



## Review article

### Pharmacognostic and pharmacological properties of Gambhari (*Gmelina arborea* Roxb.) fruits

Radhika Kumiya<sup>1\*</sup>, D. C. Singh<sup>1</sup>, G. M. Kavya<sup>2</sup> and Kiran Vashisht<sup>3</sup>

<sup>1</sup>Department of Dravyaguna, Uttarakhand Ayurved University, Rishikul Campus, Haridwar, India

<sup>2</sup>Department of Prasuti Tantra Evam Stri Roga, Uttarakhand Ayurved University, Gurukul Campus, Haridwar, India

<sup>3</sup>Department of Dravyaguna, Uttarakhand Ayurved University, Rishikul Campus, Haridwar, India.

\*Corresponding author. E-mail: [dradrikakumiya@gmail.com](mailto:dradrikakumiya@gmail.com)

#### Article history

Received : October 09, 2022  
Accepted : December 27, 2022

#### Keywords

Ayurvedic drug  
Dashmool  
Gambhari fruit  
*Gmelina arborea* Roxb.  
Kashmarya

#### ABSTRACT

*Gmelina arborea* Roxb. is one of the important medicinal plants widely propagated and cultivated species of the family *Lamiaceae*. It is commonly known as “Kashmarya” and is 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 *Dashmoola*. In Ayurvedic classical textbooks, different parts of the plant can be used medicinally like root, fruit, leaf, flower, and bark. The *Rasayana* (rejuvenative), *Medhya* (memory enhancer) and *Vrishya* (aphrodisiac) activities have been related to its edible fruits. The leaf of *Gambhari* has been mentioned in the diseases like *Vrana* (Wounds) and *Kushtha* (Skin diseases). The classical part of the plant *Gambhari* is the root. It is extensively used traditionally as an antihelmintic, antimicrobial, antidiabetic, diuretic, hepatoprotective and antiepileptic agent. The present article provides insight into the literature review of *Gambhari* fruit. The present manuscript compiles extensive information about *Gambhari* (*Gmelina arborea* Roxb.) fruit which is well-mentioned in most Ayurvedic classics like *Brihatrayee*, *Laghutree* and *Nighantu*.

DOI: 10.53517/CMDR.2581-5008.622022226

© 2022 Global SciTech Ocean Publishing Co. All rights reserved. ISSN. 2581-5008

## INTRODUCTION

*Gambhari* (*Gmelina arborea* Roxb.) belongs to the family *Lamiaceae*. It is a medium-sized to rarely large deciduous tree attaining a height of 15-20 m found scattered in deciduous forests throughout the greater part of the country upto an altitude of 500 m (API, 2001). It is named *Gambhari* because of its fast growing tree. *Gambhari* root is one of the ingredients of commonly used Ayurvedic preparation *Dashmoola* and particularly in *Brihat Panchamoola*. Mostly *Gambhari* root is used by the researcher for their work. The present manuscript highlights the importance of *Gambhari* fruit from different classical references.

## TAXONOMICAL CLASSIFICATION

According to ITIS (2022), the taxonomical classification of *Gmelina arborea* is tabulated in Table 1.

**Table 1.** Taxonomical classification of *Gmelina arborea* (*Gambhari*)

Kingdom	Plantae
Sub kingdom	Viridiplantae
Infrakingdom	Streptophyta
Super division	Embryophyta

Division	Tracheophyta
Sub division	Spermatophytina
Class	Mangoliopsida
Super order	Asteranae
Order	Lamiales
Family	Lamiaceae
Genus	Gmelina
Species	Arborea

## VERNACULAR NAMES

The name that is based on the regional normal language of everyday life and is often contrasted with the scientific name for the same organism, which is Latinized, is known as vernacular name. Different vernacular names of *Gambhari* (Sharma et al., 2000) are given in Table 2.

**Table 2.** Different vernacular names of *Gambhari*

English	Coomb teak, Cashmeri tree.
Hindi	Gamari, Gambhari, Gambhar, Gamhar, Khambhari, Sewan.
Bengali	Gamari, Gambar, Gambargachha
Gujrati	Seevan
Kannada	Kumbalamara, Seevani, Shivani, Hannu, Kasmiri marci
Malayalam	Kumilu, Kumpil, Kumil, Kumizhu, Kumbil

Tamil	Perumkumbil, Kumadi, Perunkurmizh, Komizhpazham
Telugu	Gummadi, Gumaditeku
Assam	Gomari
Oriya	Gambhari, Bhodropanni
Urdu	Gambhari

## SYNONYMS

Names and synonyms are the tools to specify the salient features of the plants, likewise, Gambhari also has synonyms (Sharma, 2000) which are tabulated in Table 3.

**Table 3.** Different synonyms of Gambhari

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

## AYURVEDIC CLASSIFICATION OF GAMBHARI

Classical categorization of Gambhari in different Ayurvedic texts is tabulated in Table 4.

**Table 4.** Classical categorization of Gambhari in different Ayurveda texts

S.No.	Classical textbooks	Varga/Gana (Reference)
1.	<i>Charak Samhita</i>	<i>Sothahara, Dahaprasamana, Virecanopaga</i> (Shastri and Chaturvedi, 2012)
2.	<i>Sushruta Samhita</i>	<i>Sarivadi, Brihatpanchamoola</i> (Shastri, 2016)
3.	<i>Astanga Hridaya</i>	<i>Sarivadi</i> (Sharma, 2006)
4.	<i>Saushrut Nighantu</i>	<i>Brihatpanchmoola</i> (CCRAS, 2022a)
5.	<i>Ashtanga Nighantu</i>	<i>Sarivadi Gana</i> (Balkrishna, 2019a)
6.	<i>Madanadi Nighantu</i>	<i>Tritiya Gana</i> (CCRAS, 2022b)
7.	<i>Dhanvantri Nighantu</i>	<i>Guduchiyadi Varga</i> (Sharma and Sharma, 2005)
8.	<i>Shodhal Nighantu</i>	<i>Anekarth Varga</i> (Dwivedi, 2009)
9.	<i>Madhav Dravyaguna</i>	<i>Phala Varga</i> (Sharma, 1973)

10.	<i>Abhidhan Ratna mala</i>	<i>Swadu Skandh</i> (Sharma, 1977a)
11.	<i>Hridya Deepak Nighantu</i>	<i>Dvipada Varga</i> (Sharma, 1977b)
12.	<i>Madanpala Nighantu</i>	<i>Abhayadi Varga</i> (Balkrishna, 2019b)
13.	<i>Kaiyaideva Nighantu</i>	<i>Aushadhi Varga</i> (Sharma and Sharma, 2006)
14.	<i>Bhavprakash Nighantu</i>	<i>Guduchyadi Varga</i> (Chunekar and Pandey, 1993)
15.	<i>Raj Nighantu</i>	<i>Prabhadradi Varga</i> (Tripathi, 2010)
16.	<i>Laghu Nighantu</i>	<i>Auoshadinaam Mala</i> (CCRAS, 2022c)
17.	<i>Mahaoshadh Nighantu</i>	<i>Bilvadi Varga</i> (Singh and Tripathi, 2006)
18.	<i>Nighantu Adarsh</i>	<i>Nirgundyadi Varga</i> (Bapalal, 2005)
19.	<i>Saraswati Nighantu</i>	<i>Mahavraksh Varga</i> (Kamat, 2006)

## BOTANICAL DESCRIPTION

As per the reviews on Indian Medicinal Plants (ICMR, 2009), the botanical description of the plant is given below.

**Habitat:** Found throughout India, from the foot of the northwest Himalayas to Chittagong and throughout the Deccan peninsula.

**Habit:** A moderate-sized unarmed deciduous tree, with greyish-yellow bark.

**Leaves:** Broadly ovate, acuminate, entire, glabrous above when mature, stately fulvous, tomentose beneath, base cordate and shortly cuneate. petiole cylindric, glandular at the top.

**Flowers:** Usually in small cymes of about 3 flowers arranged along the branches of a densely fulvous hairy panicle, buds clavate, angular, and bracts linear-lanceolate.

**Calyx:** Broadly campanulate, teeth 5, and triangular acute.

**Corolla:** Brownish-yellow, densely hairy outside, 5-lobed, and 2-lipped.

**Part used:** All the parts i.e. root, bark, leaf, flower and fruit are used for medicinal purposes.

## MACROSCOPIC & MICROSCOPIC DESCRIPTION OF GAMBHARI FRUIT

As per the reviews on Indian Medicinal Plants (ICMR, 2009), the macroscopic and microscopic description of the plant is given below.

### Macroscopic

**Fruits:** A drupe, ovoid, crinkled, black, 1.5 – 2.0 cm long, sometimes with a portion of tached pedicel, two-seeded, sometimes one-seeded, taste, sweetish sour.

**Seed:** Seeds ovate, 0.5 – 1 cm long, 0.4 -0.6 cm wide, light yellow, surface smooth, seed coat thin, papery, taste, oily.

### Microscopic

**Fruits:** Shows pericarp differentiated into single-layered epicarp, multilayered, fleshy mesocarp, hard and stony endocarp, epicarp consisting of single-layered, thin-walled cells, mesocarp a wide zone consisting of isodiametric, thin-walled, parenchymatous cells, endocarp consisting of multilayered sclerenchymatous cells.

**Seeds:** Shows outer integument consisting of 3 -5 rows of crushed, parenchymatous cells followed by inner integument consisting of 2-3 rows of thin-walled, tangentially elongated, parenchymatous cells, cotyledons of single-layered, radically elongated epidermal cells, mesophyll consisting of thin-walled cells, filled with oil globules and aleurone grains.

### AYURVEDIC PROPERTIES OF GAMBHARI FRUIT

The properties mentioned by different Ayurvedic *Samhita* and *Nighantu* are tabulated in Table 5.

**Table 5.** Ayurvedic properties of Gambhari fruit

S.No.	Property	C.S.	Su.S.	C.N.	M.P.N.	K.N.	B.P.N.	G.R.M.	Total
1.	<b>Rasa</b>								
	<i>Madhura</i>	-	-	+	-	+	+	+	4
	<i>Amla</i>	-	-	-	-	+	+	+	3
	<i>Kashaya</i>	-	-	+	-	+	+	+	4
2.	<b>Guna</b>								
	<i>Guru</i>	-	-	-	+	+	+	+	4
	<i>Sheeta</i>	-	-	-	-	+	+	+	3
	<i>Snigdha</i>	-	-	-	-	+	+	+	3
3.	<b>Virya</b>								
	<i>Sheeta</i>	-	-	-	-	+	+	+	3
4.	<b>Vipaka</b>								
	<i>Madhura</i>	-	-	-	-	+	+	+	3
5.	<b>Dosha</b>								
	<i>Tridosha shamaka</i>	-	-	+	-	-	-	-	1
	<i>Vata shamaka</i>	-	+	-	+	+	+	+	5
	<i>Pitta shamaka</i>	-	+	-	+	+	+	+	5
	<i>Rakta shamaka</i>	-	+	-	+	+	+	+	5
6.	<i>Rasayana</i>	-	+	+	+	+	+	+	6
7.	<i>Keshya</i>	-	+	+	+	+	+	+	6
8.	<i>Medhya</i>	-	+	+	-	+	-	+	4
9.	<i>Raktapitta</i>	+	-	+	-	-	+	-	3
10.	<i>Raktasangrahika</i>	+	-	-	-	-	-	-	1
11.	<i>Bhedana</i>	-	-	+	-	-	-	-	1
12.	<i>Vishudhikar</i>	-	-	-	-	-	+	-	1
13.	<i>Hridya</i>	-	+	-	-	+	-	+	3
14.	<i>Brihyan</i>	-	-		+	+	+	+	4
15.	<i>Balya</i>	-	-	-	-	-	-	+	1
16.	<i>Virsy</i>	-	-	-	+	+	+	+	4
17.	<i>Kshaya</i>	-	-	-	+	+	+	+	4
18.	<i>Murtavibandha</i>	-	+	-	+	+	+	+	5
19.	<i>Trishna</i>	-	-	-	+	+	+	+	4
20.	<i>Daha</i>	-	-	-	-	+	+	-	2
21.	<i>Kshata</i>	-	-	-	-	+	+	-	2
22.	<i>Raktamurta</i>	-	-	-	+	-	-	-	1

**Abbreviations:** C.S.- *Charaka Samhita* (Shastri and Chaturvedi, 2012), Su.S.- *Sushruta Samhita* (Shastri, 2016), C.N.- *Chandra Nighantu* (CCRAS, 2022b), M.P.N.- *Madanpala Nighantu* (Balkrishna, 2019b), K.N.- *Kaiyaideva Nighantu* (Sharma and Sharma, 2006), B.P.N.- *Bhavprakash Nighantu* (Chunekar and Pandey, 1993), G.R.M.- *Guna Ratnamala* (Pandey et al., 2006)

### TRADITIONAL/ETHNOMEDICINAL USES

Fruits are used as purgative, aphrodisiac, cough, diuretic, and tonic to promote hair growth, cooling in anaemia, ulcer, vaginal discharge, leprosy, difficulty in urination, rheumatism, discharge from the female genitals, dysentery, fever, skin disease, urticaria on itching skin, against dandruff and in biliousness (ICMR, 2009).

Administering 5 to 6 fruits of *Gamar*, boiled and then pasted, taken with a little sugar twice daily for two weeks, promotes growth and better health of foetus among pregnant women. Taking juice of 2-3 fruits of *Gamar* along with two teaspoons of juice of *Anar* (*Punica granatum*) twice daily for a week cures hemorrhagic dysentery. In case of unavailability of fresh fruits of *Gamar*, one can use a decoction of dried fruit and prepare

the decoction. Administering 2-3 fruits of Gamar (pasted after boiling) with water, twice daily at six hourly intervals, for three weeks, improves the general health of an infant and promotes growth. Administering a paste of 5 to 6 Gamar fruits (pasted after boiling) after making it into *sherbat* by mixing little honey, controls the appearance of blood in the cough or in the stool. It controls the tendency of nasal bleeding too (Patel, 2005).

Blood disorders and diseases like tuberculosis (blood coming in cough) can be cured by taking ripe fruit extract twice a day for 10 to 15 days. This extract is prepared by boiling one fistful of ripe fruits with one glass of milk and one glass of water. Traditional people were using for fetal growth by using a half glass of fruit extract by boiling one fistful of Gambhari fruits with 20 g of honey, two glasses of milk and two glasses of water till it gets reduced to one glass. This preparation (half glass) can be taken twice a day on an empty stomach during morning and night time. Tribal peoples are used ripe fruit juice as antidiabetic. Traditional people are used to getting relief from Post-delivery weakness. To cure fever due to a cold, boil *G. arborea* bark, stem and fruits in 500 ml water. Take 20 ml of this decoction each time orally twice daily for three to four days (Nayak et al., 2015a).

## THERAPEUTIC USES

Fruits are acrid, sour, bitter, refrigerant, diuretic, astringent, aphrodisiac, trichotomous, alterant and tonic. They are used for promoting the growth of hair and for anaemia, leprosy, ulcers, constipation, strangury, leucorrhoea, intrinsic haemorrhage, fevers and bilious affections (Sharma et al., 2000). *Kashmarya Phala Yusa* (soup) may be given with water and sugar in *Atisar* (diarrhoea) (Sastry, 2016). The fruits are acrid, sour, bitter, sweet, cooling, diuretic, tonic, aphrodisiac, alternative, astringent to bowels, promote the growth of hair, useful in *Vata disorder*, thirst, anaemia, leprosy, ulcers, consumption, strangury, vaginal discharge (Kirtikar and Basu, 2005). Dried fruit was reported useful in *Ksata* (lacerated wounds), *Ksaya* (immunosuppressive/emaciating disease), *Mutrakrechra* (dysuria) and *Hridroga* (cardiac disease), *Raktapitta* (haemorrhagic disorders), *Daha* (burning sensation) and *Tirsna* (polydipsia). Fruits are used as an ingredient of refrigerant and decoction for fevers and bilious affections. *Chakradatta* gave ripe fruits with honey for checking haemorrhage. Ripe fruits are dried and cooked with cow's milk for urticaria. Fruits are used in dysuria and hemorrhagic disease. The fruits are reported hepatoprotective, antibacterial, antioxidant and antidiabetic activity (ICMR, 2009).

Bark, wood, leaf, root and fruits are used in the treatment of various ailments in folk medicine. Ripe fruits are dried and cooked with cow's milk, for urticaria. Fruits are used for shortness of breath, as a cooling agent diuretic, as a nutritive, used in tuberculosis; promote hair growth, menorrhagia and burning sensation. The fruits are edible. Decoction of fruits is used to treat swelling of the body, fever and bilious disorders. Fruits powder is used with milk or ghee in pregnancy for the settlement of the foetus. *G. arborea* fruits are reported to have diuretic, antiepileptic, analgesic, antipyretic, antibacterial, antioxidant, antidiabetic and hepatoprotective activity (Chothani and Patel, 2014).

## CHEMICAL CONSTITUENTS

Fruits contain butyric and tartaric acids, saccharine substances and little tannin,  $\beta$ - sitosterol, ceryl alcohol, gmelinol, arborone, arboreal, luteolin, apigenin, quercetin, hentriacontanol, quercetogenin (Sharma et al., 2000). The seed oil was found to contain fatty acids, palmitic (14.7%), oleic (48.2%), linoleic acid (22.6%) and stearic (4.2%). Fruits contained alkaloids as well as gums, resin, mucilage, tannins, waxes and quinones (ICMR, 2009).

## PHARMACOLOGICAL PROPERTIES

### Antioxidant activity

Aqueous extracts of bark and fruit at 1%, 5% and 10% concentrations, inhibited the  $H_2O_2$  and paraquat-induced oxidative stress in mice liver slices in vitro in a concentration-dependent manner. The presence of extracts in the incubation medium significantly reduced the  $H_2O_2$  and paraquat-induced rise in LDH, SOD, CAT and GR activities in liver cells (ICMR, 2009).

### Anabolic effects

The fruits administration at 0.5 g/animal/d *p.o.* dose to normal rabbits increased the levels of  $\alpha_2$  and  $\gamma$  – globulin in serum, gain in body weight and alertness in physical behaviour as compared to control groups. These observations indicated the anabolic (*Rasayana*) activity of the fruit powder (ICMR, 2009).

### Haemagglutination activity

The saline extract of the seeds showed haemagglutinating activity against the erythrocytes of monkeys (ICMR, 2009).

### Antibacterial activity

In vitro antibacterial activity was determined against gram-positive (*Bacillus subtilis* and *Staphylococcus aureus*) and gram-negative bacteria (*Pseudomonas aeruginosa*). Coarse powder of dried fruit of *G. arborea* was made and extracted by Soxhlation method using ethanol, ethyl acetate, n-butanol and petroleum ether as solvent. The minimum inhibitory concentration for each extract was also determined using the disk diffusion technique. Only ethanol extract Showed significant antibacterial activity against both gram-positive and gram-negative bacteria and the activities shown by ethanol extract were comparable with the standard drug streptomycin. The n-butanol extract did not show any activity against test organisms, whereas ethyl acetate and petroleum ether extracts showed inhibitory action against *P. aeruginosa*. Among different organisms, *S. aureus* is found to be more sensitive to ethanolic extract while *P. aeruginosa* is sensitive to ethyl acetate and petroleum ether extracts (Nayak et al., 2012).

### Antidiabetic activity

In this study ethanol, ethyl acetate, n butanol and petroleum ether were tested in single doses in each group



of experimental animals (300 mg /kg bw) in vivo study of antidiabetic activities of fruits extracts of *G. arborea* by alloxan induced diabetic model conducted on Healthy Wister rats of either sex. Coarse powder of dried fruit of *G. arborea* was made and extracted by Soxhlation method using ethanol, ethyl acetate, n butanol and petroleum ether as solvent. The extracts of *G. arborea* were tested in single doses in each group of experimental animals (300 mg/Kg b.w). Glibenclamide was used as the standard drug in the alloxan-induced diabetic model at a dose of 5 mg/Kg of the body weight of the rat. The extracts produced a significant antidiabetic effect and are comparable with the standard drug (Glibenclamide). All the extracts were able to reduce sugar levels in the blood. The antidiabetic activity of the extracts is in the order of ethanol > n-butanol > petroleum ether > ethyl acetate. The ethanol extract was found to have good antidiabetic activity in comparison to other extracts (Nayak et al., 2012).

### Diuretic activity

The diuretic activity of different fruit extracts of the plant *G. arborea* using ethanol, ethyl acetate, n- butanol and petroleum ether as solvents. Urea (1g/kg) was used as the normal standard drug and normal saline water was 0.9 % w/v used as normal control. Urine volume was significantly increased by all the extracts (highest in n-butanol extract) in comparison to normal and standard control groups (Nayak et al., 2013). An experiment was conducted to evaluate the influence of *G. arborea* fruits meal on haematology, and certain biochemical parameters including blood enzyme profile and urine analysis of wean pigs. A significant difference was recorded in the percent of lymphocytes and neutrophils of the leucocytes and uric acid production in urine analysis (Annongu and Folorunso, 2003).

### Hepatoprotective activity

The effect of *G. arborea* fruit aqueous extracts on paraquat and hydrogen peroxide-induced oxidative stress was investigated using liver slice culture. The addition of fruit extracts along with these cytotoxic agents led to a decrease in lactate dehydrogenase release. The addition of the fruit extracts along with the pro-oxidants suppressed the enzyme activities. The extract also displayed antioxidant activity in vitro radical scavenging assays (DPPH, FRAP, ABTS) (Sinha et al., 2006).

### Anti-inflammatory activity

The anti-inflammatory activity of all the extracts of *G. arborea* fruit was found in the order of ethanol > n-butanol > petroleum ether > ethyl acetate (Nayak et al., 2015b).

### TOXICITY STUDIES

Acute and subacute toxicity studies of powder of fruits of *G. arborea* were conducted in two schedules (Acute and subacute toxicity studies) with different doses of 300 mg, 500mg, and 1g/kg for 28 days. None of the doses of this test drug produced mortality or behavioural changes. Thus the test drug at a dose of 2g/kg was proved to be non-toxic without causing any kind of variations in the behaviour,

haematology, biochemistry and histology of vital organs (Ashalatha and Sankh, 2014).

### CONCLUSION AND RECOMMENDATIONS

According to taxonomical science, *Gambhari* (*G. arborea*) belongs to the family *Lamiaceae*. In Ayurveda science, *Gambhari* root is classified into *Brihtpanchmoola* but *Gambhari Phala* (fruit) is classified into *Sarivadi Gana* in *Brihatrayee* and most of the *Nighantus Gambhari Phala* is classified as *Phala Varga* and *Guduchiyadi Varga*.

Among the various texts, the maximum *Raspanchaka* of *Gambhari* fruit is *Madhura Kashaya Rasa*, *Sheeta Virya*, *Madhura Vipaka*, *Guru*, *Snigdha*, *Sheeta Guna* with *Vata-Pitta-Rakta Dosha Shamaka*, *Rasayana*, *Keshya*, *Mutravibhandana*, *Medhya*, *Brihyan*, *Virsyas*, *Kshaya*, *Trishna Karma*. Ethnobotanical reports show *Gambhari* fruits are used by traditional people for treating bleeding disorders and for promoting the growth of fetal or infants. The main therapeutic uses of *Gambhari* fruit in *Raktipitta*, *Daha*, *Trishna Shamaka*. Acute and subacute toxicity studies confirmed that *G. arborea* fruit extract would be nontoxic in the living body. *Gambhari* fruits have reported antioxidant, anabolic, haemagglutination, antibacterial, antidiabetic, diuretic, anti-inflammatory and hepatoprotective activity.

The importance of *G. arborea* Roxb. (*Gambhari*) fruit is indicated in the present review, as one of the classical medicinal plants. It highlights the hidden knowledge about one of the important and mostly prescribed Ayurvedic plant drugs. The present review will be encouraged the researcher and physicians to use *Gambhari* fruit instead of *Gambhari* root/bark for therapeutic purposes. Provided data will be helpful to understand adulteration, substitution and availability of the genuine plant part and remove the controversy of the plant. Through the clinical trials, the pharmacological and biological actions proved are yet to be further verified and re-established.

### CONFLICTS OF INTEREST

The author(s) declare(s) no conflicts of interest.

### DECLARATION

The contents of this paper are published after receiving a signed copyright agreement from the corresponding author declaring that the contents of this paper are original. In case of any dispute related to the originality of the contents, editors, reviewers and the publisher will remain neutral.

### REFERENCES

- Annongu AA, Folorunso AS (2003). Biochemical Evaluation of *G. arborea* Fruit Meal as a Swine Feedstuff. *Biokemistri*, 15(1), 1-6.
- API (2001). The Ayurvedic Pharmacopoeia of India, Part 1, Vol. 2. Ministry of Health and Family Welfare, Dept. of ISM&H (AYUSH), Govt. of India, New Delhi, pp. 42-43.
- Ashalatha M, Sankh K (2014). Toxicity study of *Gambhari Phala Churna*. *International Ayurvedic Medical Journal*, 6(2), 959-963.
- Balkrishna A (2019a). Vaahatacharya, Ashtanga Nighantu, Divyaprakashan, Haridwar, p. 9.

- Balkrishna A (2019b). Madanpal Nighantu, Second Edition. Divya Prakashan, Haridwar, p. 13.
- Bapalal V (2005). Nighantu Adarsh, Vol . 2. Chaukhambha Bharti Academy, Varanasi, p. 246.
- CCRAS (2022a). Sushrutnighantu, E – Nighantu Collection of Ayurvedic Lexicons, Central Council for Research in Ayurvedic Sciences (CCRAS), New Delhi, 31/1. Accessed on November 07, 2022, from <https://niimh.nic.in/ebooks/e-Nighantu/sushrutnighantu/?mod=read>
- CCRAS (2022b). Madanadinighantu, E – Nighantu Collection of Ayurvedic Lexicons, Central Council for Research in Ayurvedic Sciences (CCRAS), New Delhi, 3/5-6. Accessed on November 07, 2022, from <https://niimh.nic.in/ebooks/e-Nighantu/madanadinighantu/?mod=read>
- CCRAS (2022c). Laghunighantu, E – Nighantu, Collection of Ayurvedic Lexicon, Central Council for Research in Ayurvedic Sciences (CCRAS), New Delhi, Sloke No.2/266. Accessed on November 07, 2022, from <https://niimh.nic.in/ebooks/e-Nighantu/laghunighantu/?mod=read>
- Chothani DL, Patel NM (2014). Pharmacognostic and physicochemical evaluation on fruits of *Gmelina arborea*. Pharma Tutor, 2(7), 162-166.
- Chunekar KC, Pandey GS (1993). Bhavaprakasha Nighantu of Bhavamishra, 9<sup>th</sup> Edition. Chaukhambha Orientalia, Varanasi, p. 265.
- Dwivedi RR (2009). Sodhala, Sodhala Nighantu, 1<sup>st</sup> edition. Chowkhamba Krishnadas Academy, Varanasi, p. 35.
- ICMR (2009). Reviews on Indian Medicinal Plants, Vol. 3. Medicinal Plant Unit, Indian Council of Medical Research, New Delhi.
- ITIS (2022). *Gmelina arborea* Roxb. Taxonomic Serial No.: 565214. Retrieved [November, 20, 2022], from the Integrated Taxonomic Information System (ITIS) on-line database, [www.itis.gov](http://www.itis.gov), CCO. <https://doi.org/10.5066/F7KH0KBK>
- Kamat SD (2006). Studies on Medicinal Plants & Drugs in Saraswati Nighantu, First Edition. Chaukhambha Sanskrit Pratishthan, Varanasi, p. 7.
- Kirtikar KR, Basu BD (2005). Indian Medicinal Plants. International Book Distributor, Dehradun, pp. 1931-1934.
- Nayak BS, Das MR, Sahu A, Ellaiah P, Dinda SC (2015b). Anti-inflammatory activity of *Gmelina arborea* Roxb. fruit extract. International Journal of Pharmacy and Technology, 6(4), 7573-7528. <https://doi.org/10.7897/2230-8407.06228>
- Nayak BS, Dinda SC, Ellaiah P (2013). Evaluation of Diuretic Activity of *Gmelina arborea* Fruit Extract. Asian Journal Pharmaceutical and Clinical Research, 6(1), 111-113. <https://doi.org/10.4103/0973-8258.104937>
- Nayak BS, Ellaiah P, Dinda SC (2012). Antibacterial, Antioxidant and Antidiabetic Activities of *Gmelina arborea* Roxb. Fruit Extracts. International Journal of Green Pharmacy, 6(3), 224-230. <https://doi.org/10.4103/0973-8258.104937>
- Nayak BS, Rath AK, Pattnaik SC (2015a). Traditional Use, Toxicity Study and Phytochemical Screening of *Gmelina arborea* Roxb. Fruits. International Journal of Phytopharmacy Research, 6(2), 78-81.
- Pandey K, Narayana A, Sharma PV (2006). Gunaratnamala 1st Edition. Chaukhamba Sanskrit Bhawan, Varanasi, p. 360.
- Patel S (2005). Medicinal Trees. Herbal Reference Library, p. 139.
- Sastry JLN (2016). Dravya Guna Vijnāna, Vol. 2. Chaukhamba Orientalia, Varanasi, pp. 325-326.
- Sharma PC, Yelne MB, Dennis TJ (2000). Database on Medicinal Plants Used in Ayurveda, Vol. 3. Central Council for Research in Ayurveda & Siddha, Department of Indian System of Medicine, Govt. of India, New Delhi, pp. 217-221.
- Sharma PV (1973). Madhav Dravyaguna, 1st edition. Chaukhambha Viddhya Bhawan, Varanasi, Sloke No. 21/56.
- Sharma PV (1977a). Abhidhana Ratnamala (Sadrasanighantum), 1st edition. Chaukhambha Orientalia, p. 18.
- Sharma PV (1977b). Bopadeva, Hridayadipaka Nighantu with Siddhamantraprakasa, Kaphavataghna Varga, 1st Edition. Chaukhambha Amarabhārati, Varanasi, p. 40-41.
- Sharma PV (2000). Namarupa Vijnanam. Satyapriya Prakashan, Varanasi, pp. 71-72.
- Sharma PV, Sharma GP (2005). Mahendra Bhogika, Dhanvantari Nighantu, 4<sup>th</sup> edition. Chaukhambha Orientalia, Varanasi, p. 37.
- Sharma PV, Sharma GP (2006). Kaiyadeva Nighantu, 2<sup>nd</sup> Edition. Chaukhambha Orientalia, Varanasi, p. 9.
- Sharma SP (2006). Ashtanga Samgraha of Vrddha Vagbhata, (With Sasilekha' commentary by Indu), Chowkhambha Sanskrit Series Office, Varanasi, Sutrasthan 15/11, p. 141.
- Shastri A (2016). Sushruta Samhita Ayurvedtatavasandipika, Part-I. Chaukhambha Sanskrit Sansthan, Varanasi, Sutrasthan, Sloke No. 38/39, 46/184, pp. 186, 258.
- Shastri K, Chaturvedi G (2012). Charaka Samhita, Elaborated Vidyotini Hindi Commentary, Part 1. Chaukhambha Bharati Academy, Varanasi, Sutrasthana, Sloke No. 25/40, pp. 65, 468.
- Singh AK, Tripathi I (2006). Mahousadha Nighantu (Dravyanamagunahastapustika). Chaukhambha Bharati Academy, Varanasi, p. 68.
- Sinha S, Dixit P, Bhargava S (2006). Bark and fruit extracts of *Gmelina arborea* protect liver cells from oxidative stress. Pharmaceutical Biology, 44(4), 237-243. <https://doi.org/10.1080/13880200600713667>
- Tripathi I (2010). Raja Nighantu of Narahari Pandit. Chaukhambha Krishna Das Academy, Varanasi, p. 271.

#### How to cite this article?

Kumiya R, Singh DC, Kavya GM, Vashisht K (2022). Pharmacognostic and pharmacological properties of Gambhari (*Gmelina arborea* Roxb.) fruits. Current Medical and Drug Research, 6 (2), Article ID 226.

\*\*\*\*\*