

REVIEW ARTICLE

A Review on Medicinal Fruit Bhokar of Species *Cordia dichotoma* Forst

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ABSTRACT

Cordia dichotoma belonging to family Boraginaceae is commonly known as Bhokar (India). It is a very sticky fruit available in India. This review represents brief information about the botanical description, chemical constituents and functional as well as medicinal uses of *Cordia dichotoma*. The plant also has number of pharmaceutical applications i.e. may be used as excipient in many of formulations. This review may give the helpful information about this plant.

Key words: *Cordia dichotoma*, botanical description, chemical constituents, medicinal uses, pharmaceutical application, excipient.

INTRODUCTION

Natural products have served as a major source of drugs for centuries, and about half of the pharmaceuticals in use today are derived from natural products. The use of natural substances, particularly plants, to control diseases is a centuries old practice that has led to the discovery of more than half of all modern pharmaceuticals. A growing worldwide interest in the use of phytopharmaceutical as complimentary or alternative medicine either to prevent or ameliorate many diseases has been noted in recent years.

Cordia is a genus of trees or shrubs, sometimes subscandent in the borage family Boraginaceae. The plant parts like fruits, leaves, stem bark, seeds and roots of most species of plants of the genus *Cordia*, especially *Cordia dichotoma*, *C. myxa*, *C. oblique*, *C. verbenacea*, *C. martinicensis*, *C. salicifolia*, *C. spinescens*, *C. latifolia*, *C. ulmifolia*, among others, has long been used in traditional medicine for cicatrizant, astringent, anti-inflammatory, anthelmintic, antimalarial, diuretic, febrifuge, appetite suppressant, cough suppressant and to treat urinary infections, lung diseases and leprosy.

Bhokar is a common medicinal plant in southern India and its botanical name is *Cordia dichotoma*. Bhokar's English names are Clammy Cherry, Indian Cherry and Sebesten Plum and it has

numerous names in different native Indian languages, as well. The Bengali speaking people call the plant as Bahubara, Bohari, Bohodari, Buhul or Lashora and in Gujarati; it is popular as Barghand, Gundi, Gundo and Vadgunda. Apart from Bhokar, the plant is also known as Chhotalasora and Gondi, Guslahah, Lasora and Rassala, in Hindi. The people speaking Marathi know the plant in the names of Bhokar, Chokri, Sherti, Shelu and Shelvant. The Sanskrit names of the plant include Bukam-Padaruka, Bahuvataka, Selu and Slesmataka. While the Tamil speaking people name the plant as Kalvirusu, Naruvili, Vidi, Viriyan or Viruvu; it is named as Botuka, Chinna, Inki, Iriki, Nakheri and Nakkeru, in Telugu^[1].



Figure 1: Plant of *Cordia dichotoma*

History:

Cordia dichotoma is a plant species in the genus *Cordia*. The fruit of the Fragrant Manjack is called phoa-po-chi in Taiwan where they are eaten pickled. In Burma, the pa-o people are growing the tree (called “thanpet”) for its edible leaves. It is a tree about 15 metres high, found spanning from north India and south China to Australia and Polynesia [2]. It grows wild in the northern part of peninsular Malaysia but is planted in south. Various Synonyms are *Cordia myxa* Forsk, *Cordia oblique* Wild, *Cordia myxa* Roxb etc and Common name are Bhokar, Shleshmantaka etc. The genus *Cordia*, with about 300 identified species and worldwide distribution, is one of the largest genera in the family boraginaceae [3].

Biological classification [4]:

Kingdom: Plantae

Angiosperms

Eudicots

Asterids

Division: Magnoliophyta

Class: Dicotyledons

Subclass: Astaridae

Order: Lamiales

Family: Boraginaceae

Subfamily- *Cordioidae*

Genus: *Cordia*

Species: *Cordia dichotoma* Forst.

Fragrant: Manjack

Vernacular name:

Malaysia: Sekendal, sekendai, petekat

English: Sebestan plum, soap berry, fragrant manjack

India: Gonda, lasora, leshora

Javanese: Kendal

Sumatran: Nunang

Thailand: Paw man, Phak mong, man muu, man dong.

Chinese: feng zheng zi

French: capestan.

Indonesia: Kendal, nunang, toteolo.

Laos: Man.

Myanmar: Thanat.

Distribution and ecology [5-7]:

Cordia dichotoma is a tree of 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 a variety of forests ranging from the dry deciduous forest of Rajasthan to the moist deciduous forests of Western Ghats and tidal forests in Myanmar. In Maharashtra, it grows in the moist monsoon

forest. It is also grows in Srilanka and other warmer countries. It does not grow gregariously, but is found growing singly in moist shady ravines and valleys. In areas with annual rainfall less than 500 mm, it thrives along streams or depressions where moisture is available.

Propagation [19]:

Germination is epigeous. 1 or 2 seedlings may appear from 1 stone. Propagation is through seed which should be sown direct into containers, beds or trays and pricked out when the first pair of true leaves have formed. Sowing is done in June-July at a depth of 2 cm in lines spaced about 20 cm apart. A seed rate of 80 g/sq. m of nursery area is adopted. Germination starts in about 3-4 weeks and is complete in 6 weeks. At lower altitudes, plantable seedlings can be obtained after 3-4 months in the nursery, but at higher altitudes, 9-12 months are needed. In India raising plants from stumps has been carried out successfully. The stumps should be 8-13 mm thick at the root collar, with about 4 cm stem and 20-25 cm root. Such plants should be raised in beds for 12-15 months before stumping. Shading should be for only 1 week after seedlings have been pricked out, otherwise seedlings should have full light. Frequent weeding and root pruning is necessary. Seedlings should be ready for planting in the field in about 1 year at the commencement of monsoon rains. Germination is epigeous. 1 or 2 seedlings may appear from 1 stone. Propagation is through seed which should be sown direct into containers, beds or trays and pricked out when the first pair of true leaves have formed.

Biophysical Limits

Altitude: 200-1 500 m

Mean annual rainfall: 250-3 000 mm

Soil type: The tree prefers deep moist sandy loam soils.

Tree Management

Young seedlings are frost tender and also suffer from exposure to hot sun. They are susceptible to browsing and fire, but recover appreciably from these injuries. The tree coppices and pollards well. On good sites the trees reach a height of 4 m in 4 years and a diameter of over 20 cm in 8-9 years. From pole stage it prefers complete overhead light, but seedlings and saplings can withstand a fair amount of shade.

Germplasm Management

Ripe fruits are collected from the trees and rubbed to remove the flesh. The healthy stones are dried in the shade and kept in tin containers. The stones

can be stored for 1 year in airtight containers kept in a dry place to avoid insect attack. There are 4 000-7 000 stones/kg.

1.3.4 Botanical description:

Cordia dichotoma, small to moderate-sized deciduous tree with a short bole, short crooked trunk and spreading crown. The stem bark is grayish brown smooth or longitudinally wrinkled.

Leaves are simple, entire and slightly dentate, elliptical-lanceolate to broad ovate with a round and cordate base [8].

These **flowers** are followed by 1 in (25mm) long dull pinkish edible fruits with sticky flesh flowers are short stalked, bisexual and white in colour, appear in loose corymbose cymes.

The **fruit** is a yellow or pinkish-yellow shining globose or ovoid drupe seated in a saucer-like enlarged calyx. It turns black on ripening and the pulp gets viscid. The hard stone is 1-4 seeded [9].

Odour: Characteristic. **Taste:** Sweet

The generic name honors a 16th century German botanist, Valerius Cordus. The specific epithet means having divisions always in pairs.



Fig 2: Unripe fruits



Ripped Fruits



Fruit with seed

1.3.5 Chemical constituents [5-7, 10-13].

Alkaloids, glycosides, proteins, amino acids, carbohydrates, triterpenoids, tannins, flavonoids, saponins, phenols and steroids, Arabinoglucan, pyrrolizidine alkaloids, coumarins, fats, Gum fatty acids:- palmitic acid, stearic acid, arachidic acid, behenic acid, oleic acid and linoleic acid

Flavonoid glycosides: - robinin, rutin(rutoside), datiscoside and hesperidin,

Flavonoid aglycone: - dihydrorobinetin),

Phenolic derivatives:- chlorogenic acid and caffeic acid

Sugar: - D-glucose, L-Arabinose

Bark contains a large amount of tannic acid. Fruit yields saponins, amino acids, flavonoids, sugar, gum, proteins, palmitic, stearic, linoleic acids, oleic, arachidic, behenic acids. Bark contains a principle similar to "cathartin."

1.3.6 Functional Uses:

1.3.6.1 Food: The immature fruits are pickled and are also used as a vegetable Fodder: The leaves yield good fodder and are lopped for this purpose. The seed kernel of *C. dichotoma* contains a high proportion of fatty oils and proteins (46 and 31%, respectively) which has potential as cattle feed.

1.3.6.2 Fuel: The tree is used as a fuel wood. Timber: The wood is used to make agricultural implements.

1.3.6.3 Poison: Fruit extract of *C. dichotoma* suppresses larval hatching of *Meloidogyne incognita*.

1.3.6.4 Medicine: The medicinal attributes of *C. dichotoma* have been known since a long time. Seeds of the species are anti-inflammatory, two compounds alpha-amyrin and 5-dirhamnoside have been isolated. The bark is medicinal and several chemicals have been identified; Allantoin, beta -sitosterol and 3',5-dihydroxy-4'-methoxy flavanone-7-O- alpha -L-rhamnopyranoside. The seed kernel has medicinal properties.

1.3.6.5 Services

Boundary or barrier or support: *C. dichotoma* is a quick-growing fruit tree, performing well under semi-arid conditions and suitable for planting along boundary and farm roads.

1.3.6.6 Pests and diseases

A large number of insect pests are reported, defoliators being among the most important. Larvae of some insects of the families Chrysomelidae, Glyphipterygidae, Noctuidae, Lymantreedae, Notodontidae, Pyralidae, Sphingidae and Yponomeutidae defoliate the leaves. Larvae of Gracilariidae and Lyonetiidae mine the leaves and those of Eucosmidae roll the

leaves. Larvae of some insects belonging to families Eucosmidae, Curculionidae and Pyralidae bore into the fruits and shoots. *Austrothrips cochinchinensis* forms galls and feeds on the sap. *Aceria gallae* and *A. pobuzii* infest *C. dichotoma* in Taiwan and cause galls on leaves, fruits, shoots and tender stems. The weevil *Barioscapus cordiae*, adults attack the fruits and feed on the green pedicel, sepals and pollen grains inside the buds.

1.3.6.7 Corrosion Inhibitor

Study investigated the corrosion inhibition of mild steel using *C. dichotoma* extracts. Results showed the alcoholic extracts to be a better corrosion inhibitor than toxic chemicals.

1.3.6.7 Medicinal uses

Antiulcer, wound healing, anti-inflammatory, analgesic, antidiabetic, antimicrobial, anti aging, hepatoprotective, anthelmintic (chloroform extract), laxative (fresh fruit), gonorrhea, expectorant.

In Ayurveda, leaves and stem bark used for dyspepsia, fever, diarrhea and leprosy.

The bark is moistened and applied to boils and tumors to hasten ripening.

Also used for headaches and stomachaches. Bark is used as antidyspeptic and as febrifuge.

Powdered bark used for mouth ulcers. Infusion of bark used as gargle. The bark juice, mixed with coconut milk, is used to relieve colicky pains.

In Java and Bengal, the bark is used as a tonic. In Java, the bark is used for dysentery; and with pomegranate rind, used for fevers. The bark are rubbed on the teeth to strengthen them. Leaves used for ulcers and headaches. The highly mucilaginous fruit is used for coughs and ailments of the chest, uterus and urethra. In large quantities, used as a laxative. In India traditionally used for ulcerative colitis, ulcers, and colic pain. In Bengal, fresh fruit is used as laxative and pectoral. In Java, fruit used for gonorrhea. In Punjab and Cashmere, dried fruit used as expectorant. Kernels, powdered and mixed with oil, used for ringworm. In Pakistan, used as tonic and refrigerant; for irritation of urinary passages, alleviation of thirst and dry cough.

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1.3.7 Pharmaceutical Applications ^[14, 15]:

Literature, research articles and patents reveal the following applications of *Cordia dichotoma* gum in pharmaceuticals.

1.3.7.1 Tablet binder

The fruit of *Cordia dichotoma* is highly sticky in nature this property is used for binding of tablets. In future *Cordia* gum could compete favorably with gelatin as binder in tablet formulations.

1.3.7.2 Emulsifier

The *Cordia* gum as pharmaceutical excipient, may used as an emulsifier. The *Cordia* gum will be a good option as bio-degradable, cheap, economic and easily available emulsifier in the list of pharmaceutical excipient.

1.3.7.3 Sustained/controlled drug delivery system

Natural polysaccharides and their derivatives are widely explored in the area of sustained /controlled drug delivery systems to improve patient compliance and to provide extended periods of effective blood-levels. Application of *Cordia* gum in this area is investigated by various researchers in recent years.

1.3.7.4 Matrix material

An effort has been made to evaluate the efficacy of *Cordia* gum as a novel sustained release matrix forming material in tablet formulations using diclofenac as model drug. The effect of gum on *in vitro* drug release profile was examined and compared with a commercially available sustained release diclofenac formulation. It became evident from the study that *in vitro* dissolution profile of gum formulation was similar to the marketed product. Study suggested that *Cordia* gum may be a suitable option as an excipient for matrix forming agent to impart enteric resistant and sustained drug delivery in tablet or similar formulations of other drugs too.

1.3.7.5 Transdermal Films

Cordia gum due to its good bioadhesivity may used in preparation of transdermal patches. It shows the similar effect as that of marketed products. It suggests that *Cordia dichotoma* gum has enormous potential for use in the preparation and designing of transdermal drug delivery system.

1.3.7.6 Microparticulate drug delivery

Cordia gum also used for the preparation of microspheres. Because it is a gum shows good adhesion, as it is natural there is a biodegradation after drug release. Study ensured the suitability of gum *Cordia* as a potential excipient for sustained release applications.

1.3.7.7 Nanoparticles

An investigation was made to evaluate and optimize the preparation of a novel polymer-surfactant nanoparticles (using *Cordia* gum as the polymer) for ophthalmic delivery of fluconazole using response surface methodology. A w/o/w emulsion containing fluconazole and *Cordia* gum in aqueous phase, methylene chloride as the oily phase, and di-octyl sodium sulfosuccinate and polyvinyl alcohol as the primary and secondary emulsifiers, respectively, was cross-linked by ionic gelation technique to produce fluconazole-loaded nanoreservoir system. Comparison of the *in vitro* release profile of optimized nanosuspension formulation with commercial formulation provides comparable corneal permeability of fluconazole across isolated goat cornea, indicating suitability of *Cordia* gum based nanosuspension formulation in ophthalmic delivery of fluconazole.

1.3.8 Pharmacological Properties ^[16-24]**1.3.8.1 Antiulcer activity:**

The fruits extract of *Cordia dichotoma* Forst shows antiulcer activity. Extractions of *Cordia dichotoma* fruits were carried out using ethanol. It decreases the volume of gastric secretion, free acidity, total acidity and ulcer index with respect to control.

1.3.8.2 Hepatoprotective activity:

Methanolic extract of *Cordia dichotoma* shows hepatoprotective action in male Wistar rats with carbon tetrachloride induced heart damage. Plant extract has phenolic content and anti-oxidant activity.

1.3.8.3 Wound Healing activity:

Study of ethanolic fruit extract of *C. dichotoma* showed significant wound healing activity. The fruits contain large quantities of amino acid, flavonoids, and saponins and are used as wound healing agent in households.

1.3.8.4 Anti-Inflammatory activity:

The ethanol extract and aqueous fraction of *C. dichotoma* possess acute anti-inflammatory activity. The effects of *Cordia dichotoma* Forst. seeds extracts on different phases of acute inflammation were examined. The dry powdered seeds were found to contain alkaloids, glycosides, saponins, tannins and carbohydrates. Thus it is found that ethanol extract and aqueous fraction of this plant possesses acute anti-inflammatory activity.

1.3.8.5 Antidiabetic activity:

Antihyperglycemic effects of *Cordia dichotoma* Forst in the glucose induced hyperglycemia.

1.3.8.6 Degenerative disorders:

Role of *Cordia dichotoma* seeds and leaves extract in degenerative disorders. A common theme which underlies etiology of several degenerative disorders is free radical induced stress. free radicals prime the immuno modulatory response, recruit inflammatory cells and are innately bactericidal. in the body, excess production of free radicals affect lipid cell membranes to produce lipid peroxides and reactive oxygen species (ROS), Which leads to decline in membrane fluidity and many biological changes, such as DNA damage, ageing, heart disease and cancer etc. Antioxidants serve as free radical scavengers neutralizing and defending the body from a number of diseases which are born because of generation of free radicals. They offer defense against radical toxicity by antagonizing the damages caused by free radicals. Thus, Methanolic extract of seeds and leaves of *Cordia dichotoma* has useful in degenerative disorders.

1.3.8.7 Antimicrobial activity:

Extract of cordia dichotoma also shows moderate activity against bacterial, fungal and yeast species. Water extracts of the *Cordia dichotoma* plants did not show any antimicrobial activity against all the tested microorganisms.

1.3.8.8 Antidepressant activity ^[21]:

Study of ethanolic and aqueous extracts of leaves in behavioral animal models showed antidepressant activity.

1.3.8.9 Reversible Contraceptive Potential ^[22]:

Study evaluated the ethno-contraceptive use of *C. dichotoma* leaves (LCD) in post-coital albino rats. (2-hydroxypropyl)- β -cyclodextrin (BCD) was used as bioavailability enhancer to form LCD-BCD complex, Leaves extract showed 100% anti-implantation activity. LCD-BCD complex exhibited 100% pregnancy interception and showed strong estrogenic potential with a luteal phase defect. Histological and biochemical estimations showed reversible contraceptive potential after withdrawal.

1.3.8.10 Anti-implantation ^[23]:

A methanolic extract of *Cordia dichotoma* showed significant anti-implantation activity.

1.3.8.11 Anthelmintic ^[24]:

Study evaluated the anthelmintic activity of ethanolic and aqueous extracts of *C. dichotoma* on *Eudrilus eugenieae* earthworms. Both extracts showed concentration dependent paralysis and death of worms, with the aqueous extract showing more significant activity.

1.3.8.12 Effects on Long-term Hypoperfusion / Potential Benefit for Cerebro vascular Insufficiency^[25]:

Study evaluated the effect of *C. dichotoma* on long-term cerebral hypoperfusion in rats. Long-term hypoperfusion caused a tendency for anxiety, listlessness, and depression, with histopathological changes in the forebrain. Treatment with *C. dichotoma* alleviated the behavioral, cognitive and histopathological changes, and suggests a benefit for treatment of cerebrovascular insufficiency.

1.3.8.13 Miscellaneous activity:

A method of treating a human body for delaying effects of ageing on skin thereof, by applying to a part of the skin in need thereof of a cosmetic or pharmaceutical composition containing an amount of an extract of *Cordia dichotoma* effective to inhibit activity of elastase in the skin, obtaining thereby the delaying of the effects of ageing on the skin and also some extend Larvecidal activity.

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