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Comparative studies on nutritional analysis and phytochemical screening of *Bombax ceiba* bark and seeds powder

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Abstract

The work describes in this paper details the nutritional and phytochemical analysis of bark powder and seeds powder of *Bombax ceiba*. It is a member of family Bombacaceae which is commonly known as Silk Cotton Tree. It is used by various tribal communities and forest dwellers for the treatment of variety ailments as it have a various medicinal property. The proximate analysis of *Bombax ceiba* was carried out to find out the presence of ash, moisture, protein, fiber and fat. The preliminary phytochemical screening of petroleum ether, methanol, chloroform and water extract of barks and seed powder of *Bombax ceiba* have been carried out for the various phyto-constituents. Many chemical compounds have been isolated from the different extracts of *Bombax ceiba* bark and seed powder such as tannin, saponni, alkaloids, glycosides and phenolic compounds etc. along with the presence of nutrients. The compounds isolated from this plant possess very important biological activities including immunomodulatory, cytotoxic, antineoplastic, anti-diabetic, anti-inflammatory, hypotensive, hypolipidemic, antihyperglycemic and antioxidant.

Keywords: Bombacaceae, phyto-constituents, alkaloids, glycosides and hypolipidemic

Introduction

The different medicinal plant, such as arid zone plants, herbal plants and some shrubs have the potential role in the prevention and treatment of human diseases. The arid zone plants are also known as wild plants as they do not need special care and maintenance. Such plants have some medicinal property thus used in prevention and treatment of various health ailments. They contain a variety of different nutrients and therapeutic constituents: vitamins, minerals, trace elements as well as active ingredients with a variety of medicinal actions. *Bombax ceiba* (syn. *Bombax malabaricum*) is an important medicinal plant of tropical and subtropical in India commonly known as Silk Cotton Tree or Semal. *Bombax Ceiba* (semal tree) is also known as Cotton tree belonging to family Bombacaceae of the class Magnoliopsida. It is commonly known as Simbal, Simul, Indian kapok, Purani, Pagun, Roktosimul, Indian bombax or Red Silk cotton which is an important medicinal plant [1]. Semal has gummy resin which is obtained from the bark. It is dried and sold as 'semul-gum' or 'mocharas'. It is a tall deciduous tree, with straight butteressed trunk and wide spreading branches. Almost every part of this plant is used as medicine for curing maximum number of ailments [2].

The tree forms a straight bole with horizontal or upward branches that grow in regular whorls, tier above tier, like a gigantic upside down candelabrum. The red silk-cotton has a medium growth rate and grows up to 100 feet tall. The trunk and branches are usually covered with conical thorns especially when young. Thorns on older trees are often absent. The tree often forms buttress roots but they are not as pronounced or as massive as those of *Ceiba pentandra*. Leaves are palmate and up to 24 inches long. The petioles are longer than the leaflets. Sometime in January or February the tree begins to drop its leaves in preparation for flowering. The flowers begin appearing when the tree is deciduous or nearly so. The flowers are 6 to 7 inches long and are up to 7 inches wide. They are borne solitary or in clusters at or near the ends of the branches. Releafing is completed as the fruits develop and begin to open on the tree. The fruits are large, up to 6 inches long, ovoid, pointed, woody capsules, filled with silky hairs. In April and May the pods split open (dehiscent) on the tree and disgorges quantities of silky cotton in which small brown seeds are imbedded. The bursting pods cover the neighborhood with drifting floss and are carried far by the winds. Propagation is by seeds, large cuttings or by air layering (Brown).

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The various part of *B ceiba* such as roots, leaves, seed, stem bark, flower, fruit and gum are documented to possess medicinal properties. The active components present in semal are 'lupeol, β -sitosterol and sesquiterpenes'. Lupeol is a pharmacologically active triterpenoids. It has the anti-inflammatory property. β -Sitosterol is one of several phytosterols the chemical structures similar to cholesterol. β -Sitosterols are white, waxy powders with characteristics odour. They are hydrophobic and soluble in alcohol. Sesquiterpenes belongs to the class of terpenes. It has an antiseptic, anti-bacterial and anti-inflammatory property³. The chemical investigation worldwide have revealed that the roots of semal are used for the medicinal purpose because they are rich in lupeol, β -sitosterol and sesquiterpenes⁴ which are

beneficial for health in treating some diseases.

Apart from the above active constituents, the stem, root, flower, fruit and leaves of semal have been reported to "contain many important phyto constituents including alkaloids, glycosides, flavonoids, steroids, saponins, phytosterols and triterpenoids (lupeol and beta-sitosterol), phenolic compounds and tannins⁵". The phytochemical studies of stem bark powder and seed powder are:

The seed contain n-hexacosanol, palmitic acid, octadecyl palmitate, gallic acid tannic acid, 1-gallayl- β - glucose, ethyl gallate and a mixture of α , β -and γ - tocopherol. The oil from the seed was found to contain 94.5percent mixed fatty acid composed oleic acid as a major constituent, along with myristic, palmitic, arachidic and linoleic acid^[6].



Fig 1: *Bombax ceiba* bark and seeds powder

Stem bark was reported to contain lupeol and β - sitosterol. In another studies, the presence of flavonoides, glycoside, sterol and terpenoids and absence of alkaloids and saponins was reported in the stem bark. Shamimicin, 1''', 1''''''-bis-2-(3, 4- dihydroxyphenyl)-3, 4-dihydro-3, 7-dihydroxy-5-O -xylopyranosyloxy- 2H- 1-benzopyran along with lupeol were isolated from *Bombax ceiba* stem bark^[7]. Stem bark are used as Bacterial, kidney stone, heart tonic, headache, snake bite, whereas seeds are used for chicken pox and small pox^[8]. Thus, in the present study an attempt has been made to perform the preliminary phytochemical screening of the bark and seed powder were done by extraction in different extracts.

Materials and Methods

Plant material

The bark and seed powder of *Bombax ceiba* were collected from the herbal powder agency, from jaipur.

Nutritional Analysis

The nutritional analysis of bark and seeds powder of *Bomba ceiba* was done by using methods NIN (2003). It includes moisture, ash content by NIN method, crude fiber by the method of Sharma, 2007, fat content by Soxhelt method and protein content by Micro kjeldhal method.

Qualitative phytochemical evaluation

Extraction

The coarse powder of *Bombax ceiba* bark and seed extracted with petroleum ether, chloroform, methanol and water at the ratio of 30:70. The extracts of *B. ceiba* barks were collected separately and filtered using Whatman filter paper. All the extracts were concentrated and the excessive solvents were evaporated under vacuum.

Preliminary phytochemical analysis

All plant extracts were further used for chemical tests for the presence of following phytochemicals such as phenolics compounds, alkaloids, saponin, glycosides, phytosterols, tannin, flavonoids, steroids terpenoids using the methods mentioned below.

1). Alkaloids

a. Mayer's test

Take a few ml of filtrate, a drop or two of Mayer's reagent were reagent were added by the side of test tube. A white or creamy precipitate indicate indicated the test as positive.

b. Wagner's test

Take a few ml of filtrate, few drops of wagner's reagent were added by the side of the test tube. A reddish -brown precipitate confirmed the test as positive.

2). Glycosides

a). 2 ml of aqueous extract of the samples, 5ml of Benedict's solution and few drop of dilute HCl were added and heated for minutes. The solution became red with precipitate which indicated the presence of glycosides.

b). Brontrager's Test

Take 2 ml of filtered hydrolysate, 3 ml of chloroform was added and shaken, chloroform layer was separated and 10% ammonia solution was added to it pink colour indicated the presence of glycosides.

3). Terpenoids

Libermann – Burchard's test: 2ml of acetic anhydride solution was added to 1ml of petroleum ether extract of the drug in chloroform, followed by 1 ml of concentrated sulphuric acid. A violet color ring was formed indicating the presence of terpenoids.

4). Steroids

Libermann –Burchard's test: 2 ml of acetic anhydride solution was added to 1 ml of petroleum ether extract of the drug in chloroform followed by 1 ml of concentrated sulphuric acid. A greenish color was developed which turned to blue.

5). Saponins

In a test containing about 5 ml of an aqueous extract of the drug, a drop of sodium bicarbonate solution was added. The mixture was shaken vigorously and left for 3 minutes. Honeycomb like froth was formed.

6). Tannins

Take 1-2 ml of plant extract, a few drops of 5% FeCl₃ solution were added, A green color indicated the presence of gallotannins which brown color indicated tannins.

7). Phytosterol

a. Libermann –buchard's test

The extract (50 mg) was dissolved in 2ml acetic acid anhydride, To this, one or two drops of concentrated sulphuric acid were added slowly along the side of the test tube. An array of color changes showed the presence of phytosterols.

b. The extract was treated with Salkowski's reagent

The yellowish colour with green fluorescence appearance indicated the presence of phytosterol in it.

8). Flavonoids

Shonoda Test: In a test tube containing 0.5 ml of alcoholic extract of the drug, 5-10 drops of dilute HCL was added followed by small pieces of magnesium, In the presence of flavonoids, a reddish pink or brown colour produced.

Result and Discussion

In the present study the comparison between the nutritional and phytochemical property of *Bombax ceiba* bark and seeds were estimated. The nutritional evaluation showed the presence of nutrients such as ash, moisture, protein, fat and fiber in bark and seeds powder of *Bombax ceiba* (Table 1). The preliminary phytochemical investigation on *Bombax ceiba* bark and seeds extracts revealed the presence of various secondary metabolites such as alkaloids, glycosides, steroids, flavonoids, saponin, tannin, terpenoids and phytosterols in the different extracts (Table 2 &3).

Proximate analysis of *Bombax ceiba* bark and seeds powder

showed the presence of ash, moisture, protein, fat and fiber. Table 1. depicted the value of nutrients present in bark and seeds powder. *Bombax ceiba* seeds powder was high in ash, moisture and fiber as compare to bark powder on other hand bark powder of *Bombax ceiba* was rich in fat and protein as compared to seeds powder. The bark powder was rich in fat and protein due to the presence of resin and volatile oil produced by the plant.

Table 1: Proximate Analysis of *Bombax Ceiba* Bark and Seeds Powder

S. No.	Nutrients	<i>Bombax ceiba</i>	
		Bark (g)	Seeds (g)
1.	Ash (g)	1.1±0.13	2.5±0.20
2.	Moisture (g)	7.6±0.03	9.9±0.15
3.	Fat (g)	0.21±0.07	0.17±0.10
4.	Fiber (g)	14.4±0.19	17.6±0.23
5.	Protein (g)	5.3±0.06	4.9±0.14

Table no.2 depicts the phytochemical analysis of *Bombax ceiba* bark powder in distilled water extract, chloroform extract, petroleum ether extract and methanol extract. Each extract showed the presence of different phytochemical compounds. Petroleum ether extract of *Bombax ceiba* bark powder contain glycosides, steroids, flavonoids and saponin whereas in chloroform extract of bark powder showed the presence of glycosides, steroids, terpenoids and phytosterols. On other hand the results of methanol extract bark powder showed the presences of alkaloids, glycosides, flavonoids, saponin, tannin and phytosterol. The maximum number of phytochemicals such as alkaloid, glycosides, flavonoids, saponin, tannin, terpenoids and phytosterols are present in distilled water extract. The minimum numbers of phytochemical present in petroleum ether and chloroform extract. This show that the *Bombax ceiba* barks powder was potentially rich and can help in curing various disease and disorders.

Table 2: Preliminary Phytochemical Screening of *Bombax Ceiba* Bark Powder Extract

Name of the chemical test	Petroleum ether extract	Chloroform extract	Methanol extract	Distill water extract
Alkaloids	-	-	+	+
Gylcosides	+	+	+	+
Steroids	+	+	-	-
Flavonoids	+	-	+	+
Saponin	+	-	+	+
Tannin	-	-	+	+
Terpenoids	-	+	-	+
Pytosterols	-	+	+	+

Simultaneously, Table no 3. counteract the presence of phytochemical compounds in various extract of *Bombax ceiba* seeds powder. Petroleum ether extract of *Bombax ceiba* seeds powder contain alkaloids, glycosides, steroids, flavonoids and tannin whereas in chloroform extract of seeds powder showed the presence of steroids and terpenoids only. On the other hand the results of methanol extract of seeds powder showed the presences of alkaloids, glycosides, flavonoids, saponin and phytosterol. The maximum number of phytochemicals such as alkaloid, glycosides, steroids, flavonoids, saponin, tannin and terpenoids are present in distilled water extract of seeds powder only phytosterol was absent. The estimation of phytochemical compounds in bark and seed powder extract

conclude that the distilled water extract of seeds and bark powder were rich in phytochemical compound which may help in treating many disease. In other prepared extract the powder lost their bioactive-compounds due to the chemical composition of solution used for preparing extract which makes them weak to enhance the quality of bark and seed powder. Thus, the study revealed that the bark and seed powder of *Bombax ceiba* have the potential to cure many disease.

Table 3: Preliminary Phytochemical Screening of *Bombax Ceiba* Seed Powder Extract

Name of the chemical test	Petroleum ether extract	Chloroform extract	Methanol extract	Distill water extract
Alkaloids	+	-	+	+
Glycosides	+	-	+	+
Steroids	+	+	-	+
Flavonoids	+	-	+	+
Saponin	-	-	+	+
Tannin	+	-	-	+
Terpenoids	-	+	-	+
Phytosterols	-	-	+	-

Conclusion

Bombax ceiba is a flowering plant from arid zone area as it does not need special care and maintenance but due to less awareness the peoples are not familiar with its health benefits. So, the main aim of the conducted study is to make aware from the health benefits and bioactive potential of *Bombax ceiba*. The seeds of *Bomax ceiba* were high in ash moisture and fiber whereas bark powder was high in fat and protein as it also produces resin and volatiles oil. Along with the nutrients the plant are also rich in phytochemicals which contain alkaloids, glycosides, flavonoids, steroids, saponins, phytosterols, triterpenoids, phenolic compounds and tannins which helps in increasing immunity of the body which makes the body to fight with the prone diseases. Thus, both the powders are useful for health maintenance and also help in treating many diseases.

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