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Antioxidant Potential of *Cordia dichotoma*: A Review

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Abstract

Many plants of genus Cordia comprise of trees and shrubs are widely distributed in warmer regions and have been utilized in management of various diseases. Many phytochemicals like flavonoids, alkaloids, terpenes, tannins, and glyceridess having different activities were screened and isolated from different parts of *C. dichotoma*. Various important Pharmacological properties including Antiulcer, Contraceptives, anti-inflammatory, anthelmintic, analgesic, anticancer, Antioxidant, antimicrobial, hepatoprotective, antidiabetic and others have been well documented for this plant. *C. dichotoma is a* promising source of natural antioxidants which possess remarkable therapeutic action as inflammatory activity. In the present review, we have briefly reviewed the Antioxidant *Potential of C. dichotoma* that can be followed for future research on this plant for health benefits.

Keywords: *Cordia dichotoma*, Antioxidant, anti-inflammatory, flavonoids

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Introduction

Management of diseases with agents devoid of any side effects is still a big challenge to the researchers. There is increasing interest in natural medicine due to these reasons. Plant species of the genus *Cordia* are utilized for the treatment of various illnesses that affect many human systems. *C. dichotoma* is a tree of tropical and subtropical regions, commonly known as Lasura in Hindi and Shleshmataka in Sanskrit.

Various phytoconstituents like flavonoids, triterpenes, tannins, alkaloids and fatty acids possessing different bioactivities were isolated from different plant parts of *C. dichotoma*. Many researchers reported various pharmacological applications of *C. dichotoma* such as Anti-ulcer[1], Contraceptives[2], anti-inflammatory[3, 4, 5, 6] anthelmintic, analgesic, anticancer[4,7, 8], Antioxdant[8,9], antimicrobial[10], antifungal[10], hepatoprotective[11] and diuretic purposes and for treating digestive system, respiratory, urogenital, cardiac, vascular and blood disorders. *C. dichotoma is a* promising source of natural antioxidants which possess remarkable therapeutic action as inflammatory activity and may serve as food ingredients[12, 13, 14, 15]. Thus objectives of the present review are to provide an overview of the uses of *C. dichotoma* as herbal antioxidant.

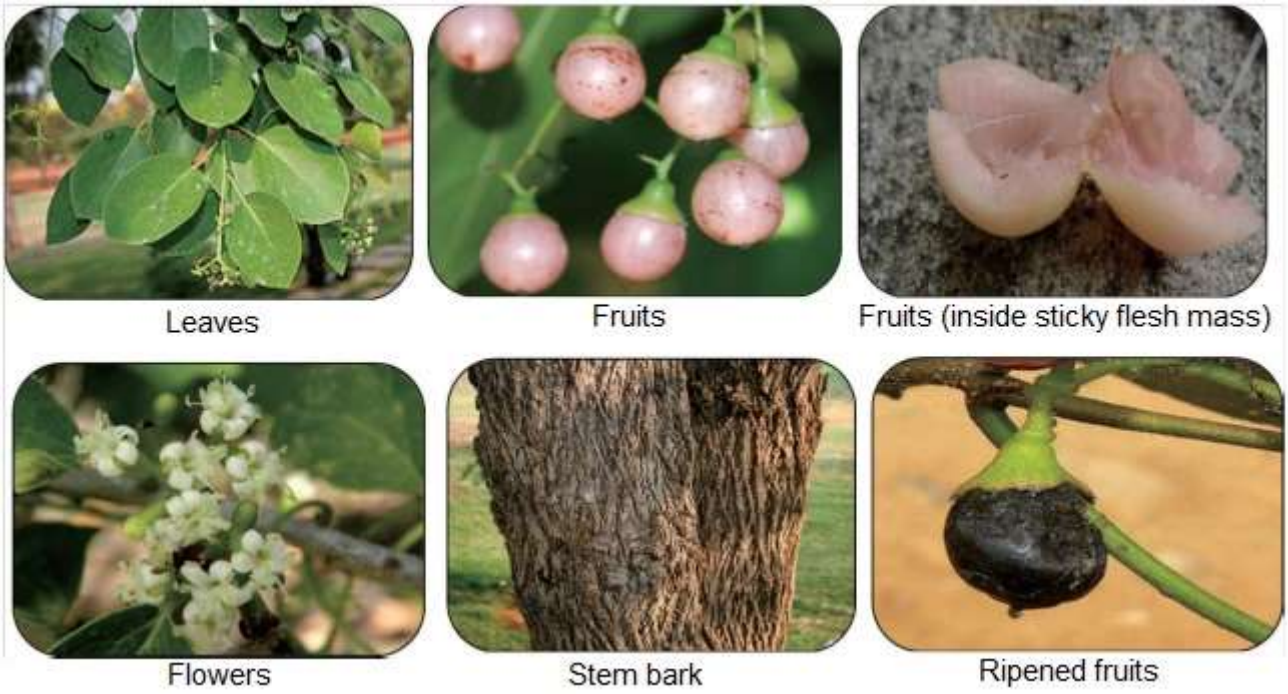

Figure 1: Various Parts of *Cordia dichotoma* plant[3]

Classification:

Kingdom: Plantae;

Division: Magnoliophyta;

Class: Dicotyledons;

Subclass: Astaridae;

Order: Lamiales;

Family: Boraginaceae;

Genus: Cordia;

Species*: C. dichotoma* Forst.

Distribution:

C. dichotoma is a tree that found in tropical and subtropical regions. It grows in the sub-Himalayan tract and outer ranges, ascending up to about 1500 m elevation. It is found in different types of forests ranging from the moist deciduous forests of the Western Ghats and tidal forests in Mayanmar to the dry deciduous forest of Rajasthan. In Maharashtra, it grows in the moist monsoon forest also[4].

Botanical description:

C. dichotoma family Boraginaceae is a small to moderate size deciduous tree with a short bole, short crooked trunk and spreading crown. The stem bark is grayish brown in color, longitudinally wrinkled or smooth. Leaves are simple, entire and slightly dentate, elliptical-lanceolate to broad ovate with the round and cordate base. These flowers are 25mm long, dull pinkish edible fruits with sticky flesh flowers are short-stalked, bisexual and white in color, appear in loose corymbose cymes.[12] The fruit is a yellow or greenish-yellow shining globose or ovoid drupe seated in a saucer-like enlarged calyx (fig. 1). It turns black on ripening and the pulp gets viscid. The hard stone is 1-4 seeded.

C. dichotoma as Herbal Antioxidant:

Free radicals are responsible for many diseases like arthritis, cancer, diabetes mellitus, aging, etc. Herbal antioxidants have gained great importance in recent years as they are utilizing in the management of such diseases due to their ability to neutralize free radicals. As plants are the source of natural antioxidants, much attention has been gain to plants. Currently, there has been an increased interest globally to identify anti-oxidant compound that has potent bioactivities and has low or no side effects. [17]

Oxidative stress is defined as an imbalance between the production of free radicals and the ability of the organism to counteract or detoxify their harmful effects through neutralization by antioxidants. As free radicals are very reactive species, their overproduction during oxidative stress can cause damage to all biological macromolecules, such as DNA, proteins and lipids, thus leading to cell damage and subsequently, to the manifestation of pathological conditions as cardiovascular diseases, diabetes and inflammatory diseases [18]. Antioxidants are secondary molecules or metabolites that act as ROS scavenger and activator of cellular antioxidative enzymes to prevent the damages induced by ROS in biological system. Hence, naturally occurring antioxidants from plant polyphenols are getting more attention in terms of practical usage as safe and potent bioactive compounds[19].

Antioxidant activity of this plant may be attributed to presence of phenols, flavones, isoflavones, flavonoids, xanthones, alkaloids, anthraquinones, phytosterols, steroids, amino acids, anthocyanins, isothiocyanate

indoles, coumarins lignans, catechins, and isocatechins etc[20, 21, 22].

Many *in vitro and in vivo* studies on antioxidant activity of *C. dichotoma* are available in literature[5,6,9,12,20,23,24]. Quercetin from *C. dichotoma* is a phytochemical with high antioxidant activity that has been shown to maintain blood pressure levels and thus improve cardiovascular function. Quercetin can inhibit platelet aggregation, increase nitric oxide activity and improve endothelial function.[20, 23]

Sharma et al studied the role of free radical scavenging *activity of C. dichotoma* seeds and leaves extract in degenerative disorders[16]. Author state that these models demonstrate positive antioxidant activity in a concentration dependant manner and demonstrate that highest concentration exhibits highest (100 µg/ml) antioxidant activity. Result concluded that antioxidant activity was more pronounced in leaves as compared to seeds.

Singh et al. were carried out a comparative study of methanolic extract of seeds and leaves of *C. dichotoma* for free radical scavenging potential in the management of degenerative disorders. Antioxidant activity was more pronounce in methanolic extract of leaves as compared to seeds[6].

Nariya et al evaluated the phenolic contents and antioxidant potential of methanolic and butanol extract of *C. dichotoma* bark. In the present study three *in vitro* models were used to evaluate antioxidant activity. The first two methods employed direct measurement of radical scavenging activity and in remaining one method evaluated the reducing power. *C. dichotoma* showed strong antioxidant activity by inhibiting DPPH activity and reducing power activities when compared with standard l–ascorbic acid. In addition, both the extracts were found to contain a noticeable amount of total phenols, which play a key role in controlling oxidation. The results present study show that the extract can be used as an easily available source of herbal antioxidant. The chemicals present in the bark such as alkaloids, terpenoids, reducing sugars, flavonoids, proteins, steroids, and tannins may be responsible for such activity[9].

Shuge et al carried out a study aiming to determine the phytochemical composition and antioxidant activity of air-dried *C. dichotoma* seeds. The results from this study indicate that *C. dichotoma* seeds are a rich source of polyphenolic compounds and amino acids, which can be used for quality assessment. Results revealed that ethanolic extract of *C. dichotoma* seeds has good antioxidant capacity[23]. Mahasweta et al examinated the antioxidant potential of *C. dichotoma* seeds. Hentricontanol Fraction (HTF), Hesperetin fraction (HF) and Taxifolin fraction (TF) from the seeds of *C. dichotoma* showed promising DPPH free radical scavenging activity at a concentration of 100 µg/mL[5].

Table 1: Reported work on Antioxidant Potential of Cordia dichotoma

S.N.	Source	Objective	Outcome	Ref
1	Sharma et al 2007	To study the role of free radical scavenging activity of *C. dichotoma* seeds and leaves extract	Author state that these models demonstrate positive antioxidant activity in a concentration dependent manner. Result concluded that antioxidant activity was more pronounced in leaves as compared to seeds	16
2	Singh et al. 2010	To compared the methanolic extract of seeds and leaves of *C. dichotoma* for free radical scavenging potential	Both the extracts showed significant activity but antioxidant activity was more pronounce in methanolic extract of leaves as compared to seeds thus it can be used in the management of degenerative disorders	6
3	Nariya et al 2011	phenolic contents were screened from methanolic and butanol extract of *C. dichotoma* bark to evaluate its antioxidant potential	Both extract showed strong antioxidant activity by inhibiting DPPH activity and reducing power activities when compared with standard l–ascorbic acid. Both the extracts were also found to contain a noticeable amount of total phenols, which play a key role in controlling oxidation. Thus extracts can be used as an easily available source of herbal antioxidant.	10
4	Rahman et al 2017	To evaluate anticancer activity of the methanolic extract of *Cordia dichotoma* leaves (MECD) against a human prostate carcinoma cell line, PC3.	Results of this study confirm that MECD possesses antioxidant property due to presence of flavonoids in MECD and may be responsible for anti-cancer activity due to dual antioxidant and pro-oxidant properties.	25
5	Ibrahim et al 2019	To investigate the chemical composition, antioxidant and	The CDFPE showed a powerful effect in scavenging superoxide radicals and chelating metals ions as well	26

		anti-tumor effects of *C. dichotoma* fruit pulp extract (CDFPE)	as high reduction capability. Results concluded that anti-tumor activity of CDFPE may be attributed due to phenols, flavonoids, tannins and glucouronic acid contents that are documented as an antioxidant, anti-inflammatory, and antitumor agents.	
6	Hussain et al 2020	To stidy the anti-inflammatory activity of *C. dichotoma* bark extract.	The antioxidant activity was evaluated using DPPH radical scavenging assay. In *in vitro* antioxidant activity, the methanolic extract of *C. dichotoma* exhibited good DPPH radical scavenging activity. Results of this study suggested that the anti-inflammatory activity of *C. dichotoma* may be due to the presence of phenolic contents or plant flavonoids in the bark extract.	27
7	Hussain et al 2020	to evaluate the antitumor and antioxidant activities of the methanol extract of C*ordia dichotoma* (MECD) against Ehrlich ascites carcinoma (EAC) in Swiss albino mice	Results of study concluded that the antitumor activity of MECD can be inferred from the increased life span of EAC bearing mice which is due to its antioxidant activity	28
8	Usmani et al 2021	To assessed the antioxidant activity of methanolic extract and different fractions of the seeds of *Cordia dichotoma*	Maximum scavenging activity was exhibited by the methanolic extract with a low IC50 value. Presence of phenolic compounds and flavonoids, which may be acting as the key factors responsible for the antioxidant activity.	29
9	Swapna et al 2021	AgNPs of *Cordia dichotoma* extract was fabricated to analyze their potential applications as antioxidant and biocidal agents	Phytomediated eco-friendly synthesized and structurally characterized AgNPs can act as antioxidants and exhibited antibacterial activity against Gram-positive (*Staphylococcus aureus*) and Gram-negative (*Escherichia coli*) pathogenic bacteria.	4

Conclusion and Future Prospective

Over the past three decades, much scientific information has been accumulated regarding phytochemicals and pharmacology of *C. dichotoma*. However, this information has not been collectively discussed together, which is very important in understanding the therapeutic utility of this plant.

Various compounds like flavonoids, triterpenes, tannins, alkaloids and fatty acids possessing different bioactivities were isolated from different parts of this plant. The various pharmacological studies carried out with extracts of different parts indicates that the *C. dichotoma* possess analgesic, anti-inflammatory, antimicrobial, antiviral, wound healing, antidiabetic and antifertility activities. Antioxidant activity was mainly attributed to the presence of flavonoids and phenolic compounds, which was confirmed by the IC50 data correlation in various reported work. Due to the very long tradition using *C. dichotoma* for management of various diseases and also because of what is known today about its chemical constituents and biological activities, it seems to be worth the effort of exploring this plant further and such information may be used for further research work related to *C. dichotoma* and other traditional systems of medicine.

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Conflict of Interest

There are no conflicts of interest

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