Ethnomedicinal and pharmacological activities of Mochrus (Bombax ceiba Linn.): An overview

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ABSTRACT

Traditional system of medicine mentioned the use of plants in treatment of various human ailments. Mochrus (Bombax ceiba Linn.) is one of the medicinal plants used in Unani medicine since ancient times. It is a very tall tree with approximately 150 feet height. It is widely found in temperate Asia, tropical Asia, Africa and Australia. In India, it can be found at altitudes up to 1500 m. In peninsular India, the tree is very common in the dry as well as moist deciduous forests and near rivers. It is reported to possess gabiz (constipative), munaif (secretive), maghairi rehm (uterine tonic), naft salam rehm (beneficial in leucorrhoea), munsik wa naghali za man (increase consistency of semen), nuallide man (production of semen), habise tanis (amenorrhoeic), daft fasaddi kheen wa safra (purifies blood and bile), taskeen hidata aza (hotness of organs), munaqvar asnim wa lissa (tonic to teeth and gums) etc. Ethnomedicinal studies prove that it is used in diarrhoea, asthma, impotency, boils, wounds, leprosy, pimples and many other skin diseases. It is an anthelmintic remedy since ancient time. Pharmacological studies like hypotensive, antioxidant, analgesic, anti-inflammatory, antipyretic, antibacterial, cytotoxic, hepatoprotective, diuretic, anthelmintic, anticancer, spermatoegenic and anti-helicobacter pylori activities have been evaluated for various parts of this plant that confirms to its use in classical medicine.

Keywords ethnomedicinal, Mochrus, traditional, pharmacological

INTRODUCTION

Bombax ceiba (Bombacaceae) is an important medicinal plant of tropical and subtropical India. “Bombax” is a Latin word means splendid or marvellous may be named after its very tall height whereas species name “ceiba” is a Latinized form of the South American name for Silk Cotton. It belongs to the family Bombacaceae which includes around 30 genera (25 genera after Heywood et al.) with about 250 species of tropical trees. It is commonly known as Simul, Sinul, Indian bombax or Red Silk cotton and found widely in temperate Asia, tropical Asia, Africa and Australia. In India, it can be found at altitudes of sea level to 1500 m elevation. The tree is a strong light-demanding, fast growing and grows best on deep sandy loams or other well-drained soils throughout the year (Rajendra, 2010).

Medicinal usage of Bombax ceiba has been reported in many traditional systems of medicine such as Ayurveda, Siddha and Unani medicine since ancient times (Chakraborty et al., 2010). This plant has been extensively evaluated for various pharmacological activities to treat diseases condition such as anti-inflammatory, anti-HIV, hepato-protective, hypotensive, antiangiogenic, antioxidant activities etc (Chaudhary and Khadbadi, 2012).

Taxonomy:

| Kingdom: | Plantae |
| Subkingdom: | Viridiplantae |
| Infrakingdom: | Streptophyta |
| Superdivision: | Embryophyta |
| Division: | Tracheophyta |
| Subdivision: | Spermatophyta |
| Class: | Magnoliopsida |
| Superorder: | Rosales |
| Order: | Malvales |
| Family: | Malvaceae (Bombacaceae) |
| Genus: | Bombax |
| Species: | ceiba (ILIS Report, 2015) |


Synonym:

Bombax ceiba Linn, Bombax malabaricum De., Salmalia malabarica (DC.) (Schoet & Endl.), Gossampinus malabarica (DC.) (Merr) (Ghani, 1971).

Vernacular names:

**Pharmacological activities of Mochras**

*Mucuna pruriens* has great beneficial effect over the membranes of the genitourinary organs. It is used for chronic inflammation of bladder, kidney and for calculi affections.

**Flowers:**
The flowers are bitter, acidic cooling, dry, astringent to the bowels, removes bile and phlegm, purify the blood, benefit the spleen and good for leucorrhoea. It is topically applied to skin affections as cooling and astringent.

**Leaves:**
It is applied topically as a paste to relieve inflammation as well as given in the form of decoction.

**Bark:**
Bark is sprinkled topically in bleeding wounds and applied as a paste in water to skin eruptions, boils, acne, pimples etc. Decoction of bark is used as demulcent, styptic and used to remove phlegmatic. Aqueous extract with curd is given for dysentery with blood.

**Seeds:**
Seeds are used for chickenpox, smallpox, canker afflictions, chronic cystitis and genitourinary diseases.

**Gum:**
The gum is acrid, astringent, demulcent, tonic, aphrodisiac and removes black bile. In powder form alone or with other herbs it is used internally to treat haematoysis, diarrhea, dysentery, bleeding piles, menorrhagia, leucorrhoea, spermatorrhoea and blood disorders. Topically it is applied as styptic, astringent, demulcent in stomatitis, dermatological ailments and burn wounds.

**Root:**
The root is sweet and cooling, demulcent tonic, slightly diuretic and astringent to the bowels. It is useful in biliousness, inflammations and excessive heat of the body. It is also employed in low vitality and debility (Jain and Verma, 2014).

**Therapeutic uses in Unani medicine:**
In Unani system of medicine more emphasis is given to the use of gumy exudates known as *mochara* obtained from its branches and stem. Due to its hot and dry temperament it is employed in disorders occurring due to cold and moist temperament. It is used in phlegmatic cough due to respiratory disorders. Tooth powder containing *mochara* is beneficial for loosen teeth and bleeding gums (Ghani, 1971). *Mochras* powder 1.25 – 2 g along with sugar is given to cure diarrhoea in children. It also cures dysentery and other gastro intestinal track disorders with loose motion. It has astringent action on uterus if kept in vagina as a pessary, thus used in leucorrhoea. To reduce or stop purpural discharge and menorrhagia *mochara* is used with razor orally. Nocturnal erections of children can be treated by this drug (Ghani, 1971). *Mochras* alone or mixed with other drugs is used to treat priyav (spermatorrhoea) and salani bal (urinary incontinence). It cures the stomatitis if applied locally (Ghani, 1971). It improves the skin complexion when used as face wash (Ghani, 1971). Bark purifies the blood and diminishes the burning sensation owing to hiddat dam wa safra. For this purpose its decoction is taken internally and paste is applied as plaster (Ghani, 1971).

**Muzarrat (advers effect):**

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**Plant description in classical literature (Mahiyat):**
Mochras is a plant exudates obtained from Simbhal tree. *Simbhal* is a very tall tree with approximately 150 feet height. Bark is whitish, leaves are like a jomun leaf, flowers are red in color and petals are very thick. Dry fruits are filled with very soft silky cotton like material (Hakeem, 2002).

*Simbhal* tree exudate (*mochara*) is a gummy material obtained from stem barks eaten by insects (Hakeem, 2002). Exudate is thick, white while depositing on the bark and becomes blackish red after drying. It is mostly tasteless but some time slightly bitter. It is available in easily breakable two shaped dry particles.

**Botanical description:**
*Bombax ceiba* is a deciduous tree of up to 45 m high, bole straight, butters 1 – 2 m high, bark 20 – 30 mm thick, grey mottled with white color; branches horizontal and more or less whorled. Leaves are digitate-compound, alternate, stipulate, stipules small, lateral; radii 12 – 25 cm, glabrous; leaves 5 – 7, whorled; lamina 10 – 20 x 2 – 6 cm, elliptic, elliptic-ovobovate, margin entire, glabrous. Flowers are bisexual, dark crimson, 6 – 7 cm across, solitary or 2 – 5 together; enaly campanulate, lobes 3 – 4 x 3 cm, glabrous outside, silky inside; petals 5, 8.5 – 18 x 3.5 – 5 cm, elliptic-ovobovate, fleshy; stamens 65 – 80, 3 – 7.5 cm long, ovary conical, tomentose, 3-celled; ovules many; style exceeding the stamens; fruit a capsule, 8 – 10 x 3 cm, downy tomentose and glabrous at maturity; seeds numerous, pyrmiform, smooth, dark brown, embedded in white cotton (ITIS Report, 2013).

**Habitat:**
It is widely found in temperate Asia, tropical Asia, Africa and Australia. In India, it is found at altitudes up to 1500 m. In peninsular India, the tree is very common in the dry as well as moist deciduous forests and near rivers. The tree is a strong light-demand, fast growing, grows best on deep sandy loam or well-drained soils, particularly in valleys and regions receiving 56 to 460 cm annual rainfall well distributed throughout the year.

**Part used:**
Fruits, heart wood, stem bark, gum, and root (Hakeem, 2002).

**Misc (Temperament):**
Coki 2°C Dry 3°C (Ghani, 1971) (Hakeem, 2002), Cold and Dry, Cold and Dry in 3°C, (Nabi, 2007) (Hakeem, 2009).

**Afal (Functions):**
Gurbah (constitutive) (Ghani, 1971; Hakeem, 2002; Nabi, 2007; Naqiff (siccative), naqawri relm (uterine tonic) (Ghani, 1971); naf sihna relm (beneficial in leucorrhoea) (Ghani, 1971); nusik miw (avacourous) (Ghani, 1971; Nabi, 2007); mbughdah miw (increase consistency of semen) (Ghani, 1971; Hakeem, 2002); muggle miw (samen procreate) (hibbis toms (amenorrhoeic)) (Nabi, 2007); dahi fawad khoon wa safra (purifies blood and bile); naqawri sihna wa tissi (tonic to teeth and gums) (Nabi, 2007).

**Medicinal use in ethno-medicine:**
Fruits: Fruit is cooling, digestible, stimulant, diuretic, tonic, aphrodisiac, expectorant, blood purifier and good for leprosy. It...
Mistletoe (corrective):
Roghjan gul (Rosa damascene oil) (Hakeem, 2002), darachini (Cinnamomum zeylanicum), shaker (sugar), roghjan balam (Prunus dulcis oil) (Hakeem, 2002; Nabi, 2007).

Badal (substitute):
Saaneg dhaak (Butea monosperma) (Hakeem, 2002; Nabi, 2007) and mastagi (Pistacia lentiscus) (Hakeem, 2009).

Miqdare hukmusr (dose):
3–6 gm (Hakeem, 2002), 2–3 gm.

Mashhoor murakkabat (formulations):
Mojjum nooros, sulafe saltan (National Formulary of Unani Medicine, 2006).

PHYTOCHEMICAL STUDIES

All parts of the plant gave beta-sitosterol and its glucosides, seeds, bark and root bark-lupeol, flowers-henricotanone, hentriacontane, root bark-hydroxy-cadaleine. The seed oil yields ascorbic, linoleic, myristic, oleic and palmitic acids. Seeds contain carotenones, n-hexacosanol, ethylgallate and tocopherols, the gum contains gallic and tannic acids, yields L-arabinose, D-galactose, D-galacturononic acid, and D-galactopyranose. Younger roots contain more sugars (arabinose and galactose) and peptic substances than the older ones. They contain mucilage, starch, mineral matter, tannins and non-tannins, along with other constituents (Khane, 2007). The alcoholic and water extracts of flowers of Bombax ceiba Linna. indicate the presence of alkaloids, flavonoids, glycosides, proteins and amino acids and cinnamurans (Antil et al., 2013).

Gums:
Hydrolysis of gum yields arabinose, galactose, galacturononic acid, rhamnose, and partial hydrolysis yields 6-O-(\(\beta\)-D-galactopyranosyl)-armonic acid)-D-galactopyranose. 2,3,4,6-tetra-, 2,6-di-, and 2,4-di-o-methyl-o-D-galactose and 2,3,5-tri and 2,5,3-di-o-methyl-L-rhamnose. Modified gum on hydrolysis has been found to yield 2,3,4,6-tetra-, 2,6-di-, and 2,4-di-o-methyl-L-D-galactose and 2,3,5-tri and 2,5,3-di-o-methyl-L-rhamnose (Fraz et al., 2006).

Khan et al. (2011) isolated and characterized a new flavone from the flower extract of Bombax ceiba using mass, NMR, IR, and UV. They also screened isolated compound for its antibacterial and anti-fungal activity (Khan et al., 2011).

Root:
The phytochemical studies on the root of Bombax ceiba showed presence of n-triaconitol, \(\beta\)-sitosterol. New glycosides identified as 5,7,3,4-tetrahydroxy-6-methoxy flavonol-3-O-\(\beta\)-D-glucopyranosyl-(1-D-xylopyranoside) sesquiterpenoids, isohemigossypol-1,2-dimethyl ether, 8-formyl-7-hydroxy-5-isopropyl-2-methoxy-3-methyl-1,3,4-napthoquinone, 5-hydroxy cadalen, and new sesquiterpene lactone, 6-dihydroxy-3-methyl-5-(1-methyl ethyl) 1,7-dimethoxy naphthalene-8-carboxylic acid (8-11) lactones were also isolated. Root bark was reported to yield lupeol, \(\beta\)-sitosterol and a napthoquinone.

A sesquiterpene lactone isolated from roots was previously identified as hemigossypol acid lactone-7-methyl ether. 2D NMR experiments have shown this was a new compound, isohemigossypol acid lactone-2-methyl ether. Phytochemical investigation of the chemical constituents of the roots of this plant afforded nine cadane sesquiterpenoids, including five new compounds (bombabaftone A-D, 1-4; bombabate, 5), and four known compounds (isohemigossypol-1-methyl ether, 6; 2-O-methylisohemigossypol acid lactone, 7; bombabate, 8; and laccaline C, 9).

Stem bark:
Bark was reported to contain lupeol and \(\beta\)-sitosterol. In another studies, the presence of flavonoids, glycoside, sterol and terpenoids and absence of alkaloids and sapovins was reported in the stem bark. Shamimun, 2011, 1',1'',1'''-bis(2,4,3'-dihydroxyphenoxy)-3', 4-dihydro-3, 7-dihydroxy-5-oxo-xylopyranosyl-2H-1-benzopyran along with lupeol were also isolated from its stem bark.

The flower:
Chemical constituents in the n-hexane fraction from the flowers of this plant were investigated using gas-liquid chromatography analysis. Analysis of the fatty acid esters established the major abundance of the saturated fatty acid over their unsaturated form. The polar methanol fraction showed presence of seven flavones i.e. vicenin 2, larin, sapmaran, cosmetin, isovitin and xanthocin and apigenin. Structures of all these molecules were also established by intensive studies of various spectral data (H-NMR, mass spectroscopy and UV) and compared with authentic samples. These compounds were described for the first time from this plant.

Extracts of n-hexane and methanolic exhibited presence of \(\beta\)-D-glucoside of \(\beta\)-sitosterol, free \(\beta\)-sitosterol, hentriacontane, hentriacontanol, kaempferol, quercetin and trace of an essential oil. A polysaccharides consisting of D-galactose, L-arabinose and L-rhamnose in the molecular ratio of 5:4:3 was isolated of the dried stamens of the flower. The fresh petals of flower were reported to yielded two anthocyanidine glycosides named A and B which characterized as pelargonidin-5-D-glucopyranoside and cyanidin-3-methyl-6-ether-3-D-glucopyranoside respectively.

The seed:
Seed contain n-hexacosanol, palmitic acid, oleic acid, different fatty acid, and a mixture of \(\alpha\), \(\beta\)-and \(\gamma\)-tocopherol. The oil from the seed was found to contain 94.5% mixed fatty acid composed of oleic acid as a major constituent, along with myristic, palmitic, arachidic and linoleic acid.

The leaves:
Shammin a flavonol C-glycoside has been isolated from the
ethanolic extract of fresh, unripe leaves of Bombax ceiba and
diluted as 2/1, 4, 5-ethylidene-3H-pyrrol-3, 5, 7-trihydroxy-6-
C-glucopyranosyl-4H-1-benzopyran-4- one through
extensive spectroscopic and 2D-NMR methods. Mangiferin, a
xanthone was isolated from 70% ethanol of the dried leaves of
this plant by repeated column chromatography of the n-BuOH
fraction. Further accurate NMR spectral assignments have been
made of the acyl and methyl derivatives of mangiferin (Fazie
and Shammin, 1999).

**ETHNO BOTANICAL STUDIES**

**Abortion:**
Oraon tribe in West Bengal use preparation of 30 g of seed
powder of Bombax ceiba and about 10 g Hing (Ferula foetida)
as an abortifacient (Mitra and Mukharg, 2009).

**Sexual debility and rejuvenator:**
Ethanolic extract of Bombax ceiba bark and flower was given
for 3 days in various sexual diseases like gonorrea leucorrea,
and menstrual disorders in women to increase sperm count,
test impotency and hydrocele in man. Another study carried
out in Chittorgarh and Udaipur district located in Rajasthan
(India) showed that bark, flower and root barks powder of this
plant are used in these disorders. Apart from sexual diseases
these plant material are also used to regularize menstruation
and urinary problems (Jain et al, 2004). Kandha tribe of Orissa
use juice of fresh stem bark of Bombax ceiba , juice of fresh
root of Aporrhais racemosa, powder of seven black peppers
and one teaspoon of sugar or gum taken orally before meals
twice a day for 21 days to cure impotency, spermatorrhea,
reduced sperm count, sterility, nocturnal emission, gonorrea
and leucorrea (Behera and Misra, 2005). Another ethno-
botanical study showed an infusion of the bark of Bombax
ceiba is used as a tonic (Sebastian and Bhandari, 1984).

**Anti-inflammatory activity:**
A study carried out by Namis et al (2009) found that Loht
community of Artemachal Pradesh use fresh paste prepared from
the bark of Bombax ceiba mixed with cow dung applied over
buck muscle of leg at night to treat hotness and inflammation
(Namis et al, 2009).

**Impotency, asthma and small-pox boils:**
Tribes of the Sembdrah district in Uttar Pradesh used 10 g
root powder of Bombax ceiba with a glass of milk as a tonic
to treat impotency. One spoonful powder of stem with a glass of
cows milk or fresh water, daily morning for 3 – 4 months
was used to treat asthma. Boils due to small-pox was treated
with local application of seed paste prepared in water (Singh et al,
2002).

**Wounds healing:**
Classical literature from Mysore and Coorg districts, Karnataka,
India mentioned the use of paste of its bark for cattle wounds
topically (Kohirasur and Singh NP, 2001). Field observations
in three villages in Newparan district of central Nepal showed
that Tharu, an ethnic group indigenous to the Terai, the
southern foothill region of the Himalayas in Nepal uses the
local application of bark juice of Bombax ceiba for the
treatment of wounds (Ghimire and Bastakoti, 2009).

**Diarrhoea:**
Tharu people also drink the bark juice of Bombax ceiba,
Mangiferina indica and Podiim guejia mixed together to cure
dysentery and intestinal spasms. Bombax ceiba bark extracts
are also taken orally to treat worms and diarrhoea (Ghumire
and Bastakoti, 2009). The native people of Mizoram state of India
use decoction of the leaves of Bombax ceiba and the bark of
Mangifera indica was taken 2 – 3 times daily orally to treat
diarrhoea (Sharma et al, 2001). People of Panchi valley,
Pune district, Maharashtra use paste made up of inner part
of root of this plant administered in the morning preferably
before meals for 2 days to treat diarrhoea (Tatli et al, 2009).

**Leprosy:**
Seeds and roots of Bombax ceiba were used by traditional
practitioners and religious healers of Bangladesh in the
treatment of leprosy (Mohill et al, 2009).

**Dermatological disorders:**
The tribal communities of North-West Frontier Province of
Pakistan employ Bombax ceiba in the treatment of skin
diseases and in folk cosmetics. For this purpose crushed fresh
bark of Bombax ceiba was applied locally on pimples, caruncules
and boils (Ahmad et al, 2010). Puswala tribal people in the
Sopada hills of Maharashtra apply concentrated bark
decoction of Bombax ceiba in the treatment of dermatological
disorders. They also use decoction of bark of Bombax ceiba
toally twice a day for 7 days to treat leucorrea (Kosidge
and Fursule, 2009).

**Helminthiasis:**
Flowers of Bombax ceiba, 25 – 50 g as feedstuff were fed to the
animal as anthelmintics in southern Punjab, Pakistan, by the
herdsmen (Jabbari et al, 2006).

**Miscellaneous Uses:**
In Eastern Rajasthan tender twig is used as toothbristle to cure
mumps and powdered flowers mixed with honey was given to
 treat menorrhagia. The thorm was rubbed on stone with
unboiled milk, made into paste and applied for 5 – 6 days on
the face to treat acne. The thorm was chewed to cure mouth
sores. The roots powdered with those of Chlorophyllum,
Capparis sepia and fruits of Pedaliah nervus were taken
with water as a tonic for 7 – 8 days to calm body heat. Root
bark extract was given as a tonic in case of sexual debility
and also as nervous tonic. Root powder mixed with sugar candy
and milk was taken to avoid impotency (Upadhyay et al, 2010).

**PHARMACOLOGICAL STUDIES**

**Hypotensive and hypoglycaemic activity:**
A novel constituent, Shaminicin, a C-flavonol glucoside from
Bombax ceiba leaves showed significant hypotensive potency
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,
however toxicological studies revealed that 500 mg/kg is a
lethal dose but it did not cause any mortality in mice at the
dose of 1 g/kg (Saleem et al, 1989). In further study Saleem et al
(2003) isolated and studied the hypotensive and toxicological
activities of shaminicin, 1), 4, 4-di-hydroxyphenyl)-3, 3-
dihydroxy-3, 7-dihydroxy-5-0-
xylopyranosyl-2H-I-benzopyran and lupeol constituents
from Bombax ceiba stem bark. Fraction ECBMM have
emerged as potent hypotensive constituents of Bombax ceiba
stem bark while shaminicin found devoid of any activity at
the dose of 15 mg/kg this time. Intravenous administration of 15
mg/kg of BCBM caused 65% fall in blood pressure of rats
for 4 min, while oral administration of 200 mg/kg for five

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days showed significant hypotension of 13.18%. Toxicology of BCBBM determined 1000 mg/kg/d as lethal dose (LD100) killing all mice by affecting their vital organs including heart, kidneys and liver. Dose at 100 mg/kg/d is also not safe in mice as it caused expiry of three animals. Researchers conclude that low doses of BCBBM (smaller than 100 mg/kg) can be useful in reducing blood pressure safely (Saleem et al., 2003).

**Antiangiogenic activity:**
You et al. (2003) has evaluated the angiogenic activity of methanol extract of the stem bark of *Bombax ceiba* and found that extract exhibits significant antiangiogenic activity on *in vitro* tube formation of human umbilical venous endothelial cells (HUVEC). In further study it was found that lupeol fractionated product of the extract has a marked inhibitory activity at 50 and 50 μg/mL on HUVEC tube formation while it does not affects the growth of tumor cell lines like SK-MEL-2, A549, and B16-F10 melanoma (You et al., 2005; Nam et al., 2003).

**Antioxidants activity:**
Mangiferin a molecule obtained from methanolic extracts of *Bombax ceiba* leaves demonstrated strong antioxidant activity using DPPH assay which was comparable to rutin. Moreover, mangiferin showed hepatoprotective activity against carbon tetrachloride induced liver injury further supporting the free radical scavenging property in the *in vivo* system. Another molecules acetyl and cinnamoyl derivatives were found to be less active than mangiferin whereas, methyl and 3,6,7-trimethyl ether tetraacetate derivatives were inactive (Dar et al., 2005). Vieira et al. (2009) also evaluated the antioxidant activity of methanolic extract of *Bombax ceiba* using (i) ability to scavenge DPPH and hydroxyl free radicals; (ii) action against lipid peroxidation and (iii) effect on myeloperoxidase activity. The extract showed significant antioxidant activity in all assays. The extract showed very low toxicity toward Vero cells (Vieira et al., 2009). Methanolic extract of roots of *Bombax ceiba* was evaluated using DPPH radical scavenging assay and reducing power assay. Extract of the roots showed a very good DPPH radical scavenging activity and reduction ability in dose dependent manner. Research concludes that antioxidant activity was due the higher percentage of phenolic compounds and tannins. Further in healthy human volunteers significantly increased in total antioxidant level was noted at the end of 4 hours after taking 3 gm of root powder (Jain et al., 2011).
Antioxidant and antihemolytic activities:
Divya et al. (2012) investigated antioxidant and antihemolytic activities of aqueous, methanol, chloroform and ethyl acetate extracts of spice and young fruit of Bombax ceiba. DPPH and TBARS methods were used to assess the antioxidant competence of extracts. Antihemolytic assay was determined using erythrocytes model and the extent of membrane damage was determined by quantifying hemolysis. Among all the four extracts studied, methanolic extract exhibited significant antioxidant and antihemolytic activities (Divya et al., 2012).

Analgetic activity:
Crude plant extract displayed significant analgetic effect in acetic acid induced writhing and hot plate test in mice. This analgetic effect was independent to opioid receptor but Mangiferin demonstrated significant interaction with the receptor at a peripheral site, with a slight contribution at the neuronal level (You et al., 2003).

Anti-inflammatory activity:
Kumar et al. (2011) evaluated the membrane stabilizing property and the antioxidantizing property of ethyl acetate soluble fraction of the gynaeum part of Bombax ceiba on human red blood cells and sheep red blood cells and compared it as a probable mode by which Bombax ceiba abrogate its effects on inflammatory conditions. The results of the study revealed that though the fraction of Bombax ceiba possesses significant anti-inflammatory property however, the extract did not showed any membrane stabilizing property (Kumar et al., 2011).

The study by Hossain et al. (2013) also confirmed the anti-inflammatory activity of methanol extract of Bombax ceiba leaves in carrageenan-induced acute inflammation rat model. It was observed that extract was non-toxic up to a dose of 2 g/kg for mice and rats, orally. It reduced lipo-polysaccharide induced NO production in macrophages in a dose-dependent fashion (p < 0.001). Study confirms that, MEBM posses anti-inflammatory activity, mediated through inhibition of (NO) production (Hossain et al., 2013).

Antipyretic activity:
Hossain et al. (2011) has carried out screening of antipyretic activity of the methanol leaf extract of Bombax ceiba in Balb/c mice and in rats. It was concluded that extract has significant antipyretic activity and inhibition of the synthesis and/ or release of inflammatory mediators may be its main mechanism of action (Hossain et al., 2011).

Hepatoprotective activity:
Ravi et al. (2010) have evaluated the hepatoprotective effect of methanolic extract of flowers of Bombax ceiba against isoniazid and rifampicin induced hepatotoxicity in rats. They found a significant decrease in alkaline phosphatase, alanine transaminases, aspartate transaminase and total bilirubin levels, but increase in the level of total protein in comparison to control. They also noted that extract significantly decreases the level of TBARS and elevated the level of GSH at all doses as compared to control. Histology of the liver tissue of the animals treated with extract showed protection from hepatotoxicity caused by antitubercular drugs. Researchers concluded that extract could limit the effect of antitubercular drugs to the extent of necrosis but not able to revert completely the hepatic injury (Ravi et al., 2010).

Diuretic activity: Jalapure et al. (2011) investigated the diuretic effects of aqueous and crude ethanolic extracts of Bombax ceiba fruits using acute model in rats. A single individual dose of aqueous and ethanol extract of Bombax ceiba fruit (200 mg/kg and 400 mg/kg, oral) each, frusemide and hydrochlorothiazide (25 mg/kg, oral) each as reference diuretic drugs, were administered orally to dehydrated rats. Control group rats were fed with normal saline (25 mg/kg, orally). Both extracts significantly increased the urine output in higher doses. Although, the onset of diuretic action was gradual (within 5 h) and lasted up to 24 h. Further, the intensity of diuresis induced by aqueous extract. 400 mg/kg in 5 h was almost similar to that of frusemide and hydrochlorothiazide. It was also observed that aqueous extract also caused marked increase in urinary Na+ and K+ levels (Jalapure and Gadge, 2011).

Aphrodisiac activity:
The aphrodisiac activity of Bombax malabaricum root extract was investigated at 400 mg/kg body weight for mount latency, intromission latency, ejaculation latency, mounting frequency, intromission frequency, ejaculation frequency, and post-ejaculatory interval parameters for a month. Parameters observed before and during the sexual behavior study exhibit extract reduced significantly. Mount latency, intromission latency, ejaculation latency and post-ejaculatory interval. The extract also increased significantly mounting frequency, intromission frequency and ejaculation frequency. These effects were observed in sexually active and inactive male mice (Chandhar and Khudabakhsh, 2015).

Antimicrobial and antibacterial activity:
Multi-drug resistant Salmonella typhi was found highly susceptible to methanol extracts of Bombax ceiba while aqueous and aqueous extracts were found less effective (Rani and Khullar, 2004).

In another study methanol and aqueous extracts showed potent antibacterial activity against Klebsiella pneumonia (Vaghasiya and Chhoda, 2009).

Digge et al. (2015) evaluate the antibacterial activity of aqueous extracts of the bark of Bombax ceiba using the four plate method against six medically important bacterial strains, namely Gram-positive Bacteria (Bacillus subtilis, Bacillus cereus and Staphylococcus aureus) and Gram-negative bacteria (Escherichia coli, K pneumoniae, and Pseudomonas aeruginosa) and compared the antibacterial potency the potency with gentamicin. They found that the aqueous extract was more significant against Gram-positive bacteria than against Gram-negative bacteria. The 100 µg/ml showed the best antibacterial activity as compared to the standard. They further commented that the presence of tannins may be responsible for significant antibacterial activity of the extract (Digge et al., 2015).

Nagamani et al. (2003) evaluate the aqueous, methanol, acetone, diethyl ether, chloroform and hexane extracts of seeds for the antibacterial property against five bacterial species namely Escherichia coli, Bacillus subtilis, Staphylococcus aureus, Enterococcus fecalis, and Alcaligenes faecalis. Antimycotic study was performed against the fungal cultures namely Candida albicans, Aspergillus niger, Aspergillus flavus, and Aspergillus fumigatus. Among the six solvent extracts tested acetone and methanol extract exhibited significant antibacterial and antifungal activity (Nagamani et al., 2014).

Anti-Helicobacter pylori activity:
Ethanol extracts of Bombax ceiba evaluated strong anti-Helicobacter pylori activities. The minimum inhibitory concentration values of the anti-Helicobacter pylori activity...
given by the ethanolic extracts ranged from 0.64 to 10.24 mg (Wang and Huang, 2005).

**Anticancer effect:**
Effects of mangiferin in rat colon carcinogenesis induced by chemical carcinogen, neo-ninhydrine (AOM) were evaluated by Yoshimi et al. (2001). They performed a short-term assay to investigate the effects of mangiferin on the development of preneoplastic lesions by AOM; aberrant crypt foci (ACF). In the short-term assay, 0.1% mangiferin in a diet significantly inhibited the ACF development in rats treated with AOM compared to rats treated with AOM alone. In continuation long-study they evaluate the effect of mangiferin on tumorigenesis induced by AOM. In the long-term assay, the group treated with 0.1% mangiferin in initiation phase of the experimental protocol had significantly lower incidence and multiplicity of intestinal neoplasms induced by AOM. Same time the cell proliferation in colon mucosa was reduced in rats treated with mangiferin. They opined that mangiferin has potential as a naturally occurring chemopreventive agent (Yoshimi et al., 2001).

**Cytotoxicity:**
Aqueous extracts of the plant *Bombax ceiba* exhibit mild cytotoxic effect in brine shrimp lethality test (Alluri and Gottumukkala, 2005).

**CONCLUSION**
This literature survey shows that *Bombax ceiba* plant has been extensively used in Unani system of medicine as well as different ethno-medicines since antiquity. Use of this plant by various ancient Unani scholars and tribal peoples is not just a myth but this practice was time tested. Its pharmacological effects were well confirmed by its repeated use in human beings and cattle. Various part of this plant is used as anti-diarrheal, sedative, blood purifier, anti-stomachic, antispasmodic, to increase the appetite, semen, semen procreator, uterine tonic, aminophores, abortifacient, anti-thermometer etc.

Scientific validation regarding antioxidant, analgesic, anti-inflammatoory, anti-pyretic, anti-cancerogenic, cytotoxic, antimicrobial activities on modern scientific parameter further authenticate the wisdom of ancient Unani scholars and tribal peoples. However there is further need to identify and isolate the pharmaceutically active molecules from different parts of this plant so as it can be better utilized.

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**CONFLICT OF INTEREST**
The authors have no conflicting financial interests.

**REFERENCES**


Chaknabotry DD, Ravi V, Chaknabotry P. Phytochemical evaluation and TLC protocol of various extracts of Bombax Ceiba Linn. JFSR. 2010;1:66-73.


Digge VG, Kuthth SS, Hogle MG, Poul BN, Judge DR. Screening of antibacterial activity of aqueous bark extract of Bombax ceiba against some gram positive and gram negative bacteria. AJPCT. 2015;3:551-555.


Hakeem MAH. Mufiadjat Azeexi. (New Delhi, India: Central Council of Research in Unani Medicine), 2009.
Pharmacological activities of Melchins


Vaghaviya Y, Chanda S. Screening of some traditionally used Indian plants for antibacterial activity against Klebsiella pneumoniae. JIMT. 2009;3:151-164.


Yoshimi N, Matsunaga K, Katayama M, Yamada Y. The inhibitory effects of mangiferin, a naturally occurring glucosylxyanthon in bowel carcinogenesis of male 1344 rats

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Pharmacological activities of Mochrus