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Endangered Ethno-Medicinal Plant, Cordia Macleodii- A Brief Review

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Abstract: *Cordia macleodii is an endangered ethnomedicinal plant found in dry deciduous forest areas of India. It is one of the 13 species belonging to the genus Cordia of the Boraginaceae family, commonly known as Dahipalas or Dahiman. The main identifying feature of this plant is that any injury to the adaxial surface of the leaf will result in persistent black markings. This plant species is at risk of extinction due to several causes, including early flowering, restricted fruit development, premature drying of fruits, and poor seed germination. C. macleodii has been highlighted for its therapeutic effects including antibacterial, antifungal, anti-inflammatory, antioxidant, wound healing, aphrodisiac and hepatoprotective abilities, and also used by different tribals of India for healing wounds, mouth sores, treating piles and diarrhoea. Leaf powder of C. macleodii is useful for treating hypertension and controlling blood urea, and the ethanolic bark extract is used against Ophiophagus hannah venom due to its antivenom properties. Various bioactive constituents, including saponins, tannins, glycosides, alkaloids, terpenoids, triterpenoids, flavonoids, lipids, fixed oils, resin and phenolic components are present in different plant parts of C. macleodii. Stem and leaf extracts of C. macleodii contain phytoconstituents like Stigmasterol, Cholest-5-EN-3OL (3β)-Carbonyl chlorinated, Campesterol and 3, 4- dihydroxy-5-methoxybenzoic acid*

Keywords: Bioactive components, Boraginaceae,Cordia macleodii, Endangered, Pharmacological activities, Phytoconstituent

I. INTRODUCTION

Medicinal plants have served as a significant part of the day-to-day healthcare practices of human beings since the ancient period. Despite their importance, the existence of several medicinal plants is in a threatened condition due to over-exploitation, destruction of habitats, agricultural encroachment, urbanization, overmining activities and unmonitored trade.

The Indian subcontinent is rich in medicinal plant diversity. Due to destructive harvesting methods and excessive harvesting of medicinal plants without much planning for future prospects, the genetic diversity of those plants is being threatened at a frightening rate. The majority of plant species are conserved through in-situ conservation but many of those species either lack seeds or contain seeds having poor germination rates. Therefore, it is crucial to maintain and protect the natural assets of Indigenous medicinal plants 2, 3 . The genus Cordia belonging to the Boraginaceae family, comprises over 300 species of shrubs and trees which are widespread across the tropical, subtropical and warm climates of tropical America, South Asia and Africa. In India, there are 13 species of the genus Cordia are found among which C. MacLeod is an endangered one which is mainly found in the dry and deciduous forest areas. This species is under threatening conditions due to early falling of flowers, limited fruit formation, immature drying of fruits and low probability of seed germination.

PLANT'S DESCRIPTION:

Cordia macleodii is a rare medicinal plant that can attain a height of about 9- 12 m with a trunk diameter of about 50-60 cm. The plant's bark is light green to corky grey in colour; reddish colour inside and forms reddish brown colour exudates on an injury. Leaves are about 5-10 cm in length and exhibit a shape of broadly ovate, rough surface area and

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cordate base with crenateserrate edges which are positioned in an alternate to sub-opposite manner. Trichomes are present on the petiole. White-coloured polygamous flowers are present in short terminal axillary corymbs. The corolla lobes are yellowish-white in colour, rectangular in form, and 0.6-0.8 cm long, while the calyx is heavily tomentose. Exerted stamens having hairy filaments are found at the base. Glabrous ovary, bilobed and capitate stigma are seen in this species. 1.2-1.9 cm long, ovoid-shaped drupes are seated at a persistent calyx. The timing for flowers and fruits is from February through August 4 Permanent black markings result from scratches on the adaxial surface of the leaf.

Fig. 1 — Cordia macleodii (Griff.) Hook.f. & Thomson in Natural Habitat with flowers and Fruits.

VERNACULAR NAMES

Vernacular names of Cordia macleodii vary due to the language variation in India. It is generally known as Dahiman, Dahipalas, Dhengan, Gonni and Kuhman (in Hindi); Baurlo, Bhoto, Sambarsinga, Panki and Shikari (in Odia); Dhaman, Dhaiwan, Dhaim, Bhoti, Dhalm and Daiwas (in Marathi); Palandekku (in Tamil); Botuku, Peddabattava, Peddabotuku and Iriki (in Telugu); Bili challe, Doddacalle, Cellu, Hadang and Hirichalle (in Kannada) 4, 7, 11 and Dadhimanth, Sitapatra (in Sanskrit) 10, 12 . C. macleodii is popular in the name of Bhojraj among the Birhore tribe of Jharkhand 13 and as Kassamar among the Korku tribe of Maharashtra 14 .

- Taxonomic Position:
- Kingdom: Plantae
- Division: Tracheophyta
- Class: Magnoliopsida
- Subclass: Lamiidae
- Superorder: Solananae
- Order: Boraginales
- Family: Boraginaceae
- Subfamily: Cordioideae
- Genus: Cordia
- Species: C. macleodii

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GEOGRAPHICAL DISTRIBUTION:

Cordia macleodii is indigenous to India and is mainly found in Odisha, Chhattisgarh, Madhya Pradesh, Maharashtra, Chotanagpur, West Bengal and Rajasthan 4, 6 . In Odisha, C. macleodii is found in the Gandhamardan hills of Bargarh district, Mayurbhanj district, Ganjam district 8, 9, 15, and also in Nayagarh forest division 16 . In Chhattisgarh, C. macleodii is found in the Koriya district, Marwahi forest division, Pendra road and also in Bilaspur 4, 17. In West Bengal, C. macleodii is found in the Amchura and Bhaluk Khulya forests of Bankura District 5 . It is also found in Thane, Mumbai, Pune, Raigad, Vidarbha and Marathwada of Maharashtra 18 .

PHARMACOLOGICAL ACTIVITIES:

As a medicinal plant, C. macleodii has many medicinal properties. Different tribes in Odisha, Chhattisgarh and Madhya Pradesh utilise distinct plant parts of C. macleodii as aphrodisiacs, for jaundice treatment, to heal wounds, mouth sores and other illnesses. The results of pharmacological research on different extracts of C. macleodii plant parts show that the plant has hepatoprotective, antiinflammatory, antibacterial, wound-healing, acute toxicity, antidepressant and antioxidant actions 8, 17, 19 .

HEPATOPROTECTIVE ACTIVITY:

Aqueous and ethanol bark extracts of C. macleodii have hepatoprotective properties as these extracts significantly reduce the Carbon tetrachloride (CCl4) induced elevated levels of liver enzymes such as SGPT, SGOT, ALP and bilirubin 24. Alcoholic extract of C. macleodii leaves also show hepatoprotective properties against CCl4-induced hepatic cell injury and ethanol-induced hepatotoxicity. The ethanolic extract of C. macleodii bark is helpful in healing liver damage whereas the aqueous and ethanolic bark extracts have abilities for liver regeneration. The presence of flavonoids in extracts may possess hepatoprotective activity.

ANALGESIC ACTIVITY:

Analgesic drugs are used as painkillers to get relief from pain. They act on the central nervous system and block the pain signals to the brain. The leaf extract of C. macleodii has significant analgesic properties as compared to Pentazocine. During the investigation of the dosedependent analgesic effect of C. macleodii using the hot plate test in mice, it has been seen that the effect of 400mg/kg dose is quite effective as the effect of Pentazocine at the dose of 10mg/kg 4, 7, 27 . The seed paste of C. macleodii, along with lump sugar is used by the Korku tribals of Maharashtra for the treatment of mental illness. Inhalation of dry leaf powder helps in getting relief from headaches 14 .

ANTI-INFLAMMATORY ACTIVITY:

Inflammation is a protective response of body tissue when it encounters harmful stimuli like pathogens, toxins, damaged cells, or irritants. To counter the inflammation that may be swelling, redness or pain; anti-inflammatory drugs are used 7 . As per a study on Wistar rats by using the carrageenan-induced rat paw enema method; it is found that Cordia macleodii leaf extract possesses significant anti-inflammatory properties. C. macleodii leaf extracts contain flavonoids that can interfere with the synthesis of prostaglandin; an important factor in the pain process during inflammation 7, 27 .

WOUND HEALING ACTIVITY:

Cordia macleodii leaves are used to heal wounds by the tribal peoples of Odisha and Madhya Pradesh. It has been reported that the ghrita (cow's ghee) based formulation of C. macleodii leaves shows significant wound-healing properties but has lesser efficiency when compared to Povidone Iodine. Leaves of C. macleodii contain tannin which may help to upregulate the formation of new capillaries during the inflammation of the wound and speed up the healing process 28, 29 . Bark paste is used to heal wounds of buffaloes and cattle 19 .

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ANTI-VENOM ACTIVITY:

The alcoholic bark extract of C. macleodii shows anti-venom properties against Naja venom 30 . As per a study on Wistar rats, it was found that the bark extract of C. macleodii has significantly inhibited symptoms like- lethality, bleeding, narcotic lesions and edema induced due to the Naja venom. Phytochemicals like- cardiac glycosides and flavonoids are present in C. macleodii extract which have protective effects against snake venom. The coagulant property of C. macleodii bark extract is capable of neutralizing the venom of Ophiophagus hannah may be by precipitating the active venom components. Due to the coagulant properties of C. macleodii bark, traditional healthcare practitioners of Chhattisgarh use it to treat snake bites 31, 32 .

ANTI-BACTERIAL, ANTI-MALARIAL AND ANTI-FUNGAL ACTIVITIES:

Chloroform, ethyl acetate leaf extracts and petroleum bark extract of Cordia macleodii have antibacterial properties against some gramnegative bacteria like- Escherichia coli, Pseudomonas aeruginosa and some gram-positive bacteria such as Staphylococcus aureus and Streptococcus pyogenes 32, 33. Besides Escherichia coli, Pseudomonas aeruginosa and Staphylococcus aureus; ethanolic leaf extract of C. macleodii also has anti-bacterial properties against Klebsiella pneumoniae and Bacillus subtilis. The methanolic bark extract of C.

macleodii exhibits antibacterial properties against Escherichia coli, Pseudomonas aeruginosa, Streptococcus pyogenes and Staphylococcus aureus 32, 34. The aqueous extract of C. macleodii shows better antibacterial potential in comparison to Ciprofloxacin against Bacillus subtilis 35. Chloroform or ethyl acetate leaf extracts of C. macleodii possess anti-malarial efficiency against Plasmodium falciparum. Aqueous and methanolic extracts of C. macleodii stem and leaves have fungicidal properties against Candida albicans. The petroleum ether bark extract and the chloroform or ethyl acetate leaf extracts of C. macleodii show anti-fungal activity against Candida albicans, Aspergillus niger and Aspergillus clavatus 33, 34 .

ANTIOXIDANT ACTIVITY:

Methanolic and butanolic bark extracts of Cordia macleodii have antioxidant properties against free radicals like DPPH (2,2- diphenyl-1-picrylhydrazyl) and Nitric oxide (NO). These extracts also have a strong reducing power compared to the standard L-ascorbic acid. Both the methanol and butanol bark extracts contain phenols which play a crucial role in controlling the oxidation process. According to the findings, C. macleodii bark extracts can be utilised as an easily accessible natural antioxidant source 7, 26, 36 . The antioxidant activity of C. macleodii is significantly influenced by the phenolic content present in its leaves and bark 37 . The pharmacological activities of different plant parts of C. macleodii are summarized in.

PHYTOCHEMISTRY:

Cordia macleodii plant parts are rich sources of different bioactive compounds which have important roles in treating diseases. The plant also contains several secondary metabolites like- Saponin, steroids, flavonoids, alkaloids, glycosides and terpenoids. C. macleodii bark contains active phytoconstituents likeStigmasterol Fig. 2, Cholest-5-EN-3OL (3β)-Carbonyl chlorinated Fig. 3 and Campesterol Fig. 4 4 . The aqueous bark extract of C. macleodii contains saponins, tannins, glycosides and alkaloids whereas the acetone, methanol, hexane and chloroform bark extracts mainly contain triterpenoids. The UV-visible spectrophotometry in a colloidal silver nitrate solution of stem extracts shows the presence of silver nanoparticles. The qualitative analysis of the leaf extract in methanol, petroleum ether and water reveals the presence of glycosides, alkaloids, flavonoids, tannins, lipids and fixed oils, terpenoids, steroids, phenolic components and resin. Phenolic and ethanolic leaf extract of C. macleodii also shows the presence of gallic acid (3, 4-dihydroxy-5-methoxybenzoic acid) Fig. 5. Chloroformic extract of leaf under UVvisible and FTIR spectra shows the presence of beta-carotene 7, 24, 38 .

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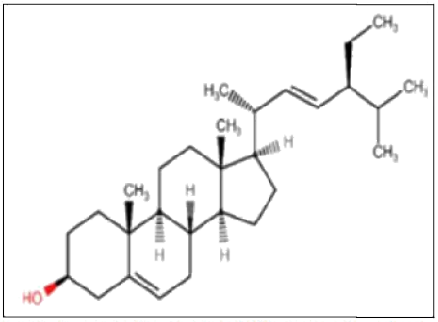

FIG. 2: STIGMASTEROL

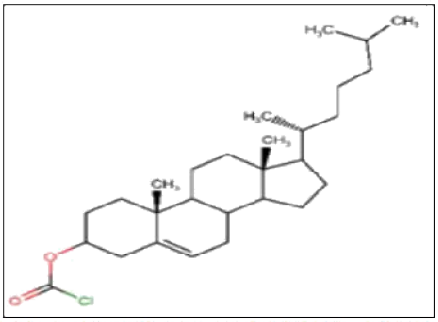

FIG. 3: CHOLEST-5-EN-3OL(3B)-CARBONYL CHLORINATED

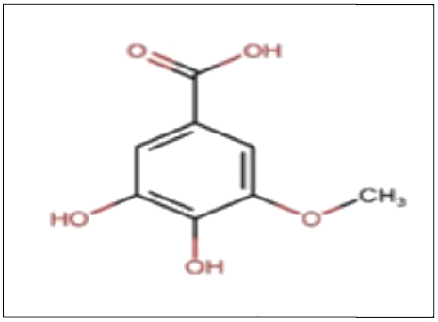

FIG. 4: CAMPESTEROL

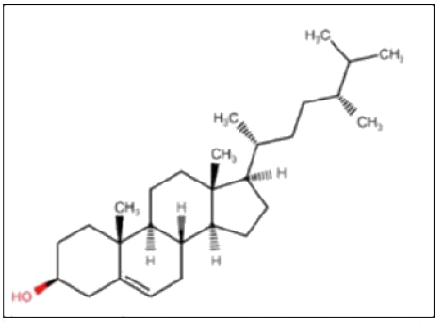

FIG. 5: 3, 4-DIHYDROXY-5-METHOXYBENZOIC ACID

II. CONCLUSION

Pharmacological studies on different plant parts of Cordia macleodii have revealed that it has hepatoprotective, antiinflammatory, antibacterial, antifungal, anti-venom, wound-healing, antihypertensive and antioxidant properties. The phytochemical screening shows the presence of secondary metabolites like- Saponin, steroids, flavonoids, alkaloids, glycosides and terpenoids. Phytoconstituents such as Stigmasterol, Cholest-5-EN -3OL(3β)-Carbonyl chlorinated, Campesterol and 3, 4-dihydroxy-5-methoxybenzoic acid are present in bark and leaves of C. macleodii.

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