

Research Article



Phytochemical Analysis and Antioxidant Efficacy of the Resin of *Bombax ceiba* (Salmali)

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ABSTRACT

In the present study phytochemical analysis and antioxidant activity of the resin of a popularly known medicinal tree, *Bombax ceiba* was undertaken. The resin is commonly used in Ayurveda system of medicine for acute dysentery, haemoptysis of pulmonary tuberculosis, influenza and menorrhagia. In the ethanolic and ethanolic water extracts of the resin saponin, tannins and flavonoids were present and terpenoids and alkaloids were absent. Glycosides were present only in the ethanolic extracts. The antioxidant property was maximum in ethanolic extract at 84.64% at 500mg concentration.

Keywords: *Bombax ceiba*, Ayurveda, Saponin, Tannins, Glycosides, Flavonoids

INTRODUCTION

The oldest documentation on human knowledge seems to be Rigveda which was written between 4500-1600 B.C. Ayurveda, which is a part of Rigveda, is the foundation of medicinal science of Hindu culture. It deals with specific properties of drugs and various aspects of science of life and the art of healing.¹

Herbal medicine is used by about 75 - 80% of the whole human population involving the use of plant extracts and their active constituents.²

Among the 7,000 species of medicinal plants recognized all over the world, about 1500 plants are systematically used in indigenous system of medicine, like Ayurveda, Unani and Siddha.

Thus there is a vast scope for search of medicinal efficacy of plants and their phyto-chemicals. The use of modern drugs is beset with safety concerns. It was estimated that 2.22 million hospitalized patients had serious Adverse Drug Reactions (ADR) and 106,000 died in a single year in the USA.

The herbal and natural products used as folk medicine have lesser incidences of reactions as compared to modern conventional pharmaceuticals.

Coupled with their reduced cost and easy availability, the use of herbal medicines is encouraging for both the consuming public and national health care institutions.³

With the increasing acceptance of herbal medicine as an alternative form of health care, the screening of medicinal plants for active compounds has become very interesting to understand the novel mechanism of action.⁴⁻⁶

In the present study phytochemical analysis and antioxidant activity of the resin of a popularly known medicinal tree, *Bombax ceiba* was undertaken. In

ayurvedic medical practice the resin of *Bombax ceiba* is used for the treatment of acute dysentery, haemoptysis of pulmonary tuberculosis, influenza and menorrhagia. It is reported to act as astringent, diuretic, expectorant, tonic, alterative, anti-inflammatory, styptic and demulcent. It is used in bladder disorders, calculus, catarrh, cystitis, gonorrhoea, sores and wounds.

Bombax ceiba Linn. (syn. *Bombax malabaricum* DC, *Salmalia malabarica*) is a deciduous tree which grows up to a maximum of 30m tall, commonly known as Silk cotton tree or Indian Red Kapok, is a member of family Bombacaceae.

The leaves are abruptly digitate and crowded at the ends of branches. The flowers are bright red and crowded at the apices of the numerous peduncles, seed embedded in white silky cotton and ovoid. This plant is found in the mixed evergreen forests of West Bengal and Assam and also grows in sub Himalayan region and lower valleys and also in Bhabar tracts of Uttar Pradesh and Bihar.

This plant is popularly known as Rakhta shalmali in Indian system of Ayurveda.

Recently the plant has undergone extensive scientific research. Various reports show that the leaves have anti-inflammatory, anti bacterial, anti viral, analgesic, oxytoxic, antioxidant, hepato-protective and anti diarrheal properties.⁷⁻⁹

The gymnasium part of the flower was reported to have antioxidant and RBC membrane stabilization properties¹⁰. Flowers are diuretic and laxative and the gum is used in haemoptysis. Seeds are used in treatment of gonorrhoea. The antioxidant and immune modulatory activity of the bark of this plant has been reported.¹¹

The bark of a related species, *Salmalia malabarica* is reported to have antimicrobial activity.¹² The root has fibrinolysis enhancing and antihyperglycemic properties¹³.



Free radical scavenging property of *Bomax ceiba* root extracts was reported.¹⁴ The medicinal effect of a related species, *Bombax malabaricum* on inflammatory bowel disease was reported.¹⁵ Antioxidant and anti hemolytic activities of *Bomabax ceiba* spike and fruit extracts was reported by Divya.¹⁶

MATERIALS AND METHODS

The resin of Salmali was procured from The Indian Medical Practitioners' Co-operative Pharmacy and Stores Ltd, Chennai, which is available with the brand name Salmali Niriyasa.

Phytochemical Analysis

Preparation of Extracts

15 grams of dried powder Salmali resin was packed in separate conical flasks for sample extraction by using ethanol and hydroethanolic solvents (20% ethanol: 80% distilled water) as solvents. The extraction was conducted with 50 ml of each solvent for a period of 48 hours.

At the end of the extraction the respective solutions were filtered and concentrated under reduced pressure and the crude extracts powders were stored in refrigerator for further use.

The extracts prepared were analyzed for the presence of alkaloids, saponin, tannins, flavonoids, glycosides and terpenoids based on the protocols available in the literature.¹⁷⁻¹⁹

Test for Alkaloids

The extract of the crude dry powder of each solvent was evaporated to dryness in boiling water bath. The residues were dissolved in 2 N Hydrochloric acid. The mixture was filtered and the filtrate was divided into two equal portions. One portion was treated with a few drops of Mayer's Reagent and one portion was treated with equal amount of Dragendorff's reagent, respectively. The creamish precipitate and the orange precipitate indicated the presence of alkaloids.

Test for Saponins

About 0.5 g of the plant extract was shaken with water in a test tube and then heated to boil. Frothing was observed which was taken as a preliminary evidence for the presence of the saponin.

Test for Tannins

About 0.5 g of extract was added was in 10 ml of water in a test tube and filtered. A few drops of 0.1% ferric chloride was added and observed for brownish green or blue-black coloration.

Test for Flavonoids

2 ml of extract solution was treated with 1.5 ml of 50% methanol solution. The solution was warmed and metal magnesium was added.

To this solution few drops of conc. Hydrochloric acid was added and the red colour was observed for flavonoides and orange colour for flavons.

Test for Glycosides

0.2 g of extract was dissolved in 1 ml of glacial acetic acid containing 1 drop of ferric chloride solution.

This was then under layered with 1ml of concentrated sulphuric acid. A brown ring obtained at the interface indicated the presence of a deoxy sugar characteristic of cardioids.

Test for Terpenoids

5ml of each extract was added to 2ml of chloroform and 3ml of con. H₂SO₄ to form a monolayer of reddish brown coloration at the interface indicated positive result for the terpenoids.

Antioxidant Activity

The antioxidant activities of the two plant extracts were studied using standard DPPH method.

Chemicals & Reagents: 1, 1-diphenyl-2-picrylhydrazyl (DPPH), Methanol, DPPH –1mg/ml in methanol and Ascorbic acid (standard) mg/ml.

Procedure

3.7 ml of absolute methanol was taken in all test tubes along with blank. 100µl of absolute methanol was added to the blank. 100 µl of Ascorbic acid was added to the tube marked as standard and 100 µl of respective samples were added to all other tubes marked as tests. 200 µl of DPPH reagent was added to all the test tubes including blank.

All the test tubes were incubated at room temperature and in dark for a period of 30 minutes. The absorbance of all the samples was observed at 517nm.

Calculation for Antioxidant Activity:

$$\% \text{ Antioxidant activity} = \frac{\text{absorbance at blank} - \text{absorbance at test}}{\text{absorbance at blank}} \times 100$$

RESULTS AND DISCUSSION

Table 1 shows the photochemical analysis results of *Bombax ceiba* in different extracts.

Table 1: Phytochemical Analysis of the resin of *Bombax ceiba*

| Sl. No. | Phytochemical | Ethanol Extract | Ethanol + Water Extract |
|---------|---------------|-----------------|-------------------------|
| 1. | Saponins | + | + |
| 2. | Flavonoids | + | + |
| 3. | Terpenoids | - | - |
| 4. | Glycosides | + | - |
| 5. | Alkaloides | - | - |
| 6. | Tannins | + | + |

'+'= Present, '-'= Absent.



Table 2 indicates the antioxidant properties of ethanolic extract of *Bombax ceiba*.

Table 2: Evaluation of Antioxidant activity by in Vitro techniques

| S. No. | Reagents | Blank | Ascorbic acid | | | | |
|---------------------------------------|------------------|-------------|---------------------------|-------------|-------------|-------------|-------------|
| | | | 100 mg | 200 mg | 300 mg | 400 mg | 500 mg |
| 1 | Methanol ml | 3.8ml | 3.7ml | 3.7ml | 3.7ml | 3.7ml | 3.7ml |
| 2 | Ascorbic acid ml | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 3 | Sample μ l | - | 100 μ l | 100 μ l | 100 μ l | 100 μ l | 100 μ l |
| 4 | DPPH ml | 200 μ l | 200 μ l | 200 μ l | 200 μ l | 200 μ l | 200 μ l |
| Incubation at dark for 30 mins | | | | | | | |
| OD at 517 nm | | 0.63 | 0.08 | 0.06 | 0.05 | 0.03 | 0.01 |
| % of antioxidant activity | | | 87.3 | 90.4 | 92.0 | 95.2 | 98.4 |
| S. No. | Reagents | Blank | Salmali Ethanolic extract | | | | |
| | | | 100 mg | 200 mg | 300 mg | 400 mg | 500 mg |
| 1 | Methanol ml | 3.8ml | 3.7ml | 3.7ml | 3.7ml | 3.7ml | 3.7ml |
| 2 | Ascorbic acid ml | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 3 | Sample μ l | - | 100 μ l | 100 μ l | 100 μ l | 100 μ l | 100 μ l |
| 4 | DPPH ml | 200 μ l | 200 μ l | 200 μ l | 200 μ l | 200 μ l | 200 μ l |
| Incubation at dark for 30 mins | | | | | | | |
| OD at 517 nm | | 0.65 | 0.50 | 0.32 | 0.20 | 0.14 | 0.10 |
| % of antioxidant activity | | - | 23.07 | 50.77 | 69.23 | 78.46 | 84.61 |

Figure 1 shows Graphical representation of antioxidant properties of *Bombax ceiba* as compared to standard.

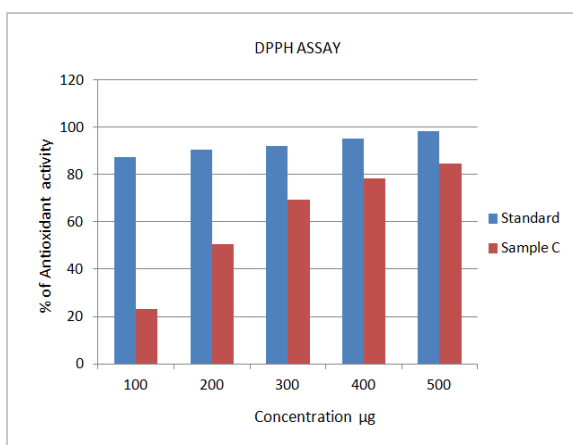


Figure 1: Percent Antioxidant activity of Salmali Ethanolic extract

Free radicals have been implicated in the etiology of several degenerative disorders including cancer, diabetes, rheumatoid arthritis, atherosclerosis, liver cirrhosis, Alzheimer's disease and other neurodegenerative disorders.²⁰ Antioxidants, the compounds that can scavenge free radicals play a significant role as they prevent damage of cell proteins, lipids, carbohydrates, nucleic acids as well as bio membranes caused by reactive oxygen species.^{21,22} Hemolysis is caused due to the destruction of erythrocytes membrane releasing of hemoglobin and other internal components into the surrounding fluid. Due to the preponderance of polyunsaturated fatty acids in the erythrocyte membranes, they are highly susceptible to oxidative

damage whose consequences are lipid peroxidation and hemolysis.

In recent years the use of herbs in traditional medicine has gained attention as they are being proven as the promising sources of various bioactive molecules. Jain and Verma have assessed the credibility of folk medicinal claims on *Bombax ceiba*²³. Verma have elaborated the medicinal values of this tree in details.²⁴ Gandhare have shown the antioxidant activity of *Bombax bark*.²⁵

The present study showed that the alcoholic and water extracts of salmali resin indicate the presence of alkaloids, flavonoids, glycosides and tannins. In our study we have found that the antioxidant property was maximum in ethanolic extract at 84.64% at 500mg concentration.

The medicinal value of plants lies in some bioactive phytochemicals that have a definite physiological action on human body and possess wide range of activities which may help to treat many diseases, for example alkaloids protect against many chronic diseases, saponins protect against hypercholesterolemia and have antibiotic properties. Steroids and triterpenoids show analgesic properties. Phytochemical screening of the alcoholic and water extracts which shows the presence of alkaloids, Flavonoids, steroids, saponins and tannins speculate various medicinal values such as anti inflammatory, anti diabetic and analgesic activities. The presence of active flavanoids in stem of *Bombax ceiba* Linn has significant anti obesity potential induced experimental obesity. The presence of triperpenoids in *Bombax ceiba* Linn provides a scientific rationale for the traditional use of this plant in the management of Diabetes. The Salmali root has been

proved to reduce over bleeding during menstruation and also in the management of Leucorrhoea.

The significant antioxidant activities including DPPH, Hydroxyl, Superoxide as well as Nitric oxide radical scavenging activities of methanol extract of Salmali may be endorsed for the presence of higher amounts of the above mentioned plant secondary metabolites. Many studies revealed that polyphenols exhibit a wide range pluripharacological effects including antimicrobial, antiinflammatory, antiallergic, hepatoprotective and anticarcinogenic actions. Many of these biological functions have been attributed to their antioxidant activity in absorbing and neutralizing free radicals, quenching singlet and triplet oxygen or decomposing peroxides.²⁶

The effective antihemolytic activity of salmali extract is because of the ability of phenolic compounds including flavonoids in neutralizing the free radicals. Membrane lipid peroxidation is regarded as a key factor for cell lysis.

Earlier reports suggested the potent antihemolytic activity of bioactive components namely Flavonoids and phenols and tannin from plant extracts and thereby protecting the erythrocytes membrane from destruction and lysis.²⁷

Insignificant hemolysis was observed when erythrocytes were treated only with plant extracts, indicating the nontoxic nature of plant extracts. Thus the extract can be justified as harmless for the cells.^{28,29}

CONCLUSION

From the above discussion it is clear that *Bombax ceiba* resin, which is already an ayurvedic medicine, has clear antioxidant properties which could be attributed to the presence of tannins, flavonoids in the plant *Bombax ceiba* L.

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