

A Review on Essentials Perspectives for *Semecarpus anacardium*

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ABSTRACT

Semecarpus anacardium Linn. Belonging to family Anacardiaceae, commonly known Bhilwa, has been used in various traditional system of medicines since ancient times. It's contained a variety of biologically active compounds and shows various medicinal properties. The fruit and nut extract shows various activities like antioxidant, antimicrobial, antiatherogenic, anti-inflammatory, anti-reproductive, hypoglycemic, CNS stimulant, anticarcinogenic and hair growth promoter. The article reviews the various activities of the plant.

Keywords: bhilawanols, pharmacological activities, *Semecarpus anacardium*.

INTRODUCTION

Plant-derived medicines have been part of traditional health care in most parts of the world for thousands for year¹. More than 80% of the population in developing countries depends on plants for their medical needs. In India, medical plants are widely used by all sections of people either directly as folk remedies or in different indigenous medicinal plants and their therapeutic values⁵. One of the plants known for having many medicinal uses in traditional system of medicine *Semecarpus anacardium* Linn. (Family: *Anacardiaceae*) is distributed in sub-Himalayan region, tropical and central parts of India. The nut is commonly known as 'marking nut' and in the vernacular as 'Ballataka' or 'Bhilwa'. It has high priority and applicability in indigenous system of medicine. The plant is a well-known for its medicinal value in Ayurvedic and Siddha system of medicine. Chemical and phytochemical analyses of its nut reveal the presence of bioflavonoid, phenolic compounds, bhilawanols, minerals, vitamins and amino acids. A variety of nut extract preparations from this source are effective against many diseases, viz., arthritis, tumors, and infections. However, the mechanism of the pharmacological action of its nut can be greatly aided by the isolation of its active principle and determination of structure–function relationship. The aim of this review is to further highlight recently discovered effects and applications of *S. anacardium*.

SYNONYMS

Sanskrit: Antahsattva, Arusharah, Aruskara (Arukara), Arzohita, Ballata (Bhallata, Ballata), Bhallataka (Bhalltaka), Bhallatakah, Viravrksa, Visasya;

English: Indian Marking Nut Tree, Marsh Nut, Oriental Cashew Nut;

Hindi: Bhela (Bhel), Bhelwa, Bhilawa (Bhilv), Bhilwa;

Tamil: Erimugi (Erimuki);

Telugu, Nallajeedi;

Gujarati: Bhilamu;

Assamese: Bhelaguti.

Bengali: Bhela (bhela), Bhelatuki.

Kannada: Bhallataka, Bhallika, Goddugeru, Karigeri.

Malayalam: Alakkuceru (alakkuceru), Chera.

Marathi: Bibba, Bibha.

Oriya: Bhollataki. Punjabi: Bhilawa.

Russian: Semekarpus Anakardii

Danish: Ostindisk elefantlus.

Dutch: Malakkanoot, Oostindische acajounoot, Oost-Indische olifantsluis.

Arabic: Habb al fahm, Habb al qalb.

French: Anacarde d'Orient, Noix à marquer, Noix des marais.

German: Anakardien-Herznuß, Malakkanub Elefantenlausbaum, Ostindische Elefantenlaus,

Greek: Semekarpus anakardion,

Italian: Anacardio orientale.

Japanese: Anakarudiumu orientaare, Anakarudiumu orientaru, Makingunatto, Makingunattsu,

Nepalese: Kaag bhalaayo.

Portuguese: Anacárdio oriental.

Spanish: Anacardio oriental.

CLASSIFICATION

Kingdom- Plantae

Subkingdom- Tracheobionta

Super division- Spermatophyta

Division- Magnoliophyta

Class- Magnoliopsida

Sub class- Rosidae

Order- Sapindales
Family- Anacardiaceae
Genus- Semecarpus
Species- S. anacardium

PLANT DESCRIPTION

Bhilwa is an average growing tree normally up to 10-15 m high and the bark is dark grey in colour which produces an irritating substance. The leaves of this plant are 30-60 cm long and 12-30 cm wide, glabrous and pubescent. The flowers produces are green-white and fruit is 2-3 m broad, ovate, smooth berry which turns black after ripening.



PHYTOCHEMISTRY

The most significant components of the *S. anacardium* Linn. are bhilwanols, phenolic compounds, biflavonoid, sterols, anacardoside, semecarpetin, nallaflavanone, jeediflavanone, semecarpuf flavanone, galluf flavanone, anacarduf flavone, bhilawanol-A, bhilawanol-B, amentoflavone, tetrahydroamentoflavone, semicarpol, anacardic acid, tetrahydrobustaflavone, O-trimethyl biflavanone A1, O-trimethyl biflavanone A2, O-tetramethyl biflavanone A1, O-hexamethyl bichalcone A, O-dimethyl biflavanone B, O-heptamethyl bichalcone B1, O-hexamethyl bichalcone B2 and O-tetramethyl biflavanone C.

PHARMACOLOGY

ANTIATHEROGENIC EFFECT

The imbalance between the pro-oxidants and antioxidants is the main cause of development of atherosclerosis. To prevent such condition, antioxidant therapy is beneficial. *Semecarpus anacardium* shows such antioxidant property. It has capacity to scavenge the superoxide and hydroxyl radicals at low concentrations. The process of atherogenesis initiated by peroxidation of lipids in low-density lipoproteins was also found inhibited by SA. Sharma *et al.* demonstrated the cardiac activity of SA, as it generally reduces the

tissue and serum hyperlipidemia by the inhibition of intestinal cholesterol absorption coupled with peripheral disposal thus possessing anti-atherosclerotic activity.

It is possible that the beneficial antiatherogenic effect may be related to its antioxidant, anticoagulant, hypolipidemic, platelet anti-aggregation and lipoprotein lipase releasing properties. The mechanism of hypotriglyceridemic effect has also been shown to be partly due to stimulation of lipoprotein lipase activity.

ANTI-INFLAMMATORY ACTIVITY

Ramprasath *et al.* investigated the anti-inflammatory effects of SA nut extract on developing and developed adjuvant arthritis. *Semecarpus anacardium* significantly decreased the Carrageenan-induced paw edema and cotton pellet granuloma. These results indicate the potent anti-inflammatory effect and therapeutic efficacy of SA Linn. Nut extract against all phases of inflammation is comparable to that of Indomethacin.

Salvem *et al.* investigated that ethyl acetate extract of SA led to the isolation of major active principle, tetrahydroamentoflavone (THA), a bioflavonoid. The *in vitro* cyclooxygenase (COX-1)-catalyzed prostaglandin biosynthesis assay of THA gave an IC₅₀ value of 29.5 μ m (COX-1) and 40.5% inhibition at 100 g/mL (COX-2). The *in vivo* Carrageenan-induced paw edema assay resulted in dose-dependent anti-inflammatory effect of THA and the activity was comparable to that of ibuprofen.

Bhitre *et al.* prepared the methanolic, ethanolic, chloroform, ethyl acetate and petroleum ether extracts of fruits of SA and tested to study the anti-inflammatory activity using the technique of Carrageenan-induced paw edema in albino rats. The extract showed significant anti-inflammatory activity comparable to the reference standard aspirin. Satayavati *et al.* and Bajpai *et al.* reported the anti-inflammatory activity of SA for both immunological and non-immunological origin. Singh *et al.* evaluated that SA extract can inhibit proinflammatory cytokine production. Crude ethanolic extract of SA nuts was studied for its anti-inflammatory activities *in vitro* using peripheral blood and synovial fluid mononuclear cells of healthy individuals and rheumatoid arthritis (RA) patients. *Semecarpus anacardium* extract inhibited the spontaneous and LPS-induced production of proinflammatory cytokines IL-1 β and IL-12p40 but had no effect on TNF- α and IL-6 production, both at protein and mRNA level. The crude extract also suppressed LPS-

induced nuclear translocation of transcription factors, NF-kappa and AP-1; the inhibition of NF-kappa B was through the inhibition of I kappa B α phosphorylation. The extract also suppressed LPS-activated nitric oxide production in mouse macrophage cell line.

ANTIOXIDANT ACTIVITY

Sahoo *et al.* investigated the antioxidant activity of ethyl acetate extract of stem bark of SA. Ethyl acetate extract showed the stronger antioxidant activity (due to presence of highest total phenolic content of 68.67% measured as pyrocatechol equivalent) compared to the other (hexane, chloroform and methanol) extracts. The isolation of the ethyl acetate extract of SA stem bark yielded a bright-yellow solid crystal, which was identified as butein. This compound exhibited antioxidant activity (IC₅₀ values of 43.28 ± 4.34 $\mu\text{g/ml}$), which was comparable to rutin, taken as a standard.

CNS ACTIVITY

Farooq *et al.* evaluated the beneficial effect of nuts of SA, extracted with milk, on CNS, mainly for its locomotor and nootropic activities in different experimental animal models. The extract tested but a slight CNS depressant effect was noted with only 150 mg/kg of the extract and it was found to possess nootropic activity.

ANTIMICROBIAL ACTIVITY

Mohanta *et al.* prepared the aqueous and organic solvent extracts of the plant and screened for antimicrobial (disc diffusion method) and phytochemical properties. The petroleum ether (PEE) and aqueous extract fractions (AQE) showed inhibitory activity against *Staphylococcus aureus* (10 mm) and *Shigella flexneri* (16 mm) at 100 mg/ml, respectively. While chloroform extract showed inhibition against *Bacillus licheniformis*, *Vibrio cholerae* and *Pseudomonas aeruginosa*, the ethanol extract showed inhibition to *Pseudomonas aeruginosa* and *S. aureus*.

ANTIBACTERIAL PROPERTIES

Nair *et al.* found that the alcoholic extract of dry nuts of SA (Bhallatak) showed bactericidal activity *in vitro* against three gram negative strains (*Escherichia coli*, *Salmonella typhi* and *Proteus vulgaris*) and two gram positive strains (*Staphylococcus aureus* and *Corynebacterium diphtheriae*). Subsequent studies have shown that the alcoholic extracts of different parts of the plant (leaves, twigs and green fruit) also possess anti-bacterial properties, especially the leaf

extract. No dermatotoxic effect (irritant property) was observed in the mouse skin irritant assay.

HYPOGLYCEMIC EFFECT

Arul *et al.* studied the effect of ethanolic extract of dried nuts of SA on blood glucose and investigated in both normal (hypoglycemic) and streptozotocin-induced diabetic (antihyperglycemic) rats. The ethanolic extract of SA (100 mg/kg) reduced the blood glucose of normal rats the blood glucose levels were measured at 0, 1, 2 and 3 h after the treatment and antihyperglycemic activity of SA was compared with tolbutamide, a sulfonyl urea derivative used in diabetes mellitus.

Krishnamurthy *et al.* developed Kalpaamrutha (KA), a modified Siddha preparation, which contains SA Linn., EO and honey, and studied for the variations in lipids, lipid-metabolizing enzymes and lipoproteins in cancerous animals and the effect of KA on the lipid metabolism. The increased levels of total cholesterol, free cholesterol, phospholipids, triglycerides and free fatty acids and decreased levels of ester cholesterol in plasma, liver and kidney found in cancer-suffering animals were reverted back to near normal levels on treatment with KA and SA. The effects of KA were found to be more effective than SA.

ANTI-CARCINOGENIC ACTIVITY

Mathivadhani *et al.* studied SA nut extract for inhibitory effect on human breast cancer cells (T47D). Cytotoxicity analyses suggested that these cells had become apoptotic. *Semecarpus anacardium* was discovered to induce rapid Ca⁽²⁺⁾ mobilization from intracellular stores of T47D cell line, and its cytotoxicity against T47D was well correlated with altered mitochondrial transmembrane potential. At the molecular level, these changes are accompanied by decrease in Bcl(2) and increase in Bax, cytochrome c, caspases and PARP cleavage, and ultimately by internucleosomal DNA fragmentation. Taken together, our results provide unprecedented evidence that SA triggers apoptotic signals in T47D cells.

Arulkumaran *et al.* investigated the protective efficacy of preparation named as Kalpaamrutha (KA) (includes SA nut milk extract, dried powder of *Phyllanthus emblica* fruit and honey) on the peroxidative damage and abnormal antioxidant levels in the hepatic mitochondrial fraction of 7,12-dimethylbenz(a)anthracene (DMBA)-induced mammary carcinoma rats. DMBA-treated rats also showed decline in the activities of

mitochondrial enzymes. In contrast, rats treated with SA and KA showed normal lipid peroxidation antioxidant defenses in mitochondrial enzymes, and indicate the anticarcinogenic activity of KA during DMBA-initiated mammary carcinogenesis. On the basis of the observed results, KA can be considered as a readily accessible, promising and novel cancer chemopreventive agent.

ANTISPERMATOGENIC EFFECT

Semecarpus anacardium extract feeding caused antispermatogenic effect evidenced by reduction in numbers of spermatogenic cells and spermatozoa in male albino rats.

ACHE INHIBITORY ACTIVITY

Vinutha *et al.* investigated for SA (stem bark), extracts including methanolic and successive water extracts for acetyl cholinesterase (AChE) inhibitory activity (*in vitro*). Results indicated that methanolic extracts to be more active than water extracts. The potent AChE-inhibiting methanolic plant extracts of SA (stem bark) comes to be 38 g/ml.

TOXICITY

Since Bhallataka is extremely hot and sharp in its attributes, it should be used with caution. Individuals showing allergic reactions to it should stop and avoid the usage of Bhallataka. It should not be used in small children, very old persons, pregnant women and individuals of predominant pitta constitution. The use of the same should be restricted in summer season. For its allergic reactions like rash, itching and swelling, the antidotes used externally are coconut oil, ointment, ghee, coriander leaves pulp or butter mixed with musta (*Cyperus rotundus*). The salt and spices should be strictly restricted and during Bhallataka treatment, it is recommended to avoid exposure to sun, heat and excessive sex. The oily part of the nut is toxic and its degree of removal is proportional to its safety margin.

Nephropathy is associated with exposure to toxins of plant origin. It was noted that with the exception of Djenkol bean nephrotoxicity, SA toxins lead to acute renal failure due to hemodynamic effects.

TRADITIONAL USES

Bhallataka is used for hair care in traditional system of medicines. It is used for dyeing, and promoting hair growth in folk medicine.

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