

BAMBUSA VULGARIS LEAVES: A COMPREHENSIVE REVIEW OF PHYTOCHEMICAL PROFILE AND PHARMACOLOGICAL POTENTIAL

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ABSTRACT

The widely distributed bamboo *Bambusa vulgaris* Schrad. ex J.C. Wendl. (family Poaceae) is said to have traditional, nutritional, and therapeutic use. *B. vulgaris* has a varied phytochemical profile, including phenolic acids, flavonoids, phytosterols, tannins, saponins, terpenes, alkaloids, and glycosides, according to the provided M. Pharm project and its referenced literature. Gallic acid, ferulic acid, caffeic acid, chlorogenic acid, catechin, rutin, β -sitosterol, and ergosterol are among the reported ingredients. Antioxidant, antimicrobial, analgesic, anti-inflammatory, antihyperglycemic, antipyretic, hepatoprotective, antiulcer, anxiolytic, and other biological actions are described in the source's summary of pharmacological investigations. Ethanolic leaf extract has received special attention. The study revealed total phenolic content of 18.4 mg GAE/g, total flavonoid content of 34.77 mg QE/g, and concentration-dependent DPPH radical-scavenging activity, which reached 85.45% at 100 μ g/mL under the described conditions. Antibacterial screening against *Escherichia coli*, *Salmonella typhi*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* showed the highest reported inhibition at 100 mg/mL. This review organizes the available information into a journal-style narrative, highlights the chemical basis of reported activities, and identifies research gaps involving standardization, mechanistic validation, safety, pharmacokinetics and in-vivo studies.

KEYWORDS: *Bambusa vulgaris*; Poaceae; phytochemicals; flavonoids; phenolics; antioxidant; DPPH; antibacterial; herbal medicine.

INTRODUCTION

Medicinal plants remain important sources of traditional healthcare and natural products. Their chemical composition can vary with species, plant part, geographical origin, environmental conditions, harvesting and extraction methods. Consequently, traditional use is valuable for identifying promising plants but does not by itself establish therapeutic efficacy or safety.^[1]

Bambusa vulgaris is a widely distributed bamboo species of the Poaceae family. The provided project highlights the presence of several phytochemical groups in different parts of the plant, with a particular focus on the leaves. Previous investigations summarized in the project indicate antioxidant, antimicrobial, and other pharmacological properties, supporting further

evaluation of this plant as a potential source of bioactive constituents. Medicinal plants continue to be important sources of traditional healthcare and natural products.^[2]

PLANT PROFILE^[2]

Scientific name: *Bambusa vulgaris*

Family: Poaceae

Taxonomical classification

Kingdom – Plantae

Phylum – Tracheophyte

Class – Piliopsida

Order – Poales

Genus – *Bambusa*

Biological source

Bambusa vulgaris Schrad. Ex J.C.Wendl. is a perennial, evergreen bamboo species belonging to the family Poaceae (Gramineae). It is commonly known as common bamboo, yellow bamboo or golden bamboo. It is an accepted species of genus *bambusa*.^[2]

Vernacular names of *Bambusa vulgaris*

The common vernacular names of *bambusa vulgaris* include common bamboo, golden bamboo, yellow

bamboo, green bamboo, ornamental bamboo, giant bamboo. The source project describes *B. vulgaris* as a bamboo in which different plant parts contain different chemical constituents. Leaves are reported to contain saponins, tannins, terpenes, flavonoids, phlobatannins, alkaloids, phenols, steroids and anthraquinones. Shoots contain proteins, carbohydrates, amino acids, gums and mucilage, while glycosides are reported in ripe stems and resin in the culm

**Bamboo stem****Bamboo leaves****Bamboo root****Major plant parts and reported constituents****Table 1**

Plant part	Reported constituents	Importance	Reference
Leaves	Phenols, flavonoids, tannins, saponins, terpenes, alkaloids, steroids	Main focus of review	
Shoots	Proteins, carbohydrates, amino acids, gums and mucilage	Nutritional/biological interest	
Ripe stem	Glycosides	Phytochemical source	
Culm	Resin	Reported plant constituent	
Roots	Phenolic compounds, flavonoids, tannins and other secondary metabolites	Reported medicinal/ phytochemical interest	
Bark/sheath	Phenolic compounds, flavonoids and others polyphenols.	Phytochemical source	
Flower	Limited specific phytochemicals information reported	Limited evidence	

ETHNOMEDICINAL AND TRADITIONAL IMPORTANCE

The source literature associates bamboo preparations with several traditional and experimental uses. For *B. vulgaris*, reported activities include analgesic, antipyretic, anti-inflammatory, antidiabetic, antioxidant, antibacterial, hepatoprotective, antiulcer and anxiolytic effects. These observations are distributed across different plant parts and extraction systems and therefore should not be treated as equivalent evidence for every leaf preparation.

PHYTOCHEMICAL COMPOSITION

Phytochemical investigations reported in the project indicate a chemically diverse profile. Carbohydrates, amino acids, minerals and vitamins occur alongside secondary metabolites. The secondary metabolites are particularly relevant because many of the reported biological activities are plausibly associated with phenolic and flavonoid-rich fractions.

Table 2.

Phytochemical class	Representative constituents reported	Reference
Carbohydrates	Cellulose, hemicellulose, starch, glycoproteins, sucrose, fructose, glucose	(3)
Amino acids	Arginine, aspartic acid, serine, glycine, glutamic acid, alanine, valine, leucine, lysine, tyrosine and others	
Phenolic compounds	p-Hydroxybenzoic, protocatechuic, caffeic, chlorogenic, p-coumaric, syringic, gallic, ferulic and vanillic acids; catechin	
Flavonoids	Rutin, schaftoside, narcissin, apigenin- and kaempferide-related glycosides	
Phytosterols	β -Sitosterol, campesterol, stigmasterol, cholesterol, ergosterol and stigmastanol	
Other groups	Saponins, tannins, terpenes, alkaloids, phlobatannins and anthraquinones	
Glycoside	Taxiphyllin (cyanogenic glycoside) reported in the cited literature	

Secondary metabolites of particular interest

The project specifically associates the leaves with ergosterol, ferulic acid, catechin, ascorbic acid, sucrose, syringic acid, valine, pantothenic acid and pyridoxine. Phenolic acids and flavonoids are of particular interest because they can participate in electron transfer, hydrogen donation and metal chelation and may therefore contribute to antioxidant activity.

PHARMACOLOGICAL ACTIVITIES

A number of experimental models are included in the source's summary of the available evidence. The results are best understood as evidence of pharmacological potential rather than proof of therapeutic efficacy because the research differ in terms of plant material, solvent, dose, and experimental methodology.

Table 3

Plant part	Solvent	Reported activity	Model / method	Reference
Leaves	Methanol	Analgesic	Acetic-acid-induced Swiss albino mouse model	(4)
Aerial parts	Methanol	Antihyperglycemic	Experimental model	(5)
Plant	Methanol	Antipyretic	Brewer's yeast-induced model	(4)
Leaves	Methanol	Anti-inflammatory	Paw edema, vascular permeability, cotton-pellet granuloma and related models	(6)
Leaves	Methanol	Antioxidant	Fe ²⁺ chelation, DPPH, ABTS, hydroxyl radical scavenging and reducing power	(7)
Leaves	Chloroform	Hepatoprotective	CCl ₄ -induced liver injury; SGOT, ALP and SGPT	(8)
Grass	Hot water	Antiulcer	Experimental model	(9)
Shoots	Methanol	Antimicrobial	Experimental screening	(10)
Extracts	Various	Anxiolytic	Experimental animals	
Root	Ethanol	Anthelmintic activity	Experimental screening	(11)
Stem	CO ₂ super critical extraction	Oral acute toxicity	SD rat	(12)
Buds	-	Cough	Prepare an infusion of the buds. Drink 1 cup per day.	(13)

Determination of Total Phenolic Contents

The total phenolic content in the methanol extract of **BVLE** was calculated using standard Folin-Ciocalteu method. Phenols are very important plant constituent. There is highly positive relationship between total phenols and antioxidant activity of many plant species, because of the scavenging ability of their hydroxyl groups. It was reported that phenolic compounds have good antioxidant properties.

Antioxidant activity

An imbalance between reactive species and antioxidant defenses leads to oxidative stress. The source project assessed the ethanolic leaf extract's total phenolic content, total flavonoid content, and DPPH radical-scavenging activity. The aluminum chloride colorimetric

method reported a total flavonoid content of 34.77 mg quercetin equivalents per gram, but the Folin–Ciocalteu method reported a total phenolic content of 18.4 mg gallic acid equivalents per gram of extract.^{[15], [14], [15], [16], [17], [18]}

The ethanolic extract demonstrated concentration-dependent radical-scavenging action in the DPPH test. At 100 µg/mL, the observed radical-scavenging activity was 85.45%, while ascorbic acid showed 92.96% under the same conditions. IC₅₀ values of 0.98 for the standard and 2.02 for the extract were reported by the project. These results are consistent with the presence of phenolic and flavonoid ingredients and indicate antioxidant potential in vitro.

Table 4.

Treatment	Concentration (µg/mL)	Absorbance of Control	Absorbance of Sample	Radical Scavenging Activity (%)
Ethanolic extract of <i>B. vulgaris</i> leaves	20	0.426	0.307	27.93
Ethanolic extract of <i>B. vulgaris</i> leaves	40	0.426	0.205	51.88
Ethanolic extract of <i>B. vulgaris</i> leaves	60	0.426	0.187	56.10
Ethanolic extract of <i>B.</i>	80	0.426	0.116	72.77

<i>vulgaris</i> leaves				
Ethanol extract of <i>B. vulgaris</i> leaves	100	0.426	0.062	85.45

Antibacterial activity

The ethanolic leaf extract was screened against *Escherichia coli*, *Salmonella typhi*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* by measuring

zones of inhibition. The source reported an increase in inhibition with increasing extract concentration, with the highest activity at 100 mg/mL.

Table 5.

Treatment	Dose	<i>E. coli</i>	<i>S. typhi</i>	<i>P. aeruginosa</i> / <i>S. aureus</i>
Ethanol extract	25 mg	2 ± 0.19	0	0 / 2 ± 0.17
Ethanol extract	50 mg	5 ± 0.09	3 ± 0.09	5 ± 0.08 / 3 ± 0.29
Ethanol extract	75 mg	7 ± 0.29	4 ± 0.29	7 ± 0.26 / 5 ± 0.23
Ethanol extract	100 mg	8 ± 0.39	6 ± 0.39	8 ± 0.25 / 7 ± 0.11

Ciprofloxacin was used as the positive standard in the reported experiment. The extract showed measurable in-vitro antibacterial activity, but its zones of inhibition were generally smaller than those produced by the standard at the tested concentrations.

Anti-microbial activity

Bamboo is just one of several phytoconstituents found in plants, each of which has unique therapeutic qualities against a variety of microorganisms. The antibacterial efficacy of the aqueous and ethanolic leaf extracts of *Bamboosa a rundinaceae* against *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aurenginosa*, and *Bacillus* sp. was investigated in 2010 by Singh et al.⁴⁵ When it came to suppressing the microorganisms against the standard penicillin, the ethanolic extract was shown to be more efficient than the aqueous extract. The antibacterial efficacy of *Phyllostachys pubescens* shoot skin (untreated and dicholormethane extract) against *Staphylococcus aureus* was further investigated by Tanaka and his colleagues⁴⁶. They discovered that both extracts had antibacterial action because they could stop *S. aureus* from growing. *Dendrocalamus asper*'s antibacterial activity against *E. coli* was assessed in 2012 by Mulyono et al.⁴⁷. They discovered that among the three distinct extract types—ethanolic, methanolic, and methanol-ethanolic—ethanolic and methanol-ethanolic showed promise as sources of antibacterial medications. Mulyono and his group⁴⁸ recently investigated *Gigantochloa apus*'s antibacterial efficacy against the diarrheagenic *E. coli* in 2013. According to their findings, *E. coli* exhibited concentration-dependent sensitivity to both the ethanolic and methanolic extracts.^{[19],[20],[21],[22]}

Anti-inflammatory and analgesic potential

Methanolic *B* has anti-inflammatory properties, according to studies compiled in the project. *vulgaris* leaf extract in models such as cotton pellet granuloma, formaldehyde-induced paw edema, acetic acid-induced vascular permeability, and carrageenan-induced peritonitis. An acetic acid-induced model in mice has also been used to report analgesic activity.^{5.4} Antihyperglycemic and other reported activities.

Hepatoprotective activity of chloroform leaf extract, antiulcer activity of bamboo material, antimicrobial activity of bamboo shoots, anxiolytic effects of *B. vulgaris* extracts, and other biological activities reported for related bamboo preparations are among the other literature summarized by the project. Methanolic preparations of aerial parts or plant material have been reported to have antihyperglycemic activity.^{[23], [24], [25]}

Anti-obesity effect

The effect of *Sasa borealis* leaf extract (SBE) on inflammatory cytokines and insulin resistance in high fat diet (HFD) induced obese mice. we found that the *S. borealis* leaf extract was effective at just 5% when administered for 12 weeks. After 12 weeks treatment they recorded that the body weight and the adipose tissue deposition were decreased significantly compared to untreated HFD mice. They also found decrease in glucose, insulin, IAUC, HOMA-IR, TNF- α , IL-6 and leptin levels. These results justified that SBE contains anti-obesity compounds.^{[26], [27], [28]}

POSSIBLE BASIS OF BIOACTIVITY

Phenolic acids and flavonoids may contribute to antioxidant effects through hydrogen donation, electron transfer and metal chelation. Tannins and saponins may contribute to antimicrobial effects through interactions with microbial membranes and proteins, while terpenoid and sterol fractions may have additional biological roles. These are plausible mechanistic interpretations; the supplied project does not establish a single active compound or definitive molecular pathway for the observed effects.

LIMITATIONS AND SAFETY CONSIDERATIONS

The evidence base is heterogeneous. Differences in extraction procedures, plant parts, solvents, concentrations and experimental models limit direct comparison among studies. In addition, qualitative phytochemical screening cannot confirm the identity or quantity of individual compounds.

Safety should be assessed independently for standardized *B. vulgaris* leaf preparations. The presence of a reported

cyanogenic glycoside in bamboo literature also reinforces the need for careful chemical characterization and appropriate processing. Findings from other bamboo species or other plant parts should not automatically be extrapolated to *B. vulgaris* leaves.

FUTURE PERSPECTIVES

- Validated HPLC/HPTLC/LC-MS fingerprinting and quantitative chemical standardization of leaf extracts.
- Bioactivity-guided fractionation to identify compounds responsible for antioxidant and antibacterial effects.
- Mechanistic studies using appropriate cellular and molecular models.
- In-vivo pharmacological validation with standardized extracts and clearly defined dose-response relationships.
- Pharmacokinetic, bioavailability, chronic toxicity and herb–drug interaction studies.
- Exploration of in-silico approaches together with experimental confirmation of predicted targets.

CONCLUSION

Bambusa vulgaris leaves contain a broad range of phytochemical constituents, particularly phenolic compounds, flavonoids, phytosterols, tannins, saponins and terpenoid-related constituents. The literature summarized in the supplied project indicates antioxidant, antibacterial and several other pharmacological activities. The reported ethanolic leaf extract showed substantial in-vitro DPPH radical-scavenging activity and concentration-dependent antibacterial effects. However, these findings should be considered preliminary. Chemical standardization, identification of active markers, mechanistic studies, safety evaluation, pharmacokinetic investigation and well-designed in-vivo studies are needed before therapeutic claims can be established.

CONFLICTS OF INTEREST

The author declares no conflict of interest for this review.

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