Original Article

A REVIEW ON: PHARMACOGNESTIC AND PHARMACOLOGICAL STUDY OF *Anthocephalus cadamba*

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DOI: 10.47750/pnr.2022.13.S10.072

Abstract

The Kadam tree is regarded as being precious to Lord Krna both religiously and culturally in India, as a result the tree is also known as Haripriya, meaning God's favourite.They are well known for the medical benefits of herbal plants and the therapeutic uses of their flower , root , bark , leave and stem against a variety of conditions including ulcers , haemophysis , diarrhea , fever , inflammation and snake bites. Using a variety of solvents many Phytoconstituents were isolated , yielding compounds like Cadambine , 3-dihydrocadambine , isodihydrocadambine , Phelasin , linalool and geraniol which were then converted into alkaloids , coumarins , terpenoids , diterpenoids , Saponins , tritorpenes , glycosides , sterols , flavonoids . The article reviewed about the pharmacological studies, medicinal value and Phytoconstituents of *Anthocephalus cadamba* .

Keywords: *Anthocephalus cadamba*, Introduction, Phytoconstituents, Pharmacological activities, Traditional use.

Introduction

Since the beginning of human civilization, medicinal plants have been used by humanity for its therapeutic value. The knowledge of the development of ideas related to the use usage of medicinal plants as well as the evolution of awareness has increased the ability of pharmacists and physicians to respond to the challenges that have been emerged with the spreading of professional services in the facilitation of human's life. *Anthocephalus cadamba* ., syn. A. indicus, A. rich (Family-Rubiaceae) commonly known as kadamba. It is said to be one of the most valuable medicinal evergreen tropical trees because of its greatest medicinal value. It is utilized for medicinal purpose in several diseases like fever, leprosy, dysentery, wound healing and hepatoprotective activity. In traditional system aqueous extract of the *Anthocephalus cadamba* leaf has been used to alleviated pain, swelling and wounds as well as treatment of menorrhagia. The decoction of the bark effective for diarrhea, dysentery and colitis and bark also beneficial for skin infection.

Figure:1- Tree of *Anthocephalus cadamba*

DISTRIBUTION:-

A.cadamba are mostly found in Asia, Australia, and the pacific regions. In India, it is mostly found in Kerala, Maharashtra, Tamil Nadu, Madhya Pradesh, Assam, and Andhra Pradesh. It is also found in Thailand and Indochina as well as the Malayasian Archipelago.

PLANT PROFILE:-

Plant Description

Anthocephalus cadamba is a larger tree, the height of this tree may reach 20-45m the diameter of trunk is 100-160cm with broad crown and straight cylindrical bole. At the age of 4 years the tree may start flowering(July toDecember). Flowers are bisexual.

Bark:-

The bark is dark gray on colour, it is smooth and very light in the young tree but rough in old tree. The bark is used to treat skin infection. When the bark is combined with water, honey and cumin, it is used to treat hoarseness of the throat . It is given to the patient orally. The use of freshwater for bathing, which keeps the skin smooth and free of infection.

Figure:2-Bark of *Anthocephalus cadamba*

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). Inflorescence in clusters; terminal globose heads without bracteoles, sub sessile fragrant, orange or yellow flowers; Flowers bisexual, 5-merous, calyx tube funnelshaped, corolla gamopetalous saucer shaped with a narrow tube, the narrow lobes imbricate in bud. Stamens 5, inserted on the

corolla tube, filaments short, and anthers basified. Ovary inferior, binocular, sometimes 4-locular in the upper part, style exerted and a spindle-shaped stigma. Fruit lets numerous with their upper parts containing 4 hollow or solid structures. Seed trigonal or irregularly shaped.

Figure:3-Leaf of *Anthocephalus cadamba*

Flower:-

The flowers are small , orange in colour in globose head which are in 3-5 cm in diameter . Flowers bisexual , 5-merous , calyx tube funnel –shaped, corolla gamopetalous saucershaped with a narrow tube , the narrow lobes imbricate in bud. Stamens 5, inserted on the corolla tube , filaments short , anthers basifixed. Ovary inferior , binocular , sometimes 4locular in the upper part, style exerted and a spindle shaped stigma.

Figure:4- Flower of *Anthocephalus cadamba*

Fruit:-

Fruits are abundant, with 4 hollow or solid structures in their upper portions . When the fruits are meaty, orange, globose pseudocarps 5-7 cm in diameter.

Figure:5-Fruit of *Anthocephalus cadamba*

Scientific classification:

Table -1

Botanical name	*Anthocephalus cadamba* (Roxb.) Miq.
Family	Rubiaceae
Subfamily	Chinchonoideae

Taxonomical Classification:

Table-2

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

CHEMICAL CONSTITUENTS:

Table-3

Bark	Astringent Tannins
Stem	Triterpenicacid, cadambagenicacid, quinovic acid, β-sitosterol
Leaf	Glycosidicindolealkaloids;Cadambine, 3α-dihydrocadambineisodihydrocadambine and two related non-glycosidic alkaloids; Cadambine and isocadambine
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, sapogenins, Saponins, terpenes, steroids, fats and reducing sugars.
Seeds	The seeds of *Anthocephalus indicus* composed of water-soluble polysaccharides D-xylose, D-mannose and D-glucose in the molar ratio 1:3:5.

Properties:

Table -4

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

Medicinal and Traditional uses:-

- Diabetes Mellitus
- Diarrhoea
- Reducing Fever
- Inflammation
- Cough
- Vomiting
- Wound
- Haemophytosis
- Ulcer
- Debility and Antimicrobial Activity

PHARMACOLOGICAL ACTIVITIES:-

Antidiabetic activity:-

Different doses of ethanolic fraction (250, 500, 750, and 1000 mg/kg body weight [body wt.]) and methanolic extract (200 and 400 mg/kg) of stem bark of *A. cadamba* were reported for its antidiabetic (hypoglycemic) potential in alloxan-induced diabetic rats and rectifying the problems such as fatigue and irritation associated with this disease. The reported experimental studies helped in proving that 400–500 mg/kg extract of drug was effective in the treatment of diabetes, and it is thought to be due to the presence of flavonoids, which stimulated the insulin secretion.The aqueous (400 mg/kg) and methanolic extracts (200 and 400 mg/kg body wt.) of the leaves had beneficial effects in reducing the elevated blood glucose level of hyperglycemic mice and rats with lipid-lowering activity.

Antioxidant activity:-

The extract of *A. cadamba* whole plant (barks, leaves, flowers, and fruits) reportedly possessed potent antioxidant activity by inhibition of lipid peroxidation and by rapid increase in the superoxide dismutase (SOD) and catalase activity. The antioxidant potential of the extracts isolated from *A. cadamba* which have the capacity to act as therapeutic agents in the treatment of radical-related pathological damage. In another study, extracts, namely, AC-4 and alkaloid-rich fraction was isolated from leaves and barks of *A. cadamba* using two varied methodologies for isolation to evaluate both in vitro antioxidant and antiproliferative properties..

Antitumor activity:-

Recently, various studies have been carried out on *A. cadamba* to evaluate its antitumor activity. Reported cytotoxicity tests on methanol extract (200 and 400 mg/kg) of *A. cadamba* leaf performing through Trypan blue method by inoculating it on Ehlrich ascites carcinoma (EAC)-treated mice and the extract showed direct cytotoxicity on EAC cell line in a dose-dependant manner and decrease in the tumor volume, viable cell count, tumor weight and elevated the life span of EAC tumor bearing mice.

Nephrotoxicity:-

Ethanol extract of *A. cadamba* roots has a potential role in the abatement of cisplatin-induced nephrotoxicity nephroprotective potential of the extract (200 and 400 mg/kg) was evaluated in Wistar rats. Simultaneously, aqueous extract of *A. cadamba* fruit possesses antidote and acts effectively against arsenic-induced nephrotoxicity. It was observed that administration of the crude extract (100 mg/kg, p.o.) reduces the toxic effect of arsenic trioxide on the kidney of mice.

Diuretic and laxative activity:-

The various extracts of the barks of *A. cadamba* were studied for its diuretic and laxative activity, and it was found that the methanol extract (300 mg/kg) of the bark of *A. cadamba* significantly showed enhancement of the urinary output (diuresis) comparatively with the aqueous, chloroform, and petroleum ether extract, whereas the chloroform extract (300 mg/kg) reportedly produced significant laxative property.

Antihepatotoxic effects:-

In 1995, reported the hepatoprotective activity of chlorogenic acid (CGA) isolated from *A. cadamba*. It was also found that the intraperitoneal (i.p) administration of CGA to mice at a dose of 100 mg/kg, i.p., for 8 days, exhibited a better liver protective action than silymarin, in carbon tetrachloride (CCl_4)-administered mice.

Analgesic, antipyretic, and anti-inflammatory activities:-

Extracts of the bark and leaf of *A. cadamba* possessed valuable properties such as analgesic, antipyretic, and anti-inflammatory activities.The defatted aqueous extract of the leaves of *A. cadamba* reportedly showed significant analgesic and anti-inflammatory activity at varying doses (50, 100, 300, and 500 mg/kg). Similarly, ethanolic extract of the leaf showed significant anti-inflammatory, analgesic, and antipyretic activity. The acute toxicity was also reported over Rats, was found to be higher than 2000 mg/kg. The methanolic extract of the bark of *A. cadamba* was effectively evaluated for analgesic, antipyretic, and anti-inflammatory activities in one of the studies.

Antifilarial and antimalarial activities:-

Mosquito-borne diseases such as malaria, dengue, chikungunya, filariasis, and Japanese encephalitis cause thousands of deaths per year in India as well as in other developing countries. Dimethyl sulfoxide extract of Cadamba slows the larvicidal effect on the filarial vector at low concentrations with LC50 at 0.61 ppm.

Sedative and antiepileptic effects:-

The sedative and antiepileptic activities of ethanolic extract of *A. cadamba* bark are also reported in various experimental animal models. The extract at dose of 100, 200, and 400 mg/kg p.o. showed significant increase in ketamine-induced sleeping time.

Antivenom activity:-

It has been found that methanolic extract of the root bark of Cadamba can be used as an antidote against snakebite. It is used in neutralizing Vipera russellii and Naja kaouthia venom, which can induce hemorrhage, cardiotoxicity, neurotoxicity, defibrinogenation, and inflammation.

Gastroprotective effects:-

The antiulcer activity of aqueous and methanol extracts of A cadamba leaves and bark was investigated in both pylorus ligation and aspirin-induced ulcer models. Both the extracts at dose of 200 and 400 mg/kg, p.o., produced significant inhibition of gastric lesion induced by pylorus-ligation induced ulcer and aspirin-induced gastric ulcer.

Anthelminthic activity:-

Aqueous and ethanolic extracts of stem–bark of this plant were screened for anthelminthic activity against earthworms, tapeworms, and roundworms using albendazole as reference drug. The ethanol extract was found potent than aqueous extract. Simultaneously, various extracts of *A. cadamba* barks possess anthelmintic activity in a dose-dependent manner. Potency of the test samples was found to be inversely proportional to the time taken for paralysis/death of the worms.

Wound-healing activity:-

Whole plant of *A. cadamba* (barks, leaves, flowers, and fruits) extract has potent wound-healing capacities which possess promising wound contraction and increased tensile strength.

Antimicrobial activity:-

Aqueous extracts of *A. cadamba* fruits reported promising antioxidant and antibacterial effect against Escherichia coli, Pseudomonas aeruginosa, Yersinia enterocolitica, Staphylococcus aureus, Bacilluscereus, and Listeria innocua. Similarly, different solvent extracts of *A. cadamba* fruits were also screened for its antimicrobial activity against Gram-positive (S. aureus and B.cereus) and Gram-negative (E. coli, Salmonellaabony, and Shigella boydii) bacterial cultures by agar well diffusion method as well as by minimum inhibitory concentration (MIC) and minimum bactericidal concentration; here, alcoholic extract showed significant antibacterial activity against E. coli and S. aureus with the zone of inhibition of 22–24 cm and low MIC value up to 1.00 mg/ml.

Toxicological studies:-

Toxicity is the fundamental science of poisons and the ancient humans categorized some plants as harmful and some as safe; therefore, considerable attention has been directed toward *identification* of plants with no toxicity that may be used for human consumption. The methanolic extract of A. cadamba barks was reported for its toxicity in various animal models. The results suggested that acute toxicity was found in animal models at doses range higher than 3000 mg/kg, and there was no mortality found.

Conclusion:

Research in medicinal plant has gained a renewed focus recently. The main reason is that the other system of medicine associated with number of side effects that often cause to serious problems. Though *Anthocephalus Cadamba* has various medicinal activities but it is time to explore its medicinal values at molecular level with the help of various biotechnological techniques.Several parts of *A. cadamba* including stem bark, stem, leaves, bark, root bark, flower, seed, heartwood, sapwood, and branches contain a number of phytoconstituents that belong to alkaloids, coumarins, terpenoids, diterpenoids, triterpenes glycosides, sterols, flavonoids, amides, and fatty acids. This review mainly highlights about pharmacological and phytochemical studies which have illustrated therapeutic potential and phytochemical constituents of *A. cadamba*.

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