Chapter II

Review on a medicinal liana of India (*Combretum roxburghii* Spreng.)

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ABSTRACT

Combretum, encompassing approximately 200-250 species, thrives across the tropics and subtropics. *Combretum roxburghii*, a prominent species in this genus, is highly adaptable to various habitat. Medicinally, *C. roxburghii* is valued for its antibacterial, antifungal, anti-inflammatory, and antioxidant properties. Traditional uses range from treating infections and wounds to managing diabetes, malaria, and respiratory conditions. Its bioactive compounds, including flavonoids, tannins, saponins, alkaloids, and glycosides, underpin these pharmacological activities. Morphologically, *C. roxburghii* is a woody climber or large shrub with distinctive four-winged samaras aiding in wind dispersal. This review highlights the morphological characteristics, medicinal uses, bioactive compounds, and pharmacological activities of *C. roxburghii*, highlighting its importance in traditional medicine and potential for future drug development. Continued research into its phytochemistry and therapeutic potential could yield new medicinal applications.

Keywords: *Combretum*, bioactive compounds, traditional knowledge, pharmacological activities

INTRODUCTION

Combretum consists of approximately 200-250 species that are found across the tropics and subtropics, including Africa, India, and China, but they are notably absent from Australia and the Pacific Islands. The species

within the *Combretum* genus range from trees to shrubs, woody climbers, with sub herbaceous forms being very rare (Roy et al. 2014; Sharma et al. 2021). *Combretum roxburghii*, among them, is also known for its adaptability and found in tropical and subtropical regions of Southeast Asia. The distribution is spread along several countries, where it can grow in different ecosystems (Saxena and Brahmam, 1995). The species is not only found in the deciduous forest but also in the bank of the river as well as in the scrubland (Begum et al. 2016). The vitality of this plant that is tolerant to different types of soils as well as climate. It provides habitat and shelter for different wildlife. The dense canopy help birds, bugs, and small animals, contributing to local biodiversity. The plant's flowers produce nectar, attracting pollinators such as bees, butterflies, and other insects. These pollinators play a crucial role in the ecosystem by facilitating the reproduction of many other plant species. Additionally, the seeds and fruits are consumed by various animals, contributing to their diet and aiding in seed dispersal (Present study). It is used in traditional medicine for its antibacterial and antifungal properties to treat infections (Begum et al. 2016; Sharma et al. 2021). It has anti-inflammatory effects, alleviating pain and swelling from conditions like arthritis. The plant's antioxidant compounds help neutralize harmful free radicals, and its leaves and bark are applied to wounds to promote healing (Rout and Bhatnagar, 2023). Additionally, it is used to manage digestive issues and respiratory ailments (Kadavul and Dixit, 2009). Expanding the scientific understanding of this plant can offer valuable insights into various aspects of plant biology, ecology, and the possibility of uncovering new compounds that can be advantageous for human health.

MORPHOLOGY

It is a woody climber or large shrub or a liana. It can grow up to 5-10 meters in height when it climbs or spreads as a shrub. The stems are woody and can become quite thick with age. The bark is generally rough and can have a greyish to brown colouration. Leaves are arranged oppositely or sub-oppositely on the stem. They are broadly ovate to elliptic in shape. Leaf length typically ranges from 5 to 15 cm and width from 3 to 8 cm. The upper surface of the leaves is smooth and glossy, while the lower surface is slightly hairy. The leaf margins are entire. Flowers are borne in dense, axillary or terminal racemes or spikes. Each flower has a tubular calyx with

four spreading lobes. Flowers are small, typically less than 1 cm in diameter. They are usually white or yellowish-white. The fruit is a four-winged samara, characteristic of the Combretaceae family. Each samara is about 2.5 to 4 cm long, initially green, turning brown as they mature. The wings of the samara are papery and aid in wind dispersal (Plate 1; Figure 1; Saxena and Brahmam, 1995; Roy et al. 2014; Kumar et al. 2022).

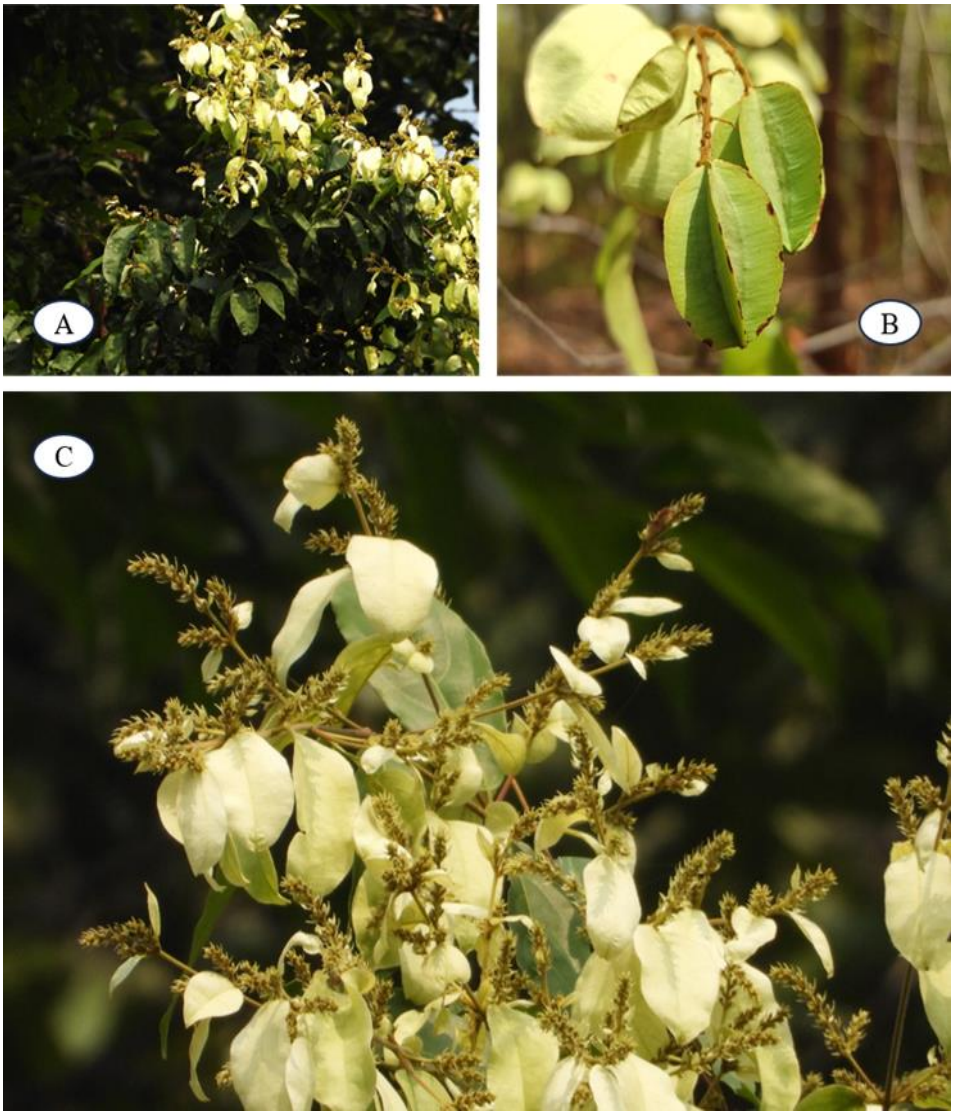


Plate 1: Vegetative parts of *C. roxburghii* A) Whole plant, B) Fruits, C) Flowers



Figure 1: Habitat of *C. roxburghii*

MEDICINAL USES

C. roxburghii extensively used in traditional medicine against inflammation, infection, diabetes, malaria, bleeding, diarrhoea, cancer, and other disorders. The leaves are used as an antiseptic to clean wounds and prevent infections (Agra et al. 2007). The young white leaves are crushed & made juice. The juice is taken to reduce the problems of diarrhoea. Leaf extracts are used to reduce fever. The leaves are applied topically to reduce inflammation and swelling (Rout et al. 2023). The mature leaf paste is used against skin infections. Bark decoctions are consumed to treat diarrhoea, and dysentery (Begum et al. 2016; Nayak and Kumar, 2023). The bark has astringent properties and is used to treat various skin conditions. Bark paste is applied to wounds to promote healing. Bark paste is applied externally to reduce inflammation. The bark paste is mixed with turmeric & applied to reduce muscle inflammation. Fruit paste is applied to reduce inflammation caused by accident. Root extracts are used to treat digestive problems such as stomach pain and indigestion (Kadavul and Dixit, 2009). Root decoctions are also used to reduce fever. Various parts of the plant are used for their analgesic properties to relieve pain. The plant is used to treat respiratory conditions such as coughs and asthma (Nayak and Kumar,

2023). Some traditional medicine practices use extracts of *C. roxburghii* to help manage blood sugar levels. Grinding the plant parts and mixing with water to form a paste for topical application (Roy et al. 2014; Rout et al. 2023). These traditional uses highlight the importance of *C. roxburghii* in various cultural medicinal practices, emphasizing its role in treating a range of ailments.

BIOACTIVE COMPOUNDS

C. roxburghii is known for its many bioactive substances, that are responsible for the plant-based drug and has been extensively studied for their pharmacological activities. Key bioactive constituents found in *C. roxburghii* are flavonoids, tannins, saponins, alkaloids and glycosides. Flavonoids like quercetin and kaempferol have strong antioxidant and anti-inflammatory effects (Bhatnagar et al. 2012). The plant's astringent and antimicrobial properties are partly due to tannins, which are polyphenolic compounds. *C. roxburghii* has Saponins that can affect immune system responses while having properties against fungi as well as inflammation. Although in small amounts, alkaloids have been shown to work against pain and malaria hence not neglecting an important part of the plant's clinical properties (Rout and Bhatnagar, 2023). Glycosides including cardiac glycosides are good for heart conditions by regulating heart rate and cardiac output. Research also shows antibacterial properties of the plant against many bacteria. Presence of phenolic acids like gallic acid and ellagic acid adds to its antioxidant property. All these bioactive compounds put together make the plant good for treating inflammation, infections, and cardiovascular diseases. It has been traditionally used in folk medicine for wound healing, which can be attributed to its bioactive components that promote cell regeneration and reduce microbial contamination (Toklo et al. 2021; Rout and Bhatnagar, 2023). The plant's extracts have been utilized in various formulations, including teas, ointments, and tinctures, reflecting its versatility in medicinal applications. *C. roxburghii* is a valuable medicinal plant with a rich composition of bioactive compounds that confer numerous health benefits. Continued research into its phytochemical properties and mechanisms of action may lead to the development of new therapeutic agents derived from this plant.

PHARMACOLOGICAL ACTIVITIES

C. roxburghii is renowned for its diverse pharmacological activities, making it a significant plant in traditional and modern medicine. The primary pharmacological properties of this plant include:

Antioxidant activity: Flavonoids and phenolic acids like quercetin, kaempferol, gallic acid and ellagic acid in *C. roxburghii* exhibit strong antioxidant properties. They remove free radicals and save the cell from stress and damage (Rout and Bhatnagar 2023; Das et al. 2020).

Anti-inflammatory activity: Flavonoids and saponins have shown significant anti-inflammatory effects. They are active and reduce inflammation by cox-2 and pro-inflammatory cytokines (Roy et al. 2014).

Antimicrobial activity: Tannins, alkaloids and phenolic compounds in *C. roxburghii* are antibacterial and antifungal. It is useful against many bacteria and fungi for infection (Sharma et al. 2021).

Anticancer activity: Some studies show that *C. roxburghii* extract is cytotoxic to cancer cell lines. Tannins and flavonoids are there so it is anticancer through apoptosis and cell cycle arrest (Bhatnagar et al. 2012).

Antidiabetic activity: Extracts are good for diabetes by inhibiting carbohydrate metabolism enzymes and reduce blood sugar. Flavonoids and tannins play a crucial role in this activity (Begum et al. 2016).

Cardioprotective activity: Cardiac glycosides in *C. roxburghii* are good for heart. It regulates heart rate and cardiac output and is good for some cardiovascular diseases (Sharma et al. 2021).

Hepatoprotective activity: Antioxidant of bioactive compounds protect liver from toxin and stress (Sharma et al. 2021).

Analgesic activity: Alkaloids and other bioactive compounds in *C. roxburghii* exhibits pain-relieving properties. It is pain relief by pain signal inhibition and inflammation reduction (Rout and Bhatnagar 2023).

Wound healing activity: Traditional uses of *C. roxburghii* for wound healing is there because of antimicrobial and anti-inflammatory properties. (Roy et al. 2014; Sharma et al. 2021).

Antimalarial activity: Some alkaloids and other bioactive compounds in *C. roxburghii* have shown antimalarial properties. So, it is good for treatment and prevention of malaria (Roy et al. 2014).

C. roxburghii possesses a wide range of pharmacological activities that contribute to its therapeutic potential. Its bioactive compounds offer multiple health benefits, making it a valuable plant in both traditional and contemporary medicine.

CONCLUSION

Combretum roxburghii, a versatile and resilient species, plays a significant role in both ecological and medicinal contexts. Its ability to thrive in diverse ecosystems contributes to local biodiversity, offering habitat and sustenance to various wildlife and pollinators. Medicinally, *C. roxburghii* is a powerhouse of bioactive compounds, providing a wide range of pharmacological activities, including antioxidant, anti-inflammatory, antimicrobial, anticancer, antidiabetic, cardioprotective, hepatoprotective, There is a potential for discovering new therapeutic agents, explore its value in both traditional and modern medicine.

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