



REVIEW ON ANTICANCER , ANTIOXIDANT AND ANTIMICROBIAL ACTIVITIES OF SEMECARPUS ANACARDIUM

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ABSTRACT

Semecarpus anacardium Linn. (Family: Anacardiaceae), commonly known as 'Ballataka' or 'Bhilwa', has been used in various traditional medicine systems for various diseases since ancient times. Its nuts contain a variety of biologically active compounds such as bioflavonoids, phenolic compounds, bhilawanols, minerals, vitamins and amino acids, which show various medicinal properties. The fruit and nut extract shows various activities like antiatherogenic, antiinflammatory, antioxidant, antimicrobial, CNS stimulant, hypoglycemic, and anticancer activity. The fruits and seeds of *semecarpus anacardium* are widely used for the treatment of cancer, inflammation, neuroprotective and other physiological disorders. *Semecarpus anacardium* nut milk extract is one of the ingredients of a Siddha medicine called Kalpaamruthaa and is reported to have antioxidant, analgesic and antipyretic properties. Nut extracts exhibit antitumor activity due to the dissociation of hypoxic and angiogenic substances. For patients with rheumatoid arthritis, milk extract of the *semecarpus anacardium* nut inhibits the production of inflammatory cytokines. *Semecarpus anacardium* nut oil has been reported to have cytotoxic effects against acute myeloid leukemia.

KEYWORDS

Semecarpus anacardium, Anticancer, Anti-inflammatory, Neuroprotective effects, Apoptosis, Hypoglycemic, Nut extract, Antioxidant, Antimicrobial .

INTRODUCTION

Semecarpus anacardium Lin. (Family: Anacardiaceae) Distributed in the sub-Himalayan region and tropical and central regions of India. This nut is popularly known as 'marker nut' and also popularly known as 'ballataka' or 'bhilwa'. This has high priority and applicability in indigenous health systems.

Semecarpus anacardium Lin. (Family: Anacardiaceae) is a plant known as medicinal or valuable plant in Ayurvedic and Siddha medicine systems. Chemical and phytochemical analysis of nuts revealed the presence of bioflavonoids,

phenolic compounds, bilawanol, minerals, vitamins and amino acids. Extract preparations from this source are effective against many diseases. These include arthritis, tumors, and infections. However, the pharmacological mechanism of action of nuts is greatly facilitated by isolating the active components and determining their structural and functional relationships. *Semecarpus anacardium* Lin. (Family: Anacardiaceae) is distributed in the sub-Himalayan region and tropical and central parts of India. This nut is commonly known as 'marker nut' and commonly known as 'ballataka' or 'bhilwa'. It has high priority and applicability in indigenous health systems.

BOTANICAL DESCRIPTION

This is a medium-sized deciduous tree found in hot regions outside the Himalayas and in India at altitudes up to 3500 feet. This plant is found in abundance in the states of Assam, Bihar, Bengal, Orissa, Chittorgarh in central India, and the western peninsula of the Eastern Islands in northern Australia. Irregularly laminated, the leaves are simple alternate, obovate, oblong, 30-60 cm long, 12-30 cm wide, with rounded tips, scaly, glabrous above, more or less pubescent below. The flowers are greenish-white, arranged in panicles, and appear with new leaves from May to June. It is easily recognized by its large leaves and red flames that exude resin that turns black when exposed to light. The nuts are oval, about 2.5 cm long, smooth and shiny black. It is more common in dry areas rather than damp areas. The fruit ripens from December to March and is 2-3 cm wide. It has no particular affinity with soil. It is a moderately shaded, obliquely oval or oblong drupe, 2.5-3.8 cm long, compacted when ripe, glossy black, with a disc-shaped orange container, calyx. Located at the base and tip stem. The bark is gray and releases an irritant secretion when cut. The fruit's outer shell produces a corrosive black resinous substance known as "cashew nut shell liquid" (CNSL), which is used in a variety of industrial and medical applications.

Taxonomical classification

Kingdom: Plantae

Subkingdom: Tracheobionta

Super division: Spermatophyta

Division: Magnoliophyta

Class: Magnoliopsida

Subclass: Rosidae

Order: Sapindales

Family: Anacardiaceae

Genus: *Semecarpus*

Species: *Anacardium*

language	Common names
marathi	Bibbba
siddha	Serangkottak
hindi	Bhilawa,bhilwan
Ayurveda	Agnimukh,bhalltak
sanskrit	Agnimukh,bhallatak
urdu	Baldur,bhilvan
latin	Semicarpus anacardium linus
oriya	Bhollataki bholai
malyalum	Tenkotta
english	Marketing nut
Gujrati	Bhilamo
punjabi	Bhilwa
kannada	Karee geru
tamil	Senkottai tatamkottan

SYNONYMS

Common names in Sanskrit: Antahsattva, Arusharah, Aruskara (Arukara), Arzohita, Balla'ta (Bhallata, Ballata), Bhallataka (Bhalltaka), Bhallatakah, Viravrksa, Visasya; in English: Indian Marking Nut Tree, Marsh Nut, Oriental Cashew Nut; in Hindi: Bhela (Bhel), Bhelwa, Bhilawa (Bhilv).

PHYTOCHEMISTRY

The most significant components of the *S. anacardium* Linn. are bhilwanols, phenolic compounds,[7,8] biflavonoids,[9] sterols and glycosides.[8,10] Bhilwanol from fruits was shown to be a mixture of cis- and transisomers of ursuhenol; this compound consists mainly of 1,2-dihydroxy-3(pentadecadienyl 8',11')benzene and 1,2,hydroxy-3(pentadecadenyl 8')benzene.[11] Other components isolated are, anacardoside, semecarpetin, nallaf flavanone, jeedif flavanone, semecarpuff flavanone, galluff flavanone, anacardufflavonemono-olefinyl, diolefin II, bhilawanol-A, bhilawanol-B, catechol.



Fig : Flower of semecarpus anacardium

Fig : Flower of semecarpus anacardium



Proximate principle, minerals and vitamins contents in semecarpus anacardium nuts .

EXTRACTION METHOD

Bioactivity- tailored isolation and characterization

The Kernel where washed in the hexane Air dried ground to coarse powder stirred with hot methanol (1.5L) 24 hour with occasional boiling the methanolic extract was concentrated in a hot evaporator under reduced pressure at 50 degree Celsius and the dence oily mass obtained dissolved in 25 ml ethyl acetate and filtered the filtrate was again

Nutrient	Nutrient composition {in 100 gram.sq}
Moisture,gram	3.8
Energy,kcal	587
Protein,gram	26.4
Fat,gram	36.4
Carbohydrate, gram	28.4
Fibre, gram	1.4
Ash, gram	3.6
Calcium,mg	295
Iron,mg	6.1
Phosphorus,mg	836
Zinc, mg	-

concentrated by rot evaporation under reduced pressure at 50 degree Celsius and the residue was chromatography on a silica gel column for initial clean up and fractionation the fraction having cytotoxic activity MTT assay where collected pulled together and evaporated of the solvent under reduced a pressure to obtain an oily fraction it was saponified with sodium hydroxide and the non saponified fraction was extracted into ethyl acetate neutralized the excess alkali washed dried and the solvent evaporated of in a rot evaporator under reduced a pressure at 50 degree

Celsius to obtain and oily product analysis of the product on GC of the pics characteristics of orthodihydroxybenzene with aliphatic side chain watch evident separation of the mixture was undertaken by semipreparative thin layer chromatography on silica gel (RP- 18 F254s) plates (emd chemicals inc san Diego CA) and developed in acetonitrile water 99.5;0.5 the bands corresponding to molecular masses 316 and 318 were scrapped of into acetone stirred for an hour and evaporated of the solvent the cytotoxicity assay revealed that the compound with the mass 316 is more active and its final purification was performed by preparative column silica gel 60 RP 18 e m d chemicals san Diego and you look and you lotion with acetonitrile water 95.5 the poor fraction where polarder together and the solvent evaporated under vacuum yielding and oily product 200 mg it was characterised further with GC/MS IR proton NMR carbon NMR correlation spectroscopy c o s y and heteronuclear correlation spectroscopy hectare the configuration of the olifinity linkage in the liquid chain are asiguda from the copiling constant of the olifenic protons in the 600 mhz protonium NMR spectra while the location of the olefenic linkage are established by the collisionally induced dissociation CID spector of the lithium adduct cation of the liquid by the tandem mass ms/ms spectral technique.

PHARMACOLOGICAL ACTIVITY

1. Analgesic Activity

Analgesic activity of Petroleum Ether, chloroform and methanol extract of Soxhlet Apparatus was investigated by tail flicking and writhing method using acetyl salicylic acid as the standard reference. The methanol extract at 50 mg/kg showed a significant analgesic activity. However, methanol extract was more potent than the petroleum Ether and chloroform extract.

2. Anticancer activity

a) SA nut extract has been studied to have an inhibitory effect on human breast cancer cell line (T47D). At the molecular level, it showed decrease in bcl and increase in Bax, cytochrome, caspases and PARP cleavage, ultimately by internucleosomal DNA fragmentation. b) restoration of energy metabolism in leukemic mice treated by SA nut milk extract. *Semecarpus anacardium* treatment was also compared with imatinib mesylate (standard drug). *Semecarpus anacardium* administration resulted in clearance of the leukemic cells from the bone marrow and internal organs in leukemia animals. c) We studied the protective effects of a formulation called Kalpaamrutha (KA) (containing SA nut milk extract, dried *Phyllanthus emblica* fruit powder, and honey) against peroxidative damage and abnormal antioxidants. Dimethylbenzanthracene (DMBA) treated rats also showed decline in the activities of mitochondrial enzymes, while rats treated with SA and KA showed normal lipid peroxidation antioxidant defences in mitochondrial enzymes, and indicate the anticarcinogenic activity of KA during DMBA-initiated mammary carcinogenesis. d) it was studied the anti-mutagenic effect of SA under in vivo condition. SA, which showed a significant inhibition of induced aberrations at the 12 h pretreatment periods when mice were intraperitoneally treated with 500 and 250 mg/kg of SA. The results on the reduction of induced chromosome aberrations clearly show that SA serves as an antioxidant because of the presence of flavonoid and its administration may be protective and therapeutic. e) It was observed that aqueous extracts of medicinal vegetation were tested for cytotoxicity the use of brine shrimp lethality test. Out of the 120 plants tested, SA (*Anacardiaceae*) showed significant cytotoxicity with LC₅₀ of 29.5 µg. Joseph studied the anticancer effect of Ayurvedic preparation made from SA nuts. They have found that after 154 days of experiment both liver enzymes and hepatocellular carcinoma (HCC) marker were increased in HCC along with neoplastic changes in liver and were decreased in SA milk extract treated group. The Ayurvedic drug showed positive correlation with the action of doxorubicin. This study demonstrated the efficacy of SA milk extract for the treatment HCC.

3. Antioxidant activity

It has been observed that Kalpaamruthaa showed normal lipid peroxide level and antioxidant defences⁶², measured antioxidant status in blood, and vital organs (liver, kidney and breast tissue) of control and experimental animals. In cancer condition, lipid peroxidation (LPO) was increased and antioxidant levels were decreased. On drug (SA and KA) administration, decreased LPO and increased antioxidant. by investigated the antioxidant activity of ethylacetate extract of stem bark of SA. Ethyl acetate extract showed stronger antioxidant activity (as it had the highest total phenolic content measured as catechol equivalents at 68.67%) compared to other extracts (hexane, chloroform, methanol) . Isolation of the ethyl acetate extract of SA stem bark yielded bright yellow solid crystals identified as butein. This compound showed antioxidant activity

4 Antimicrobial Activity

It is also found that presence of flavonoid and alcoholic extract of dry nuts of SA shows antifungal activity (*Aspergillus fumigatus* and *Candida albicans*) at 400 mg/ml concentration. Botshowed inhibition in growth, reduction in size of cells and sporulation also decrease.it was investigated that its nut oil show significant antimicrobial activity against several Gram positive (*Bacillus subtilis*, *Staphylococcus aureus*) and Gram negative (*Proteus vulgaris*, *Escheria coli*) Bacterial. It had 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 100mg/ml, respectively while chloroform extract showed inhibition against *Bacillus licheniformis*, *Vibrio cholerae* and *Pseudomonas aeruginosa*. The ethanol extract showed inhibition to *Pseudomonas aeruginosa* 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*). Studies showed that the alcoholic extracts of different parts of the plant (leaves, twigs and green fruit) also possess anti-bacterial properties. No dermatoxic effect (irritant property) was observed in mouse skin.

5. Hypoglycemic Activity

The effect of ethanolic extract of dried nuts of SA on blood glucose and investigated in both normal (hypoglycemic) and streptozotocin-induced diabetic (antihyperglycemic).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. developed Kalpaamruthaa (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 Kalpaamruthaa and *Semecarpus anacardium*. The effect of SA was less as compared to KA.

6. Antispermatic effect (reproductive function)

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

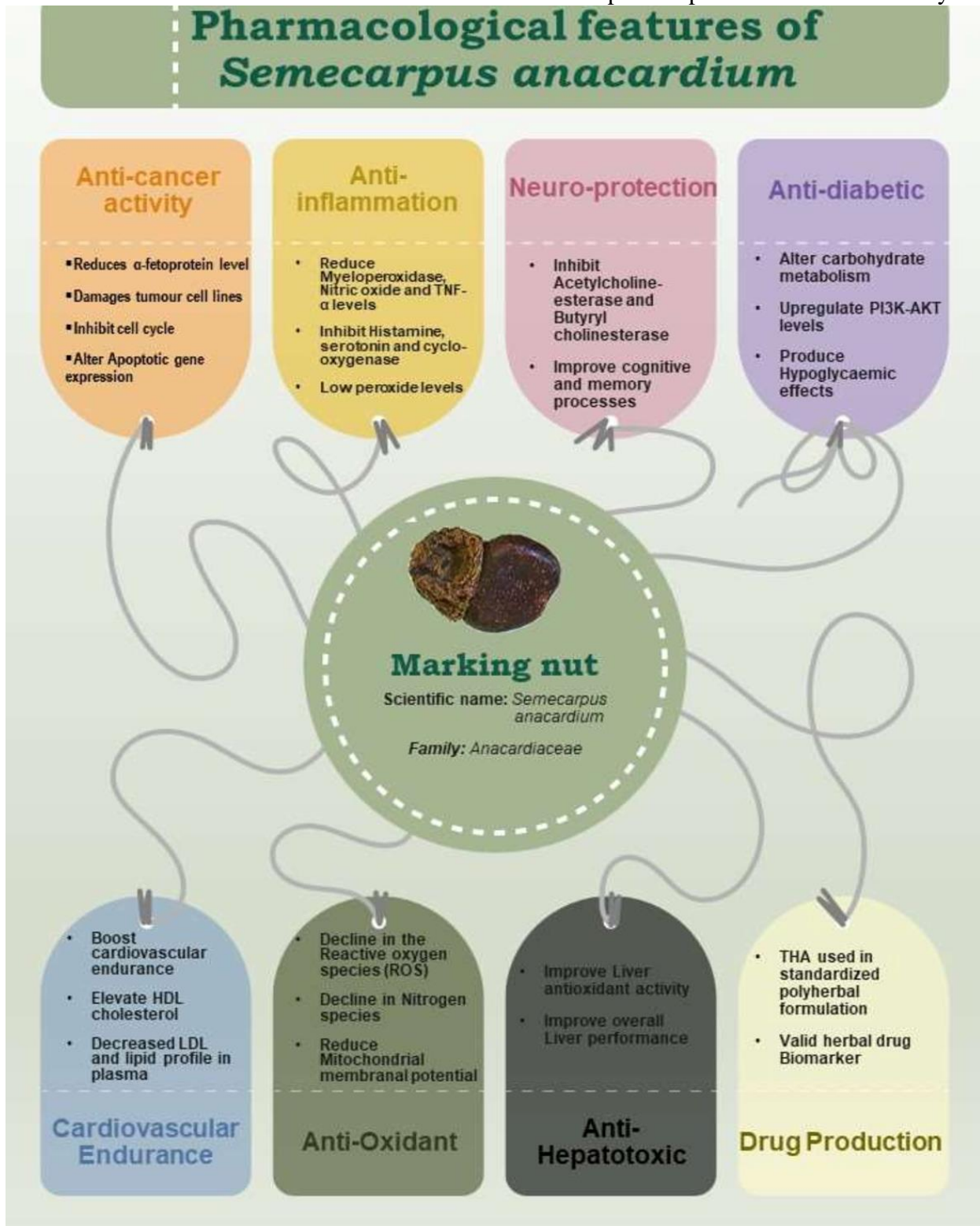
Vinutha et al. investigated for SA (stem bark), extracts including methanolic and successive water extracts for acetylcholinesterase (AChE) inhibitory activity (in vitro). Results indicated that methanolic extracts to be more active than water extracts. The potent AChE-inhibiting methanolic plant extracts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

Current status :

Due to the toxic activities, large size, allergic effect are loss of traditional knowledge generation by generation, most of the peoples don't know the importance and proper use of Semecarpus anacardium, that's why now a day's peoples are avoiding to gardening it in surrounding area. now Semecarpus anacardium plant has become a wild plant, it found only in forest area. Day by day the quantity of this plant is decreasing, it is need to aware it's importance to



society otherwise it will become rare and we will lose one of important plant from the dictionary of Indian



medicinal

Figure 1: Overview of effects seen in *Semecarpus anacardium* extracts

Conclusion and Future direction:

Recently, the use of herbal products as therapeutic agents has increased. Several pharmaceutical companies are investing capital in plant-based medicines primarily because of their therapeutic effects on multiple target organs rather than a single organ. The available literature suggests that *Semecarpus anacardium* is a potential candidate for recognition as a “herbal medicine.” The phytochemicals present in SA have proven

potential as anticancer, anti-inflammatory, neuroprotective, antihelminthic, and antibacterial therapeutic agents. Also, the bioactive compounds present in the nuts showed significant positive changes at the physiological, neurological, behavioral, and cellular levels in the treated animals. However, there is little data regarding the changes induced at cellular molecular, genetic, and proteomic levels by treatment with SA extracts. Various types of drugs, so-called epigenetic drugs, have appeared. These therapeutics target proteins involved in chromatin remodeling, DNA methylation, and histone modification in all cell types (Kirk et al., 2008). These drugs can influence the epigenetic landscape of neurons. H. Neuroepigenome and cellular plasticity. They also have anticancer properties (Patnaik Tremolizzo et al., 2014). This class of drugs can also be developed as complementary and alternative medicine (CAM) and integrative medicine (IM). and claims to have no side effects [IM is a combination of conventional medicine and CAM]. It treats both psychological and physiological dysfunctions (Kanherkar et al., 2017). Based on evidence from other studies, we can speculate that *Semecarpus anacardium* extract could be used as an effective epigenetic drug in the near future. Once individual bioactive components are identified and the molecular mechanisms of their action are understood, they can be used to treat a variety of diseases other than cancer, inflammation, and neurodegenerative diseases.

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