



Review Article

A Review on Ethanomedical Uses, Phytochemicals and Pharmacological Profile of *Bambusa arundinacea* Retz:VISHAL SONI^{*1}, ARUN KUMAR JHA², JAYA DEWEDI³¹Department of Herbal Drug Research, B.R. Nahata College of Pharmacy, Research Centre, Mhow Neemuch Road, Mandsaur 458 001, INDIA²Banasthali Vidyapith Banasthali University, Rajasthan, 304022, INDIA³Sankaracharya college of Pharmacy Junawani, Bhilai Chattisghur, 490020, INDIA**ARTICLE DETAILS***Article history:*

Received on 04 July 2012

Modified on 15 October 2012

Accepted on 20 October 2012

*Keywords:**Bambusa arundinacea*,

Phytopharmacological properties,

Phytochemicals,

traditional uses.

ABSTRACT

India has a great wealth of various naturally occurring plant drugs which have great potential pharmacological activities. *Bambusa arundinacea* is one amongst them. *Bambusa arundinacea* has been proven to have great pharmacological potential with a great utility and usage as folklore medicine. Various parts of this plant such as Leaf, root, shoot and seed possess Anti inflammatory, Antiulcer, Anti-diabetic, Anti-oxidant, anthelmintic, astringent, emmenagogue activity. Various phyto-pharmacological evaluations have been reported in this literature for the important potential of the *Bambusa arundinacea*. This review mainly focuses on the traditional, phytochemical and pharmacological information of *Bambusa arundinacea*.

© KESS All rights reserved

INTRODUCTION

In recent years, focus on plant research has increased all over the world and evidence show immense potential of medicinal plants used in various traditional systems. Herbal drugs have got tremendous momentum in global health care system. Many plants have been found to have therapeutic potential and are being used since time immemorial. The beneficial therapeutic effect of these medicinal herbs is seen in their continued use and proven scientifically [1]. *Bambusa arundinacea* Retz. (Poaceae) commonly known as 'bans' is mainly distributed in Central and South India, cultivated in Bengal and North-Western India. The leaves of *Bambusa* are emmenagogue and are used as a folk medicine for the treatment of cough, fever and leprosy. It was reported that the extract of *B. arundinacea* showed anti-inflammatory, antiulcer, antifertility, antimicrobial and hypoglycaemic activities. The hypoglycemic properties of extracts of *bambusa* leaves have also been established. Previous research on this plant has resulted in the isolation of flavones glycosides [2].

A bamboo culm consists of an internode (which is hollow for most bamboo) and a node, which is solid and provides structural integrity for the plant. At the node are one or more buds (depending on the species) which produce side branches. The root (burnt root) is applied to ringworm, bleeding gums, painful joints. Seeds are acrid, laxative, said to be beneficial in strangury and urinary discharge. Bark is used for skin eruptions. Leaf is emmenagogue, antileprotic, febrifuge, bechic, used in haemoptysis[3]. Bamboos, a group of arborescent grasses, have closely been associated with mankind since ancient time. They are used for a variety of purposes such as mat making, traditional instruments, furniture, musical instruments, flooring and construction materials, paper making, fencing, fodder, fuel wood, cooking utensils, floats for timber and rafts, sericulture industry, and waste water management. *Bambusa arundinacea* (Poaceae) is commonly known as bans. The leaves of *Bambusa* are emmenagogue and are used for the treatment of inflammatory diseases, wound healing, ulcers and paralytic complaints [2,3].

Regional and other names

Gujarati (Toncor, Wans, Vanskapur, Vas-nu-mitha); English (Bamboo, Bamboomanna, Giant

***Author for Correspondence:**

Email: vishal@brncop.com

Thorny Bamboo); Hindi (Bans-lochana, Banskapur, Vanoo, Banz); Bengoli (Bans-Kapur, Baans, Baansh, Baroowa Bans); Sanskrit (Vanshalochana, Venulavanam); Arab (Tabashir); Marthi (Bansa, Baambii, Bansamitha); Tamil (Munga-luppa, Mullumangila, Mulmunkil, Mungil); Telugu (Veduruppu, Mulkas Veduru, Mullu Veduru); Maliyalam (Moleuppa); Kannad (Bidaruppu, Tavakshira); Burma (Vd-chha, Vathega-kiyo, Vasan, Vathe gasu); Unani (Tabashir, Tawashir)^[4].

Botanical description

Thorny tree, stems many, tufted on a stout root-stock, grows upto 30 meter high; culms 15-18cm across; nodes prominent, the lower emitting horizontal almost naked shoots armed at the nodes with 2-3 stout recurved spines; internodes upto 45 cm. long. Leaves 17.5 - 20.5 X 2-2.5 cm, linear or linear - lanceolate, tip stiff, glabrous or puberulous beneath, margins scabrous, base ciliate, mid-rib narrow, leaf-sheath ending on a thick callus and shortly bristly auricle. Inflorescence, an enormous panicles often occupying the whole stem. Caryopsis (grain) oblong, 5-8 mm long, grooved on one side. Flowering and Fruiting : Once in life time, often during September - May ^[5-9].

Ethanomedical uses

- The extract of the plant *Bambusa aurundinacea* Retz. had been used in folk medicines to treat various inflammatory conditions. In Ayurveda, the leaves, the stem and roots are used as astringent, laxative and as diuretic. An ointment from the root is said to be a folk remedy for cirrhosis and hard tumor. Shoot of *Bambusa aurundinacea* Retz. is used for dislodgement of worms from ulcer. Leaf bud (decoction) of *Bambusa aurundinacea* Retz. is used to encourage the free discharge of menses. Leaves are useful in leprosy, hematenesis, fever and haemoptysis. Leaves are also used in cough paralytic complications and in snake bites. An ointment from the *Bambusa aurundinacea* Retz. root is said to be a folk remedy for cirrhosis and tumors, especially tumor of abdomen, liver, spleen and stomach. Tabasheer, a siliceous secretion of *Bambusa aurundinacea* Retz. (up to 97 % SiO₂), considered aphrodisiac, cooling, and tonic is used in asthma, cough. Leaves given to horse suffering from coughs and colds ^[10].
- Tribal women around Salem in Tamil nadu chew leaves of *Bambusa aurundinacea* Retz.

in the morning and evening for 1-3 days to induce abortion of an early conception ^[11].

- The extracts of *Bambusa arundinacea* have been used in Indian folk medicine to treat various inflammatory conditions. The plant has antiulcer activity also. It is thought that these two properties in the same extract are very useful in the treatment of inflammatory conditions. It is well known fact that the most of the available anti-inflammatory drugs are ulcerogenic^[12].
- Leaves decoction is used to stimulate menstruation and as an antispasmodic to help relieve menstrual pain, in dysmenorrhoea and amenorrhoea. A decoction of bamboo joints is said to increase the flow of lochia after delivery ^[13].
- *Bambusa* leaf juice is given for strengthening the cartilage in osteoarthritis and osteoporosis. It plays a part in the integrity of the bones, arterial walls, skin, teeth, gums, hair and nails and has been used to alleviate eczema and psoriasis. It is used in diarrhoea, dyspepsia, flatulence and worm problems. Silicates of *Bambusa* are very useful in creation of the body's structural matrix for forming and repairing connective tissue ^[14].
- An ointment from the root is said to be a folk remedy for cirrhosis and hard tumors, especially tumors of the abdomen, liver, spleen and stomach. Tabasheer, a siliceous secretion (up to 97% SiO₂), considered aphrodisiac, cooling, and tonic, is used in asthma, cough and debilitating diseases (C.S.I.R., 1948-1976) ^[15].
- Seeds of *Bambusa arundinacea* Willd, by the Kani tribes of Kanyakumari district, southern Western Ghats. Method of seed collection, storage and mode of consumption by indigenous people have been described. The indigenous community not only uses the seeds as a food, but also as commercial commodity to improve the economy. The Kani tribes believe that the seeds of *Bambusa arundinacea* enhance the fertility, so that there is great demand of seeds of this species in pharmaceutical industry to manufacture drugs to improve fertility ^[16].

Phytochemicals

Bamboo leaves have been used in traditional Chinese medicine for treating fever and detoxification for over 1000 years.



Figure 1: *Bambusa aurundinacea* (Retz.) Plant



Figure 2: *Bambusa aurundinacea* (Retz) Roots.



Figure 3: *Bambusa aurundinacea* (Retz.) Flowers



Figure 4: *Bambusa aurundinacea* (Retz.) Leaves.

Table 1: Specifications of anti-oxidant of bamboo leaves

Parameters	Specification	Methods
Total flavonoids	15.6%	Photocolorimetric method with aesculin standard
Phenolic acids	7.9%	Photocolorimetric method with para-hydroxybenzoic acid standard
Phenolic acids	7.9%	Photocolorimetric method with para-hydroxybenzoic acid standard
Ash	1.24%	Ignition at 550C
Protein	1.24%	Kjeldahl
Total heavy metals	As <0.0003	Atomic absorption spectroscopy
Moisture	4.9%	Air oven

Table 2: Describes chemical composition of *Bambusa arundinacea* [4]

Component	Content Percentage (%)
Silica	90.56%
Potash	1.10%
Peroxide of Iron	0.40%
Alumina	0.40%
Moisture	4.87%

Recently, some biologically active components in bamboo leaves and their potential health benefits have been widely studied. An ethanol/water extract of bamboo leaf mainly contains flavone glycosides, phenolic acids, coumarin lactones, anthraquinones and amino acids. Many papers have indicated that a flavonoid-rich bamboo leaf extract has multiple biological effects, such as anti-free radical, anti-oxidation, anti-aging, anti-fatigue, anti-bacteria, anti-virus, and prevention of cardiovascular diseases, and can be used as a pharmaceutical intermediate, dietary supplement, cosmetic ingredient, and food additive^[2]. Chemical investigation of this plant, triterpenes and steroidal glycosides were the major phytoconstituents. In the course of phytochemical investigation of *Bambusa*, Stigmast-5, 22-dien-3 β -ol, Stigmast-5-en-3 β -ol- β -D glucopyranoside, were isolated in good quantities. The synergistic hypoglycaemic effect of these two compounds has been well established. Along with the two new compounds *i.e.* 17, 20, 20-tri demethyl-20 α -isopranyl oleanane and a new acid, eicosanyl dicarboxylic acid, another two known compounds α -amyirin acetate and urs-12-en-3 β -ol- β -Dglucopyranoside have been isolated for the first time from this plant. The silicious substance found near the joint inside is white camphor like crystalline in appearance, slightly sticky to the tongue and sweet in taste^[4,17]. Shoot has active constituents are Oxalic acid, reducing sugar, resins, waxes, HCN, benzoic acid, diferuloyl arabinoxylanhexa saccharide, diferuloyl oligosaccharide (Tadash, 1991), (5, 5'-di--(diferul-9, 9'-dioyl)-[α -L-arabinofuranosyl-(1 \rightarrow 3)-O- β -D-xylopyranosyl-9 (1 \rightarrow 4) -D xylopyranose] (taxiphyllin). Seed contain arginine, cysteine, histidine, isoleucine, leucine, lysine, methionine, phenylamine, threonine, valine, tyrosine, niacin, riboflavin, thiamine^[18,19]. Leaves mainly contain Protein, glutelene, contains lysine, methionine, betain, cholin, proteolytic enzyme, nuclease, urease^[19].

The phytochemical investigation of an ethanolic leaf extract of *Bambusa arundinacea* Retz. furnished 6 constituents, two of which represented new natural entities. Remaining four compounds which are previously reported from the other plant sources have been isolated for the first time from the leaves of *Bambusa arundinacea* Retz. Spectroscopic structure elucidation of the new natural products is described. The new compounds are characterized as 17, 20, 20-tri demethyl-20 α -isopranyl oleanane and eicosan-1, 20-dioic acid^[2]. A number of studies of bamboo have yielded information about the chemical constituents, but no systematic evaluation has been carried out, so it is difficult to determine which of the identified compounds might be among the primary active constituents. The bamboo leaves, obtained from the common tall bamboos (species of *Phyllostachys*, rather than the small *Lophatherum*) have recently been utilized as a source of flavonoids (e.g., vitexin and orientin), used as antioxidants. The flavonoids may reduce inflammation, promote circulation, and inhibit allergy reactions. A juice made from the leaves has been made into a bamboo flavored beer^[20]. *Bambusa Arundinacea* extract contains Silicates (60% - 70%) which are responsible for its action in curative disease like diarrhoea, dyspepsia, flatulence and worm problems, inflammations, ulcers and wounds^[12]. . Nayak S & Rout GR analyzed the isolation and characterization of microsatellites in *Bambusa arundinacea* and cross species amplification in other bamboos^[21]. Six microsatellites, three polymorphic and three monomorphic, were characterized in a bamboo species, *Bambusa arundinacea* belonging to the family Poaceae^[22]. Plant acid invertases, which are either associated with the cell wall or present in vacuoles, belong to family 32 of glycoside hydrolases (GH32). Homology modeling of bamboo vacuolar invertase Bobfruct3 using Arabidopsis cell-wall invertase AtcwINV1 as a template showed that its overall structure is similar to GH32 enzymes, and that the three highly conserved motifs, NDPNG, RDP and EC, are located in the active site. This study also used site-directed mutagenesis to examine the roles of the conserved amino acid residues in these three motifs, which include Asp135, Arg259, Asp260, Glu316 and Cys317, and a conserved Trp residue (Trp159) that resides between the NDPNG and RDP motifs. The mutants W159F, W159L, E316Q and C317A retained acid invertase activity, but no invertase activity was observed for the

mutant E316A or mutants with changes at Asp135, Arg259, or Asp260. The apparent Km values of the four mutants with invertase activity were all higher than that of the wild-type enzyme. The mutants W159L and E316Q exhibited lower kcat values than the wild-type enzyme, but an increase in the kcat value was observed for the mutants W159F and C317A. The results of this study demonstrate that these residues have individual functions in catalyzing sucrose hydrolysis.

Pharmacological profile

Anti-inflammatory and antiulcer activity

The antiinflammatory effect of the methanol extract of the leaves of *Bambusa arundinacea* against carrageenin-induced as well as immunologically 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 and phenylbutazone (Non-Steroidal Antiinflammatory Agent, NSAIA) has been studied and found to be the most potent antiinflammatory activity experimentally with least toxic (no ulcerogenic) activity. Thus, the combination of herbal product (methanol extract of *Bambusa arundinacea*) with modern medicine (NSAIA) will produce the best antiinflammatory drug and will be useful for long-term treatment of chronic inflammatory conditions like rheumatoid arthritis with peptic ulcer, which are common [12].

Anthelmintic Activity

Ethanol extract of the root part of *Bambusa arundinacea* was investigated for their anthelmintic activity against *Pheritima posthuma*. The study involves the determination of paralysis time and death time of the worms in the different doses of the extracts (10, 20 and 50 mg/ml). The extract exhibited significant anthelmintic activity in a dose dependent manner compared to the control. Activity was comparable with the reference standard Pipeazine citrate (15 mg/ml) and Albendazole (10 mg/ml)[23].

Antidiabetic activity

Aqueous ethanolic solvent extracts of *Bambusa arundinacea* seeds 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. The results of this comprehensive study reveal that *Bambusa arundinacea* seed shown statistically significant Anti-Diabetic activity in comparison to the standard glibenclamide [24].

Antibacterial activity

Water-phase extract of bamboo shavings (WEBS), 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. The WEBS exhibited antimicrobial activity against *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli*, *Aspergillus niger*, *Penicillium citrinum* and *Saccharomyces cerevisiae* with a concentration-dependent relationship [25].

Protective effects

Two biological activities of bamboo-derived pyrolyzates were investigated; the protective effects against N-methyl-daspartate (NMDA)-induced cell death in primary cultured cortical neuron and the anti-plasmin effects determined by using fibrin and fibrinogen degradation products (FDPs) assay. 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. In addition, *Phyllostachys nigra* pyrolyzates also exhibited anti-plasmin action in a FDP assay. It is of interest to note that pyrolyzates exhibited activities of NMDA-receptor antagonist and antifebrin (ogen), since a combination of NMDA receptor antagonists, glucocorticosteroids, GABAergic drugs and heparin are useful for treatment in delayed postischemic injury. Results indicate that the pyrolyzates derived from bamboo may have antiapoptotic effects, and can be useful as a supplement for ischemic injury treatment [3].

Antifertility activity

An ethanolic extract of *Bambusa arundinacea* tender shoots (BASE) caused a reduction in fertility of male rats. After administration of 300 mg/kg per day of BASE for 7 days, the fertility index decreased to 15% for control rats and to

23% after a 7-day recovery period, respectively. The number of cohabited females being successfully inseminated was reduced especially after 4 days of treatment. Complete recovery of mating behaviour was evident 8 days after BASE withdrawal. The number of spermatozoa in the caput and cauda epididymis were decreased concomitant with a decrease in the motility of spermatozoa collected from the cauda epididymis. The weights of testes, epididymides, vas deferens and prostate were also significantly decreased. The serum profile of protein and oxaloacetic/pyruvic transaminase activity show the extract to be relatively non-toxic^[14].

Insecticidal activity

Asian Centers of Diversity, bamboos are reported to tolerate insects, laterites, low pH, slope, and weeds ($2n = 72, 70$) (Duke, 1978). Eight grams of raw shoots or slightly more improperly cooked shoots can cause death. Young shoots contain 0.03% HCN (C.S.I.R., 1948–1976). Hairs on various bamboos, and fungi which live thereon, may cause dermatitis (Mitchell and Rook, 1979). Benzoic acid and traces of cyanogenic glucoside present in shoots have lethal effect on mosquito larvae (has antiseptic and larval properties)^[6].

Antiarthritic activity

Anti-arthritic activity of *Bambusa arundinacea* in treating Rheumatoid Arthritis (RA) using CFA-induced arthritis animal model was investigated. In the present study, the effect of *Bambusa arundinacea* Methanolic extract on the Arthritis was studied by analyzing various markers of Bone erosion like histological, radiological analysis of the joints. For evaluation of Anti-arthritic activity other parameters analyzed are Paw volume, Arthritic index, Rheumatoid Factor, Erythrocyte Sedimentation Rate (ESR) and Spleen histopathology. The powdered leaves are used for hot extraction by using methanol as solvent. The Anti-arthritic activity of the dry extracts was performed using female rats of about 200 to 250gms. The Methanolic extract of *Bambusa arundinacea* significantly (dose dependent) decreased the bone erosion, spleen enlargement & rheumatoid factor etc. at a dose (100mg/kg, 200mg/kg, 300mg/kg) compared to the control group but less compared to Standard drug (Dexamethasone 5 mg/kg i.p)^[3].

Miscellaneous

- Bamboo is the main food of the Giant Panda; it makes up 99% of the Panda's diet. Soft bamboo shoots, stems, and leaves are the

major food source of the Giant Panda of China.

- Bamboo is used in Chinese medicine for treating infections and healing. It is a low-calorie source of potassium. It is known for its sweet taste and as a good source of nutrients and protein.
- When bamboo is heated at very high temperature in an airless vessel, it becomes charcoal, which is used like other charcoal products, as a fuel component, a deodorizer, or an absorbent. The vapor that comes off the heated bamboo can be condensed to produce a liquid known as bamboo vinegar. Bamboo vinegar has been produced in Japan (where it is called *chikusaku-eki*) for many years and is used medicinally to treat eczema, atopic dermatitis, and other skin diseases; it is most commonly applied by adding to bath water. Bamboo vinegar is recognized as an anti-inflammatory and anti-fungal.
- Pickled bamboo, used as a condiment, may also be made from the pith of the young shoots.
- In addition, bamboo is frequently used for cooking utensils within many cultures. In modern times, some see bamboo tools as an eco-friendly alternative to other manufactured utensils.
- In Ayurveda, the Indian system of traditional medicine, the silicious concretion found in the culms of the bamboo stem is called *banslochan*. It is known as *tabashir* or *tawashir* in *Unani-Tibb* the Indo-Persian system of medicine. In English it is called "bamboo manna". This concretion is said to be a tonic for the respiratory diseases.
- In addition, the fiber of bamboo has been used to make paper in China since early times. A high quality hand-made paper is still produced in small quantities. Coarse bamboo paper is still used to make spirit money in many Chinese communities. Bamboo's natural hollow form makes it an obvious choice for many instruments, particularly wind and percussion. There are numerous types of bamboo flute made all over the world, such as the dizi, xiao, shakuhachi, palendag, jinghu, angklung, ities.
- Bamboo was in widespread use in early China as a medium for written documents. The earliest surviving examples of such

documents, written in ink on string-bound bundles of bamboo strips (or "slips"), date from the 5th c. BC during the Warring States period.

Ayurvedic Preparations

- Sitopaladi choorna
- Talisadi choorna
- Vanslochan

Possible Combinations: Bambusa arundinacea + piper longum + cinnamomum camphora (curing lung disease)

CONCLUSION

Herbs are an integral part of nature. Herbal medicine is based upon the premise that plants contain natural substance that can promote health and alleviate diseases. To treat various ailments most of local population depends on native medicinal plants. This paper reports ethnomedical uses, phytochemicals present and biological activities of *Bambusa arundinacea* that is commonly used in traditional system of medicines. The reported biological activities are the outcome of the traditional claims. The present literature supports the potential of *Bambusa arundinacea* as a medicinal tree mankind and justify the inclusion of these drugs in traditional preparation.

REFERENCES

- [1] Jarald Edwin, Joshi S.B., Jain D.C. A brief review on few Indian medicinal plants. International journal of green pharmacy. 2007; (1) 3-4:1-12.
- [2] Nazreen S, et al. Phytochemical investigation of *Bambusa arundinacea* Retz. International Journal of Natural Product Science. 2011; 3: 1-7.
- [3] *Rathod Jaimik D1, Pathak Nimish L1, Patel Ritesh G1, Jivani Nuruddin P1, Patel Laxman D1, Chauhan Vijay2. Ameliorative effect of *bambusa arundinacea* against adjuvant arthritis-with special reference to bone erosion and tropical splenomegaly. Journal of Drug Delivery & Therapeutics. 2012; 2(3): 141-145.
- [4] Watt G. A Dictionary of the Economic Products of India, reprinted edition, volume-I, Periodical Expert, Delhi. 1972; 383-391.
- [5] Cooke T. The Flora of the Presidency of Bombay. Reprinted edition, volume-III, Botanical Survey of India, Calcutta. 1967;569.
- [6] Anonymous. Flora of Maharashtra State, Monocotyledones, edited by Sharma BD et al. Botanical Survey of India, Calcutta. 1996; 412.
- [7] Anonymous. The Wealth of India, Raw materials, volume-2B, Council of Scientific and Industrial Research, New Delhi .1988:1-38.
- [8] Bole PV, Pathak JM. Flora of Saurashtra, Botanical Survey of India. Part – III. 1988: 392.
- [9] Brandis D. The Forest Flora of North West and Central India, Bishen Singh Mahendra Pal Singh, DehraDun. 1972; 564-566.
- [10] Nandkarni KM. Indian Materia Medica, Bombay Popular Prakashan; Vol-1, 3rd Edition Reprint; 2000.p. 217-218.
- [11] Bhaduri B, Ghose CR, Bose ANM, Basu UP. Antifertility activity of some medicinal plants., Ind.J. Exp. Bio. 1968 ; (6): 252-253.
- [12] Muniappan M, Sundararaj T. Anti-inflammatory and antiulcer activities of *Bambusa arundinacea*. J. Ethanopharmacology. 2003; (88) (2-3):161-167.
- [13] Gupta, DP. The Herbs Habitat, Morphology & Pharmacognosy of medicinal plants. Published and distributed by Smt. Premlata Gupta; 2008.p.217-218.
- [14] Vanithakumari G, Manonayagi, S, Padma, S, Malini, T. Antifertility effect of *Bambusa arundinacea* shoot extracts in male rats., J-Ethnopharmacol . 1989; 25(2):173-80.
- [15] Atal CK, Kapur BM. Cultivation and Utilization of Medicinal plant, Regional Research Laboratory, CSIR, Jammu-Tavi. 1982:514-519.
- [16] Kiruba S, Jeeve S, Manohardas S, Kannan D. Bamboo seed as a mean to sustenance of the indigenous community. Indian Journal of Traditional knowledge. 2007;6(1):199-203. 2006.
- [17] Vaidya B. Some Controversial Drugs in Indian Medicine, Chaukhambha Orientalia, Varanasi.1982; 203-207.
- [18] Ghosh NN, Ghosh S, Chopra RN. Chemical and pharmacological examination of the young sprouts of *Bambusa arundinacea*. Arch Pharm Berl. 1938; 276- 351.
- [19] Chatterjee A, Pakrashi SC. The Treatise on Indian Medicinal plants, National Institute of Science communication, New Delhi. 2001; 6: 50-51.
- [20] *Dharmananda, Subhuti*. Bamboo as medicine by Ph.D., Director, Institute for

Traditional Medicine, Portland, Oregon, 2004.

- [21] Nayak Sumitra, G. Rout, Vana Ranjan. Isolation and characterization of microsatellites in *Bambusa arundinacea* and cross species amplification in other bamboos African. Journal of Biotechnology. 2005; 4 (2):151-156.
- [22] Tai-Hung Chen 1, Yu-Chiao Huang 1, Chii-Shen Yang, Chien-Chih Yang, Ai-Yu Wang, Hsien-Yi Sung *. Insights into the catalytic properties of bamboo vacuolar invertase through mutational analysis of active site residues. Phytochemistry. 2009; 70:25-31.
- [23] Kumar Sundeep 1*, Raju MBV2 SC, Dinda1, S. Sahu1. Evaluation of Anthelmintic Activity of *Bambusa Arundinacea*. Asian J. Pharm. Tech. 2012; 2(2):62-63.
- [24] Macharla SP. Antidiabetic activity of *Bambusa Arundinacea* seed extract on alloxan induced diabetic rats. International journal of pharmaceutical and research development. 2011; 3(5):83-86.
- [25] Zhang J., Gong J., Ding Y., Lu B., Wu X., Zhang Y. Antibacterial activity of water-phase extracts from bamboo shavings against food spoilage microorganisms. African Journal of Biotechnology. 2010; 9(45):7710-7717.