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Pharmacological Review on *Cordia dichotoma* Frost.

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ABSTRACT

Cordia dichotoma Forst. (Family Boraginaceae) is a tree of tropical and sub-tropical regions, grows in the sub-Himalayan tract and outer ranges, ascending upto about 1500 m elevation. It found in a variety of places like, the dry deciduous forests of Rajasthan and moist deciduous forest of western Ghat and tidal forests in Myanmar. The common name of the plant is Lasura, Borla, Bhokar etc. Phytochemically it consists of carbohydrates, alkaloids, glycosides, flavonoids, tannins and saponins. Chemical screening of both fruit and leaves shows the presence of pyrrolizidine alkaloids, coumarines, flavonoids, saponins, terpenes and sterol. Pharmacologically proved activities are anti-ulcer, wound healing, anti-inflammatory, antioxidant, anti-diabetic and hepatoprotective activity.

Keywords: *Cordia dichotoma,* Hepatoprotective activity

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INTRODUCTION

Plant derived medicines are considered to be first line of defense in maintaining health and combating diseases and even today plant source is principle source of new drug of therapeutic property. Approximately 72000 plant species were estimated for having medicinal properties worldwide out of which India recognizes more than 3000 plant species having medicinal values[1]. Ayurveda is science of life, pointed out concept of positive health means metabolically well-balanced human beings. Foremost indigenous system listed medicinal plants such as Sidha (600), Ayurveda (700) and Amchi (600), Unani (700), Allopathy which 90 plant species for ailment [2].

Cordia dichotoma is one of the traditional medicinally important deciduous plants available all over India. The fruit has been reported to be rich in polysaccharide. Ripe fruit of *C. dichotoma* produces a jelly-like, sticky mass. Unani system of medicine uses plant as antibacterial, antiviral and antitussive. Joshandah, polyherbal formulations, are extensively used by the masses in India for the treatment of common cold, catarrh, cough, respiratory distress, fever of which *C. dichotoma* is chief ingredient. From the ancient time, leaves and stem bark are used in treatment of dyspepsia, fever, diarrhea, leprosy, gonorrhea and burning sensation. Leaf of plant traditionally show the therapeutic uses and actions such as anthelmintic, astringent, diuretic, demulcent, purgative, expectorant, tonic, ulcer and cough [3].

Geographical Distribution:-

C. Dichotoma is commonly present in tropical and subtropical regions. It grows in sub-Himalayan tract and outer ranges, ascending up to about 1500 m elevation. It is found in dry deciduous forests of Western Ghats in India and tidal forests in Myanmar. In Maharashtra, it grows in moist monsoon forest [4]. It does not grow gregariously, but is found grown singly in moist shady ravines and valleys. The species is wide spread in Philippines and found thickets and secondary forest at low and medium altitudes. It also distributed southern China and Formosa and throughout other like Peninsular Malaysia to tropical Australia and Polynesia [5]. The species is propagated by seeds.

Table 1: Geographical distribution and common names of *Cordia dichotoma* [5].

Scientific classification	Vernicular name	Local names
Kingdom: Plantae Division: Mangliophyta Class: Dicotyledons Sub-class: Asteridae Order: Lamiales Faimly: Boraginaceae Genus: Cordia Fragrant: Manjack Species: *C. dichotoma* Forst.	Malaysia: Sekendai, Sekendal, Petekat English: Soap berry, Sebestean plum, Fragrant manjack India: Leshora, Gonda, Lasora Javanese: Kendal Sumatran: Nunang Thailand: Paw man	Bengal: Buhal, Bahubara English: Sebesten, Clammy cherry, Indian cherry Gujrati: vadgundo, Gunda Hindi: Lasura, Bhokar, Borla Javanese: Kendal Lao: Man, Sino-Tibetan, Man Khok Malay: Petekat, Sekendai Tamil: Kalvirusu, Vidi, Naruli Nepali: Bohori, Kalobohori Thai: Mandong, Manma, Phakmong Sanskrit: Shelu, Bahuvarkha.

Morphology of *C. Dichotoma*:

Cordia dichotoma is small to medium size deciduous tree with a short crooked trunk, short bole and spreading crown. Leaves are simple, entire and slightly dentate, elliptical-lanceolate to broad ovate with a round and cordate base. The stem bark is grayish brown smooth or longitudinally wrinkled. Flowers are short stalked, bisexual and white to pinkish in colour and appear in loose corymbose cymes. Fruits are edible with sticky flesh mass. It is yellow or pinkish yellow shining globose or ovoid drupe seated in saucer-like enlarged calyx, it turns black on ripening and the pulp gets viscid [6].

Figure 1: Different parts of plant *Cordia dichotoma.*

Nutritional value:

The whole plant of *Cordia dichotoma* is edible and is used as food. Immature fruits are pickled and are used as vegetable. Mixture of flower and curd applied two times in a day used to protect body against heavy sun heat waves [6].

The rural people of coastal areas of Orissa eat the ripe fruits raw. The seed kernals of plant contain high quantity of fatty oil and proteins which has potential as cattle feed. The polysaccharide gum (97 %) obtained from plant used for various pharmaceutical purposes. Chromium present in the fruit has therapeutic value in diabetes. A fruit also contain some anti nutritional factors such as phytic acid (355 mg), phytic phosphorous (100 mg) and oxalic acid (250 mg) per 100 g (table 2). New natural cellulose fabrics were identified from the branches of *Cordia dichotoma* [7].

Table 2: Nutritional value of various plant parts of *Cordia dichotoma* [7].

Plant part	Nutritional value
Leaves	12-15% crude protein, 16-27% crude fibers, 42-53% nitrogen free extract 2-3% ether extract, 13-17% total ash, 2-4 % total calcium 0.3% phosphorous.
Seed kernals	32 g water; per 100 g, 46% fatty oils, 31% protein.
Fruits	70% pulp which contain per 100 g, 6 g water, 35 g proteins, 37 g fats 18 g carbohydrates. Ca (55 g), P (275 mg), Zn (2 mg), Fe (6 mg), Mn (2 mg), Cr (0.2 mg), Cu (1.6 mg/100 gm)

Biological Investigation

Numerous *Cordia* species were mentioned in traditional literatures of Ayurveda and Materia Medicas for the treatment of various disease and disorder conditions. Moreover, the plant species has been reported for various pharmacological activities and are listed in table.

Table 3: Different species of *Cordia* and their uses [8].

Cordia Species	Part used	Reported activities
Cordia alliodra	Root, bark	Antifungal, Larvicidal
Cordia corymbosa	Fruits	Antimicrobial, cytotoxic
Cordia myxa	Fruit and leaves	Astringent, anthelmintic, diuretic, demulcent, antimicrobial, alcoholic liver cirrhosis.
	Bark	Antifertility, antihistaminic, antitumour.
Cordia globosa	Root	Cytotoxic
	Leaves	Vasodilator, Spasmolytic
Cordia oblique wild	Seeds	Anti-inflammatory
Cordia latifolia roxb.	Ripen fruit	Anti ulcer
Cordia goetzei gurke	Stem bark	Antifungal

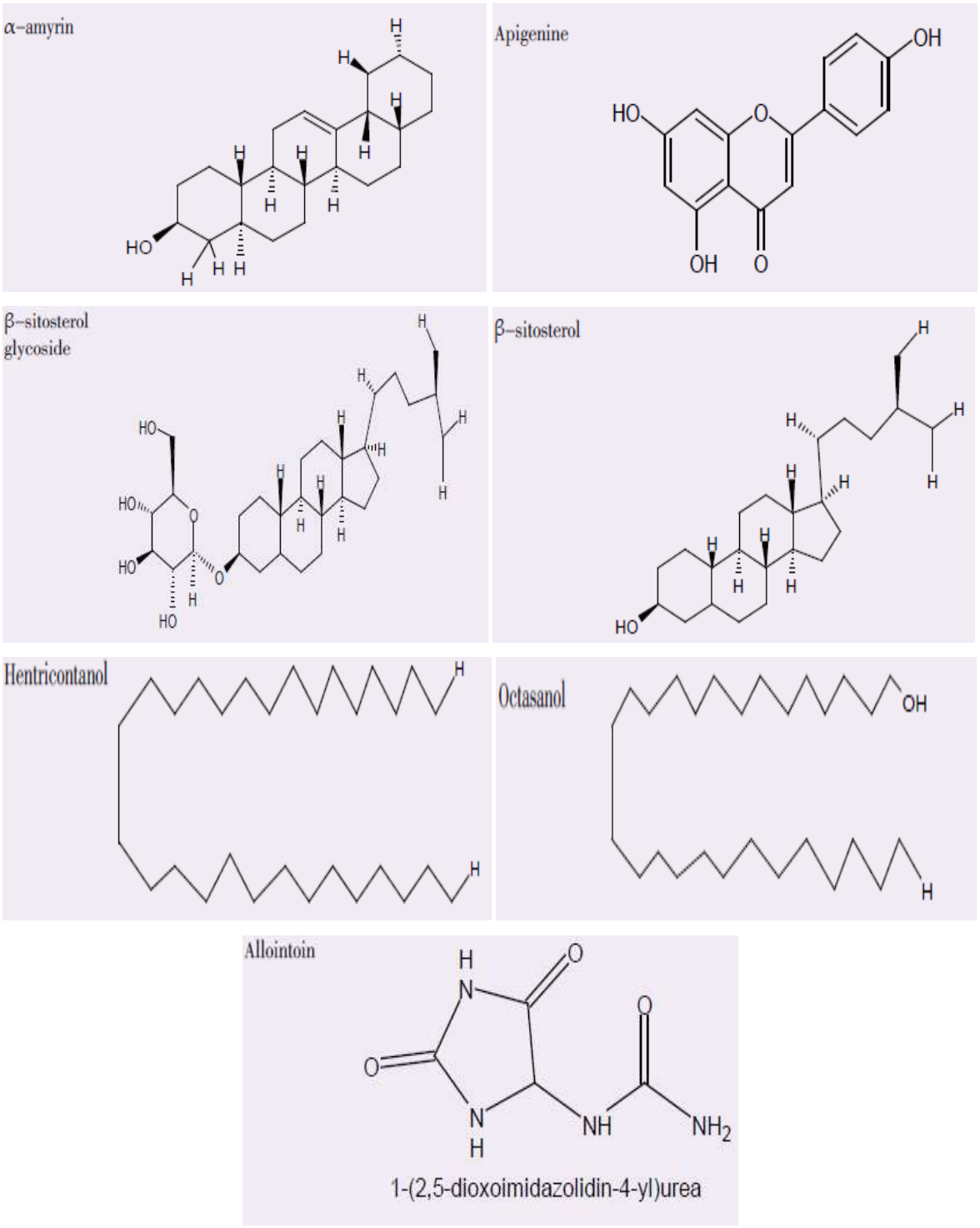
Cordia francisci ten.	Leaves	Analgesic, anti-inflammatory, antiarthritic, rheumatism, painfull menstruation, gastric ulcer
Cordia monosperma	Ariel parts	Antimicrobial
Cordia sinensis	Bark	Stomach disorders, chest pain
Cordia spinescens L.	Leaves	Antiviral, anti-HIV
Cordia subcordata	Nut/Seed	Famine treatment
Cordia ulmifolia	Leaves	Cytotoxic, hepatotoxic, anti-inflammatory, analgesic, fetus toxicity
Cordia fragrantissima	Wood	Leishmanicidal
Cordia curassavica	Roots	Antifungal, Larvicidal, Antibacterial
Cordia verbencea	Ariel parts	Antimicrobial
	Leaves	Antiserum action
Cordia cylindrostachya	Fruits	Anthelmintic
Cordia linnaei Stearn	Roots	Antifungal, Larvicidal
Cordia martinicensis	Leaves	Cytotoxic, Hepatotoxic, Anti-inflammatory, Analgesic
Cordia multispicata Cham.	Leaves	Antiandrogenic, anti-inflammatory, analgesic, anti-arthritic
	Fruits	Cytotoxic, chest and urinary infections, anthelmintic, diuretics, astringent, demulcent,expectorant
Cordia perrottettii DC.	Fruits	Antioxidant
Cordia plauhiensis frensen.		Larvicidal
Cordia rufescens		Abortive, anti-inflammatory, Dysmenorrheal treatment
Cordia salicifolia Cham.	Whole plant	Antiviral, excitory and negative ionotropic effect
Cordia serratifolia Kunth.	Leaves	Analgesic, anti-inflammatory, antiarthritic
Cordia verbenacea DC	Aerial parts	Antimicrobial
	Leaves	Antiserum action, Potentiation

Phytochemicals:

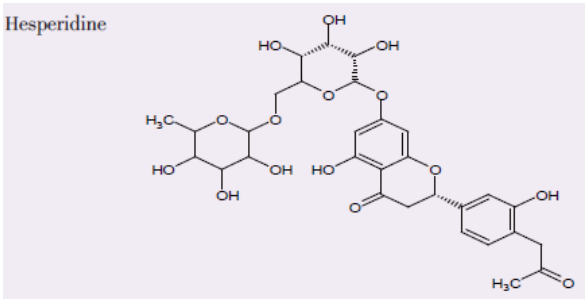
Several chemicals have been identified from seeds of c. dichotoma. The seed contains α-amyrins, betulin, octacosanol, lupeol-3-rhamnoside, β-sitosterol, β-sitosterol-3glucoside, hentricontanol, hentricontane, taxifolin-3-5-dirhamnoside, hesperitin-7-rhamnoside and fatty acids such as palmitic acid, stearic acid, arachidic acid, behenic acid, oleic acid and linoleic acid. Four flavonoid glycosides (robinin, rutin, datiscoside and hesperidine), a flavonoids aglycone (dihydrorobinetin) and 2 phenolic derivatives (chlorogenic acid and caffeic acid) were isolated from seeds. The significant anti-inflammatory activity of seeds is because of α-amyrins and taxifolin-3, 5-dirhamnoside (71.4%, 67.8% respectively). The seeds also contain fatty acids and flavonoids [8].

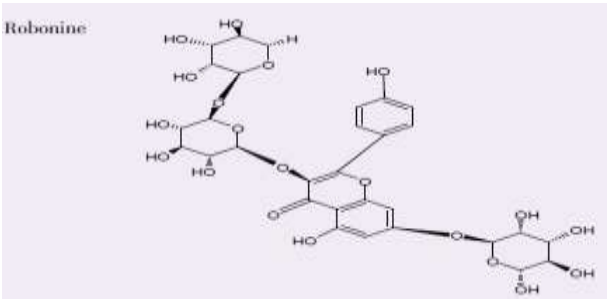
The bark also comprise medicinal properties and contains several chemicals including allntoin, β-sitosterol and 3', 5-dihydroxy-4'-methoxy flavones-7-o-alpha-L-rhamnopyranoside. Fruits and

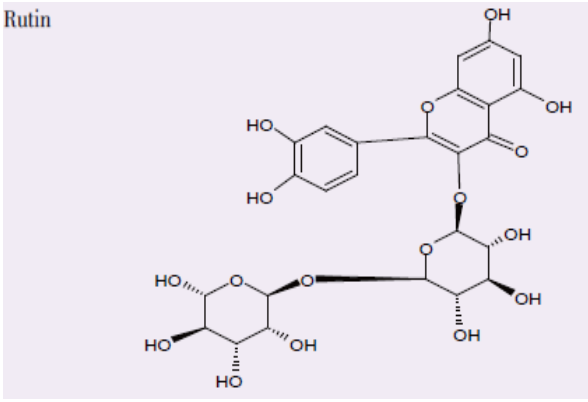
leaves showed presence of pyrrolizidine alkaloids, coumarins, flavonoids, saponins, terpenes and sterols. Fruit has been identified for arabinoglucan, D-glucose (67.6%) and L-arabinose (13.2%). Leaves also contain quercetin and quercitrin [9].

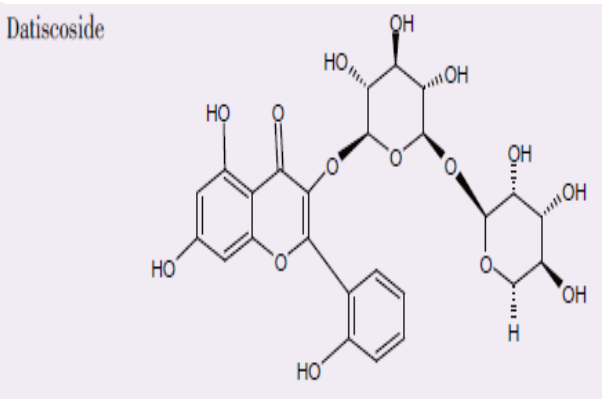


Four flavonoid glycosides:

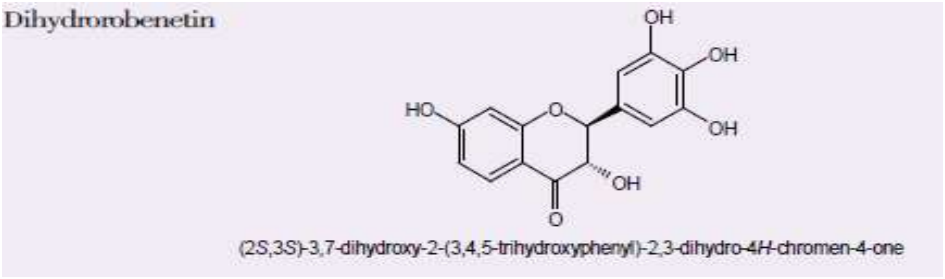




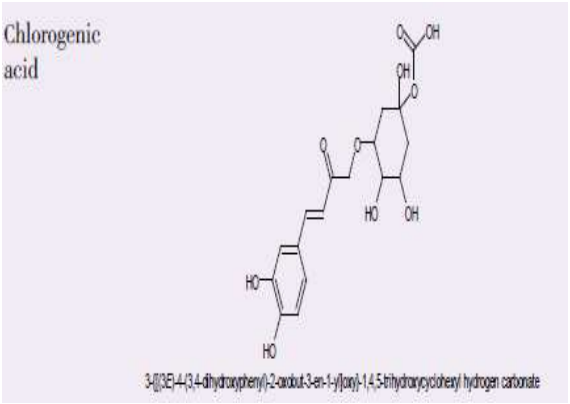


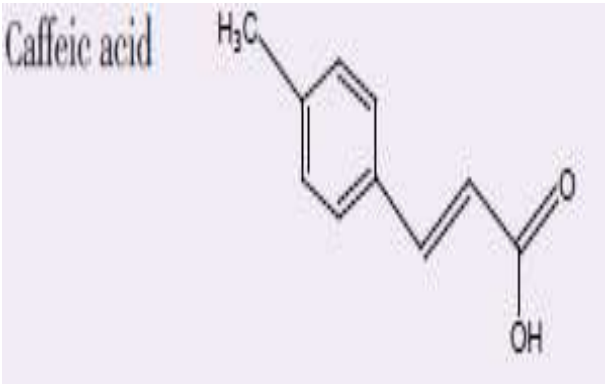


A flavonoids aglycone



Two phenolic derivatives





Traditional uses:

- The fresh fruit is used in traditional medicine for its laxative properties, and for chest complaints, while dried it is an expectorant and clears nasal and bronchial congestion. The kernels when mixed with oil are applied on affected areas to get rid of ringworm [10].

- When the fresh bark is moistened in a little water it is applied to boils and tumors and also the bark is used internally for headaches and stomach aches. A decoction of the bark is said to aid digestion and clear up digestive problems. It contains tannins so is also used for diarrhea and dysentery and during fevers. The powdered bark is put on mouth ulcers and an infusion made with it is used as a gargle for sore throats. The sap from the bark is mixed with coconut milk for colic; the fresh fruit is also used for gonorrhea [10].
- The seeds have anti-inflammatory properties and both these and the seed kernel are also used in traditional medicine. The tree is used as an immuno-modulator, for diabetes, to protect and heal the liver and as a diuretic. In Ayurveda the leaves and stem bark are used to treat dyspepsia, fever, diarrhea and leprosy. The leaves are used for hepatitis and for asthma in children [11].
- It has been found that the leaves and seeds have antioxidant properties with the leaves being more powerful than the seeds in this regard [8].

Pharmacological activities

Wound healing activity:

The wound healing activity of fruits of *Cordia dichotoma* was screened using three different models, *viz.* excision wound, incision wound and dead space wound in wistar rats. The doses of fraction determined by acute toxicity study using up and down and was found to be 300 mg/kg. The earlier epithelization of wound and significant increase in tensile strength as compared to control was found in rats treated with fraction of ethanol extract [12].

Antimicrobial, antifungal activity and antibacterial activity:

Antibacterial and antifungal potential of plant bark investigated. Antibacterial activity of ethanol and the butanolic extracts of the bark were carried out against two Gram negative bacteria *E. coli* and *pseudomonas aeruginosa* and two Gram positive bacteria *Streptococcus pyrogenes and staphylococcus aureus.* The antifungal activity of the extract was carried out against that *Aspergillus niger, Aspergillus clavatus* and *Candida ablicans,* the pathogenic fungi. Zone of inhibition of extracts was compared with that of different standards like ampicilline, ciprofloxacin, norfloxacin and chloramphenicol for antibacterial activity and nystatin and griseofulvin for antifungal activity [8]. When tested for antibacterial effects by disc diffusion method, it showed dominant zone of inhibition of against both gram negative and gram positive bacteria such as *streptococcus aureus, streptococcus pyogenes, vibiro cholera, streptococcus epidermis, hafina and E. coli* which is comparable with kanamycin (30µg/ml). The extract showed remarkable inhibition

of zone for bacterial and fungal growth and the result obtained were comparable with that of standards drugs against the tested organisms [13].

Analgesic and cytotoxic activity:

Crude ethanolic extract of *C. dichotoma* was evaluated for the analgesic, antibacterial and cytotoxic activity. The extract produced significant writhing inhibition in acetic acid induced writhing mice at the oral dose of 500 mg/kg body weight respectively (P<0.001) which was compared to the standard drug diclofenac sodium at the dose of 25 mg/kg of body weight. Moreover, when tested for toxicity using brine shrimp lethality bioassay, the extract showed potent activity against the brine shimp salina (LC_{50}: 20 µg/ml and LC_{90}:180µg/ml). The overall result represents significant analgesic, antibacterial and cytotoxic activities of the extract [13].

Antioxidant activity:

Activity was evaluated by in-vitro models *viz.* DPPH and hydrogen peroxide model. These models showed positive antioxidant activity in a concentration dependent manner and highest concentration exhibit highest (100 µg/ml) antioxidant activity. This activity was more pronounced in Methanolic extract of leaves as compared to seeds [14].

Antidiabetic activity:

The fruit pulp of the plant was screened for antidiabetic activity. Animals were administered with increasing dose of methanolic extract (5, 50, 300, 2000 and 5000 mg/kg) to determine changes in parameters for assessing toxicity. No mortality was observed up to 2 g/kg. So, 200 mg/kg dose was considered for further experiment. Alloxan induced diabetic study were randomly assigned into four groups each having six rats. Significant reduction in blood glucose level and rate of body weight loss was observed [15].

Anthelmintic activity:

The aqueous and ethanol extracts of fruit of plant showed significant anthelmintic activity. Study was carried out using *Eudrilus euginiae* earth worm. It showed paralysis and death of worms at concentration 10-100 mg/ml in dose dependent manner. Aqueous extract of the plant fruit showed potent anthelmintic activity than ethanol extract [16].

Ulcerative colitis:

The dried bark of plant was powdered and Methanolic extract was obtained using soxhlet extraction. Apigenin is isolated from methanol extract of plant bark. Apigenin isolated from plant bark in the ulcerative colitis showed significant healing [17].

Gastroprotective and Antiulcer effect

The gastro protective effect of some extracts of the ripe fresh fruit of *Cordia dichotoma* was investigated in aspirin induced gastric ulcer model and pylorus ligation model in rats. Effective reduction in ulcer index is observed in water extract treated wistar rats as compared to Methanolic extract and results were compared with standard ranitidine (50 mg/kg). The water extract showed significant antiulcer effects [18].

Anti-inflammatory activity:-

Transdermal films were prepared using natural polymer (fruit gum) of plant with different percentage of plasticizer (glycerin 0.10, 0.20 and 0.25% w/v), preservatives (methyl paraben 0.1% w/v) and drug (neomycin 0.2% w/v). The films were casted on glass plates under dried controlled condition. These films were evaluated by various parameters like thickness, tensile strength, water uptake, folding endurance and skin irritation test. The films were screened for the anti-inflammatory activity using carrageenan induced rat paw edema model. The results were compared with standard drug, diclofenac sodium. the %age of inhibition of edema was considered as a mark of anti-inflammatory potential and it was found to be highest in 0.20 % (w/v) glycerin treated animals which indicate significant anti-inflammatory activity of plant [19].

SUMMARY:

As the data presented above, it is clear that the plant *Cordia dichotoma* is beneficiary in certain diseases and hence have possessed some pharmacological importance. With different animal studies this plant is explored for its different pharmacological activities like anti-oxidant, hepatoprotective, analgesic, wound healing, anti-ulcer, anti-inflammatory, antidiabetic and anti-fungal. With this review, I want to point out about two things. One, there are many plants like this plant, which has miraculous power to cure life threatening disorders and second, they are available in limitless quantity in our surrounding and are easily approachable. So there is vast source of drugs available to us by Mother Nature. All we need to do is to explore them. In coming time researchers should focus on natural sources of drugs than synthetic ones. This will not just provide us with many useful alternative drugs than harmful one but also connects us with nature and it will inspire us all to conserve it.

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