CHAPTER 01

Mythological and medicinal significance of the Cannonball tree (*Couroupita guianensis* Aubl.)

Saraswati Majhi[1], Vivek Kumar[2], Tekameren Walling[3], Kadambini Das[4], Vivek Chauhan[5], Sanjeet Kumar[6] and Sweta Mishra[6*]

[1]Department of Botany, Shailabala Women's Autonomous College, Cuttack, Odisha, India
[2]Department of Botany, Chaudhary Charan Singh University, Meerut, Uttar Pradesh
[3]Department of Botany, Sao Chang College, Tuensang, Nagaland, India
[4]University Department of Botany, Babasaheb Bhimrao Ambedkar Bihar University, Bihar, India
[5]Research Scholar, Terrestrial Ecology Division, Gujarat Institute of Desert Ecology (GUIDE), Bhuj, Gujarat, India
[6]Ambika Prasad Research Foundation, Odisha, India
***Email ID:** swetamishra.aprf@gmail.com

Licensed under a Creative Commons Attribution 4.0 International License

ABSTRACT

The Cannonball tree (*Couroupita guianensis*) is a tropical species revered for both its mythological and medicinal significance in South and Southeast Asia, despite its origins in Central and South America. In Hindu tradition, the spectacular hooded flowers are seen as symbolic of the naga (cobra), with the central stigma resembling a Shiva lingam, and offered at Shiva temples and sacred spaces, and known as "Nagalingi." Beyond its spiritual values, nearly all parts of the Cannonball tree are used in traditional medicine to treat hypertension, pain, inflammation, wounds, infections, and stomach problems. As a result, the Cannonball tree plays a significant dual role in both mythological contexts and folk healing practices across different cultures. This review highlights the mythological and medicinal significance of *C. guianensis*, along with its morphology and pharmacological activities.

KEYWORDS: Cannonball tree, traditional medicine, mythology, bioactive compounds

INTRODUCTION

Couroupita guianensis, commonly known as the cannonball tree, is a large deciduous tropical tree belonging to the Lecythidaceae family. It is native to the rainforests of Central and South America, ranging from Costa Rica to Brazil and northern Bolivia (Lim 2012; Kumar et al. 2022). This tree is widely cultivated in tropical and subtropical regions around the world for its striking appearance, fragrant flowers, and culturally significant fruits. Cannonball tree can reach heights of up to 35 meters and features clusters of large, elliptic to oblong leaves. One of the most unique characteristics is the production of exceptionally distinctive flowers that bloom directly on the trunk and large branches–a phenomenon known as cauliflory (Santosh and Arakera 2017; Joshi et al. 2024). These flowers are brightly coloured in shades of red, pink, and yellow, are highly fragrant, and possess two distinct types of stamens. The tree's globose, woody fruits resemble cannonballs and can measure up to 25 cm in diameter. Each fruit contains hundreds of seeds embedded in a white pulp that oxidizes to a bluish-green upon exposure to air. When the mature fruits drop, they create a loud impact, often splitting open and releasing a characteristic odour (Reshma and Sunilkumar 2018). *C. guianensis* is known for its significant medicinal and cultural value. Various traditional practices in South America, India, and Southeast Asia utilize nearly every part of the tree, including its flowers, leaves, bark, and fruit, to treat a wide range of health conditions. These ailments include wounds, inflammation, infections, tumors, hypertension, and gastrointestinal ailments (Sheba and Anuradha 2020; Soni 2023). Scientific research supports many of these traditional uses by demonstrating their antimicrobial, anti-inflammatory, antioxidant, analgesic, and anticancer properties. The tree's rich chemical composition features bioactive compounds such as terpenoids, flavonoids, quinone, glycosides, and alkaloids, all of which contribute to its pharmacological potential (Sheba and Anuradha 2020; Joshi et al. 2024). In addition to its medicinal uses, *C. guianensis* is deeply rooted in mythology and religious practices, particularly in Hinduism and Buddhism. In India and Sri Lanka, the flowers are symbolically associated with the cobra and Shiva's lingam, leading to their use in rituals and worship at temples (Kavana et al. 2021). In Buddhist cultures, the tree is often mistaken for the sacred Sal tree, which is revered in connection with the life events of Gautama Buddha. For these reasons, *C. guianensis* is of significant interest to ethnobotanists, pharmacologists, and cultural historians alike. Ongoing research into its phytochemistry and pharmacological effects continues to uncover its potential as a natural source of novel therapeutic

compounds. This unique species represents a convergence of natural beauty, cultural reverence, and medicinal promise (Chavda 2015; Kumar et al. 2022; Jagannatha et al. 2024). Keeping the importance of this tree species, this chapter is written to draw attention towards its values and conservation.

MORPHOLOGY

C. guianensis, is a large deciduous tree that can grow up to 35 meters (110 feet) tall. Its leaves are clustered at the ends of branches, typically measuring between 8 to 31 cm, though they can occasionally reach lengths of up to 57 cm. The leaves are simple, arranged alternately or spirally, with an entire margin, pinnate venation, and a leathery texture. The tree produces highly distinctive flowers that grow in long, cauliflorous racemes, which can be up to 80 cm long, sprouting directly from the trunk or large branches. Each flower is up to 6 cm in diameter and features six fleshy, waxy petals that are red to orange on the inside and yellow on the outside. The floral structure consists of two sets of stamens: one forming a central ring, and the other arranged in a prominent, hood-shaped formation. The flowers emit a strong fragrance, especially during the night and early morning. The fruits of the tree are large, round, and woody, resembling cannonballs, with diameters of up to 25 cm. These fruits have a hard shell that encloses seeds embedded in a white pulp, which turns blue upon exposure to air due to oxidation. A single tree can produce as many as 150 fruits at a time, with each fruit containing between 65 to 550 seeds, maturing over a period of one to one-and-a-half years (Sundararajan and Koduru 2014; Sheba and Anuradha 2020; Kumar et al. 2022; Nayak and Kumar 2023; Figure 1).

TRADITIONAL MEDICINAL USES

Each part of *C. guianensis* has unique medicinal uses, which are supported by its bioactive phytochemicals and ethnomedicinal history (Figure 2).

Leaves: The leaves are commonly used in both South American and Indian traditional practices. The juice from the leaves is applied topically to treat skin diseases, wounds, ulcers, and scabies owing to its antibacterial, antiseptic, and wound-healing properties. Internally, leaf extracts are utilized for managing hypertension, pain, inflammation, and certain tumors. Additionally, they are known to alleviate stomach issues, promote rapid healing, and reduce pain (Velliangiri and Subban 2012; Shah et al. 2013; Nayak and Kumar 2023).

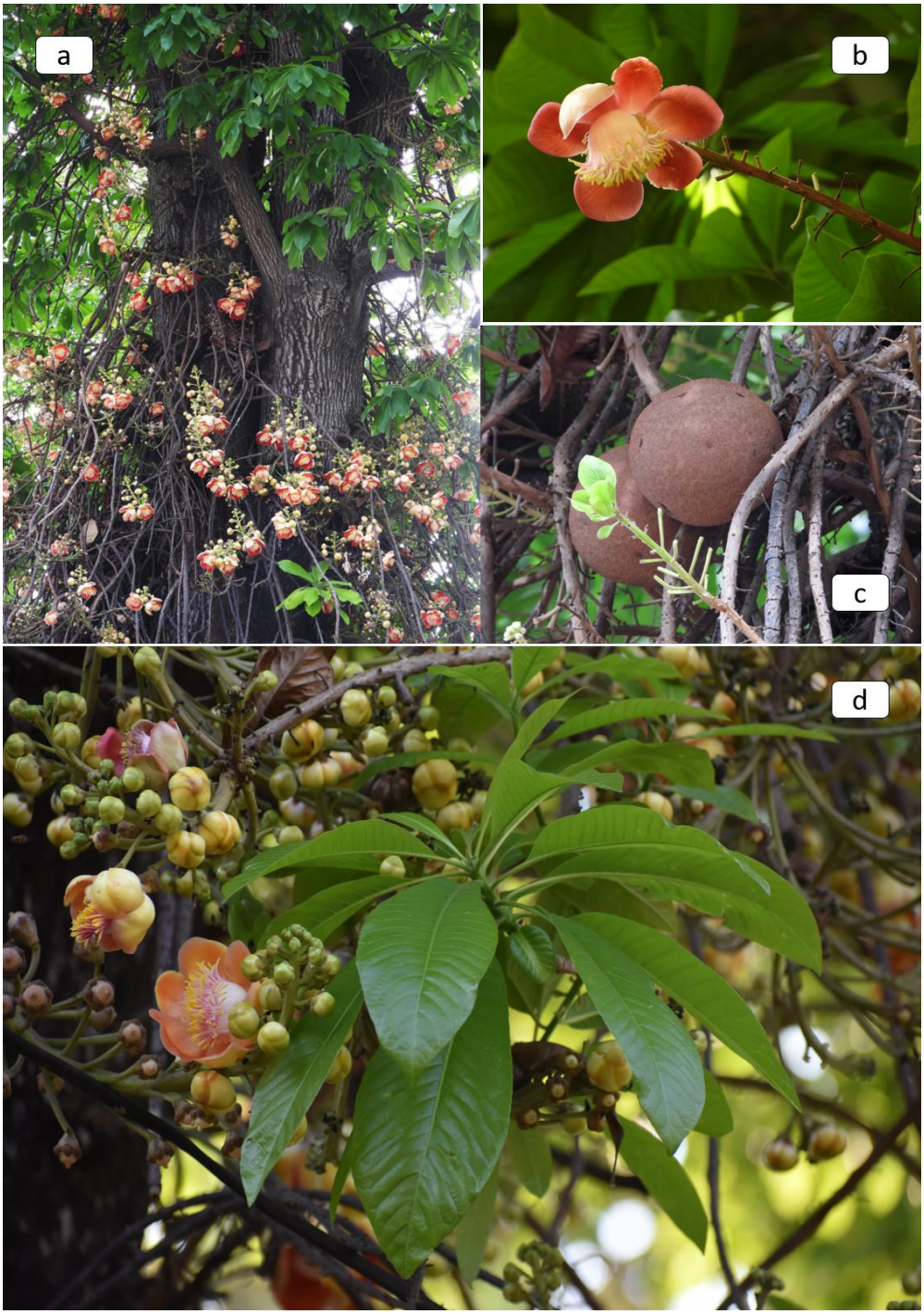


Figure 1: Vegetative parts of *C. guianensis*; a) Flowering stem, b) Flower, c) Fruits, d) Leaves

Flowers: Flower extracts are utilized in the treatment of fungal diseases, skin lesions, and chronic wounds. Additionally, flower infusions are employed to manage inflammatory reactions, bleeding hemorrhoids, gastritis, and as analgesics. In some areas, flower extracts are also used for scorpion stings, to combat malaria, and as part of fertility-modulating remedies (Soni 2023).

Bark: Decoctions of the bark are used to treat hypertension, pain, tumors, and gastrointestinal disorders. Additionally, when applied topically, the bark can help relieve swelling and skin conditions. Bark extracts are particularly valued for their ability to control excessive bleeding and inflammation, and they are sometimes included in remedies for viral and bacterial infections (Sheba and Anuradha 2020; Nayak and Kumar 2023).

Fruit pulp: Traditionally, the pulp is used to disinfect wounds, treat ulcers and manage scabies. It also serves as a remedy for dysentery, piles, and skin infections. In folk medicine, fruit extracts are used to treat malaria, toothache, scorpion bites, and various microbial infections, displaying activities comparable to those of some standard pharmaceutical drugs (Reshma and Sunilkumar 2018; Nayak and Kumar 2023).



Figure 2: Traditional medicinal uses of different plant parts of *C. guianensis*

MYTHOLOGICAL VALUES

C. guianensis holds significant mythological and religious value in Hindu and Buddhist traditions, especially in India, Sri Lanka, and parts of Southeast Asia,

despite being native to South America and not originally mentioned in ancient scriptures (Sundararajan and Koduru 2014; Soni 2023).

Hindu mythological value: In Hinduism, the tree is popularly called "Nagalingam" or "Shivalinga Pushpam." The unique structure of its flower, which resembles a cobra (Naga) with a central white stigma akin to a Shiva Lingam, gives it profound symbolic meaning. Due to their visual resemblance, the flowers are considered sacred and are frequently offered in worship at Shiva temples throughout India. As a result of this symbolism, the cannonball tree is widely venerated and often planted at religious sites, despite its foreign origins (Chavda 2015; Joshi et al. 2024).

Buddhist mythological significance: *C. guianensis* is often incorrectly identified in South and Southeast Asia as the legendary "Sal tree", which is associated with the birth and death of Gautama Buddha, the founder of Buddhism. In Buddhist interpretations, the bulge of the flower is seen as a stupa (reliquary shrine), while the stamens at the base represent devotees who are worshipping relics. The tree is commonly found in the premises of Buddhist monasteries and temples, and its blossoms are frequently used as offerings during religious rites and festivals (Al-Dhabi et al. 2012; Chauhan et al. 2019).

PHARMACOLOGICAL USES (Figure 3)

Antimicrobial activity: *C. guianensis* has demonstrated strong antimicrobial properties, with extracts from leaves, bark, and flowers inhibiting the growth of various pathogenic bacteria and fungi. Both methanolic and ethanolic extracts have been reported to be effective against *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa*. The antimicrobial effect is mainly attributed to the presence of terpenoids, flavonoids, phenolics, and quinones, which disrupt microbial cell walls and interfere with metabolic processes (Al-Dhabi et al. 2012).

Antifungal activity: Antifungal activity has been observed against species such as *Candida albicans* and *Aspergillus niger*. These findings support its traditional use in treating skin infections, wounds, and other microbial diseases. The antimicrobial efficacy is primarily due to the presence of phytoconstituents like terpenoids, flavonoids, and quinones, which inhibit microbial growth and survival (Chavda 2015; Jasmine and Moorthi 2017).

Anti-inflammatory activity: Ethanolic extracts from leaves and flowers showed a significant reduction in carrageenan-induced paw edema in rats,

suggesting an inhibition of inflammatory mediators like prostaglandins. The bioactive compounds responsible for this effect include triterpenoids, steroids, saponins, and flavonoids, which help in modulating inflammatory pathways and reduce tissue swelling (Jagannatha 2024).

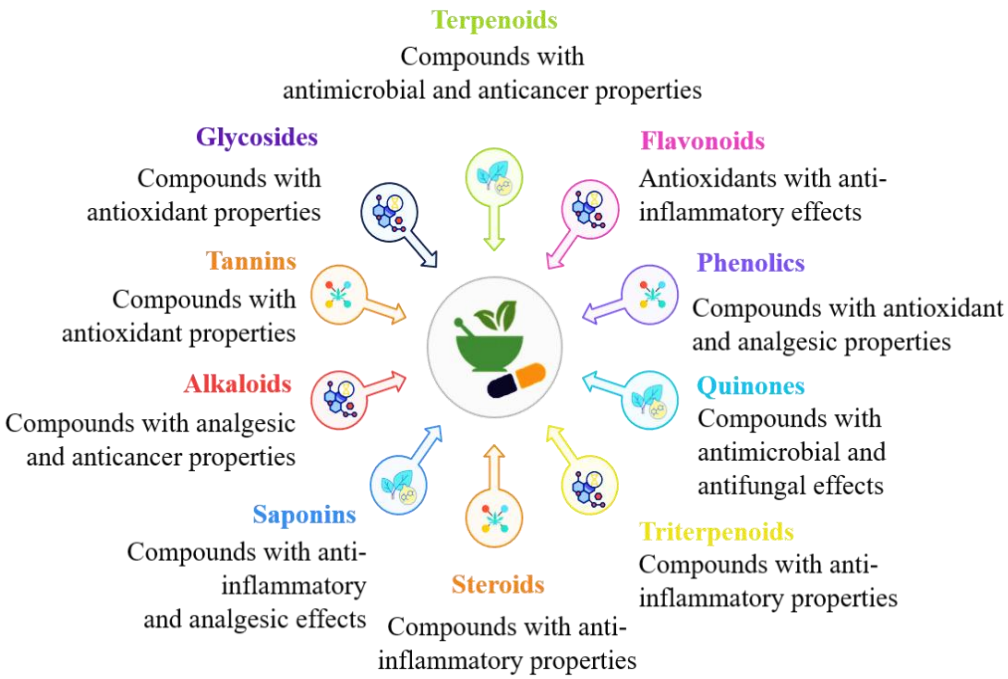


Figure 3: Bioactive compounds present in *C. guianensis* and their pharmacological importance

Analgesic activity*:* Extracts from the bark and leaves of *C. guianensis* have shown analgesic properties by reducing pain perception in experimental models. The analgesic effect is primarily attributed to the presence of alkaloids, saponins, and phenolic compounds, which influence pain mediators and may act through either central or peripheral mechanisms (Sundararajan and Koduru 2014).

Antioxidant activity: The fruit pulp and flower extracts of *C. guianensis* are rich in phenolic compounds, flavonoids, tannins, and glycosides, which contribute to their strong antioxidant activity. Studies using DPPH and ABTS assays have shown that these compounds effectively scavenge free radicals, thereby reducing oxidative stress. This is important because oxidative stress is a key factor in the development of chronic diseases such as cardiovascular disorders, diabetes, and cancer (Mandal and Ghosal 2014; Jagannatha 2024).

Anticancer activity: Some studies have reported that extracts of *C. guianensis* exhibit cytotoxic activity against specific cancer cell lines. The presence of indole alkaloids, flavonoids, and terpenoids has been associated with the plant's ability to induce apoptosis and inhibit the proliferation of cancer cells. Although these findings are still in preliminary stages, they suggest that the plant may be a promising source of anticancer agent (Jagannatha 2024).

CONCLUSION

C. guianensis is not only a botanical marvel but also a profound symbol of cultural heritage and healing. Revered in Indian tradition, this sacred tree is intricately linked to Lord Shiva, with its delicate flowers symbolizing purity and divinity. Such deep-rooted mythological connections have ensured its preservation in temple complexes and sacred groves, making it a living testament to spiritual reverence. Beyond its rich religious symbolism, *C. guianensis* possesses remarkable medicinal properties that have been valued for centuries. Traditional healing systems utilize its leaves, flowers, fruits, and bark to address a variety of health concerns, including skin infections, wounds, toothaches, respiratory issues, and digestive disorders. Scientific studies have validated many of these ethnomedicinal claims, uncovering a trove of bioactive compounds such as flavonoids, terpenoids, alkaloids, and phenolic compounds that contribute to its powerful antimicrobial, anti-inflammatory, analgesic, and antioxidant effects. The significance of this tree stretches far beyond its sacred status; it is a vital reservoir of pharmacological potential that we cannot afford to overlook. Protecting and studying *C. guianensis* is essential not only for honouring our cultural roots but also for advancing modern medicine with innovative therapeutic agents. By embracing its dual legacy, we can foster both the preservation of cultural heritage and the enhancement of global health, making a compelling case for its conservation and further exploration.

REFERENCES

Al-Dhabi NA, Balachandran C, Raj MK, Duraipandiyan V, Muthukumar C, Ignacimuthu S, Khan IA and Rajput VS. (2012). Antimicrobial, antimycobacterial and antibiofilm properties of *Couroupita guianensis* Aubl. fruit extract. BMC Complementary and Alternative Medicine. 12 (242): 242.

Chauhan HH, Chavan MD, Choudhary RR, Madkaikar HM, Dalvi TS, Shah NJ. (2022). Screening of phytochemicals from *Couroupita guianensis*

as drug candidates against lethal diseases using in-silico analysis. International Journal of Applied Chemical and Biological Sciences, 3(2): 9-19.

Chavda VP. (2015). Cannon Ball Tree: The Alchemist Plant. Innoriginal International Journal of Sciences. 2(5):6-9.

Jagannatha S, Maity S, Santra A, Kuruvalli G, Reddy VD and Golla R. (2024). An updated review on ethnomedicinal uses phytochemistry and pharmacological activities of *Couroupita guianensis*. Pharmacognosy Reviews. 18(36): 111-116.

Jasmine FS and Moorthi VP. (2017). *Couroupita guianensis*: The reservoir of medicinal compounds of human welfare. Asian Journal of Pharmaceutical and Clinical Research. 10(3):50 -52.

Joshi A, Wattamwar SS, Pawar CV, Shahakar MG, Bubane CC and Saindane SS. (2024). The Cannonball Tree: A Tree of Beauty and Mystery Mugdha. International Research Journal of Biological Sciences. 13(1): 29-34.

Kavana GB, Pavithra S and Vidya SP. (2021). *Couroupita guianensis*- A sacred plant of India. Floriculture and Landscape Architecture. Horticultural. 16(6): 34-36.

Kumar S, Mishra S, Mishra AK and Kumar SN. (2022). Floral diversity of Koira & Barsuan Ranges of Bonai Forest Division, Odisha. Bonai Forest Division, Odisha and Ambika Prasad Research Foundation, Odisha, India.

Lim TK. (2012). *Couroupita guianensis*. In: Edible medicinal and non-medicinal plants (Lim TK, ed). Springer Verlag, Berlin Heidelberg, pp 133-137.

Mandal P and Ghosal M. (2014). Assessment of Antioxidant Activity and Polyphenolic Content of *Couroupita guianensis* during Flower and Fruit Maturation. International Journal of Recent Scientific Research. 5(5): 1-8.

Nayak S and Kumar S. (2023). Medicinal plants used by tribals of Odisha. State Medicinal Plants Board and Ambika Prasad Research Foundation, Odisha; APRF Publishers, India.

Reshma Y and Sunilkumar T. (2018). Phytochemical analysis of fruit pulp of *Couroupita guianensis* Aubl. Journal of Pharmacognosy and Phytochemistry. 7(2):877-879.

Santosh P and Arakera SB. (2017). Genetic Diversity Analysis of *Couroupita guianensis* Aubl. based on RAPD Marker. Research in Biotechnology, 8: 12-15.

Shah GN, Shete SA, Patil VS, Patil KD and Killedar S. (2013). Standardization and antibacterial activity of *Couroupita guianensis* fruit pulp extract. International Journal of Pharmacognosy and Phytochemical Research. 4: 85-89.

Sheba LA and Anuradha V. (2019). An updated review on *Couroupita guianensis* Aubl: a sacred plant of India with myriad medicinal properties. Journal of Herbmed Pharmacology. 9(1):1-1.

Soni PK. (2023). *Couroupita guianensis* Aubl. (Lecythidaceae): A Medicinal Plant: Ayurvedic and Modern View. International Journal for Multidisciplinary Research. 5(3): 1-13.

Sundarajan R and Koduru R. (2015). Hepatoprotective and antioxidant effects of Couroupita guianensis on carbon tetrachloride-induced liver damage. International Journal of Phytomedicine. 7(3):281-289.

Velliangiri P and Subban R. (2012). Quantification of quercetin and stigmasterol of *Couroupita guianensis* Aubl. By HPTLC method and in vitro cytotoxic activity by MTT assay of the methanol extract against HeLa, NIH 3T3 and HepG2 Cancer Cell Lines. International Journal of Pharmacy and Pharmaceutical Sciences. 4(4):126- 130.