



Bambusa arundinacea- An Overview

Dhruti Bhatt^{1*}, Neeraj Kumar¹, Nipun Dashora¹, Ashok Dashora¹, Lalit S Chauhan²

¹Geetanjali Institute of Pharmacy, Udaipur-313002

²Department of Pharmaceutical Sciences, Mohanlal Sukhadia University, Udaipur

ABSTRACT

Bamboo (*Bambusa arundinacea*) belonging to family Graminae (Poaceae) is commonly known for its food and nutritional values throughout the world. The medicinal properties of root, leaf and other parts of the plant are also well known in traditional system of medicine. The bamboo tree parts are used for the development of various Ayurvedic and Pharmaceutical products. In the present review the medicinal value, pharmacological and pharmacognostical properties of its various parts have been discussed to provide collective information on its multipurpose values.

Key Words- Bamboo, Ayurvedic, Pharmacological, Pharmacognostical, Medicinal.

INTRODUCTION

Bamboo is the member of Graminae (Poaceae) family. Bamboos differ from other members of the grass family by the presence of branches at each node. A bamboo culm consists of an internode (which is hollow for most bamboo) and a node, which is solid and provide structural integrity for the plant [1]. The length can vary and some plants are as short as 30 centimeters, while

giant timber bamboo can grow to a hollow culm or stem, with nodes or joints between segments of the stem, and oval leaves. It is one of the world's fastest-growing plants and is a versatile renewable resource with applications ranging from construction materials to culinary ingredients [2].

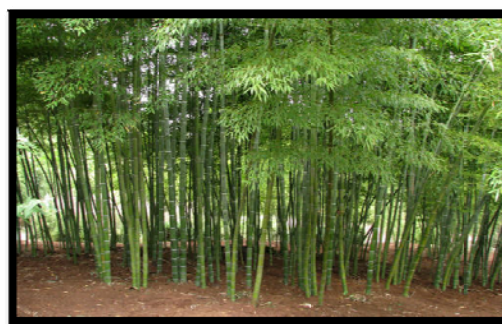


Figure 1: *Bambusa arundinacea*

***Corresponding Author:**

Dhruti Bhatt

Geetanjali Institute of Pharmacy, Udaipur-313002,
Rajasthan, India

E.Mail: dhruti.bhatt008@gmail.com

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The bamboo's lifespan is not very long only about 20 years, and it flowers once every 7 to 20 years, depending on the species. Interestingly, all the bamboo of a particular species will flower at exactly the same time, regardless of their geographical location. Being a very versatile plant, it grows in a lot of different climates and can be found on all the continents except Antarctica [3]. Tensile strength of bamboo is superior to mild steel, and a weight-to-strength ratio better than graphite. A testament to its durability is the fact that a stand of bamboo plants near ground zero at Hiroshima in 1945 survived the atomic blast and sent up new shoots within days [4].

Seeds and shoots of plant are often used as food. The stems are highly versatile and can be used to create bridges, cooking vessels, furniture, paper pulp, weapons, and other items. Particularly in India and China, bamboo has also been used for medicinal purposes. Covering nearly 9 million hectares of land, Indian bamboo accounts for 36 % of the world's bamboo [5, 6]. Some of the species are: *Acidosasa edulis*, *Bambusa bambos*, *Bambusa vulgaris*, *Phyllostachys nigra* (Black Bamboo), *Lophatheri gracilis*, *Coniogramme japonica*, *Phyllostachys pubescens*, *Rhaphis excelsa* and *Phyllostachys bambusoides* [7, 8]. Leaves as well as young shoots are often used for preparing delicious soups and pickles. It is highly

nutritious [9]. Adult culms are useful for the production of high quality charcoal along with the fibers which are ideal for paper and pulp production. Because of a high growth rate (typically matures within 5–7 years) plus a number of important fuel characteristics such as low ash content, alkali index or heating value, bamboo is a promising energy crop for future [10]. Part used are leaves, exudate, stem, shoots, bark and roots. It is commonly known as Wans, Vanskapur (Guj.), Bamboo, Bamboo manna (Eng.), Bans- lochana, Banz (Hindi), Bans-kapur, Baansh (Beng.), Vanshalochana (Sans.), Tabashir (Arab), Bansa, Baambii (Marathi) [11].

PLANT PROFILE

- Domain : Eukaryota
- Kingdom : Plantae
- Subkingdom : Viridiaeplantae
- Phylum : Tracheophyta
- Subphylum : Euphyllophytina
- Infraphylum : Angiospermae
- Class : Spermatopsida
- Subclass : Commelinidae
- Superorder : Juncanae
- Order : Poales
- Family : Gramineae
- Subfamily : Bambusoideae
- Tribe : Bambuseae
- Subtribe : Bambusinae

- Genus : Bambusa
- Specific epithet: arundinacea



Figure 2 *Bambusa arundinacea*

REGIONAL AND OTHER NAMES [12]:

- Gujarati : Wans, Vanskapur
- English : Bamboo, Bamboo manna
- Hindi : Bans- lochana, Banz
- Bengali : Bans-kapur, Baansh
- Sanskrit : Vanshalochana
- Arab : Tabashir
- Marathi : Bansa, Baambii
- Filipino : Kawayan
- Chamorro : Piao
- Chinese : Zhu
- Japanese : Take
- Korean : Dae and Daenumu
- Myanmar : Wa
- Vietnamese : Tre
- Indonesian : Bambu

ACTIVE CONSTITUENTS

Bamboo plant has unusually high level of acetylcholine which acts as a neurotransmitter. Main constituents are silica (90.56 %), potash (01.10 %), peroxide of iron (00.90 %), alumina (00.40 %), moisture (04.87 %). Other constituents are cholin, betain, hydrate of silicic acid nuclease, urease, proteolytic enzyme, cyanogenetic glycoside, alkaloid, Vitamin C, flavonoids, hydrocyanic acids, glutelin protein and benzoic acid [13].

PHARMACEUTICAL USES

Roots: Roots are used to stimulate blood circulation, rheumatism, curative for rabies, venereal diseases, cancer, anxiety, fever, sleeping problems, general restlessness, astringent, antipyretic and diuretic. [14]

Shoots: Used for hematuria., stomach disorders, appetizer, treatment of respiratory diseases, cleaning wounds and maggot- infested sores, contain 0.3 % of hydrocyanic acid which is lethal to the mosquito larvae, stimulates menstruation cycle, induce labor in the last month of pregnancy, bleeding piles, gonorrhoea, keeping blood pressure to normal levels, anti-cancer, anti-bacterial, anti-fungal, anti-viral, anti-inflammatory and anti-oxidant properties and kills intestinal worms [15].

Leaves: antipyretic, diuretic, head and chest colds, pharyngitis, stomatitis, arthritis, haemoptysis, febrifuge, antileprotic [16], counteracting spasmodic disorders and secretion of bleeding, treat diarrhea, cooling tonic, treatment of cough and asthma [17].

Bark: Styptic to stop bleeding, skin eruptions, anti-emetic. [18]

Stem: Used as splints in fracture, stimulate menstruation, sedative, expectorant, antitussive used for bronchial, cerebral infections, used for vomiting and nose bleedings¹⁹.

Exudate: Anti-inflammatory, tonic for lungs, cross-linking agent, providing strength, flexibility and resilience to collagen and elastin connective tissues [19].

DISTRIBUTION

A common bamboo found distributed throughout the moist parts of India, upto an altitude of 1250 m particularly near river banks in Central and South India ascending upto 1100 m on the Nilgiri also cultivated in many places in North-West India and Bengal. It also occurs in Sri Lanka, Malaya, Peru and Myanmar [20].

MACROSCOPIC CHARACTERISTICS

Bamboos characterized by woody, pointed stems, commonly called culms arising from the

underground woody jointed rhizomes. Culms are round & smooth. Diameter – few mm to > 30cm. The number of fiber bundles & the manner of their scattering add much to the hardness of the culm. The thickness of the outer shell & the deposit of silica in outer cortical layer also make it very hard. Ordinarily culms don't bear any branches to a considerable height. Rhizomes is the pachymorph type, woody in nature, arched slightly, upturned sharply at the tip in manner of a walking stick handle, becoming thick & broad at the end bearing the culms & narrow at the proximate end called neck where it attached to the older rhizomes. [20]

PHARMACOLOGICAL STUDIES

Anti-diabetic activity: Aqueous ethanolic extract of *Bambusa arundinacea* seed were tested for anti-diabetic activity using alloxan induced diabetic rats and compared with standard. The result expressed that aqueous ethanolic extracts had shown significant protection and maximum reduction in blood glucose was observed in alloxan induced diabetic rats. [20]

Anti-fertility Activity: 1 kg tender shoots of *Bambusa arundinacea* are fed immediately after parturition and the placenta will drop within two hours. The fertility index decreased to 15% for control rats and to 23% after females being successfully inseminated was reduced especially

after 4 days of treatment. The number of spermatozoa in the caput and cauda epididymis was decreased concomitant with a decrease in the motility of spermatozoa collected from the cauda epididymides. The weights of testes, epididymides, vas deferens and prostate were also significantly decreased. [20]

Antimicrobial Activity: Water-phase extract of bamboo shavings by supercritical carbon dioxide extraction, was evaluated for its antimicrobial action against the range of food borne and food spoilage pathogens using agar disc diffusion assay in nutrient agar and Czapek Dox Agar media. These exhibited antimicrobial activity against *Staphylococcus aureus*, *Bacillus subtilis*, *E. coli*, *Aspergillus niger*, *Penicillium citrinum* and *saccharomyces cerevisiae* with a concentration-dependent relationship. The minimum inhibitory concentrations (MICs) against the tested bacterial strains were found in the range of 4.9 – 32 mg/ml using the two- fold dilution method. [20]

Anti inflammatory: The extracts of leaves of *Bambusa arundinacea* have been used in Indian medicine to treat various inflammatory conditions. The combination of methanol extract and phenylbutazone (NSAIDs) has been studied and found to be the most potent anti inflammatory activity experimentally with least toxic (no ulcerogenic) activity. [21]

Anti ulcer activity: Anti-Ulcer activity of the methanol extract of the leaves of *Bambusa arundinacea* against carrageenin-induced paw oedema and also its antiulcer activity in albino rats have been studied and found to be significant when compared to the standard drugs. The combination of methanol extract of *Bambusa arundinacea* with NSAIDs will produce the best anti ulcer conditions like rheumatoid arthritis with peptic ulcer. [21]

Protective Effects: The Protective effects against N-methyl-d-aspartate (NMDA) - induced cell death in primary cultured cortical neuron Treatment of neuronal cells with pyrolyzates of *Phyllostachys pubescens*, *Phyllostachys nigra* and *Phyllostachys bambusoides* resulted in restored cell viability when compared to untreated cells in an NMDA-induced neuronal cell death assay. In addition, cortical neurons treated with *Phyllostachys pubescens* and *Phyllostachys nigra* showed a reduction of apoptosis following exposure to NMDA, as determined by Hoechst 33342 staining. [21]

Anthelmintic activity: Indian adult earth worm (*Pheretima posthuma*) were collected. Ethanolic extract of *Bambusa arundinacea* was qualitatively tested for the presence of flavonoids, tannins and phenolic compounds. The Anthelmintic activity was evaluated on adult Indian earthworm *Pheretima posthuma* due to its anatomical and physiological resemblance with the intestinal

roundworm parasites of human. Paralysis was said to occur when the worms do not revive even in normal saline. Death was concluded when the worms lose their motility followed with fading away of their body colour. [22]

PHARMACOGNOSTICAL STUDIES

Radio-Sensitivity to Gamma rays: The radio-sensitivity of *Bambusa arundinacea* was assessed by exposing the seeds to gamma rays with 10 to 150 kR doses at 10 kR intervals. Two treatments were accommodated in each tray and in each treatment 1 000 seeds sampled at random from among the irradiated seeds were sown in furrows spaced 5 cm apart. Distilled water was sprayed on alternate days. Observations on seed germination and seedling mortality were recorded on the 8th, 11th, 13th, 17th, 21st, and 28th days after sowing. Seedling survival, shoot and root lengths, number of leaves and internodes were recorded on the 28th day. Types and frequency of different chlorophyll mutations were also scored. LD-50 was estimated using linear regression analysis. [23]

Chlorophyll Deficient Seedlings: The seeds of *Bambusa arundinacea* were collected after monsoon and sown after the onset of winter by mechanically scarifying the seed coat. Seeds initiated germination after 19 days from the date

of sowing. The seedlings were observed to note the vigour and growth. Interestingly, there were few chlorophyll deficient seedlings in the batch and they constituted 0.57 per cent of total. Albinism was recorded in *Bambusa arundinacea* seedlings. This suggests the loss of genetic heterozygosity of a species within the population.[24]

Studies carried out on Roots:

Pharmacognostical evaluations like microscopical studies are carried out by taking free hand sections. The sections were stained with safranin and fast green. Powdered materials of root part were cleared with NaOH and mounted in glycerin medium after staining different cell components were studied and measured.[25]

Macroscopic Character: Macroscopical characters reveal that root is 0.1 to 0.2 mm in diameter, cylindrical in shape; surface is smooth, Yellowish brown in colour. Root is odorless and mucilaginous in taste.[25]

MICROSCOPIC CHARACTERISTICS

Transverse section of tap root - Epidermis-The TS of the root shows a single layer of epidermal cell. Cortex- Epidermis is followed by cortex. It consists of Phellogen, Phelloderm and endodermis. Cork cambium-Cambium contains three to five layers of rectangular parenchymatous cells. Endodermis- Endodermis

is single layered, radial walls, slightly thickened, free from starch. Vascular bundle- It consists of radial vascular bundles. The xylem and phloem are observed in patches.[25]

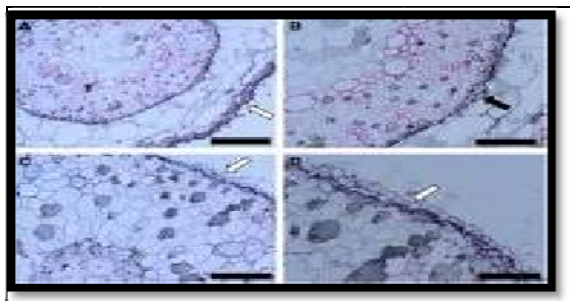


Figure 3: Transverse Section of the Root

Transverse section of lateral root - Epidermis-

The transverse section of the lateral root shows single layer epidermis, consists of polygonal elongated parenchymatous cell.

Cortex- Epidermis is followed by Phellogen. It consists of single layer, thick walled, lignified cells. Vascular bundle- It consists of radial vascular bundle. Xylem is exarch.[25]

Powder Microscopy of root - Fiber- The fibers are found in groups, lignified, thick walled with a narrow lumen. Cork cell- The fragments of cork composed of thin walled rectangular with yellowish brown matter is found. Crystal-The prism of calcium oxalate are found scatter. Starch grains-Starch granules are found scattered. They are simple and spherical and usually smaller.

Vessel-Pitted & annular xylem vessels are found.[25]

TLC SCREENING FOR ANTIOXIDANT ACTIVITY OF DIFFERENT SPECIES

B. multiplex, *B. textilis*, *B. ventricosa*, *B. pervariabilis*, *B. fargesii*, *Chimonocalamus delicatus*, *Dandrocalamus oldhamii*

Interest in the antioxidant activity of bamboo leaves is growing.

The results showed that the methanolic extract of possessed the highest antioxidant activity among the selected bamboo species. To rapidly identify the antioxidant compounds, the crude extract of was analyzed by HPLC-UV, and HPLC-micro-fractionation of the extract was carried out and three antioxidant fractions were isolated. These three antioxidant compounds were identified - (1) isoorientin 2"-O- α -L-rhamnoside (2) and isoorientin.[26]

Isolation and characterization of

microsatellites: Six microsatellites, three polymorphic and three monomorphic have been characterized for the first time in a bamboo species, *Bambusa arundinacea*. Cross species amplification was tested in 18 other bamboo species. Monomorphic simple sequence repeats (SSRs) were found to be cross amplified in most of the species tested and polymorphic ones in only three to four species. This study will help in population genetic studies in bamboo species.[27]

SUMMARY AND CONCLUSION

In this review “*Bambusa arundinacea*- An Overview” we have included all the review of literature along with their small highlight of experimental work done on the plant. Prior to the review of literature we have mentioned the introduction, plant profile and active constituents present in the various different parts of that particular plant. Bamboo consists of fresh leaves & dried fruits. Bamboos are members of the **Graminae (Poaceae)** family, as are corn, sugar cane other grasses. Bamboos differ from other members of the grass family by the presence of branches at each node. One of the world’s fastest-growing plants, bamboo is a versatile renewable resource with applications ranging from construction materials to culinary ingredients. There are various tests performed on the plant *Bambusa arundinacea* such as Pharmacological studies – Anti-diabetic activity, Anti fertility activity, Anti inflammatory activity, Anti ulcer activity.

- Pharmacognostic studies – Bamboo dry extract, TLC showing Antioxidant activity, Lateral and Transverse section of root.
- Miscellaneous Studies – Studies of volatile chemicals present in leaf, Isolation and characterization of microsatellites present in *Bambusa arundinacea*.

There are various Ayurvedic marketed preparations in which *Bambusa arundinacea* such as – Vamsa Rochna, Sitopaladi churna, Talisadi churna, Bamboo manna etc. which are used in maintaining physique, Maintaining Homeostasis and increasing resistance power.

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