



A Brief Review on *Anthocephalus cadamba*

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Abstract

Anthocephalus cadamba is a belonging of the Rubiaceae family. It is an ayurvedic treatment that is used for therapeutic purposes in a number of nations, including China, India and Egypt. *Anthocephalus cadamba* is an ayurvedic treatment that has been listed in a number of Indian medical texts. We discussed the phytochemistry of *Anthocephalus cadamba* and its use in the treatment of diabetes, diarrhoea, fever, inflammation, haemoptysis, cold, vomit, infections, wounds, debilitation, snake bite and antibacterial activity in this communication. Triterpenes, triterpenoid glycosides, flavonoids, saponins, indole alkaloids; cadambine, cadamine, isocadambine, isodihydrocadambine are the main elements of the plant. The medicinal properties pharmacological activity and toxicological studies of *Anthocephalus cadamba* are discussed in this article.

Keywords: *Anthocephalus cadamba*; Introduction; Plant Profile; Indole Alkaloids; Pharmacological Activities; Antimicrobial Action and Toxicological Studies; Traditional Uses

Introduction

The majority of the world's population relies on medicinal plants for their health care [1-3]. In numerous countries, there are a variety of plants used for therapeutic purposes. Ayurvedic medicine has a long history in India and its adjacent nations. India is renowned as the "Botanical Paradise" since it is the world's largest producer of medicinal plants. Medicinal plants can treat a variety of illnesses and diseases, including diabetes, cardiovascular disease, cancer and liver damage. *Anthocephalus cadamba* (Rubiaceae) a Miq., Syn.

A. indicus, *A. rich*, *A. chiensis* (Lam.) Rich. Ex. Walp, *Neolamarckia cadamba* (Roxb.) Bosser. (Family-Rubiaceae) commonly known as Kadamba. It is used to treat a variety of illnesses, including fever, leprosy, dysentery, blood and skin. It also has anti-oxidant, wound-healing and hepatoprotective properties. *Anthocephalus cadamba* is an ayurvedic treatment that has been mentioned in several Indian literatures for its pharmacological properties such as anti-diarrhoea and detoxification, painkiller and seminal fluids.

Aqueous extract of the *Anthocephalus cadamba* leaf has been used in traditional medicine to treat pain, swelling and wounds, as well as menorrhagia. The bark decoction is useful for diarrhoea, dysentery and colitis and the bark is also useful for skin infections [4-14].

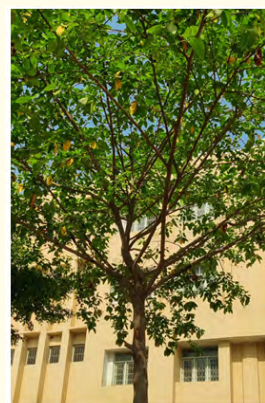


Figure 1: Picture of *Anthocephalus cadamba* Tree. (IFTM University Lodhipur Rajput, Moradabad).

Distribution

Chota Nagpur (Bihar), Orissa, Andhra Pradesh, Andaman and Nicobar Islands, Karnataka, Kerala and Madhya Pradesh are among the Indian states where it may be found. It's also found in Thailand and Indochina, as well as the Malaysian Archipelago and Papua New Guinea [15].

Plant profile

Plant description

Anthocephalus cadamba is a bigger tree with a height of 20-45 metres and a trunk diameter of 100-160 cm. It has a broad crown and a straight cylindrical bole. At the age of four, kadam may begin to flower. It blooms in India from July to December. Flowers are bisexual [16].

Bark

The bark of the young tree is smooth and light, whereas the bark of the older tree is tough. The bark is used to treat infections on the skin. When *Anthocephalus cadamba* bark is combined with water, honey and cumin, it is used to treat hoarseness of the throat (zeera). Orally, it is given to the patient. The use of freshwater for bathing, which keeps the skin smooth and free of infection [17].



Figure 2: Bark of *Anthocephalus cadamba* Tree. (IFTM University Lodhipur Rajput, Moradabad).

Leaf

Leaves are glossy green, opposite, simple, more or less sessile to etiolate, ovate to elliptical and more or less sessile to etiolate (15-50 x 8-25 cm). Clustered inflorescence with terminal globose

heads without bracteoles and sub sessile fragrant orange or yellow flowers; Flowers are bisexual and 5-merous, with a funnel-shaped calyx tube and a gamopetalous saucer-shaped corolla with a narrow tube and narrow lobes that imbricate in the bud. Stamens 5, filaments short and anthers basifixed, inserted on the corolla tube. Ovary inferior, binocular, sometimes 4-locular in the upper section, with a spindle-shaped stigma and style extruded. Fruits have four hollow or solid structures in their upper portions, allowing them to grow in numbers. Seeds that are trigonal or irregular in form.



Figure 3: Leaves of *Anthocephalus cadamba* Tree. (IFTM University Lodhipur Rajput, Moradabad).

Flower

The blooms are small, orange-colour and arranged in a globose head with a diameter of 3-5 cm. Flowers are bisexual and 5-merous, with a funnel-shaped calyx tube and a gamopetalous saucer-shaped corolla with a narrow tube and narrow lobes that imbricate in the bud. Stamens 5, filaments short, anthers basifixed, placed on the corolla tube. Ovary inferior, binocular, sometimes 4-locular in the upper section, with a spindle-shaped stigma and style extruded. Vegetables are made from flowers.



Figure 4: Flower of *Anthocephalus cadamba* Tree.

Fruit

Fruits are abundant, with four hollow or solid structures in their upper portions. When ripe, the fruits are meaty, orange, globose pseudocarps 5-7 cm in diameter and yellow [18-20].



Figure 5: Fruit of *Anthocephalus cadamba* Tree.

Scientific classification

Botanical name	<i>Anthocephalus cadamba</i> (Roxb.) Miq.
Family	Rubiaceae
Subfamily	Cinchonoideae

Table 1

Taxonomical Classification

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Gentianales
Family	Rubiaceae
Genus	<i>Anthocephalus</i>
Species	<i>Cadamba</i>
Vernacular Name	Kadamb

Table 2

Vernacular names of *Anthocephalus cadamba*

Language	Name
Hindi	Kadam, Kadamba
Gujarati	Kadamb, Kadam
Sanskrit	VrttaPuspa, Priyka
English	Wild cinchona

Marathi	Kadamb
Punjabi	Kadamb
Assam	Roghu, Kadam
Tamil	Vellaikkatampu, Arattam, Kadappai
Malayalam	Katampu, Attutekka
Kannada	Kadambamara, Kadavala, Neirumavinamara
Telugu	Kadambamu, Kadimi chettu
Indonesia	Jabon
Malaysia	Kalempayan
Cambodia	Thkoow

Table 3

Synonyms

- *Anthocephalus chinensis* (Lamk.) A. Rich. ex Walp.
- *Sarcocephalus cadamba* (Roxb.) Kurz.
- *Anthocephalusma crophyllus* (Roxb.) Havil.
- *Anthocephalus indicus* A. Rich.
- *Nauclea cadamba* (Roxb.)
- *Anthocephalus morindae* folius Korth.
- *Neolamarckia cadamba* (Roxb.) Bosser

Analytical parameters of *Anthocephalus cadamba*

S. No	Parameters	Result
1.	Foreign matters	Not more than (nmt) 2%
2.	Total ash	8-9%
3.	Acid-insoluble ash	0.6-1.5%
4.	Water-soluble ash	2-2.5%
5.	Sulfated ash	4-4.5%
6.	Alcohol-soluble extractive values	4-6%
7.	Water-soluble extractive values	4.5-5.0%

Table 4

Chemical constituents [21-25]

Bark	Astringent, Tannins
Stem	Triterpenic acid, cadambagenic acid, quinovic acid, β sitosterol
Leaf	Glycosidicindole alkaloids; cadambine, 3 α dihydrocadambineisodihydrocadambine and two related non-glycosidic alkaloids; cadamine and isocadamine
Fruit	Essential oil and the main constituents of oils are linalool, geraniol, geranyl acetate, linalyl acetate, α -selinene, 2-nonanol, β -phellandrene, α -bergamottin, p-cymol, curcumene, terpinolene, camphene and myrcene.
Whole Plant	Indole alkaloids, terpenoids, saponin, terpenes, steroids, fats and reducing sugars.
Seeds	The seeds of <i>Anthocephalus indicus</i> composed of water-soluble polysaccharides D-xylose, D-mannose and D-glucose in the molar ratio 1:3:5.

Table 5

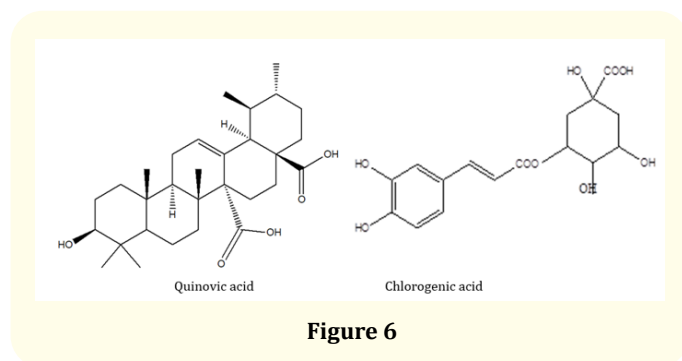


Figure 6

Properties

Taste	Bitter
Qualities	Dry in Nature
Potency	Cold
Specification Action	Pain Reliefs

Table 6

Ayurvedic uses

Santals

S. No.	Part	Use
1.	Bark	Paste is given to the patients of continuous fever to drink, juice squeezed out from the paste obtained by grinding this bark along with barks of mango tree and sal tree is given to the patient of cholera with a little shell lime;
2.	Decoction of stem-bark	Given to the patient of dyspepsia;
3.	Leaf	To cover sores and wounds, Juice of leaf with common salt: in stomach pain.

Table 7

Shukla Yajurveda

S. No.	Part	Use
1.	Bark	Strengthens body and removes fever, in rectifying defects of semen, to cure urinary troubles;
2.	Leaf	Cures pimples and wounds, analgesic;
3.	Leaf- juice	Stops burning sensation of palms and feet and scaling off of skin; Extract of leaf: for gargle
4.	Fruit	Good to quench thirst during high fever

Table 8

Shushrutasamhita

S. No	Part	Use
1.	Leaf	Analgesic, useful in diseases caused by phlegm, rheumatism and in inflammation of glands;

Table 9

Medicinal and traditional uses

- Diabetes Mellitus
- Diarrhoea
- Reducing Fever

- Inflammation
- Cough
- Vomiting
- Wound
- Haemoptysis
- Ulcer
- Debility and Antimicrobial Activity.

Biological significance

Anthelmintic activity

Cadamba's anthelmintic activity has recently been discovered. Due to morphological and physiological similarities with human intestinal roundworm parasites, it was tested on adult Indian earthworms, *Pheritima posthuma*. Each group was given aqueous and ethanolic extracts of *Cadamba* mature bark in doses ranging from 10 mg/ml to 25 mg/ml, as well as a vehicle (piperazine citrate, 15 mg/ml, produced in 1% tween-80). It was discovered that paralysis and ultimate death of a single worm took over 4 hours. Here, paralysis was defined as the failure of a normal worm to recover in saline, whereas death was defined as the loss of motility followed by the fading of the worm's body colour [26-28].

Antifungal activity

Cadamba's antifungal properties have been established. They found that extracts from the *Cadamba's* bark and leaves had antifungal activity against *Aspergillus fumigatus* and *Candida albicans*. They also discovered that the *Cadamba* leaf extract outperforms the bark extract in terms of antifungal activity [29].

Antifilarial and antimalarial activities

Malaria, dengue fever, chikungunya, filariasis and Japanese encephalitis are all mosquito-borne diseases that kill thousands of people each year in India and other developing nations. As a result, mosquito management is a major matter that must be addressed in order to improve the health and quality of life of the country's citizens and visitors. Due of growing resistance and revival against manmade pesticides, vector-borne illness management has failed. A number of studies have been published on the use of plant extracts to kill mosquito larvae [30-31].

Antibacterial activity

Cadamba fruit extracts, both alcoholic and aqueous, are shown to have significantly higher antibacterial activity against microorganisms (*Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Micrococcus luteus*, *Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Salmonella typhi*, *Klebsiella pneumonia*, *Proteus mirabilis*, *Candida albicans*, *Trichophytonrubrum*, *Asperagillus niger*, *Asperagillus flavus* and *Asperagillus nidulans*) [32-34].

Pharmacological activities

Analgesic, antipyretic and anti-inflammatory activities

Anthocephalus cadamba bark and leaf extracts have analgesic, antipyretic and anti-inflammatory properties. At different concentrations (50, 100, 300 and 500 mg/kg), the defatted aqueous extract of *Anthocephalus cadamba* leaves demonstrated considerable analgesic and anti-inflammatory effects. Some researchers effectively investigated the methanolic extract of *Anthocephalus cadamba* bark for analgesic, antipyretic and anti-inflammatory properties [35-38].

Antidiabetic activity

In alloxan (120-150 mg/kg) induced diabetic rats, an alcoholic extract of the stem bark of *Anthocephalus cadamba*, syn. *Neolamarckia cadamba*, was found to have antidiabetic (hypoglycemic) potential, alleviating symptoms such as weariness and discomfort. The presence of flavonoids, which stimulate insulin secretion or have an insulin-like effect, is assumed to be responsible for the effectiveness of the 400-500 mg/kg extract of medicine in the treatment of diabetes in experimental trials. The alcoholic and aqueous extracts of *Anthocephalus cadamba* roots had anti-diabetic effect when administered at a dose of 400 mg/kg body weight to normoglycemic and alloxan-induced hyperglycaemic rats [39-41].

Antidiarrhoeal activity

The dry hydroethanolic extract (200-500 mg/kg) of *Anthocephalus cadamba* flowering tops reduced the frequency of faecal dropping in castor oil-induced diarrhoea in mice in a dose-dependent manner. The extract also caused a dose-dependent decrease in the formation of intestinal fluids [42].

Diuretic and laxative activity

The diuretic and laxative activity of various extracts of *Neolamarckia cadamba* barks were studied and it was discovered that the methanol extract (300 mg/kg) of the bark of *Neolamarckia cadamba* significantly increased urinary output (diuresis) when compared to aqueous, chloroform and petroleum ether extracts, whereas the chloroform extract (300 mg/kg) produced significant laxative property [43].

Anti-hepatotoxic effects

Anthocephalus cadamba has been reported to have hepatoprotective properties. The presence of chlorogenic acid (CGA) identified from *Anthocephalus cadamba* is responsible for the hepatoprotective action. In CCl₄-treated mice, intraperitoneal injection of CGA at a dose of 100 mg/kg for 8 days had a stronger liver protective effect than silymarin (SM). CGA's hepatoprotective properties are due to its antioxidative action. CCl₄ is employed as a liver damage model [44].

Hypolipidemic activity

The workers' experiments revealed a significant reduction in lipid levels in diabetic rats induced by alloxan (150 mg/kg body weight). In dyslipidemic mice, oral administration of *Anthocephalus indicus* root extract (500 mg/kg body weight) for 30 days resulted in significant reductions in total cholesterol, phospholipids, triglycerides and lipid peroxides [45].

Antioxidant activity

By reducing lipid peroxidation and increasing superoxide dismutase (SOD) and catalase activity, *Anthocephalus cadamba* Syn. *A. indicus* extract has significant antioxidant action [46].

Antimicrobial and wound healing activity

Antimicrobial activity has been observed in *Anthocephalus cadamba*. *Escherichia coli*, *Micrococcus luteus*, *Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Salmonella typhi*, *Klebsiella pneumonia*, *Proteus mirabilis*, *Candida albicans*, *Trichophyton rubrum*, *Aspergillus niger*, *Aspergillus flavus* and *Aspergillus nidulans* have been reported. Experiments have also revealed that *A. cadamba* extract has a strong wound-healing ability. The aqueous extract of *A. cadamba* was also reported to be effective against the *Rathyibacter triticia* causative organism of wheat tundu disease and against animal foot and mouth disease [47-49].

Anthelmintic activity

The anthelmintic activity of aqueous and ethanolic extracts of adult *Neolamarckia cadamba* bark against earthworms, tapeworms and roundworms has been documented [50].

Toxicological studies

In mouse models, the toxicity of a methanolic extract of *Anthocephalus cadamba* barks was investigated. The findings indicated that acute toxicity was observed in animal models at dosages more than 300 mg/kg, with no mortality observed at the 300 mg/kg dose. At a dose of 600 mg/kg, sub-acute toxicity was tested. According to the findings, *A. cadamba* is non-toxic at doses of 600 mg/kg [51].

Formulation and analytical studies

Anthocephalus cadamba, in the form of churna (nygrodhadi kvatha churn) and oil, has been widely employed in ayurvedic formulations (grahanimihira taila). It is commonly utilized by tribes in the western ghats in the form of a paste to cure skin ailments. Various methods for analysing *Anthocephalus* extract have been established previously, including HPTLC, TLC and various spectroscopic techniques including as IR, Mass and NMR spectroscopy.

Conclusion

The study of therapeutic plants has recently regained popularity. The main reason for this is because the other system of treatment is connected with a slew of negative side effects that frequently result in catastrophic complications. Though *Anthocephalus cadamba* possesses a variety of therapeutic properties, it is time to investigate its medicinal potential at the molecular level using various biotechnological techniques. Only a few toxicological investigations have been published. The work could potentially be done in this approach to ensure that the plant is free to use.

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