



**International Journal of Biology, Pharmacy  
and Allied Sciences (IJBPAS)**

*'A Bridge Between Laboratory and Reader'*

[www.jibpas.com](http://www.jibpas.com)

---

## PHYTOPHARMACOLOGY AND APPLICATIONS OF *CORDIA*

### *MACLEODII*: A MIRACULOUS PLANT

AHIRWAR K\*, KUMAR A, NAG M AND KHAN J

University Department of Pharmacy, Sant Gahira Guru Vishwavidyalaya, Sarguja, Ambikapur  
(C.G.), 497001, India

\*Corresponding Author: Khemkaran Ahirwar: E Mail: [khempharma@yahoo.co.in](mailto:khempharma@yahoo.co.in)

Received 8<sup>th</sup> May 2022; Revised 16<sup>th</sup> June 2022; Accepted 27<sup>th</sup> Aug. 2022; Available online 1<sup>st</sup> April 2023

<https://doi.org/10.31032/IJBPAS/2023/12.4.7018>

#### ABSTRACT

The use of plants and plant products as medicinal plants based on their therapeutic potential is well recognized and has been used for the treatment of various diseases and ailments since ancient times. *Cordia macleodii*, commonly known as Dahiman or Dahipalas or Shikari, a plant belonging to the family Boraginaceae, is one of the rare medicinal plants reported to possess potential therapeutic activities such as anti-inflammatory, antimicrobial, analgesic, hepatoprotective, wound healing, antihypertensive and antioxidant. The presence of various bioactive compounds like terpenoids, flavanoids, glycosides, phenols, tannins, saponins, steroids, volatile oils, amino acids, alkaloids, and resins make *C.macleodii* a valuable potent herbal medicinal plant. Though the plant has potential health benefits and medicinal value, there is only limited literature available about the plant, so there is a need for an extensive survey and exploration of knowledge about *C.macleodii*. The present review summarizes geographical sources, phytochemical constituents, potential biological activity and application, ethnobotanical and medicinal uses, and toxicity. The review finally concluded with a discussion of future prospects.

**Keywords:** *C.macleodii*, flavanoids, alkaloids, wound healing, anti-inflammatory, ethnobotanical, antivenom

## 1. INTRODUCTION

The basic needs of mankind such as food, clothing, housing, and medicine are majorly sourced and fulfilled by plants. The medicinal use of plants and natural products in the treatment of kinds of ailments is well recognized and can be evidenced in various civilizations such as the Chinese, Indian, Roman, and Greek civilizations [1]. In India, Medicinal plants and natural products are widely used in the pharmaceutical industry as processed products and as traditional folk medicine in Siddha, Ayurveda, and Unani systems of medicine [2]. The phytochemical screening for biological activity estimated around 2.5 lacs to 5.0 lacs of plant species out of 4.5 million plant species in India. Recently, there is a growing interest in the use of herbal medicine and biologically active constituents as alternative medicine in the treatment of diseases and the development of novel herbal formulations by the pharmaceutical industry.

*Cordia* is a genus comprised of trees and shrubs which are mostly distributed in warmer regions. Out of 300 identified species worldwide of the genus *Cordia*, about 13 species are found in India. *C.macleodii* is one of the plants of the

genus *Cordia* and belongs to the Boraginaceae family. The plant is commonly known as Dahiman or Dahipalas or Shikari plant and is the size of a small tree with white flowers. The leaves are green ovate, having a base and margin cordate and crenate dentate respectively [3]. *C.macleodii* is native to India, mostly found in dry deciduous and moist forest regions such as Odisha, Madhya Pradesh, Maharashtra, Chhattisgarh, and Tamilnadu. Medicinally, the plant is used for various purposes like healing wounds, and mouth sores, treating jaundice, and also as an aphrodisiac by the tribal people. The reported pharmacological activities of plant *C.macleodii* include anti-inflammatory, antivenom, antimicrobial, hepatoprotective, wound healing, analgesic, and antioxidant activities based upon various pharmacological studies. Terpenoids, flavanoids, glycosides, phenols, tannins, saponins, steroids, volatile oils, amino acids, alkaloids, and resins are among the major compounds and secondary metabolites isolated from *C.macleodii* [4]. The presence of medicinal properties, pharmacological activities, and various phytochemicals

makes the *C.macleodii* an important ethnomedicinal plant in India [5].

This review aims to present a comprehensive assessment of plant botany, phytochemical constituents, potential biological activity and application, ethnobotanical and medicinal uses, and toxicity of plant *C.macleodii*.

## 2. BOTANICAL DESCRIPTION, TAXONOMY, AND GEOGRAPHICAL SOURCES

Sr. No	Language	Synonym of <i>C.macleodii</i>
1.	Bengali	Sitapatra
2.	Hindi	Dahiphalas, Dahiman
3.	Kannada	Bili challe, Doddacalle, Hadang, Hirichalle
4.	Marathi	Bhoti, Daiwas, Dhaim, Dhaiwan
5.	Oriya	Baurlo, Bhoto, Sambarsinga, Panki, Shikari
6.	Tamil	Palandekku
7.	Telugu	Botuku, Iriki, Pedda batava, Pedda botuku

### 2.3. Geographical sources

The largest genus cordia belonging to Boraginaceae are mainly found in the tropical region and occasionally in subtropical areas. The plant *C.macleodii* is widely distributed in Central India, Deccan, North Kanara, and the Carnatic region. In India, it is spread especially in the region of Bihar hills, Madhya Pradesh, Chattisgarh, Karnataka, Chota Nagpur, and Konkan [6].

### 2.4. Parts used

The whole plant finds application in the treatment of various diseases. However; the parts of the plant mostly used are leaves, seeds, bark, and stem [5].

### 2.1. Classification

Botanical name: *Cordia macleodii*

Common name: Macleod Cordia.

Family: Boraginaceae (Forget-me-not family)

Synonyms: *Hemigymnia macleodii*, *Lithocardium macleodii*, *Gerascanthus macleodii*

### 2.2. Common vernacular names [5, 6]

### 2.5. Taxonomic description of the plant

#### *C.macleodii*

Leaves alternate, cordate-ovate, obtuse, 3-5 nerved, permanently tomentose beneath, scarcely subopposite; mature 12.5 cm in diameter, petiole 2.5-5 cm, inflorescence corymbs, short tomentose, calyx about 1.2 cm, tubularclavate, densely tomentose, ribbed upwards or much smaller, not (or obscurely) ribbed. Corolla- lobes about 1.6 cm, oblong, or much shorter. Fruit is acutely conical till nearly ripe, persistent calyx broadly funnel-shaped or sub-campanulate [5,7].

---

### 3. MACROSCOPIC AND MICROSCOPIC CHARACTERS OF *C.macleodii*

#### 3.1. Macroscopic Characters [5, 7, 8]

The plant *C.macleodii* is a small/medium-sized polygamous deciduous tree/shrub. It has 10–15 meters in height with a trunk of size 45–60 cm in diameter. The morphology of various parts of the plant is discussed below.

##### 3.1.1. Bark

It is light green (when fresh)/grayish brown (when dried mature) in color on the outer surface, 12–15 mm thick; carrot red color from inside. It has the property to form exudates upon injury. The outer surface of the bark is rough; whereas the inner surface is white and fibrous in nature. The bark has a coarse texture with splintery fracture. It has no characteristic taste and odor.

##### 3.1.2. Leaves

The leaves of the plant are dark green in color with a shiny appearance, broadly ovate in shape. The ventral surface of the leaf is hairy and light green in color. Leaves are obtuse and bluntly acuminate with the size of 15–20 cm × 12–18 cm. Many white cystoliths are present in 4–6 nerves from the deep cordate base. The petioles are alternate with the entire or

dentate margin having size of 3.8–7.5 cm long.

##### 3.1.3. Flowers

The flowers are polygamous, subsessile yellowish/orangish white in color with densely paniculated terminal and axillary tomentose cymes/spikes. Male flowers do not contain style and stigma but have a rudimentary ovary.

##### 3.1.4. Calyx

It exists in tubular or campanulate shape. It contains 8–10 mm long, short lobes, obconic, densely tomentose, ribbed, and obtuse 4–6 short teeth.

##### 3.1.5. Corolla

It is infundibuliform yellowish-white in color. Lobes (6–10) are present in the form of hypocrateriform or campanulate. The size is about 1.5 cm long; lobes have a size range from 2.0–3.0 mm, greater than the tube, spatulate-oblong, obtuse, and veined. Four locules with one erect ovule are present in the ovary.

##### 3.1.6. Stamens

It is filamentous and hairy at the base; Usually, 6 in number, and is exerted. Stamens exist at the base with pubescent or glabrous filaments.

##### 3.1.7. Anthers

Male flowers have large anther compared to hermaphrodite flowers.

### 3.1.8. Fruits

Fruits are mainly globose, ovoid /ellipsoid in shape having bony endocarp and viscid pulp. Drupes are yellowish apiculate subglobose shapes seated on the broadly campanulate toothed or lobed, ribbed calyx. The macroscopic features are shown in **Figure 1**.

### 3.2. Microscopic Characters [5, 7, 8]

Transverse sections of leaves, petiole, and bark are discussed under microscopic features of *C. macleodii*.

#### 3.2.1. Transverse section of bark

The transverse section of bark shows tangentially, elongated, and radially arranged 10-12 cork. Phelloderm is present in cork cambium; consists of parenchymatous stone cells, prismatic calcium oxalate crystals, tannins, and fibers. Primary and Secondary phloem are wide and consist of sieve tubes, companion cells, phloem parenchyma, and tangentially running bands of thick-walled lignified fibers interrupted/transversed by heterogenous medullary rays. The microscopy of bark is shown in **Figure 2**.

#### 3.2.2. Transverse section of leaf

The midrib of the leaf is dorsiventral when seen under the transverse section. The upper layer epidermis is a single

rectangular cell with a thick cuticle. However in the lower region of the lamina; the epidermal cells are smaller in size. The narrow palisade cells are visible in mesophyll which is radially elongated. Stellate parenchymatous tissues with air spaces in the upper and lower region are also present. A semilunar vascular bundle with a parenchymatous bundle sheath containing brownish content is visible in the midrib. bicollateral i.e phloem patches are present on both sides of the xylem. Four to six layers of collenchymas are observed underneath both epidermises. In young leaves; stomata can be differentiated easily and in the lamina, these are seen maximum on the lower surface and minimum on the upper surface. The shape of stomata is mainly ranunculaceous and cruciferous (anisocytosis and anomocytic). Prismatic calcium oxalate crystals are also visible. The upper and lower epidermis consists of numerous glandular and non-glandular types of trichomes. These trichomes are both unicellular and multicellular uniseriate with a bulbous base/head respectively. Some of the glandular trichomes contain unicellular stalks, and multicellular heads and are larger in size. The midrib is divided into three regions

namely upper, middle and lower. The lower region is circular, the middle shows a vascular bundle, and the upper region is slightly elevated with collenchyma patches. The microscopy of the leaf is shown in **Figure 3**.

### 3.2.3. Transverse section of the petiole

The petiole is urn-shaped with an outer epidermal surface consisting of numerous glandular and non-glandular trichomes and collenchyma patches. The upper part of the petiole has a narrow channeled groove in the middle region and is laterally elevated on either side

containing vascular bundles. The lower region is circular and occupies the major portion. Bi-collateral phloem patches and starch grains surrounded by a parenchymatous bundle sheath are seen on both the outer and inner regions of the xylem. Radial medullary rays are present between the vascular bundles with a pith in the center. Parenchymal cells are mostly filled with dark brownish/reddish content enclosing the prismatic crystals of calcium oxalate. The microscopy of the leaf is shown in **Figure 4**.



Figure 1 – *C. mocleodii* plant



Figure 2 - Transverse section of the petiole

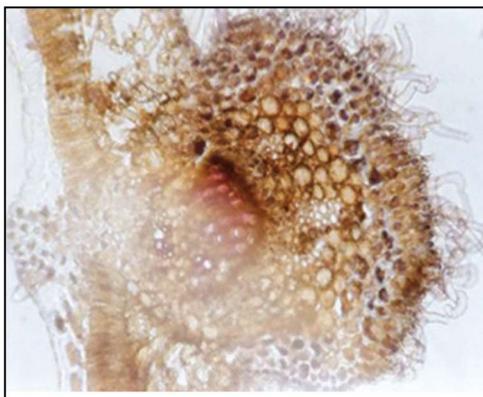


Figure 3: Transverse section of the midrib of leaf

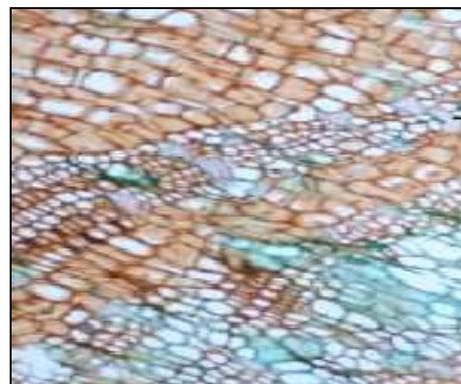


Figure 4: Transverse section of bark

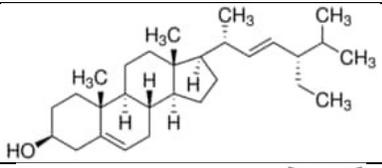
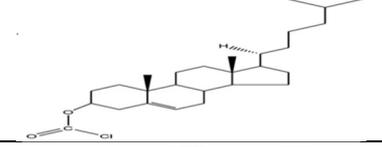
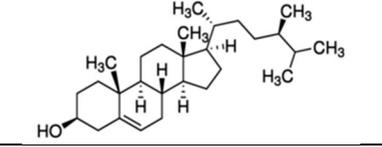
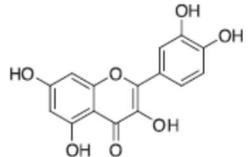
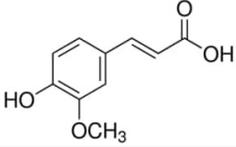
#### 4. PHYTOCONSTITUENTS OF PLANT

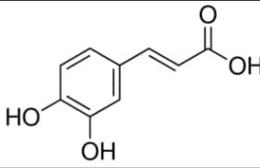
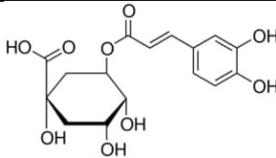
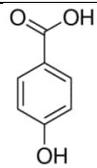
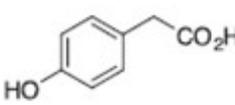
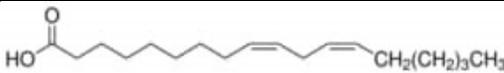
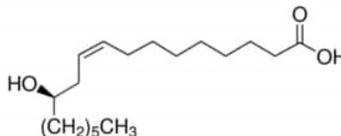
##### *C.macleodii*

Phytoconstituents are non-nutritional chemical moieties present on plants which having great therapeutic potency. These phytoconstituents are responsible for the various pharmacological activities of plants. The study about the phytoconstituents is done under the subject of phytochemistry. A preliminary

analysis of various parts of *C.macleodii* plants reveals the presence of various constituent groups such as terpenoids, glycosides, tannins, flavonoids, steroids, phenols, alkaloids, resins, amino acids, and carbohydrates. The chemical constituents isolated from different parts (wood, bark, leaves, and flowers) of the plants with their chemical structures are described in **Table 1**.

**Table 1: List of identified compounds obtained from various parts of *C.macleodii***

Plant parts	Identified compound	Chemical structure	References
<b>Steroids</b>			
Bark	Stigmasterol		[9]
	Cholest-5-En-3ol (3beta)-carbonyl chlorinated		[9]
	Campesterol		[9]
<b>(A) Flavonoids</b>			
Leaves and Flowers	Quercetin		[8,10]
	Kaempferol		[8,10]
<b>(B) Phenolic &amp; Phenolic acids</b>			
Leaves and Flowers	Ferulic acid		[8,10]

Plant parts	Identified compound	Chemical structure	References
	Caffeic acid		[8,10]
	Chlorogenic acids		[8,10]
	p-Hydroxybenzoic acid		[8,10]
	p-Hydroxyphenyl lactic acid		[8,10]
	<b>Fatty acids</b>		
	Arachidic acid	$\text{CH}_3(\text{CH}_2)_{17}\text{CH}_2\text{COOH}$	[8,10]
	Linoleic acid		[8,10]
	Lauric acid	$\text{CH}_3(\text{CH}_2)_9\text{CH}_2\text{COOH}$	[8,10]
	Myristic acid	$\text{CH}_3(\text{CH}_2)_{11}\text{CH}_2\text{COOH}$	[8,10]
Wood	Oleic acid	$\text{CH}_3(\text{CH}_2)_6\text{CH}_2\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$	[8,10]
	Palmitic acid	$\text{CH}_3(\text{CH}_2)_{13}\text{CH}_2\text{COOH}$	[8,10]
	Ricinoleic acid		[8,10]
	Stearic acid	$\text{CH}_3(\text{CH}_2)_{15}\text{CH}_2\text{COOH}$	[8,10]

## 5. APPLICATION AND PHARMACOLOGICAL ACTIVITY OF *C.macleodii*

### 5.1. Antioxidant

This miracle plant has also been shown to produce strong antioxidant activity, which is similar to flavonoids [3]. The antioxidant potential of *C.macleodii* leaf extracts was investigated using in-vitro proven methods. The *C.macleodii* extracts showed strong radical scavenging against DPPH and Nitric oxide radicals, as well as good reducing ability. Leaf ethanolic extract suppresses DPPH (2, 2-diphenyl-1-picryl-hydrazyl-hydrate) and nitric oxide radicals at an 800 gram per ml dose [3, 11]. The same dose of ethanolic extract suppressed reducing power and iron chelation in animal models. The antioxidant enzymes Superoxide dismutase (SOD), Catalase (CAT), and Glutathione peroxidase (GPx) interact with the ligand C.-1, which has a scavenging action and a greater impact on anti-oxidant activity [3, 11].

The DPPH radical scavenging activity assay, the Folin Ciocalteu reagents for phenolic content, and the Oyaizu technique for reducing power were all used to evaluate *C.macleodii* bark extracts for antioxidant activity in vitro.

At the different concentrations studied, *C.macleodii* bark extracts had an antioxidant activity that was equivalent to that of normal ascorbic acid. When compared to conventional L-ascorbic acid, the *C.macleodii* extracts showed significant antioxidant activity, blocking DPPH and lowering power activities.

Total phenols, which play an important role in oxidation regulation, were discovered in significant amounts in bark extracts. The extracts of *C.macleodii* bark can be employed as a conveniently available source of natural antioxidants, according to the studies [12].

### 5.2. Antihypertensive

It is a circumstance in which the blood exerts too much strain against the arterial walls. *C.macleodii* has hypertensive properties in addition to its other medicinal properties [3]. For the study, researchers randomly chose 20 patients and placed them into two groups, administering the leaf powder twice daily for a month. One group was given *C.macleodii* leaf powder, while the other was given supagandha powder [13]. The study found that *C.macleodii* leaf powder was effective in diastolic and systolic hypertension, based on scientific

evidence and statistical data. It was also discovered to regulate blood urea levels.

### 5.3. Antimicrobial

The antioxidant capacity of *C.macleodii* leaf water extract was shown to be greater than that of the conventional medication ciprofloxacin [3]. The *C.macleodii* extracts were effective against gram +ve bacteria like *B. subtilis* and fungi like *A. niger*. It was discovered that extracts taken after twelve hours had higher antibacterial and antifungal properties than those collected after six hours. Improved extraction methods and identification of chemical constituents in leaf and stem extracts might lead to the development of a new antibacterial agent for the general public [14].

By agar plate technique zone of inhibition with various standards, the *C.macleodii* bark methanolic extract exhibited considerable antibacterial effect against two-gram -ve bacteria *Pseudomonas aeruginosa*, *E. coli*, and two-gram +ve bacteria *Staphylococcus aureus*, *Streptococcus pyogenes*. Bacterial growth inhibition was more apparent in *S. aureus* and *E. coli* than in the other organisms studied [15]. The antifungal effects of *C.macleodii* leaf and stem extracts from various solvents were

examined. Only one fungal strain was used in the experiment, and the antifungal efficacy of the water extracts was shown to be outstanding. In comparison to the other extract, the stem and leaf are larger [16].

### 5.4. Anti-inflammatory

Inflammation is a complex pathophysiological protective tissue response to various stimuli (damaged cells or pathogens) involving immune cells, blood vessels, and certain mediators, leading to the accumulation of blood cells and plasma fluid locally [17]. Antiinflammatory activity has been studied in several plants which have been reported to have flavanoid content. Therefore, *C.macleodii* leaf extract has been studied for anti-inflammatory activity by using the carrageenan-induced rat paw edema method. Significant inhibition of paw edema has been observed by the extract of *C.macleodii* leaf when compared with the control group, which shows remarkable anti-inflammatory activity. The extent of edema inhibition caused by *C.macleodii* extract and caused by standard Diclofenac diethylamine was found to be 44 % and 92 % respectively [18].

### 5.5. Hepatoprotective

The liver is the most vital organ, as it regulates a variety of metabolic functions. It is critical to protect the liver from the adverse effects of ingested hepatotoxins or to counteract changes in the anti-radical defense mechanisms; drugs capable of doing so are known as hepatoprotective agents [19].

Plants and natural items have long been used to protect, prevent, and treat liver disease around the world. The claims of therapeutic usefulness of numerous of these herbal substances have been supported by scientific investigation, as indicated by the extensive work on their hepatoprotective potentials [20].

In this context, Qureshi and colleagues used a carbon tetrachloride-induced liver injury model in rats to test the hepatoprotective efficacy of alcoholic leaf extract of *C.macleodii*. They reported a significant decrease in the levels of serum glutamate pyruvate transaminase (SGPT), Alkaline Phosphatase (SALP), and serum glutamate oxaloacetate transaminase (SGOT) and total bilirubin in pretreated rats with *C.macleodii* leaf extract [11].

### 5.6. Antivenom

Snakebites are a serious and widespread global health issue. For a very long plant-based anti-snake venom has been the effective treatment for snakebites [21]. *C.macleodii* is a rare medicinal and timber plant successfully used for the treatment of snakebites [22]. In this regard, Soni *et al.*, examined the antivenom efficacy of alcoholic bark extract of *C.macleodii* against Najain Wistar rats. The extract of *C.macleodii* effectively reduced the mortality, edema, hemorrhagic and necrotizing lesion induced by Naja venom in rats at doses of 400 and 800 mg/kg. Further, the defibrinogenating and coagulant activity of Naja venom were neutralized by the bark extract. The cardiotoxic effects of extract were also counteracted in isolated frog hearts [23].

### 5.7. Wound healing

A wound is a physical, chemical, or microbiological harm to living tissue that disrupts its cellular, structural, and functional integrity. Wound healing is a sequential process that involves the regeneration or restoration of wounded tissue [24].

In this context, Bhide *et al.*, examined wound healing properties of leaves of

*C.macleodii* Hook. They examine the effect of *C.macleodii* on excision, incision, and dead space wound. They reported that the extract exhibited no activity over excision wound contraction, however, weak tensile strength encouraging activity and new vessel formation was reported in the incision

wounds and dead space wounds respectively. Further, very less granulation tissue formation was reported in *C.macleodii*. In addition, higher fiber content and angiogenesis than the control group were also reported (Figure 5) [25].

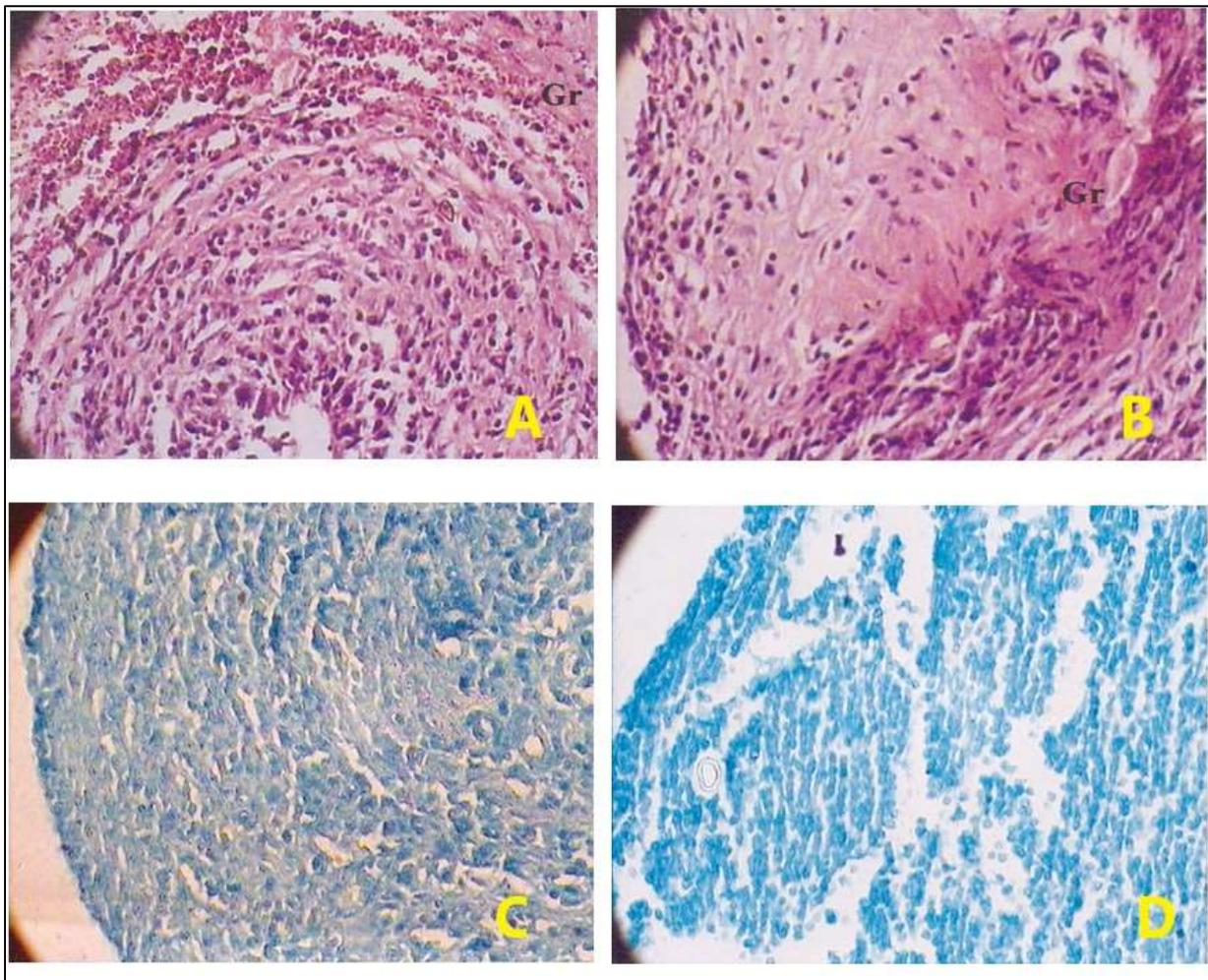


Figure 5: Photomicrographs of granulation tissue (1×400 magnification): a- Control group (HE stain), b- *C.macleodii* treated (HE stain); c-Control group (P blue stain); d- *C.macleodii* treated (P blue stain) (Adopted by [25]) Where, Gr-Granulation; Ang-Angiogenesis

In another research, Sharma *et al.*, conducted an exploratory, open, and controlled study to investigate the wound

healing effects of ghrita-based *C.macleodii* leaf. They divided 20 patients into two groups at random and

treated them with *C.macleodii* ghrita and povidone-iodine. The wound size of the *C.macleodii* ghrita treated group was much less than the povidine iodine treated group, indicating that the ghrita-based formation of *C.macleodii* has high wound healing activity [26].

#### 6. ETHNOBOTANICAL, TRADITIONAL, AND MEDICINAL USES OF *C.macleodii*

*C.macleodii* Hook is a plant that belongs to the family Boraginaceae. It is found in some states of India like Odisha, Madhya Pradesh, and Chhattisgarh and traditionally being used for the treatment of various ailments. It has been used ethnomedicinally by tribal people of the mentioned states. Different parts of *C.macleodii* are being used for different purposes like leaf and bark of the plant is used to heal the wounds, and the leaf is also used for the treatment of mouth sore. Moreover, seeds are used as aphrodisiacs, and bark is used for the treatment of jaundice [27]. Studies performed on *C.macleodii* shows that the plant possesses various pharmacological property such as analgesic property, and anti-inflammatory property, it also acts on microbes and possesses antifungal property, and wound healing property. In addition, it shows properties like

antioxidant, hepatoprotective properties, and antihypertensive properties that can be used for therapeutic purposes. *C.macleodii* Hook acts on both the division of the nervous system which is the central nervous system and peripheral nervous system to impart their analgesic property [18, 28]. Inflammation is a condition where the body shows a variety of biological responses to different kinds of environmental stimuli. Studies confirm that leaves of *C.macleodii* Hook are capable to show anti-inflammatory properties [17, 18]. Furthermore leaves of *C.macleodii* Hook act as a potent antimicrobial agent, especially against gram-positive bacteria like *B. subtilis* and antifungal agents like *A. niger*. Whereas studies showed that the bark of *C.macleodii* Hook possesses antibacterial properties against both gram-positive as well as gram-negative bacteria like *E. coli*, *Pseudomonas aeruginosa*, and *Streptococcus pyogenes*, *Staphylococcus aureus* respectively [15, 16]. *C.macleodii* Hook shows hepatoprotective properties as the leaves of the plant possess the potential of repairing and regenerating damaged liver cells. Furthermore, leaves and barks of *C.macleodii* Hook scavenges the free radicals like nitric

oxide and DPPH and acts as an antioxidant [11, 12]. The wound healing property of leaves of *C.macleodii* Hook has been reported and it shows significant improvement in wound tenderness, wound discharge, size of the wound, and margin of wound [11, 25]. The leaf of *C.macleodii* Hook also has antihypertensive properties and it is beneficial in both systolic and diastolic hypertension [29]. The bark of *C.macleodii* Hook shows antivenom properties against the venom of the Naja cobra snake and reduces activity like lethality, neurotoxicity, edema, and cardiotoxicity [23].

## 7. TOXICITY

Acute toxicity study of *C.macleodii* Hook extract has been carried out by staircase method by administering initially 500 mg/kg oral dose in 2 mice individually and the mice were kept under observation for 24 hours then the dose is increased to 1000mg/kg and after 24 hours of observation, mortality was observed. Finally, the dose is increased to 2000mg/kg and mortality, as well as toxicity, is observed after 24 hours. The result of the study showed *C.macleodii* Hook shows no signs of mortality or toxicity even at an oral dose as high as

2000mg/kg though some animals were found to be depressed [18, 30].

## 8. CONCLUSION

The present need and growing worldwide interest in the development of new medicinal agents from natural sources and the use of phytopharmaceuticals as an alternative medicine for the treatment of many diseases have made scientists refresh and uncoil their literature. The present review summarises comprehensive information on phytoconstituents, isolated compounds, plant botanical information, plant habitat and morphology, biological and pharmacological aspects, and studies reported on the plant *C.macleodii*. The plant *C.macleodii* is reported to have analgesic, anti-inflammatory, hepatoprotective, antimicrobial and antifungal, antioxidant, wound healing, antihypertensive activities, and has antivenom potential with no major toxic effects confirmed by various pharmacological screening and clinical trials based studies. Since the plant *C.macleodii* has been underexplored among other *C.* species and only a little research has been done, so many of its traditional uses still need to be proven scientifically and required to be explored.

The knowledge and information reported in this review will help to recognize the importance of *C.macleodii* as a potential ethnomedicinal plant which may help in finding ways for new drug discovery for the treatment of various diseases.

## 9. FUTURE PROSPECTIVE

The efforts must be focused on more research on its phytochemical and biological evaluation of various traditional therapeutic activities which are still unexplored scientifically. Emphasis should be placed on biotechnological studies, genetic improvement of plants, development of novel drug delivery systems, and industrial collaboration to get commercial benefits from such important medicinal plants.

## REFERENCES

[1] B. Mahesh, S. Satish, Antimicrobial Activity of Some Important Medicinal Plant Against Plant and Human Pathogens, *World J. Agric. Sci.* 4 (2008) (2008) 839–843.

[2] D. Srinivasan, S. Nathan, T. Suresh, P.L. Perumalsamy, Antimicrobial activity of certain Indian medicinal plants used in folkloric medicine, *J. Ethnopharmacol.* 74 (2001) 217–220.

[3] H. Singh, P.M. Singh, *Cordia Macleodii* (Dahiman Ped): An Updated Review,

(n.d.).

- [4] A. Dixit, J. Chandrakar, *Cordia macleodii* Hook f. Thomson-A potential Medicinal Plant, *Int. J. Phytomedicine.* 6 (2017) 394–398. <https://doi.org/10.5138/09750185.2105>.
- [5] B. Bhide, A.P.G. Pillai, V.J. Shukla, R.N. Acharya, Pharmacognostic evaluation of leaf of *Cordia macleodii* Hook., An ethnomedicinally important plant., *Ayu.* 32 (2011) 254–257. <https://doi.org/10.4103/0974-8520.92551>.
- [6] V. Kumar, S.S. Tiwari, A.N. Shukla, S. Srivastava, A.K.S. Rawat, Pharmacognostic and phytochemical evaluation of *Cordia macleodii*, *J. Med. Aromat. Plant Sci.* 33 (2011) 59–63.
- [7] S. Pandey, S. Kushwaha, S. Singh, S. Chaurasia, K. Mishra, Phytochemical And Pharmacological Investigation Of *Cordia Macleodii* Hook, (2020).
- [8] M.J. Oza, Y.A. Kulkarni, Traditional uses, phytochemistry and pharmacology of the medicinal species of the genus *Cordia* (Boraginaceae), *J. Pharm. Pharmacol.* 69 (2017) 755–789.
- [9] P.B. Nariya, V.J. Shukla, R.N. Acharya, M.B. Nariya, P. V Bhatt, C.M. Pandit, R. Tada, Isolation and characterization of phytosterols from *Cordia macleodii* (Hook f. and Thomson) bark by chromatographic and spectroscopic method, *Asian J Pharm Clin Res.* 7

- (2014) 86–88.
- [10] E.F.F. Matias, E.F. Alves, M.K. do N. Silva, V.R. de A. Carvalho, H.D.M. Coutinho, J.G.M. da Costa, The genus *Cordia*: botanists, ethno, chemical and pharmacological aspects, *Rev. Bras. Farmacogn.* 25 (2015) 542–552.
- [11] N.N. Qureshi, B.S. Kuchekar, N.A. Logade, M.A. Haleem, Antioxidant and hepatoprotective activity of *Cordia macleodii* leaves, *Saudi Pharm. J.* 17 (2009) 299–302. <https://doi.org/10.1016/j.jsps.2009.10.007>.
- [12] P.B. Nariya, V.J. Shukla, R.N. Acharya, Phytochemical screening and in vitro evaluation of free radical scavenging activity of *Cordia macleodii* bark.(HOOK. F. & THOMSON), *Free Radicals Antioxidants.* 2 (2012) 36–40.
- [13] M. Dikshit, M. Jaiswal, A Study of Antihypertensive Action of Dadhimanth Hook (*Cordia macleodii*.f. and Thomson.), *J. Ayurveda.* V (2011) 58–65.
- [14] D. Joshi, R. Patel, N. Patel, D. Patel, C. Pandya, Antimicrobial Evaluation of Leaf and Stem Extract of *Cordia macleodii*, *Open Pharm. Sci. J.* 1 (2014) 1–3.
- [15] N.N. Qureshi, B.S. Kuchekar, N.A. Logade, M.A. Haleem, others, Investigation of antimicrobial activity of *Cordia macleodii* and *Leucas ciliata* leaves., *Int. J. PharmTech Res.* 2 (2010) 118–120.
- [16] O. Chaubey, R. Upadhyay, N. Tripathi, A. Ranjan, A comparative antimicrobial study of *Cordia macleodii* Hook, *IOSR J. Pharm. Biol. Sci.* 10 (2015) 1–3.
- [17] L. Ferrero-Miliani, O.H. Nielsen, P.S. Andersen, S. Girardin, Chronic inflammation: importance of NOD2 and NALP3 in interleukin-1 $\beta$  generation, *Clin. & Exp. Immunol.* 147 (2007) 227–235.
- [18] N.N. Qureshi, B.S. Kuchekar, N.A. Logade, M.A. Haleem, others, Analgesic, anti-inflammatory and acute toxicity studies on *Cordia macleodii* and *Leucas ciliata* leaves., *Int. J. PharmTech Res.* 2 (2010) 1311–1315.
- [19] L. V Krepkova, A.N. Babenko, O.L. Saybel, I.A. Lupanova, O.S. Kuzina, K.M. Job, C.M. Sherwin, E.Y. Enioutina, Valuable Hepatoprotective Plants-How Can We Optimize Waste Free Uses of Such Highly Versatile Resources?, *Front. Pharmacol.* 12 (2021) 738504.
- [20] R. Rouf, P. Ghosh, M. Uzzaman, D.K. Sarker, F.T. Zahura, S.J. Uddin, I. Muhammad, others, Hepatoprotective Plants from Bangladesh: A Biophytochemical Review and Future Prospect, *Evidence-Based Complement. Altern. Med.* 2021 (2021).
- [21] C. Lizarzaburu-Ortiz, G. Yumi, A.

- Carvajal, A.B. Pachacama, A. Berrazueta, E. Rojas, A Rare and Urgent Consequence After a Snake Bite, *Cureus*. 14 (2022).
- [22] S.P. Lakhmale, R. Acharya, N. Yewatkar, Ethnomedicinal claims on antivenom activity of certain fruit and seed drugs-A review, *Ayurpharm Int J Ayur Alli Sci*. 1 (2012) 21–29.
- [23] P. Soni, S.H. Bodakhe, Antivenom potential of ethanolic extract of *Cordia macleodii* bark against *Naja* venom, *Asian Pac. J. Trop. Biomed*. 4 (2014) S449--S454.
- [24] A. Sharma, S. Khanna, G. Kaur, I. Singh, Medicinal plants and their components for wound healing applications, *Futur. J. Pharm. Sci*. 7 (2021) 1–13.
- [25] B. Bhide, B.K. Ashok, R.N. Acharya, B. Ravishankar, Anti-microbial and wound healing activities of *Cordia macleodii* Hook. f & Thoms. leaves, (2011).
- [26] S. Ashish, *Cordia macleodii* ), *Ayurpharmacy Int. J. Ayurvedic Allied Sci*. 2 (2013) 98–104.
- [27] P.C. Dubey, R.L.S. Sikarwar, A. Tiwari, Ethobotany of *Cordia macleodii*, *Shodha Samagya*. 2 (2008) 31.
- [28] K.H. Kumar, P. Elavarasi, Definition of pain and classification of pain disorders, *J. Adv. Clin. Res. Insights*. 3 (2016) 87–90.
- [29] M. Dikshit, M. Jaiswal, A study of antihypertensive action of *Dahimanth Hook. Cordia macleodii*, *J. Ayurveda*. 2 (2011) 59–64.
- [30] S. Ashish, V.J. Shukla, S.K. Gupta, A comparative antimicrobial study on *Cordia macleodii*. Hook leaf water extract and its ghrita base formulation, *Int. J. Ayurvedic Med*. 4 (2013) 9–16.