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Review on Ethnobotany Phytoconstituents and Phytopharmacology of *Bombax ceiba* Linn.

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Abstract

Plants have been an important source of medicines since the beginning of cultivation. *Bombax ceiba* is commonly known as silk cotton tree and semal which belongs to family Bombacaceae. Its medicinal usage has been reported in the traditional systems of medicine such as Ayurveda, Siddha and Unani. It has a wide range of medicinal and pharmacological applications. Many parts of the plant (root, stem bark, gum, leaf, prickles, flower, fruit, seed and heartwood) are used by various tribal communities and forest dwellers for the treatment of a variety of ailments. The plant literature survey shows that the plant possesses astringent, cooling, stimulant, diuretic, aphrodisiac, demulcent and tonic effects and also helps in treatment of dysentery. It also possesses important pharmacological activity such as aphrodisiac, anti-inflammatory and hepatoprotective activity in addition to anticancer and anti-HIV activity, it has an anti-Helicobacter pylori, antiangiogenic, analgesic and antioxidant activity and hypotensive, hypoglycemic and antimicrobial activity. It is reported to contain important phytoconstituents such as naphthol, naphthoquinones, polysaccharides, anthocyanins, shamimin and lupeol. This paper provides an overview on pharmacological, phytochemical properties and therapeutic properties of the plant.

Keywords

Bombax ceiba, Simbal, Simul, Ethnobotanical uses, Phytochemistry, Pharmacological activities.

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INTRODUCTION

Ayurvedic system of medicine is a traditional system of medicine, native to the Indian subcontinent and practiced in other parts of the world as a form of alternative medicine. In Sanskrit, the word Ayurveda consists of the words ayus, meaning "life" and Veda, meaning "related to knowledge" or "science". Evolving throughout its history, Ayurveda remains an influential system of medicine in South Asia (1). The present review on Bombax ceiba Linn or Salmalia malabarica (DC.) Schott & Endl classified the plant belonging to family Bombacaceae (2) Bombax ceiba Linn., a large, deciduous tree, commonly known as Silk Cotton Tree, Indian Red Kapok tree, Semal, Shimul, Shalmali etc.; is a member of family Bombacaceae. It is found throughout India and other parts of tropical and sub-tropical Asia, Australia and Africa (3). The plant is one among five trees of

'Panchwati' and therefore, it has a spiritual importance (4). Ayurvedic scripture 'Rajnighantu' has beautifully described its characteristics and properties and states that the tree is Yamadruma, Diirghadruma, Kantakdruma, Nirgandhpushpi etc. It has beautiful red flowers and large fruits which yields gum and cotton. It is large and long living tree species that give strength to body, mind and heart (5). The therapeutic effects have been reported in roots, gums, stem bark, flowers, seeds, prickles and young fruits. The family Bombacaceae consists of 22 genera and 150 species. Genera Bombax consists of 60 species, Ceiba 15 species, Durio 15 species, Salmalia 10 species and Adansonia 10 species (6). This tropical tree has a straight tall trunk and its leaves are deciduous in winter. It bears red flowers with five petals appear in the spring before the new foliage. It produces a capsule which, when ripe, contains white fibers like cotton. Its trunk bears spikes to deter attacks by animals (7).

Botanical classification [8]

Kingdom	: Plantae
Division	: Magnioliophyta
Class	: Magniolipsida
Order	: Malvales
Family	: Bombacaceae
Genus	: Bombax
Species	: ceiba

Vernacular names [9]

Hindi	: Semal, Semar
English	: Silk-cotton tree
Sanskrit	: Moca
Urdu	: Sembhal
Gujarati	: Shemalo
Telugu	: Buruga
Assam	: Simalu
Bengali	: Shimool

Habitat and distribution

Bombax ceiba is widely found in temperate Asia, tropical Asia, Africa and Australia. In India, it can be found at altitudes upto1500 m. In peninsular India, the tree is very commonly seen in the dry and moist deciduous forests and also near rivers. This tree is a great light-demander and fast growing tree. Bombax ceiba grows luxuriously on deep sandy loams or other well-drained soils, especially in valleys, in the regions that are receiving 50 to 460 cm. annual rainfall well distributed throughout the year [10].

General description

The various parts of Bombax ceiba like leaves, roots, stem bark, seed, flower, gum and fruit are reported to possess rich medicinal components in ethnobotanical surveys conducted by ethnobotanist and in traditional system of medicine such as Ayurvedic. Semal is a lofty, deciduous tree grow up to 40 m tall with horizontally spreading branches and young stems covered with hard prickles. Bark is grey brown or silver grey colored with hard sharp conicles prickles. Leaves are large, spreading, glabrous, leaflets lanceolate, 3-7 margin entire. Flowers are red numerous, appearing when the tree is bare of leaves, stamens many arranged in five bundles of 9-12 each and an inner bundle of 15. The fruits are brown capsule-like up to 15 mm long, filled with numerous black seeds. Seeds are smooth, black or grey embedded in long white wool, which are irregular obovoid in shape, smooth and oily with dense silky hair. Gum is light brown to opaque or dark brown called as semul gum (11).

Ethnoherbological Properties

Tribal people residing all over India are well knowledged with the plant's usage. B.ceiba was used as aphrodisiac, in sexual diseases and as a tonic, half a cup of ethanol extract of bark and flower was given for 3 days to men and women to treat with sexual diseases like leucorrhoea, gonorrhea as well as also used to regulate menstrual abnormalities in women [12]. About 30g of seed powder of B. ceiba and about 10 g Hing are used as an abortifacient by the Oraon tribe in West Bengal [13]. Another study on B. ceiba showed that plant is utilized in the treatment of hydrocele, leucorrhoea, gonorrhoea and to regularize menstruation, urinary problems and as a tonic [14]. It is also prescribed for increasing sperm in semen and to act as an aphrodisiac. Studies on the ethnomedicobotany of the Kandha tribe of Orissa revealed that fresh stem bark of B. ceiba, with some other herbs taken orally to cure gonorrhoea, impotency, spermatorrhea, sterility, nocturnal emission and leucorrhoea [15]. B. ceiba extract mixed with cow dung was applied over back muscle of leg at night to treat hotness and inflammation [16, 17]. The plant is one among five trees of 'Panchwati' and hence, has spiritual importance. It is the large and long-living tree that provides strength to body, mind and heart [18].

Phytoconstituents reported in Bombax ceiba:

Bark contains lupeol, saponins, tannins, gums and 4,5,7- trihydroxyflavone-3-O-β-D-glucopyranosyl (1-4)-α-L-rhamnopyranoside, nhexacosanol and palmitic acid isolated from seeds, lactone isolated from root bark, polysaccharide isolated from flowers-had a continuous backbone of 4(1-4)- β-linked D-galactopyranose and 2 (1-3)- β-linked Larabinopyranose units with β-linked D- galactose and α-linked L rhamnose and L-arabinose units as end groups [19]. Leaves contain a flavonol C-glycoside shamimin [20]. Hemigossypol-6-methyl

ether was isolated from the root bark of B.malabaricum along with isohemigossypol-l-methyl ether [21]. From Bombax ceiba stem bark a Shamimicin, (3, 4- dihydroxyphenyl)-3, 4-dihydro-3, 7- dihydroxy-5-O - xylopyranosyloxy- 2H-1-benzopyran along with lupeol were isolated [22]. From the dried leaves of B. malabaricum in the same year, mangiferin, a xanthone was separated by repeated column chromatography of the n- BuOH fraction [23]. From the root bark of B. malabaricum, new sesquiterpene lactone, 5-isopropyl-3-methyl-2, 4, 7trimethoxy-8, 1- naphthalene carbolactone together with naphthoquinone, 8-formyl-7-hydroxy-5-isopropyl-2-methoxy3methyl 1, 4naphthoquinone were isolated [24]. Phytochemical investigation of Bombax malabaricum shows the presence offive new compounds (bombamalones A-D, 1-4; bombamaloside, 5), and four known compounds (isohemigossypol-1-methyl ester, 6; 2-Omethylisohemigossylic acid lactone, 7; bombaxquinone B, 8; and lacinilene C, 9) [25]. A new naphthoquinone together with 7hydroxycadalene and 8-formyl-7-hydroxy- 5-isopropyl-2-methoxy-3methyl-1, 4-naphthoquinone were isolated from the heartwood of Bombax malabaricum. The new naphthoquinone was characterized as 7-hydroxy5-isopropyl-2-methoxy-3-methyl-1, 4-naphthoquinone based on spectral and chemical studies [26].

Traditional properties

Use of Bombax ceiba plant for the treatment of various ointments by tribal community is well established. Half a cup of ethanol extract of bark and flower of Bombax ceiba plant is given for 3 days to both men and women with sexual diseases like hydrocele, leucorrhoea, gonorrhea and is also used to check menstrual disorders in women by the tribal area of southern Rajasthan [27]. The study carried in Kandha tribe of Orissa showed that one teaspoon juice of fresh stem bark of Bombax ceiba, one teaspoon juice of fresh root of Asparagus racemosus, powder of seven black peppers (dried seed of Piper nigrum L., Piperaceae) and one teaspoon of processed sugar or gum taken orally on an empty stomach two times daily for 21 days to cure gonorrhoea, impotency, spermatorrhea, sterility, nocturnal emission and leucorrhoea. It is also prescribed for increasing sperm in semen and to act as aphrodisiac (Manu Vhokta) [28]. The study carried out in Sitamata Wildlife Sanctuary of Chittorgarh and Udaipur district located in the southwest region of Rajasthan showed that bark, flower and powdered root barks of B. ceiba is used for treating hydrocele, leucorrhoea, gonorrhoea and to regularize menstruation and urinary problems [29] The traditional study on anti-inflammatory activity of plant was carried out by the Lohit community of Arunachal Pradesh showed that fresh paste prepared from the bark of Bombax ceiba mixed with cow dung is applied over back muscle of leg at night to treat inflammation [30].Root powder of Bombax ceiba is used as a tonic to treat impotency, 10 g of root powder was advised daily with a glass of cow milk by tribes of the Sonbhadra district in Uttar Pradesh[31]. A powder of stem prickles was used to treat asthma; about 10 g (one spoonful) powders is taken with a glass of cow's milk/fresh water in the morning for 3-4 months. Seed paste prepared in water was applied on small-pox boils. [31]. The paste of Bombax ceiba bark externally is used for treatment of cattle wounds in Mysore and Coorg districts of Karnataka [32]. The bark juice of Bombax ceiba is applied locally for the treatment of wounds [33]. The bark juice is mixed with the bark juice of Magnifera indica and P. guajava and drunk to control dysentery and intestinal spasm. The resin was also taken orally to treat worms and diarrhea; root juice is consumed to treat abdominal pain and gonorrhea [33]. The native people of state Mizoram uses this plant as traditional herbal medicine. Decoction of the leaves of B. ceiba and the bark of Mangifera indica is taken (5 ml, 2-3 times daily) orally to treat diarrhea [34]. The root bark of Bombax ceiba is peeled with a sharp knife and the inner white portion is crushed and made into a fine paste. The paste is then added to 30–50 ml of water and administered in the morning, preferably on an empty stomach for 2 days to treat diarrhea in Parinche valley, Pune district, Maharashtra [35].

Pharmacology of Bombax ceiba linn

Antioxidant activity

The antioxidant activity of a root extract of B. ceiba was evaluated using several antioxidant assays, in terms of its: ability to scavenge DPPH and reducing power assay. Methanolic extract of the roots has showed a high amount of phenolics (30.95% w/w) and tannins (15.45% w/w) and a very good DPPH radical scavenging activity in a dose dependent manner [36].

A study was undertaken to evaluate the in vitro antioxidant potential of bark of Bombax ceiba (Bombacaceae). Aqueous and ethanolic extracts of the bark were subjected to in vitro antioxidant activity screening models [37].

Hypotensive activity

Shamimin along with lupeol [lup-20 (29) en-3b-ol], which possesses a potent hypotensive activity, have been isolated from B. ceiba stem bark. filtrate from BCBM (Methanolic extract of defatted stem bark) is one of the most active fractions has revealed its

adverse effects on heart, liver and kidneys of mice at the dose of 1000 mg/ kg/d [38].

Antiangiogenic activity

Methanol extract of the stem barks of B. ceiba was reported to have a significant antiangiogenic activity on in vitro tube formation of human umbilical venous endothelial cells. The result indicated bioactivity-guided fractionation and isolation was also carried out on this extract [39]. 2.10.4. Hypotensive, hypoglycaemic activity.

In this study it has been reported that shamimin, a C-flavonol glucoside isolated from Bombax ceiba leaves showed potency as a hypotensive agent at the doses of 15 mg/kg, 3 mg/kg, 1 mg/kg and significant hypoglycaemic activity at 500 mg/kg in Sprague-Dawley rats [40].

Analgesic activity of bombax ceiba showed by where is Dar et.al. obtained Mangiferin, 2-Beta-D-glucopyranosyl-1, 3, 6, 7tetrahydroxy- 9H-xanthen-9-one, directly from methanolic extracts of B. ceiba leaves demonstrated strong antioxidant activity using DPPH assay. Additionally, crude plant extracts and purified mangiferin have failed to exhibit acute anti-inflammatory activity whereas, these extracts displayed significant analgesic effect in acetic acid-induced writhing and hot plate tests in mice [41].

Hepatoprotective activity

Several Researchers reported that the methanol extract of flowers of B. ceiba (MEBC) investigated and it was found that MEBC significantly decreased the level of TBARS and elevated the level of GSH at all doses as compared to control. The biochemical parameters and histopathological studies results shown that the MEBC were not able to completely revert the hepatic injury induced by INH and RIF, but it could limit the effect of INH and RIF to the extent of necrosis [42].

Aphrodisiac activity

In this study the aphrodisiac activity of B. ceiba root extract was evaluated by many scientists the root extract (400 mg/kg body wt/day) was administered orally by gavage for 28 days. Intromission latency (IL), ejaculation latency (EL), Mount latency (ML), intromission frequency (IF), mounting frequency (MF), ejaculation frequency (EF) and post-ejaculatory interval (PEI) was the parameter observed. These effects were studied in sexually active and inactive male mice and the extract has shown aphrodisiac effect [43].

Antipyretic activity

A group of workers have reported that the methanol extract of Bombax malabaricum leaves (MEBM) was evaluated for the antipyretic activity in rats. The MEBM has possessed a significant antipyretic activity in Baker's yeast induced pyrexia [44].

Antimicrobial activity

Plant extracts (methanol and aqueous) were assayed for their activity against multi-drug resistant Salmonella typhii. A strong antibacterial activity was observed due to methanol extracts treatment against Salmalia malabarica [45]

Diuretic activity

The study reported on diuretic effects of aqueous and crude ethanol extracts of Bombax ceiba L. fruits using acute model in rats, indicated that the aqueous and ethanol extracts of B. ceiba fruit (200 mg/kg and 400 mg/kg, p.o.), was significantly increased the urine output in higher doses. These effects will demonstrate a possiblediuretic actions of B. ceiba fruit extracts and support its folklore use in various urinary ailments [46].

CONCLUSION

A broad literature survey and analysis related to this plant has exposed that B. ceiba has a long history of traditional use for a wide range of diseases. It is an important species which has an economic and ecological importance and should be conserved for ecological perspective.

Much of the traditional uses have been validated by scientific research. The plant is used in dysentery, menorrhagia, skin troubles, haemorrhoids, for the treatment of snake bite and scorpion sting, boils, leucorrhoea, internal bleeding, calculus affections chronic inflammation, ulceration of blader and Kidney, gonorrhea, haemoptysis, influenza, enteritis, pulmonary tuberculosis, cystitis and catarrahal affections bleeding piles, are reported in the present review confirm the therapeutic value of B. ceiba. The presence of interesting/novel chemical compounds in the plant indicates that the plant could serve as "lead" for development of novel herbal drug for curing above disorders in the coming years. In this regard, further studies need to be carried out to explore specific and target agents of B. ceiba for its potential in preventing and treating the diseases.

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