

BEYOND THE COTTON: A REVIEW OF THE SILK COTTON TREE (*BOMBAX CEIBA* LINN.)

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ABSTRACT

Herbal plants having medicinal properties, are the basic and most integral part of traditional medicinal system for the treatment of a variety of human disease. More and more people are looking for plant-based ingredients and natural products are emerging as a significant source of new molecular structures that lead to new drugs in all major ailments. Among so many herbs used in traditional medicinal system, Silk cotton tree or *Bombax ceiba* Linn. One of the herbaceous plant, which belongs to Bombacaceae family is well-liked among various tribal communities in the treatment of many widespread diseases and nutritional disorders. This plant is well-known for its towering height. It is mainly found in mild temperate and equatorial regions reaching approximately 1500 meters. Diverse elements of this plant, which may include the leaf, flower, root, bark, thorn etc. deal with multiple ailments and are frequently employed by native peoples and indigenous forest communities. Its therapeutic wellness activity to some extent is owing to the presence of phytoconstituents viz. shamimicin, bioflavonoids, phenol compounds, bombamalonones, sesquiterpenes. The present review is focused to reiterate diverse dimensions of scientific inquiries on the *Bombax ceiba* Linn, pharmacological activities e.g. hypolipidemic, anti-hyperglycemic, anti-inflammatory, antioxidant, etc., polyherbal formulations containing *B. ceiba* and strategies to conserve this wonder plant.

KEYWORDS: Herbal medicinal plants, *Bombax ceiba*, Shamimicin, Hypolipidemic, Anti-hyperglycemic, Polyherbal formulations.

KEY MESSAGE

Beyond its botanical significance, the silk cotton tree holds deep cultural and spiritual meaning in tribal communities. This review explores the diverse ethnobotanical, pharmacological activities and poly herbal formulations of this iconic tree and effectively summarize the exciting future aspects. It encourages further exploration and sustainable utilization of this resource.

INTRODUCTION



Fig. 1: Silk cotton tree: *Bombax ceiba*.



Fig. 2: Flower of silk cotton tree.



Fig. 3: Leaves of silk cotton tree.



Fig. 4: Fruits of silk cotton tree.



Fig. 5: Roots of silk cotton tree.



Fig. 6: Bark of silk cotton tree.

TRIVIAL NAMES

Hindi: Simbhal doda, Semal
 English: Red Silk-cotton tree
 Sanskrit: Mocharasa
 Marathi: Shalmali
 Gujarati: Savar
 Telugu: Boorugu chettu
 Assamese: Dumboil
 Bengali: Lal Shimul [1.]

TAXONOMICAL CLASSIFICATION

Kingdom : Plantae
 Division : Magnoliophyta
 Class : Magnoliopsida
 Order : Malvales
 Family : Bombacaceae
 Genus : Bombax
 Species : ceiba.^[2]

Table 1: Parts of the plant, Phytoconstituents present, Ethnomedicinal uses.^[2,3,4,5]

S.NO.	PARTS OF THE PLANT	PHYTOCONSTITUENTS PRESENT	ETHNOMEDICINAL USES
1.	LEAF	Shamimin , Mangiferin	Anti- inflammatory
2.	FLOWER	Flavones eg. β -sitosterol vicenin, linarin, saponarin, cosmetin, isovitexin, and apigenin,	removes bile and phlegm, cooling and astringent
3.	SEEDS	Palmitic acid, gallic acid, fatty acid oleic acid	To treat Mucous membrane inflammation and interstitial cystitis
4.	FRUIT	Ceiba alkaloids A&B, quercetin, kaempferol, beta-sitosterol, betulinic acid	diuretic, expectorant tonic, aphrodisiac, leprosy
5.	BARK	Lupeol and β -sitosterol, flavonoides, glycoside, sterol and terpenoids, Shamimicin	topically in bleeding wound, boils, acne, pimples
6.	GUM	arabinose, galactose, galacturonic acid, rhamnose	haemoptysis, diarrhoea, astringent, bleeding piles
7.	ROOT	β -sitosterol, sesquiterpenoids, bombamalones, bombamaloside	demulcent tonic, biliousness, in low vitality and debility

TRADITIONAL USES

Silk cotton tree, is a healing tree used in India for wellness benefits, documented in the traditional Indian medicinal system. The fruits, flowers and bark of the tree were found to be effective in wound healing and reviving dysfunctioning of sexual activity and low sperm motility. The gums obtained from Silk cotton tree is significantly used in the treatment of menorrhagia, GIT disorders and liver disorders. The immature roots of *Bombax ceiba* were used to treat leukorrhea. It has been used as a vitalizer for older patients. It is reported significantly as constipative. It increase consistency and production of semen, amenorrhoeic and used to purify blood and bile and as an anthelmintic.^[6,7,8]

PHARMACOLOGICAL ACTIVITIES**Anti-Inflammatory**

Human Red Blood Corpuscles membrane stabilizing method when used to assess anti-inflammatory activity of *Bombax ceiba*, it was found that the tree indicated excellent anti-inflammatory activity.^[13]

Anti-obesity

Shukla K et,al; studied that methanolic or hydro-alcoholic extract of *Bombax ceiba* stem bark has obesity reducing properties combating high fat diet-induced obesity in rats by virtue of the presence of active flavanoids and lupeol.^[3]

Anti-urethral

B. ceiba extracts has shown potential anti urethral activity against hyperoxalouria.^[14]

Antimicrobial

Bombax ceiba extracts were prepared from dried powder of the plant and analyzed for *Staphylococcus Lactobacillus* and *Streptococcus Spp.* using agar well diffusion assay. It was found that the extract has shown excellent antimicrobial potential against oral health conditions like gingivitis, gum disease, and tooth decay. Antifungal activity against fungi, was also tested for chloroform and carbon tetra chloride extract and both demonstrated significant activity against *Aspergillus* and *Candida albicans*.^[17]

Anti-diabetic

One study found that the extracts obtained from the bark and leaves of *Bombax ceiba* gave significant results when evaluated for its low glucose level and lipid lowering capacity.^[15]

Hepatoprotective

The extract of flowers of *Bombax ceiba* was evaluated for its antihepatotoxic effect on rats. The study was found helpful for the industry to produce cost effective and superior herbal drugs with fewer adverse effects, for the treatment of hepatotoxicity.^[3,13,14]

Hypotensive

Study conducted on *Bombax ceiba* stem bark explained the hypotensive evolution of this wonder plant.^[3]

Anti-oxidant

As per the study conducted on the Bark, Root and fruit of *Bombax ceiba*, it was found that this giant tree has shown a robust antioxidant potential defense system by reducing Oxidative stress.^[13,17]

Anti-hemolytic

Study performed on *Bombax ceiba* methanolic extracts, demonstrated notable anti-hemolytic potential. The assay was conducted using erythrocytes.^[9,11]

Antipyretic

The leaves of *Bombax ceiba* contains tannins, triterpenoids, flavonoids etc. Study was conducted on rats using methanolic extract of leaves of *Bombax ceiba*, for its antipyretic potential and has indicated as significant febrifuge.^[3,11]

Aphrodisiac

The root extract of *B. ceiba* was investigated for its sexual stimulant potential and was found effective as an aphrodisiac.^[9]

Angiogenesis inhibitor

In vitro study was performed on the methanolic extracts of *Bombax ceiba* stem barks for angiogenic capacity and demonstrated significant antiangiogenic activity.^[10]

Bombax ceiba Oil for production of Biofuel:

Shukla.K. et;al. revealed that when inedible *Bombax ceiba* oil was selected as a feedstock for the production of biofuel using Calcium Oxide-nanoparticles as catalyst, it was found to be a potential biodiesel source options.^[11]

POLYHERBAL FORMULATIONS OF *Bombax ceiba*

Study suggested that a herbal gel formulation was developed using *Psidium guajava* leaf which contains Phenolic acids, quercetin, flavonoids and *Bombax ceiba* thorn extracts containing Shamimin to treat mouth ulcers, it was found that the polyherbal formulation was more enduring, harmless and accomplished in comparison to synthetic formulations.

The study concluded that mouth ulcers could be treated effectively using *Psidium guajava* leaf extract and *Bombax ceiba* thorn extract. It could enhance penetration of the drug from the affected area.^[19] Raj et al. 2016, suggested that when the combinations of methanolic extract of three different plants (*Curcuma longa*, *Ficus benghalensis*, *Bombax ceiba*) were evaluated for their antibacterial activity it was found that combination consists of phenolic and flavonoid compounds and combination of selected methanol extract had better inhibitory activity compared to methanol extract of single plants against bacterial strain. The study concluded that the antibacterial and antioxidant properties of the selected drugs were suitable in developing a Gel formulation for the successful management of the Acne P. acne.^[20] Gum obtained from the tree of *Bombax ceiba* L. (Malvaceae) is mixed with gum obtained from inflorescence of *Musa paradisiaca* along with ghee to treat inflammatory bowel disease (IBD). Gandhi T et.al; 2022 screened a developed polyherbal formulation of three different plants, *Hollarrhena antidysentrica*, *Aegle marmelos* and *Bombax malabericum* to treat chronic inflammation of gastrointestinal tract in rats. Moreover, it was concluded that the use of the polyherbal formulation was found to be promising to treat IBD by using the combination of the three plants.^[22] Randive DS et.al; 2022 presented their work focused on various cosmetic formulations. The formulation was developed using *Lantana camara* Linn. leaf extract and *Bombax ceiba* Linn. thorn extract. The formulations were evaluated for various parameters and the outcome revealed that the color extracted from polyherbs, proven to be a better alternative as compared to non-natural colorants.^[23] Raj VK, et.al; separated flavonoids and phenolic compounds from various plant parts of *C.longa*, *B.ceiba*, *F.bengalensis* and *L.culinaris* methanolic extracts. Their research work reported the significant antibacterial, antioxidant and anti-inflammatory activity of these selected plants against P. acnes bacteria.^[24] Nguyen-Thanh T et.al; 2024 studied that when two randomized controlled trials were conducted on males with oligospermia, with one study having the administration of the extract obtained from the roots of *Withania somniferum*, while the other study

provided a polyherbal formulation consisting of *Chlorophytum spp. roots*, *Hygrophila spp. seeds*, *M. pruriens seeds*, *M. pudica seeds*, *A. senegal sap*, *Astragalus spp. root*, *P. ovata seed coat*, *B. ceiba sap* and *Eurycoma spp. roots*. The case reports describe patients who were given treatment plans of the Polyherbal formulation has shown promising results.^[25]

Sangthong S et.al; 2024, studied that the crude extracts of leaves of fresh green tea, flowers of *B. ceiba*, roots, rhizome of lady finger and ginger were used as traditional medicine in Thai foods. Also their ethanolic extracts were evaluated for antimicrobial activity and skin-related disease, where the polyherbal formulation has shown promising results.^[26]

Unknown facts of *Bombax ceiba*

The silk cotton tree, a majestic giant with a rich history, has some fascinating lesser-known facts. In Mayan mythology, the *Bombax ceiba* tree was considered as a symbol of ancient history. The axis represents a connection between the underworld, the earth, and the Heavens. It was believed to be a sacred tree of immense spiritual significance. The silk cotton tree is a keystone species, providing crucial habitat for a wide range of wild life including birds, bats and insects, its dense canopy offers shelter and nesting sites showing its ecological importance. The tree has unique adaptations to thrive in its environment, its large, buttressed roots help anchor it firmly in the ground, while its smooth bark minimizes damage from climbing animals. In many cultures, this tree holds deep cultural and religious significance. It features in folklore, art, and literature so have Cultural significance.^[27,28,29,30,31,32,33]

Conservation strategy

Bombax ceiba faces threats like deforestation, habitat loss, and overexploitation therefore in-situ conservation in protected areas should be established and protected areas like national parks, wildlife sanctuaries, and reserves where it naturally occurs should be maintained. The degraded habitats must be restored by controlling invasive species, preventing soil erosion, and reintroducing native plant species. Ex-situ conservation can be done by cultivating silk cotton trees in botanical gardens and arboreta. These serve as gene banks and living collections. Seeds of diverse silk cotton tree populations may be collected and stored in Seed banks to preserve genetic diversity.^[34,35,36] Sustainable utilization can be promoted by using Non-timber forest products eg. Its fibres are used for stuffing, medicinal uses, and its role in supporting biodiversity. Sustainable harvesting practices for timber and other products to minimize the impact on tree populations should be implemented.^[37,38] Raise awareness, educate local communities about the ecological and cultural importance of the silk cotton tree. Community based conservation involve local communities in conservation efforts, such as tree planting, monitoring and protection.^[39,40] Economic incentives provide economic incentives to local communities for its conservation eg. eco-tourism and

sustainable product development, research and monitoring. Research on the ecology, genetics and reproductive biology of this tree must be conducted. Species-specific conservation action plans based on scientific research and monitoring data should be developed.^[41,42]

CONCLUSION AND FUTURE MONITORING

The miracle herb *Bombax ceiba* had been traditionally used to treat kidney stones, kidney disorders, Urinary Tract Infections, GIT disease, skin, inflammatory, respiratory and gynecological diseases, anti-diabetic, anti-obesity and antiulcer activities among the various tribes of the Himalayan region and has the potential to protect people against life threatening diseases at an early stage³ Therefore, there is a considerable room for further knowledge of pharmacologically active molecules and their mode of action from different parts of this plant, also there is a need to explicate the mechanistic way and perform phytochemical profiling of the isolated bioactive plant compounds. Active phytoconstituents of the plant could be used for the pharmaceutical research and development. There is an imperative need for scientific inquiry in future for some provisions and the utilization of this tree. Furthermore, lack of clinical trials of some activities creates a need for pharmaceutical innovations on this plant, so that the therapeutic potential of *Bombax ceiba* may be expanded.

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