INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

Research Article

To Develop Formulation and Evaluation of *Bombax Ceiba* Flowers Avaleha

Minal Thawari*[1], Jija Lode[2], Kishoree Patharkar[3], Mayuri Manjekar[4], Payal Dongre[5]

[1,2,3,4] *Department of Pharmaceutical Science, Siddhivinayak College of Pharmacy, Warora, Chandrapur, Maharashtra, India 442914*
[5] *Department of Pharmaceutical Science, Sai College of Pharmacy Mangli Tumsar, Bhandara, Maharashtra, India 441912*

ARTICLE INFO
Published: 24 Jul. 2025
Keywords:
Avaleha, Bombax ceiba, Herbal formulation, Medicinal plant, Phytochemicals, Bombacaceae, Health supplement, Anti-helminthic activity
DOI:
10.5281/zenodo.16411752

ABSTRACT

Avaleha is a traditional Ayurvedic formulation prepared as a semi-solid dosage form, rich in nutrients, herbs, and essential minerals. It plays a significant role in promoting health and managing various ailments. In recent years, the relevance of such formulations in preventive and therapeutic applications has grown considerably. Bombax ceiba, commonly known as the silk cotton tree, has long been used in Ayurveda due to its valuable pharmacological properties. This plant, belonging to the family Bombacaceae, is often referred to as kapok or mocha. Its flowers and bark have demonstrated effectiveness in managing conditions such as cholera, tuberculosis, urinary tract infections, and cough. Decoctions made from the bark are traditionally used for treating fever, while the heartwood is advised for diabetic individuals. The formulation was tested for quality (like ash value, moisture content) and phytochemicals such as bombic acid and gallic acid were found. These compounds may improve alertness, concentration, and even help fight parasitic infections, showing its potential use for students and general wellness.

INTRODUCTION

Plants are often referred to as nature's biochemical laboratories due to their ability to synthesize a wide range of compounds. While they produce essential nutrients like carbohydrates, proteins, and lipids necessary for human nutrition, they also generate a variety of secondary metabolites, such as glycosides, alkaloids, and tannins. These secondary compounds often exhibit significant therapeutic properties. Bombax ceiba is one such medicinal plant that has gained attention for its

***Corresponding Author:** Minal Thawari
Address: *Department of Pharmaceutical Science, Siddhivinayak College of Pharmacy, Warora, Chandrapur, Maharashtra, India 442914*
Email : sujatasamant1357@gmail.com
Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

multiple health benefits. Research has shown that extracts from Bombax ceiba possess anti-diabetic properties, primarily due to their inhibitory effect on digestive enzymes such as alpha-amylase and alpha-glucosidase. Particularly, extracts from the plant's flowers and thalamus show higher inhibition in comparison to other solvent extracts[1].

For centuries, plants have played a crucial role in traditional medicine systems around the world. Due to increasing global interest in natural remedies, there is growing demand for plant-derived health products such as medicines, supplements, and cosmetics. Bombax ceiba Linn. (family: Bombacaceae), a large deciduous tree found in India, Sri Lanka, and Southeast Asia, is traditionally used to treat a variety of ailments. Almost all parts of this plant—including roots, bark, gum, leaves, flowers, and seeds—are known for their therapeutic uses. Literature reports suggest that this plant has astringent, cooling, stimulant, diuretic, aphrodisiac, and tonic properties. It has also shown potential in managing dysentery[2].

Furthermore, Bombax ceiba has demonstrated numerous pharmacological activities. These include anti-inflammatory, hepatoprotective, antioxidant, antimicrobial, analgesic, anti-HIV, and anti-Helicobacter pylori actions. Its extracts are known to contain beneficial compounds like naphthol derivatives, polysaccharides, anthocyanins, shamimin, and lupeol.

One of the primary uses of this plant is in combating helminthic infections, which are caused by parasitic worms affecting the gastrointestinal system and other organs. Conditions such as roundworm, whipworm, and hookworm infections can lead to symptoms like abdominal pain, vomiting, nausea, and diarrhea. Conventional anthelmintic drugs, while effective, often come with adverse effects such as headaches, loss of appetite, hair loss, and drug resistance upon prolonged use.

Considering these challenges, the exploration of plant-based alternatives for deworming is both timely and necessary. Herbal formulations may offer safer, more accessible, and cost-effective treatment options with minimal side effects. According to the World Health Organization (WHO), nearly 75% of the world's population relies on traditional herbal remedies to meet their healthcare needs, emphasizing the importance of developing plant-based anthelmintic agents[3]. Among its many pharmacological benefits, Bombax ceiba is especially noted for its antiparasitic (anthelmintic) potential. Moreover, ongoing studies continue to highlight its anti-inflammatory action. The present study aims to investigate these properties in detail.

Phytochemical Constituents

Bombax ceiba flower extracts contain important compounds:

- **Polyphenols:** Highest in ethanol and water extracts.
- **Flavonoids:** Found in ethyl acetate, hexane, and acetone extracts.
- **Tannins:** Most concentrated in water extracts.
- **Antioxidant & Anti-inflammatory Activity**
  - **Antioxidant:** Ethanol and water extracts show strong free radical scavenging (antioxidant) activity.
  - **Anti-inflammatory**: Ethyl acetate extract significantly inhibits nitric oxide, showing good anti-inflammatory potential[4]

About Avaleha & Its Importance

1. Avaleha is a semi-solid Ayurvedic formulation made by boiling herbs and mixing with jaggery or honey.
2. It enhances absorption and taste, making it both therapeutic and palatable.
3. In this study, Bombax ceiba was used due to its antibacterial, antioxidant, and anti-inflammatory benefits.
4. The formulation helps in boosting health and managing common infections naturally.

PLANT PROFILE

- **Plant Name:** Bombax ceiba
- **Scientific Name:** Ceiba pentandra Linn
- **Common Name:** Red Silk Cotton Tree
- **Kingdom:** Plantae
- **Division:** Magnoliophyta
- **Class:** Magnoliopsida
- **Order:** Malvales
- **Family:** Malvaceae
- **Genus:** Bombax
- **Species:** B. ceiba
- **Binomial Name:** Bombax ceiba Linn.,
- **Synonym:** Salmalia malabarica

Fig. 01: Bombax Ceiba Flowers

DESCRIPTION OF PLANT

Bombax ceiba is a tall deciduous tree that typically grows up to 20 meters in height, although older trees can reach as much as 60 meters. It thrives in tropical climates. In its younger stages, the trunk and branches bear sharp conical spines which gradually wear off with age. The leaves are compound and palmate, generally made up of six leaflets that radiate from the tip of the petiole. These leaflets range in size from 7–10 cm in width and 13–15 cm in length, with smaller ones ranging from 5 to 6 cm.

Its petiole (leaf stalk) can extend up to 20 cm (8 inches), while the tree's flowers, either solitary or in small clusters, appear at the tips or sides of the branches. When in bloom, the tree sheds its leaves, showcasing bright red flowers. The petals, which can reach up to 12 cm in length, are cup-shaped with three to five lobes. Each lobe measures approximately 3–5 cm in diameter. The stamens are grouped into five clusters, each containing more than 60 stamens. The style measures about 9 cm long, and the stigma is deep red. The ovary is pink in color, measuring about 1.5–2 cm in length and covered with fine white hairs.

Fruits are elongated, oval-shaped capsules containing numerous seeds enveloped in a silky white fiber. Each fruit grows to about 13 cm in length. The unripe fruit is greenish, turning brown as it matures. This species is commonly found in countries across South and Southeast Asia, including India, Myanmar, Thailand, Malaysia, Vietnam, and Indonesia. It is frequently planted along roadsides and in public gardens due to its vibrant red flowers, which bloom from March to April.

PHYTOCONSTITUENTS

Bombax ceiba is rich in a variety of phytochemicals that contribute to its medicinal properties. These include: Polyphenols, Flavonoids, Carotenoids, Coumarins, Saponins, Tannins, Phenolic acids, Isoflavones, Lignans, Anthraquinones, Procyanidins, Stilbenoids, Ginsenosides, and others.

These compounds exhibit several pharmacological actions such as antioxidant, anti-inflammatory, antimicrobial, and hepatoprotective effects, making the plant highly beneficial for herbal drug formulations.

Phytochemicals in the Leaves: Preliminary screening of Bombax ceiba leaves confirms the presence of glycosides, phenolic compounds, flavonoids, saponins, carbohydrates, and proteins. Specifically, the leaves have been found to contain flavonol C-glycoside and shamimin, a known bioactive constituent[10,11].

Phytochemicals in the Flowers: The flowers of Bombax ceiba contain complex polysaccharides. These include chains of β(1→4)-linked D-galactopyranose and β(1→3)-linked L-arabinopyranose units, which are further connected to terminal sugars like α-linked D-galactose, α-linked L-rhamnose, and L-arabinose. These sugar chains are considered valuable for their biological functions[13]

Phytochemicals in the Seeds: Seeds of Bombax ceiba yield significant bioactive compounds such as N-hexacosanol and palmitic acid. In addition, the seed oil has been found to contain phytosterols, stearic acid, linoleic acid, oleic acid, and enzymes like lipase[12].

ETHNOBOTANICAL USES

1. Traditionally used to reduce symptoms of nausea, hyperacidity, dyspepsia, flatulence, and vomiting.
2. Possesses anthelmintic (anti-parasitic) activity, particularly effective against intestinal worms.
3. Applied in the treatment of skin-related conditions and infections.
4. The bark is boiled and consumed as a decoction to manage fever.
5. Widely used in managing diseases such as cholera, tuberculosis, urinary infections, nocturnal emissions, and impotency.
6. Decoction of the bark is also used as a natural remedy for constipation[14,16]

METHODOLOGY

- **pH Determination**

The pH of the Avaleha was measured using a benchtop digital pH meter.

- **Raw Material Testing**

Ash Value: Refers to the inorganic residue left after ignition of the sample. For Avaleha preparations, this should not exceed 2% as per Ayurvedic pharmacopoeia standards.

Loss on Drying: This test determines the moisture content by heating the sample until a constant weight is achieved. It reflects the percentage of water and volatile matter present in the sample.

EXTRACTIVE VALUES

a) **Alcoholic Extract Procedure:** The powdered plant material is soaked in ethanol. After 24 hours, the mixture is filtered using standard filtration methods (filter paper and funnel).The clear filtrate is then separated and used for analysis[17]

Fig 02: Bombax ceiba in alcoholic extract

b) **Aqueous Extract Procedure:** 100 ml of distilled water is mixed with 2 g of *Bombax ceiba* powder.The mixture is heated for 30 minutes in a water bath.After cooling, it is filtered and used for further tests[17]

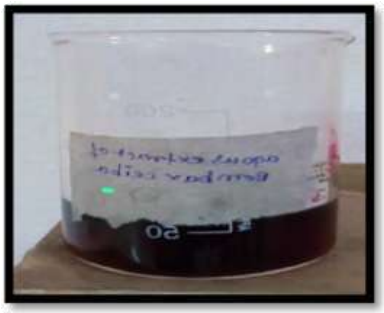


Fig 03: Bombax ceiba in Water extract

PRELIMINARY PHYTOCONSTITUENT EVALUATION

- **Tests for Alkaloids**

a) Wagner's Test: A small amount of extract was treated with 3–5 drops of Wagner's reagent (a mixture of iodine and potassium iodide). The appearance of a reddish-brown precipitate indicated the presence of alkaloids.

b) Mayer's Test: Few drops of Mayer's reagent were added to 1 mL of the extract. Formation of a pale yellow precipitate confirmed the presence of alkaloids.

c) Dragendorff's Test: The extract was treated with Dragendorff's reagent. A reddish or orange precipitate suggested alkaloid content.

d) Hager's Test: The extract was tested with Hager's reagent. A yellow precipitate indicated the presence of alkaloids[11,17].

- **Tests for Carbohydrates**

a) Molisch's Test: A drop of alcoholic α-naphthol was added to the extract. When concentrated sulfuric acid was gently added along the sides of the test tube, a violet ring formed at the interface, indicating carbohydrates.

b) Benedict's Test: The extract was treated with Benedict's reagent and gently heated in a water bath. Formation of a brick-red or orange precipitate confirmed the presence of reducing sugars.

c) Fehling's Test: Equal parts of Fehling's solution A and B were mixed with the extract and heated. A red precipitate signified the presence of sugars[11,17].

PHARMACEUTICAL EVALUATIONS

Method of Preparation of Avaleha:

The Avaleha was prepared by first collecting fresh Bombax ceiba flowers, washing them thoroughly, and drying them in shade for several days. Once completely dry, the flowers were ground into a fine powder.

To prepare the Avaleha, 20 g of Bombax ceiba flower powder was mixed with 100 g of jaggery. The mixture was heated gently to achieve a uniform blend. Flavoring agents such as cardamom, clove, and beetroot (as a natural coloring agent) were added to improve taste and appearance. Heating continued until a thick, semi-solid consistency was achieved. The final product was then allowed to cool and stored in an airtight container[18].

Evaluation Parameters:

1. pH: The formulation showed a neutral pH, indicating it is gentle for internal use.

2. Moisture Content: Moisture levels were determined to assess the stability of the product. According to comparative studies, Avaleh prepared using Humdard brand (15.29%) had the

lowest moisture content, followed by Himani Sonachandi (16.71%) and Dabur (17.28%).

Formula used:

Moisture Content (%) = (W − d) / W × 100

Where:

W = Weight before drying

d = Weight after drying

3. Spoon Test: The Avaleha passed the spoon test, showing it retained proper semi-solid consistency and stickiness, indicating correct preparation. It has become a popular choice, especially during the pandemic, as a natural health-supporting formulation free from harmful additives[18].

Fig 04: Spoon Test

TLC VALUE

After determination of extractive value of different value of different samples of Avaleha these extracts were further dissolved in 0.5 ml of their respective solvents and 10 microlitre of each sample was applied on thin layer chromatography plates manually. With the help of TLC chamber, the TLC patterns were observed in 0the solvent system

(a) toluene: ethyl acetate: methanol 80:20:10 and solvent system.

(b) Methanol, 12. The chromatograms were visualized under 254 nm and 365 nm[19]

Rf value is the ratio of distance travelled by solute and distance travelled by solvent.

R_f = distance travelled by solute / distance travelled by solvent.

Standard R_f value = 0.75

Fig.05:TLC for Avaleha

RESULTS

PHARMACEUTICAL PROPERTIES

Table no. 01:Organoleptic properties of formulation

Sr. No.	Properties	In-house formulation
1.	Colour	Brown
2.	Odour	Characteristics/ pleasant
3.	Appearance	Semi-solid

Table no. 02: Physicochemical properties of *Bombax Ceiba.*

Sr. No.	Parameters	Result
1.	Percentage Ash Value	09%
2.	Loss on Drying (Moisture Content)	14.2%
3.	Extractive Value (For Alcoholic Extract)	63.5%
4.	Extractive Value (For Aqueous Extract)	130%

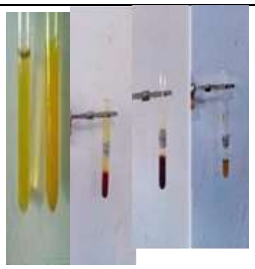
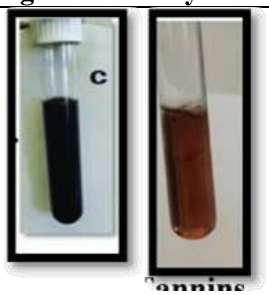
Table no. 03:Pharmaceutical parameters of in-house formulation.

Sr. No.	Parameters	In-house Formulation (F_1)	Marketed Formulation (F_2)
1.	Ph	Basic	Slightly acid
2.	Viscosity	Thick	Thick
3.	Homogeneity	Good	Better
4.	Appearance	Not change in colour	Not change in colour
5.	Thermal stabilities	Stable at 45º c ± 48 Hrs	Stable at 45 º c ± 45 Hrs

Table no. 04:Thin Layer Chromatography of *Bombax Ceiba* flower for Avaleha.

Sr. No.	Stationary phase	Mobile phase	Rf
1.	Silica gel G	Methanol:Toluene: Dichloromethane (1:2:1)	0.75

Table no. 05:Physicochemical Screening of *Bombax Ceiba*

Sr. No.	Plant Constituents	Test Regent	Aqueous Extract	Ethanolic Extract	Diagrams
1.	Alkaloids	1. Dragendorff's reagent 2. Wagner's reagent 3. Mayer's reagent 4. Hager's reagent	+ + + +	+ + + +	 Fig 06: Alkaloids
2.	Carbohydrates	1. Molish's test 2. Fehling's test	+ +	+ +	 Fig 07: Carbohydrates
3.	Tannins	1. Ferric chloride test 2. Led acecate test	+ +	+ +	 Fig 08: Tannins
4.	Flavonoids	Shinoda test	+	+	 Fig 09: Flavonoids
5.	Proteins	Biuret reagent	+	+	 Fig 10: Proteins

6.	**Ammonia**	**Ninhydrin**	+	+	 **Fig 11: Ammonia**

(+) indicate Test positive & (-) indicate Test negative.

DISCUSSION AND SUMMARY

In present research work attempts were made for developing a quality control profiling of Avaleha formulation along with evaluation and under the study of helminthics activity. Estimation of various quantative parameters which will help using setting standard for a particular product where these standard might prove beneficial for identification and characterization of that particular drug formulation. With the help of these standards one can maintain quality and purity of that particular drug and its formulation prevent it from being adulterated by drug of same genus or other species having low potency. Its present study deals with phytochemical investigation of bombax ceiba flower including determination of loss on drying, ash value, and extractive value.

The different medicinal plant, such as arid zone plants, herbal plants and some shrubs have potential role in the prevention and treatment of various health ailments. This tree is rich in phytochemicals. Extract have confirmed the presence the presence of alkaloids, flavonoids, glycosides, coumarins, protein and amino acids. It has numerous documented effects, some of which are anti- inflammatory, antimicrobial, antidiabetic and hypotensive.

Avaleha is an ayurvedic health supplement which is made up of a super- concentrated blend of nutrient- rich herbs and minerals. It is formulated by processing around 50 medicinal herbs and their extracts, including the prime ingredients. Avaleha possesses multiple health benefits and has been widely used since ancient times as a health supplement as a medicine for enhancing immunity.

Avalehaha been a part of every Indian life from the day it was introduced, irrespective of socio culture, political and scientific factors. It was one of the most appreciate foods for its antiaging effects long before vitamins minerals and antioxidant. It is also beneficial to in asthma, diarrhoea, wound healing and tuberculosis. This research is an attempt to discuss the various ethnobotanical and traditional uses along with reported phytochemical and pharmacological activities of *bombax ceiba.*

CONCLUSION

The above literature survey revealed that bombax ceiba L. contain so much medicinal properties. It is used in many herbal formulation and traditional medicine system. It contains many phytoconstituents which show great medical properties. Bombax ceiba shows antioxidant, diuretic, anti-leprosy. It is used in treatment in blood purifier, inflammation and shows the antimicrobial, analgesic property.

The whole plant of bombax ceiba is very useful, barks, roots, flowers, and seeds have lots of chemical constituents. Practical aspects show that the bombax ceiba is the king of herb. Thus, from phytochemical evaluation it can be conclude that, the formulation in the present investigation shows

good. Pharmaceutical properties and the various investigation study of bombax ceiba shows a good anti helminthic activity. Hence it will act as a referential data can be useful performing human trials for anti-helminthic activity of the formulation.

REFERENCES

1. Mir MA, Mir BA, Bisht A, Rao Z, Singh D. Antidiabetic properties and metal analysis of Bombax ceiba flower extracts. Glob. J. Addict. Rehabil. Med. 2017;1:1-7.
2. Chaudhary PH, Tawar MG. Pharmacognostic and phytopharmacological overview on Bombax ceiba. Syst. Rev. Pharm. 2019 Jan 1;10(1):20-5.
3. Khokra, S. L., Gagat, S., Narang, R., &Devgun, M. (2020). Ex vivo: Anthelmintic evaluations of Bombax ceiba stem extract. International Journal of Pharmaceutical Sciences and Drug Research, 12(5), 431-436.
4. Nikita S, Shweta S. Ethnomedicinal, phytoconstituents and phytopharmacology of Bombax ceiba L. A review. Int. J. Pharmacogn. 2020;311:311-5.
5. Chaudhary PH, Khadabadi SS. Bombax ceiba Linn.: pharmacognosy, ethnobotany and phyto-pharmacology. Pharmacognosy Communications. 2012 Dec 19;2(3):2-9.
6. Joshi KR, Devkota HP, Yahara S. Chemical analysis of flowers of Bombax ceiba from Nepal. Natural Product Communications. 2013 May;8(5):1934578X1300800508.
7. Arafa AF, Foda DS, Mahmoud AH, Metwally NS, Farrag AR. Bombax ceiba flowers extract ameliorates hepatosteatosis induced by ethanol and relatively moderate fat diet in rats. Toxicology reports. 2019 Jan 1;6:401-8.
8. Rathore D, Srivastava R, Geetanjali G, Singh R. Phytochemical screening, antioxidant and antibacterial activities of Bombax ceiba flower.
9. Jaffar HM, Rizwan B, Sukhera S, Noreen S, Koser N, Islam Z, Batool SA. A comprehensive review on therapeutic properties of Bombax ceiba: therapeutic properties of Bombax ceiba. Pakistan BioMedical Journal. 2023 Apr 30:08-15.
10. Karole S, Gautam GK, Gupta S. Physicochemical, qualitative and quantitative phytochemical analysis of the leaf and bark of Bombax ceiba L (Red Silk Cotton Tree). Journal of Drug Delivery and Therapeutics. 2018 Nov 2;8(6-S):105-.
11. Shukla RK, Nandan K, Shukla A, Kaur A. Phytochemical analysis and nutritive value of Bombax ceiba Linn.(petals). Plant Archives (09725210). 2020 Apr 1;20(1).
12. Kumari S, Kumari A, Ambastha S, Perween Z, Patnaik A, Sharan L. Pharmacological attributes of Bombax ceiba L. Paripex-Indian Journal of Research. 2022;11(3):69-71.
13. Kumari K. Phytochemical and Pharmacological Overview of Bombax ceiba Flowers.
14. Srivastava M, Shanker K. Duranta erecta Linn: A critical review on phytochemistry, traditional uses, pharmacology, and toxicity from phytopharmaceutical perspective. Journal of Ethnopharmacology. 2022 Jul 15;293:115274.
15. Chaudhary PH, Khadabadi SS. Bombax ceiba Linn.: pharmacognosy, ethnobotany and phyto-pharmacology. Pharmacognosy Communications. 2012 Dec 19;2(3):2-9.
16. Anandarajagopal K, Sunilson JA, Ajaykumar TV, Ananth R, Kamal S. In-vitro anti-inflammatory evaluation of crude Bombax ceiba extracts.
17. Sharma R, Martins N, Kuca K, Chaudhary A, Kabra A, Rao MM, Prajapati PK. Chyawanprash: a traditional Indian bioactive health supplement. Biomolecules. 2019 Apr 26;9(5):161.

18. Rameshwar V, Kishor D, Tushar G, Siddharth G, Sudarshan G. A Pharmacognostic and pharmacological overview on Bombax ceiba. Sch Acad J Pharm. 2014;3(2):100-7.

HOW TO CITE: Minal Thawari, Jija Lode, Kishoree Patharkar, Mayuri Manjekar, Payal Dongre, To Develop Formulation and Evaluation of Bombax Ceiba Flowers Avaleha, Int. J. of Pharm. Sci., 2025, Vol 3, Issue 7, 3320-3329. https://doi.org/10.5281/zenodo.16411752