the range 5-6, tolerating 4-7.5.

***Mallotus nudiflorus*:** Plant of the moist to wet tropics, where it is found at elevations up to metres. It grows best in areas where annual daytime temperatures are within the range 25-37degree centigrade, but can tolerate 12-42degree centigrade, when dormant, the plant can survive temperatures down to about -5degree centigrade, but young growth can be severely damaged at 0degree centigrade. It prefers a mean annual rainfall in the range 2000-4000mm, but tolerates 1000-5100mm. prefers a position in full sun, tolerating light shade. Succeeds in a fertile, moist to wet soil, preferring sandy to loamy soils but tolerating clayey soils. Prefers a pH in the range 5.5-6.5, tolerating 4.5-7.

**(J) Chemical constituents**<sup>[6, 7]</sup>***Gmelina arborea*:**

The root of this tree contain gmelofuran (a cadinane type furanosesquiterpene), beta- sitosterol, gmelinol, hentriacontanol, ceryl alcohol and n-octacosanal. Heartwood yield ceryl alcohol, beta-sitosterol, gmelinol,

cluytyl ferulate and lignans such as arborone, 7-oxodihydrogmelinols, arboreal, gmelanone, 6''-bromoisoarboreal, epieudesmin and gummidiol. Leaves contain alkaloids, flavonoids like apigenin, luteolin, quercetin and quercetogenin besides beta-sitosterol and hentriacontanol.

**Mallotus nudiflorus:** Plant contains a pyridine alkaloid, N-methyl-5-carboxamide-2-pyridine. Leaves contain an alkaloid, nudiflorine. Bark yields taraxerone and betasitosterol. Seeds contain an alkaloid ricinidine. The seeds also contain a maytansiniod compound, trewiasine (TWS).

#### K) Action and uses<sup>[8, 9, 10]</sup>

##### **Gmelina arborea**

- Oil prepared with *Gambhari patra* is used for external application (Anangaranga).
- *Kasmarya phala yusa* may be given with water & sugar in *Atisar*.
- Flowers of *Kovidar*, *Kasmarya* & *Salmali* are useful as diet in *Raktapitta*.
- Cold infusion of *Kasmarya* is given with sugar in *Pitta jvara*.

#### (1) Pharmacognostical study

##### (a) Organoleptic study

[Table no: 1.3]

S. No.	Character	S-1	S-2
1.	Shape	Channeled pieces, quilled at some places	Flat and some channeled pieces
2.	Size	0.2-0.7cm	0.15-0.5cm
3.	Fracture	Short	Splintery
4.	Odour	Not distinct	Not distinct
5.	Colour	Outer surface: Yellowish brown Inner surface: Reddish brown	Outer surface: greyish brown Inner surface: yellowish
6.	Taste	Madhura, Tikta, Kashay	Tikta, Kashay
7.	Texture	Smooth	Smooth

##### (b) Microscopic study

Transverse section of stem bark of *Gmelina arborea* Roxb. ex Sm. showed the presence of multiple layers below the epidermis i.e. cork cambium, secondary cortex, phelloderm, phloem parenchyma, phloem and stone cells.

##### (b) Powder microscopy

[Table no: 1.4]

Features	S-1	S-2
Cork cells	+	+
Stone cells	+	+
Calcium oxalate crystals	+	+
Patches of fibers	+	+
Vessels elements	+	+

- The bark is a bitter tonic and stomachic, and is considered useful in fever and in fever and indigestion.
- To prevent abortions in the early stage of pregnancy, a powder of the bark and black gingelly seeds, *manjista* and *satavari*, is given in milk.

##### **Mallotus nudiflorus**

- The plant is used to relieve swelling and to treat flatulence, excessive bile and sputum.
- The leaves are applied on wound to heal them with good efficiency.
- Decoction of root is used as stomachic and alternative in flatulence.
- Decoction of root is also used as gout, rheumatism.
- Decoction of root is used in malignancy especially leukemia and hepato-biliary affections etc.

#### OBSERVATION AND RESULT

**S-1** stem bark of *Gmelina arborea* Roxb. ex Sm., **S-2** stem bark *Mallotus nudiflorus* Linn. (Kulju & Welzen)

Transverse section of stem bark of *Mallotus nudiflorus* Linn. (Kulju & Welzen) showed the presence of cork cambium, secondary cortex, phloem parenchyma and calcium oxalate crystals.

## (2) Physicochemical study

[Table no: 1.5]

S. No.	Test	S-1	S-2
1.	Foreign Matter	0	0
2.	Moisture content (%)	8.50%	8.13%
3.	Swelling factor	0	0
4.	Aqueous soluble extract (%)	24.31%	7.06%
5.	Alcohol soluble extract (%)	17.49%	13.28%
7.	Total ash (%)	9.09%	11.20%
8.	Water soluble ash (%)	20.78%	26.85%
9.	Acid insoluble ash (%)	5.30%	8.05%

## (3) Phytochemical study

## (a) QUALITATIVE TEST

## (i) Carbohydrate test [Table No: 1.6]

S. No.	Name of test	S-1					
		n- hexane	Chloroform	Ethyl acetate	Ethanol	Aq. Ehanol	Aqueous
A.	Molisch test	+ve	+ve	-ve	-ve	-ve	-ve
B.	Benedict test	-ve	-ve	-ve	-ve	+ve	+ve
C.	Iodine test	-ve	-ve	-ve	-ve	-ve	-ve
D.	Fehling test	-ve	-ve	-ve	-ve	+ve	+ve
E.	Barfoed's test	-ve	-ve	-ve	-ve	-ve	-ve

S. No.	Name of test	S-2					
		n- hexane	Chloroform	Ethyl acetate	Ethanol	Aq. Ehanol	Aqueous
A.	Molisch test	+ve	+ve	-ve	-ve	-ve	-ve
B.	Benedict test	-ve	-ve	-ve	-ve	+ve	+ve
C.	Iodine test	-ve	-ve	-ve	-ve	-ve	-ve
D.	Fehling test	-ve	-ve	-ve	-ve	+ve	+ve
E.	Barfoed's test	-ve	-ve	-ve	-ve	-ve	-ve

## (ii) Alkaloids [Table No: 1.7]

S. No.	Name of test	S-1					
		n- hexane	Chloroform	Ethyl acetate	Ethanol	Aq. Ehanol	Aqueous
A.	Mayer's test	-ve	-ve	-ve	-ve	-ve	-ve
B.	Dragondrof test	-ve	+ve	-ve	-ve	-ve	-ve

S. No.	Name of test	S-2					
		n- hexane	Chloroform	Ethyl acetate	Ethanol	Aq. Ehanol	Aqueous
A.	Mayer's test	-ve	+ve	-ve	-ve	-ve	-ve
B.	Dragondrof test	-ve	-ve	-ve	-ve	-ve	-ve

## (iii) Amino acid: [Table No. 1.8]

S. No.	Name of test	S-1					
		n- hexane	Chloroform	Ethyl acetate	Ethanol	Aq. Ehanol	Aqueous
A.	Nin-hydrine test	-ve	-ve	-ve	-ve	-ve	-ve

S. No.	Name of test	S-2					
		n- hexane	Chloroform	Ethyl acetate	Ethanol	Aq. Ehanol	Aqueous
A.	Nin-hydrine test	-ve	-ve	-ve	-ve	-ve	-ve

## (iv) Proteins [Table No: 1.9]

S. No.	Name of test	S-1					
		n- hexane	Chloroform	Ethyl acetate	Ethanol	Aq. Ehanol	Aqueous
A.	Biuret test	-ve	-ve	-ve	-ve	-ve	-ve
S. No.	Name of test	S-2					
		n- hexane	Chloroform	Ethyl acetate	Ethanol	Aq. Ehanol	Aqueous
A.	Biuret test	-ve	-ve	-ve	-ve	-ve	-ve

## (v) Saponin: [Table No. 1.10]

S. No.	Name of test	S-1					
		n- hexane	Chloroform	Ethyl acetate	Ethanol	Aq. Ehanol	Aqueous
A.	Foam test	+ve	+ve	-ve	- ve	+ve	+ve

S. No.	Name of test	S-2					
		n- hexane	Chloroform	Ethyl acetate	Ethanol	Aq. Ehanol	Aqueous
A.	Foam test	+ve	+ve	-ve	- ve	-ve	-ve

## (vi) Glycosides: [Table No. 1.11]

S. No.	Name of test	S-1					
		n- hexane	Chloroform	Ethyl acetate	Ethanol	Aq. Ehanol	Aqueous
A.	Borntrager's test	-ve	-ve	-ve	-ve	-ve	-ve
B.	Killer- killianitest	-ve	-ve	-ve	-ve	-ve	-ve
C.	With dilute HNO <sub>3</sub>	-ve	-ve	-ve	-ve	-ve	-ve

S. No.	Name of test	S-2					
		n- hexane	Chloroform	Ethyl acetate	Ethanol	Aq. Ehanol	Aqueous
A.	Borntrager' test	-ve	-ve	-ve	-ve	-ve	-ve
B.	Killer- killiani test	-ve	-ve	-ve	-ve	-ve	-ve
C.	With dilute HNO <sub>3</sub>	-ve	-ve	-ve	-ve	-ve	-ve

## (vii) Lipid and Fat: [Table No. 1.12]

S. No.	Name of test	S-1					
		n- hexane	Chloroform	Ethyl acetate	Ethanol	Aq. Ehanol	Aqueous
A.	Greasy spot test	-ve	-ve	-ve	- ve	-ve	-ve

S. No.	Name of test	S-2					
		n- hexane	Chloroform	Ethyl acetate	Ethanol	Aq. Ehanol	Aqueous
A.	Greasy spot test	-ve	-ve	-ve	- ve	-ve	-ve

## (viii) Steroids: [Table No. 1.13]

S. No.	Name of test	S-1					
		n- hexane	Chloroform	Ethyl acetate	Ethanol	Aq. Ehanol	Aqueous
A.	Salkowaski test	+ve	+ve	+ve	- ve	-ve	-ve

S. No.	Name of test	S-2					
		n- hexane	Chloroform	Ethyl acetate	Ethanol	Aq. Ehanol	Aqueous
A.	Salkowaski test	+ve	-ve	-ve	- ve	-ve	-ve

## (ix) Flavanoids: [Table No.1.14]

S. No.	Name of test	S-1					
		n- hexane	Chloroform	Ethyl acetate	Ethanol	Aq. Ehanol	Aqueous
A.	Sinoda's test	-ve	-ve	-ve	-ve	+ve	+ve

S. No.	Name of test	S-2					
		n- hexane	Chloroform	Ethyl acetate	Ethanol	Aq. Ehanol	Aqueous
A.	Sinoda's test	-ve	-ve	-ve	-ve	+ve	+ve

(x) **Tannin:** [Table No.1.15]

S. No.	Name of test	S-1					
		n- hexane	Chloroform	Ethyl acetate	Ethanol	Aq. Ehanol	Aqueous
A.	Lead acetate test	-ve	-ve	-ve	-ve	+ve	+ve
B.	Acetic acid test	-ve	-ve	-ve	-ve	-ve	-ve
C.	Dilute HNO <sub>3</sub> test	-ve	-ve	-ve	-ve	+ve	+ve

S. No.	Name of test	S-2					
		n- hexane	Chloroform	Ethyl acetate	Ethanol	Aq. Ehanol	Aqueous
A.	Lead acetate test	-ve	-ve	-ve	-ve	+ve	+ve
B.	Acetic acid test	-ve	-ve	-ve	-ve	-ve	-ve
C.	Dilute HNO <sub>3</sub> test	-ve	-ve	-ve	-ve	+ve	+ve

(b) **Quantitative test**

[Table no: 1.16]

S.no.	Sample	% of Alkaloid	% of flavonoid	% of steroid
1.	S-1	5.78%	22.80%	2.79%
2.	S-2	17.41%	8.19%	1.16%

(c) **Thin layer chromatography** establish in phytochemical fingerprint profiling in drug for identity.

*Gambhari* stem bark shows under Conc. Sulphuric acid. R<sub>f</sub> values are - R<sub>f</sub> - 0.06, 0.10, 0.19, 0.29, 0.36, 0.72, 0.87.

*Pani-gambhar* stem bark shows under Iodine Vapour. R<sub>f</sub> values are - R<sub>f</sub> - 0.06, 0.11, 0.32, 0.48, 0.71, 0.82

**DISCUSSION**

The macroscopic study, microscopic study, R<sub>f</sub> value of stem bark of *Gmelina arborea* Roxb. ex. Sm. & *Mallotus nudiflorus* (L.) Kulju & Welzen was done to present identification parameters which is an essential tool for standardization.

Physicochemical study of stem bark of *Gmelina arborea* Roxb. ex. Sm. & *Mallotus nudiflorus* (L.) Kulju & Welzen was done to present parameters for quality, purity & safety assurance of the crude drug & the amount of active constituents in different chemicals.

**Phytochemical (Qualitative Analysis)**

Phytochemical Qualitative analysis of stem bark of *Gmelina arborea* Roxb. ex. Sm. & *Mallotus nudiflorus* (L.) Kulju & Welzen was done to present the parameters for presence of phytoconstituents in plant extracts which are known to exhibit medicinal as well as physiological activities.

**Phytochemical (Quantitative Analysis)**

Flavonoid, Steroids, Alkaloids are secondary metabolites present in plants which are responsible for different actions on biological system.

[Fig.1.1] Stem bark *Gmelina arborea*



[Fig.1.2] Flowering of *Gmelina arborea*



[Fig.1.3] Stem bark of *Mallotus nudiflorus*



[Fig.1.4] Flowering of *Mallotus nudiflorus*



A.



B.

[Fig.1.5] A. TLC of *Gmelina arborea* B. Fig.1.6 TLC of *Mallotus nudiflorus*

**CONCLUSION**

- ❑ Pratinidhi dravya (substitute for herbal drugs) are narrated in Ayurvedic classical texts when original or a form of drug is not available. In Ayurveda there are many drugs combined in single formulation, some of them were difficult to get and some species got destroyed with development of civilization and industrialization. This resulted in scarcity and less availability of the ingredient in the formulation which may cause a drastic or no effect of formulation at all. Hence ancient seers of Ayurveda advised some drugs which can be used when other drug with similar properties is not available for medicinal purpose. Substitute drugs also known as should possess similar properties i.e. proven on the basis of pharmaco-therapeutically activity.
- ❑ Root of *Gambhari*, is one of the ingredients of *Dashmula*, an important formulation in ayurveda. Although the stem bark of *Brihat Panchmula* are used in the place of root bark because of saving the life of plants. The increase annual demand of the raw drug and decline in availability of the authentic species have led to arbitrary substitution and adulteration in the raw drug market. The commentator of *Bhavprakash Nighantu*, *K C Chunekar* have mentioned *Pani-gambhar* as a substitute of *Gambhari*. because of its synonym "*Gamhar & Sivani*" resemblance with *Gmelina arborea*.
- ❑ Preliminary phytochemical tests with stem bark extract of *Gmelina arborea* and *Mallotus nudiflorus* have showed positive result for different bioactive molecules.
- ❑ *Gmelina arborea* and *Mallotus nudiflorus* have showed similar positive results in qualitative phytochemical analysis like foam's test (indicates saponin was present), fehling's test (presence of reducing sugar), Shinoda's test (indicates Flavonoid may be present).
- ❑ *Gmelina arborea* and *Mallotus nudiflorus* stem bark have evaluated positive result in different phytochemical constituent specially in flavonoid, tannin and alkaloid.
  - Total flavonoid content found maximum in stem bark of *Gmelina arborea*.
  - Total steroid content found more in stem bark of *Gmelina arborea*.
  - Total alkaloid content found more in stem bark of *Mallotus nudiflorus*

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