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## **CORDIA MACLEODII (DAHIMAN PED): AN UPDATED REVIEW**

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**ABSTRACT:** *Cordia macleodii* is an 8-10 m high small-sized tree belongs to the family *Boraginaceae* and commonly known as Dahiphalas or Dahiman ped. Many studies indicate that the plants of *Cordia macleodii* show analgesic, anti-inflammatory, antimicrobial, wound healing, hepatoprotective, acute toxicity, antihypertensive, and anti-oxidant activity. *Cordia macleodii* contains various types of bioactive compounds like amino acids, alkaloids, carbohydrates, flavonoids, glycosides and tannins, phenols, steroids, terpenoids, and resin, which play an important role in health management. An extensive survey of literature has been made on *Cordia macleodii* using published review and research articles in journals, botanical textbooks and scientific databases.

**INTRODUCTION:** Medicinal plants with therapeutic potential are commonly used throughout the world as a folk medicine in various indigenous medicine systems such as Ayurveda, Siddha, Unani, etc. Therapeutic plants can be used as a refined pharmaceutical industry product or as polyherbal extract. Various medicinal plants have been identified as laboratories for the biosynthesis of a wide range of compounds, including glycosides, alkaloids etc. <sup>1, 2</sup>. Active plant constituents play an important role in the prevention and treatment of diseases. Therefore active plant products can be used to develop a new formulation for the novel drugs in the pharmaceutical field <sup>3</sup>.

As per World Health Organization, a medicinal plant is defined as a whole plant, or plant parts contain a substance that can be used for therapeutic purposes or which is a precursor for the synthesis of useful drug <sup>4</sup>. Medicinal plants are rich sources of useful compounds that can be used in the synthesis of medicines. In addition, these plants play a major role in the development of human culture around the world <sup>5</sup>.

WHO recently published a strategic plan for the development and promotion of traditional medicine in the following four areas <sup>6, 7</sup>.

1. Identification of traditional medicine, introduction of a correct policy and plan.
2. Development of research and education, especially at the university level.
3. Establishment of unity and cooperation among the traditional and modern medicine employees.

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4. Cultivation of the needed herbs to prevent destruction of natural resources. Boraginaceae is a plant family consists of herbs, shrubs, and trees, comprising 130 genera and approx 2,300 species. The Boraginaceae family is divided into six subfamilies, but they are treated as separate families.

In which the Cordioideae is one and contains the genus *Cordia*<sup>8, 9</sup>. Thirteen species of this genus found in India. *Cordia macleodii* is one of them, a rare and commonly known as Dahiphalas or Dahiman. It is a small-sized tree, native to India and having white flowers, broadly ovate, glabrous, green leaves with a cordate base and crenate dentate margins. Various pharmacological studies indicate that the plants of *Cordia macleodii* show analgesic, anti-inflammatory, antimicrobial, wound healing, hepatoprotective, acute toxicity, and antioxidant activity<sup>10, 11</sup>.

**Morphology:** 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. Calyx is 0.6 to 0.8 mm long, obconic, densely tomentose, ribbed, lobes. The corolla is yellowish-white in color. The drupes are 1.2 to 1.9 cm long, ovoid, acuminate at apex, seated at persistent calyx. The flowers appear in March to April, and fruits appear in Mar to June<sup>12, 13, 14</sup>.

#### Organoleptic Parameters:

Leaf - Taste: Bitter, Odour- Astringent,

Bark - Taste: characteristic, Odour- Astringent,

#### Vernacular Name:

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



FIG. 1.1: *CORDIA MACLEODII* TREE



FIG. 1.2: LEAVES



FIG. 1.3: FLOWERS WITH LEAVES

**Taxonomy:**

<b>Domain</b>	: Eukaryota
<b>Kingdom</b>	: Plantae
<b>Subkingdom</b>	: Viridaeplantae
<b>Phylum</b>	: Tracheophyta
<b>Subphylum</b>	: Euphyllphytina
<b>Class</b>	: Magnoliopsida
<b>Subclass</b>	: Lamiales
<b>Superorder</b>	: Solananae
<b>Order</b>	: Boraginales
<b>Family</b>	: Boraginaceae
<b>Subfamily</b>	: Cordioideae
<b>Genus</b>	: Cordia
<b>Species</b>	: macleodii

**Distribution:** *Cordia macleodii* is native to India. It is frequently distributed in moist and drug deciduous forests of India such as Chhattisgarh (Marwahi forest division, Pendra Road and

Bilaspur), Karnataka (Belgaum, Chikmagalur, Dharwad, and Mysore), Maharashtra (Dhule, Akola, Nasik, Pune, Satara, Raigad, and Thane) Madhya Pradesh and Odisha<sup>15, 16, 17</sup>.

**Phytochemistry:** The various phytochemical tests show that *Cordia macleodii* contains various types of phytoconstituents, which plays an important role in medicine, like flavonoids, glycosides, tannins, phenols, steroids, terpenoids, alkaloids and resin, etc. It also contains amino acids and carbohydrates etc.<sup>15, 18, 19, 20, 21</sup>. 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*.

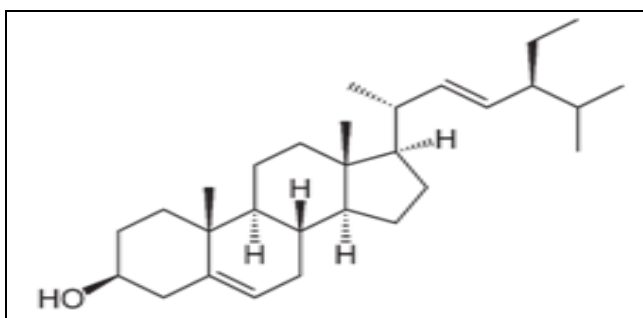


FIG. 1.4: STIGMASTEROL

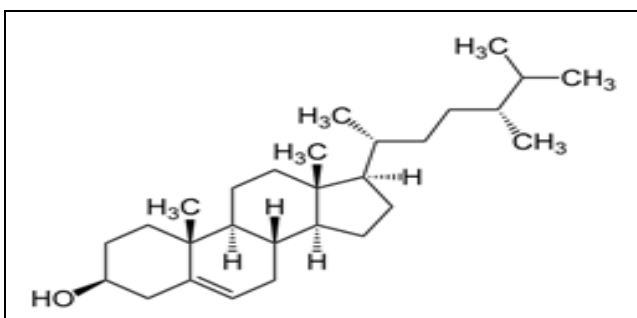


FIG. 1.5: CAMPESTEROL

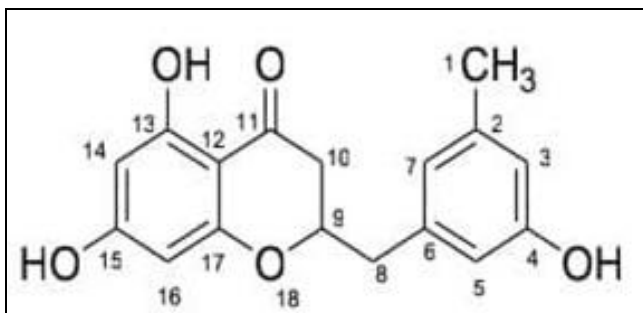


FIG. 1.6: (3-HYDROXY-5-METHYLBENZYL) 2, 3-DIHYDRO- 5, 7-DIHYDROXYCHROMEN-4-ONE

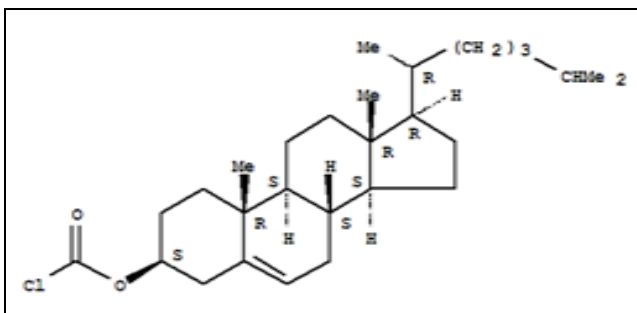


FIG. 1.7: CHOLEST-5-EN -3OL (3-BETA) - CARBONYL CHLORINATED

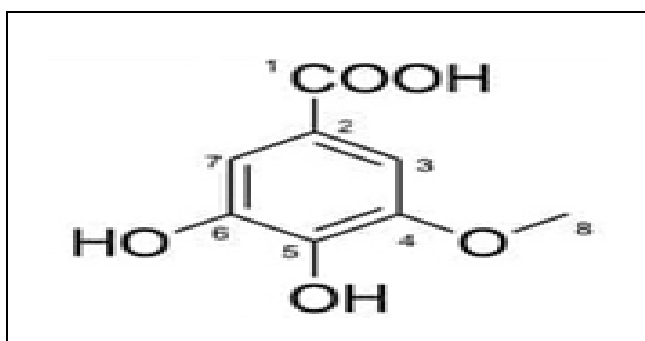


FIG. 1.8: 3, 4-DIHYDROXY-5-METHOXYBENZOIC ACID

**Pharmacological Action:** Various pharmacological studies carried out with extracts and purified compounds indicates that the plants of *Cordia macleodii* have analgesic, anti-inflammatory, antimicrobial and antifungal, wound healing, hepatoprotective, antioxidant, anti-hypertensive activities and has antivenom potential.

**Analgesic Activity:** Analgesics or painkillers are commercially available drugs or groups of drugs



used to relieve pain, and they act in various ways on the central and peripheral nervous system<sup>22</sup>. The extracts of *Cordia macleodii* were investigated for analgesic activity using hot Plate test in mice at different time intervals in hot plate analgesiometer study. Extracts of *Cordia macleodii* demonstrated good analgesic activity. Analgesic effects of the extracts at doses of 400 mg/kg were comparable with the analgesic effect of Pentazocin at 10 mg/kg. After the administration of the doses, the analgesic effects of the extracts were maximum at 60 and 90 min<sup>23, 15</sup>.

**Anti-Inflammatory Activity:** Inflammation is defined as the complex biological response of body tissue to harmful stimuli such as pathogen, damaged cells, or irritants and is a protective response involving immune cells, blood vessels, and molecular mediators<sup>24</sup>. *Cordia macleodii* leaves extracts were checked for anti-inflammatory activity by carrageenan-induced rat paw edema method. *Cordia macleodii* extracts inhibited the carrageenan induced edema when compared with the control group, and the extracts demonstrated significant anti-inflammatory activity. Five hours after carrageenan challenge, the *Cordia macleodii* extract inhibited edema to the extent of 44% in comparison with standard Diclofenacdiethylamine which inhibited edema to the extent of 92%<sup>23</sup>.

**Antimicrobial and Antifungal Activity:** The antibacterial potential of water extract of the leaf (1B) of *Cordia macleodii* was found to be more than the standard drug ciprofloxacin. The *Cordia macleodii* extracts were active against gram-positive bacteria *B. subtilis* and fungi *A. niger*. It observed that the extracts collected after 12 h exhibited comparatively more antibacterial and antifungal values than the extracts collected after 6 h. Further optimization in the extraction method and identification of the chemical constituent in the leaf and stem extracts can help in providing a newer antimicrobial agent to the society<sup>25</sup>.

The *Cordia macleodii* bark methanolic extract also showed significant antibacterial activity against two gram-negative bacteria *E. coli*, *Pseudomonas aeruginosa*, and two gram-positive bacteria *Streptococcus pyogenes*, *Staphylococcus aureus* by agar plate method zone of inhibition with different standard. Growth inhibition of bacteria was more pronounced on *E. coli* and *S. aureus* as compared

to the other tested organism<sup>18</sup>. The leaf and stem extracts of *Cordia macleodii* of different solvents were investigated for evaluating antifungal properties. For the study, only a single fungal strain was taken, and was observed that antifungal potential of the water extracts was found to be excellent. Leaf (38 mm) and stem (22 mm) compared to the other extract<sup>26</sup>.

**Hepatoprotective Activity:** Aqueous and ethanolic extracts of *cordial macleodii* have hepatoprotective activity effect against CCL4 and ethanol induced hepatotoxicity in rats and suggest that aqueous and ethanolic extracts of barks *Cordia macleodii* have the capacity to regenerate and repair liver<sup>27</sup>. The extracts were evaluated for hepatoprotective activity by carbon tetrachloride (CCl<sub>4</sub>) induced liver damage model in rats in comparison with reference standard Silymarin. *Cordia macleodii* leaves extracts inhibited CCl<sub>4</sub> induced increase in total bilirubin and GOT, GPT, and ALP levels in serum as compared with CCl<sub>4</sub> treated group as compared to the reference standard Silymarin<sup>28, 15</sup>.

**Antioxidant Activities:** *Cordiama cleodii* leaves extracts were tested for antioxidant activity by four *in-vitro* established methods *viz.* DPPH radical scavenging method, Nitric oxide radical scavenging method, Reducing power method, and Iron chelation method. *Cordia macleodii* extracts have been found to have good radical scavenging activity against DPPH, and Nitric oxide radicals, and extracts also had the good reducing ability as evaluated by the Reducing power method and Ion chelation method<sup>29</sup>.

*Cordia macleodii* bark extracts were tested for antioxidant activity in different *in-vitro* models such as, the DPPH free radical scavenging assay, phenolic content by Folin Ciocalteau reagent, and reducing power methods using the Oyaizu method. *Cordia macleodii* bark extracts demonstrated a comparable antioxidant activity with that of standard ascorbic acid at the varying concentration tested. The *Cordia macleodii* extracts exhibited strong antioxidant activity by inhibiting DPPH and reducing power activities when compared with standard L-ascorbic acid.

The extracts of bark were found to contain a noticeable amount of total phenols, which play a major role in controlling oxidation. The study

shows that the extracts of *Cordia macleodii* bark can be used as an easily accessible source of natural antioxidant<sup>30</sup>.

**Wound Healing Activity:** Wound healing properties of ghrita based formation of *Cordia macleodii* leaf has been reported through an exploratory, open, and controlled study. For the evaluation, randomly, 20 patients were selected in two groups. In which one group was treated with *C. macleodii* ghrita and second one was with povidine iodine as a local application. The action of the drug on signs and symptoms was observed. The study shows significant change in discharge, tenderness, wound margin, and wound size in *Cordia macleodii* ghrita treated group<sup>31</sup>.

The *Cordia macleodii* leaves aqueous extract was tested for its wound healing activity on Wistar strain albino rats using the excision and incision wound model. The finding obtained from the results generated in wound healing activity, which involved studying the impact of local application of *Cordia macleodii* on excision wound, incision wound, and dead space wound, shows that it has no influence over excision wound contraction. The extract has weak tensile strength promoting property in incision wound and revascularization and ground substance formation in the dead space wound<sup>32</sup>.

**Antihypertensive Activity:** According to WHO, more than 140 mg of systolic and 90 mg of diastolic pressure is hypertension. The leaf powder of *Cordia macleodii* was evaluated for anti-hypertension activity, for the evaluation, researcher were randomly selected 20 patients and divided into two groups. In which one group is treated with *Cordia macleodii* leaf powder, and another one is treated with supagandha powder. The study shows that the leaf powder of *Cordia macleodii* Hook. (Boraginaceae) has been reported beneficial on scientific base and statistical measurements on diastolic and systolic hypertension<sup>33</sup>.

**Antivenom Activity:** A study was conducted to determine the antivenom potential of ethanolic extract of bark of *Cordia macleodii* against Naja venom included pharmacological effects such as lethality, hemorrhagic lesion, necrotizing lesion, edema, cardiotoxicity, and neurotoxicity. The study was found that at the dose of 400 and 800 mg/kg

ethanolic extract of *Cordia macleodii* bark significantly inhibited the Naja venom-induced lethality, hemorrhagic lesion, necrotizing lesion and edema in rats. The antivenom potential of ethanolic extract of bark of *Cordia macleodii* against Naja venom poisoning may be due to precipitation of active venom constituents<sup>34</sup>.

**Acute Toxicity:** The extracts of *Cordia macleodii* were tested for the acute toxicity by using the staircase method, and the study was carried out at the range from 500 mg/kg to 2 g/kg oral dose. At the initial stage, the dose of 500 mg/kg was administered individually in 2 mice, and mortality was observed for the next 24 h, and then 1000 mg/kg was administered individually in 2 mice, and mortality was observed for the next 24 h. At last dose was increased by 200 mg/kg up to the dose 2000 mg/kg, and animals were observed for the mortality and toxicity. Acute toxicity study shows that there is no mortality even at a dose of 2000 mg/kg in other words, the *Cordia macleodii* did not produce toxic affect up to 2 g/kg in oral dose<sup>23</sup>.

**CONCLUSION:** *Cordia macleodii* is a rare, small tree and frequently distributed in moist and drug deciduous forests of India. Pharmacological investigations and clinical trials based studies confirmed that *Cordia macleodii* have analgesic, anti-inflammatory, antimicrobial and antifungal, wound healing, hepatoprotective, antioxidant, antihypertensive activities and has antivenom potential. Pharmacological studies also confirmed that *Cordia macleodii* did not produce any toxic effect.

Only a few pharmacological and phytochemistry studies have been conducted on this plant. Till now, only five active phytoconstituents have been isolated from this tree. They are as follows, Stigmasterol, Campesterol, 2-(3-hydroxy-5-methylbenzyl) 2, 3 - dihydro - 5, 7 -dihydroxychromen - 4 - one, Cholest - 5 - en - 3ol (3Beta)-Carbonyl chlorinated and 3,4-dihydroxy-5-methoxybenzoic acid are present in leaves and bark of *Cordia macleodii*. Significant pharmacological actions, plant morphology, plant habitat, and plant phytochemistry have been described.

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