



Contents lists available at ScienceDirect

Asian Pacific Journal of Tropical Biomedicine

journal homepage: www.elsevier.com/locate/apjtb



Document heading

doi:

© 2012 by the Asian Pacific Journal of Tropical Biomedicine. All rights reserved.

# Preliminary phytochemical screening, pharmacognostic and physicochemical evaluation of leaf of *Gmelina arborea*

Daya L. Chothani<sup>1\*</sup>, N. M. Patel<sup>2</sup><sup>1</sup> Hemchandracharya North Gujarat University, Patan (N.G.) – 384 265<sup>2</sup> Principal, Sri B.M. Shah College of Pharmacy, Modasa–383315()

## ARTICLE INFO

### Article history:

Received 17th June 2012

Received in revised form 5 September 2012

Accepted 7 December 2012

Available online 28 December 2012

### Keywords:

*Gmelina arborea*

Preliminary Phytochemical Screening

Leaf constant

physicochemical

stomata

## ABSTRACT

**Objective:** The aim of present study was to carry out preliminary phytochemical screening, detailed pharmacognostic profile and physicochemical evaluation of leaf of *Gmelina arborea*. **Methods:** Fresh leaf and dried powder of the leaves were studied by morphology, microscopy, preliminary phytochemical screening, and fluorescence analysis of powdered drug. Other physicochemical parameters were also performed as per WHO guide lines. **Result:** The detailed microscopy revealed that the presence of anomocytic stomata and covering uni-multicellular trichome. Leaf constant such as stomatal number, stomata index, vein islet number, vein termination number were also determined. Physicochemical parameters and fluorescence analysis were also studied. The preliminary phytochemical screening showed the presence of steroid, triterpenoid, saponin, protein, phenolic compound, flavanoid and carbohydrates. **Conclusions:** The result of these studies could be useful for correct identification and detection of adulterants of this plant material.

## 1. Introduction

*Gmelina arborea* is an unarmed, moderately sized to large deciduous tree, about 30 m or more in height and a diameter of up to 4.5 m. Leaf is used as carminative, in headache, in anasarca, asthma, bronchitis, cholera, colic pain, dropsy, epilepsy, phthisis, rheumatism, small pox, sore, spleen complaints, syphilis, throat swelling, urticaria, as antidote to snake bite and some other poisons, cough, gonorrhoea. Leaf-paste is applied in on wounds. Charaka prescribed a paste of the leaves as ingredients of a medicated clarified butter for stiffness of the back, facial paralysis; prescribed the soup of fruits in diarrhoea. A paste of leaf is applied to the head for the relief of headache in fever. [1–3] The leaves are used in dyspepsia, cough, wound treatment, [4] Leaf paste in cephalgia and foul ulcer. [5] The juice of leaf is used as foetid discharge, worm from ulcers, demulcent, [6] diabetes and antidote. [7] Leaf has reported anthelmintic activity [8] and antimicrobial activity.[9] The current study was

carried out to provide requisite pharmacognostic details, phytochemical aspects and preliminary phytochemical screening of leaf of *G. arborea*.



Figure 1. Plant of *Gmelina arborea*

\*Corresponding author: Ph.D Scholar Hemchandracharya North Gujarat University, Patan (N.G.) – 384 265

Phone No: +919924214110,

E-Mail: daya.herb@gmail.com

## 2. Material and methods

### 2.1 Plant material

Fresh leaves of *G. arborea* were collected from Vadodara in the month of August–September 2011. Plant was identified at Botany Department of The M. S. University, Vadodara. Voucher specimen (DC–GM–1) was stored in herbarium of our laboratory. Leaves were separated, dried under shade and powdered.

### 2.2 Reagent and Chemicals

All the chemicals and reagents used were of analytical grade, purchased from Sigma chemical co. (St Louis, MQ, USA) and Merck (Darmstadt, Germany).

### 2.3 Pharmacognostic study [10–12]

Leaves were subjected to morphological examinations. Microscopic evaluation of leaf was carried out by taking the transverse sections using standard procedures and then subjecting them to microscopic examination. The powdered samples were also subjected to histological examinations using standard procedures and their diagnostic features were identified and recorded and observed under Zeiss microscope using Mips Olympus camera. Various leaf constant like stomatal number, stomatal index, palisade ratio, vein islet number and vein termination number were also determined. Different diagnostic features were identified and reported in the results.

### 2.4 Fluorescence analysis [13]

The fluorescence nature of powder drug was analyzed and the observations with different chemicals were also carried out and recorded.

### 2.5 Physicochemical evaluation of Leaf of *Gmelina arborea* [14]

The various physicochemical properties like water soluble extractive value, alcohol soluble extractive value and loss on drying) were determined as per WHO guidelines.

### 2.6 Preliminary Phytochemical screening [15]

Phytochemical screening was carried out by using procedure by Kokate. All the extracts were concentrated by distilling the solvent and the extracts were dried under reduced pressure. Consistency, color, appearance of the extracts and their percentage yield were noted. The extracts obtained from successive solvent extraction were then subjected to various qualitative chemical tests to determine the presence of various phytoconstituents like alkaloids,

glycosides, carbohydrates, phenolics and tannins, proteins and amino acids, saponins, and phytosterols using reported methods.

## Results

### 3.1 Morphological study

Morphological character of leaf plant is reported in Table 1. and compared with reported character in Figure–2.

**Table 1**

Morphological characters of leaf of *G. arborea*

Parameters	Characters
Color	Dark green
Size	7–21cm length and 7–13 cm width
Shape	Broadly Ovate or cordate
Apex	acuminate or caudate
Margin	entire on mature plants but strongly toothed or lobed on young leaf
Venation	reticulate
Surface	Smooth
Base	Cordate
Petiole	5–15 cm
Midrib	Prominent on lower surface
Odour	Characteristic and slightly disagreeable
Phyllotaxy	Opposite
Taste	Slight



**Figure 2.** Leaf of *G. arborea*

### 3.2. Microscopical Characters:

#### 3.2.1 Microscopy of leaf

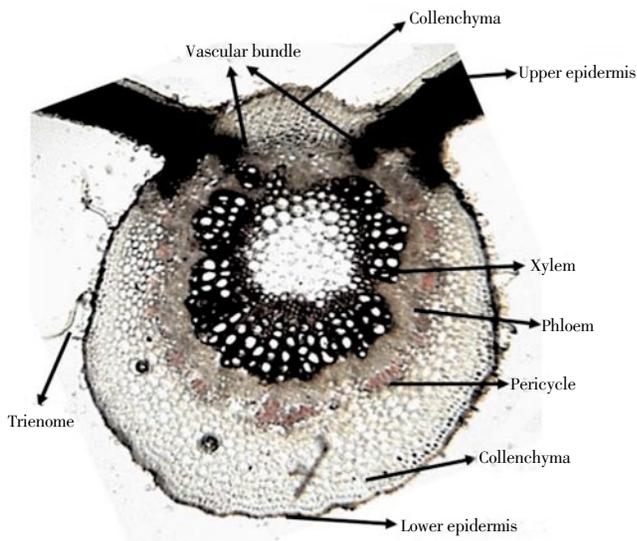
Transverse section of leaf shows following characters (Figure 3, 4)

Lamina: It is a dorsiventral. Upper epidermis is Single layered with polygonal cells covered outside with a thick walled cuticle, covering trichome and anomocytic stomata are present. Mesophyll is a differentiated into palisade and spongy parenchyma. Palisade single layered present below the upper epidermis. Vascular strand are in mesophyll. Spongy parenchyma is a thin, 3 to 6 layers loosely arranged with intercellular space. Lower epidermis is very similar to upper epidermis but more number of anomocytic stomata

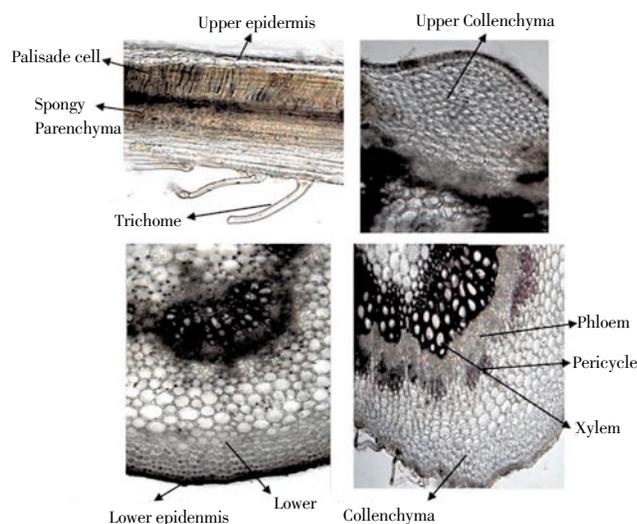
and uni–multicellular (2–3 celled) trichomes are present on the lower epidermis.

**Midrib**

Epidermal layers of lamina are in continuity with that of midrib. The dorsal surface and ventral surface are bulged. A 2 to 4 layered collenchyma can be seen below the upper epidermis and above the lower epidermis. Two small vascular bundles are present below the upper collenchymatous layer of midrib. The rest of midrib is occupied by the cortical parenchyma with the collateral vascular bundle embedded in the middle. Xylem is towards the centre and phloem towards the periphery. Parenchymatous tissue is thin walled with prominent intercellular spaces. The vascular bundles are surrounded by incomplete sheath of pericycle. Ground tissue is present in the centre of vascular bundle.



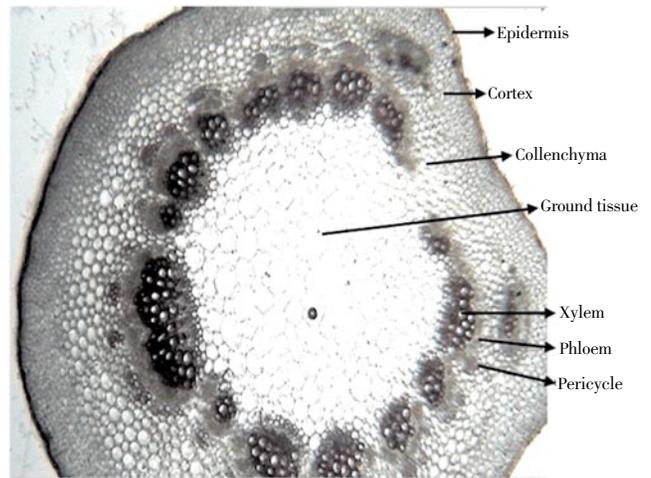
**Figure 3.** T.S of *G. arborea* leaf



**Figure 4.** Microscopical character of leaf of *G. arborea*

**3.2.2 Microscopical character of Petiole**

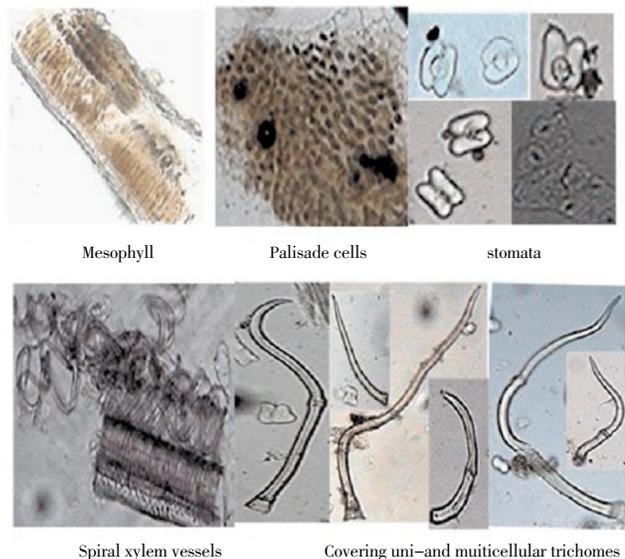
It is more or less concave –convex, having single layered epidermis with cuticle. Trichomes are present on epidermis. Dorsal surface is convex and grooved. Below the each groove vascular bundle is present. Outer 3–5 layer of cortex is collenchymatous while inner 3–4 layers are parenchymatous cells contain chlorophyll. Endodermis is indistinct. Vascular bundle are collateral arranged in ring, grouped of lignified pericycle fibre crown the phloem. Ground tissue is made up of parenchymatous cells with intercellular space.(Figure 5.)



**Figure 5** T.S. of petiole of leaf of *G. arborea*

**3.3 Leaf powder characteristic**

It is dark greenish color, bitter taste and characteristic odour. Leaf powder microscopy shows presence of anomocytic stomata, covering trichome, spiral xylem vessels, lamina fragments and mesophyll are reported in Figure 6 .



**Figure 6.** Powder characteristic of leaf of *G. arborea*

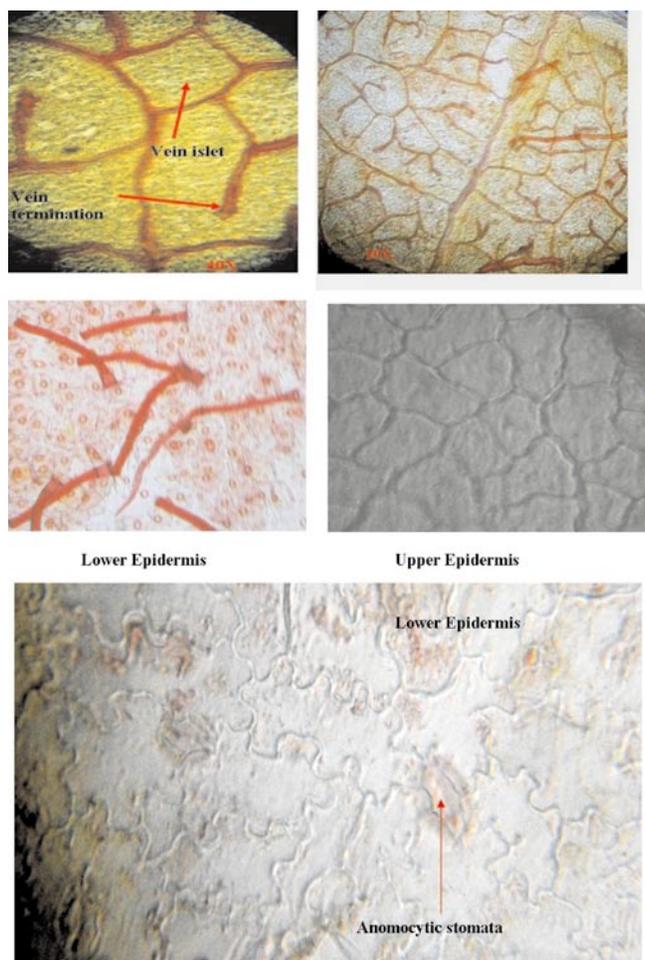
### 3.3 Quantitative Microscopy of leaf

Various leaves constant like stomatal number, stomatal index etc. are reported in table 2 and Figure 7.

**Table 2**

Leaf constant of *Gmelina arborea* leaf

Parameter	Value (in 1 mm <sup>2</sup> area )
Stomatal number (lower epidermis)	205–225
Stomatal index(lower epidermis)	8–18.7–27.8
Palisade ratio	4.25–5.6–6.3
Vein termination number	10–20
Vein islet number	30–40



**Figure 7.** Surface preparation of *G. arborea* leaf

### 3.5 Fluorescence analysis

### 3.6 Physico chemical constant

Physico –chemical constant leaf of *Gmelina arborea* are given in Table 4.

**Table 3**

Fluorescence analysis of powder with various reagents

Reagent	Visible light	U.V. light
Drug powder as such	Light green	NF
NaOH (aqueous)	Brownish yellow	Greenish yellow
NaOH (alcohol)	Green	Golden Yellowish
HCL	Light green	Light green
H2So4	Light yellowish	Greenish yellow
powder + Nitric acid	Light yellowish–brown	Greenish yellow
Picric acid	Yellowish green	Yellowish green
Acetic acid	Light yellowish–brown	Golden yellow
NH3	Yellowish green	Intense Yellowish green
KOH(alcohol)	Brownish –yellow	Greenish yellow

**Table 4**

Physicochemical constant of leaf of *Gmelina arborea*

Parameter	*Average values %w/w
Water soluble extractive value	24%
Alcohol soluble extractive value	17.5%
Loss on drying	2%

\*The values given here are expressed as percentage of air dried material. Each value is average of three determinations.

### 3.7 Preliminary phytochemical screening

A successive solvent extracts of leaf was studied for their phytochemical profile. Their % yield, color and consistency are recorded in Table– 5. The extracts obtained from successive solvent extraction were then subjected to various qualitative chemical tests for the identification of various plant constituents. A leaf shows the presence of carbohydrates, Saponins, steroid, flavonoid, phenolics compound. ( Table 6.)

**Table 5**

Preliminary phytoprofile of leaf of *G. arborea*

Extracts	Color and consistency	%Yield (w/w)
petroleum ether	Dark green, Sticky	3.76%
Toluene	Dark green, Sticky	1.92%
Chloroform	Dark green, Sticky	1.56%
Ethyl acetate	Dark green,Sticky	2.26%
Methanol	Green,Sticky	19.36%
Water	Brown.,non sticky	26.3%

## 4. Discussion

Pharmacognostic study is the initial step to confirm the identity and to assess the quality and purity of the crude drug. Quality control of crude drugs is very challenging task because of complex nature of chemical constituents. Microscopical evaluation is simplest and reliable tool for correct identification of herbs as well as small fragment of crude drugs or powderd drugs and

**Table 6**Qualitative chemical test on extracts of leaves of *Gmelina arborea*

Chemical constituent	P.E ext.	Tol. ext.	CHCl <sub>3</sub> ext	E.A.ext	Methanol ext	Water ext
Carbohydrates	–	–	–	–	+	+
Proteins	–	–	–	–	–	+
Saponins	–	–	–	–	+	+
Alkaloids	–	–	–	–	–	–
flavonoids	–	–	–	–	+	–
Tannin & phenolics	–	–	–	+	+	+
Steroids & triterpens	+	+	+	+	–	–

P. E. = Petroleum ether, Tol. = Toluene, E.A. = Ethyl acetate, (– = absent, + = positive)

detection of adulterants and substituents. [16–18] There is no pharmacognostic work reported on leaf of this plant. So the present work was undertaken for development of pharmacognostic standard of leaf of *G. arborea*. Some of the diagnostic features of the leaf drug noted from the microscopical study are anomocytic stomata, covering trichome. Physicochemical studies revealed the presence of, alcohol soluble extractive; 17.5% and water soluble extractive; 24.0%. Preliminary phytochemical study showed that the presence of steroid, saponin, carbohydrates triterpenoid and phenolic compound. The details of pharmacognostic characters, various evaluative parameters, results of preliminary and detailed phytochemical analysis established in the present study will facilitate in identifying the genuine drug and will also be useful in preparation of monographs of leaf of this plant.

### Conflict of interest statement

We declare that we have no conflict of interest.

### Acknowledgment

The authors are grateful to pioneer Pharmacy College, Vadodara for providing necessary equipments to complete this research work.

### References

- [1] <http://www.bsienviis.nic.in/medi.htm#Gmelina%20arborea>
- [2] Khare CP. Indian herbal remedies: rational Western therapy, ayurvedic, and other traditional usage, botany. Springer; 2004, p. 236.
- [3] Khare CP. Indian Medicinal Plants: An Illustrated Dictionary, Springer; 2007, p. 291.
- [4] Dinesh Kumar Tyagi. Pharma forestry: field guide to medicinal plants. Atlantic Publishers & Dist; 2005, p.157.
- [5] Warriar PK, Nambiar VPK, Ramankutty C. Indian medicinal plant: A compendium of 500 species, 1994, Volume 3, p. 91.
- [6] Kirtikar KR, Basu BD. Indian Medicinal Plants., 2nd edn, Bishen Singh Mahendra Pal Singh, Dehradun; India, Vol. 2, 1975, p.1932–40.
- [7] Pandey CN. Medicinal plants of Gujarat, Gujarat Ecological Education and Research Foundation, Gujarat (India), 2005, p. 190
- [8] Ambujakshi HR, Thakkar H, Shyamnanda, Anthelmintic activity of *Gmelina arborea* Roxb. Leaves extract. *International Journal Of Pharmaceutical Research And Development* ,2009; **1**(9):1–4
- [9] M. El–Mahmood, J. H. Doughari and H. S. Kiman. In vitro antimicrobial activity of crude leaf and stem bark extracts of *Gmelina arborea* (Roxb) against some pathogenic species of Enterobacteriaceae. *African Journal of Pharmacy and Pharmacology* Vol. 4(6). pp. 355–361, June 2010 Available online <http://www.academicjournals.org/ajpp>.
- [10] Khandelwala KR, Kokate CK, Pawar AP, Gokhale SB. Practical Pharmacognosy. Nirali Prakashan, 1988, 2nd edition, p.31–40.
- [11] Evans WC. Trease and evans pharmacognosy. 15th ed. London: Saunders Ltd.; 2003, p. 545–547.
- [12] Kumar D , Jyoti G, Kumar S , Renu A, Kumar T, Ankit G. Pharmacognostic evaluation of *Cayratia trifolia* (Linn.) leaf, *Asian Pac J Trop Biomed* 2011;2012; **6**–10.
- [13] Pratt RJ, Chase CR. Fluorescence of powdered vegetable drugs with particular reference to development of a system of identification. *J Am Pharm Assoc Am Pharm Assoc* 1949; **38**: 324–333.
- [14] WHO. Quality control methods for medicinal plant material. Geneva: WHO; 1992, p. 22–34.
- [15] Kokate CK, Practical Pharmacognosy, 4th edition, Vallabh Prakashan, New Delhi, 2005 , p. 107–111.
- [16] Iqbal Ahmad, Farrukh Aqil, Mohammad Owais. Modern Phytomedicine: Turning Medicinal Plants into Drugs, John Wiley & Sons, 2007. p 34
- [17] Wallis TE. Textbook of pharmacognosy 5th Edn. CBS. Publications: 111–117.
- [18] Pratima H and Pratima Mathad. Pharmacognostic Evaluation and Phytochemical Analysis of Leaves of *Cajanus cajan* L. *Journal of Advances in Developmental Research* **2** (2) 2011: 181–185.