

PHARMACOGNOSTIC AND PHARMACOLOGICAL ACTIVITIES OF *CORDIA
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Article Received on 29/04/2023

Article Revised on 19/05/2023

Article Accepted on 09/06/2023

ABSTRACT

Cardia macleodii is a plant species traditionally used in Ayurvedic medicine for treating various ailments. This review highlights the Pharmacognostic and pharmacological activities of *Cardia macleodii*. The plant has been reported to have potent anti-inflammatory, cardioprotective, hepatoprotective, antioxidant, anticancer, and antimicrobial properties. The presence of bioactive compounds, including sterols, flavonoids, alkaloids, phenolic acids, and triterpenoids, has been identified and studied in detail. *Cardia macleodii* demonstrated potent antioxidant and hepatoprotective activity, as well as anti-inflammatory and cardioprotective properties. Additionally, it showed antimicrobial activity against several bacterial and fungal strains and cytotoxic effects on cancer cells. Overall, these results indicate that *Cardia macleodii* has significant pharmacological potential and could be a promising source for developing novel therapeutic agents. However, further studies are necessary to explore its full pharmacological potential and identify the mechanisms of action of the bioactive compounds present in the plant.

KEYWORDS: *Cardia macleodii*, Boraginaceae, *Dahiman Ped*, Pharmacological action.

INTRODUCTION

Cardia macleodii Hook, Belongs to the widely utilised significant family Boraginaceae (Ehretiaceae), a folklore medicinal plant native to India, is a little tree that is infrequently found in the forests of various states, including Orissa, Chhattisgarh, and Madhya Pradesh. It is often known as Phanki/Shikariin local language. The Deccan and Carnatic regions are where it is found.^[1] By the tribal tribes of Orissa, Chhattisgarh, and Madhya Pradesh, the plant is utilised ethnomedicinally for a variety of purposes, including curing wounds (leaf, bark), mouth sores (leaf), treating jaundice (bark), and acting as an aphrodisiac (seed).^[2] Previous research on *Cardia macleodii* included pharmacognostic evaluation of the plant's leaf^[3] and presence of several phytoconstituents, including alkaloids, glycosides, phenols, flavonoids, terpenoids, and tannin found in the leaves' extract using a variety of solvents.^[4] There have been reports of pharmacological effects of *C. macleodii* leaf powder, including antihypertensive action,^[5] antibacterial and wound healing effects of leaves. A strategic plan for the growth and promotion of traditional medicine in the following areas was recently published by WHO.^[6,7]

1. Determining traditional Medicine and Introducing the appropriate Plan and Policy.
2. Improvements in Education and Research, particularly at the university level.

3. Fostering Cooperation and Unity among practitioners of both Conventional and Modern medicine.

Six subfamilies make up the Boraginaceae family, but they are all regarded as different families. Six subfamilies make up the Boraginaceae family, but they are all regarded as different families. In which the Cordioideae is one and contains the genus *Cordia*.^[8,9]

This genus has thirteen species in India. One of them is *Cordia macleodii*, a rare species also called *Dahiphalas* or *Dahiman*. It is a little tree with white blooms, green leaves with cordate bases and crenate dentate margins, and it is endemic to India. The plants of *Cordia macleodii* appear to have analgesic, anti-inflammatory, antibacterial, wound-healing, hepatoprotective, acute toxicity, and antioxidant action, according to several pharmacological studies.^[10,11]

Plant profile

It is a 9-12 m high tree with light green bark having thickness 12-15 mm **Fig. 1.1**. The leaves are broadly ovate **Fig. 1.2**, shiny dark green on the dorsal surface, and light green on the ventral surface with numerous hairs. Flowers are yellowish-white in color **Fig. 1.3**, polygamous, subsessile, in the dense paniculate terminal

and axillary tomentose cymes; male flowers with a rudimentary ovary but without style or stigma.

Obconic, densely tomentose, ribbed, lobe-like, and 0.6 to 0.8 mm long, the calyx. Yellowish-white is the colour of

the corolla. The drupes have an ovoid shape, are 1.2 to 1.9 cm long, acuminate at the apex, and are seated at persistent calyxes. Flowers start to bloom in March or April, and fruits start to appear in March or June.^[12,13,14]



Fig. 1.1: *Cordia macleodii* tree.



Fig. 1.2: Leaves of *cardia macleodii*.

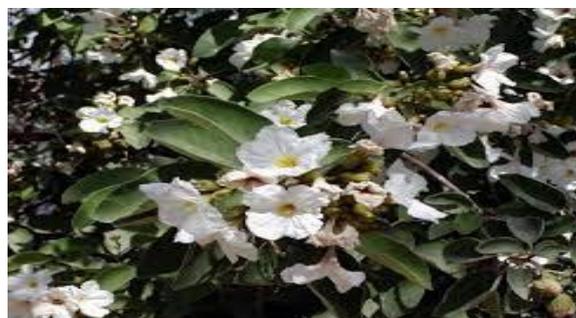


Fig. 1.3: Flowers of *cardia macleodii*.

Taxonomy of *cordia macleodii*

Domain – Eukaryota

Kingdom – Plantae

Subkingdom – Viridaplantae

Phylum – Tracheophyta

Order – Boraginales

Family – Boraginaceae

Subfamily – Cordioideae

Genus – *Cordia*

Species – *Macleodii*

Subphylum: Euphyllophytina

Class – Magnoliopsida

Subclass – Lamiidae

Superorder – Solananae

Organoleptic parameters

Leaf - Taste: Bitter, Odour- Astringent,

Bark - Taste: characteristic, Odour- Astringent.^[16,17]

Vernacular name

Hindi	Dahipalas, dhengan, gonni, Dahiman
Kannada	Cellu, bilichalle, doddachalle
Marathi	Bhoti, daiwas, dhaim, dhaiwan, dhalm, dhaman
Tamil	Palandekku
Telugu	Iriki, peddabatava, peddabotuku

Synonym

- *Gerascanthus macleodii* (Griff.) Borhidi
- *Hemigymnia macleodii* Griff.
- *Lithocardium macleodii* (Griff.) Kuntze

Chemical constituents

Numerous chemicals found in the plant have been identified through studies currently available, including:

1. Sterols: *Cardia macleodii* includes a variety of sterols, such as stigmasterol, campesterol, dehydroepiandrosterone, and cholesterol.
2. Flavonoids: Flavonoids such quercetin, kaempferol, isorhamnetin, and luteolin are found in *Cardia macleodii*.
3. Alkaloids: *Cardia macleodii* has been found to contain alkaloids, such as choline, betaine, and trigonelline.
4. Fatty acids: Oleic, linoleic, and palmitic acids are among the fatty acids found in *Cardia macleodii*.
5. *Cardia macleodii* contains the carotenoids lycopene, beta-carotene, and zeaxanthin.
6. Triterpenoids: Ursolic acid and oleanolic acid are two of the triterpenoids found in *Cardia macleodii*.
7. Phenolic substances: *Cardia macleodii* includes a number of phenolic substances, such as ellagic acid, caffeic acid, and chlorogenic acid.

8. Additional Substances: Additional substances found in *Cardia macleodii* include ascorbic acid, tocopherols and elements like zinc, copper, and iron.

These substances have been found in a variety of plant tissues, including the leaves, stems, roots, and flowers. The evidence provided suggests that the plant includes a variety of bioactive compounds that may have therapeutic capabilities, while additional research is necessary to discover all of the chemical elements contained in *Cardia macleodii* and their therapeutic potential.

Photochemistry

The results of the numerous phytochemical analyses indicate that *Cordia macleodii* includes a variety of phytoconstituents, including flavonoids, glycosides, tannins, phenols, steroids, terpenoids, alkaloids, resin, and others. Additionally, it includes carbs, amino acids, and more.^[18,19,20,21,32]

Few known compounds such as Stigmasterol **Fig. 1.4**, Campesterol **Fig. 1.5**, 2-(3-hydroxy-5-methylbenzyl)-2,3-dihydro-5,7-dihydroxychromen-4-one **Fig. 1.6**, Cholest-5-en-3ol (3Beta)-Carbonyl chlorinated **Fig. 1.7** and 3,4-dihydroxy-5-methoxybenzoic acid **Fig. 1.8** are present in leaves and bark of *Cordia macleodii*.

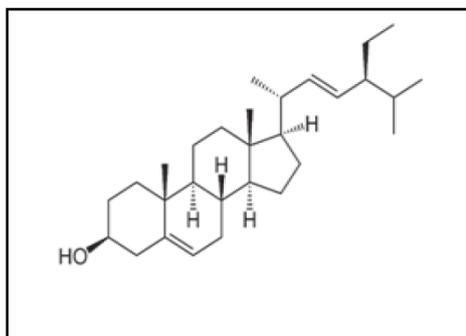


Fig. 1.4: Stigmasterol.

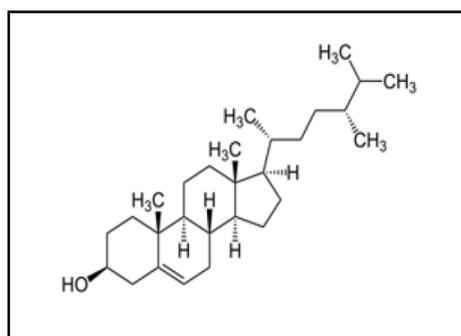


Fig. 1.5: Campesterol.

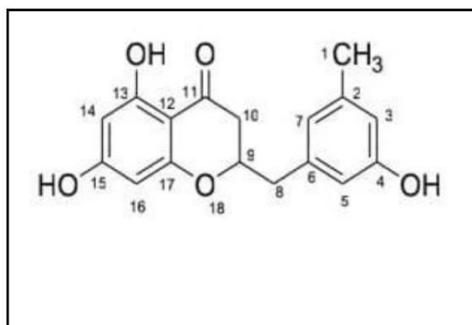


Fig. 1.6: (3-Hydroxy-5-Methylbenzyl) 2,3-Dihydro-5,7-dihydroxychromen-4-ONE.

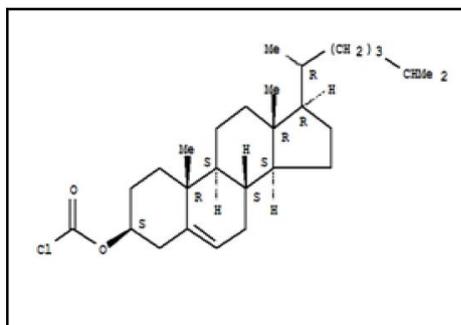


Fig. 1.7: cholest-5-EN-3OL (3-BETA) -carbonyl chlorinated.

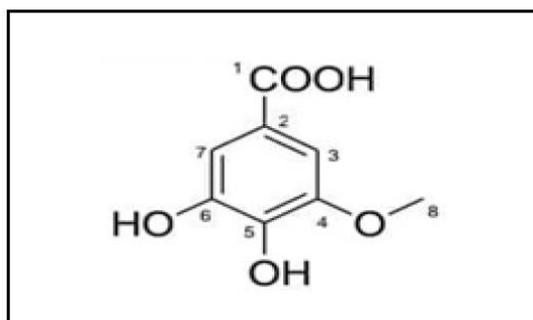


Fig. 1.8: 3, 4-Dihydroxy-5-Methoxybenzoic ACID.

Pharmacological activities

Pharmacological action

The plants of *Cordia macleodii* have been shown through a number of pharmacological investigations using extracts and purified components to exhibit analgesic, anti-inflammatory, antibacterial and antifungal, wound healing, hepatoprotective, antioxidant, anti-hypertensive, and antivenom potential properties.

Analgesic activity

Commercially available medications or classes of medications used to treat pain are known as analgesics or painkillers. They have a variety of effects on the central and peripheral nervous systems.^[22] In a hot plate analgesimeter investigation, the analgesic efficacy of *Cordia macleodii* extracts was examined in mice at various time intervals. *Cordia macleodii* extracts showed effective pain-relieving properties. The 400 mg/kg dose of the extracts had analgesic effects that were comparable to Pentazocin's 10 mg/kg dose. The analgesic effects of the extracts peaked at 60 and 90 minutes after the doses were given.^[22,15]

Anti-inflammatory activity

The complicated biological reaction of body tissue to noxious stimuli like pathogens, damaged cells, or irritants is known as inflammation. It is a defence mechanism involving immune cells, blood vessels, and chemical mediators.^[24] By using a method that causes rat paw edoema in response to carrageenan, the anti-inflammatory activity of *Cordia macleodii* leaf extracts was evaluated. When compared to the control group, *Cordia macleodii* extracts reduced the amount of edoema caused by carrageenan, and they also showed a substantial reduction in inflammation. The *Cordia macleodii* extract inhibited edoema to a degree of 44% five hours after carrageenan challenge, compared to conventional Diclofenacdiethylamine, which inhibited edoema to a degree of 92%.^[23]

Antimicrobial and Antifungal activity

It was discovered that the aqueous extract of *Cordia macleodii* leaf 1B has greater antibacterial power than the common antibiotic ciprofloxacin. *B. subtilis*, a gram-positive bacterium, and *A. niger*, a fungus, were both susceptible to the *Cordia macleodii* extracts' activity. In comparison to extracts obtained after 6 h, it was shown

that extracts collected after 12 h had higher antibacterial and antifungal properties. A fresh antibacterial agent for society may be provided by further improvement of the extraction process and identification of the chemical ingredient in the leaf and stem extracts.^[25]

By using the zone of inhibition method on agar plates with various standards, the *Cordia macleodii* bark methanolic extract also demonstrated significant antibacterial activity against two gram-negative bacteria, *E. coli* and *Pseudomonas aeruginosa*, and two gram-positive bacteria, *Streptococcus pyogenes* and *Staphylococcus aureus*. Compared to the other examined organisms, *E. coli* and *S. aureus* showed the strongest bacterial growth inhibition.^[18] By using the zone of inhibition method on agar plates with various standards, the *Cordia macleodii* bark methanolic extract also demonstrated significant antibacterial activity against two gram-negative bacteria, *E. coli* and *Pseudomonas aeruginosa*, and two gram-positive bacteria, *Streptococcus pyogenes* and *Staphylococcus aureus*. Compared to the other examined organisms, *E. coli* and *S. aureus* showed the strongest bacterial growth inhibition.^[26]

Hepatoprotective activity

Aqueous and ethanolic extracts of *Cordia macleodii* bark have been shown to have hepatoprotective efficacy against CCL4 and ethanol-induced hepatotoxicity in rats, suggesting that they may be able to regenerate and repair liver tissue.^[27]

By using a carbon tetrachloride (CCl₄)-induced liver injury model in rats and comparing the extracts to the reference standard silymarin, the extracts' hepatoprotective efficacy was assessed. Comparatively to the CCl₄-treated group and the reference standard Silymarin, *Cordia macleodii* leaf extracts reduced the amount of total bilirubin, GOT, GPT, and ALP in serum.^[28,15]

Antioxidant activities

Four in-vitro known methods, including the DPPH radical scavenging method, the Nitric oxide radical scavenging method, the reducing power method, and the iron chelation method, were used to investigate the antioxidant activity of *Cordia macleodii* leaf extracts.

According to tests using the Reducing Power Method and the Ion Chelation Method, *Cordia macleodii* extracts demonstrated strong reducing ability as well as good radical scavenging activity against DPPH and Nitric oxide radicals.^[29]

Several in-vitro models, including the DPPH free radical scavenging assay, the Folin Ciocalteu reagent, and the Oyaizu method, were used to investigate the antioxidant activity of *Cordia macleodii* bark extracts. At the various concentrations studied, *Cordia macleodii* bark extracts showed antioxidant activity that was comparable to that of regular ascorbic acid. When compared to conventional L-ascorbic acid, the *Cordia macleodii* extracts showed significant antioxidant activity by blocking DPPH and lowering power activities.

Total phenols, which are important in regulating oxidation, were discovered to be present in observable amounts in the bark extracts. The research demonstrates that *Cordia macleodii* bark extracts can be used as a convenient source of the natural antioxidant.^[30]

Wound healing activity

An exploratory, open, and controlled investigation has revealed the *Cordia macleodii* leaf's ghrita-based creation possesses wound-healing qualities. 20 patients were randomly divided into two groups and used for the evaluation. In which one group received treatment with *C. macleodii* ghrita while the other received a local application of povidine iodine. It was noted how the medicine affected the symptoms and indications. The study demonstrates a substantial change in wound size, tenderness, wound margin, and discharge in the group treated with *Cordia macleodii* ghrita.^[31]

An excision and incision wound model was used to examine the *Cordia macleodii* leaves aqueous extract's capacity to speed up the healing of wounds in Wistar strain albino rats. The conclusion drawn from the outcomes of the wound healing activity, which comprised examining the effects of local application of *Cordia macleodii* on excision wound, incision wound, and dead space wound, demonstrates that it has no bearing on the contraction of the excision wound. The extract promotes revascularization and ground material production in the dead space wound as well as incision wounds with weak tensile strength.^[32]

Antihypertensive activity

The WHO defines hypertension as systolic and diastolic pressures that are greater than 140 and 90 mg, respectively. Researchers put a total of 20 patients into two groups and assessed the leaf powder of *Cordia macleodii* for its ability to lower blood pressure. Wherein one group receives treatment with *Cordia macleodii* leaf powder, while a second group receives treatment using supagandha powder. According to the study, *Cordia macleodii* Hook. (Boraginaceae) leaf powder has been

shown to reduce diastolic and systolic blood pressure on a scientific basis and statistically.^[33]

Antivenom activity

The *Cordia macleodii* bark's ethanolic extract was tested for its ability to act as an antivenom against *Naja* venom. Pharmacological effects tested included mortality, hemorrhagic lesion, necrotizing lesion, edoema, cardiotoxicity, and neurotoxicity. According to the study, *Cordia macleodii* bark ethanolic extract significantly reduced the mortality, hemorrhagic lesion, necrotizing lesion, and edoema that *Naja* venom-induced in rats at doses of 400 and 800 mg/kg. It is possible that the precipitation of active venom components is what gives *Cordia macleodii* bark's ethanolic extract its antivenom capability against *Naja* venom poisoning.^[34]

Acute toxicity

Using the staircase approach, the acute toxicity of *Cordia macleodii* extracts was evaluated, and the study was conducted at oral doses ranging from 500 mg/kg to 2 g/kg. In the beginning, the dose of 500 mg/kg was given to 2 mice individually, and mortality was noted for the following 24 hours. Then, the dose of 1000 mg/kg was given to 2 mice individually, and mortality was noted for the following 24 hours. The final dose was increased by 200 mg/kg to a dose of 2000 mg/kg, and the animals' toxicity and death were assessed. In other words, the *Cordia macleodii* did not induce harmful effects even at a level of 2000 mg/kg, according to an acute toxicity investigation.^[23]

CONCLUSION

The plant is known to have a number of medical benefits, including antioxidant, anti-inflammatory, cardioprotective, and hepatoprotective actions. The precise identification of the plant and its distinction from other plant species will be aided by the botanical description of the plant in detail, which should include information on its morphology, anatomy, and classification. *Cordia macleodii*'s vegetative and reproductive portions' physical and chemical traits, as well as the plant's chemical components, have all been thoroughly examined. Additionally, the numerous analytical approaches and procedures utilised to assess the plant pharmacognostically have been presented.

An uncommon, tiny tree found regularly in India's humid, drug-filled deciduous woodlands is called *Cordia macleodii*. According to pharmacological studies and clinical trial-based research, *Cordia macleodii* has the ability to serve as an antivenom and exhibits analgesic, anti-inflammatory, antibacterial and antifungal, wound healing, hepatoprotective, antioxidant, and antihypertensive properties. Additionally, pharmacological research verified that *Cordia macleodii* had no harmful effects.

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