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Pharmacognostical & physico-chemical studies on the root of *Bambusa arundinacea*

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ABSTRACT

Bambusa arundinacea is an important medicinal plant which belongs to family Poaceae, used in Ayurveda, Siddha and Unani system of medicine. In Ayurveda & Siddha root is used as katu rasam, kashaya anurasam, katu vipaka, guru, ruksham, kaphaharam, vatapitta karam, guru vidhahi and saram. Young shoots of the bamboo made into a poultice is a most efficacious application for dislodgement of worms from ulcers. Pickles or curry prepared out of the tender shoots give much benefit to persons suffering from lack of digestion as it promotes appetite and digestion. The silicious concretion as found in the joints of the female bamboo, it is useful in fever, cough, consumption, paralytic complaints, debilitating diseases, asthma, snake-bite, etc. Root is given as a specific in eruptive affections. The present study provides taxonomical, pharmacognostical and physico-chemical details helpful in laying down standardization and pharmacopoeial parameters. The important parameters studied are macroscopical and microscopical character, measurement of length, width and diameter of starch grain, fibre and calcium oxalate crystals. Histochemical test, Behaviour of powdred materials, histochemical studies, behavior of powder with different chemical reagent & fluorescence analysis. Physico-chemical studies revealed total moisture content(8%), total ash (6.5 %), watersoluble ash (6.41 %), acid insoluble ash (3.5%), sulphated ash (7%), petroleum ether extractive (0.33%), chloroform extractive (1.66%), acetone extractive (7.66%), methanol extractive (7.96%), water extractive (8.4%). Inorganic element showed the presence of iron, sulphate, chloride and nitrate.

Key words: macroscopical and microscopical character, physico-chemical analysis, inorganic element analysis & fluorescence analysis

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INTRODUCTION

Bambusa arundinacea of family poaceae is distributed throughout India, except Himalaya and Indo-Gangetic Plain. The plant is large densely caespitose thorny bamboo with curving branches form a thick rootstocks; culms bright green, shining, up to 24 to 30m high and 15-18 cm diameter, branches from the base, the lower joints giving out long horizontal shoots armed at the o73 nodes with 2-3 recurved thorns and with few leaves. Leaves linear-laceolate or linear, 12-20 x 1.2-1.8 (2.5) cm, rounded at the base into a short, 2.5 mm petiole, glabrous above except for long hairs near the base, glabrous or puberulous beneath, scabrous on one or both margins and ciliate towards the base; leaf-sheath striate, glabrous or slightly pubescent, ending in a thick, often ciliate callus and a short auricle furnished with a few stiff, curved, white, deciduous bristles, edges ciliate; ligule short. Panicle often occupying the whole

plant. Spikelets 1.2-2.5 cm long, sessile in close dense clusters along the twigs or 7.5-18 mm in much lager clusters. Glumes 0-2, ovate or ovate-lanceolate, acute or mucronate, many nerved. Lemmas 3-7, lower 2-sexual, upper male with 2-3 upper most imperfect. Keel of palea ciliate. Anthers yellow, obtuse, 5 mm long.

The interior stalks or stems (bamboo hollows) of female plant containing silicious concretion (deposite) called tabashir (bamboo manna). Tabashir contains silica 90% or silicum as hydrate of silicic acid, peroxide of iron, potash, lime, aluminia, vegitable matter. 'cholin, betain, nuciease, urease, proteolytic enzyme, diastatic and emulsifying enzyme, cyanogenetic glycoside'.

Young shoots of the bamboo made into a poultice is a most efficacious application for dislodgement of worms from ulcers. Leaf bud is administered in decoction to encourage the free discharge of the menses or lochia after delivery when it is scanty. Used in leprosy, fevers and haemoptyis, and also in case of children suffering from thread worms. Pickles or curry preparedout of the tender shoots give much benefit to persons suffering from lack of digestion as it promotes appetite and digestion. The silicious concretion as found in the joints of the female bamboo, it is useful in fever, cough, consumption, paralytic complaints, debilitating diseases, asthma, snake-bite, etc. Root is given as a specific in eruptive affections. [1, 2]

MATERIALS AND METHODS

Pharmacognostical evaluations like microscopical studies are carried out by taking free hand sections. The section were stained with safranin and fast green [3,4,5]Powdered materials of root part were cleared with NaOH and mounted in glycerin medium after staining different cell component were studied and measured. Photographs of different magnifications were taken with Sony digital camera. For normal observation bright field was used. For the study of crystal, starch grains and lignified cells, polarized light was employed. Since these structures have birefringent property, under polarized light they appear bright against dark background. Powder of the dried root was used for chemical analysis. Histochemical study, measurement of length, width and diameter starch grain, fibre and calcium oxalate crystals, physico-chemical studies , behaviour of powder drug towards different chemical reagent, fluorescence analysis were carried out [6,7,8,9,10,11].

RESULTS AND DISCUSSION

MACROSCOPIC CHARACTER

Macroscopical characters reveal that root is 0.1 to 0.2mm in diameter, cylindrical in shape, surface is smooth, yellowish brown in colour. Root is odorless and mucilaginous in taste (Table-1)

MICROSCOPIC CHARACTER

Transverse section of tap root

Epidermis-The transverse section of the root shows a single layer of epidermal cell. It consists of thin parenchymatous cell, which measures about 32.54-48.71µ.

Cortex- Epidermis is followed by cortex. It consists of phellogen, phelloderm and endodermis. Phellogen consists of single layer of sclerenchymatous cell. Phelloderm consists of 14-15 rows of round shaped parenchymatous cell. The cells are measured from 69.08-113.89µ. The cells are devoid of starch grain and calcium oxalate crystals.

Cork cambium-Cambium contains three to five layers of rectangular parenchymatous cells, measures about 32.27-48.71µ.

Endodermis- Endodermis is single layered, radial walls, slightly thickened, free from starch. The cells are measured about 18.59µ.

Pricylcle- Pericycle is present between vascular bundle and endodermis.

Vascular bundle- It consists of radial vascular bundles. The xylem and phloem are observed in separate patches, placed on the alternate radii on the axis. Xylem is exarch (the protoxylem is pointing towards the periphery and meta xylem lies towards central). So the growth of xylem is centripetal. Xylem vessels are lignified, scattered, annular & pitted. Xylem parenchyma consists of parenchymatous cell without intercellular spaces which surrounds the xylem

vessels. Conjuctive tissue consists of radially elongated conjuctive cells. Patches of phloem are seen around the vessels.

Pith- Pith is large and consists of thin polygonal parenchymatous cell with intercellular spaces. The cells are measured about 32.27-48.52µ.

Fig-1- Transverse section of tap root
Fig-1(a)-Magnification of epidermis, phellogen cork.
Fig-1(b)- Magnification of cork cambium, endodermis, pericycle, xylem parenchyma, xylem.
Fig-1(c) - Magnification of phloem, xylem parenchyma, xylem
Fig-1(d) - Magnification of pith, parenchyma.

Transverse section of lateral root
Epidermis- The transverse section of the lateral root shows single layer epidermis, consists of polygonal elongated parenchymatous cell, measures about 32.54-65.08µ.

Cortex- Epidermis is followed by phellogen. It consists of single layer, thick walled, lignified cells. Phelloderm present below phellogen, consists of 2-3 layers of elongated thick wall cells which are closely arranged. The cells are larger more towards outer part & smaller towards inner part. The larger cells measure about 97.62µ and smaller cells 48.57µ.

Vascular bundle- It consists of radial vascular bundle. Xylem is exarch. Xylem vessels are lignified, scattered, annular and pitted. Xylem parenchyma is closely arranged and surrounds the vessels. Phloem is present in patches. These are present in small groups around the protoxylem. Central region contains large pith cavity. Conjuctive tissue consists of radially elongated conjuctive cells. Parenchymatous cell contains starch granules.

Fig-2- Transverse section of lateral root
Fig-2(a) -Magnification of epidermis, phellogen, cork, phloem.
Fig-2(b) -Magnification of meta & proto xylem, xylem parenchyma. Parenchyma.
Fig-2(c) -Magnification of pith, parenchyma , pith cavity.
Fig-2(d) -Magnification of xylem, parenchyma.
Fig-2(e) - Enlarge portion of parenchyma, xylem parenchyma, starch granules.

POWDER MICROSCOPY OF ROOT
Fibre-The fibres 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. These occur singly or in small groups.

Histochemical test
The histochemical test was carried out in root and it showed the presence of starch, polyphenols, lignins and flavonoids (Table-3).

Measurement of length, width and diameter starch grain, fibre and calcium oxalate crystals.
The length of fibre of root varies from 357.94-406.75µ and average length was found 381.37µ. The widthof fibre of root varies from 16.27-48.81µ and average width was found 33.39µ**.** The diameter of calcium oxalate crystal of root varies from 65.08-244.05µ and average diameter was found 152.89µ. The diameter of starch grain of root varies from 16.27-32.50µ and average diameter was found 26.43µ. (Table-2).

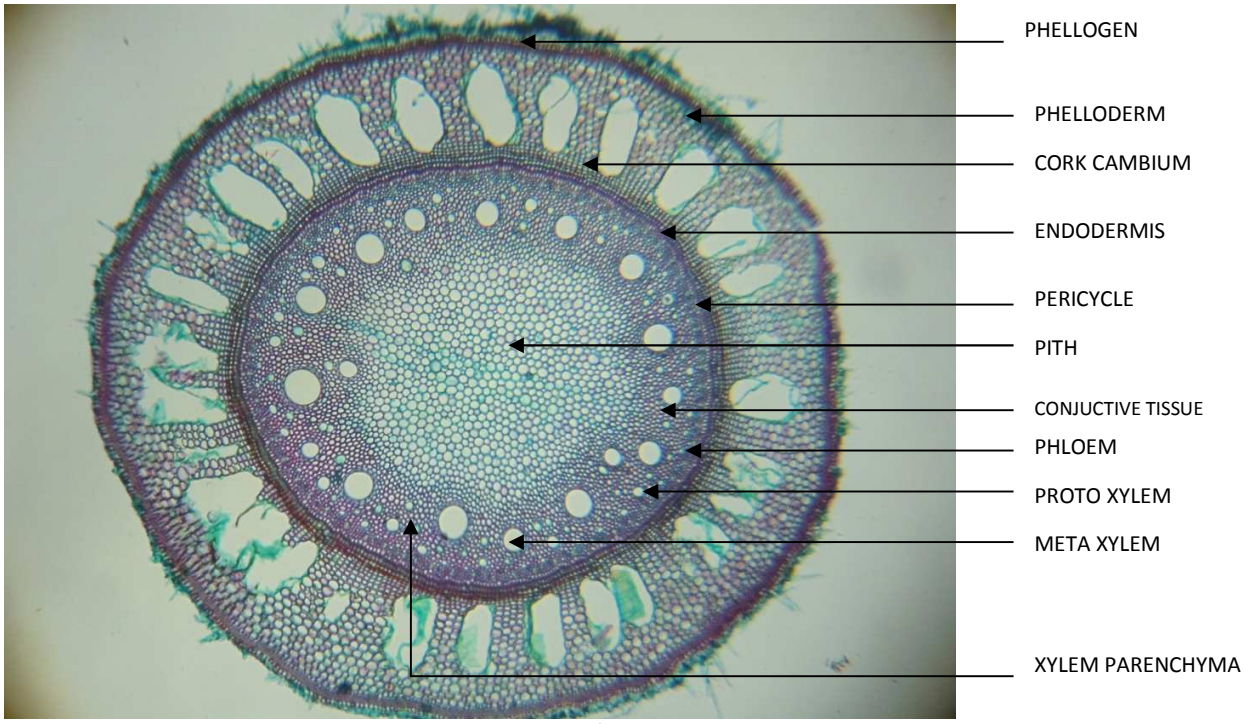

Fig-1

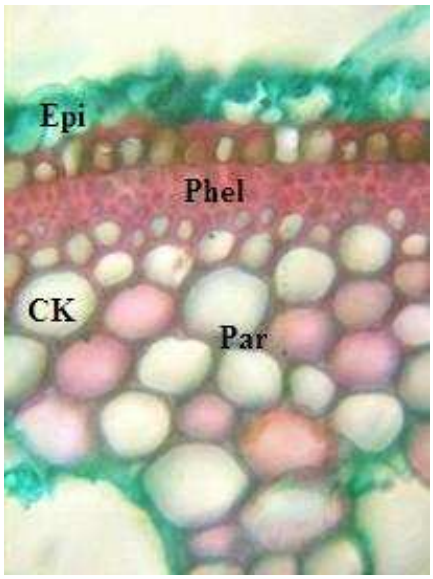

Fig-1(a)

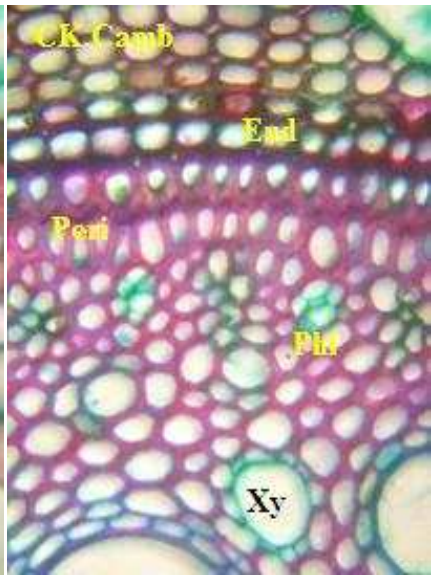

Fig-1(b)

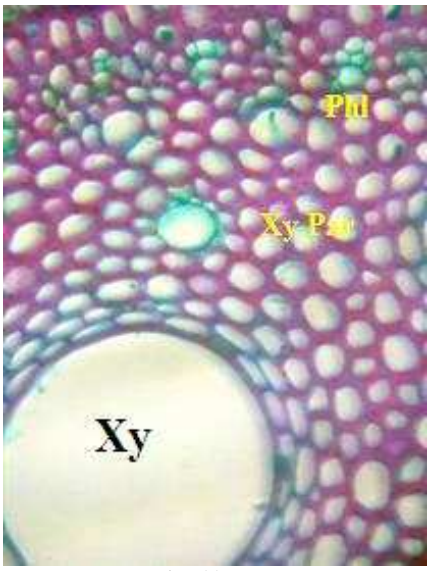

Fig-1(c)

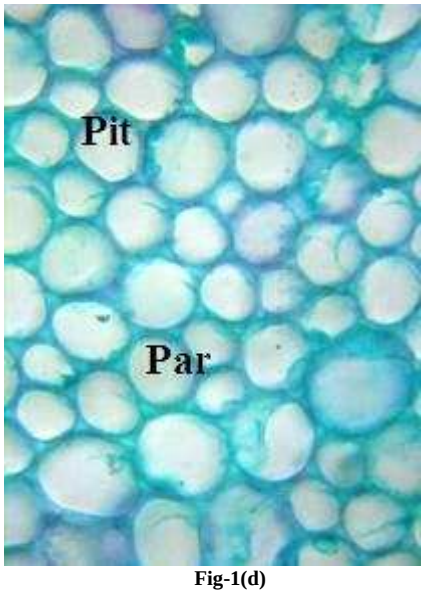

Fig-1(d)

Epi-Epidermis, Phel-Phellogen, Ck.Camb-Cork cambium, End-Endodermis, Peri-Pericycle, CK-Cork, Phl-Phloem, Xy.par-Xylem parenchyma, Pit-Pith, Xy-Xylem, Con.ti-Conjuctive tissue.

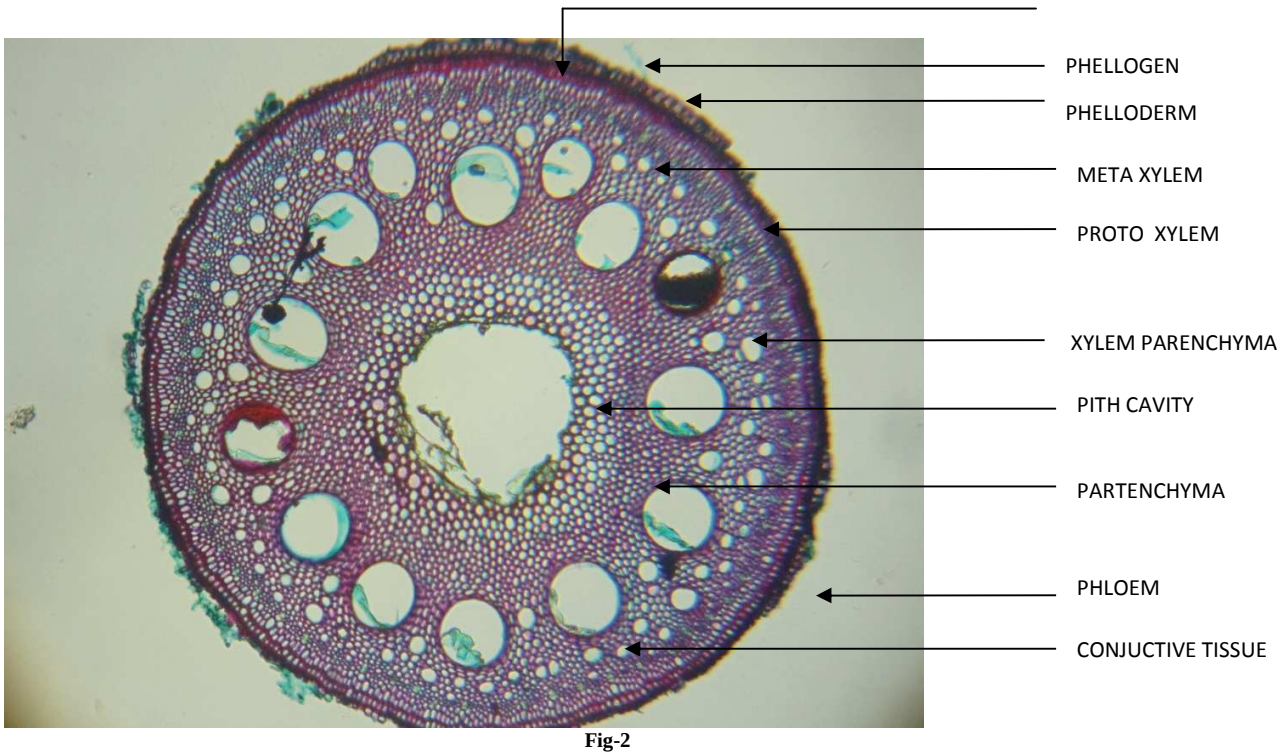

Fig-2

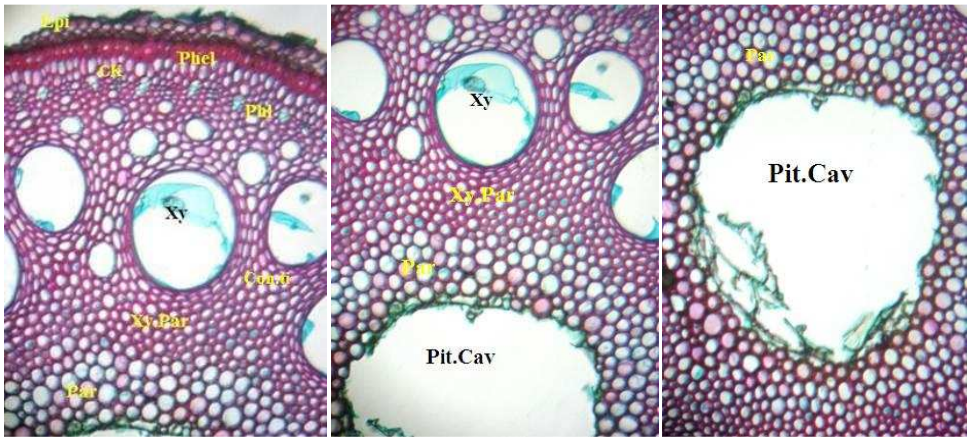

Fig-2(a) **Fig-2(b)** **Fig-2(c)**

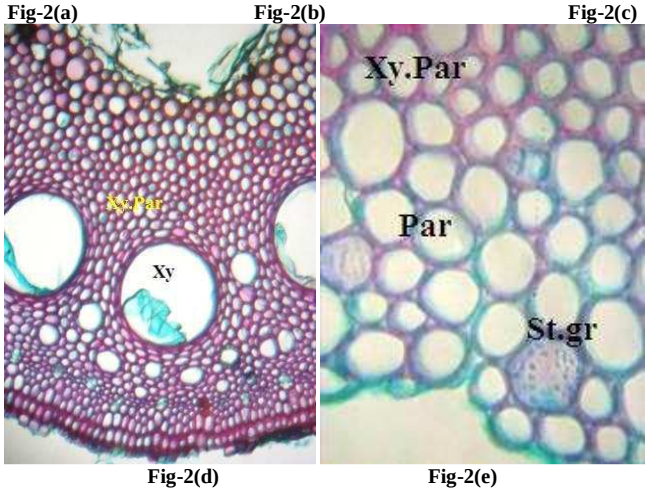

Fig-2(d) **Fig-2(e)**

Epi-Epidermis, Phel-Phellogen, End-Endodermis, Peri-Pericycle, CK-Cork, Phl-Phloem, Xy.par-Xylem parenchyma, Pit-Pith, Xy-Xylem, St.gr-Starch granules, Con.ti-Conjuctive tissue

POWDER MICROSCOPY

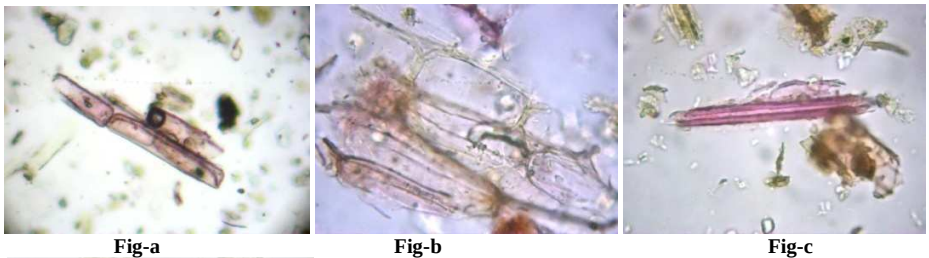

Fig-a **Fig-b** **Fig-c**

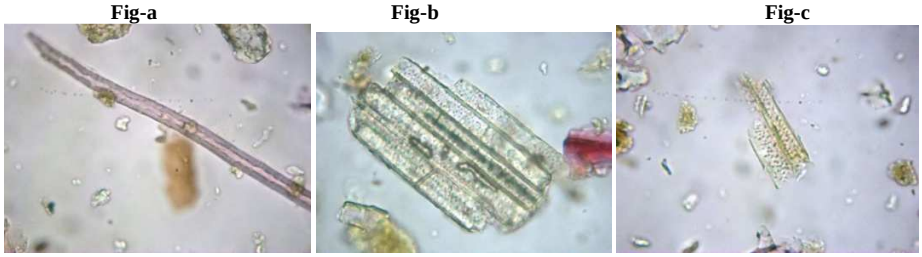

Fig-d **Fig-e** **Fig-f**

Fig-g

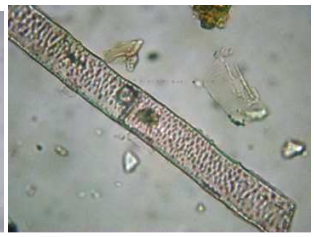

Fig-h

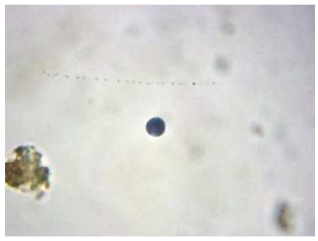

Fig-i

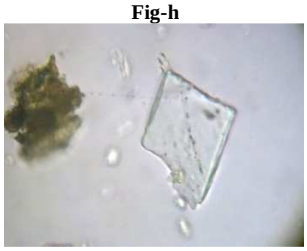

Fig-j

Fig-a ,b- Cork cell, c & d-Fibre, e,f & h-Pitted vessels, g-Annular vessel, i-Starch grain, j-Crystals.

PHYSICO-CHEMICAL ANALYSIS

Ash values

The total ash, water soluble ash, acid insoluble ash and sulphated ash of root were found to be 6.5%w/w, 6.41w/w, 3.5%w/w and 7%w/w (Table-4). Total ash and water soluble ash were found to be more in drugs. . Acid insoluble ash was found to be less than total ash, water soluble ash and sulphated ash. Sulphated ash was found to more than total ash, acid insoluble ash and water soluble ash. Ash value is a measure of the quality and purity of the drug.

Inorganic element

Element analysis of ash was carried out and it showed the presence of iron, sulphate, chloride and nitrate. (Table-5).

Total extractive values

The petroleum ether, chloroform, acetone, methanol and water extractive values of root were found to be 0.33w/w**,** 1.66w/w, 7.66w/w, 7.96 w/w & 8.4w/w. The root showed more amount of water soluble component than petroleum ether, chloroform, acetone and methanol extracts (Table-4).

Loss on drying

The moisture content of root was found to be 8 w/w, which was shown in (Table-4).

Behaviour of powdred materials towards some chemical reagents

The behaviour of the powdered root were treated with Picric acid, conc.sulphuric acid, con.hydrochloric acid, con.nitric acid, glacial acetic acid, 5% ferric chloride, sodium hydroxide (5N), potassium hydroxide (5%), Iodine/20 solution were observed and the results are present in (Table-6).

Fluorescence analysis

Fluorescence analysis of entire root has been carried out in daylight and under U.V light. The powders were treated with different organic solvents and solutions were again observed in normal daylight and under U.V. light and the observations are pooled in (Table-7).

Table-1 Macroscopical character

Colour	Yellowish brown
Odour	odourless
Taste	mucilagenous
shape	cylindrical
Texture	Smooth surface
Diameter	0.1-0.2mm

Table-2 Quantitative microscopy

Parameters	Minimum value	Maximum value	Average value
Length of fibre	365.4 µ	406.75 µ	381.37µ
Width of fibre	16.27 µ	48.81 µ	33.39µ
Diameter of starch grain	16.27 µ	32.54 µ	26.43µ
Diameter of calcium oxalate crystals	65.08 µ	244.05 µ	152.89µ

Table-3 Histochemical test

SL.NO	Reagent	Test for	Inference
1	Iodine	Starch	+
2	IKI	Starch	+
3	Sudan red-III	Oil globules	-
4	Ferric chloride	Tannin/Phenils	-
5	Toluidine blue	Polyphenols	+
6	Phloroglucinol + HCL	Lignins	++
7	KOH 5%	Flavonoids	+++
8	Dragendorf's reagent	Alkaloids	-

+ mild, ++ moderate, +++ frequent.

Table-4 Physico-chemical analysis

Tests	Results
Moisture content	8 w/w
Ash values	
Total ash	6.5 w/w
Water soluble ash	6.41 w/w
Acid in soluble ash	3.5 w/w
Sulphated ash	7 w/w
Extractive value	
Petrolium ether	0.33 w/w
Chloroform	1.66 w/w
Acetone	7.66 w/w
Methanol	7.96 w/w
Water	8.4 w/w

Table-5 Determination of inorganic elements

SL.NO	TEST FOR	INFERENCE
1	Calcium	-
2	Magnesium	-
3	Sodium	+
4	Potassium	-
5	Iron	+++
6	Sulphate	+++
7	Phosphate	-
8	Chloride	++
9	Carbonate	-
10	Nitrate	+

-Absent, +Present, ++Moderate, +++Frequent

Table-6 Behaviour of root powder with different chemical reagents

SL.No	Acid/Reagent	Observation
1	Powder as such	Brown
2	Powder + Picric acid	Yellow
3	Powder + Con.Nitric acid	Reddish brown
4	Powder + Con.HCL	Light brown
5	Powder + Con.H_2SO_4	Dark black
6	Powder + Glacial acetic acid	Light brown
7	Powder + 5% $FeCl_3$	Yellowish green
8	Powder + NaOH(5N)	Brown
9	Powder + KOH (5%)	Brown
10	Powder + Iodine/20	Light brown

Table-7 Fluorescence analysis of the root powder

SL.No	Reagent	Day light	Short wave
1	Powder as such	Brown	Light green
2	Powder + 1N NaOH in methanol	Brownish black	Deep green
3	Powder + 1N NaOH	Brown	Green
4	Powder + Ethanol	Brownish black	Deep green
5	Powder + HNO_3+NH_3 solution	Reddish brown	Deep green
6	Powder + 50%HNO_3	Light brown	Light green
7	Powder + 1N HCL	Brown	Light green
8	Powder + HCL	Brownish black	Green
9	Powder + H_2SO_4	Deep black	Dark green
10	Powder + 50% H_2SO_4	Light brown	Dull green
11	Powder + Glacial acetic acid	Brown	Dull green
12	Powder + HNO_3	Yellowish brown	Green

CONCLUSION

The present work focuses on the pharmacognostical and physico-chemical investigation of *Bambusa arundinacea*. The pharmacognostical characters and physic-chemical studies help in the identification of the drugs and also in laying down pharmacopeial standards.

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