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Review

Review on Pharmacological activity of *Caesalpinia bonducella*.

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Abstract

Numerous herbal medicines have been used to cure and control a wide range of disorders in different medical systems. The plant *Caesalpinia bonducella* has been utilized in various traditional medical systems to cure human diseases and maladies. The *Caesalpinia bonducella* L., sometimes referred to as Nata Karanja, is a prickly shrub that grows in the warmer regions of Sri Lanka, Myanmar, and India. Many medicinal qualities of plants have been described, including antiviral, antiasthmatic, antiamebic, antiestrogenic, and antianaphylactic effects. *Caesalpinia bonducella's* ability to reduce blood sugar has mostly been tested in rat and rabbit models, with notable results. Numerous alkaloids, glycosides, terpenoids, and saponins are said to be present. It has been described as having anti-inflammatory, anti-tumor, anti-bacterial, anti-filarial, anti-inflammatory, anti-diabetic, and antioxidant properties. Hypoglycemic, immunomodulatory, and anxiolytic effects. The goal of this review is to gather all available data regarding the phytochemical and pharmacological activities of this substance. Consequently, this information will assist generate interest in the plant and could be helpful in the development of novel formulations.

Keywords: *Caesalpinia bonducella*, β-caesalpin, antioxidant activity, Homoisoflavonoids, Bonducellin.

INTRODUCTION

The thorny shrub *Caesalpinia bonducella* (L.) Flem. Fever nut, also known as *bonduc* nut (Family: *Caesalpiniaceae*) and sometimes called Nata Karanja (Hindi). It's a key medication in traditional medicinal practices including Ayurveda, Siddha, Unani, and homoeopathy and is found in the hotter regions of India, Myanmar, and Sri Lanka.[1,2] The plant has therapeutic qualities in all parts, it is a very useful medicinal plant that is used in conventional medicine. The vegetation has been claimed to have antinociceptive, anti-inflammatory, antimalarial, anti-inflammatory, antimicrobial, antipyretic, analgesic, antibacterial, antispasmodic, antioxidant, antiproliferative, antipsoriatic, antitumor, larvacidal, muscle contractile, hepatoprotective, anticonvulsant, and antifilarial properties.

The roots are regarded as febrifuge and anthelmintic in Madagascar; they are much utilized as an astringent in cases of blennorrhea and leucorrhoea. In fever a root decoction is recommended in Guinea. The root bark has antitumor and placental removal properties. Root bark has several characteristics. such as anthelmintic and febrifuge, etc. It is applied locally to lesions and used as a rubifacient in Jamaica. In situations of hernia, the

powdered bark consumed with honey is used. The roots are eaten in cases of hernia and used in Himachal Pradesh for diabetes and intermittent fever. The roots are used to treat diabetes and intermittent fever in Himachal Pradesh.[3] The primary goal of this work is to examine the root bark of *Caesalpinia* using microscopic, physico-chemical standard, and phytochemical examination. *Bonducella (L.) Flem*, which could be utilized to correctly identify this medication.

Useful part of the plant: Root, stem, leaves, bark, seeds and nuts are used for medicinal purpose.

Geographical distribution

Plant is diffused in Bangladesh, Srilanka, Myanmar, Vietnam and China also available in the tropical and the subtropical parts of Asia. It is similarly prevalent in Nicobar Andaman Islands, and in India particularly in the tropical area.[4]

Taxonomic classification[5]

Kingdom	Plantae
Phylum	Magnoliophyta
Division	Magnoliopsida
Class	Angiospermae
Order	Fabales
Family	Fabaceae/caesalpiniaceae
Genus	Caesalpinia
Species	*Bonducella*

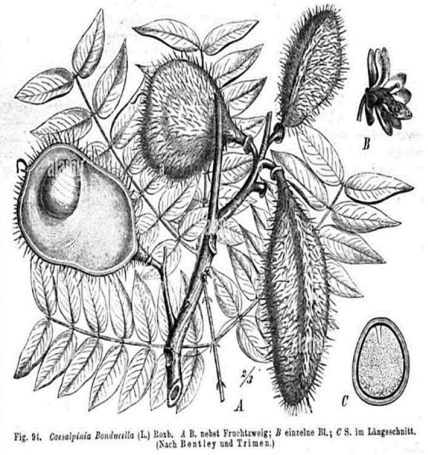


Fig. 91. *Caesalpinia Bonducella* (L.) Roxb. *A* B, nebst Fruchtzweig; *B* einzelne Bl.; *C* S. im Längsschnitt. (Nach Bentley und Trimen.)

LEAF **SEED** **ROOT**

Vernacular names

Kannada	Gajjga, Kiri gajjuga, Gajjekayi.
English	Nicker Seed, Nicker Nut, Fever Nut, Bonduc Nut.
Hindi	Kantikaranja, Sagar Gota, Kantkarej.
Sanskrit Name	Kakachika, Valli, Kantakikaranja, Karanja Tirini, Kantakini.
Marathi	Gajaga. Unani: Karanjwaa.
Urdu	Aktimakit.
Tamil Name	Kazarci, Kalarciver, Kalarcip paruppu,
Telugu	Gaccakayai, Mullathige.

Botanical description[6]

Following botanical characters have been described for this plant

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

Morphological characters

In addition to having strong, straight, yellow prickles, *C. bonducella* is a shrub with dark grey branches

Leaves

The leaves of the *C. bonducella* shrub are big, branching, and measure between 30 and 60 centimeters in length. The leaf's dorsal side has prickly petioles. The foundation of the leaf has extended and reduced pinnae. Features six to eight groups of pinnae with a mucronate tip few and stipulary-spines.[7,8]

Flower

The plant produces big blooms with axillary racemes at the top that are slender at the base. The plant's flowers often measure 15 to 25 centimeters in length. Short pedicles, measuring about 5 millimeters in blooms and about 8 millimeters in fruits, are produced by the plant in its buds. [9]

Seeds

Due to close squeezing of neighboring seeds, the hard-coated, greenish-gray seeds have a small compression on one side. Black, spherical seeds and characterized by vertical fissures. Dry seed kernels are discovered to be severed from the testa, which is approximately three layers that range in thickness from 1 to 1.25 millimeters. It displays a closed hilum and micropyle. Hilum typically has a pale portion remaining to the funicle, surrounded by a dark area. Micropyle is located close to a dim district. It has a seed coat that is somewhat green to Grayish and some what faint pastel blue in nature.

Leaflets

6–9 pairs of 2-3.8 by 1.3–2.2 cm leaflets. Membranous, elliptic-oblong, obtuse, emarginated or retuse, strongly mucronate; petioloules, very short; stipels of short hooked spines; glabrous above, somewhat puberulous below. Approximately 18–75 x 12–40 mm leaflet blades. stalks of leaflets, 1-2 mm in length.[10]

Chemical constituents of plant

Different parts of this plant have yielded several useful phytochemicals, including the seeds, which include caesalpin and β-caesalpin, as well as terpenoids. It is discovered that kernels include the phytosterols heptocosane and sitosterol. noncrystalline, neutral saponin, bonducin, bitter glycoside, It is determined that leaves contain pinitol, glucose, and calcium. Bark containing brazzillin exhibits homoisoflavonoids. 6-omethylcaesalpinianone and caesalpinianone roots contains cassane furanoditerpene, caesalpinin, bonducellpins A, B, C, D and diosgenin.[11,12]

Phytochemistry

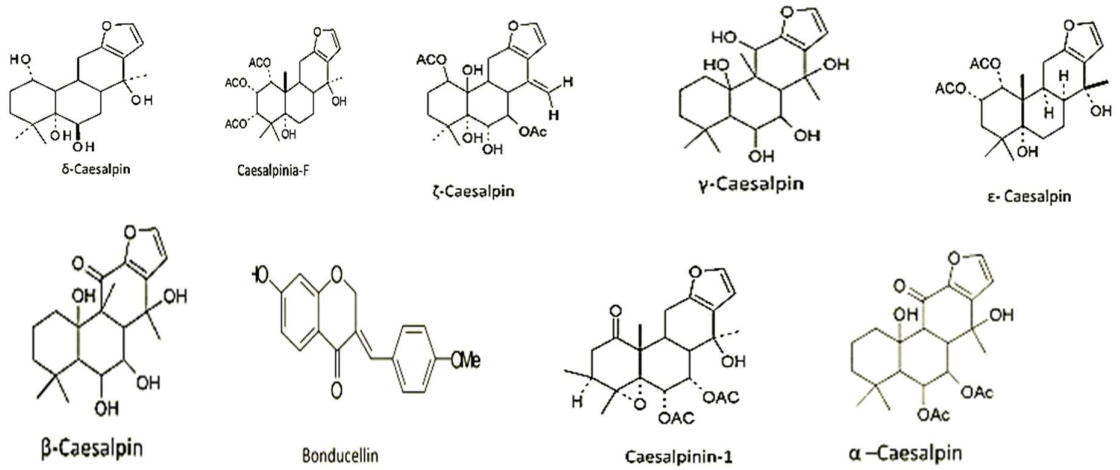
It was discovered that the leaves, twigs, fruits, and stem of the *C. bonducella* plant were abundant in a variety of alkaloids. While different sections of the plant have a lot Numerous phytochemicals, seed kernels have been investigated intricately. Numerous sources indicate that there may be some alkaloids, especially the plant's natin.However, the outcome had some ambiguity and was not definitive.The sulfur-containing molecule bonducin was the first non-alkaloidal phytochemical discovered in the plant's seeds and belongs to the glycoside family. The bonducin chemical structure has just now been figured out. The plant's seeds were discovered to be high in many enzymes, including saponin, protease, catalase, amylase, peroxidase, and urease. twigs it was discovered that the plant was enhanced with steroidal saponin.[13,14,15]

Roots

The shrub was found to have *caesalpinina* and cassane furanodi terpene. Additionally, the roots demonstrated the presence of diosgenin and Bonducellpins A, B, C, and D. The climber's bark was extracted using ethanol, and the results showed five novel homo-isoflavonoids and two new ones more natural items.[16]

Leaves

Leaves of *C. bonducella* were found to contain pinitol, glucose, and minerals like calcium and phosphorus. Phytochemicals bonducin and brazillin were also present in the leaves.[17]



S. No.	Parts	Pytoconstituents Name
1	Leave	Pinitol, glucose, calcium, brazzillin
2	Bark	Homoisoflavonoids, 6-Omethylcaesalpinianone, and caesalpinianone
3	Seed Kernel	Phytosterols- sitosterol, heptocosane noncrystalline, bitter glycoside, bonducin, neutral saponin
4	Root	Cassane furanoditerpene, caesalpinin, bonducellpins A, B, C , D, and diosgenin
5	Seed	Neutral saponin, terpenoids, caesalpin, β-caesalpin and α- caesalpin

Traditional and Modern Uses

- Indigenous people all around the world have linked *C. bonducella* to a variety of illnesses.
- The seeds have been utilized as a styptic and to address ailments suchhydrocele, malaria, colic discomfort, helminthiasis, and skin illnesses, as well as inflammation.
- In Chennai's Madras, an ointment prepared from the plant's ground seeds in Castor oil is a useful tool for reducing the symptoms of hydrocele
- and external application of orchitis. It has also been discovered that the oil extracted from the plant's seeds can regulate seizures and paralysis episodes.
- In Guinea the shrub's ground seeds are utilized as a vesicant. when combined with an equal amount of pepper, powdered seeds given to patients suffering from malaria were discovered to have weak antiperiodic characteristics.[18]
- When administered internally, a paste made of powdered seeds and water has been proven to be highly helpful in cases of snake bite, although it cannot be regarded as an antidote to snake poison.

- Plant seeds, when crushed and eaten with honey and sprinkled with long pepper, has been discovered to have expectorant properties.
- Within the roasted seeds have been utilized by the West Indies indigenous people to manage diabetes problems.
- Adult dosage of 15–30 grains of powdered seed kernel with equal amounts of black pepper eaten three times a day has been discovered to be extremely helpful in all instances of basic, ongoing, and sporadic fevers.
- The plant's twigs and leaves have been used historically to address liver problems, inflammation, and malignancies as well as dental pain
- The climber's fluids and leaves have been traditionally employed to treat ailments like Smallpox and elephantiasis[19.]

Pharmacological activity

Anti-tumor (Malaya Gupta *et al*.,2004**)**

Extract of *Caesalpinia bonducella* in methanol the anticancer efficacy of FLEMING (Caesalpiniaceae) leaves (MECB) was assessed in Swiss albino mice harboring Ehrlich ascites carcinoma (EAC). The dosages of the extract were 50, 100, and 200 mg/kg body. 14 days following the 24-hour tumor inoculation, weight per day. Following the last dosage and an 18-hour fast, the mice were offered as sacrifices. The current investigation focuses on how MECB affects the development of transplantable mouse tumors, the lifespan of hosts that carry EAC, the hematological profile, and biochemical markers including lipid peroxidation (LPO), glutathione content (GSH), and superoxide catalase (CAT) and dismutase (SOD) activities. Significantly ($P<0.01$), MECB reduced tumor size, packed cell volume, and number of viable cells; additionally, it extended the life of Mice with EAC tumors. When mice were given extracts, their hematocrit levels returned to nearly normal. Lipid peroxidation was dramatically ($P<0.05$) reduced by MECB, while GSH, SOD, and CAT levels were significantly ($P\sim0.05$) raised. TheMECB was discovered to be given daily (i.p.) to the mice without causing any obvious short-term harm. At dosages of 50, 100, 200, and 300 mg/kg for 14 days. The mice receiving treatment displayed clear toxic just 300 mg/kg produced symptoms. The findings show that MECB demonstrated strong antitumor and antioxidative capacity in mice carrying EAC.[20]

Anti-pyretic(Archana P. *et al.,* 2005**)**

The antipyretic and antinociceptive properties of ethanolic extract (70%) of *Caesalpinia bonducella* seed kernel have been tested in adult albino rats or mice of both sexes at 30, 100, and 300 mg/kg orally. Rats with pyrexia brought on by Brewer's yeast showed significant antipyretic efficacy in response to the extract. In the hot plate and tail flick procedures, the extract exhibited a notable central analgesic effect. Additionally, it demonstrated a strong peripheral analgesic effect in the Randall-Selitto assay in rats and the acetic acid-induced writhing test in mice. Additionally, it greatly reduced the mice's rear paw licking that was brought on by formalin. The results of this study validate the use of the ethanolic extract of *Caesalpinia bonducella* seed kernel in the treatment of pain and pyretic disorders by indicating that it has strong antipyretic and antinociceptive properties.[21]

Antiproliferative activity (Yadav PP *et al*.,2009**)**

A compound derived from *Caesalpinia bonduc* cassane diterpenes was tested for its ability to inhibit the growth of MCF-7 breast cancer cells and DU145 prostate cancer cells. Cervical Carcinoma (C33A), and African Green monkey kidney (KF) cells exhibit antiproliferative activity.[22]

Anti-ulcer (Ansari JA *et al*.,2012**)**

The aqueous extract of *C. bonducella* had antisecretary and ulcer-healing properties. This herb can be used to treat stomach issues. Also, the extract significantly decreased the free, overall acidity, stomach capacity, and raised the pH of the stomach juice. There is evidence of CBD in the aqueous extract. of steroids, flavonoids, alkaloids, triterpenes, saponins, and tannins. primarily due to anti-ulcer action flavonoids. The *C. bonducella* leaf methanolic extracts (Linn.) Flem. exhibit strong anti-ulcer properties.[23]

Anti-cancer (Franklyn Nonso Iheagwam *et al*.,2019**)**

Caesalpinia bonduc's binding energy and protein interaction were very similar to those of previously approved anti-cancer medications. They extra possess positive ADMET attributes, i.e. It is similarly possible to observe phytochemical isolates as secure and so become more firmly established as an effective commercial anti-cancer medications.[24] Methanol extract from the leaves of *C. bonducella* was assessed for Ehrlich ascites anticancer activity carcinoma (EAC) - Swiss albino mouse behavior. It caused a discernible drop in the volume of the packed cell, tumor size and number of viable cells, and it prolonged the lives of mice with EAC tumors. A poll indicates that CBME has a very significant anticancer and antioxidant role.[25]

Anti-fungal: (Shukla S *et al*.,2011**)**

The aqueous and ethyl acetic acid-extracted *C. bonducella* seed has a moderate level of antifungal activity against Candida, Fusarium oxysporum, Aspergillus Niger, and Alternaria solani. albicans. It indicates that *C. bonducella* may be able to exert control. major infections caused by fungi. Perhaps as a result of the presence of several bioactive substances, such as oils, glycosides, tannins, resins, phenols, saponins, and sterols Flavonoids and alkaloids in *C. bonducella* seeds.[26]

Anti-diabetic: (Parameshwar S *et al*.,2002**)**

An "antidiabetic" is a medication that helps people with diabetes stabilize and manage their blood glucose levels. In the management of diabetes, these are regularly employed. The diabetic mouth medicineeffects of several *C. bonducella* seed kernel extracts were documented *C. bonducella* seed kernels have been reported by Parameshwer et al. to use, primarily in the treatment of diabetes mellitus, traditional medicine of the Caribbean, including the Andaman and Nicobar Islands . The powdered seed kernel used in the experiments was additionally stated to have a hypoglycemic effect. In diabetic-induced rats, glibenclamide and the polar extracts (ethyl acetate and aqueous) both significantly affected hypoglycemia. Additionally, it encourages the repair of lipid changes brought on by diabetes as well as liver glycogen levels. Moreover, non-polar extracts were shown to have an anti-diabetic effect, the researchers claim. When the time arrived Comparing the ether extract to non-polar extracts, it showed a mild anti-diabetic effect. activity, while no activity was detected in the petroleum ether extract. It was reported that both polar extracts contained triterpenoidal glycosides; hence it is assumed that they are responsible for the antidiabetic action.[27]

Anxiolytic activity: (Ali A *et al*.,2008**)**

The effectiveness of *C. bonducella* seed extract as an anxiolytic in experimental animals was investigated by Ali et al., and their results were published. Each of the three test doses of extract (400, 600, and 800) was used in a stair-case model experiment. exhibited notable anxiolytic effects that were dose-dependent. by climbing a greater number of steps, although none of the three Test doses significantly affected upbringing. In a similar vein, in the medium and high doses of the Elevated Plus Maze (EPM) model revealed activity, whereas insufficient dosages did not. The quantity of entries and the amount of time spent in welcoming arms rose significantly as the medium and high dosages, although the quantity of admissions and duration of folded arms dropped dramatically. The frequency, latency, and duration of head dippings were all markedly increased by medium and high extract dosages (600 and 800 mg/kg), but not the rearing. Conversely, modest doses in Hole-board model studies did not record any kind of action. On the other hand, 800 mg/kg of extract in the LDT model a noticeably longer period of time, the quantity of crossings in the shorter time spent in the dark section and more light compartment and decreased the quantity of light and dark readings. compartments, suggesting a state of anxiety. In between and above dosages significantly enhanced center locomotion, overall movement, and grooming number in research using the Open-Field Test (OFT) methodology, even though there was a significant reduction in immobility time. Every dosage of theTest extract did not appear to have any influence on urination, feces, or rising. In the Mirrorchamber model of anxiety, similar to the above, both medium and high doses significantly decreased the time latency to enter the mirror chamber and increased the number of entries and time spent in the room. Consequently, the experimental model's findings Clearly demonstrate the anxiolytic qualities of *C. bonducella* extract.[28.]

Antioxidants: (Sachan NK *et al*.,2010**)**

Antioxidants are substances that help stop or reduce the harm that is done to cells when free radicals, which are erratic molecules that the body produces as a reaction to stresses from the environment and elsewhere. They are occasionally called dubbed "free-radical scavengers." Sources of antioxidants can be both organic and created by humans. Major antioxidant discoveries were made by Kumar et al. activity in the chloroform extract of *C. bonducella* seeds. In their endeavors, they total phenolic content and DPPH free radical scavenging activity were employed. assessment, as well as Chloroform detection using the carotene bleaching test. *C bonducella* seed extract for anti-oxidant properties. The results of their investigation showed that the chloroform extract's IC50 value was 170 ± 4.08 µg/mL. The reported total phenolic content was 21.96 percent. 2.12 (at 1000 µg/mL), and 24.96 ± 0.31 was the overall antioxidant activity. whereas the average BHA was 46.70 ± 0.43. Consequently, the existence of antioxidant capacity in a *C. bonducella* seed chloroform extract was discovered in this work.[29]

Anti-microbial (Simin K *et al*.,2001, Jabbar *et al*., 2007, Wadkar GH *et al*.,2010**)**

Simin et al. have reported the antibacterial activity of seed extracts and the pure component bondenolide that was obtained from *C. bonduc*. The ethyl acetate fraction, the methanol extract, and bondenolide and the portion of the *C. bonducella* methanol extract that is soluble in water were examined for their ability to combat germs and mold, in addition to a test for phytotoxicity in this work.[30] Jabbar et al. used in-vitro and in-vivo studies to reveal the anthelmintic property of *C. bonducella* for the first time; as a result, the study group further justified

why *C. bonducella* was used in Pakistan's conventional medical practice [31]. Leaves of *C. bonducella* were examined for antihelmintic action against Ascardia and Phertima posthuma galli. Various concentrations of the extracts were employed in the experiments, and In the test, the examined extracts exhibited potent anthelmintic activity.[32]

Anti-bacterial: **(**Saeed MA *et al*.,2001**)**

Four triterpenoids and methanol extract that were separated from *Caesalpinia bonducella* seeds exhibited a broad spectrum of inhibitory efficacy against gram-positive and gram-negative bacteria.[33]

Pharmacological review of plant *Caesalpinia bonducella*

Sl.no	Pharmacological Activity	Screening Models	Plant parts	observation	REFERENCE
1	Antipyretic and analgesic activity	Extraction, characterization and antibacterial activity	Ethanolic extract (70%)	Ethanolic extract of seed kernel possesses potent antipyretic and anlgesic activities.	Archana P. *et al.,* 2005
2	Antibacterial activity	*Caesalpinia bonducella* seed oil	N-hexane extract	Oil of *Caesalpinia bonducella* showed antibacterial activity against Pseudomonas aerugenosa	Raman N. *et al.*,2000
3	Antitumor Activity and Antioxidant Status	Ehrlich ascites carcinoma in Swiss Albino Mice	Methanol extract	Significant antitumor and antioxidant activity.	Gupta M. *et al*.,2004
4	Anticarcinogenic activity	Hepatocellular carcinoma induced by N.-nitrosodiethylamine	Methanol extract	Anticarcinogenic properties of MECB may also be explained by its strong antioxidant capacity	Gupta M. *et al*.,2005
5	Antidiabetic activity	Diabetes induced hyperlipidemia	Seed extracts	The extracts significantly lowered the elevated cholesterol as well as LDL level. The antihyperglycemic action of the extracts may be due to the blocking of glucose absorption.	Kannur D.M. *et al.,*2006

6	Anti-inflammatory, antipyretic and analgesic properties.	Carrageenan-induced rat paw oedema, brewer's yeast induced pyrexia, acetic acid-induced writhing and hot plate reaction time in experimental rats.	Seed oil	The paw volumes, pyrexia and writhes in experimental rats were reduced significantly ($p < 0.05$) as compared to that of control, and hot plate test showed significant licking effect in rats.	Shukla S. *et al.,*2009
7	Anxiolytic activity	Stair-case model	Seed extract	Showed a significant and dose dependent anxiolytic activity by increasing the number of steps climbed, without any significant effect on rearings.	Ali N. *et al*.,2008
8	Immunomodulatory activity	Neutrophil adhesion test, haemagglutinating antibody (HA) titre, delayed-type hypersensitivity (DTH) response, phagocytic activity and cyclophosphamide induced myelosuppression	Ethanolic seed extract	Significant increase in percent neutrophil adhesion to nylon fibers as well as a dose-dependent increase in antibody titre values, and potentiated the delayed type hypersensitivity reaction induced by sheep red blood cells.	Shukla S. *et al.,*2009
9	In-vitro and in-vivo antimicrobial activities	In-vitro-microbroth dilution assay In-vivo- chronic Pseudomonas aeruginosa, Pneumonia mimicking that in patients with cystic fibrosis	vitro-seed coat and seed kernel extracts In-vivo-hydroalcoholic extract	Showed potent antimicrobial activity.	Arif T. *et al*., 2009
10	Oral hypoglycemic effect	Glucose loaded, streptozotocin diabetic and	Aqueous extract of seeds shell	Oral administration produced very significant blood sugar lowering.	Biswas TK, et al, 1997

		alloxan diabetic model			
11	Adaptogenic activity of seed extracts in rats	Cold stress model and swim endurance model	Seed coat as well as kernel extracts	Seed extracts showed adaptogenic activity.	Kannur DM, et al,2006
12	Advanced studies on the hypoglycemic effect	Type 1 and 2 diabetes mellitus in Long Evans rats	Aqueous and ethanolic extracts of the seeds	Significant blood sugar lowering effect was observed in type 2 diabetic model.	Chakrabarti S, et al, 2003
13	Isolates three Cassane Diterpenes and testing for their antiproliferative activity	Breast adenocarcinoma, prostate carcinoma, Cervical carcinoma and Vero (African green monkey kidney fibroblast) cells	Ethanolic extract	Showed significant activity.	Yadav pp, et al, 2009
14	Phytochemical studies and isolation of two Homoisoflavonoids and testing for glutathione S transferase inhibitory, antifungal activity.	-	Ethanolic extract	Ethanolic extracts yielded two new Homoisoflavonoids, Caesalpinianone, and 6-O methylcaesalpinianone and posess glutathione S transferase inhibitory and antifungal activity.	Ata A, et al, 2009
15	Hypoglycemic, antihyperglycemic and hypolipidemic activities	Streptozotocin (SZ) diabetic rats	Aqueous and 50 % ethanolic extracts	Shows significant antihyperglycemic and hypolipidemic effects.	Sharma SR et al 1997

16	Contractile activity of uterine smooth muscle of pregnant rats	Contractile activity of uterine smooth muscle of pregnant rats	f Extract	Extract increased the contractile force in isolated strips in a concentration dependent manner.	Datte JY et al 1998
17	Antifilarial activity	Experimental filarial infections	Seed kernel extract and fractions	Showed Microfilaricidal, Macrofilaricidal and female-sterilizing efficacy against L. Sigmodontis and Microfilaricidal and female-sterilizing efficacy against B. malayi in animal models, indicating the potential of this plant in providing a lead for new antifilarial drug development.	Fatma N et al 2008
18	Isolation of New cassane butenolide hemiketal diterpenes and antiproliferative activity	The structures of two new Cassane butenolides, Caesalpinolide A (1) and B (2), were elucidated by the analysis of spectroscopic data and relative stereochemistry was assigned on the basis of ROESY correlations. Inhibition of MCF-7 breast cancer cell lines along with the inhibition of endometrial and cervical cancer cell lines.	Ethanolic extract and further fractionation of the EtOH extract and column chromatographic purification of the hexane fraction	Compounds 1 and 2were found to inhibit MCF-7 breast cancer cell lines.	Yadav P *et al* 2007
19	Isolation, partial characterization and insecticidal Properties of Plant	Insecticidal properties of a trypsin and chymotrypsin inhibitor	Seed extracts	Showed significant insecticidal activity	Bhattacharya A *et a*l 2007

20	Antioxidant activity and total phenolic content of ethanolic extract of seeds	DPPH radical scavenging assay, Measurement of total phenolic content of the ethanolic extract was achieved using Folin–Ciocalteau reagent containing 62.50 mg/g of phenolic content	Ethanolic extract of seeds	The ethanolic extract was also found to scavenge the superoxide generated by EDTA/NBT system. Total phenolic content of extract was found significantly higher when compared to reference standard gallic acid. The ethanolic extract also inhibited the hydroxyl radical, nitric oxide, superoxide anions.	Shukla S *et al* 2009
21	Leaf extract induces an increase of contractile force in rat skeletal muscle in situ	Measurement of isometric-tension anesthetized	Leaf extract	Stimulation of the muscle contractile activity, an effect which may be due to an activation of the cholinergic mechanism.	Datte JY *et al* 2004
22	The antioxidant and reactive Oxygen Species Scavenging Activity	Total antioxidant activity, scavenging activities for various ROS, ion chelating activity and phenolic and flavonoid contents	70% methanolic extract	Showed significant antioxidant and ROS scavenging activity; which may be due to the presence of phenolic and flavonoid compounds	Mandal S *et al* 2009
23	Inhibition of protein synthesis of filarial parasites	Glucose uptake, glycogen synthesis and succinate dehydrogenase activity.	Fractions	All fractions were found to inhibit protein synthesis which was very well correlated with in-vivo activity and was possibly the mechanism of Macrofilaricidal activity.	Somnath S *et al* 2001

24	Isolated the irritant Isolated the irritant potential of four triterpenoids.	Identified as alpha amyrin, beta-amyrin, lupeol and lupeol acetate	seeds	Reported that the alpha amyrin, beta-amyrin, lupeol acetate were the most potent and persistent irritant compound whereas the lupeol was the least potent and least persistent compound.	Saeed MA *et al* 2003
25	Isolation and identification two new cassane diterpenes	Two new cassane diterpenes, named caesaldekarins	Ethanol extract of roots	The structures of caesaldekarins F and G were established by the use of 2-D NMR Spectroscopy.	Peter SR *et al* 1998
26	Chemical investigation of the plant Caesalpinia bonducella	Four cassane furanoditerpenes were isolated and identified.	Roots	The four compounds were designated as bonducellpins A, B, C and D	Peter SR *et al* 1998
27	Chemical investigation of the plant Caesalpinia bonducella	Isolation of D (+) – pinitol.	Methanol extract of its defatted fruit shells	The structure and stereochemistry of D(+) pinitol was studied by the use of 2D-NMR spectroscopy.	Mondal DN *et al* 1993
28	Isolattion three Cassane Diterpenes.	Hemiketals, Caesalpinolide-C, Caesalpinolide-D, Caesalpinolide -E and one Cassane Furanoditerpene were isolated.	-	The molecular structures were elucidated using NMR spectroscopy. The isolated compounds were tested for their antiproliferative activity against breast adenocarcinoma,	Yadav PP *et al* 2009

				prostate carcinoma, Cervical carcinoma and Vero (African green monkey kidney fibroblast) cells.	
29	Phytochemical studies on the ethanolic extracts.	Yielded two new Homoisoflavonoids, Caesalpinianone, and 6-O methylcaesalpinia non e along with five known natural products, namely, Hematoxylol, Stereochenol A, 60 O-Acetylloganic acid, 40-O-Acetylloganic acid, and 2-O-b-D glucosyloxy-4 Methoxy benzene propanoic acid.	Ethanolic extracts	Structures of these compounds were elucidated with the aid of extensive NMR spectral studies. All of these compounds exhibited different levels of Glutathione S-Transferase (GST) inhibitory and antifungal activities.	Ata A *et al* 2009
30	Isolation of A new cassane diterpene.	Isolation of Neocaesalpin , along with a known Triterpene, β-amyrin.	Seeds	The structure and relative stereochemistry was determined by spectral methods.	Zhaohua Wu *et al* 2007
31	Isolation New cassane butenolide hemiketal diterpenes from the marine creeper Caesalpinia bonduc and their antiproliferative activity	Two new Cassane butenolides, Caesalpinolide A (1) and B (2), Epimeric at the Hemiketal position were isolated.	Marine creeper	New cassane butenolide hemiketal diterpenes were isolated from the marine creeper & possess antiproliferative activity.	Yadav PP *et al* 2007

32	Chemical Studies on the Philippine Crude Drug Calumbibit (Seeds of Caesalpinia bonduc	The Isolation of New Cassane Diterpenes Fused with a, b-Butenolide	Seeds	New Cassane Diterpenes were isolated.	Kinoshita T *et al* 2000
33	Isolation of minor seven caessane diterpenoids.	Studied minor seven caessane diterpenoids of Caesalpinia bonduc including caesaldekarin A.	Roots	The 1H and 13 C NMR spectra of all seven compounds were completely assigned by using a combination of 2-D NMR spectroscopy.	Deon LL *et al* 1998
34	Identification of fatty acid triglycerides as the macrofilaricidal principles.	Fatty acids comprising these triglycerides have been identified as palmitic, stearic, octadeca-4-enoic and octadeca-2,4-dienoic acids	Seeds kernel	Fatty acid triglycerides as the macrofilaricidal principles were identified.	Rastogi S, *et al* 1996
35	New cassane diterpenes named neocaesalpins C and D were isolated from the Philippine crude drug calumbibit botanically originating from the seeds of Caesalpinia bonduc.	These compounds are characterized by the presence of the a, b-butenolide moiety.	Seeds	Their structures were elucidated on the basis of the spectroscopic evidence.	Kinoshita *T et al* . 2000

CONCLUSION

Caesalpinia bonduc, commonly known as the Grey Nicker or Bonducella Nut, has garnered significant scientific interest due to its impressive array of biological properties. Research into this plant has revealed that it contains numerous bioactive compounds with potential therapeutic applications. These compounds demonstrate a broad spectrum of pharmacological activities, including anti-inflammatory, antimalarial, antimicrobial, and analgesic effects. Such findings underscore the plant's considerable promise in the realm of medicinal chemistry and pharmacology.

To fully harness the therapeutic potential of Caesalpinia bonduc, further research is imperative. Detailed phytochemical analysis is needed to isolate and characterize the specific compounds responsible for its observed biological activities. Advanced analytical techniques, such as chromatography and mass spectrometry, will be crucial in this process. Additionally, systematic pharmacological studies and clinical trials are required to assess the safety, efficacy, and optimal dosages of these compounds.

In conclusion, *Caesalpinia bonducella* represents a valuable resource for drug discovery and development. Its diverse biological activities suggest it could contribute to the development of novel therapeutic agents. By investing in comprehensive research and development efforts, we can unlock the full potential of this plant, paving the way for innovative treatments that could significantly benefit human health and well-being. Collaborative efforts between botanists, pharmacologists, and clinical researchers will be essential in translating the promising results of preliminary studies into practical applications that address pressing health challenges.

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