



Caesalpinia bonducella L.: A nutraceutical plant

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ABSTRACT

The focus on medicinal plant research has been increased worldwide because of the belief that “green medicine” is safe and cheaper than synthetic drugs. The plant *Caesalpinia bonducella* L. has been used in different system of traditional medication for the treatment of various diseases and ailments of human beings. It is reported to contain various amino acids, fatty acids, starch, alkaloids, glycosides, terpenoids and saponins. It has been reported to exhibit anthelmintic, antiestrogenic, antimalarial, antispasmodic, Ca⁺⁺ antagonistic, antiproliferative, antipsoriatic, antitumor, anxiolytic, larvicidal, immunomodulatory, antiamyloidogenic, antihyperlipidemic, antipyretic, analgesic, diuretic, antidiabetic, anti-inflammatory, antioxidant, antimicrobial and antifilarial activities. This review attempts to encompass the available literature on *C. bonducella* with respect to its pharmacognostic characters, chemical constituents, nutritional characters, various pharmacological activities, traditional uses and modern use.

Key words: *Caesalpinia bonducella* L., Chemical constituents, Nutritional characters, Pharmacological activity.

INTRODUCTION

Caesalpinia bonducella L. is an herb reported in Ayurveda, an ancient traditional system of medicine in India. “Bonducella” the name of the species is derived from the Arabic word “Bonduce” meaning a “little ball” which indicates the globular shape of the seed [1]. The seeds are grey coloured and resemble eyeballs, which explains the Ayurvedic name of the drug ‘kuberakshi’, meaning eyes of ‘Kubera’, the Hindu God for wealth [2]. *C. bonducella* is used by traditional Siddha practitioners in Malabar regions for psoriasis treatment [3] and also finds use in the traditional medicine system of Pakistan [4].

TAXONOMIC POSITION

Kingdom : Plantae
Phylum : Magnoliophyta
Division : Magnoliopsida
Class : Angiospermae
Order : Fabales
Family : Fabaceae / Caesalpinaceae
Genus : *Caesalpinia*
Species : *bonducella*

REGIONAL / VERNACULAR NAME

According to Singh and Raghav [5], following regional and vernacular names have been used to describe this plant.

Hindi Name : Kantkarej, Kantikaranja, Sagar Gota.

English Name : Fever nut, bonduc nut, nicker nut, nicker seed

Sanskrit Name : Kakachika, Kantakikaranja, Kantakini, Karanja, Krakachika, Kuberaksah, Kuberakshi, Kuberaksi, Latakaranja, Prakirnah, Tirini, Valli, Varini, Vitapakaranja.

Urdu Name : Akitmakit Persian Name: Khayahe-i-iblas
 Bengali Name : Nata
 Marathi Name : Gajaga
 Kannada Name : Gajjiga, Kirigejjuga, Gajikekayi
 Malayalam Name: Ban-karetti, Kaka-moullou, Kazhanji, Kalanci, Kajanchikkur
 French Name : Bois
 Telugu Name : Mulluthige, Gaccakayai
 Tamil Name : Kalarciver, Kalarcik Koluntu, Kalarcipparuppu, Kazharchikkaai, Kalachikai, Kalichikai, Kazarci, Avil

HABIT AND HABITAT

C. bonducella is a viny perennial shrub growing in shade as well as in open condition. Generally found up to an altitude of 1,000 m in Himalaya and wild throughout the plains on waste lands or coastal areas of India. It is also found in deltaic region of western, eastern and southern India. Found particularly in the seacoast throughout the hotter parts of India, Burma and Sri Lanka [6].

BOTANICAL DESCRIPTION

Following botanical characters have been described for this plant [1, 6 - 9]

Foliage	Evergreen
Roots	Deep roots, tap roots
Type of stem	Hard and woody
Leaf type	Bipinnately compound, elliptical, ovate shaped
Leaf arrangement	Alternate
Leaf colour	Green
Leaf surface	Glossy
Seed type	Dicot
Odour	Characteristic
Taste	Bitter

TRADITIONAL USES

Root, stem, leaves, bark, seeds and nuts have been used for various medicinal purposes by human beings. Occurrence of various chemical constituents and reserve food materials in different parts of *C. bonducella* were shown in Table 1 and 2.

The seed is claimed to be styptic, purgative, anthelmintic and controls inflammations, useful in colic, malaria, hydrocele, skin diseases and leprosy. In Chennai, an ointment is made from the powdered seeds with castor oil and applied externally in hydrocele and orchitis [1, 10].

Table 1: Major chemical constituents of *C. bonducella*

S. No.	Parts studied	Chemical constituents identified	Reference
1.	Whole plant	Steroidal Saponin, Fatty Acids, Hydrocarbons, Phytosterols, Isoflavones, Amino acids and Phenolics Alkaloids present Bonducin (a homoisoflavone)	Tummin Katti [13]. Ghatak [14] Purushothaman et al. [15]
2.	Seed Kernel	Phytosterols- Sitosterol, Heptacosane Noncrystalline Bitter Glycoside Bonducin Neutral Saponin	Balmain et al. [16] Williamson [17]
3.	Seed	Noncrystalline Bitter Glycoside Bonducin, Neutral Saponin Neutral Saponin Terpenoids, Caesalpin, β -Caesalpin and α -Caesalpin	Kapoor et al. [18], Tummin Katti [13] Patwardhan et al. [19] Puri [20]

The seeds are considered as tonic, febrifuge, anthelmintic, antibleorrhagic, and specific in the treatment of hydrocele. The oil from the seeds is used in convulsions and paralysis. In Guinea, the pounded seeds are considered vesicant. The powdered seeds were mixed with equal part of pepper powder and given to malarial patients and was found to possess feeble antiperiodic properties.

Table 2: Reserved food materials identified in the kernels of *C. bonducella*

S. No.	Parts studied	Major molecules identified	Reference
1	Seed kernel	Fatty Oil , Starch, Sucrose	Tummin Katti [13].
		Fatty Acid- Stearic, Palmitic, Oleic, Linoceric, Linolenic, and a Mixture of Unsaturated Acids of low Molecular Weights	Chopra [21]
		Aminoacid- Aspartic Acid, Lysine, Glycine, Leucine, Histidine, Isoleucine, Serine, R-Amino-Butyric Acid, Tyrosine, Citrulline, Glutamic Acid, Threonine, Arginine, Proline, L-Alanine, Methionine, Phenyl Alanine, Cystine, Valine, Tryptophan	Sotelo et al. [22]
2	Seed	Pentoan, Starch, Water Soluble Mucilage, 4-O-Methyl Myoinositol Hydrate	Moon et al. [12]

In malignant malaria, seeds are not active. The seeds are ground in water and given internally in snakebite [11]. *C. bonducella* seed along with long pepper powder act as a good expectorant. Burnt seeds with alum and burnt arecanut are used as a good dentifrice and useful in spongy gums, gum boils, etc. in West Indies, the roasted seeds are used as an antidiabetic medicine [10, 12].

The kernel of the seed is very much useful and valuable in all ordinary simple, continued and intermittent fevers. The kernel powder mixed with equal parts of black pepper is taken thrice a day in a dose of 15-30 grains by adults and 3-4 grains by children. Decoction of roasted kernels is used in asthma. Children who are unable to digest mother's milk are given the extract of the kernel or its powder along with ginger, salt and honey to get good stomachic effect. Paste prepared from kernel gives relief from boils and other swellings. A cake made of 30 grains of powdered kernels, fried in ghee taken twice a day is a valuable remedy in cases of acute orchitis, ovaritis and scrofula. [1, 10, 12, 17]. In La Reunion and Madagascar, the roots are considered as febrifuge and anthelmintic, they are much used as an astringent in leucorrhoea and blennorrhagia.

In Guinea, a decoction of the root is prescribed in fever. The root-bark is good for tumours and for removing the placenta after child birth [8]. Bark of root possesses many properties and useful in intestinal worms, amenorrhoea, cough, and acts as anthelmintic. In Jamaica, it is used as rubifacient and as a local application for sores. Flowers are used in treating ascites and fruits in treating urinary disorders, leucorrhoea, piles and wounds. Leaf and twigs are traditionally used in the treatment of tumors, inflammation and liver disorders. They are also useful for treating toothache. Leaf juice has been used traditionally in elephantiasis and smallpox.

USE IN AYURVEDIC MEDICINE

Rasa (taste) : Tikta (bitter), kashaya (astringent)

Veerya (potency): Ushna (hot)

Dosha : Pacifies tridosha

Vipak : Katu, Kapha, Vat Samak, Sotha Har, Badana Sthapan, Dipan, Anuloman, Swashar, Mutral and Jwaraghan [2].

MODERN USES

Various biological actions and medicinal properties of *C. bonducella* were given in Table 3. Powder of *C. bonducella* was made official in the Indian Pharmaceutical Codex 16 for the dose of the powder being 15-18 grains. It is said to produce lots of perspiration, leading to the reduction of fever. Kernel powder with sugar and goat milk is useful in liver disorder [13].

NUTRITIONAL VALUE

C. bonducella has been reported to contain the nutrients such as crude fibre 12.79 – 14.07%, Protein 18.65 - 20.32%, Fat 6.54 - 7.23%, Carbohydrate 16.91- 18.56%, Food energy (Kcal/100g) 376.27 – 402.12, Calcium 0.150 - 0.184%, Phosphorus 0.17 - 0.22%, Sodium 0.07 - 0.08%, Iron 0.22 - 0.5%, Vitamin C 0.016 - 0.043 (IU/g) and Vitamin A 416.75 – 700.14 (IU/g) [55]. Nutritional value of seed of *C. bonducella* is energy value (73.6%), crude fibre (3.3 mg/g), total fat (3.6%), free amino acids (1.82%), protein (17.6%) and carbohydrates (18.4%), free fatty acid (0.03 mg/g), vitamin E (6.09 µg/g), vitamin C (4.2 µg/g), thiamine (10.6 µg/g), niacin (22.6 µg/g) and riboflavin (89.6 µg/g) and cellulose (2.59 mg/g) contents of the selected plant material were observed. XRF and flame photometry data suggested that the plant is rich in minerals especially K, Ca, Fe, P, S, Mg, Si, Cl, Pb, Pd, Al, Mo, Cu and Zn. Enzymes such as lipase (12.9 µg/g), amylase (12.3 µg/g), catalase (9.6 µg/g), alkaline phosphatase (0.56 µg/g) and acid phosphatase (0.25 µg/g) were present in *C. bonducella* seeds [32].

Table 3: Biological activity of *C. bonducella*

S. No.	Parts studied	Biological activity	References
1	Chloroform extract of <i>Caesalpinia bonducella</i> L. seed	Antioxidant activity	Shukla et al. [23], Kumar et al. [11]
	Hydromethanolic extract of the seeds of <i>Caesalpinia bonducella</i> L.		Jana et al. [24]
	Methanol extract of <i>Caesalpinia bonducella</i> L.		Kumar et al. [11]
	Hydro methanolic extract of the seeds of <i>Caesalpinia bonducella</i> L.		Jana et al. [24]
	Aqueous extract of seed shell of <i>Caesalpinia bonducella</i> L.		Biswas et al. [25]
2	Eethyl acetate and Aqueous extracts of <i>Caesalpinia bonducella</i> L. seed kernels	Antidiabetic activity	Parameshwar et al. [26]
	Aqueous, ethanol and chloroform extracts of bark and root of <i>Caesalpinia bonducella</i> L.		Patil et al. [27]
	The seeds of <i>Caesalpinia bonducella</i>		Kannur et al. [28]
3	The seeds <i>Caesalpinia bonducella</i> L.	Anti hyperlipidemic activity	Kannur et al. [29]
4	The seeds <i>Caesalpinia bonducella</i> L.	Anti-inflammatory activity	Shukla et al. [30], Archana et al. [31],
	Aqueous extract of <i>Caesalpinia bonducella</i> L. seed		Manikandaselvi et al. [32]
5	Flower extract of <i>Caesalpinia bonducella</i> L.	Analgesic Activity	Aruna Devi et al. [33]
6	The leaf of <i>Caesalpinia bonducella</i> L.	Anthelmintic activity	Jabbar et al. [4]
			Wadkar et al. [34]
7	<i>Caesalpinia bonducella</i> L. seed kernel	Antifilarial activity	Gaur et al. [35]
	Ehanolic leaf extracts of <i>Caesalpinia bonducella</i> L.		Subramani et al. [36]
	An Ethanolic extracts of the root and stem of <i>Caesalpinia bonducella</i> L.		Dhar [37]
8	Seed extracts and bondenolide of <i>Caesalpinia bonducella</i> L.	Antimicrobial activity	Simin et al. [38]
	Seeds of <i>Caesalpinia bonducella</i> L.		Arif et al. [39]
	Polymethylene from ethyl acetate leaf extract of <i>Caesalpinia bonducella</i> L.		Sagar and Vidyasagar [40], Khan et al. [41]
9	Alcohol extract of seeds of <i>Caesalpinia bonducella</i> L.	Antiestrogenic activity	Salunke et al. [42]
10	Cassanediterpenes from the seed kernels of <i>Caesalpinia bonducella</i> L.	Antimalarial activity	Pudhom et al. [43]
11	<i>Caesalpinia bonducella</i> L. seeds	Antispasmodic activity	Khan et al. [41]
12	<i>Caesalpinia bonducella</i> L. seeds	Ca++ antagonist effect	Khan et al. [41]
13	Cassane diterpenes from <i>Caesalpinia bonducella</i> L.	Antiproliferative activity	Yadav et al. [44]
14	Leaves of <i>Caesalpinia bonducella</i> L.	Antipsoriatic activity	Muruganatham et al. [3]
	Petroleum ether fraction of ethanolic extract of <i>Caesalpinia bonducella</i> L. seeds		Deepika et al. [45]
15	Methanol extract of <i>Caesalpinia bonducella</i> L. leaf	Antitumor activity	Gupta et al. [46]
16	Petroleum ether extract of seeds of <i>Caesalpinia bonducella</i> L.	Anxiolytic activity	Ali et al. [47]
17	Petroleum ether, Ethanolic and Aqueous extracts of dried leaf and fixed oil from the seeds of <i>Caesalpinia bonducella</i> L.	Larvicidal activity	Saravanan et al. [48]
18	Ethanolic extract of seeds of <i>Caesalpinia bonducella</i> L.	Immunomodulatory activity	Tummin Katti [13], Parameshwar et al. [26]
	Aqueous extract of <i>Caesalpinia bonducella</i> L. seeds		Shukla et al. [49]
19	Leaf extract of <i>Caesalpinia bonducella</i> L.	Muscle contractile activity	Datté et al. [50]
20	Methanolic extract of <i>Caesalpinia bonducella</i> L.	Hepatoprotective activity	Kumar et al. [11]
21	Aqueous extract of Leaf of <i>Caesalpinia bonducella</i> L.	Anti-amyloidogenic activity	Ramesh et al. [51]
22	Ethanolic extract of <i>Caesalpinia bonducella</i> L. seed kernel	Antipyretic and analgesic activity	Archana et al. [31]
23	Aqueous and Methanolic extracts of the dried seeds of <i>Caesalpinia bonducella</i> L.	Diuretic activity	Khedkar et al. [52]
24	Leaf powder extract of <i>Caesalpinia bonducella</i> L.	Acute oral toxicity studies	Pingale [53]
25	Methanolic extract of <i>Caesalpinia bonducella</i> L.	Acute and Sub-acute toxicity	Pillaia and Suresh [54]

CONCLUSION

The nutraceutical potential of this plant in terms of its efficacy and versatility is such that further detailed research appears crucial. Acute toxicity studies also revealed its safe for consumption to human beings. So this herb will be more useful for marketed nutraceutical preparation. Also the plant shows the many pharmacological actions on various diverse disease and illness, so the plant is beneficial asset for the Indian nutraceutical industry.

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