

A Review on Pharmacological Activity and Phytochemical Analysis of *Ceiba speciosa* (A. St-Hil.) Ravenna

Dr. S. R. Butle*¹, Mansi Lungase¹, Gopika Nawgaje¹, Tejasvi Tribhuwan¹, Shruti Waikar¹, Mayuresh Rajurkar¹, Neha Kulkarni²

¹Swami Ramanand Teerth Marathwada Nanded University, Nanded

²Government College of Pharmacy Karad Saidapur

ABSTRACT

Ceiba speciosa (formerly *Chorisia speciosa*), commonly known as the silk floss tree, is a species native to South America, widely recognized for its ornamental value and ecological significance. However, beyond its aesthetic appeal, *C. speciosa* has a rich history of traditional medicinal use and contains a diverse array of bioactive compounds. These plants are traditionally used for many health disorders, e.g., headache, fever, diabetes, diarrhea, parasitic infections, peptic ulcer and rheumatism. This review synthesizes current knowledge on the phytochemical composition and ethnopharmacological applications of *Ceiba speciosa*, highlighting its potential as a source of novel therapeutic agents. Phytochemical investigations reveal the presence of flavonoids, tannins, terpenoids, alkaloids, and phenolic compounds, which contribute to its reported antioxidant, antimicrobial, anti-inflammatory, and analgesic activities. Ethnopharmacological data indicate that various parts of the plant, including the bark, leaves, and flowers, have been traditionally used in the treatment of wounds, respiratory conditions, digestive disorders, and skin ailments in indigenous medicine. Despite its promising pharmacological potential, research on *C. speciosa* remains limited, particularly regarding the isolation of bioactive constituents, mechanism of action, and clinical validation. This review aims to bridge the knowledge gap, providing a foundation for future phytochemical and pharmacological research to explore its therapeutic potential more systematically. Expanding scientific understanding of *Ceiba speciosa* could contribute to the development of novel plant-based drugs and sustainable medicinal resources.

Keywords: *Ceiba speciosa* (A. St-Hil.) Ravenna, Ethnopharmacology, Phytochemicals, antioxidant, anti-inflammatory, analgesic

INTRODUCTION

Ceiba speciosa, also known as the *silk tree*, *floss-silk tree*, or *ceiba*, is a large, deciduous tree native to South America. It is famous for its striking appearance, which includes a spiny trunk, large colourful flowers, and cotton-like fibers that surround its seeds, giving the tree its name. The tree is not only valued for its aesthetic appeal but also for its cultural and medicinal uses in various regions. The species belongs to the *Malvaceae* family and has been traditionally utilized for a range of purposes, including in folk medicine and for producing products from its wood and fibers. It is also an important species for ecological balance in its native habitat, playing a role in the local ecosystem.

1.1 Botanical Description

Ceiba speciosa is a large tree, typically growing to heights of 10 to 30 meters, with a distinctive spiny, swollen trunk that helps in water storage, particularly in drier climates. The trunk is covered in conical, sharp spines that help protect it from herbivores. The tree has a broad, spreading crown that provides significant shade and has large, palmate leaves that are 5- to 7-lobed. The flowers of *Ceiba speciosa* are one of its most striking features. They are large, showy, and typically come in shades of white to pink, with five petals arranged in a funnel-shaped pattern. These flowers are a source of nectar for pollinators, including birds and insects. The tree also produces a distinctive fruit, which is a capsule that contains numerous seeds surrounded by cotton-like fibers, hence the term "floss-silk tree." The seeds of the tree are coated in soft, silky fibers that can be used to make lightweight textiles or as stuffing material in pillows.

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.



and cushions. The tree's ability to store water in its trunk allows it to survive in dry conditions, making it an adaptive species in its native environments.

Ceiba speciosa is part of the genus *Ceiba*, which includes other large tropical trees known for their massive size and distinctive features, such as the *Ceiba pentandra* (Kapok tree). It is classified within the *Malvaceae* family, which also includes species like hibiscus and durian.

1.2 Origin and Distribution

Ceiba speciosa is native to the tropical and subtropical regions of South America, primarily found in countries like Brazil, Argentina, and Paraguay. It thrives in a variety of habitats, ranging from savannas to forest edges, and can also grow in dry or disturbed

environments, where its ability to store water in the trunk provides it with a competitive advantage. The species has a limited distribution in the wild but is widely cultivated in other parts of the world due to its aesthetic appeal and the utility of its fibers and wood. It has been introduced to regions outside its native range, such as parts of Africa, Asia, and Central America, where it adapts well to similar tropical and subtropical climates. In its natural environment, *Ceiba speciosa* is typically found at low to moderate elevations and is often associated with areas that experience seasonal rainfall, which supports its growth. While the tree can withstand periods of drought, it thrives best in areas with well-drained soil and sufficient moisture.

1. Plant Profile:(*Ceiba speciosa*)



Fig. 2.1 a) *Ceiba speciosa* (A. St-Hil.) Ravenna

Botanical name: *Ceiba speciosa* (A. St-Hil.) Ravenna

Family: Malvaceae

Synonyms: Ceiba tree, Chorisia speciosa, Floss silk tree, Silk floss tree

2.1 Taxonomic Classification

- **Kingdom:** Plantae
- **Division:** Angiosperms
- **Class:** Eudicots
- **Order:** Malvales
- **Family:** Malvaceae
- **Genus:** Ceiba
- **Species:** *Ceiba speciosa*

3. Extraction and fractionation

3.1 Maceration extraction:

Extraction and fractionation Leaves dry powder of *Ceiba speciosa* (500 g) were separately macerated in 85% Methanol at room temperature for 7 days. The resulting extracts were concentrated via rotatory evaporator at 45°C, the crude 85% methanolic extracts were successively fractionated by using petroleum ether, dichloromethane, Ethylacetate, n-butanol and water.

4. Pharmacological Activity

4.1 Antibacterial Activity of *Chorisia speciosa*

Kausar et al. analyzed the essential oil of *Chorisia speciosa* leaves, identifying 25 volatile compounds via GC-MS, with caryophyllene (32.26%) as the most abundant. The oil exhibited strong antibacterial activity, particularly against *Staphylococcus aureus* (25 mm inhibition zone) and *Escherichia coli* (15 mm), but was ineffective against *Salmonella typhi*. The antibacterial effects are attributed to sesquiterpenes and other bioactive compounds, suggesting *C. speciosa* essential oil as a potential natural antimicrobial agent, especially against Gram-positive bacteria.

4.2 Antimicrobial and Cytotoxic Activities of *Ceiba speciosa*

1. **Abdel-Aziz et al.** evaluated *C. speciosa* leaf extracts, finding that dichloromethane and petroleum ether extracts exhibited strong antimicrobial activity against *Staphylococcus aureus* and *Candida albicans* (inhibition zones: 16–23 mm). Petroleum ether, ethyl acetate, and dichloromethane extracts showed moderate cytotoxicity against HepG2 cells, while water extracts were non-cytotoxic with weak antimicrobial effects. HPLC analysis identified bioactive compounds, suggesting potential applications in antimicrobial and cancer therapies.
2. **Khan et al.** studied *Chorisia speciosa* leaf extracts, reporting antibacterial activity against *B. cereus*, *S. aureus*, *K. pneumoniae*, and *P. aeruginosa* and moderate antifungal activity against *C. albicans*. Methanol and chloroform extracts exhibited dose-dependent anti-inflammatory and antipyretic effects, with methanol extract at 400 mg/kg showing results comparable to Diclofenac sodium. The study highlighted *C. speciosa* as a promising source of bioactive compounds but noted limitations in toxicity analysis and microbial strain testing.

4.3 Antiulcerogenic Activity of *Ceiba speciosa*

Dörr et al. investigated the antiulcerogenic and anti-inflammatory effects of *Ceiba speciosa* stem bark ethanolic extract. Phytochemical analysis confirmed the presence of flavonoids, phenolic compounds, sugars, and quinic acid derivatives, contributing to its

strong antioxidant activity. The extract reduced pro-inflammatory cytokines (TNF- α) and inhibited inflammatory enzymes (p38 α , JAK3, JNK3). In vivo studies demonstrated its effectiveness in reducing leukocyte recruitment, protein extravasation, and preventing ethanol-induced gastric ulcers in rats, outperforming Omeprazole. These results suggest *C. speciosa* extract as a promising natural treatment for gastrointestinal disorders and inflammation.

4.4 Anti-Diabetic Activity of *Ceiba speciosa*

Santos et al. investigated the aqueous bark extract of *Ceiba speciosa* (ECE) using *Caenorhabditis elegans* to assess its hypoglycemic potential and toxicity. ECE (5–250 μ g/mL) was non-toxic, with no adverse effects on survival, reproduction, or feeding. It did not protect against oxidative stress but significantly reduced whole-body glucose levels and increased the lifespan of glucose-exposed worms. However, it did not reduce glucose-induced lipid accumulation. Phytochemical analysis confirmed the presence of flavonoids and phenolic acids, suggesting a role in glucose metabolism. These findings highlight *C. speciosa* bark extract as a safe and promising candidate for managing hyperglycemia.

4.5 Antioxidant and Anti-Obesity Activities of *Ceiba speciosa*

1. **Malheiros et al.** evaluated *C. speciosa* bark extracts (LAECs & Cs1), rich in polyphenols and flavonoids, showing strong antioxidant activity (>85% DPPH inhibition at 50 μ g/mL) and low toxicity (minimal DNA damage at ≤ 10 μ g/mL).
2. **Rosselli et al.** analyzed *C. speciosa* seed oil, identifying 14 fatty acids (linoleic & palmitic dominant) and rare cyclopropane fatty acids. It exhibited strong antioxidant (DPPH IC₅₀ = 77.44 μ g/mL) and anti-obesity effects by inhibiting lipase, α -amylase, and α -glucosidase.
3. **Das et al.** compared *C. speciosa* and *Leucas cephalotes*, with methanol extracts showing potent antioxidant activity (DPPH IC₅₀ = 34.13 μ g/mL), attributed to high phenolic, flavonoid, and tannin content.

4. Chen et al. optimized the extraction of *C. speciosa* flower pigment (FPCS), which showed strong antioxidant properties (DPPH IC₅₀ = 49.78 µg/mL) and reduced oxidative stress in LPS-induced mice, with no observed toxicity.
5. Nasr et al. isolated bioactive compounds from *C. speciosa* leaves, including β-amyrin and Verbascoside. Methanol and dichloromethane extracts exhibited strong antioxidant activity, confirmed via HPLC analysis.

Phytochemical Screening:

Sr. No	Plant Part	Chemical Compounds	References
1	Leaves	Gallic acid, Chlorogenic acid, Catechin Methyl gallate, Caffeic acid, Syringic acid, Pyro catechol, Rutin, Ellagic acid, Coumaric acid, Vanillin, Ferulic acid, Naringenin, Taxifolin, Cinnamic acid, Kaempferol, β-amyrin, Verbascoside, p-hydroxy benzoic acid, β-sitosterol-3-O-β-d-glucopyranoside, succinic acid, astragalin, Cinaroside, β-sitosterol, tiliroside, rhoifolin, caryophyllene (32.26 %), Bicyclogermacrene (9.88 %), humulene (9.26 %), α-selinene (9.18 %) and β-elemene (8.06 %).	
2	Stem Bark	alkaloids, flavonoids, Saponins, terpenes, steroids, Naphthalene, glycosides, tannins, cyclopropenoid, fattyacids, carbohydrates, Gallic acid, Chlorogenic acid, Caffeic acid, Ellagic acid, Rutin, Quercetin Kaempferol.	
3	seed	Myristic acid Palmitoleic acid Palmitic acid Margaric acid Malvalic acid Linoleic acid Oleic acid Stearic acid Sterculic acid Dihydrosterculic acid Gondoic acid Arachidic acid Behenic acid Lignoceric acid.	

CONCLUSION:

Ceiba speciosa, or the silk floss tree, is a plant rich in bioactive compounds like flavonoids, tannins, and terpenoids, which contribute to its antioxidant, antimicrobial, anti-inflammatory, anti-diabetic, and anti-obesity effects. Traditionally used for treating various health conditions, different parts of the tree, such as leaves, bark, and seeds, exhibit notable pharmacological activities. Despite its potential, more research is needed to isolate active compounds, understand their mechanisms, and validate their clinical applications. *Ceiba speciosa* shows promise as a source for natural therapeutic agents.

REFERENCE

1. Abdel-Aziz, A.-W., Elwan, N., Abdallah, magda, Shaaban, R., Osman, N., & Mohamed, M. (2021). High Performance Liquid Chromatography Fingerprint Analyses, In vitro Cytotoxicity, Antimicrobial and Antioxidant Activities of the Extracts of *Ceiba speciosa* Growing in Egypt. *Egyptian Journal of Chemistry*, 64(4), 2–3. <https://doi.org/10.21608/ejchem.2021.58716.326>
2. Al-Askar, A. A. (2023). Phytochemical Properties of Silk Floss Tree Stem Bark Extract and Its Potential as an Eco-Friendly Biocontrol Agent against Potato Phytopathogenic Microorganisms. *Horticulturae*, 9(8), 912. <https://doi.org/10.3390/horticulturae9080912>
3. Das, R., & Suthakaran, R. (2022). Total phenolic content, flavonoid content and antioxidant potential of *Ceiba Speciosa* and *Leucas cephalotes*. *International Journal of Health Sciences*. <https://doi.org/10.53730/ijhs.v6ns1.7239>
4. Dörr, J. A., Bitencourt, S., Bortoluzzi, L., Alves, C., Silva, J., Stoll, S., Pinteus, S., Boligon, A. A., Santos, R. C. V., Laufer, S., Pedrosa, R., & Goettert, M. I. (2018). In vitro activities of *Ceiba speciosa* (A.St.-Hil) Ravenna aqueous stem bark extract. *Natural Product Research*, 33(23), 3441–3444. <https://doi.org/10.1080/14786419.2018.1478823>
5. dos Santos, F. B., Quines, C. B., Pilissão, L. E. B., Dal Forno, A. H. de C., Rodrigues, C. F., Denardin, C. C., Farias, F. M., & Ávila, D. S. (2020). Aqueous Bark Extract of *Ceiba speciosa* (A. St.-Hill) Ravenna Protects against Glucose



- Toxicity in *Caenorhabditis elegans*. *Oxidative Medicine and Cellular Longevity*, 2020, 1–9. <https://doi.org/10.1155/2020/1321354>
6. Haider, S. A., Asim, F., Rehman, Z. U., Shakir, L., Mustafa, M. W., Masih, S., Israr, U., Asif, K., Siddique, M., Rafaqat, A., Ramzan, H. M., & Shoukat, A. (2023). Exploring the anti-inflammatory and anti-pyretic potentials of methanolic and aqueous fruit extracts from *Ceiba speciosa*. *International Journal of Health Sciences*, 7(S1), 2102–2120. <https://doi.org/10.53730/ijhs.v7ns1.14462>
 7. Khan, A. (2015). Antimicrobial, Anti-Inflammatory And Antipyretic Activity Of *Chorisia Speciosa* Leaves. (Bombacaceae).
 8. Nisar, M. F., Jaleel, F., Waseem, M., Ismail, S., Toor, Y., Haider, S. M., & Zhong, J. L. (2014). Ethno-medicinal Uses of Plants from District Bahawalpur, Pakistan. *Current Research Journal of Biological Sciences*, 6(5), 183–190. <https://doi.org/10.19026/crjbs.6.5191>
 9. Ramadan, M., Darwish, F., Assaf, M., & Nasr, E. (2016). Macro- And Micromorphology Of The Leaf, Stem, Stem Bark And Fruit Of *Chorisia Speciosa* A. St. Hil Cultivated In EGYPT. *Bulletin of Pharmaceutical Sciences. Assiut*, 39(1), 1–25. <https://doi.org/10.21608/bfsa.2016.62579>
 10. Rosselli, S., Tundis, R., Bruno, M., Leporini, M., Falco, T., Gagliano Candela, R., Badalamenti, N., & Loizzo, M. R. (2020). *Ceiba speciosa* (A. St.-Hil.) Seeds Oil: Fatty Acids Profiling by GC-MS and NMR and Bioactivity. *Molecules*, 25(5), 1037. <https://doi.org/10.3390/molecules25051037>
 11. Stenglein, S. (2007). Leaf anatomy of *Ceiba chodatii* and *Ceiba speciosa* (Bombacaceae).

HOW TO CITE: Dr. S. R. Butle*, Mansi Lungase, Gopika Nawgaje, Tejasvi Tribhuwan, Shruti Waikar, Mayuresh Rajurkar, Neha Kulkarni, A Review on Pharmacological Activity and Phytochemical Analysis of *Ceiba Speciosa* (A. St-Hil.) Ravenna, Int. J. Sci. R. Tech., 2025, 2 (7), 83-87. <https://doi.org/10.5281/zenodo.15804235>