**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, antioestrogenic, antimalarial, antispasmodic, Ca²⁺ antagonistic, antiproliferative, antipsoriatic, antitumor, anxiolytic, larvicidal, immunomodulatory, antiamyloidogenic, antihyperlipidemic, antipyretic, analgesic, diuretic, anti-diabetic, 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 / Caesalpiniaceae
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 : Gajigaja, Kirigejiga, Gajjekayi
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, Kazar

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 seeds are considered as tonic, febrifuge, 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

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

The seeds are considered as tonic, febrifuge, anthelmintic, antiblennorrhagic, 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*

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Parts studied</th>
<th>Major molecules identified</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Seed kernel</td>
<td>Fatty Oil, Starch, Sucrose</td>
<td>Tummin Katti [13].</td>
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<td></td>
<td></td>
<td>Fatty Acid- Stearic, Palmitic, Oleic, Linoceric, Linolenic, and a Mixture of Unsaturated Acids of low Molecular Weights</td>
<td>Chopra [21]</td>
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<td></td>
<td></td>
<td>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</td>
<td>Sotelo et al. [22]</td>
</tr>
<tr>
<td>2</td>
<td>Seed</td>
<td>Pentoan, Starch, Water Soluble Mucilage, 4-O-Methyl Myoinositol Hydrate</td>
<td>Moon et al. [12]</td>
</tr>
</tbody>
</table>

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 blemorrhagia.

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 rubificient 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 Jwaragahan [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) 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*

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

REFERENCES

[23] S Shukla; A Mehta; J John; S Singh; P Mehta; SP Vyas. Food Chem Toxicol., 2009, 47(8), 1848-1851.
[33] R Aruna Devi; SK Tandan; D Kumar; P Shailesh. Pharm Biol., 2008, 46(10-11), 668-672.
[34] GH Wadkar; SR Kane; SS Matapati; MG Hogade. J Pharm Res., 2010, 3(5), 926-927.
[44] PP Yadav; R Maurya; J Sarkar; A Arora; S Kanojiya; S Sinha. *Phytochem.*, 2009, 70(2), 256-261.
[45] KSN Deepika; K Rama Navya; M Meenakshi Sundaram; N Ravichandran; C David Raj; P Brindha. *Int J Pharm Pharm Sci.*, 2014, 6(8), 311-314.