

Mochrus (*Bombax ceiba* Linn.): A Comprehensive Review on Pharmacology Phytochemistry, and Ethnomedicinal Uses

Suhail Fatima¹, Aisha Siddiqui^{2*}, Afshan Khan³

¹ Dept. of Amraze Niswanwa Qabalat, School of Unani Medical Education and Research, Jamia Hamdard, New Delhi. India.

^{2,3} Dept. of Ilmul Advia, School of Unani Medical Education and Research, Jamia Hamdard, New Delhi. India.

ABSTRACT

The medicinal plants are extensively used for curing variegated malady in day to day life. There is an emergent demand for plant based medicines, food supplements, health products, pharmaceuticals etc. Mochrus (*Bombax ceiba* Linn.) is one of the valuable medicinal plants used in Unani system of medicine since relic belongs to family *Bombacaceae*. It is a tall tree and widely distributed through India, Africa, Australia and tropical Asia. Many parts of the plant (root, stem bark, gum, leaf, prickles, flower, fruit, seed and heartwood) are used for the treatment of a variety of ailments. It is reported to possess *nafe sailanur reham* (beneficial in leucorrhea), *mujaffif* (siccative), *muqawwi reham* (uterine tonic), *qabiz* (constipative), *muallide mani* (production of semen), *mumsik wa mughalliz mani* (increase consistency of semen), *dafe fasaad khoon wa safra* (purifies blood and bile) etc. It is used in asthma, diarrhoea, wound, leprosy, boils and many other skin diseases. Also possess some important pharmacological activities such as antioxidant, analgesic, antipyretic, antibacterial, diuretic, hepatoprotective, anticancer, hypoglycaemic and hypotensive etc. It is reported to contain phytoconstituents like polysaccharides, naphthoquinones, anthocyanins, lupeol and naphthol etc. This paper provides a compendium review on pharmacological, phytochemical properties and therapeutic benefits of the plant.

Keywords: *Bombax ceiba* Linn., Ethnobotanical uses, Phytochemistry, Pharmacological activities.

INTRODUCTION

Mochrus (*Bombax ceiba* Linn.) is an essential medicinal plant of subtropical and tropical India belongs to the family *Bombacaceae*. It is a deciduous tree attaining a height upto 40-50m and a girth more than 6 m, distributed throughout the hotter parts of the country about 1500m (Anonymous, 2007). Also found in Africa, Australia, temperate and tropical Asia. A lofty, deciduous, buttressed tree with stout hard prickles at base, the tree attains a height upto 40m and a girth upto 6m or more having a clear hole of 24-30m, buttresses are present only in trees of about 30 years age or more. Leaflets 5-7, lanceolate, glabrous. Flowers large, bright red. Capsules woody. Seeds enveloped in copious floss (Anonymous, 1997). It is commonly known as Simbal, Simul, Indian bombax or Red Silk cotton etc (Chakraborty et al., 2010). Semal has gummy resin which is obtained from the bark. It is dried and sold as 'semul-gum' or 'mocharas'. Almost every part of this plant is used as medicine for curing maximum number of ailments (Shadma W et al., 2014). It has number of traditional uses, and its medicinal usage has been reported in the Indian traditional systems of medicine. According to Ayurveda, it has stimulant, astringent, hemostatic, aphrodisiac, diuretic,

antidiarrheal, cardi tonic, emetic, demulcent, antidysenteric, and antipyretic properties (Williamson et al., 2005; Singh and Panda, 2005). It is reported to possess *nafe sailan reham* (beneficial in leucorrhea), *mujaffif* (siccative), *muqawwi reham* (uterine tonic), *qabiz* (constipative), *muallide mani* (production of semen), *mumsik wa mughalliz mani* (increase consistency of semen), *dafe fasaad khoon wa safra* (purifies blood and bile) etc. It is used in asthma, diarrhoea, wound, leprosy, boils and many other skin diseases. Also possess some important pharmacological activities such as antioxidant, analgesic, antipyretic, antibacterial, diuretic, hepatoprotective, anticancer, hypoglycaemic and hypotensive etc. It is reported to contain phytoconstituents like polysaccharides, naphthoquinones, anthocyanins, lupeol and naphthol etc. This paper provides a compendium review on pharmacological, phytochemical properties and therapeutic benefits of the plant.

Synonyms

Bombax ceiba Linn. (Ghani N, 1971; Kirtikar and Basu, 1987; Anonymous, 1972)
B. malabaricum (Kirtikar and Basu, 1987; Anonymous, 1972)
Gosampinus malabarica DC. (Anonymous, 1972)

Taxonomical Classification (USDA Classification; Singh and Panda, 2005)

- Kingdom: Plantae
- Subkingdom: Tracheobionta
- Superdivision: Spermatophyta
- Division: Magnoliophyta

*Correspondence: Aisha Siddiqui

E-mail: afshankhan2490@gmail.com

Received Aug 26, 2019; Accepted Sep 23, 2019; Published Nov 29, 2019

doi: <http://dx.doi.org/10.5667/tang.2019.0019>

©2019 by CellMed Orthocellular Medicine Pharmaceutical Association

This is an open access article under the CC BY-NC license.

(<http://creativecommons.org/licenses/by-nc/3.0/>)

- Class: Magnoliopsida
- Subclass: Dilleniidae
- Order: Malvales
- Family: Bombacaceae
- Genus: *Bombax* L.
- Species: *ceiba* L.

Vernaculars (Anonymous, 1972; Dymock, 1976; Ghani N, 1971; Khan M.A, 1303; Khan A.R, 1290)

- Assam: Dumboil, Semul
- Andaman: Didu, Semul
- Sanskrit: Samali, rakta-pushpa, Kattu-Imbal, Karpushpa, Niryasaha (gum), Pachha (gum)
- Hindi: Semul, Shembal, Kaantisenbal, Mocharas (gum), Supari kaphul (gum)
- Bengali: Simul, Shembal, Simbal, Senur
- Bombay: Seml, Savara
- Marathi: Saur, Simlo, Samar, Ratoshemalo, Semul
- Gujrat: Sawar, Simlio, Shemalo
- Telgu: Booruga, Konda-booruga, Pula, Salmalai, Mocha-ras (gum)
- Tamil: Mullilavu, iilavam, Pula-maram, Mocha-ras (gum)
- Kannad: Booruga, Kempubooruga
- Malaya: Mullilavau, Mullila-pula, Mallu-buragamara
- Oriya: Bouro, Buroh
- English: Red silk cotton-tree, Cotton tree
- French: *Bombax de Malabar*
- Unani: Murghmocha, Sebhah, Semal, Mochras (gum)
- Urdu: Sembhal, Mochra (gum), Sebhalkagond (gum)

Distribution

It is distributed throughout the hotter parts of India, Ceylon and Malaya. This plant is common in higher altitude up to 1350m-1500m throughout India. Also found from India and Southern China to Australia (Anonymous, 1972; Ambasta et al., 1986; Hussain A, 1992; Ghani N, 1971; Satyawati, 1976; Thakur et al., 1989)

Botanical Description

The plant is a lofty, deciduous, buttressed tree with stout hard prickles at the base, attaining a height up to 40 m and girth upto 6 m or more. The trees in full bloom present a striking blaze of colour and are grown in the avenues (Anonymous, 1972). At the end of winter season this tree is very remarkable object, being entirely destitute of leaves, and loaded with large flowers followed by capsules (Anonymous, 1972; Ambasta et al., 1986; Dymock, 1976; Thakur et al., 1989)

Stem: Base of the trunk is buttressed, the branches are in whorls (Anonymous, 1972; Ambasta et al., 1986; Dymock, 1976; Thakur et al., 1989)

Leaves: Leaves digitate and large, leaflets 3-7 in number entire, 7.5-18 cm long, glabrous, penninerved, reticulately veined, lanceolate or oval, cuspidate, acute at the base, petioles 20 cm long, glabrous, stipules small, triangular and caduceus (Anonymous, 1972; Ambasta et al., 1986)

Flowers: They are 10-15 cm in diameter, crimson (red) yellow or orange coloured and fleshy before new leaves appeared,

numerous, clustered at the end of branches, cup-shaped (Kirtikar and Basu, 1987; Anonymous, 1972; Dymock, 1976; Thakur et al., 1989)

Calyx: Thick usually 3-lobed, lobes are rounded, densely silky within, glabrous (Kirtikar and Basu, 1987; Anonymous, 1972; Dymock, 1976; Thakur et al., 1989)

Corolla: Bright red, tomentose on the outside, sparingly pubescent within, petals are elliptic-oblong, recurved with close parallel veins (Kirtikar and Basu, 1987; Anonymous, 1972; Dymock, 1976; Thakur et al., 1989)

Stamens: They are more than 60, arranged in 5 bundles of about 9-12 each, and in inner bundle the 5 innermost are longest, filaments are flattened, slightly pubescent and about more than half as long as the petals, connate only at the base of bundles (Kirtikar and Basu, 1987)

Ovary: Conical, glabrous, style little longer than stamen, stigma 5, linear, 6 mm long (Kirtikar and Basu, 1987)

Capsule: Egg shaped, green, containing brown seed (wt about 4-5th wt of a grain), and a quantity of fine silky cotton 20. Capsules are 100000000000-12.5 cm long, ovoid, dirty brown in colour, 5-valved, lined within with white silky hairs (Kirtikar and Basu, 1987; Thakur et al., 1989)

Roots: Young roots are yellowish white in colour when bark has been removed, soft mucilaginous (Dymock, 1976).

MORPHOLOGY

Macroscopic: The gum of *Salmalia malabarica* (DC) Schott & Endl. is amorphous, opaque, solid, brick-red to black in colour. The pieces are irregular and of different sizes varying from 2.5-5.0 cm long. The surface is quite smooth and shiny and sometimes a small portion of bark is attached. The odour is slightly pungent and taste is acrid. Fracture is hard, difficult to break but brittle.

Microscopic: The powder of the crude drug shows the presence of abundant brick-red granules of different sizes. During the investigation different tissues are also reported. Among these fragments of tissues, cork cells are found in abundance. In surface view the cork cells are hexagonal to polygonal or oval with slightly thickened wall containing reddish brown contents and they are of 54.00-94.50 x 18.00-54.00 micron in size. These cells show the presence of tannins with ferric chloride solution. The fibres are also studied but lesser in number and they are large and usually found fragmented. They occur singly or occasionally in groups of two or three. Individual fibres are fusiform with bluntly pointed ends; the walls are straight, thickened and lignified with somewhat uneven lumen and few inconspicuous pits and of 288.00-738.00 x 10.00-18.00 micron in size. The starch grains are numerous, oval to round, simple, 4.00-9.00 micron in length and are found singly or in groups (Anonymous, 1997)..

PHYTOCHEMISTRY

The chemical compounds have been secluded from different

parts of *B. ceiba*. These belongs to steroids, flavonoids, phenolics, sesquiterpenoids, neolignans and naphthoquinones.

Root bark	8 compound
Stem bark	3 compound
Heart wood	3 compound
Leaves	2 compound
Flowers	78 compound
Seeds	19 compound
Gum	11 compound

So many compounds have been isolated from its various parts, out of which some of them are bombamalosides, shamimicin, bombasin, bombamalones, bombasin 4-o-glucoside, and bombalin which have been isolated first time from any plant species (Jain and Verma, 2012). In a preliminary phytochemical study, roots have shown the presence of flavonoids, tannins, saponins, steroids, cardiac-glycosides, and phenols besides carbohydrates and amino acids (Jain V et al., 2011). The stem-bark contains Shamimicin, a flavanoid which was screened for its hypotensive activity in animal model (Saleem R et al., 2003). Methanolic extract of leaves has demonstrated presence of steroids, carbohydrates, tannins, triterpenoids, deoxy-sugar, flavonoids, and coumarin glycosides (Hossain E et al., 2011). Flowers have been shown to contain the β -d-glucoside of β -sitosterol, free β -sitosterol, hentriacontane, hentriacontanol, traces of an essential oil, kaempferol, and quercetin (Gopal and Gupta, 1972). Gum of *B. ceiba* contains a mixture of various sugars and gallic and tannic acids (Bose and Dutta, 1963).

Mizaj (Temperament): Cold ^{2°} Dry ^{3°} (Hakeem M.A, 2002). Cold ^{3°} Dry ^{3°} (Ghani N,1971; Kabiruddin, 1955).

Hissa Mustamela (Parts Used): Gum, root stem-bark, fruits, heartwood (Hakeem M.A)

Miqdare Khurak (Therapeutic Dose): 4-6gm (Hakeem M.A).3-5gm (Kabiruddin, 1955)

Mazarrat (Advere Effects): It increases Yabusat (dryness) (Hakeem M.A, 2002; Hakeem, 2009; Nabi, 2007). Muwallide Khilt Ghaleez (Procreator of thick humour)

Musleh (Correctives): followings are used as its correctives
Roghan gul (*Rosa damascena* oil) (Hakeem M.A, 2002)
Darchini (*Cinnamomum zeylanicum*) (Hakeem M.A, 2002; Nabi, 2007; Kabiruddin, 1955)
Shakar (Sugar) (Hakeem M.A, 2002; Nabi, 2007; Kabiruddin, 1955)
Roghan badam (*Prunus dulcis* oil) (Hakeem M.A, 2002; Nabi, 2007; Kabiruddin, 1955)

Badal (Substitute): Samage Dhaak (*Butea monosperma*) (Hakeem M.A, 2002; Nabi, 2007)
Mastagi (*Pistacia lentiscus*) (Hakeem M.A, 2002; Hakeem, 2009)
Post Darakhte Anar (*Pomegranate Bark*) (Anonymous, 1972)

Murakkabat (Compound Formulations): Majoon Mochras, Sufoof Sailan (Hakeem M.A, 2002; Hakeem, 2009)

PHARMACOLOGICAL ACTIONS

- Mulattif (Demulcent) (Anonymous,1972; Ambasta et al.,1986; Dymock,1976; Hussain, 1992; Satyawati, 1976; Thakur, 1989)
- Habissudam (Haemostatic) (Anonymous,1972; Hussain, 1992; Ghani N, 1971; Kabiruddin, 1955; Satyawati, 1976)
- Qabiz (Astringent) (Anonymous,1972; Hussain, 1992; Ghani N, 1971; Kabiruddin, 1955; Satyawati, 1976; Dymock,1976)
- Muqawwi (Tonic) (Kirtikar and Basu, 1994; Nadkarni, 1994; Anonymous,1972; Ambasta et al.,1986; Hussain, 1992)
- Mubaddil (Alterative) (Kirtikar and Basu, 1994; Anonymous,1972; Hussain, 1992; Hakeem,2002)
- Muqawwi Bah (Aphrodisiac) (Kirtikar and Basu, 1994; Nadkarni, 1994; Hussain, 1992; Ghani,1971)
- Qabize Urooq Damviya (Styptic) (Kirtikar and Basu, 1994; Nadkarni, 1994; Ambasta et al.,1986)
- Mulayyan (Laxative) (Hussain,1992)
- Muwallide Mani (Semen Procreator) (Hakeem, 2002)
- Mumsik Mani (Hakeem, 2002, Ghani N, 1971; Kabiruddin, 1955)
- Mujaffif (Siccative) (Ghani N,1971)
- Muqawwi Rehm (Uterine Tonic) (Ghani N,1971)
- Mughallize Mani (Semen Viscositor) (Hakeem, 2002, Ghani N, 1971; Kabiruddin, 1955)
- Habise Tams (Amenorrhoeic) (Nabi,2007)
- Muqawwi Asnan wa Lissa (Tonic to teeth) (Hakeem, 2002; Nabi,2007)
- Dafe Fasad Khoon wa Safra (Purifies blood and bile) (Hakeem, 2002; Nabi,2007)
- Muharrik (Stimulant) (Anonymous,1972)

THERAPEUTIC USES

- Ishaal (Diarrhoea) (Kirtikar and Basu, 1994; Nadkarni,1994; Anonymous, 1972; Dymock, 1976)
- Zaheer Muzmin (Chronic Dysentery) (Kirtikar and Basu, 1994; Nadkarni,1994; Anonymous, 1972; Dymock, 1976)
- Sailan-ur-Rehm (Vaginal Discharge) (Kirtikar and Basu, 1994; Nadkarni,1994; Anonymous, 1972; Dymock, 1976)
- Qulaud Dahn (Stomatitis) (Kirtikar and Basu, 1994; Hakeem,2002)
- Hirkatul Baul (Burning Micturition) (Kirtikar and Basu, 1994; Hakeem, 2002; Kabiruddin M,1955)
- Amraze Fasad Balgham wa Safra (Diseases of Bile and Phelgm) (Kabiruddin M,1955)
- Nafsud Dam (Haemoptysis) (Anonymous,1972)
- Baul Fil Firash (Bed Wetting) (Kabiruddin M,1955)
- Sulsul Baul (Dribbling of Urine) (Kabiruddin M,1955)
- Kasrate Tams (Menorrhagia) (Kabiruddin M,1955)
- Jiryaane Mani (Spermatorrhoea) (Ghani,1917)
- Tahreeke Dandaan (Loosen Tooth) (Kabiruddin M,1955; Kabiruddin M,1955)
- Lissae Damia (Bleeding Gums) (Ghani,1917)

- Amraze Dam (Blood Diseases) (Kirtikar and Basu, 1994)

PHARMACOLOGICAL STUDIES

- Antimicrobial activity (Hussain, 1992)
- Antibacterial activity (Hakeem, 2002)
- Antioxidant activity (Hakeem, 2002; Nabi, 2007; Ghani N, 1971; Khan M.A, 1303; Nadkarni, 1994)
- Cancer cell growth inhibition (Kabiruddin, 1955)
- Antibecity (Yu YG et al, 2011)
- Antiachne activity (Tundia R et al., 2014)
- Analgesic activity (Dar A et al., 2005)
- Cardioprotective activity (Lin CC et al., 1992)
- Aphrodisiac (Surveswaran S et al., 2007)
- Antihyperglycemic and Antihyperlipidemic Activity (Thakur R.S., 1989)
- Hepatoprotective Activity (Satyawati, 1976)
- Antiangiogenic Activity (Khan A.R, 1290)
- Cytotoxicity (Patanakar SP, 2005)
- Antipyretic (Saleem R et al., 1999)
- Hypotensive and Hypoglycemic activity (Kumar NS, 2011)

ACKNOWLEDGEMENTS

None

CONFLICT OF INTEREST

The authors have no conflicting financial interests.

REFERENCES

Ambasta SP. The useful plants of India Public information Directorate (P.I.D). (New Delhi, India: Publication & Information Directorate and C.S.I.R), 1986, pp.50, 76,77,124,375,690.

Anonymous, Wealth of India, 1972, pp.175-183.

Anonymous. Standardisation of single drugs of Unani medicine, Part 3. CCRUM, Ministry of Health and Family Welfare, Govt of India. 1997, pp.218-220.

Bhargava C, Thakur M, Yadav SK. Effect of *Bombaxceiba* L. on spermatogenesis, sexual behaviour and erectile function in male rats. *Andrologia*. 2012;44 Suppl 1:474-8.

Bose S, Dutta AS. Structure of *Salmaliamalabarica* gum. I. Nature of sugars present and the structure of aldobiuronic acid. *J Indian Chem Soc.* 1963a;40:257-62.

Bose S, Dutta AS. The structure of *Salmaliamalabarica* gum. II. Structure of the degraded gum. *J Indian Chem Soc.* 1963b;40:557-61.

Chakraborty DD, Ravi V, Chakraborty P. Phytochemical Evaluation and TLC Protocol of Various Extracts of

BombaxCeibalinn., International Journal of Pharmaceutical Sciences and Research. 2010;1(8):66-73.

Dar A, Faizi S, Naqvi S, Roome T, Zikr-ur-Rehman S, Ali M, Firdous S, Moin ST. Analgesic and antioxidant activity of mangiferin and its derivatives: The structure activity relationship. *Biol Pharm Bull.* 2005;28:596-600.

De D, Ali KM, Chatterjee K, Bera TK, Ghosh D. Antihyperglycemic and antihyperlipidemic effects of n-hexane fraction from the hydro-methanolic extract of sepals of *Salmaliamalabarica* in streptozotocin-induced diabetic rats. *J Complement Integr Med.* 2012;9: Article 12.

Dymock, W., Warden, C.J.H. and Hooper, D. 1976 *Pharmacographia India* M/S Bishan Singh, Mahender Pal Singh, Dehradun, vol 1,2,3 pp.215-218,362-365, 522-532, 311-313.

Ghani N. *Khazainul Advia*. Vol. 1. (New Delhi, India: Idara Kitabus Shifa), 1971.

Gopal H, Gupta RK. Chemical constituents of *Salmaliamalabarica* schott and endl. flowers. *J Pharm Sci* . 1972;61:807-8.

Government of the Health and Family Welfare. The Ayurvedic Pharmacopoeia of India. Part I. Vol. 3. (New Delhi, India: Government of the Health and Family Welfare), 2007. pp. 183-4.

Gupta P, Goyal R, Chauhan Y, Sharma PL. Possible modulation of FAS and PTP-1B signaling in ameliorative potential of *Bombaxceiba* against high fat diet induced obesity. *Complement Altern Med*, 2013;13:281.

Hakeem MA. *Bustanulmufradat*, (New Delhi, India: Idara Kitabus Shifa), 2002.

Hakeem MAH. *Mufradat Azezi*. (New Delhi, India: CCRUM), 2009.

Hossain E, Mandal SC, Gupta JK. Phytochemical screening and in vivo antipyretic activity of the methanol leaf-extract of *Bombaxmalabaricum* DC (Bombacaceae). *Trop J Pharm Res.* 2011;10:55-60.

Hussain A. *Dictionary of India Medicinal Plant*. (Lucknow, India: Central Institute of Medicinal and Aromatic Plants), 1992, pp. 43,44,81,130,302,303,495.

Jain V, Verma SK, Katewa SS, Anandjiwala S, Singh B. Free radical scavenging property of *Bombaxceiba* Linn. *Root. Res J Med Plants.* 2011;5:462-70.

Jain V, Verma SK. *Pharmacology of Bombaxceiba*. (Heidelberg, Germany: Springer), 2012.

Kabiruddin, H., 1955. *Makhzanul Mufradat (Urdu)*. Lahore, Pakistan: Sheikh Mohammad Bashir and Sons. Vol.2. pp. 216, 325-326, 370,371,285.

Kirtikar K, Basu B. *Indian Medicinal Plants*. 2nd ed., Vol. 1. (New Delhi, India: BH Publishing Co.), 1994. pp. 1401.

- Krishanaraju AV, Rao TVN, Sundararaju D, Yanisree M, Tsay HS, Subbaraju GV. Assessment of Bioactivity of Indian Medicinal Plants using Brine Shrimp (*Artemiasalina*) Lethality Assay. *IJASE*. 2005;3(2):125-134.
- Kumar NS. Evaluation of RBC Membrane stabilization and antioxidant activity of Bombaxceibain an in vitro method. *Int J Pharm Bio Sci*. 2011;2:220-226.
- Lin CC, Chen SY, Lin JM, Chiu HF. The pharmacological and pathological studies on Taiwan folk medicine (VIII): The anti-inflammatory and liver protective effects of 'mu-mien'. *Am J Chin Med*, 1992;20:135-46.
- Nabi MG. Makhzanemufradatwamurakkabat. (New Delhi, India: CCRUM), 2007.
- Nadkarni KM. Indian Material Medica. Vol. 2. (Bombay, India: Popular Prakashan Ltd.), 1994.
- Patanakar SP. Phytochemical Investigation and Pharmacological Evaluation of Aerial Parts of *Salmaliamalabarica*. Schott and Endl. For Antiacne Activity, M. Pharma Dissertation. (Bangalore, India: Rajiv Gandhi University of Health Sciences), 2005.
- Patel SS, Verma NK, Rathore B, Nayak G, Singhai AK, Singh P. Cardioprotective effect of Bombaxceiba flowers against acute adriamycin-induced myocardial infarction in rats. *Rev. Bras. Farmacogn*. 2011;21:704-9.
- Rani P, Khullar N. Antimicrobial evaluation of some medicinal plants for their anti-enteric potential against multi-drug resistant *Salmonella typhi*. *Phytother Res*. 2004;18:670-3.
- Ravichandran G, Bharadwaj VS, Kolhapure SA. Evaluation of efficacy and safety of acne-N-pimple cream in acne vulgaris. *The Antiseptic* 2004;101:249-54.
- Said A, Aboutable EA, Nofal SM, Tokuda H, Raslan M. Phytoconstituents and bioactivity evaluation of Bombaxceiba L. Flowers. *J Tradit Med*. 2011;28:55-62.
- Saleem R, Ahmad M, Hussain SA, Qazi AM, Ahmad SI, Qazi MH, Ali M, Faizi S, Akhtar S, Husnain SN. Hypotensive, hypoglycaemic and toxicological studies on the flavonol C-glycoside shamimin from Bombaxceiba. *Planta Med*. 1999;65:331-334.
- Saleem R, Ahmad SI, Ahmed M, Faizi Z, Zikr-ur-Rehman S, Ali M, Faizi S. Hypotensive activity and toxicology of constituents from Bombaxceiba stem bark. *Biol Pharm Bull*. 2003;26:41-6.
- Satyavati GV, Gupta AK, Tandon SN, Seth SD. Medicinal Plants of India, (New Delhi, India: Indian council of Medicinal research), 1976, pp.82,84,144,145.
- Shyur LF, Tsung JH, Chen JH, Chiu CY, Lo CP. Antioxidant properties of extracts from medicinal plants popularly used in Taiwan. *Int J ApplSci Eng* 2005; 3:195-202.
- Singh MP, Panda H. Medicinal Herbs and their Formulations. Vol. 1. (New Delhi, India: Daya Publishing House), 2005, pp.176-8.
- Singh MP, Panda H. Medicinal herbs with their formulation, New Delhi: India, Daya publishing house), 2005, pp.176-77.
- Surveswaran S, Cai YZ, Corke H, Sun M. Systematic evaluation of natural phenolic antioxidants from 133 Indian medicinal plants. *Food Chem*. 2007;102:938-53.
- Thakur RS, Puri HS, Husain A. Major Medicinal Plants of India. (Lucknow, India: Central of Institute of Medicinal and Aromatic Plants), 1989, pp.120-122,170-172,347-348, 536-538.
- Tundis R, Rashed K, Said A, Menichini F, Loizzo MR. In vitro cancer cell growth inhibition and antioxidant activity of Bombaxceiba (*Bombacaceae*) flower extracts. *Nat Prod Commun*. 2014; 9:691-4.
- Vaghasiya Y, Chanda S. Screening of same traditionally used Indian plants for antibacterial activity against *Klebsiella pneumonia*. *J Herbal Med Toxicol*. 2009;3:161-64.
- Wahab S, Hussain A, Farooqui AHA, Hussain MP, Hussain MS, Rizvi A, Ahmad MF, Ansari NH. In vivo Antioxidant and Immunomodulatory Activity of BombaxceibaBark - Focusing on its Invigorating Effects. *American Journal of Advanced Drug Delivery*. 2014; 2(1):1-13.
- Williamson EM. Major Herbs of Ayurveda. (Edinburgh, Scotland: Churchill Livingstone Publisher), 2002. pp.261.
- You YJ, Nam NH, Kim Y, Bae KH, Ahn BZ. Antiangiogenic activity of lupeol from Bombaxceiba. *Phytother Res*. 2003;17:341-4.
- Yu YG, He QT, Yuan K, Xiao XL, Li XF, Liu DM, Wu H. In vitro antioxidant activity of Bombaxmalabaricum flower extracts. *Pharm Biol*. 2011; 49:569-76.