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Unlocking the Potential of *Bambusa vulgaris*: Science and Promise

Veeresh Shivaraj¹, Dr. Deeparani Urolagin^{1*}, Dr. Sowmya B A²,
Harish N¹, Vishalakshi¹, Vinay K M¹, Pruthvi Patil¹, Deborshi
Nath¹, Saurabh Kumar¹, Ravindra Mishra³

¹R R College of Pharmacy, Bengaluru, ²East West College of Pharmacy, Bengaluru.

³Shriram College of Pharmacy, Banmore

Veeresh Shivaraj, ORCID: 0009- 0008- 7129 -8218,
Dr. Deeparani Urolagin, ORCID: 0000-0003-2391-3526,
Dr. Sowmya B A, ORCID : 0000-0002-4776-9322,
Harish N, ORCID : 0009-0007-5716-6203,
Vishalakshi, ORCID : 0009-0007-5837-6325,
Vinay K M, ORCID : 0009-0005-6813-0500,
Pruthvi Patil, ORCID : 0009-0006-6514-1981,
Deborshi Nath, ORCID : 0009-0005-6821-1546,
Saurabh Kumar, ORCID : 0009-0006-3537-1014,
Ravindra Mishra ORCID : 0000-0002-3754-7646

Corresponding author: Dr. Deeparani Urolagin, Department of Pharmacology, R R
College of Pharmacy, Bengaluru– 560090, India,
E-mail address: deepaurolagin@gmail.com

ABSTRACT: *Bambusa vulgaris*, widely referred to as common bamboo, is a clumping bamboo species occurring throughout tropical and subtropical regions of Asia, Africa, and the Americas. Owing to its rapid growth, adaptability, and broad range of uses, it is considered an important bamboo species from both commercial and ecological perspectives. The plant is recognized by its sturdy green to yellow culms and abundant foliage and grows successfully under varied environmental conditions, especially in warm and humid areas. Its uses extend from construction, furniture, paper manufacture, handicrafts, and bioenergy to environmental applications such as soil stabilization and erosion management. The shoots contain several chemical constituents, including quercetin, gossypin, kaempferol-7-glycoside, and kaempferol. Flavonoids such as orientin, isoorientin, isovitexin, vitexin, and tricetin are also reported in bamboo shoots and leaves. These flavonoids are distributed among different bamboo tissues, particularly the shoots, sheaths, and leaves. Continued investigation of the species' growth characteristics, ecological effects, and scope for sustainable utilization remains important to researchers.

KEYWORDS:

Bambusa vulgaris, Bamboo,
pharmacological activities, anti-
inflammatory, antioxidants.

INTRODUCTION:

Bambusa vulgaris, commonly called common bamboo or golden bamboo, is a rhizomatous member of the family Poaceae occurring widely in tropical and subtropical regions. The species originated in southern China and is now cultivated extensively across the world, particularly in humid tropical environments and naturalised areas. It develops dense, bright-green tufted culms that generally attain a height of 10–20 m (30–70 ft), with a diameter of 4–10 cm and wall thickness of 7–15 mm. [1]

Bamboo cultivation covers at least 37 million hectares globally, representing about 3.2% of the forest area of the countries where it occurs and nearly 1% of the world's total forest area. In southern tropical Asia, bamboo occupies approximately 80% of the reported land area. South America also shows a high diversity and widespread occurrence of bamboo species. Madagascar

represents an important bamboo-rich country in Africa. Data concerning the extent of bamboo forests were contributed to the Global Forest Resources Assessment 2000 (FRA 2000) by eleven countries, comprising two from Central and South America, eight from Asia, and one from Africa [2]



Figure 01: *Bambusa vulgaris*

PLANT PROFILE [3]:

- **Scientific name:** *Bambusa vulgaris*.
- **Common name:** Golden bamboo.
- **Kingdom:** Plantae
- **Clade:** Tracheophytes
- **Clade:** Angiosperms
- **Clade:** Monocots
- **Clade:** Commelinids
- **Order:** Poales
- **Family:** Poaceae
- **Genus:** Bambusa
- **Species:** *B. vulgaris*.

Bamboo shoots have been reported to contain kaempferol-7-glycoside, quercetin, and gossypitin. The shoots and leaves [4] also contain flavonoids including orientin, isoorientin, isovitexin, vitexin, and tricetin. A large proportion of the flavonoids present in bamboo tissues, including leaves, shoots, and sheaths, occurs as flavonoid ligands or free aglycones. Seven flavonoid compounds identified include apigenin 6, 8-di-C-L-arabinopyranoside, 6-C-D-glucopyranosyl, 8-C-L-arabinopyranosylchrysin, 5,7,4'-trihydroxy-3',5'-dimethoxyflavone, narcissin, rutin, D-glucopyranoside, and kaempferide 3-O-L-rhamnopyranosyl [5]. Bamboo leaves contain about 2–5% flavones, which have been associated with free-radical neutralisation, reduced blood lipids, and prevention of sub-nitrification.

Bamboo shoots provide vitamins, minerals, dietary fibre, phytosterols, and phenolic compounds [6]. Consumption of these components has been associated with reductions in low-density lipoprotein (LDL), total blood cholesterol, bowel-movement frequency, and increases in faecal volume [7]. However, bamboo shoots also contain cyanogenic glycosides, which are considered anti-nutritional constituents and have been linked with their acidity and unpleasant odour [8]. Studies have further indicated that bamboo shoots may influence hormone metabolism, reproductive functions, and hepatic xenobiotic transformation enzymes [9].

Bamboo has attracted increasing attention because of its nutritional and therapeutic value and its relevance to the food, pharmaceutical, and cosmetic sectors. The leaves and shoots have been traditionally used as natural remedies and may have further therapeutic applications. In India, bamboo has reportedly been used medicinally for more than 10,000 years. Bamboo manna was incorporated with other herbs in Chyawanprash, a traditional health preparation associated with youth, beauty, and longevity. Chyawanprash has subsequently received wider recognition for its reported anti-aging and anti-stress properties. Bamboo has also remained an important component of traditional Asian medical systems, including Chinese and Indian Ayurvedic medicine [10, 11].



Fig.02: Process of collection, washing, drying, powdering and extraction of the leaves of *Bambusa vulgaris*

Phytochemical review of *Bambusa vulgaris*:

Table 01: Presence of Phytochemicals:

Test	Methanolic extract	Ethanolic extract	Aqueous extract
Alkaloids	-	-	-
Flavonoids	+	+	+
Saponins	+	+	-
Glycosides	-	-	-
Resins	+	+	+
Fixed Oils	+	+	-
Phytosterols	+	+	+
Tannins	+	+	+
Phenols	+	+	+

The study evaluated the extracts of bamboo for the presence of flavonoids, saponins, resins, fixed oils, phytosterols, phenols, and tannins [12].

Ayeni MJ, Oyeyemi SD, et al. (2018) reported that the leaves of *B. vulgaris* and *A. altilis* contained alkaloids (10.64% and 14.80%), saponins (2.33 and 3.90%), flavonoids (4.60 and 3.70%), tannins (0.67 and 1.89 mg/100 g), and phenols (0.23 and 1.89 mg/100 g), respectively. Proximate analysis showed low moisture levels (12.27% and 14.88%), moderate crude fat (6.00 and 6.91%), low crude protein (2.84 and 2.15%), high crude fibre (16.96 and 9.96%), ash (11.82 and 15.92%), and carbohydrate contents of 50.12 and 50.19% [13].

G. Y. Coffie, C. Antwi-Boasiako, et al. (2014) evaluated the leaves under both wet and dry conditions. Saponins, general glycosides, coumarins, and cyanogenic glycosides were detected in the leaves of all the species examined. Flavonoids and polyphenols were also reported in *B. ventricosa* and *O. abyssinica*. In contrast, anthraquinones, anthracene glycosides, triterpenoids, alkaloids, carotenoids, and steroids were absent from all the species or varieties investigated. Air-dried bamboo leaves generally retain their phytochemical constituents and may therefore be utilized as hay or feed while fresh leaves can serve as succulent feed. Among the three species assessed, *B. vulgaris* was considered the safest because it contained four types of phytochemicals [14, 15].

Pharmacological Review of *Bambusa vulgaris*:

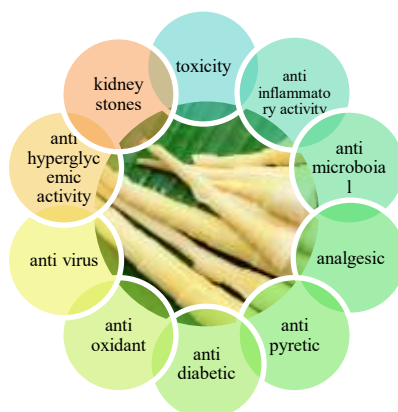


Figure 3: Pharmacological activities of Bamboo

1. Toxicity: Methanolic bamboo extracts selected for *in-vivo* studies have been investigated for antidiabetic, antipyretic, and anti-poisoning effects. Acute toxicity testing was conducted in mice before the *in-vivo* experiments according to established procedures. All animals in stages 1 and 2 of the acute toxicity assessment survived the observation period. No obvious toxic signs were observed in animals receiving 2000 mg/kg body weight, and animation was noted in all animals during necropsy. Based on these findings, the median lethal dose (LD) of *Bambusa vulgaris* was considered to be greater than 2000 mg/kg body weight and was classified as category 2 [16].

2. Anti-inflammatory Effects: Carey, W.M. et al. (2009) investigated the effect of methanolic extract of *B. vulgaris* (MEBV) on inflammation in mice. Acute inflammatory models included formaldehyde-induced paw oedema and acetic acid-induced vascular permeability, while subacute anti-inflammatory activity was assessed using cotton pellet granuloma, plasma MDA estimation, and carrageenan-induced peritonitis [17].

Oral administration of MEBV at 100, 200, and 400 mg/kg produced a dose-related reduction in paw volume in the formaldehyde-induced paw oedema model compared with the control. The 400 mg/kg dose produced a significant effect ($P < 0.01$), and its anti-inflammatory activity was reported to be comparable with diclofenac at 10 mg/kg p.o. The greatest anti-inflammatory response was observed within three hours across the tested doses [18].

3. Anti-microbial activity: The antibacterial potential of *Bambusa vulgaris* was investigated in relation to its phytochemical constituents. In vitro testing was carried out using methanol leaf extract against Gram-positive bacteria, Gram-negative bacteria, and fungi, with inhibition-zone diameter measured by the filter-paper disc method. Among the organisms tested, *B. subtilis* and

other Gram-positive bacteria showed the strongest activity. Inhibition zones of 25–35 mm were recorded, particularly in relation to kanamycin resistance. The antifungal inhibition zone produced by the extract was reported to be closer to the standard than the antibacterial standard [19].

4. **Analgesic activity:** In the acetic-acid-induced writhing test, MEBV produced significant analgesic activity in a dose-dependent manner. Relative to the control group, the number of writhes was reduced by 25.9%, 29.6%, and 37.0% following MEBV administration at 50, 100, 200, and 400 mg/kg. These findings were compared with aspirin administered at 200 and 400 mg/kg, which produced reductions of 40.7% and 19%, respectively. At 400 mg/kg, the highest dose tested, MEBV showed greater analgesic activity than aspirin at 200 mg/kg [20].

5. **Antipyretic activity:** The methanolic extract of *Bambusa vulgaris* has also been evaluated for antipyretic activity. Experimental animals showed a significant rise in rectal temperature 18 hours after administration of Brewer's yeast. The study indicated a variable fever-reducing response with the bamboo extract, while a dose of 1000 mg/kg BW produced marked antipyretic activity. With both tested doses, body temperature declined after two hours and had returned to normal by the end of the fifth hour.

6. **Anti-diabetic activity:** Administration of *Bambusa vulgaris* methanol extract at 100, 200, and 400 mg/kg resulted in marked reductions in blood glucose levels of 32.8, 45.8, and 55.3%, respectively, compared with control animals. Glibenclamide at 10 mg/kg produced a 50.8% reduction. Overall, the aerial part of the plant demonstrated considerable antihyperglycemic potential, which was suggested to be associated with its alkaloid and saponin constituents [20].

7. **Anti-oxidant activity:** Antioxidants help protect biological systems from the harmful effects of free radicals. Satya et al. (2009) reported 28.27% antioxidant activity for fresh bamboo shoots using the DPPH radical-scavenging assay. The DPPH assay also reported IC₅₀ values for radical-scavenging activity in chloroform, acetone, and methanol extracts of *B. vulgaris* leaves, with the values for the extracts reported as 262.90 µg/ml and other corresponding values in the study [21].

8. **Antivirus:** Ethanol extracts prepared from *Aframesmammegnekn* and *Bambusa vulgaris* were evaluated for antiviral effects using standard laboratory assays against poliovirus, yellow fever virus, and measles virus. Both extracts showed activity against one or two of the tested viruses. *A. meleguetae* produced MIC values of 125 and 250 µg/ml against measles and yellow fever viruses, respectively, whereas *B. vulgaris* inhibited measles virus at an MIC of 62.5 µg/ml. Neither extract showed activity against type 1 poliovirus [22].

9. **Antihyperglycemic:** Methanolic extract of *Bambusa vulgaris* (MEBV) has demonstrated antihyperglycemic activity. In oral glucose tolerance experiments, MEBV lowered blood glucose in a dose-dependent manner at 50, 100, 200, and 400 mg/kg body weight. The reported reductions were 84, 12.8, 45.5, and 55.3%, respectively, although the effect at 50 mg/kg was not statistically significant. Glibenclamide at 10 mg/kg body weight reduced blood glucose by 50.5%. At the highest dose evaluated, MEBV therefore showed greater antihyperglycemic activity than glibenclamide [23].

10. **Kidney Stones:** *Bambusa vulgaris* is a widely distributed bamboo species, and several studies have examined the ability of its leaf extracts to inhibit calcium oxalate crystallization, the principal component of many kidney stones. Using a titrimetric method, alcohol extracts of *B. vulgaris* leaves showed an inhibitory effect similar to Cystone, a patented preparation used for kidney-stone management. Alcohol was extracted from powdered leaves using a Soxhlet apparatus, while the aqueous extract was obtained by macerating dried leaves for seven days. The alcohol extracts inhibited calcium oxalate crystallization by 75.13±0.50% and 82.91±1.18% in groups 1 and 2, respectively, whereas Cystone produced a maximum inhibition of 91.1±0.69%. These findings indicate that the alcoholic leaf extract may have activity comparable with Cystone in preventing calcium oxalate deposition. Further investigation and characterisation of its active constituents may support the development of new agents for urolithiasis [24].

According to the current investigation, the alcohol extract of *Bambusa vulgaris* leaves has action comparable to that of Cystone in preventing calcium oxalate deposits from forming. New medications for urolithiasis patients may result from additional analysis of the alcohol extract of *Bambusa vulgaris* leaves and subsequent characterisation of its active ingredients.

Conclusion: *Bambusa vulgaris* has considerable ecological, economic, and cultural value. Its ability to grow rapidly under diverse conditions and its wide range of applications support its use in sectors such as construction, handicrafts, paper manufacture, and bioenergy. The plant also contributes to soil stabilization and erosion control, making it relevant to sustainable land management. Flavonoids and other chemical constituents identified in the shoots and leaves provide a basis for continued investigation of its

medicinal and bioactive potential. Further studies on growth characteristics, ecological effects, and sustainable management may strengthen understanding of the species and its possible contribution to environmental and economic needs.

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