Caesalpinia bonducella F - An Overview

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ABSTRACT: Many herbal remedies have been employed in various medical systems for the treatment and management of different diseases. The plant Caesalpinia bonducella (syn: Caesalpinia Crista Linn.) has been used in different system of traditional medication for the treatment of diseases and ailments of human beings. It is reported to contain various Alkaloids, Glycosides, Terpenoids and Saponins. It has been reported as anti-asthmatic, anti-diabetic, anti-inflammatory, anti-oxidant, anti-bacterial, anti-filarial, anti-tumor, anxiolytic, immunomodulatory, hypoglycemic, activity. This review attempts to encompass the available literature on Caesalpinia bonducella with respect to its pharmacognostic characters, chemical constituents, summary of its various pharmacological activities and traditional uses. [Report and Opinion. 2010;2(3):83-90]. (ISSN: 1553-9873).

Keywords: Caesalpinia bonducella. Pharmacology, Traditional Uses, Review

INTRODUCTION

Plants have played a significant role in maintaining human health and improving the quality of human life for thousands of years and have served humans well as valuable components of medicines, seasonings, beverages, cosmetics and dyes. Herbal medicine is based on the premise that plants contain natural substances that can promote health and alleviate illness. In recent times, focus on plant research has increased all over the world and a large body of evidence has collected to show immense potential of medicinal plants used in various traditional systems. Today, we are witnessing a great deal of public interest in the use of herbal remedies. Further more many western drugs had their origin in plant extract. There are many herbs, which are predominantly used to treat cardiovascular problems, liver disorders, central nervous system, digestive and metabolic disorders. Given their potential to produce significant therapeutic effect, they can be useful as drug or supplement in the treatment / management of various diseases. Herbal drugs or medicinal plants, their extracts and their isolated compound(s) have demonstrated spectrum of biological activities. Such have been used and continued to be used as medicine in folklore or food supplement for various disorders. Ethnopharmacological studies on such herbs/medicinally important plants continue to interest investigators throughout the world. Caesalpinia bonducella is an Indian herb reported in Ayurveda, the ancient Hindi medicine system of India. Caesalpinia bonducella belonging to Family: Caesalpiniaceae. Found throughout India and tropical countries of the World 1, 11. The plant was much confused with Caesalpinia bonducella (Syn. C. bonduc) and was described under the same 2,3,4,5,6,7,8. Beside this species like C. nuga 1, 3, 4,9,10 and C. jayoba are also sometimes wrongly designated as synonyms for C. crista. In fact, C. jayoba is an adulterant of C. crista 7.

“Bonducella” the name of the species is derived from the Arabic word “Bonduce” meaning a “little ball” which indicated the globular shape of the seed 11.

Synonyms 1, 4, 13:

Kakachika, Karanja and Latakaranja in Sanskrit; Kathkaranj in Hindi; Fever nut in English; Nata in Bengali; Avil in Tamil; Akitmakit in Urdu; Gajaga in Marathi; Bois canic in French.

Geographical Distribution:

An armed liana, up to 15 m in height, found up to an altitude of 1,000 m in Himalaya and wild throughout the plains of India and; it is also found in deltaic region of western, eastern and southern India 1. Found particularly along the seacoast throughout the hotter parts of India, Burma and Sri Lanka, 14

Plant Parts Used 14, 15: Nuts, root, bark and leaves

Ayurvedic Description 14, 15:

Properties: Rasa-katu, tikta; Guna-laghu, rooksha, teekshna; Veerya-ushna; Vipak-katu.

Action and Uses: Kapha, vat samak, sotha har, badana sthapan, dipan, anuloman, krimighan, rakt sodhak, swashar, mutral, jwaraghan.

PHARMACOGNOSTIC STUDIES

The Macro and microscopical features of the seed, leaf and flowers have been studied.

Macroscopic Characteristics 4, 11, 14, 15:

An extensive climber; branches finely grey-downy, armed with hooked and straight hard yellow prickles.

Leaves: Leaves are with large, leafy, branched, basal appendages; 30-60 cm. long; petioles prickly; stipules a pair of reduced pinnae at the base of the leaf each furnished with a long mucronate point; pinnae 6-8 pairs, 5-7.5 cm. long, with a pair of hook stipulary spines at the base. main leaf axis armed with stout, sharp, recurved spines, divided into 4-8 pairs of secondary branches.

Leaflet: Leaflets 6-9 pairs, 2-3.8 by 1.3-2.2 cm., membranous, elliptic-oblong, obtuse, strongly mucronate, glabrous above, more or less puberulous beneath; petioloules very short; stipels of short hooked spines.

Flowers: Flowers in dense (usually) long-peduncled terminal and supraaxillary racemes dense at the top, lax downward, 15-25 cm. long; pedicels very short in bud, elongating to 5 mm. in flower and 8 mm. in fruits, brown-downy; bracts squarrose, linear, acute, reaching 1 cm. long, fulvous hair. Calyx 6-8 mm. long, fulvous hairy; lobes obovate-oblong, obtuse. Petals oblanceolate, yellow.

Seeds 11, 12, 16, 17, 18: Seed coat is hard, glossy, and greenish to ash grey in colour. And is traversed by circular and vertical faint markings of the cracks, forming uniform rectangular to squarish rectulations all over the surface Seeds 1-2, oblong, lead-colored, 1.3 cm. long.. A raised hilum with remains of the stalk lies in the centre of the dark spot, at the narrow edge of the seed. Adjacent to the hilum, lies a faint coloured circular to oval elevated micropyle. In dry seed, kernel gets detached from the testa. Testa is about 1-1.25 mm in thickness and is composed of three distinct layers, the outermost - thin and brittle, the middle one - broad, fibrous and dark – brown and the innermost – white and papery.

The seed is exalbuminous. The kernel surface is furrowed and ridged, hard, pale yellowish – white, circular to oval, flattened and about 1.23- 1.75 cm. in diameter.. A scar of the micropyle lies at one end of the kernel, from where arises a prominent ridge demarking the two cotyledons of the embryo. Plumule – radical axis is thick, cylindrical and straight. Taste is very bitter and odour is nauseating and unpleasant.

Microscopic Characteristics 11, 14, 17:

Seeds: Seeds show a palisade layers which is composed of vertical, columnar, and laterally closed appressed cells. Thickenings are present on the walls of palisade cells which in tangential section appear as 6-10 denticulate projections into the lumen of cells. Then after that there is the layer of bearer cells and a thick zone of parenchymatous cells. The majority of bearer cells are T-shaped, thick walled and nonlignified.

Some of the major diagnostic microscopic characters of the powder are columnar palisade cells, bone shaped thick walled parenchymatous cells with brown content and cells filled with starch grains are

Identification Test 14

Powder does not show any fluorescence when exposed to ultraviolet light. However, the extract in 1% NaOH

solution ethyl alcohol and solvent ether emitted a green fluorescence under ultraviolet light.

PHYTOCHEMISTRY 11, 14, 15, 20

The unnamed alkaloid has been isolated from the leaves, stem, twig, and fruits of the plant19

Seed Kernel:

Each and every part of the plant is claimed to possess some therapeutic properties, but seed kernel alone has been systematically studied so far.

Alkaloids: There is controversial reports exist regarding the presence of alkaloids in C. crista. Earlier workers detected an alkaloid "Natin" in the plant but could not confirm the presence 21, 22. The presence of alkaloid in the seed 23 and twigs 24 and its absence in stem and leaf was indicated in later reports.

Glycosides: First non- alkaloidal bitter principle isolated 25 from the seed of C. crista was Bonducin (Bonducellin) 26 (fig 01). It was detected as a glycoside 27 and was said to be sulphur containing compound. But later on 28, the compound (C20,H28,O8- m. p.119.200C) was found to be devoid of sulphur. The structural formula of Bonducin (a homoisoflavone) has been well established recently 29. Saponin 21, 28 was reported in seed, but later on was found to be devoid of this 30. Number of enzymes like protease, urease, amylase, peroxidase, catalase and oxidase has been reported in the seed 31. Steroidal saponins 24 was found in the twigs of the plants contain

Terpenoids (1, 5, 6, 7, 14-Voucapanepentol derivative) (fig 02): Caesalpin (C24H32O8) (1-ketone 6, 7-diacetylcassane) M. W. -448.512, β-caesalpin (C20H28O6) (1-ketone 5, 6, 7, 14-tetrahydroxy voucapanone) M. W. -364.438 and α-caesalpin (C34H56O7) (o-tetradecanoyl voucapane diterpenoid) M. W.-576.812 (fig 03) were the first three bitter cassane/voucapane diterpenoids isolated from the seeds of C. crista 32-34. Determination of the functional group 35, other chemical aspects 36, structure elucidation 37,38,39,40, etc. were exhaustively studied by number of workers. δ–caesalpin (C20H30O6) (1α, 5α, 6α, 7α, 7β, 14β-cassane) M.W. -366.453 is hydrolysed product of γ-caesalpin and a reduced product of α-caesalpin 39 and β-caesapin. α-caesalpin on hydrolysis yields acetic acid, myristic acid and a crystalline bitter compound (C20H30O6). The structural relationship of α, β and γ caesalpins with vinaticole, vouncapenic and cassaic acids have been established 41. Three more Caesalpins – E caesalpin, F caesalpin (fig 04) and Y caesalpin have also been isolated from kernels of C. crista. Y caesalpin, a minor constituent, is closely related to δ–caesalpin 42 and F caesalpin is closely related to E caesalpin 43.

Reserved Food Materials of the Kernals

The kernals contains fatty oil (20-24%); starch, sucrose, two phytosterols, one of them identified as sitosterol, and a hydrocarbon (mp 58-590C) identified as heptocosane 28, 44. Ghatak's investigated the presence of noncrystalline bitter glycoside bonducin, a neutral saponin, starch, sucrose, an enzyme, and yellow oil from seeds kernels. A white amorphous bitter substance (0.035%) has been reported 21. The oil, which is thick and pale yellow with a disagreeable smell, has the following characteristics: saponification value 197.9; sp gr 0.926; acetyl value 35.6; iodine value 111.0; acid value 8.5; and unsaponified matter 1.1%. The constituents of fatty acid are stearic, palmitic, oleic, linoceric, linolenic, and a mixture of unsaturated acid of low molecular weights 15, 18, 45.

Seed kernels of C. crista content protein which varies from 7.4 30 to 18.4 44 to 25.3 46 percentage. Amino acids composition was also studied by number of workers 44, 46, 47, -are as follows: aspartic acid-9.5%, lysine-7.9%, glycine-6.9%, leucine-6.3%, histidine-5.1%, isoleucine-5.1%, serine-3.8%, r-amino-butyric acid-3.7%, tyrosine-3.7%, citrulline-3.6%, glutamic acid-3.6%, threonine-3.6%, arginine-3.4%, proline-3.3%, L-alanine-2.5%, methionine-2.1%, phenyl alanine-1.4%, cystine-1.2%, valine-1.2% and tryptophan-0.8%.

The amino acid substrate specificity of glutamyl-t-RNA synthetase prepared from the seed was also studied 48. Number of workers studied seed protein of Caesalpinaceae by chemotaxonomic view point 11, 49, 50, 51, 52. The non-protein amino acids detected in the seed were r-ethylidene glutamic acid, r-methylene glutamic acid, r-ethyl glutamic acid and traces of r-OH-r-methyl gltamic acid and B-OH r-methyl glutamic acid, accumulation of r-methyl glutamic acid being extremely large 53. Some of the common carbohydrates reported in the seed are pentoan (16.8%) 30, starch (6.1%) 54 and water soluble mucilage (4.4%) 30. 4-o-methyl myoinositol hydrate was isolated from C. crista grown in China.

Roots

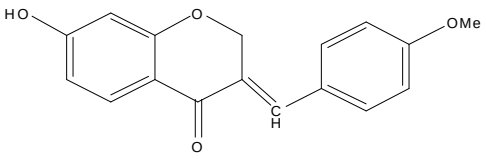
A new rearranged cassane furanoditerpene, caesalpinin (fig 05), was isolated from the roots of Caesalpinia boducella 55. Two new cassane diterpenes, named caesaldekarins F and G, were isolated and identified from the roots of Caesalpinia boducella. The recently reported caesaldekarin C was also isolated from the roots of this plant 56 (fig 06). Bonducellpins A, B, C and D was also reported 15, 57. Diosgenin (steroidal saponin) also occurs in root 15, 58.

Bark

Ethanolic extracts of bark of Caesalpinia bonduc (Fabaceae) yielded two new homoisoflavonoids, 6-O-methylcaesalpinianone and caesalpinianone along with five known natural products namely- hematoxylol, 6′-O-acetylloganic acid, 4′-O-acetylloganic acid stereochenol A, and 2-O-β-d-glucosyloxy-4-methoxybenzenepropanoic acid 59.

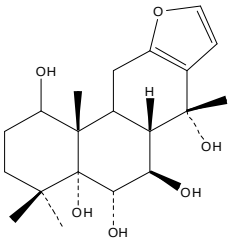
Leaves

The leaves contain pinitol (4.1%), glucose and minerals like calcium (2%) and phosphorous (0.3%). Brazillin and bonducin have been isolated from leaf 15, 60. A waxy material and an amorphous bitter principle (C20H32O8, m. p. 119.12, yield 0.35%) have also been isolated from the leaves 15,61. The waxy material on saponification yields mysteric acid and an alcohol.



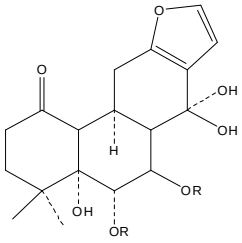
Bonducellin

Fig No. 01



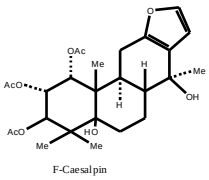
1,5,6,7,14- VOUACAPANEPENTOL

Fig No. 02

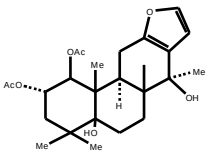


R= Ac Alpha caesalpin
R= H Beta caesalpin

Fig No. 03

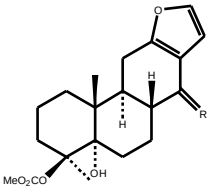


F-Caesalpin



E-Caesalpin

Fig No. 04



R= H2
R= CH2

Fig No. 05

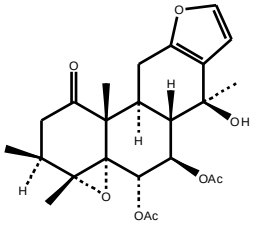


Fig No. 06

R=H2 Caesaldekarin C

R=CH2 Caesaldekarin F

Caesalpinin

PHARMACOLOGICAL STUDIES

Although a lot of pharmacological investigations have been carried out based on the ingredients presents but a lot more can still be explored, exploited and utilized. A summary of the findings of these studies is presented below.

Ant diarrheal Activity in Mice 62

Significant anti diarrheal activity in mice was shown by the nuts of C. bonducella Antiviral Activity against Vaccinia Virus 63

The alcoholic extracts of roots and stem showed antiviral activity against vaccinia virus.

Ant fertility Activity of Seeds in Rats and Mice 64

Ant fertility action of seeds was noted in rats and mice.

Antibacterial activity of Caesalpinia bonducella seeds 65

Four triterpenoids which was isolated and methanol extract from the seeds of Caesalpinia

bonducella showed a wide range of inhibiting activity against both gram-positive and

gram-negative bacteria.

Oral Anti diabetic Activities of Different Extracts of Caesalpinia bonducella Seed Kernels 66

The seed kernel powder was reported to have hypoglycaemic activity in experimental animals. Four extracts (petroleum ether, ether, ethyl acetate and aqueous) were prepared from the seed kernels and tested for their hypoglycaemic potentials in normal as well as alloxan induced diabetic rats. In normal rats, only ethyl acetate and aqueous extracts showed a minimum significant hypoglycaemic effect, compared to that of glibenclamide. In diabetic rats, the non-polar extracts i.e. the ether extract showed a marginal anti diabetic activity, while the petroleum ether extract failed to showed significant hypoglycaemic effect, besides, reversing the diabetes induced changes in lipid and liver glycogen levels .But both the polar extracts (ethyl acetate and aqueous) as well as glibenclamide, showed. Since both the polar extracts were, chemically, found to contain triterpenoidal glycosides, we presume that they might be the active principles contributing to the ant diabetic actions.

Hypoglycaemic effect of Caesalpinia bonducella F. in type 1and 2 diabetes in Long Evans rats 67

Caesalpinia bonducella, is used by the tribal people of India for controlling blood sugar was earlier reported by us to possess hypoglycaemic activity in animal model and it is distributed throughout the coastal region of India and used ethnically This prompted us to undertake a detail study with the aqueous and ethanolic extracts of the seeds of this plant in both type 1 and 2 diabetes mellitus in Long Evans rats. Significant blood sugar lowering effect ($P<0.05$) of C. bonducella was observed in type 2 diabetic model. Special emphasis was given on the mechanistic study by gut absorption of glucose and liver glycogen.

Antitumor Activity and Antioxidant Status of Caesalpinia bonducella against Ehrlich Ascites Carcinoma in Swiss Albino Mice 68

The methanol extract of Caesalpinia bonducella FLEMING (Caesalpiniaceae) leaves (MECB) were evaluated for antitumor activity against Ehrlich ascites carcinoma (EAC)-bearing Swiss albino mice. The extract was administered at the doses of 50, 100, and 200 mg/kg body weight per day for 14 days after 24h of tumor inoculation. After the last dose and 18h fasting, the mice were sacrificed. The present study deals with the effect of MECB on the growth of transplantable murine tumor, life span of EAC-bearing hosts, haematological profile, and biochemical parameters such as lipid peroxidation (LPO), glutathione content (GSH), superoxide dismutase (SOD), and catalase (CAT) activities. MECB caused significant ($P<0.01$) decrease in tumor volume, packed cell volume, and viable cell count; and it prolonged the life span of EAC-tumor bearing mice. Haematological profile converted to more or less normal levels in extract-treated mice. MECB significantly ($P<0.05$) decreased the levels of lipid peroxidation and significantly ($P<0.05$) increased the levels of GSH, SOD, and CAT. The MECB was found to be devoid of conspicuous short-term toxicity in the mice when administered daily (i.p.) for 14 days at the doses of 50, 100, 200, and 300 mg/kg. The treated mice showed conspicuous toxic symptoms only at 300mg/kg. The results indicate that MECB exhibited significant antitumor and antioxidant activity in EAC-bearing mice.

Antipyretic and Analgesic Activities of Caesalpinia bonducella Seed Kernel Extract 69

Ethanolic extract (70%) of Caesalpinia bonducella seed kernel has been subjected for its antipyretic and antinociceptive activities in adult albino rats or mice of either sex at 30, 100 and 300mg/kg orally. The extract demonstrated marked antipyretic activity against Brewer's yeast-induced pyrexia in rats. The extract had signicant central analgesic activity in hot plate and tail ick methods. It also exhibited marked peripheral analgesic effect in both acetic acid-induced writhing test in mice and Randall-Selitto assay in rats. It also signicantly inhibited the formalin-induced hind paw licking in mice.

Antidiabetic activity of Caesalpinia bonducella F. in chronic type 2 diabetic model in Long-Evans rats and evaluation of insulin secretagogue property of its fractions on isolated islets 70

Caesalpinia bonducella F. is ethnically used by the tribal people of Andaman and Nicober Island as a remedy of symptoms of diabetes mellitus. Both the aqueous and ethanolic extracts showed potent hypoglycemic activity in chronic type 2 diabetic model. Two fractions BM 169 and BM 170 B could

increase secretion of insulin from isolated islets. This report prompted the detail investigation of hypoglycemic activity of Caesalpinia bonducella seeds, initially on physiological hyperglycemic model and then on type 1 and type 2 sub-acute diabetic animal models which has already been reported. Evaluation of different extracts from Caesalpinia bonducella in chronic type 2 diabetic model along with insulin secretagogue activity of five fractions isolated from the Caesalpinia bonducella seed kernel are presented.

Antidiabetic activity of Caesalpinia bonducella seed extracts in rats 71

The extracts (300mg/kg) when oral administration produced significant anti hyperglycemic action as well as it lowered the BUN levels significantly. In the same study the action of the extracts on diabetes induced hyperlipidemia was analyzed where the extract significantly lowered the elevated cholesterol as well as LDL level. The drug has the potential to act as ant diabetic as well as antihyperlipidemic. The anti hyperglycemic action of the extracts may be due to the blocking of glucose absorption. Caesalpinia bonducella seed extracts were subjected for screening of antidiabetic activity in alloxan induced hyperglycemia

Anti filarial activity of Caesalpinia bonducella against experimental filarial infections 72

Crude extract showed gradual fall in microfilaria (mf) count in L. sigmodontis-cotton rat model from day 8 post-treatment attaining more than 95 per cent fall by the end of observation period. It also exhibited 96 per cent macrofilaricidal and 100 per cent female sterilizing efficacy. The butanol fraction F018 caused 73.7 per cent reduction in mf count and 82.5 per cent mortality in adult worms with 100 percent female sterilization. The aqueous fraction F019 exerted more than 90 per cent microfilaricidal activity and 100 per cent worm sterilization. Two chromatographic fractions, F024 and F025 of hexane soluble fraction exhibited 64 and 95 per cent macrofilaricidal activity, respectively. Both the fractions caused gradual fall in microfilaraemia and 100 per cent worm sterilization. In B. malayi-M. coucha model F025 showed gradual reduction in microfilaraemia and caused 80 per cent sterilization of female parasites. Seed kernel extract and fractions of C. bonducella showed microfilaricidal, macrofilaricidal and female-sterilizing efficacy against L. sigmodontis and microfilaricidal and female-sterilizing efficacy against B. malayi in animal models.

Anxiolytic Activity of Seed Extract of Caesalpinia Bonducella (Roxb) In Laboratory 73

The present study was aimed to explore the anxiolytic activities of seed extract of C. bonducella in experimental animals, mice and rats. In Stair-case model, all the three doses i-e low, medium and high 400, 600 and 800mg/kg of Petroleum ether extract of Caesalpinia bonducella (PECB) had showed a significant and dose dependent Anxiolytic activity by increasing the number of steps climbed, without any significant effect on rearings by all these three doses. Similarly in EPM model medium and high doses, but not the low dose of PECB had significantly enhanced both number of entries and time spent in open arms and decreased in number of entries and time spent in closed arms. In Hole- board model, medium and high doses 600 and 800mg/kg but not the low dose 400mg/kg of PECB had significantly enhanced the number, latency and the duration of head dipping but not the rearings. However in LDT model high doses 800mg/kg of PECB had significantly exhibited anxiolytic activity by increasing time spent, number of crossings in light compartment and decreased the time spent in dark compartment and decreased the number of rearings in both light and dark compartments. In OFT models, medium and high doses 600 and 800mg/kg but not the low dose 400mg/kg of PECB had significantly enhanced total locomotion, central locomotion, number of grooming but the immobility time has drastically reduced. All doses of PECB have not exerted any significant effect with rearing, defecation and urination. Moreover in Mirror-chamber model of anxiety, both medium and high doses 600 and 800mg/kg but not the low dose 400mg/kg of PECB had significantly reduced the time latency to enter in to the mirror chamber and increased the number of entries and time spent in the chamber. Thus the result recorded with above experimental models confirms the anxiolytic activity of PECB.

Anti-inflammatory, antipyretic and analgesic properties of Caesalpinia bonducella F. seed oil in experimental animal models 74

Various concentrations of the seed oil of C. bonducella (100, 200 and 400 mg/kg orally) were tested in carrageenan-induced rat paw oedema, brewer's yeast-induced pyrexia, acetic acid-induced writhing and hot plate reaction time in experimental rats to assess the anti-inflammatory, antipyretic and analgesic activities,. The paw volumes, pyrexia and writhes in experimental rats were reduced signicantly ($p<0.05$) as compared to that of control, and hot plate test showed signicant licking effect in rats. In the present study, we

investigated the effects of C. bonducella seed oil on acute and chronic inflammation. These results clearly indicate that the oil of C. bonducella seeds could be a potential source and used as anti-inflammatory, antipyretic and analgesic agent.

Antioxidant activity and total phenolic content of ethanolic extract of Caesalpinia bonducella seeds 75

Ethanolic extract of Caesalpinia bonducella seeds as a natural antioxidant was used to assess the in vitro potential. The DPPH activity of the extract (20, 40, 50,100and200 µg/ml) was increased in a dose dependent manner, which was found in the range of 38.9374.77 % as compared to ascorbic acid (64.2682.58%).The IC50 values obtained for ethanolic extract and ascorbic acid in DPPH radical scavenging assay were 74.73 and 26.68 µg/ml, respectively.The ethanolic extract was also found to scavenge the superoxide generated by EDTA/NBT system. Measurement of total phenolic content was achieved using Folin- Ciocalteau reagent containing 62.50 mg/g of phenolic content, which was found signicantly higher when compared to reference standard gallic acid for ethanolic extract of C. bonducella. The ethanolic extract also inhibited the hydroxyl radical, nitric oxide, superoxide anions with IC50 values of 109.85, 102.65 and 89.84l g/ml, respectively. However, the IC values for the standard ascorbic acid were noted to be 70.79, 65.98 and 36.68 µg/ml respectively. The results obtained in this study clearly indicate that C. bonducella has a signicant potential to use as a natural antioxidant agent.

Immunomodulatory activities of the ethanolic extract of Caesalpinia bonducella seeds 76

Oral administration of ethanolic seed extract of Caesalpinia bonducella (200500mg/kg) evoked a signicant 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 which evaluated the Immunomodulatory activity. Also it prevented myelosuppression in cyclophosphamide drug treated rats and good response towards phagocytosis in carbon clearance assay. The results obtained indicate that Caesalpinia bonducella possesses potential Immunomodulatory activity and has therapeutic potential for the prevention of autoimmune diseases.

TRADITIONAL AND MODERN USES

Seeds 1, 11, 12, 14, 15: The seed is claimed to be styptic, purgative and anthelmintic 77 and cures inflammations; useful in colic, malaria, hydrocele, skin diseases and leprosy (Yunani). In Madras, an ointment is made from from the powdered seeds with castor oil and applied externally in hydrocele and orchitis. The seeds are considered tonic, ferifuge, 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 to malaria patients and were found to posses feeble antiperiodic properties. In malignant malaria, they did not do any good. The seeds are ground in water and given internally in snake-bite (Brihannighantaratnakara). The seeds are not an antidote to snake-venom (Mhaskar and Caius) 4, 12. Seed and long pepper powders taken with honey gives good expectorant effect. Burnt seeds with alum and burnt arecanut are a good dentifrice useful in spongy gums, gum boils, etc. In West Indies, the roasted seeds are used as ant diabetic 1.

The kernel of the seed is very useful and valuable in all ordinary cases of 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. It was made official in the Indian Pharmaceutical Codex 16 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 gives good result results in liver disorder 78 Decoction of roasted kernels was used in asthama. Children unable to digest mother’s milk were 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 such 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.

Root 1, 11, 12, 15: In La Reunion and Madagascar, the roots are considered 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 4. Bark of root possesses number of properties like febrifuge and anthelmintic etc. In Jamaica, it is used as rubifacient and as a local application for sores. The bark powder with honey is

taken in cases of hernia 79. In Himachal Pradesh, the roots are used in intermittent fever and diabetes.

Leaves 1, 11 12, 15: The juice of leaves is anthelmintic; good in elephantiasis and small pox; destroys the bad odour due to perspiration. In disorders of liver, the tender leaves are considered very efficacious. In Cochin China they are reckoned as a deobstruent and emmenagogue; and an oil expressed from them is given in convulsions, palsy and similar complaints. In Malsya, the young leaves are used in intermittent fevers, and for expelling intestinal worms. In Ceylon, they are applied for toothache, and they are also given for worms in children. In Guinea, the boiled leaves are used as a gargle for sore throat 4, 12. Leaves ground with onion, if applied on plague boils gives good relief. Finely powdered leaves are prescribed as a uterine tonic after child birth. The leaf extract with asafetida is prescribed in cases of indigestion.

Flowers1, 11, 12, 15: The flower is bitter cures Kapha and Vata . The ash is used in ascites.

Fruits 1, 11, 12, 15: Aphrodisiac, anthelmintic; cures urinary discharges, piles and wounds. The oil from fruit is good for indolent ulcers (Ayurveda) 4, 12. Roasted fruits are used in eye diseases, hyperacidity and as fish poison. In Hawaii islands, the pulp of the pod is used for purifying the blood, in congestion and as a laxative. In Philippines, fresh fruit powder with garlic and mixed with lukewarm water is rubbed on the body to mitigate fever 80.

Stems 11: The stem is used in eye diseases and as a fish poison. In Sri Lanka, the plant is used for the treatment of skeletal fractures.

Ethanoveterinary Usage 15: The seeds, leaves and roots are used for the treatment of tachycardia, bradycardia, tuberculosis, and tympanitis, pain in the abdomen, fever, cold and cough and liver fluke in ruminants 81.

SAFETY PROFILE 15:

The maximum tolerated dose of the 50% ethanolic extract was found to be more than 1000 mg/kg body weight when tested in adult male albino mice 82.

DOSE 14, 15:

Seed powder: 1-2 gr; root powder: 1-2 gr; leaf infusion: 12-20 ml.

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