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Pharmacognostical and phytochemical investigation of *Butea frondosa* Linn. bark

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ABSTRACT

Butea frondosa,is an important medicinal plant. The bark is reported to possess astringent, bitter, pungent, alternative, aphrodisiac and anthelmintic properties. It is useful in tumour, bleeding piles and ulcer.The roots are useful in elephantiasis and in curing night blindness and other defects of sight. The root bark is used as an aphrodisiac and as analgesic and anthelmintic. The flowers are reported to possess astringent, diuretic, depuretive, aphrodisiac and tonic properties; they are used as an emmenagogue and as poultice in orchitis and to reduce swellings, for bruises and sprains. They are also effective in leprosy, leucorrhoea and gout. Seeds are reported to possess aperient and rubefacient properties. The important parameters studied are macro and microscopical character, measurement of fiber length & diameter starch grain, histochemical studies, ash analysis, inorganic element, total extractive values, moisture content, behavior of powder with different chemical reagent & fluorescence analysis. In the present paper an attempt has been made to find out, botanical, physico-chemical and preliminary phytochemical characteristics of Butea frondosa bark.

Key words: *Butea frondosa*, bark, macro and microscopical character, physicochemical analysis, fluorescence analysis & phytochemical screening.

INTRODUCTION

Butea frondosa a deciduous tree with a somewhat crooked trunk, up to 15 m in height and 1.6-2.0 m in girth; commonly found throughout India, except in the arid regions. Bark of the tree is bluish grey or light brown; leaves long-petioled, 3-foliate, leaflets coriaceous, broadly obovate from a cuneate or deltoid base, glabrescent above, densely finely silky below; flower buds dark brown, flowers bright orange-red, sometimes yellow, in 15 cm long racemes on bare branches; pods pendulous, silky-tomentose, 10-13 cm long, containing one seed at its apex; seeds flat, reniform, 3.3-3.8 cm X 2.2-2.5 cm. The bark is reported to possess astringent, bitter, pungent, alternative, aphrodisiac and anthelmintic properties. It is useful in tumour, bleeding piles and ulcer. The decotion is prescribed in cold, cough, fever, various form of haemorrhage, in menstrual disorders and in the preparation of tonics and elixirs. The roots are useful in elephantiasis and in curing night blindness and other defects of sight. The root bark is used as an aphrodisiac and as analgesic and anthelmintic. The leaves are used as astringent, tonic, diuretic and aphrodisiac properties. The flowers are reported to possess astringent, diuretic, depuretive, aphrodisiac and tonic properties; they are used as an emmenagogue, and as poultice in orchitis and to reduce swellings, for bruises and

sprains. They are also effective in leprosy, leucorrhoea and gout. Seeds are reported to possess aperient and rubefacient properties. A decotion of the seeds is given in gravel. [1]

MATERIALS AND METHODS

The bark material was collected from the fully grown trees found in Barpali, Bargarh, Odisha, in the month of February. For microscopical studies free hand sections of fresh barks were cut cleared with chloral hydrate solution and water, stained with safranin according to the prescribed methods [2]**.** Powder of the dried bark was used for chemical analysis. Histochemical study ,measurement of diameter of starch grains and length of phloem fiber, physico-chemical studies and preliminary phytochemical screening, behaviour of powder drug towards different chemical reagent, fluorescence analysis, preliminary phytochemical screening of the extract were carried out [3,4,5,6,7,8,9]. Thin layer Chromatography studies of the different extracts (petroleum ether, chloroform, ethyl acetate & methanol) were carried out in various solvents at 30°C using silica gel GF 254 plate as adsorbent [10].

RESULTS AND DISCUSSION

Macroscopic Character
Bark is bluish grey or light brown in colour. Odour is odourless and taste is tasteless. Surface is rough, young parts are tomentose or downy. **(Table-1)**.

Microscopic Character
Transverse Section of Bark

Cork- The young stem bark consists of a 2-4 layer of epidermis of rectangular type of cells having brown pigment.

Phelloderm - Following the cork, is the phelloderm which composed of four to five layers of rectangular parenchyma. Cork is thin walled and flattened outer surface.

Cortex- This layer consist of 10-15 layers of parenchymatous cells . Many layers of thin walled cellulosic parenchyma with very small intercellular spaces are present.

Phloem fiber- The fibers are lignified and thick in the outer part with cellulosic inner part. It is wider towards cork region and narrow towards pith region.

Xylem vessels- Wood vessels are 150-220µ in diameter with thick and lignified walled.

Xylem parenchyma- The cells are irrerular in shape and have thin wall.

PLATE-I Transverse section of *Butea frondosa* bark. Fig-1(a,b)

Powder microscopy bark
Powder drug consist of fragments or entire pieces of fibers measuring 33.75 µ which are encircled by a parenchymatous sheath of cells possessing rows of prisms of calcium oxalate. Brown colored polygonal thin walled cork cell are seen in powder drug. Abundant parenchymatous cell measuring 8 to 20µ wide and up to 136µ long and simple or compound starch grain measuring upto14.47-28.94 µ are found in the powder. Prisms shaped calcium oxalate crystals found scattered throughout the powder.

PLATE-II: Powder microscopic character of bark
Fig-2(a,b): Phloem fiber
Fig-2 (c): Parenchyma
Fig-2 (d,e): Cork cell
Fig-2 (f,g): Cork region
Fig2 (h): Starch grain
Fig-2 (i): Calcium oxalate crystal.

Histochemical test
Transverse sections of *Butea frondosa* bark were treated with routinely used chemicals and reagents, gave positive tests for starch, tannin, phenol, polyphenol, lignin, steroid, flavonoid and alkaloid. **(Table-2).**

Physico-chemical and Preliminary phytochemical analysis.
Ash values
The total ash, water soluble ash, acid insoluble ash and sulphated ash of *Butea frondosa* bark were found to be 12.5 w/w, 7 w/w, 1.5 w/w, 17 w/w. The total ash value and water soluble ash value of *Butea frondosa* bark powder were found to be more in crude drug. Sulphated ash was found to more than total ash and water soluble ash. Acid insoluble ash was found to be very less than total ash, water soluble ash and sulphated ash. Ash value is a measure of the quality and purity of the drug. (**Table-3)**

Total extractive values
The extractive values were determined to find out the amount of soluble compounds. The petroleum ether, chloroform, ethyl acetate and methanol extractive values of *Butea frondosa* bark were found to be 1.5 w/w, 4 w/w, 2.7 w/w, & 8 w/w. The bark showed more amounts of methanol soluble components than petroleum ether, chloroform & ethylacetate extracts. (**Table-3)**

Loss on drying
The moisture content of bark was found to be 2.6 w/w (**Table-3)**.

Element Analysis
Element analysis of ash was carried out and it showed the presence of calcium, iron, sulphate, phosphate, chloride and carbonate. **(Table-4)**.

Behaviour of powdred materials towards some chemical reagents
The behaviour of the powdered bark was 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-5).**

Fluorescence analysis
Fluorescence analysis of entire bark 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-6)**

Extraction
The dried bark powder of the material was initially extracted succesively with petroleum ether, chloroform, ethyl acetate & methanol by soxhlet apparatus for 18 hrs and solvent removed by distillation. The percentage of yield of the extract of bark was found to be 1.2 w/w, 3.5 w/w, 3.7 w/w & 8.9 w/w. The qualitative investigation test performed in the extracts. The petroleum ether extract of bark showed the presence of carbohydrate, alkaloids, tannin & phenol. The chloroform extract of bark showed the presence of carbohydrate, glycosides, flavonoids & alkaloids. The ethyl acetate extract showed the presence of carbohydrate, steroid, glycosides, flavonoids & alkaloids. The methanol extract showed the presence of carbohydrate, steroid, glycosides, flavonoid, tannin & phenol, alkaloids. (**Table-7**).

Thin layer chromatographic studies
Thin layer chromatographic studies were carried out in methanol extract. The methanol extract showed maximum two spots on TLC plate. Vanilin sulphuric acid is used as detecting agent. The solvent systems used and Rf values recorded were given in **(Table-8).**

PLATE-I TRANSVERSION SECTION OF BARK OF BUTEA FRONDOSA

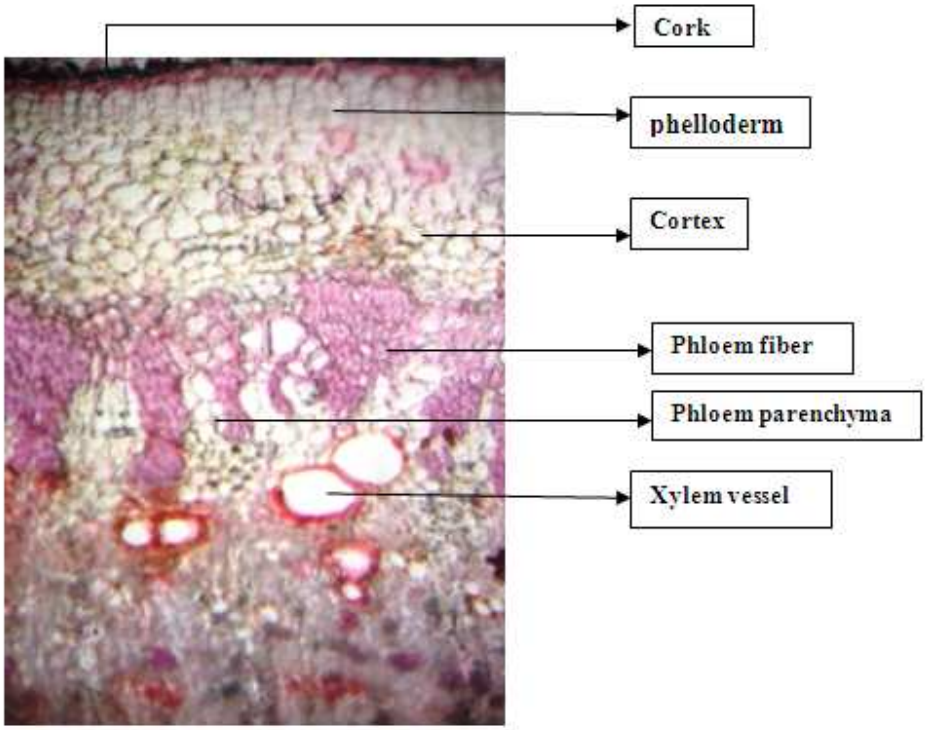

Fig-1(a)

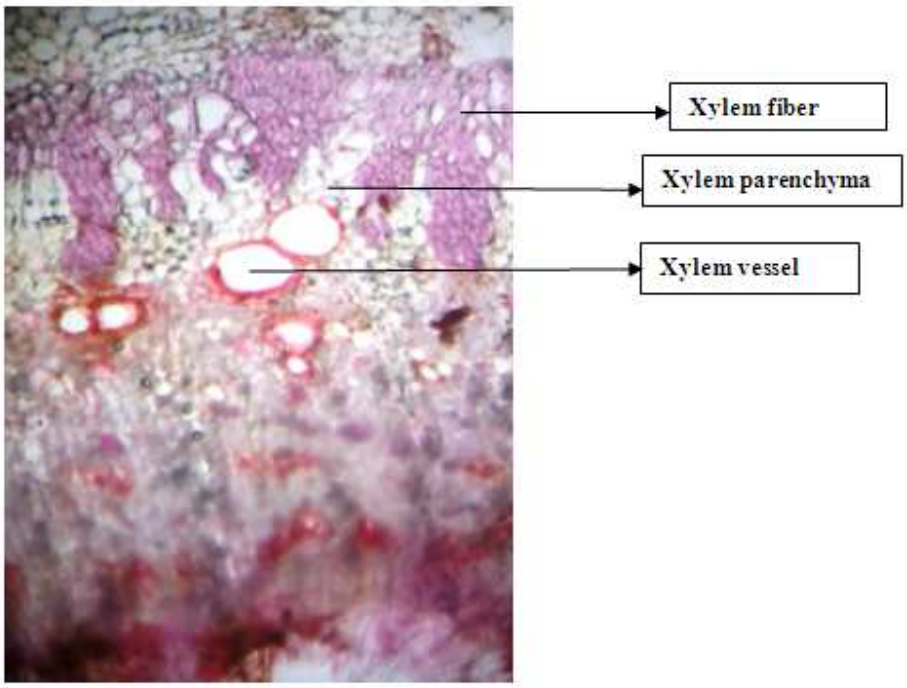

Fig-1(b)

PLATE-II POWDER MICROSCOPIC CHARACTER OF BARK BUTEA FRONDOSA

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

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

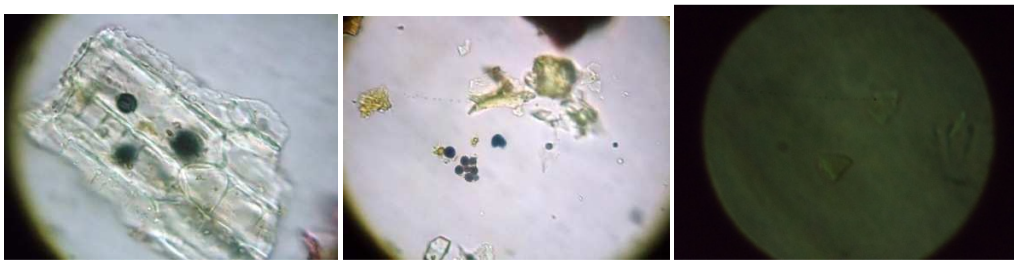

Fig-2(g) **Fig-2(h)** **Fig-2(i)**

Table-1 Macroscopic characters of *Butea frondosa* bark

Colour	Bluish grey or light brown
Odour	Odourless
Taste	Taste less
Texture	Rough

Table-2 Histochemical test of *Butea frondosa* bark

SL.No	Reagent	Test for	Inference
1	Section + Iodine solution	Starch	+
2	Section + IKI	Starch	+
3	Section + Sudan Red	Oil globules	-
4	Section + Ferric chloride	Tannin/Phenol	+
5	Section + Lugol's iodine	Tannin	+
6	Section + Toluidine blue	Polyphenol	+
7	Section + Phloroglucinol & HCL	Lignins	+
8	Section + Liberman	Steroid	+
9	Section + 5% KOH	Flavonoid	+
10	Section + Dragendorff's reagent	Alkaloid	+

+ Present, - Absent

Table-3 Physicochemical parametes of *Butea frondosa* bark

Ash value in percentage	
Total ash	12.5 w/w
Water soluble ash	07 w/w
Acid insoluble ash	1.5 w/w
Sulphated ash	17 w/w
Extractive value in Percentage	
Petroleum ether	1.5w/w
Chloroform	4 w/w
Ethyl acetate	2.7w/w
Methanol	8 w/w
Loss on drying	2.6 w/w

Table-4 Test for inorganic elements of *Butea frondosa* bark

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	-

+ Present, - Absent

Table-5 Behaviour with different chemical reagents of *Butea frondosa* bark powder

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

Table- 6 Fluorescence analysis of *Butea frondosa* bark powder

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

Table-7 Preliminary phytochemical screening of *Butea frondosa* bark extracts

Test	Petroleum ether	Chloroform	Ethyl acetate	Methanol
TEST FORCARBOHYDRATE				
Molish test	+	+	++	+++
TEST FOR PROTIEN				
Millon's test	-	-	-	-
TEST FOR STEROID				
Salkowski reaction	-	-	+	+
Liebermann-Burchard reaction	-	-	+	+
TEST FOR GLYCOSIDES				
Baljet test	-	+	++	++
Legal test	-	+	++	++
Saponin glycosides	-	-	-	-
TEST FOR FLAVONOIDS				
Shinoda test	-	+	++	+++
Lead acetate test	-	+	++	+++
TEST FOR ALKALOIDS				
Dragendorff's test	+	+	++	+++
Meyer's test	+	+	++	++
Hager's test	+	+	++	++
Wagner's test	+	+	++	++
TEST FOR TANNINS & PHENOLS				
5% $FeCl_3$	+	-	-	+++
Lead acetate	+	-	-	+++

+ Mild, ++ Moderate, +++ Frequent, - Absent

Table- 8 Thin layer chromatographic studies of *Butea frondosa* bark extract

Extract	Solvent systems	Spraying reagent	No. spots	Rf. values
Methanol	Petroleum ether:Diethyl ether (1:9)	Vaniline sulphuric acid	2	0.69 0.61
	Acetone:Ethyl acetate(3:7)	Vaniline sulphuric acid	1	0.45
	Chloroform:Acetone(2:8)	Vaniline sulphuric acid	1	0.74
	Chloroform:Methanol(1:9)	Vaniline sulphuric acid	3	0.42 0.56 0.35

CONCLUSION

The present work focuses on the pharmacognostical and phytochemical investigation of *Butea frondosa* bark. As there is no pharmacognostical and anatomical work on records for this traditionally much valued plant, present work is taken up in the view to lay down the macroscopic and microscopic standards, which could be used in deciding the genuineness of the above-described plant irrespective of their collection from different sources. Macroscopic and microscopic descriptions are provided from diagnostic point of view. The colored photographs of the bark of the above-mentioned plant might facilitate the researcher for identification. The results of the phytochemical screening, chemomicroscopical tests and fluorescence behaviors of the of the powdered drug of the bark can be considered as distinguishing parameters to identify and decide the authenticity of the above mentioned herbal drug and thus can be used as standards for reference purpose also. The outcome of the quantitative parameters described on the above mentioned plant part (bark) might be useful in the determining the authenticity of the drugs.These parameters, which are being reported for the first time, could be useful in the preparation of the herbal section of different Herbal Pharmacopoeia.

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