

Nutraceutical wild Fruits of India-*Lasora* (*Cordia*)-History, Origin and Folklore

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Abstract

Review Article

Strikingly similar fruits of *Cordia dichotoma*, *C. myxa* and *C. sinensis* are known as *Lasora* in vernacular languages in India and Pakistan. The trio has been used since ages in India, Indonesia, Iran, Iraq, Arab and Africa as folk medicine and in Ayurvedic, Arabian, Chinese, Unani (Greek), Persian and Siddha systems of medicine. Most of plant parts, like roots, twigs, roots, stem and root bark, leaves, seeds and even the gum are useful. Folks in various countries and parts of India use fruits, tender leaves and inflorescence as vegetable. Fruits are eaten as raw and used pickled. In many parts of India, Africa and East Asia these species serve as source of survival and food during famines. *Cordia* has long been used as an anti-diabetic, anthelmintic, anti-inflammatory, anti-malarial, astringent, cicatrizant, diuretic, hepato-protective, immune-modulator and febrifuge and as an appetite and cough suppressant in folkloric and traditional medicine. *Cordia* for long employed to treat urinary infections, lung diseases and leprosy in traditional medicine. The timber and wood is turned into various types of handles, utensils and agricultural tools. Trio seems to be a future green resource source of dye, fodder, fiber, as a corrosion inhibitor, cosmetic and anti-aging agent, pharmaceutical binder for tablets, sustained drug delivery and an anti-capping agent. The present paper reviews the history, distribution, use as food, forage and feed, as medicine in folk, animal and human health; pharmaceutical and therapeutic uses, cultural, ecological and nutritional value, and miscellaneous uses and disadvantages of *Lasora*.

Keywords: *Cordia dichotoma*, *Lasora*, folk medicine, Ayurvedic.**Copyright @ 2020:** This is an open-access article distributed under the terms of the Creative Commons Attribution license which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use (NonCommercial, or CC-BY-NC) provided the original author and source are credited

INTRODUCTION

In India and Pakistan, the plants and fruits of *Cordia dichotoma*, *C. myxa*, and *C. sinensis* are known as *Lasora*. Genus owes its name to the German Physician and Botanists, Euricius Cordus (1486-1535) and his son Valerius Cordus (1515-1544), after whom Linnaeus named the taxon in 1753. Species names *dichotoma* and *myxa* are derived from Greek words, *dichotomous* (meaning cut in two equal halves) and *myxa* (mucus) respectively while *sinensis* is from Latin word for Chinese. *C. myxa* L. described by Linnaeus is divided today into three species: *Cordia myxa* L., *C. crenata* Del., and *C. dichotoma* Forst. (= *C. obliqua* Wild.) [1].

Habit and Distribution

Cordias are small to medium sized trees up to 5-10 m height with a short bole and spreading crown. These grow wild, rarely cultivated and are found growing singly. The stem bark is grayish brown, smooth or longitudinally wrinkled. Flowers are white, fragrant in

large lax terminal and axillary, peduncle cymes which open only at night. Flowering time varies from place to place. Flowering starts from Feb- May according to regions. Trees bear cherry-sized fruit from March through June in some parts of India, and July through August in other regions [2]. Sanskrit entitled *Namarupajnanam* [3] describes *Cordia dichotoma* (*Sleshmastaka*) as a handsome middle-sized tree (*kantavrksaka*) growing wild in hilly area (*sailusa*, *sailu*) with fragrant flowers (*gandhapuspa*) appearing in spring (*vasantakusuma*) having pearl shaped fruits (*muktaphala*) in abundance (*bahuphala*), with slimy and sticky pulp (*picchila*) which are cold to touch as well as in *virya* (*sitaphala*). It is disliked by noble persons and birds (*dvijakutsita*). The pulp is sweet with slightly astringent drying after-taste.

The Three Cordias

C. dichotoma Forst. f. (*CD*) known popularly as Indian cherry is native to northern India, Pakistan, Nepal, Sri Lanka, Myanmar, The Philippines, China,

Ryuku Islands, Taiwan, New Guinea, northern Australia and New Caledonia. In India, CD grows in wild form in the states of Rajasthan, Punjab, Haryana, Himachal Pradesh, Uttar Pradesh, Madhya Pradesh, Maharashtra, Gujarat, Bihar, Andaman, Nicobar and Diu islands. It was introduced in Mauritius around 1837 and is naturalized in the coastal zone and along roads [4] CD has been named variously as *C. oblique* Willd., *C. obliqua* Willd., *C. myxa* auct. Non L. (but not of L.), *C. griffithii* C. B. Clarke., *C. ixiocarpa* F. Muell., *C. brownie* DC. and *C. wallichii* G. Don. [5]

C. myxa L.(CM) known as Assyrian plum is found both in the temperate and tropic regions of world and is a native of India, Iran and Pakistan and naturalized in southern Iran and Iraq, various oases in Arabia, some Mediterranean districts and in northern and tropical Africa [6]. Plant also occurs in Myanmar, Sri Lanka, China, and tropical Australia [7]. For synonymy see *Cordia myxa* L.-The plant list [8]

C. sinensis Lam.(CS) is native to Egypt, Ethiopia, India, Israel, Jordan, Madagascar, Mozambique, Namibia, Pakistan, Senegal, Somalia, South Africa, Sri Lanka, Kenya, Sudan, Tanzania, Yemen and Zimbabwe [9]. In India, it grows in Delhi, Haryana, Punjab, Rajasthan, Gujarat and South India, called *Gondhi* or *Gondhini*, *laghuslemastaka*. In Ayurveda, plant is considered as a source of *Laghuslemastaka*, a substitute of *Stemastaka* [10]. CS has been named variously as *Cordia gharaf* (Forssk.) Ehrenb. ex Asch.; *Cordia reticulata* Roth) non Vahl; *Cordia rothii* Roem. & Schult.; *Cordia subopposita* DC. and *Cordia oblongifolia* Hochst. ex DC. [11]

CD and CM produce big while CS yields smaller fruits and is referred as small lasora or *Laghuslemastaka*. Plants of CM and CD are similar therefore confused and difficult to differentiate the two but the fruit of former tends to be more tan than pink. Wild relatives of *C. myxa* (=CD) and *C. sinensis* (=C. *rothii*) occur in Gangetic plains of India [12].

HISTORY

Written Records

Lasora fruit finds reference in ancient Indian scriptures as Manusmriti (2000BC), Kalpasutra (1500-800BC), Valmiki's Ramayana (500AD), Mahabharata (in present form, 400 AD), Brhatsamhita of Varahmihira (505-587 AD), Amarkosha (500-800 AD), Vishvavallabha of Chakrapani (1577 AD) [13-15] and in Manasollasa (12th Century) [16]. Among ancient and, it is referred and described Ayurvedic treatises as Charak Samhita (600BC), various other Nighantus, and agricultural treatise, Vrikshayurveda of Surpala (1000 AD) [17].

The history of CM and CS may be traced from history of bird liming. The first-century geographer

Strabo mentions about birdlime being used to catch apes in India during the period of Alexander's attack [18]. CS is recorded in Egypt since the pre-dynastic period (3100 BC) [19]. Probably the earliest reference to *C. myxa* (*slemastaki*) in India appears to be in Kautilya's Arthashastra (321-296BCE) [20]. The earliest written record of CM in Africa seems to be that of Theophrastus (*Enquiry into Plants* 4.2.10; 372-287BC) where he mentioned cake making from fruits of CM in Thebes, Egypt. According to Pliny, CM acclimatized in Italy, in the early Roman period. It finds reference in Hebrew texts of the Roman period {Mishnah, *Shabbat* 8.4; 2nd cent. AD; Babylonian Talmud (Jewish six) (*Abodah Zarah* 14a; *Bekhoroth* 8a)}. Mattioli, Italian Physician, Botanist (1500-1577) mentioned export of CM glue from Syria (including Palestine) and Egypt to Venice [6, 21] Kislev [6] writes "Pharchi (1852), who lived in Palestine in the fourteenth century A.D., translated *gufnin* (in Mishnah, *Demai*; Babylonian Talmud, *Berakoth* 40.2) as *sebesten*". At Carthage, the eastern Roman Empire, *Cordia* has been noticed during the Byzantine period [22].

Archaeological Evidences

Fossils found in several layers at Inamgaon in India as 11 stones were identified as CM [23]; Kislev [6] has treated these as CD on basis of the prevailing confusion in nomenclature. The earliest fossil record of *C. myxa* L. in modern Israel and Egypt seems to be that found at Ashkelon dating back to the medieval Islamic period (10 to 12th Century AD) [6, 21].

Names

CD is referred as *Selu* in Manusmriti (2000 BC) and *Uddalak* in Valmiki Ramayana [13]. Amarkosha (500-800 AD) lists five names in Sanskrit (*Selu*, *Slesmatak*, *Sheet*, *Udalo* and *Bahuvara*) while *Namarupajnanam* as mentioned earlier, provides 11 names of CD based on the plant character [3].

Vernacular and common names of three *Cordia* species are prevalent in as many as 67 languages, dialects / countries (Table-1). CD and CS respectively have higher number of names and in more Asian and African languages/ dialects indicating their nativity and distribution. The common Hindi name for CD, is spelled variously as *Lasora*, *Lahsaura*, *Lasoor*, *Lasura*, *Lasuda*, *Lasoda*, *Lashora* and *Lisora*. CD has more names in Kannada and Tamil (22 each), Telugu [18] and Marathi [17] followed by Hindi and Sanskrit (Table-1).

Uses

Fruits, twigs, leaves, stem bark, gum and roots of the trio offer multifarious uses. In Ethiopia, Kenya, Tanzania, Uganda and Zimbabwe, CS is a tree of many uses in Africa as; fruits and seed are edible, parts used as human and veterinary medicine, vermifuge, fodder, and bird forage. Wood is used as firewood, timber, and for making charcoal and furniture, tools, carvings, utensils,

walking sticks and arrow. Its resin, gum and latex are also useful. In addition these items of day to day use, it plays important role in rituals [24].

Food

The kernel, leaves, flowers, tender branches of CD, CM and CS are edible and used as a food. Ripe fruits of the three species are edible and eaten fresh, while unripe fruits are used as vegetable and pickled [25, 26]. Leaves, flower buds and fruits are used as vegetable.

Fruits

When fresh, fruit is slightly astringent but pleasant-tasting and thirst-quenching. Tribals in Poona, coastal areas of Orissa, Miris of Assam and Palliyars of Tamil Nadu eat the ripe CD fruits raw [27-29]. The Malinke ethnic of Senegal eat wild CM fruits [30] and Maasai, Sanjoo, Gogos, Kurya, Barbaigs and Zulu tribes of Kenya and tribes in Akole, Tehsil, Ahmednagar, India consume CS fruits [31, 32]. CS fruit serves as a famine food for the Kara and Kwegu tribe of Ethiopia [33].

Earlier, CM fruits and *Pterocarpus santaloides* were used to sweeten porridge. Now, its use is supplanted by industrial sugar despite the risks [30]. While in Tanzania, CS fruit is used in porridge as a sugar substitute besides consumption as a dessert with baobab meal [24]. The sweet mucilaginous pulp may be eaten fresh while fruit cover and seeds are discarded. Large quantities of the CS fruits are gathered, pounded to a sticky mass, sun-dried and stored in a wooden container (Turkana). Whenever it is needed, water is added to soften it before being served.

As a Vegetable

Mahars in Gujarat, people of Rajasthan and HP in India and Rendille in Kenya use unripe fruits as vegetable [34, 35]. Folks in Rajasthan cook fruits of *gunda* (CM), *gundi* (*Cordia gharaf*= CS) and *saijna* (*Moringa oleifera*) together and eat as a vegetable. The famous *pachkutta* (fruit of five trees) includes *kair* (*Capparis decidua*), *kumut* (*Acacia Senegal*), *sangri* (*Prosopis cineraria*), *kachra* (*Cucumis* spp.) and *gunda* (CM). All these five are mixed together and cooked as a nutritious vegetable eaten along with bread [36]. People in Maharashtra prepare the young inflorescence into a vegetable while those in Alaknanda Valley, Garhwal; Himachal Pradesh, Chhattisgarh, and Gujarat, tribes in Ahmednagar and Kolhapur Districts of Maharashtra, Bastar and Mandala district of Madhya Pradesh and Pa-O (Karen) of Myanmar use leaves as vegetable [37-41]. Santals and others in MP eat tender leaves alone while in Mizoram, folks eat leaves with meat [42]. Manabos of Philippines eat young leaves dipped in honey in times of famine. CS serves as a good source of food for the wandering pastoralists in East Africa. Humans and animals use leaves, flowers, fruit and kernel as food while Pokot and Maasai tribes eat the raw root

[43, 44]. For the Rendille people of Kenya fruits are virtually the only fresh vegetable foodstuff.

The seed can also be eaten as a nut. The stone of CD has a heavy, disagreeable odor when cut, but its kernel tastes like fresh filberts [45]. A clear gum produced is also edible.

As Spice

CD and CM fruits are used as spices in many countries. Dried CM fruits are sold in the spice markets of Egypt as sapistan [46]. CD fruit has a tart, tangy flavor and used in sautéing and marinating and to stupefy. Its flavor complements a number of spices as Ker (*Capparis decidua*), raw mango, raw papaya, lemon, garlic, ginger, vinegar, chili, turmeric and cumin. In Taiwan fruits are pickled whole and used in soups and as a topping for tofu and vegetables. In Indonesia, CD leaves are used to wrap fish for cooking. Green, unripe fruit has a sour taste that can easily be confused for raw mango in its pickled form. In India, sour unripe fruits are cut in half, destoned and pickled while in Taiwan it is pickled along with seeds and is used as an appetizer. Sandawe tribe in Kenya uses CS roots for flavouring [43].

Use in Brewing

People in various places use the trio in brewing liquor and for flavoring. People in East Africa, use the CS fruit pulp for brewing local beer. Folks in Uttar Pradesh, India, use ripened CD fruits in making country liquor and while in Tropical Africa and Himachal Pradesh, India folk use CM fruits to flavor sorghum beer and food [45, 47, 48]. The fresh CS fruits are squeezed in water to dissolve the pulp and made into juice. The juice is mixed with tamarind (*Tamarindus indica*) juice and fermented. Fresh juice may also be drunk (Turkana). In Nebi district, Uganda fruit juice is fermented to make alcoholic beverage [49]. In Taiwan Cumming cordia (CD) is converted by boiling into Pobzuihi, a widely used traditional food [50]. The fermented fruits together with black beans are used in Chinese cooking and fresh fruits to stupefy fish.

Fodder and forage

CM leaves serve as a good fodder and lopped for this purpose. The fruit are an important food for antelopes, giraffe, deer, monkeys, baboons, Asian elephants and birds. The leaves provide browse for animals such as antelope, giraffe and deer and serve as fodder for goats and as feed for larvae of the butterfly and serve good forage for elephants and honey bees. In Berenty, Madagascar, the lemurs feed leaf and floral buds. The camels have a very strong liking for CS. In Pureto Rico leaves serve as a feed for Zenaida Dove (*Zenaida aurita*). In Iran CM fruits are used in feed of animals as antimicrobial particularly for gastrointestinal disorders and analgesia [51].

CD leaves contain 12-15 % crude protein, 16-27 % crude fibre, 42-53 % nitrogen-free extract, 2-3 % ether extract, 13-17 % total ash, 2-4 % calcium and about 0.3 % phosphorus [9.1]. Nutritive value of fodder is DCP (Digestible Crude Protein) 5.4 kg, TDN (Total Digestible Nitrogen) 26.9 [52]. The DCP is fairly high as compared to conventional fodders. The TDN is lower in compared to poor type roughages. CD seed kernel contains a high proportion of fatty oils and proteins (46 and 31%, respectively) which has potential as cattle feed. The fruit pulp and seeds contain (51.8%) oil [53].

Leaves of CD, *Moringa oleifera*, *Albizia lebbek*, guava and fruits of CD as well as clove show fed in fodder show anti-methanogenic activity [54]. Supplementation of CD leaves @ 5% in OM with wheat straw, afforded increased body weight gain (17%) in lactating buffaloes without any change in milk yield and composition [55].

Medicine

C. dichotoma, *C. myxa* and *C. sinensis* have been used in medicine for human and animals since long.

Veterinary

Three *Cordias* are widely used in treatment of animal ailments in Africa and India. They are traditionally used to check bloat and diarrhea, fix fractured bones, aid in conceiving, prevent uterus prolapse and yoke gall [56].

In Gujarat CS (= *C. gharaf*) fruits, leaves and branches are fed to animals for treatment of diarrhea [57]. Ash of Pearl millet and CD leaves is used to cure uterus prolapse [58]. Drenching with daadriya herb blended CM gum in groundnut oil cures foot and mouth disease of cattle [59]. Drenching the animal with CM bark paste and *Flacourtia indica* mixed in water is given for easy calving [60]

Tender leaves of *Cordia* along with small bulbs of *Allium cepa* are fed to the cows and buffaloes prior to heat period to increase fertility and chances of conception. Similarly, an extract of *Cordia*, sugar and *majith* (*Rubia cordifolia* L. sensu Hook f.) is also used to aid cows and buffaloes to conceive [61]. CD leaf ash is used to prevent yoke gall [62]. In Gujarat, CD bark paste is used for fractures [63]. Strips of dry inner bark of CS (=CG, CR) are tied on fractured bone of cattle leg [35]. Fresh and semi-ripen CD fruit juice mixed with sugar is used to cure pneumonia in goats and sheep [64].

Maasai of Tanzania use stem bark, roots, roots without bark, root decoction and bark in treating cattle diseases [65]. While in Ormaland - Kenya, use of CS twig checks mastitis [66]. Zarmas of southwestern Niger, West Africa use CS root and stem bark decoction for washing inflamed eyes of animals [67] and tribes in Tanzania use these for bovine conjunctivitis [24, 68, 69].

In Sudan, stem bark of *Cordia ovalis* and CS is used in itchy skin and to retain placenta [70].

Traditional Medicine Systems

In addition to folk uses plants and parts are widely used in Unani (Greek), Chinese, Ayurvedic and Siddha system of medicine.

Unani (Greek) System

In Unani system the plant is used as antibacterial, antiviral and antitussive (anti cough). CD is chief ingredient of Joshandah, polyherbal formulations, extensively used by the masses in India for the treatment of common cold, catarrh, cough, respiratory distress, and fevers. CD is also used in Pakistan in Unani (Greek) preparation of formulations as Arq Hara Bhara, Dayaquza, Itrifal Zamani, Joshanda, Laooq Sapistan, Laooq Sapistan Khiyar Shanbari, Safuf Habis, Sherbet Arzani, Sherbet Shafa, and Shrebet Zufah Murakkab compounds. In Unani medicine, the fruit supplemented purgatives as a way of counteracting their bad side effects [2].

Chinese Pharmacopia

In Uighur medicine, healers use Abnormal Savda Munziq (ASMq), an herbal formula composed of 10 medicinal herbs including CD as an important component [71] for preventing cancer, diabetes, cardiovascular disorders, and chronic asthma [72].

In Ayurveda

A number *Cordia* species find mention in Ayurveda literature and Materia Medica for the treatment of various disease and disorder conditions. CD finds reference in a many Ayurvedic treatises: *Kaidav nighantu*, *Nighantu adarsh*, *Shankar nighantu*, *Bhavprakash nighantu*, *Raaj nighantu*, and *Madanpal nighantu* [17]. Almost all plant parts of CD are used for medicinal purposes. Names of CD in Sanskrit indicate that plant is efficacious in many disorders (*uddala*, *bahuvara*) and is anti-poisonous (*visaghati*) [3].

The unripe and ripe fruits, leaves, bark and seed oil possesses specific Ayurvedic characteristics that determine their respective use. Sason and Sharma [17] presents a comparative table of the *Guna* (quality), *Karma* (action) and indications for various ailments cured with CD as described in various *Nigantus*. Plant is used in dyspepsia, fever, diarrhea, leprosy, skin diseases, dry cough, jaundice, wound purification, mouth ulcer, gonorrhoea, ringworm and to increase male potency. Being sweet, astringent and bitter in taste, CD acts as hair tonic and controls poison, skin eruptions, ulcers, and herpetic skin lesions, other type of skin diseases and vitiated humors {*kapha*(phlegm) and *pitta*(bile)}.

The ripe CD fruit is sweet in taste and being demulcent enhances *kapha* and cold. Fruit is considered cold to touch as well as *virya* (potency) and therefore,

called as (*sitaphala*, cold fruit). As a drug, it excites *kappa* (*slesmataka*) and induces sleep (*selu*). The fruits are used against diarrhoea, cold, acidity and delirium [73, 74]. CD fruit acts as an expectorant, diuretic and anthelmintic. Sushutra, prescribes *Cordia* fruits as a coolant and astringent, to be used for biliousness, cough and internal hemorrhage.

Its unripe fruit is constipative, drying, and controls the vitiation of *Pitta*, *Kappa*, and *Rakta* (blood), balances *Kappa* in the body. It is used in the treatment of fever of various etiology, cough, bronchitis, asthma, rhinitis and balances in the body. The half ripe fruit makes a tasty broth which is hot in effect as per Ayurveda practitioners. The fruit makes an excellent pickle too which is not so hot. In fact the preserve is quite effective against indigestion. A fine powder of tender fruits mixed with goat milk and sugar destroys upadamsa (soft chancre) [75].

Carak-samhita(C-S) and Sushrut-samhita (SS) describe use of bark paste in eruptive boils (Vrindamadhava, VM), in case of poison entered into blood, in all type of spider poisoning, to control intrinsic hemorrhage and in erysipelas. Bark paste is applied to eyes (C-S) and oil from seed kernels is used as snuff and massage for blackening of hair (Cakradatta) [76]. Kauyilya Arthshastra refers to use of *Cordia* as a constituent of the remedy against poisons and poisonous compounds applied against one's own enemy or people [21].

It is one of the constituent in formulation: Lauk Aspistan, used for cough and cold, makes phlegm thin and extrudes it. Ripe and dry fruit is a constituent of syrup Jhuffa used as *anupan* (adjutant) for taking Bhagotar Gutika prescribed to check cough and asthma [79]. *Karbudar* (*lasoda*) is a constituent of many formulations used to do emesis (of upper part of body) [75]. It is one among the constituents of *Gojihvaadi kvaatha /choorna* and *Putikranjadhayadi choorna* [77].

As Folk Medicine

The trio has been used in folk medicine since long. Folk use of CD is common in India, Indonesia, the Philippines, Thailand and Indo-China, that of CS in India, Djibouti, Kenya, Ethiopia, Somalia, South Africa and *C. myxa* in Europe, Africa, Iran, Baluchistan, Pakistan, and India.

CD serves as immunomodulator, antidiabetic, anthelmintic, astringent, diuretic, hepato-protective, demulcent and expectorant [78, 79]. In folk medicine it is used in treatment of inflammation, bronchitis, fever, wound healing, chest infection, lung disease, cholera, cold, colic, constipation, cough, headache, ulcers, urine disease and urticaria. In UP, CD plant is used in chronic orthopedic fever, dropsy,

dysentery, dyspepsia, cholera, catarrh, and headache and skin diseases [80].

Some ethnic communities use leaf decoction and leaf extract to cure cough, sore throat and in hair oil [81-84]. In Rajasthan, the leaf juice is considered cooling, and is applied as a poultice to treat migraine, inflammation and swellings. Green fresh leaves are used in treatment of jaundice and for increasing power in Pakistan and Andhra Pradesh [85, 86]. In Sindh Pakistan, people use leaves for hepatitis and asthma [80]. Gond Maria and Halba tribals of Madhya Pradesh use leaf paste for ulcers [88]. In Mali, *Cote de ivoire* and UP India, people apply the leaves to wounds, ulcers and headache [84] and to treat the effects of *tse-tse* fly and other insect bites [81, 89].

Bark decoction aids in digestion and clears up digestive problems. Stem bark decoction is taken for dyspepsia, fever, diarrhea, dysentery, headache, stomach-ache, indigestion, burning sensation, leprosy, skin diseases and as a tonic in various parts of India [90-92]. In Myanmar bark is used to treat catarrh and the Javanese use it for fevers [89]. Tribals in Puna use bark and fruits in respiratory tract infections, cough and as an anthelmintic [40]. In Orissa stem bark is used as an astringent and in toothache and for strengthening teeth [93]. The bark juice administered in coconut milk is given in severe colicky pains [94]. The powdered bark is put on mouth ulcers and its infusion is used as a gargle for sore throats. Moistened bark is applied externally on boils and tumors to hasten ripening. The Santals use bark powder for external application in prurigo. Tribals of Nizamabad, Andhra Pradesh, orally take stem bark extract for cure of scabies [95]. Lodhas use stem bark decoction with common salt (3: 1) in gripe [82].

Lodhas prescribe root bark paste as cure for eruptions like pimples [82]. Folk in Sri Lanka use CD in bronchial diseases and pneumonia, bark as a laxative and root in urinary diseases [96].

Tribals in North Gujarat take mixture of CD flowers and curd to protect body against heavy sun heat waves [97].

CD fruit is very mucilaginous and highly esteemed for coughs and diseases of the chest, uterus and urethra. Consumption of ripe sweet fruits reduces the inflammation due to acidity [98]. The fruits are useful in ulcers, leprosy, skin diseases, burning sensation, bronchitis, dry cough, constipation and chronic fever [88, 91]. Santhals use ripe fruits as purgative and Lodhas give fruit mucilage with paste of long peppers (2: 1) as demulcent [82].

In HP fruit is given as expectorant in curing lung diseases [99]. Similarly, people of Rajasthan, use a decoction of fennel, CD and *munaka* (dried large raisin)

to soften and draw the cough out of body [100] while in Aligarh, folk take pills of crushed, roasted fruits of CD, *Psidium guajava*, *Solanum surtense*, *Syzygium cumini* and *Calotropis procera*, mixed with honey to cure cough and asthma [101].

In North Karnataka oral intake of fruit juice used as a blood purifier [102]. In Pakistan CD fruit is considered demulcent, expectorant, tonic and refrigerant and used to reduce irritation of urinary passage, alleviation of thirst and dry cough [103].

Lodhas of MP, India use CD dried seed powder with seed oil of *Schleichera oloesa* for removing tattooing marks on forehead. Powdered seed mixed with oil applied topically is a good remedy of ring worm [82, 91]. Seed decoction is used for sore throat [81]

CM Folk Medicine

Sebasten plums (CM) have analgesic, astringent, anti-inflammatory, emollient, lubricating, softening and laxative properties. Written sources show that Sebasten fruits were used in Rome more as medicine than as food. CM is widely used as traditional medicine for coughs, chest-complaints, inflammations of the digestive and urinary tract in tropical Africa, in the near and Middle East and were also used in Western Europe, towards the 18th and beginning of the 19th centuries [104]. Santhals use CM in fever, dropsy, anasarca, urticaria and dyspepsia, cholera and dysentery [105].

In Africa, the fruit pulp is employed to treat diarrhea, dysentery, tuberculosis, wounds, ulcers, calm abscesses and rheumatic pains and as a vermifuge [45, 89]. In Tanzania the fruit pulp is applied to ring worm. In Malaysia, the fruit mucilage is given to treat coughs and other chest complaints. It is also used to treat uterus and urethra disorders [94].

Unripe fruit used in pickle is carminative and ripened fruit is used in the medicines for lungs and pulp in medicines for brain [86]. In Iran, CM with three other seeds (Barhang, *Plantago major* L., Gudamah, *Alyssum campestre* L. and *bihidana*, *Pyrus cydonia* L.) is used as a tonic and remedy for diarrhea. Being demulcent it is useful for coughs and chest complaints. A mixture of *Cordia myxa* and other fruits with lime juice and sugar, is given as an infusion for headache, fevers (not malarial), and to soften faces before purgation [106]. In Iran, traditional healers (*Attar*) use CM fruit for pharyngitis and as antitussive (cough), febrifuge and laxative [107]. In India the fruits are used in constipation, stomach worms, piles and toothache [108].

CM root mixed with *Viola* sp., *Nymphaea alba* L., and *Cichorium intybus* L. is used in Iran, Baluchistan, and India as a resolvent and cooling medicine for bilious attacks [106]. Tribes in Africa use root decoction to treat malaria in Africa but it can cause an abortion [69]. In

Sindh, Pakistan, people use the whole plant of *liyar* (CM) in hepatitis and against post injury infection and leaves in treatment of jaundice.

In India folk apply stem bark paste over skin for herpes Zoster and over spider bite portion of skin [109] and folks in Orissa use stem bark as astringent and in toothache [110]. Bark decoction being astringent and used as gargle. Mixed with catechu stem bark is chewed as a substitute for pan (betel leaves) to redden lips [108].

CS in Folk Medicine

CS is used traditionally for headaches, cough, chest complaints, fever, malaria, intestinal disorders, conjunctivitis, rheumatism, edema, gonorrhoea, syphilis, rabies, sickle cell anemia, ulcer, toothache, worm infestation and as diuretics [31, 68].

Both CS roots and bark are used to treat a variety of disorders in humans and livestock. The Samburu of Kenya use CS bark for diarrhea and chest pains [111, 112] or pleurisy associated with lung infection. Borana people in Ethiopia, chew bark for stomach disorders. In India, bark is used as astringent in Orissa. 2-3 gm of powders of *Mimosa pudica* and *C. gharaf* stem bark with a pinch of common salt is boiled in a glass of water and the bark decoction is gargled for relieving pains in gums and teeth [113].

Gogos, Maasai and Kipsigis use a root decoction with milk in malaria [68, 114]. Kara and Kwego people in Ethiopia use root infusion for treating respiratory infection and tuberculosis [33]. Samburu pastoralists in Africa use boiled gum with milk to treat bronchus and pneumonia [115]. The Suiei Doroba tribe of Kenya, use soaked root in water or with honey and soda ashes for curing stomach ache and diarrhea [116]. In Tanzania, roots and bark is used for stomach disorders. Root decoction is used in malaria. Giriomas of Kenya take boiled roots to treat paralysis and inhale steam from boiled leaves under blanket especially for shortness of breath [117]. A Tribe of Angola, West Africa, use pounded roots of *Grewia angloensis* and CS (=C. *gharaf* CG) in anemia, common dropsy, hydropsy [118] and branches in setting dislocations and fractures of limbs. Sambarus use a hot decoction of flower in eye infection and malaria fevers [119].

People of Somalia, in chicken pox take handful of fresh CS leaves, boil in water in one liter of and prescribe half a cup three times a day and wash the patient with the decoction [120]. In Randa area, Djibouti, tribals use water soaked with fresh CS leaves as shower bath and in infection diseases [121]. While folks in Senegal use the leaves either alone or mixed with drug-plants, as a fever remedy [122]. Tribals of Ahmednagar District, Maharashtra, use handful of fresh, young and healthy crushed CS leaves with honey, cow ghee and glycerine in cow milk, for cure of mouth ulcer and tongue irritation [123].

Use in Male and Female Problems

Trio is widely used in traditional and folkloric medicine in male and female sexual disorders. The plant parts are useful both in conceiving and also as an abortifacient. The decoction prepared from CD fruits (one cup) taken from 2nd day of menstruation period for three days, helps in conceiving of a woman not getting pregnant. Whereas consumption of CD leaf paste along with the sun-dried paddy grains helps prevention of ovulation, and thus the eliminating possibility of pregnancy [124]. Folks in Sindh Pakistan, orally give CD boiled leaves and decoction for prevention of recurrent abortion [88]. CD stem bark is used as abortifacient [125]. People in Africa use CM root decoction to treat malaria which may induce an abortion. CS roots can also induce abortion [68]. Maasai of Kenya chew the root and swallow the saliva as an abortifacient [120]. Locals in Kasumu, Kenya use CS roots with *Ochol* (*Euclea divinorum*) roots as medicine for pregnant women [126].

Trio is also useful in menstrual disorders. Korku tribe, Maharashtra, take stem bark powder with water to cure menstrual disorders [127]. Tribals of Nandurbar and Nasik District, Maharashtra use stem bark decoction for cure of excessive menstruation [128, 129]. Folks in Somalia, use CS boiled roots to treat dysmenorrhea [130]. Tribals of Nasik district, North Karnataka and Himachal Pradesh eat fruits for treatment of gonorrhoea [129]. While in Gujarat leaves are used for this purpose [91].

CD bark and root forms part of formulations for increasing vigor and sperms [100]. People in Orissa and Maharashtra, use CM leaf and fruits for cure of spermatorrhoea and fever [130]. In Dera Gazi Khan, Pakistan, eating of CM fruit before meal is prescribed in treatment of masculine sexual weakness [131]. Green fresh leaves are used in treatment of jaundice and for increasing power in Pakistan and Andhra Pradesh [85, 86].

Use in Agriculture

Ancient treatise, Brhatsamhita elaborates on use CD (*slemstaka*) oil as manure [132], while *Vrikshayurveda* mentions its use for induction of immediate sprouting of seeds [133].

Prediction of antimicrobial/insectidal herb on basis of Ayurvedic determinants

CD being *guru* (heavy) and *rooksha* (dry), soothing (*snigdhi*) / slimy/*picchal* in *guna* (quality); sweet, pungent, bitter and astringent in taste; sweet, *katu* in *vipaka* (transformed taste), *ushna* (hot) and sweet in *veerya* (potency) [17] possesses all the requisite qualities of an herbal antimicrobial identified earlier [134]. Review of literature on pharmacological testing reveals that CD possesses anti-worm and antimicrobial properties as can be predicted on the basis of Ayurvedic

characteristics of antimicrobial plants [134] and is a potential herbal insecticide/antimicrobial as corroborated by pharmacological testing by various researchers (Table-2). Similar prediction for *Vitex nirgundi* [135] is corroborated by pharmacological testings.

Wood and Timber

The *lasura* tree yields, high quality wood, grayish brown in color and weighs nearly 15 to 18 kg per cubic foot. It is moderately hard, though not very durable for outdoor work, planes well to a smooth surface and takes good polish. It is generally used for making ornamental furniture, house posts, beams, scantlings, planks, dugout canoes, boats, tea boxes, cart shafts, axles, yokes, well-curbs, agricultural implements, combs, gun stocks, naves, spokes, etc. It is also used for making quality toys, bowls and wooden utensils for kitchens for handling sour recipes. The wood, being light and yet reasonably strong, is therefore used to build houses in China, India and fuel wood and charcoal in Philippines [136]. Maher tribe of Gujarat uses CD stem for making '*Dhosari*' and '*Ravai*' (churning rod) and CS(=CG=CR) stem for making '*Kadhamnu*' seed drill (*Orni*), *Khapari*, handle of Kodari and mill [35].

The timber of CM is soft and light, and not very durable. In Egypt it was used to make horse saddles, while that of CS is a good kindling wood and is considered one of the best for lighting fire by friction. It is used for firewood and for making furniture and tools.

Other Uses

Marakwet Community in Kenya and people in Oman use twigs of CS as tooth brush [137]. However, Ayurvedic literature forbids use of CD twigs for this purpose. In Myanmar, the leaves are used as plates and a substitute for cigar wrappers and covering Burmese cheroots.

Tribes in Kenya, India and Tanzania, use CS stems in hut-construction and to construct the fence of the animal enclosure [24, 138] and use bark for covering huts. Gabra people collect wood for house poles at certain ritually prescribed times of the year. Turkana tribe (South Kenya) hollow out the larger pieces into pots [116] and use the hard wood of CS (*edome*) to make hunting or combat bow. In Ethiopia Kara and Kwegu people use branches for making yibet, oar and bee hive [33].

Rural people use the slimy fruit as glue to stick paper and the CD plant owes its name (*lekhasataka*) to this property [3]. CD stem bark with catechu is chewed as a substitute for *paan* (betel leaves) to redden lips [108].

Sudanese use brown and slightly scented heart-wood of CS as a substitute for sandalwood. People

in Burkino Faso, use ash from the young branches as a soap.

Fumigation of Milk Containers

Maasai and Gabra of Kenya and Rendille of Ethiopia use CS stems and roots for cleaning calabashes and smoking/fumigating gourds [139]. Gabra women use dried taproots split into several pieces [140]. This process of cleaning and smoking is known as Qorasum technology (QT) in Kenya. Garba women use QT for preservation of milk and curd and to impart flavour and smell to food and to ensure the proper maintenance of vessels of food storage. It plays a critical role in the preservation of milk, fat and meat products, vital in pastoralist nutrition.

Fuel

The Mehar tribe of Gujarat uses dried stem of CD and CS for fire [35], whereas the people of Burkino Faso never use CS for this purpose.

As Ornamental

CS has white sweetly-scented flowers and is planted as an ornamental shrub in North Nigeria. In the township of Merca in Somalia it has been planted as an avenue-tree. CS is used for charcoal burning in Kenya that caused decline in plant population [141]. CD is a quick-growing fruit tree, suitable for planting along boundary and farm roads [75].

Nutritional value

CD, CM and CS fruits are nutritious with additional advantage of high dietary fiber content that plays an important role in decreasing risk of many metabolic diseases. Trio fruits have high calorific value respectively as 684, 281.4 and 318 kcal/ 100 g DW and are important sources of dietary calorie.

CD fruit is equally nutritious as banana and guavas (135Rathore, 2009). CD fruit pulp (100 g) contains 35 % protein, 18% carbohydrate, 37% fat and 6 % water while minerals content (mg/100g) was Ca(55), Zn(2), Iron (6), P(275), Mn(2), Cr(0.2) and Cu (1.6) [143]. CD fruit can fulfill the dietary need of potassium and zinc content [144]. Chromium present in CD fruit has therapeutic value in diabetes.

CM fruits are a good source of proteins, carbohydrates, phosphorous, calcium, fat and essential minerals as zinc [38, 144-147]. The proximate composition and mineral constituents of CM fruit show 6.7% ash, 8.32% crude protein, 2.2% crude lipid, 25.7% crude fiber, and 57.08% carbohydrates. Mineral ranges (mg/100g dry weight, DW) were: K (7.83), Na (1.62), Ca (0.46), Fe (0.51) and Zn (0.35) [146]

Fruit is rich in sugar contents but typically acid less in nature. CM fruits contain (g/100 g of dried product): water 6.21, glucose 12.75, fructose 9.38,

sucrose 29.09 and starch 29.09. Ripe CM fruit is sweet because of its high amount of sucrose, d-glucose, and d-fructose, d -rhamnose and galacturonic acids. Anti nutrients are in low quantity being 355 phytic acid and 250/100g oxalate in CD fruits [141] 248mg/100g phytic acid and 1.39 (TIU/g) of Trypsin inhibitor content in CM fruits [144].

On basis of a comparative study of the mineral contents of CM with recommended dietary allowances (RDA), Aberoumand and Deokule [145] suggested that CM fruit could be a good supplement for nutrients such as fiber, protein and carbohydrates and should be promoted as a carbohydrate and protein supplement for cereal-based diets in poor rural communities.

Phytochemicals

A number of research workers have analyzed active chemicals that impart medicinal properties to these plants. Various types of chemicals extracted from three Cordias show diverse activities: analgesic, anti-inflammatory, immunomodulatory, antimicrobial, antiparasitic, insecticidal, cardiovascular, respiratory, gastrointestinal and protective effects. Antibiotic-modifying, antinociceptive, antifertility, toxicity, anti-snake bite, hypolipidemic, immunomodulatory and antioxidant. Pharmacology and phytochemical components of the trio and their role has been reviewed [25, 93, 143, 149-153].

CD fruits contain saponins, amino acids, flavonoids, sugar, gum, proteins, and fatty acids as palmitic, stearic, linoleic acids, oleic, arachidic, behenic acids; flavonoids such as kaempferol, quercetin, isorhamnetin, (butanol fraction) and arabinoglucan i.e. D-glucose and L-arabinose, glycosides, aglycone and L-rhamnopyranoside. CD seed contains α - amyryns, betulin, octacosanol, lupeol-3rhamnoside, β -sitosterol, β -sitosterol-3glucoside, hentricontanol, hentricontane, taxifolin-3-5-dirhamnoside, hesperitin-7-rhamnoside and fatty acids [154, 155].

Fruits of CD, CS and CM show activity on respiratory system disorder while fruits of CD and CM reveal antimicrobial, anthelmintic, antioxidant, diuretic and juvenomimetic activity. CD fruit is hypolepidemic, hypoglycemic, shows anti-implantation and hypotensive activity while CM fruits are astringent, diuretic, demulcent, are cardio-protective and show antioxidant activity (Table-2).

Roots contain Hesperetin 7- rhamnoside, a glycoside of hesperetin Lupa-20, 29-ene-3-o-D-maltoside and [149, 150]. CD twigs contain β -sitosteryl-3 β -glucopyranoside-6'-O-palmitate, nervonyl 4-hydroxy-transcinnamate ester, and β -sitosterol [152].

CM leaves contain chemicals as linolenic acid, linoleic acid, oleic acid, sitosterol, oleic acid [158, 159] pyrrolizidine alkaloids [159], carotenoids [160]. Leaf extract showed anti-implantation activity, suggesting its

possible use as a natural contraceptive drug [161]. Leaves of the three *Cordias* show anti-inflammatory activity and are useful in digestive system disorders (Table-2).

Table-1: Names of *Cordia dichotoma* *C. myxa* and *C. sinensis* in various Indian languages

Language / Country	<i>Cordia dichotoma</i>	<i>Cordia sinensis</i> Lam.	<i>Cordia myxa</i> L.
English	Clammy Cherry, Indian Cherry, Sebesten Plum, Fragrant manjack, Snotty gobbles, Glue berry, Pink pearl, Bird lime tree	Grey-leaved cordia, Grey-leaved saucer-berry, woolly saucer-berry	Assyrian plum, Clammy cherry, Glueberry, Indian cherry, Large sebesten, Sapistan, Sapistan plum, Sapistan tree, Sebestan tree, Sebesten plum, Selu, Sudan teak, Dog's Teat, Indian saucer berm
Gujrati	Vado gundo, Barghand, Gundi, Gundo Vadgunda.	Gundhi, Nana Gunda, Liar, Gundi, Liyaar	Bargund, Gadgundi, Gunda, Nanugundi, Pisten, Sepisten.
Haryana	Laswara, lesua	Guntia, gondi	
Pakistan	Bara lasura		lasuri
Hindi	Bhairala, Bhokar, Chhotalasora, Gondi, Lasora, Boria Lesuda; bada-goonda, bara-gunda, bhokar, chokar-gond, gondi, gonni, gunda, lasoora, lasora, lasura, lesuwa, lisora, Rasalo	Gondhi, Gondni, Gundi	lasora, chokargond, lasua
Kannada	Challe, Challehannu, bankegida, challebankegida, chikka challe, chikka-salle, chotte, doda chillu, dodda changate, dodda solle, haadige, hire challe, hiri saale, kaadu chaale, kaadu challe, Kendal, kendala, mannadike, mannadik, mannadike mara, salle	Jerubonpli, Kadusalle, kiricalle, Kirichalle, kirisale, kirikalle, kirisele, Narevali, narivuli, Nar	challe, chikkasalle, , salle cikkacalle, hadige, , kaadchellai, kaducalle, kadusalle, , cholle mannadike, chikkasalle, chikkusalle, cikkacalle calle, hadaga, cella chella, chelle, solle,
Mallayam	Naruvari, Narunari, Naruviri, naruveeli, cheruviri	Veri, Verasham, Pasakaimarum, viri	vida, vidi, vidimaram, virashamvirigi, viri, virigi, viriyasam, virusham, viruvu, naruvili, naruveli Viriyasam naruvili, periya- periya-chettu, periya-naruvili, periya-viri, valiyvanicci, valiyavarich,
Malyali	Valluku maram		
Marathi	Bekar, Bhokaribakar, bargud, bhakram, bhokar, bhokara, bhokur, chokri, godan, goden, gondhen, montabhokar, semar, shelu, sherti, vargund, vhadli	Bokur, Gondani, Lahan-selti, Lahan-Bhakarn Gondhan	Gondhen Bohbeer
Rajasthan Udaipur	Umbio, leshwa	Jungle Bundi(Alwar)Noni gundhi(Kota)	Gonda, Lasora or lehsua
Sanskrit	Bahuvara, shlesh-Malaka, Selu, Slesmataka, bauvaraca, slesmatakah, uddalaka	Bahuvaraka, Karabudaz, lagushlemastaka, Shelu, Slemastaka Bahuvaraka, Laghushita	selu, sukeshmaphala, selluh
Tamil	Uddhala, cavarittakikam, cavarittakikamaram, cirunaruvili, citam, jollai, kalliyavam, kalliyavamaram, kalviricu, kalvirusu, mukku-chali, naruli, naruvili, naruvalli, naruveli, naruvili, , naruvuli, perunaruvuli, vidi, virusham, viruvu, viricu	Nariviri, Nariviran, Naruvili, Sandanomamani, Selu, Sirunaruvuli, Irula Sellai Masmooki, perunauvulli, vidi, virusham	Ali, Namviri, Naruvili, Mukku-Chali ceruvanacchi, ceruviri cheruvanacchi, cheruviri, kalvirusu,
Telugu	Banka Nakkera, Nekkara, bankanakkera, bankiriki, botgiri, botuka, chinna-nakkeru, chinnabotuku, chinnanakkera, iriki, nakaru, nakkera, nakkeri, nekkara, pedda botaka, pedda irki, urunakkera, virigi	Chinbotuku, Chinnabotuku, Chinnairiki, Cinna botuku, Cinnbotuku, , cinnbotatuku, cinnvirigi, Nakker	banakarkkiri, banka-nakkera, botuka chinnabotaku, cinnabotuku, chinnanakeru, padda-botuka, pedda-nakkera-chettu, nakeru, nakkera, nakkeri, nakkeru, nakkiri, nekkara, nekra, urunakkera, iriki, irkee, irki, vura-nakkeru.
Arabic	Dabak, Dabk	Underab	Sapistan, Alpmb tree, Alpmb - sewn - Alhambo - Gao - gauge BD , dabk , Mujayta, mujaytā, mujaytī, mujatā`

Cordia dichotoma

Assamese: Goborsuta Goborhut, bahubara, **Bangla:** Chhotobohnari, Buhul or Lashora; **Chhatisgarhi:** Lasua; **Dogri:** Lasura; **Uriya:** Amobhoto, Gondi; **Manipuri:** Lamkelaba; **Meghalaya Khasi:** Dieng Mong; **Mizo:** Muk-fang; **Punjabi:** Laswara; **Mallayal:** Valluku maram; **Tribals:** **Miris:** Sirma, Siumang; **Lodhas:** hemrum, **Santal:** buch, **Gonds:** Bohar; **Handia and Maria:** Bohbeer; **Tibii/Unani:** Sapistan, Dabak, Babak; **MP:** Debbaru.

Bangla Desh: Kalhuza, bohari, Bella, Chaine (**Mogh**); Bol-mimang, Thakaksum (**Garo**). Kalahuza, (**laleng, Partha**), Bonary, Bohari; Bohal, Buhal (**Chittagong**); Aslia, Kalahuza (**Sylhet**). Bongol gaas (**Chakma**); **Chinese:** Po Bu Zi Ye, po bu mu, Feng zheng Zi, shuai, bu zi, po bu ye, lan bu (zi)zha, bu bao mu, po bu shu, xiang bo ye, Shù zǐ zǎi; **Uighur China:** Pobumuguo; **Japanese:** Husayou; **Lao (Sino-Tibetan):** man, 'man khôk; **Malaysia:** Sekendal, Sekendai, Petekat; **Mayanmar Karen People:** Thanat; **Nepali:** Bohori, Kalo bohori; **Pakistan: Sindhi:** Giddori, Lessori; **Pusto:** Lasora; **Persian:** Sapistan, Suspistan; **Thai:** Mandong, Manma, Phakmong;

Phillippines: Tagalog: Anong, anono, Anonang bakir, Anonung, Anunong, Saloyong;

Ifugao: Anunong; **Bisaya:** Anunong; **Sulu:** Guma, nunag; **Ibanag:** Anonang; **Iloko:** Anonang, anonag-bakir, sinaligan; **Bikol:** Anonang; **Bikano:** Anonang; **Manasaka:** anonan; **Maranao:** nonan; **Cebuano:** anunan;

Indonesia: (Balinese): Korean: posayep; **Javanese:** Kendel; **Malay C (Indonesia):** Manonang, Nimang Sekndai, Sekendal, Tomatangtang; **Manggarai:** nunan; **Rembong:** nunan; **Halmahera:** Toteolo; **Sumatra, Malay:** Nunang;

Taiwnese Chinese: Chhiū chí á. Phòà pò chí.; **Paiwan:** Adodan, Baaryuu; **Atayal :** Tatugatum; **Bunun:** Pananun; **Formosan:** qaNuNaq; **Keyu Hakka:** Lan bu zii. Lan2 bu2 shu2;

Vietnamese: Thiên đầu thống, Ong bầu, Tráí keo l [as] b[aj]c, l[as] tr[aws]ng Tác dụng của, thành phần của;

French: Sébestier dichotome, capestan; **Russian:** Kordiia indijskaia, Kordiia vil'chataia.; **Paraguay:** Petereby; **Papua New Guinea:** Cordia

Cordia Sinensis

Ethiopia: Malló mucci: shengolochi (M); **Kara:** midir, togoz; **Kwego:** chuwachoch; **Bo:** ubacho, ulicha, underab (A); **Galinya:** maderra; **Somali:** Koha, Mahrari; **Djibouti (Randa):** Maderto(Geez?); **Sudan: Ama / Nyman:** Kabide; **Dinka:** Akoc, Akuei, Akoy; **Nuer:** Nyot; **Andrab, Andarab;** **Kenya: Samburu: Borena:** Harores, mader-b, Madheer raphachoooor, madeer-qoowe, madee'r, Maderboor; **Chonyi:**

mkayukayu; **Gabra:** mad'eera ; **Giriama:** mderia, kayukayu; **Ilchamus:** salapani, lgweita; **Kamba:** kithea, muthei-munini, kithia; **Kasigau:** izera; **Kipsigis:** nokirwet; **Konsogna:** Maderta; **Maa:** ol-durgo, ol-dorko, ol-olgot; **Dry bushland: Malakote:** Madera, Mutalya-naja **Orma:** mader, madera; **Somali:** marer mareer; **Riverine forest: Malakote mutalya-chana,** mutaale; **Orma:** Kote; **Somali:** : marer-khoh; Tana **Marakwet:** Adomoyon, Adomeyon; **Pokomo:** muhale, mhali, mtale; **Pokot:** adomeyon, adomeon, adome (fruit) katuntulion; **Rendille:** gaer, koh, madeer, gayer, gaeer; **Samburu:** lkweit, Igoita; dorgo, manturre, lgueita, lgweita-orok, silapani; **Sanya:** ho'orocho; **Tugen:** adumewa, edoma (leaves), adomewa, Adomeyo; **Turkana:** edome; **Swahili:** Mnya, mate, mkamasi; **Giriama of Basi:** Mkayukayu; **SuieIDorobo:** silapani (lgweita); **Rendille (Marsabit district. K):** Lgoita; Wardei: Marer; **Chad (Zaghawa):** Andarab, turu;

Umbundu Angola: Angola: (olo) ngombe, (omu) puka Umbundu; **Namibia:** (omu) koyo, (omu) tua-koyo (Nyaneka); **Mozambique:** cambununo, duva; **Namibia: Oshiwambo:** Kaliko; **Otjiherero:** Omusepa; Omupombo, osepa omusepa, Omuzipa; **Caprivi:** Muliza; **Oshiwambo, Oshikwanyama:** omiku yumbwa O-Ok; **Khukh Namibia:** es, is, khos; **Kwanyama (Namibia):** omiku yumbwa, omupombo; **Afrikaans N:** Langblaarpiering bessie; **Damara>Nama (Namibia):** aes, nai; **German N:** Schleimbeerenstrauch.;

Afrikaans SA: grysblaarpieringbessie; **Tsonga SA:** mpon'wana, mtlele; **Tswana:** mwarasupe; **Venda SA:** mutadola; **Lunyaneka:** omukoio; **Kwanyama:** omuku yumbwa; **Konsogna:** Madertta (Konsogna);

Somalia: mareer; **Mauritania:** 'Maine'A akjül (Aub.); **Senegal:** Maure'A) akjül (Aub.); **Serer(Senegal):** Subduam, suo mág; **Wolof Sene:** Mbey mbey, nehneh, tâpus; **Mali Songhai:** Barmadangaïe, fifrigui; **TamachekMali:** tadanu; **Ghana:** gonyont ; **Arabic Niger:** hen'darabaïe; **Southwestern Niger:** barmandagaye; **Hausa Niger:** tedanat, tidani; **Kanuri Niger:** Kabulu, Kabula; **Tamachuk Niger:** Tadanu; **Tubu Niger:** Kohul; **Arabic Nigeria:** Inderab; **Hausa Nigeria:** tadana, tidani; **Kanuri Nigeria:** kabilla; **Nigeria: Hausa:** Tadana, **Kanuri Niger:** Kabilla; **Zarma:** Fifrigi; **Niger WA:** bomo-dangay (Zama); **Niger: /Wadaabe:** dornohi;

Tanzania: Habusu, ngheghi; **Filome:** baghalmo-lambi; **Gogo:** mdawi, mdawisogwe; **Gorowa:** hanarmo; Hehe: Mdawi; **Iraqw:** Bagalimo; funidang, hararmo; **Maasai:** oldorko, olofot, oldurgo, oldurogo; **Mbugwe:** mochocho; **Nyamwezi:** mlembu, mnembu; **Nyaturu:** mdumwa-kiguu; **Pare:** Mpololo; **Hehe:** Mdawi; **Hadza:** undushiipi, kisinubi; **Rangi:** mnembu; **Iraqw:** bagharimo, funidang, hararmo; **Swan:** mkamasi, nyamate.; **Tanzania:** edorko; mudawe; **Sandawi:** angweegwee; **Swahili:** mkamasi, mnya mate.

Wood Names: Swahili: Nyamate; **Indonesia:** Salimuli; Mal, kalamat, **Papua New Guinea:** Keroseni wood, Cordia, Island wood; **Philippines:** balu anonang; **Mayanmar:** Sandawa; **Thailand:** mamlong, kalamat; **Kenya:** Muthea; **Boarno Euthopia:** Madheera-raphachoo

***Cordia myxa* L.**

Crotian: asirijska šljiva; **German:** Brustbeeren; **Greek:** Myxia (Cyprus).

Hungry: asirijska šljiva; **French:** Capestan, Bois savon, Prunier d'Assyrie, Sébeste (fruit), Sébestier (tree), Sébestier domestique, Sébestier mixa, Sébestier officinal, Sébestier vrai; **Italian:** Frutto di visco, Tibisco; **Portugese:** Sebeteira, Sebeteiro-do-Sudão; **Russian:** Kordiia miksa, Kordiia slizistaia; **Spanish:** Ciruelo asirio; **Tibet:** Sle ma sma ta ka; **Euthopia:** Galinya: marad, madad; **Ghana:** Lobotilli gbli, tungbo; **Guinea:** darama, degue, darama, ndeke, ndien, ntu, sanadjo;

Ivory Coast: darama, clede, lobotili gbli, ndele, tia, manohi; **Mali:** colle, darama, daramba, degue, daramba, ndarma, ndeke, ndike, tiamanobi, tungue'; **Senegal:** darama, darama tunko, degue, daramba, mbey, mbay-gile, narr, ndege, nedeke, sub, subdjuam, tamanohi, tamus; **South Africa:** muTsikiri(shona); **Upper Volta:** ndeke, tango, tunguo;

Indonesian: Kayu semang; **Malaku island Indonesia:** Ai Huluti;

Spanish castellano: sebestén

Iraq: Banbar, Bumber; **Kuwait:** Bambar; **Pakistan:** lasuri **Urdu:** dabk, sapistane-kalan, moklat-ahe-kabur, sugpistan; **Persian:** Sepistan, Sebestan or sapistan, dogs' dugs.

MP: Labhera, Lasora; **Punjabi:** Lassora, Lasūrā, Lasūrḥā; **Unani:** sapistane-kalan, moklat-ahe-kabur, sugpistan.

Table-2: Pharmacological Activity of *Cordia dichotoma*, *C. myxa* and *C. sinensis*

	<i>Cordia dichotoma</i>	<i>Cordia myxa</i> L.	<i>Cordia sinensis</i>
Fruits	Anthelmintic [198, 199]	Antioxidant [219]	Antioxidant, Anti-Glycation Anti-Inflammatory [233]
	Wound healing [200]	Antioxidant, hepatoprotective chemically induced fibrosis [219]	
	Hypolepidemic effect [79]	anti-inflammatory [220]	Immunomodulator [234]
	Antimicrobial [93]	Gastroprotective [221]	
	Analgesic, antibacterial, cytotoxic [201]	cardioprotective plant extract [222]	Antitubercular plant extract [111]
	Degenerative disorder [154]	analgesic, antiinflammatory [223]	
	Anti-inflammatory [202]		
	Antioxidant activity [93]		
	Gastroprotective antiulcer [203]	Immunomodulator [224]	
	Hypotensive & respiratory stimulation [204]	Anti lesmanic MUCILAGE Extract [225]	
	Antipyretic [73]		
	Antidiabetic [205]		
	Antimicrobial [206]		
	Diuretic [207]		Cardioprotective [225]
	Antiulcer [208]		acute inflammation [226]
Leaves	Antifertility [208, 143, 161]	Analgesic and anti-inflammatory [226]	
	Hypoglycemic, antihyperglycemic [5, 28]	Analgesic and anti-inflammatory [227]	Wound healing [236]
	Anthelmintic [143, 161]		
	Antibacterial' Antimicrobial [143, 161]		
	Analgesic [143, 161]	Antitumour [228]	
	Antiglycemic [143, 161]		
	Antiulcerogenic [143, 161]		
	Antitermite [209]		
	Antidepressant activity [210]		
Bark	Ulcerative colitis [211]	Anthelmintic [227]	
	Antimicrobial; antifungal [212]		Cardotonic, stem bark antidiabetic [149]
		Insecticide [48, 230]	Antimicrobial, anticarcinogenic [235]
	Antioxidant [93]		Antibacterial [237]
	Analgesic [213]	Anxiolytic [231]	
	Anti-implantation [214]		
	Antioxidant nariya [215]		
Seed	Wound healing [216]		
	Antioxidant [28, 217]	Astringent [232]	
Seed & leaf	Antimicrobial activity [218]		

Cosmetic

Ayurvedic treatises have recommended use of *Cordia* for skin [17]. CD plant extract is used in cosmetic and pharmaceutical compounds for the treatment of skin aging. An aqueous extract of the plant inhibited the elastase activity. An anti-wrinkle cosmetic gel contained *Cordia* dried extract. US registered a patent no. US 6238674 B1 [162] for use of extract of *C. dichotoma* as “A method of treating a human body for delaying effects of aging 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 *C. dichotoma* effective to inhibit activity of elastase in the skin, obtaining thereby the delaying of the effects of aging on the skin” [163] suggested use of *C. myxa* in preparation of topical cream, because of pharmacological effects such as anti-inflammatory activity.

Gum as a Binder

The CD seed mucilage gum is can be used as a binding agent in the conventional tablet formulation. It has greater potentialities to become the new source of binder and could also be exploited for the commercial production of gums [164] *Cordia* species fruit mucilage has potential for many pharmaceutical applications as an anti-capping agent with different binder, tablet binder, emulsifier, for sustained control of delivery system through transdermal film, micro particulate and nano-particulate delivery system [165].

Cordia dichotoma fruit mucilage (CDFM) appears to be suitable for use as a release retardant in the manufacture of prolonged release matrix tablets because of its good swelling, good flow and suitability for matrix formulations. Dried (CDFM) can be used as an excipient for making prolonged release matrix tablets. Gum cordia (*C. myxa*) can substitute the synthetic polymers as HPMC in preparation of buccal tablets so useful in dentistry as powdered mucilage significantly effects the tablet characteristics, and increasing in muco-adhesiveness [166].

Cordia gum can serve as a good option as bio-degradable, cheap, economic and easily available emulsifier in pharmaceutical excipient and could compete favorably with gelatin as binder in tablet formulations due to its good bio-adhesivity [167]. It is good option in preparation of transdermal patches microspheres and nano-suspension formulation in ophthalmic delivery of fluconazole. The *Cordia* gum may also be a suitable option as an excipient for matrix forming agent to impart enteric resistant and sustained drug delivery in tablet.

As glue

The pulp of half ripe fruit can be used as an alternative to paper glue in office work. Manabos and

Cebuanos tribes of Philippines and people in Assam and Mahars of Gujarat use the gelatinous substance of CD fruit as gum for pasting cardboard and paper sheets [2, 35, 168].

Coating Pine nuts

Gum coating increases shelf life of Pine nuts (*Chilgoza*, *Pinus gerardiana*). It is a rich source of unsaturated fatty acids and the un-shelled nuts are highly susceptible to rancidity. Coating with Gum *Cordia* containing CM extract exhibited highest (ca. 95%) increase in shelf life. While, samples treated with alpha tocopherol did not improve the oxidative stability [169].

Fiber Source

New natural cellulose fabrics identified from CD branches possess structure and their properties suitable for blending and processing with biodegradable polymers to make green composites for various types of applications [170].

In Sudan CS (=CR) is one of the 13 used species for fiber extraction. Most of the extracted fiber is used locally or traded outside the production area as raw or processed products [171] The inner bark of CS is fibrous and a fibre can be extracted to produce strong cordage and a caulking material for boats and paper pulp [122].

Bark is used for making ropes utilized locally used for building huts, bed making, well lining, and livestock tying. Bast from CM in the Philippines, and that from CD and CS is used to make rope [122, 170].

Corrosion Inhibition

Alcoholic extracts of stem, leaves and fruits are effective for corrosion inhibition activity in acidic media for mild steel and aluminum and activity is attributed to the alkaloid allantoin and flavanoids that are cause of inhibition activity [172].

Dyes

C. dichotoma bark gives red dye on fabric with alum as mordant [173]. Leaves, roots and fruits yield yellow and red dye [173, 174]. The bark contains 2% tannin and finds use in industry [175].

Coppicing ability

CM and CS are fast growing and plants possess good coppicing ability. The coppicing is a very effective and fast growing method for producing timber, fuel wood, fodder and other products of plant without replant and may be very useful to achieve the goal of demand of the people of village community [25, 176].

Cordia in Folklore

Lasora has penetrated the folklore because of its multifarious uses. Many villages in India owe their

names to this plant as village *Lasoda*, in Swai Madhopur, Jaipur. *Bahuvara* of Mirzapur district UP appears in historical records being given in charity by the King. A great sage and teacher of Vedanta owed his name to Uddalaka also known as Uddalaka Aruni. Gundia, a Bhil clan of Rajasthan, owes its name to *Cordia gharaf* (CS) [177].

CD is the provincial tree of Phra Nakhon Si Ayutthaya Province of Thailand. An African country, Burkino Faso issued a philatelic stamp in 1977 showing wild fruits of *C. myxa*. Here, the Bobo people consider its wood too sacred to burnt [178].

Proverbs

People of Rajasthan, India, discriminate CD and CS as is evident from folk saying '*Karam futya re kesva, gundi ke lagya laswa*' ie. When fortune frowns the unprecedented may happen like a tree of *gundi* bear fruits of *leswa*. Separate common names for two species are prevalent in number of vernacular languages [179].

In Kannnda, '*Challehannu thinsidra?*' means asking the other "*were you conned, (persuaded by deception) ?*" [180]. *Challehannu means Cordia*.

Punjabi language uses *Lasoda* as a medium to convey the human nature '*Ākar cūre dī les lasūde dī*'-literally it means 'Arrogance is identified with a sweeper/low caste and the stickiness with *Cordia*'. It is said so 'When some low person is arrogant / proud'

In Hindi, *lasora* is a simile for big eye. In Jain literature, *Cordia* fruit is symbolic of eye balls as elaborated by an incidence wherein a raged king who was blind asked the soldiers to take out eyes balls of all the culprits and asked to keep these in a tray. The soldiers instead of eyeballs placed the tray filled with *Cordia* fruits. The blind king frequently touched these and cherished the touch.

CS appears in pre-islamic Arabic poem by Al-DamyatI, *Mujam Asmd^h al-Nabdttdt*, Cairo 1965, identifies the botanical items *gharf* (1.2); *Cordia gharaf* [181].

Use in Rites de passage and Cultural Beliefs

People of Manabo Abra province in Philippines use CD leaves decoction for bathing a new-born child and its mother. In India, in Horaray Asrology, plant is associated with planet Jupiter and *Svati nakshtra*, however, some associate this *nakshtra* with *Terminalia arjuna* [182].

In East Africa, CS is widely used in rituals of Gabra, Samburu, Masai and Boran tribes of Kenya, Maasai of Tanzania and Rendille of Ethiopia. *Gaayer* (CS) is the most important tree of the Rendilles, due to its numerous practical and ritual uses. It is highly imprudent

to carelessly step over the stick (made of CS) of certain men when it is lying on the ground. During transportation of new house to a new settlement site for the first time, a *gaayer* twig is pinned on top of the load of the camel bull used for this purpose [137].

Samburu and Rendille spread branches at site of building the house of newly married couple, branches are also put above the house during *almadho* and *soriyo* ceremonies. Maasai use CS sticks to settle the disputes and to stop a fight or to prevent oneself from being attacked; a stick is placed between the opposing parties. In Gabra, Northern Kenya, like all married men, *ad' abrella* (ritual expert) carries a stout shepherd's staff made of from this ritually significant tree. This tree is most commonly used in Gabra country and furnishes wood for making of mens' and womens' marriage sticks (the *herori* and *siqqe*). In *Oramo* these sticks are linked to the origin of institution of marriage [183].

Among the Dhaasanac of South-West Ethiopia, the *tuurperim* (priest) have paramount ritual importance, both in war and during the *dimi* ceremony as in which the ritual tree called *mier* (Singulative: *miedi*) (*C. rothii* or *sinensis*) is cut [184].

Symbolic Uses

In Western Africa, CM is charged with magical and religious meaning and used in mourning rituals [45]. Such symbolism could also have existed in Egypt, where *Cordia* is mentioned in various funeral contexts until Pre-dynastic times [19]. Endocarps are reported in Pharaonic (Thebes; 12th dynasty) and Roman (Douch, Hawara) funeral sites [6]. The symbolic meaning of *Cordia* could then have crossed the Mediterranean Sea as [104] recorded *Cordia* in the cremation grave from Nîmes, Avenue Jean Jaure's in France, and concluded its use as a plant offering, and as an indication of high social status or for its cultural/symbolic value.

Among Gabra of Kenya and Rendille of Ethiopia CS is also used in the camel trust system. Rendille deposit a twig of gaeer (R) madeer (b) in the house of the camel donor as a ritual payment [185, 186]. At the time of asking favor for a camel mare the borrower is required to give a gift to the giver a *gaayer* twig and grease his head. These are two symbolical benefactions meant to put moral pressure on the potential giver.

Taboos

Vrikshayurveda of Surpala, and Vishvavallabha forbade planting of *sleshmataka* and some other trees considered inauspicious near residence of a happy person or in home gardens [15, 133]. While Manasollasa goes on to say "the Kings wishing welfare must never plant in a garden, trees like *Butea monsperma*, *Bauhinia variegata*, *Tamarindus indica*, *Cordia dichotoma*, *Terminalia arjuna* and *Pongamia*

pinnata” [16]. In Mahabharata, the use of long bottle gourd, Kalasaka (curry leaf), Slemastaka, Sudersana(?), leaves of Bamboo or *Karira (Capparis decidua)* is interdicted [187]. *Manusmriti, Manava Dharmasastra* [188] advises that “One should carefully avoid red exudation from trees and (juices) flowing from incisions, the *Selu* (fruit), and the thickened milk of a cow (colestrum)”

Cordia was used at the time of sacrifice. In the great horse sacrifice of the Ramayana, twenty-one posts were erected, six made each of *Vilva (Agle marmelos)*, *Khadira* or *Acacia*, six of *Palasa (Butea frondosa)*, one of *Udumbara (Ficus glomerata)*, *Sleshmataka (Cordia f)*, and one of *Devadru*, the *Deodar* pine tree [189].

Disadvantage

As referred earlier, in Taiwan pickled fruit (with stone) is used as an appetizer. The sticky pulp and indigestible seeds of this fruit can form a phytobezoar if ingested excessively. Phytobezoars are classically found in adults with a history of previous gastric surgery, conditions of reduced gastric acidity, poor gastric mixing, or delayed motility [190].

DISCUSSION

Hippocrates nearly 2500 years ago said so “Food is the medicine and medicine is the food” and (Proper diet is the medicine and there is no medicine like proper diet). Even good medicines will not cure a patient without an appropriate accompanying diet. *Cordia* species fit into the Hippocratic criteria of food being a nutraceutical food having therapeutics activity against a number of ailments.

Cordia apart from being traditional and famine time food possess many advantages as having good nutritional value due to presence of minerals. A comparison of nutritive value and energy obtained of commercially available fruits viz. apple, banana, grapes [191] with wild fruits reveal that *Salvadora oleoides*, *Cordia dichotoma* and *Carissa carandas* are nutritionally superior [142, 148]. Consumption of *Cordia* in sufficient amount could contribute greatly towards meeting human nutritional requirement for normal growth and adequate protection against diseases arising from malnutrition [142]. It has been suggested that the nutritive values (NV) of the wild edibles are good and in many cases superior to conventional food resources [192] and the statement stands true for *Cordia* also.

In addition to food, the three *Cordias* (referred as trio) have multifarious uses. Trio may serve as forage plants, fodder for cattle, and goats and a green source of dye, fodder, fiber, and a corrosion inhibitor. CD is one of many recommended trees that can stand against dust pollution [193]. However, its tolerance to stand tannery effluent is low in comparison to *Acacia nilotica*, *Ficus*

religiosa, *Pongamia pinnata* and *Cassia auriculata* [194]. CD is a good fodder, but generally used on a small scale more so during grass famines though available most of the year. A high proportion of fatty oils and proteins in seed kernels (46 and 31%, respectively) make these potential source as cattle feed [68]. Feed supplementing with CD leaves increase body weight gain in lactating buffaloes without affecting the milk yield and composition and reduces methane production [54, 55].

Cordia fruit mucilage has potential for many pharmaceutical applications as an anti-capping agent with different binder [164], tablet binder, emulsifier, for sustained control of delivery system, through transdermal film, microparticulate and nano-particulate delivery system.

Folkloric use of *Sleshmataka* in cattrah, cough and cold, fever, pain, skin diseases, urinary problems, inflammation, jaundice, wounds, toothache, kidney stone, hepatitis, sexual weakness is based on its use in traditional systems. In Uighur medicine, healers use *Abnormal Savda Munziq (ASMq)*, an herbal formula composed of 10 medicinal herbs including CD as an important component [64] for preventing cancer, diabetes, cardiovascular disorders, and chronic asthma [72]. Some of the pharmacological activities proved in pre-clinical trials (Table-2) confirm Ayurvedic uses of *Cordia* as diuretic, antipyretic, analgesic, anti-inflammatory, wound healing, astringent, anthelmintic explained in old texts conveying good knowledge of the ancient sages.

A perusal of table on indications for various disease condition prepared from 8 Nighantus reveal [17] that CD is listed in 7 as *varnya* (cosmetic, aid to complexion), followed by *kushtghna* (eliminates skin diseases, antiscorbutic), *krimighna* (anthelmintic), and *visarpa*(erysiphales); *vishghna* (anti-poison) and *vishphot* (herpes zoster, shingles), *Masurika*(small pox); *kusht* (leprosy killer), *keshya*(promotes hair and hair health), *malavrodhak*(constipation), as *amavicar*(ama is toxin produced in body by undigested food that become fetid, *vicar*=disorder), *shool* (stomach pain), *mutrakrish*(in dysuria and difficulty of passing urine).

Karami *et al.*, [163] prepared a cosmetic cream from CD and American patent office has issued a patent for anti-wrinkle gel based on CD extract. These two instances corroborate and speak high of the practical knowledge saved in ancient Indian treatises.

Main hindrances in popularity of these small berries include unavailability of high yielding varieties, low keeping quality of ripe fruits that restrict its transportation to far off places, better post harvest handling technology such as atmosphere packing methods to extend shelf life and further extend

marketing opportunities. Unripe *lasora* is easy to find in season as it transports well, making them prime for distribution to far-off markets because of its popularity in traditional dishes [2]. Varietal improvement programs on CD and CM are in progress in India and Kuwait. Central Arid Research Institute has released two elite genotypes, CAZRI-G 2021 and CAZRI-G 2025 of *C. dichotoma*, with consistent fruit yield (59.5 kg and 98.2 kg) and pulp content [54]. There is urgent need of studies for introduction of better post harvest handling that can help to maintain the freshness of the fruit and enhance its competitive marketing edge. Some practices recommended so far include harvesting fruit at yellowish green stage to maintain fruit weight and minimize shriveling, plucking fruits with stalk and packing in bamboo basket. Modified atmosphere packaging studies supported with fruit biology and physiology are also needed to extend the shelf life of the fruit [194].

People in tribal areas still use many of wild fruits as a supplement of their basic food needs; however, the present generation is unaware of its importance. The dependence & popularity of these nutraceutical wild fruits has gradually declined with introduction of exotic fruits (olives, black berries, crane berries, avocado and broccoli) coupled with undue advertisement and favor by modern chefs on food channels have pushed our valuable plants far behind. Another threat posed is expanding area under urbanization.

Unfortunately, CD is now listed as an underutilized fruit [195] while *C. myxa* L. and *C. sinensis* (= *C. rothii*) respectively as a vulnerable taxon and a threatened species in India [196]. Hence onus comes to natural resource-experts to find out way to conserve and utilize these valuable nutraceutical fruits. As a remedy, a wider and sustained acceptance of wild fruits as important dietary components must be stimulated. For value addition, efforts on part of Governmental agencies, Institutes, research scientist, pharmaceutical companies, should be directed to increase ways of added and increased utilization on dietary uses, and production. For this immediate need would be on concerted efforts towards clinical trials to confirm multitude of pre-clinical results and to put these to production level through increased demand from industry and creating awareness among young generation regarding its potential.

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