



A Literature Review of Importance Pharmacological Activities of Few Plants of Anacardiaceae Family

Dr. Swapna Tandale¹, Dr. Sanjivani S. Shekokar²

¹Post Graduate Student, Department of Dravyaguna, Government Ayurved College, Nanded.

²Associate Professor and Head of Department, Department of Dravyaguna, Government Ayurved College, Nanded.

ABSTRACT: *Ayurvedic* literature shows that plants of Anacardiaceae family are having many important medicinal uses as well as commercial uses. The present study is aimed to study the characteristics and uses of some important plants belonging the Anacardiaceae family. A literature review of few important plants of the family is being carried out in this study with the help of literature from *Ayurvedic* texts and with help of various related web portal and articles. Most of the plants from Anacardiaceae family are flowering plants, having resin which causes irritation present in bark of stem, pericarp of fruit or leaf.

KEY WORDS: - Anacardiaceae, anti-inflammatory, anti-pyretic, anti-cancer, antimicrobial,

INTRODUCTION

Anacardiaceae family also called as Mango, Cashew or Sumac family, this family consist of about 80 genera and more than 700 species and Plants of Anacardiaceae mostly occurs in tropical and subtropical areas occurs in temperate regions¹.

Members of family have resinous ducts in the bark and characteristically exude gums and resins that becomes black when exposed to air. Resin of some plants used as varnish. The fruits are commonly fleshy drupes. Most of the plants of Anacardiaceae family are included in *Bhallatakadi Varga* in *Aadarsh Nighantu*. It has been described that these plants are having many useful properties such as *Bala vardhak* and *Rasayan*. Most of plants are having edible fruits².

AIM

To review the important characteristics features of some plants of Anacardiaceae family.

Objectives: -

1. To study the *Ayurvedic* and Modern texts of botany, Pharmacognosy and other related texts
2. To study the references of Anacardiaceae family plants from various sources on Web portals
3. To prepare a thorough review as per the obtained data about Anacardiaceae family

Common morphological characteristics of Anacardiaceae family: -

1. Resins – Some plants of this family have resinous ducts present in the inner fibrous bark and pericarp of fruit leaves, roots and pith of stem which secretes the skin irritant substance e. g. *Semecarpus anacardium* L., *Anacardium occidentale* Linn. Some economically important plants belonging Anacardiaceae family such as Cashew, Mango, *Bhallatak*, *Priyangu*, etc., may also be nuts³.
2. Fleshy drupe fruit is the specific characteristic of Anacardiaceae family³.

3. Leaves are often dorsiventral and reticulately veined, perianth when present usually arranged in whorls 5 or 4 if in whorls of 3 then vascular bundles in a stem arranged in a ring less commonly less than 5 in a whorl³.
4. It is dicotyledonous and perianth is present with two or more whorls and clearly differentiated into calyx and corolla (having separate petals), Stamens few - less than 15, Gynoecium - 2 many united carpels and Flowers unisexual of polygamous³.
5. Plants - trees or shrubs³.
6. Leaves – simple³ (but compounds in Spondias, Odina and Rhus alternate but opposite in Dobinea)
7. Flowers - small, regular, bisexual but often unisexual by reduction, with more or less cup shaped glandular disc between the stamens³.
8. Sepals - usually 5, connate, fused at base³.
9. Petals - usually 5, free³.
10. Stamens - 10 in 2 whorls, free³.
11. Carpels - 3 to 5, United, functionally one³.
12. Ovary is one celled³.
13. Ovule – solitary³.
14. Style usually one³.
15. Seeds exalbuminous, Embryo covered with fleshy cotyledons³.
16. Nectaries are present as a staminal, intrastaminal, or extrastaminal nectariferous disk³.

Specific Characteristics of Some plants of Anacardiaceous family

Mangifera L.

Latin name- *Mangifera indica* L., English name: Mango, Sanskrit name - *Aamra*

Tall evergreen trees with dense crowd of spreading branches, leaves are oblong – lanceolate entire acute or acuminate. Flowers are in large terminal panicles. Drupes often obliquely pyriform 6-20 cm long. Seed oblong⁴

Semecarpus L. f.

Latin name: - *Semecarpus anacardium* L., English name: - The Marking-nut tree

Sanskrit name: - *Bhallatak*

Small dioecious trees ,3-4 m tall young parts grey pubescent in color. Leaves are Oblong to oblanceolate and rounded or subcordate at base With entire cartilaginous margin Glabrous above Flowers are Subsessile, Clustered in pubescent panicles as long as or shorter than the leaves. Drupes shining black obliquely ovoid, 2-2.5cm long seated on a fleshy, edible, orange colored thalamus. Two parts of Fruit i.e false fruit and true fruit [Fig No.1] . True fruit has Inner layer and outer layer⁵

Chemical constituent: - 1 } Irritant oil 2 } Bhilawanol 3 } Semecarpol⁶

Pericarp contain: - Anacardic acid, Cardol, Semecarpol, Bhilawanol, etc

Buchanania Spreng

Latin name: - *Buchanania lanzan* Spreng (synm: *Buchanania latifolia* Roxb.) Sanskrit name: - *Priyal*

Large shrubs or small trees, young part silky pubescent Leaves are thickly coriaceous oblong –ovate Rounded at base, Obtuse or emarginate, Glabrous above flowers are Small, sessile in terminal and axillary, Ovaries one perfect⁷

Spondias L.

Latin name: - *Spondias pinnata* (Synm: - *Spondias mangifera* Willd.), English name: - Indian Hog plum

Sanskrit name: - *Ambada*

Medium sized glabrous tree, Leaves are pinnate, Leaflets 3-5 pairs opposite, Leaflets oblong of ecliptic Flowers are Bisexual, polygamous, sessile, clustered in terminal panicles, Drupes obvoid, Seed one or two to three⁸.

Anacardium occidentale Linn.

Latin name: - Anacardium occidentale Linn., English name: - Cashew, Sanskrit name:- *Kajutak*

A small tree with short thick crooked trunk branches terete, glabrous. Leaves are Coriaceous, Obovate or elliptical, rounded at apex, glabrous, finely reticulately veined. The real fruit from cashew tree is the nut, a brown, reniform achene composed of the pericarp (shell) and the almond. The peduncle known as the cashew apple [Fig No. 2], responsible for 90% of the weight, is, a pseudo fruit. Its color ranges from yellow to red. Both parts are edible, but the nut needs to be removed from the shell that contains a corrosive liquid called “cashew nut shell liquid⁹.”

PHARMACOLOGICAL USES OF SOME PLANTS ANACARDIACEAE FAMILY: -

Mangifera indica

Amra

Ripe fruit of *Amra* is *Madhur rasatamak* and having *Kashayanurasa* , *Guru* in *guna*, *Shita Virya* and acts as *Vrashya*, *Balya* and *Hridya*¹⁰

Mangifera indica shows pharmacological activities such as –

- 1) Anticancer activity: In a study, Cytotoxic activities of mango were found against the breast cancer cell lines MCF 7, MDA-MBA-435, MDA-N; colon cancer cell line (SW-620); renal cancer cell line (786-0)¹¹
- 2) Antidiabetic activity: Alcoholic extract of mango leaves showed Anti-diabetic effect at dose of 50, 100, 150 and 200 mg/kg body weights in rabbits as well as in another study it was found that aqueous extract of mango leaves showed hypoglycemic effect in diabetic rats¹².
- 3) Anti-inflammatory activity: *Mangifera indica* showed anti-inflammatory activity of mangiferin is related with the inhibition of iNOS and cyclooxygenase-2 expression¹³.
- 4) Hepatoprotective activity: Mango pulp extract showed effective in combating oxidative stress induced cellular injury of mouse liver by modulating cell –growth regulators¹⁴.
- 5) Analgesic and Antipyretic activity: The stem bark extract of MI showed potent antipyretic activity in mice¹⁵.
- 6) Anti-diarrheal activity: Sairam K et al., investigated The potential anti-diarrheal activity of methanolic and aqueous extracts of seeds of *M. indica*¹⁶ and Alkizim et al., also studied Anti-diarrheal activity of mango kernel aqueous extract at 0.25 to 0.50 mg/ml dose¹⁷
- 7) Antiviral activity: Mangiferin proved to be potent antiviral agent against herpes simplex virus [77-78], HIV and hepatitis B virus¹⁸ . Zhu XM et al., (1993) in an in vitro study to assess the effect of mangiferin against Herpes simplex virus (HSV) type 2; mangiferin did not directly inactivate HSV-2 but inhibits the late event in HSV-2 replication¹⁹ . In an another in vitro study, mangiferin was also able to inhibit HSV-1 virus replication within cells²⁰]and to antagonize the cytopathic effects of HIV²¹ .
- 8) Anti-amoebic activity: Tona L et al. investigated Anti-amoebic activities of mango extract²²
- 9) Cardio protective activity: Devi et al., (2006) investigated the potent effect of mangiferin on the isoproterenol- induced myocardial infarction in rats in an in vivo study²³.
- 10) Laxative activity: Mangiferin significantly accelerated gastro intestinal tract (GIT) movement at oral doses of 30 mg/kg and 100 mg/kg by 89% and 93%, respectively in an in vivo study²⁴

Semecarpus anacardium

Bhalltaka

Bhalltaka is having *Tikshna guna* and is having irritant sap. *Bhalltaka* is having *Kashay* and *Madhur rasa*, *Laghu guna*, *Ushna Veerya*, useul property is *Vata kaphghna* and *Shukral*. Useful in *Udar rog*, *Gulma*, *Agnimandya*, *Krumiroga*²⁵.

The formulations made up from the *Semecarpus anacardium* are used as analgesic, antipyretic (*Anacardiaceae* | SpringerLink). There are many commercial uses of *Semecarpus anacardium* l. Such as juice of pedicels with water used as marking ink to write on cloth, from pedicels can obtain black dye, gums is collected from bark of tree, acrid juice which is obtained from wood is dangerous for health of human, wood of *Bhallatak* is used for the charcoal preparation²⁶

1) Antiatherogenic effect

The main cause of development of atherosclerosis is the imbalance between the pro-oxidants and antioxidants for prevent such condition, antioxidant therapy is useful as *Semecarpus anacardium* (SA) is having antioxidant property through radical scavenging activity. 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 *Semecarpus anacardium*²⁷

2) Anti-inflammatory activity

Semecarpus anacardium significantly decreased the carrageenan-induced paw edema and cotton pellet granuloma. The results indicated the potent anti-inflammatory effect and therapeutic efficacy of SA Linn. Nut extract against all phases of inflammation is comparable to that of indomethacin²⁸.

3) Antioxidant activity:

Semecarpus anacardium has been showed antioxidant activity in various study. Administration of the aqueous extract of SA to lymphoma transplanted mouse leads to increase in the activities of antioxidant enzymes, whereas LDH activity is brought down significantly indicating a decrease in carcinogenesis²⁹.

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) extracts³⁰.

4) CNS activity

Farooq et al. investigated the useful 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 activity³¹.

5) 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 fl exneri* (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*³².

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 assay³³.

6) Hypoglycemic effect

Arul et al. investigated the effect of ethanolic extract of dried nuts of SA on blood glucose and investigated in both normal (hypoglycemic) and streptozotocin-induced diabetic (antihyperglycemic) rats³⁴.

7) Anti-carcinogenic activity

Arulkumaran et al. studied the protective efficacy of preparation named as Kalpaamruthaa (KA) (combination of 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 agent³⁵.

8) Reproductive Function (Antispermatic Effect)

Semecarpus anacardium extract feeding caused antispermatic effect evidenced by reduction in numbers of spermatogenic cells and spermatozoa in male albino rats³⁶.

Anacardium occidentale

Kajutak

Kaju is having *Madhura* and *kashay rasa*, *madhur Vipak*, and *Ushna Veerya*. Acts as *Keshya*, *Angnikruta*³⁷.

Cashew is good source of energy, immunity booster, acts as an antioxidant, its bark is an antihypertensive and useful in diabetic patient. Also useful in skin disease like acne, antiaging due to rich in vitamin C³⁸

Anacardium occidentale The bark of Cashew is used as a Yellow dye in Cambodia, the timber is used in boat making, furniture. Charcoal can be prepared from the wood of Cashew tree, the shells yield a black oil called as CNSL (Cashew Nut Shell Liquid) which is similar quality and heat content to Light Fuel Oil used as biomass fuel for clean power generation³⁹

1) Antioxidant activity:

Fermented fruit juice of *A. occidentale* was reported with high antioxidant activity⁴⁰

In vitro Studies *A. occidentale* revealed high antioxidant activity through DPPH radical scavenging, ferric thiocyanate, and thiobarbituric acid assays. Good antioxidant capacity of red and yellow cashew was also observed using 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) and DPPH radical scavenging assays⁴¹.

2) Antibacterial properties

In antibacterial property of medicinal plants from Nigeria, *A. occidentale* hydroethanolic extracts (leaf/bark) showed potential antibacterial effects against *Escherichia coli*, *Staphylococcus aureus*, *Enterobacter species*, *Streptococcus pneumoniae*, *Corynebacterium pyogenes*, *Enterococcus faecalis*, multi-resistant *S. aureus*, *Acinetobacter species*, *Pseudomonas aeruginosa*, and multi-resistant *P. aeruginosa* during cavity diffusion tests with inhibition halos varying from 6 to 14 mm⁴²

The dried extract obtained from *A. occidentale* leaf powder dye (20%; 200 mg/mL) showed an effect against *S. aureus* which produced the largest inhibition zone (12 mm). In comparison, gentamicin and chloramphenicol produced halos of 20 and 21 mm, respectively⁴³

4) Anti-diabetic activity:

Cashew nuts contain high mono saturated fat that is beneficial for decreasing the blood glucose level and increase insulin production. Thus, diabetes can be managed by cashew pieces. They are essential for type 2

diabetes. They are lower in sugar and higher in fiber; when these factors are combined, they decreased the blood glucose level and prevent the development of type 2 diabetes⁴⁴

5) Anti-cancer activity:

Cashew act as an antioxidant and prevent the growth of cancer cells by removing the free radicals from the body. A class of flavonoids called Proanthocyanidins fight tumor cells and prevents them from further division. High copper content and proanthocyanidins in cashew nut fight copper content in cashew helping to prevent colon cancer⁴⁵

6) Nephroprotective activity:

. Potassium is a common mineral is acquire on a regular basis excepts from delicate coconuts and cashew nuts, also potassium is an essential element to protect the human renal system. As it contains sodium and potassium, so, it can be used to treat dehydration and essential minerals, which are suitable for the kidneys. 28.35gm of cashew portion gives 0.00015kg of potassium⁴⁶⁻⁵⁰

Buchanania lanzan Spreng. :

Priyal

The *Phala Priya* has *Madhur ras*, *Guru Snigdha* and *Sara guna*. Useful in *Jwar*, *Trushna*, *Vata Pitta roga*. And *Priyal majja* is *Vrashya* and *Hrudya*⁵¹.

Leaves are anti-inflammatory Root extract has antimicrobial and anti-biofilm properties. The root extract shows wound healing property as well as root extract is proved for antibacterial activity⁵²

1) Adaptogenic activity:

The methanolic extract of *Buchanania lanzan* was showed significant anti-stress activity of in-vivo, in both normal and stress induced rats⁵³.

2) Anti-inflammatory and analgesic activity agent:

The methanolic root extract of *Buchanania lanzan Spreng.* was investigated for anti-inflammatory and analgesic agent activity in animal model. Analgesic activity was tested in acetic acid-induced writhing model in mice and hot plate reaction time model in rats and anti-inflammatory activity⁵⁴ in carrageenan-induced rat paw oedema model. The methanolic root extract showed significantly reduce writhes in experimental mice were as compared to that of control, and hot plate test showed significant licking effect in rats. Paw volumes was significantly reduced in treated animals and results clearly indicated that methanolic extract could be a potential source for using as anti-inflammatory and analgesic agent⁵⁵

3) Anti-Diabetic and anti-Hyperlipidemic Activity:

The anti-diabetic and anti-hyperlipidemic activity of *Buchanania lanzan* of methanol leaf extract was studied on wister rats by using streptozotocin or streptozotocin + nicotinamide, administered intraperitoneally to induce types I and II diabetes. The Wister rats with blood glucose levels $>190 \pm 8$ mg/dl were administered methanol leaf extract or positive control for 21 days and blood glucose and lipid profile was evaluated. The result showed significantly decreased blood glucose level and serum lipid profile, compared to normal value in streptozotocin-induced types I and II diabetic's rats⁵⁶.

Anti-diarrhoeal activity:

Anti-diarrhoeal activity of *Buchanania lanzan Spreng* alcoholic roots extract was investigated on mice by using castor oil induced diarrhoeal test to assess the anti-diarrhoeal activity and gastrointestinal tract transit of charcoal meal test to assess the anti-propulsive activity. The alcoholic extract of roots significantly reduced faecal output in castor oil induced diarrhoea and also reduced the number of diarrhoeal episodes. It also significantly reduced the intestinal propulsion of charcoal meal in mice⁵⁷

4) Antiulcer activity:

The ethanolic extract of *Buchanania lanzan* Spreng roots was evaluated the effects of antiulcer activity using ethanol induced ulcer in mice and pylorus ligation induced ulcer in rats. The extract showed a dose-dependent protection against gross damaging action of ethanol and pylorus ligation on gastric mucosa of animals and shown significant protection of ulcer index in both the models. Thus, results clearly demonstrated that ethanolic extract possess of good preventive and therapeutic action on the gastric ulcers⁵⁸.

5) Diuretic Activity:

The diuretic activity of total alcoholic extracts and its polar and non polar fractions of fruits of *Buchanania lanzan* were evaluated in Wistar albino rats. Lipschitz method was employed for the assessment of diuretic activity, comparable with frusemide as standard drug. Total alcoholic extracts, n-hexane insoluble and n-hexane soluble fractions of fruits showed significant diuresis when compared with control at 5 hrs. The result which obtained need further study to encourage the isolate active phytochemical constituent for exploring exact mechanism of diuresis⁵⁹.

Spondias pinnata: -

Amratak

The Ripped *Amratak* is having *Kashaya* ,*madhur rasa*, *Madhur vipak* , *Sita veerya* and *Snigdha Guna* . Acts as *Balya*, *Bruhan* and *Vatpitta Shamak*⁶⁰

Spondias pinnata's bark has Cytotoxic Activity, Haepatoprotective action, Antioxidant, Hypoglycemic action, Anti helminthic activity⁶¹.

The pulp of fruit is acid and astringent useful in bilious dyspepsia also antiscorbutic. Leaves and bark are aromatic and astringent and administered in dysentery, bark is used as refrigerant, gum is demulcent, Juice of leaves is applied locally on earache⁶².

Antioxidant activity: The strong antioxidant activity of plants belonging to genus *Spondias* has been attribute mainly to their flavonoids and phenolic content .

1) Hepatoprotective Activity:

The ethyl acetate and methanolic extracts of *S.pinnata* stem heart wood possess a marked in vivo hepatoprotective effect on CCl₄ in toxicated rats. The hepatoprotective effect in this study was attributed to the presence of flavonoids⁶³.

2) Antiarthritic Activity:

Nitric oxide plays an important role in various inflammatory processes. However, sustained levels of production of this radical are directly toxic to tissues and contribute to the vascular collapse associated with septic shock, whereas chronic expression of nitric oxide radical is associated with various degenerative diseases, including carcinomas and inflammatory conditions such as juvenile diabetes, multiple sclerosis, arthritis, and ulcerative colitis. The toxicity of NO increases greatly when it reacts with a superoxide radical, forming the highly reactive peroxy-nitrite anion (ONOO⁻). Hazra et al. (2008) proved that the methanolic extract of *S. pinnata* inhibits nitrite formation in vitro by directly competing with oxygen in the reaction with nitric oxide. The results revealed that IC₅₀ of the methanolic extract (tested at 200µg/ml) was 716.32µg/ml which was lower than that of the reference compound gallic acid (IC₅₀ = 876.24µg/ml). The scavenging percentages were 22.3 and 15.8% for *S. pinnata* and gallic acid, respectively. This study proved that the extract exhibited more potent peroxy-nitrite radical scavenging activity than the standard gallic acid⁶⁴

3) Analgesic and Antipyretic Activities:

Panda et al. (2009) tested the analgesic activity of the ethanolic extract of *S. pinnata* bark The analgesic activity was evaluated using acetic acid, formalin test, and hot plate model. The extract showed a dose-dependent analgesic effect (50–100mg/kg, p.o.) in the acetic acid test, comparable to the effect of acetyl

salicylic acid. Terpenoids, flavonoids, and tannins were responsible for the analgesic activity⁶⁵. Panda et al. (2014) also evaluated the antipyretic activity of *S. pinnata* bark ethanol extract (200 and 400mg/kg, p.o.). Pyrexia was induced in Albino rats by brewer's yeast. The extract showed a significant reduction in pyrexia, which continued for 5 hours after drug administration⁶⁶

4) Thrombolytic Activity:

Manik et al. (2013) showed that both ethyl acetate and aqueous extracts of *S. pinnata* fruit at the concentration of 10mg/ml have a significant thrombolytic activity compared to streptokinase as a standard substance⁶⁷

Antihypertensive Activity:

Das and De (2013) tested the in vitro antihypertensive activity of the aqueous extract of *S. pinnata* fruit (20µg/ml). The angiotensin-converting-enzyme inhibitory activity was assayed using ACE from rabbit lung and N-hippuryl-L-histidyl-L-leucine as a substrate. This showed 50% inhibition of ACE enzyme⁶⁸

5) Diuretic and Laxative Activity:

Mondal et al. (2009) showed that the administration of chloroform and the methanol extracts of *S. pinnata* bark (300mg/kg) to Wistar Albino rats produced significant diuretic and laxative activities as compared to reference standards furosemide and agar⁶⁹.



Fig No. 01⁷⁰



Fig. No. 02⁷¹

REFERENCES

1. <http://www.britannica.com/topic/list-of-plants-in-the-family-Anacardiaceae-2039149>
2. Bapalal g. Vaidya. Nighantu Adarsh Vol 1 st, Varanasi: Chaukhamba Publication: 2017 page no. 314
3. K.R. Kirtikar, B.D. Basu Indian Medicinal Plants vol 1st, 2nd edition, Lalit Mohan Basu, page no.

4. K.R. Kirtikar, B.D. Basu Indian Medicinal Plants vol 1st , 2nd edition, Lalit Mohan Basu, page no. 652
5. K.R. Kirtikar, B.D. Basu Indian Medicinal Plants vol 1st , 2nd edition, Lalit Mohan Basu, page no. 666
6. P.V. Sharma. Dravyagunvigyan Vol 2nd Varansi , Chaukhamba Bharati Publication: 2017 page no.166
7. K.R. Kirtikar, B.D. Basu Indian Medicinal Plants vol 1st , 2nd edition, Lalit Mohan Basu, page no. 659
8. K.R. Kirtikar, B.D. Basu Indian Medicinal Plants vol 1st , 2nd edition, Lalit Mohan Basu, page no. 672
9. K.R. Kirtikar, B.D. Basu Indian Medicinal Plants vol 1st , 2nd edition, Lalit Mohan Basu, page no. 657
10. Muanza DN, Euler KL, Williams L, Newman DJ. Screening for antitumor and anti-HIV activities of nine medicinal plants from Zaire. International Journal of Pharmacology. 1995; 33:98.
11. Krushnachandra Chunekar Bhavprakash Nighantu Varanasi Chaukhamba Publication 2018 Page no.540
12. Wadood N, Abmad N, Wadood A. Effect of *Mangifera indica* on blood glucose and total lipid levels of normal and alloxan diabetic rabbits. Pakistan Journal of Medical Research 2000; 39(4):142-145.
13. Beltrana AE, Alvareza Y, Xaviera FE, Hernanza R, Rodriguez J, Nunez AJ et al. Vascular effects of the *Mangifera indica* L. extract (Vimang). European Journal of Pharmacology 2004; 499:297-305.
14. Nithitanakool S, Pithayanukul P, Bavovada R. Antioxidant and hepatoprotective activities of Thai mango seed kernel extract. Planta Medicine 2009; 75:1118-1123.
15. Awe SO, Olajide OA, Oladiran OO, Makinde JM. Antiplasmodial and antipyretic screening of *Mangifera indica* extract. Phytotherapy Research 1998; 12:437-438.
16. Sairam K, Hemalatha S, Kumar A, Srinivasan T, Ganesh J, Shankar M et al. Evaluation of anti-diarrheal activity in seed extracts of *Mangifera indica*. Journal of Ethnopharmacology 2003; 84:11-15.
17. Alkizim FO, Matheka D, Abdulrahman FK, Muriithi A. Inhibitory effect of *Mangifera indica* on gastrointestinal motility. Medicinal Chemistry and Drug Discovery 2012; 2(1):9-16.
18. Chattopadhyay U, Guha S, Ghosal S. Antitumor, immunomodulatory and anti-HIV effect of mangiferin, a naturally occurring glucosylxanthone. Chemotherapy 1996; 42:443-451.
19. Zhu XM, Song JX, Huang ZZ, Whu YM, Yu MJ. Antiviral activity of mangiferin against herpes simplex virus type 2 in vitro. Zhongguo Yao Li Xue Bao 1993; 14:452-454.
20. Zheng MS, Lu ZY. Antiviral effect of mangiferin and isomangiferin on Heppex simplex virus. Chinese Medical Journal. 1990; 103:160-165.
21. Guha S, Ghosal S, Chattopadhyay U. Antitumor, immunomodulatory and anti-HIV effect of mangiferin: A naturally occurring glucosylxanthone. Chemotherapy 1996; 42:443-451.
22. Tona L, Kambu K, Ngimbi N. Antiamoebic and spasmolytic activities of extracts from some antidiarrheal traditional preparations used in Congo. Phytomedicina 2000; 7:31-38.
23. Devi CS, Sabitha KE, Jainu M, Prabhu S. Cardio protective effect of mangiferin on isoproterenol induced myocardial infarction in rats. Indian Journal of Experimental Biology. 2006; 44:209-215.
24. Morais TC, Lopes SC, Karine-Carvalho MMB, Arruda BR, Souza FTC, Trevisan MTS et al. Mangiferin a natural xanthone, accelerates gastrointestinal transit in mice involving cholinergic mechanism. World Journal of Gastroenterology. 2012; 18(25):3207-3214.
25. Krushnachandra Chunekar Bhavprakash Nighantu Varanasi Chaukhamba Publication 2018 Page no. 134

26. (<http://tropical.theferns.info>viewtr...Semicarpous> anacardium – Useful Tropical Plants)
27. Sharma A, Mathur R, Dixit VP. Hypocholesterolemic activity of nut shell extract of Semecarpus anacardium (Bhilawa) in cholesterol fed rabbits. *Indian J Exp Biol* 1995;33:444-8.
28. Ramprasath VR, Shanthi P, Sachdanandam P. Immunomodulatory and anti-inflammatory effects of Semecarpus anacardium LINN. Nut milk extract in experimental inflammatory conditions. *Biol Pharm Bull* 2006;29:693-700
29. Verma N, Vinayak M. *Bioscience Reports Immediate Publication*; 2008. p. BSR20080035
30. Sahoo AK, Narayananana N, Sahanaa S, Rajanb SS, Mukherjee PK. In vitro antioxidant potential of Semecarpus Anacardium L. *Pharmacologyonline* 2008;3:327-35.
31. Farooq SM, Alla TR, Rao NV, Prasad K, Shalam K, Satyanarayana S. A study on CNS effect of nut milk extract of Semecarpus anacardium. *Pharmacologyonline* 2007;1:49-63.
32. Mohanta TK, Patra JK, Rath SK, Pal DK, Thatoi HN. Evaluation of antimicrobial activity and phytochemical screening of oils and nuts of Semecarpus anacardium. *Sci Res Essay* 2007;2:486-90.
33. Nair A, Bhide SV. Antimicrobial properties of different parts of Semecarpus anacardium. *Indian Drugs* 1996;33:323-8.
34. Arul B, Kothai R, Christina AJ. Hypoglycemic and antihyperglycemic effect of Semecarpus anacardium Linn in normal and streptozotocin-induced diabetic rats. *Methods Find Exp Clin Pharmacol* 2004;26:759-62.
35. Arulkumaran S, Ramprasath VR, Shanthi P, Sachdanandam P. Alteration of DMBA-induced oxidative stress by additive action of a modified indigenous preparation--Kalpaamruthaa. *Chem Biol Interact* 2007;167:99-106.
36. Sharma A, Verma PK, Dixit VP. Effect of Semecarpus anacardium fruits on reproductive function of male albino rats. *Asian J Androl* 2003;5:121-4.
37. Nighantu Ratnakar
38. Article: Medical Uses of Cashew (*Anacardium occidentale*) : Review)
39. (http://enwergypedia.info/wiki/Cashew_Nut_Shells_as_Fuel)
40. Patra JK, Singdevsachan SK, Swain MR. Biochemical composition and antioxidant potential of fermented tropical fruits juices. *Agro Food Indus Hi Tech.* (2016) 27:29–33. [[Google Scholar](#)]
41. Moo-Huchin VM, Moo-Huchin MI, Estrada-León RJ, Cuevas-Glory L, Estrada-Mota IA, Ortiz-Vázquez E, et al. . Antioxidant compounds, antioxidant activity and phenolic content in peel from three tropical fruits from Yucatan, Mexico. *Food Chem.* (2015) 166:17–22. 10.1016/j.foodchem.2014.05.127 [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]
42. Kudi AC, Umoh JU, Eduvie LO, Gefu J. Screening of some Nigerian medicinal plants for antibacterial activity. *J Ethnopharmacol.* (1999) 67:225–8. 10.1016/S0378-8741(98)00214-1 [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]
43. Martínez Aguilar Y, Rodríguez FS, Saavedra MA, Hermosilla Espinosa R, Yero OM. Secondary metabolites and *in vitro* antibacterial activity of extracts from *Anacardium occidentale* L. (Cashew tree) leaves. *Rev Cubana Plantas Med.* (2012) 17:320–9. [[Google Scholar](#)]
44. Bes-Rastrollo, M., J. Sabate, et al. (2007). "Nut consumption and weight gain in a Mediterranean cohort: the SUN study." *Obesity* 15(1): 107-107.
45. Fraser, G. E. (1994). "Diet and coronary heart disease: beyond dietary fats and low-density-lipoprotein cholesterol." *The American journal of clinical nutrition* 59(5): 1117S-1123S
46. Karthick, R., and M. Sundararajan. "Hardware Evaluation of Second Round SHA-3 Candidates Using FPGA (April 2, 2014)." *International Journal of Advanced Research in Computer Science & Technology (IJARCST 2014)* 2.2.

47. Karthick, R., et al. "High resolution image scaling using fuzzy based FPGA implementation." *Asian Journal of Applied Science and Technology (AJAST)* 3.1 (2019): 215-221.
48. P. Sabarish, R. Karthick, A. Sindhu, N. Sathiyathan, Investigation on performance of solar photovoltaic fed hybrid semi impedance source converters, *Materials Today: Proceedings*, 2020, <https://doi.org/10.1016/j.matpr.2020.08.390>
49. Karthick, R., A. Manoj Prabakaran, and P. Selvaprassanth. "Internet of things based high security border surveillance strategy." *Asian Journal of Applied Science and Technology (AJAST)* Volume 3 (2019): 94-100.
50. Karthick, R., and M. Sundararajan. "A novel 3-D-IC test architecture-a review." *International Journal of Engineering and Technology (UAE)* 7.1.1 (2018): 582-586.
51. Krushnachandra Chuneekar Bhavprakash Nighantu Varanasi Chaukhamba Publication 2018 Page no. 564
52. Ashok Pattanaik, Rahul Sarkar: Pharmacological studies on *Buchanania lanzan* Spreng-A focus on wound healing with particular reference to antibiofilm properties
53. Mehta SK, Naira N, Bains N. Adaptogenic activity of methanolic extract of *Buchanania lanzan* leaves an experimental study in rat model. *Pelagia Research Library Der Pharmacia Sinica*, 2011, 2 (3): 107-112.
54. Mehta SK, Mukherjee S, Jaiprakash B, Anti-inflammatory activity of the methanolic extract of *Buchanania lanzan* leaves by carrageenan induced rat paw oedema method. *International Journal of Pharmaceutical Sciences Review and Research*. 2011; 6 (2): 90-98
55. Patsnaik AK, Kodati D, Pareta SK, Patra KC, Harwansh RK. Analgesic and anti-inflammatory activities of *Buchanania lanzan* Spreng. *Roots Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 2011; 2 (1): 419 -425.
56. Sushma N, Smitha PV, Gopal YV, Vinay R, Reddy NS, Mohan CM, Raju AB. Antidiabetic, Antihyperlipidemic and Antioxidant Activities of *Buchanania lanzan* Spreng Methanol Leaf Extract in Streptozotocin-Induced Types I and II Diabetic Rats. *Tropical Journal of Pharmaceutical Research*. 2013; 12 (2): 221-226.
57. Kodati D, Pareta SK, Patnaik A. Antidiarrhoeal activity of alcoholic extract of *Buchanania lanzan* Spreng. *Roots. Pharmacologyonline*. 2010; 3: 720-726.
58. Kodati D, Pareta S, Kartik C. Antiulcer activity of ethanolic extract of *Buchanania lanzan* Spreng. *Roots Annals of Biological Research*, 2010; 1 (4): 234-239.
59. Shailasree S, Ruma K, Harishchandra S. Prakash Curative properties of *Buchanania lanzan*: As evaluated by its anti-oxidant, anti-inflammatory and DNA protective properties. *Journal of Natural Pharmaceuticals*. 2012; 3 (2): 71-77.
60. Krushnachandra Chuneekar Bhavprakash Nighantu Varanasi Chaukhamba Publication 2018 page no.541
61. <http://www.easyayurveda.com/2017/12/18/wild-mango-hog-plum-spodias-pinnata/amp/>)
62. *The Indian Materia Medica*
63. B.G.Rao and N.J.Raju, "Investigation of hepatoprotective activity of *Spondias pinnata*," *International Journal of Pharma Sciences and Research*, vol. 1, no. 3, pp. 193–198, 2010.
64. B. Hazra, S. Biswas, and N. Mandal, "Antioxidant and free radical scavenging activity of *Spondias pinnata*," *BMC Complementary and Alternative Medicine*, vol. 8, article 63, 2008.
65. B.K.Panda, V.J.Patra, U.S.Mishra et al., "Analgesic activities of the stem bark extract of *Spondias pinata* (Linn.f) Kurz," *Journal of Pharmacy Research*, vol. 2, no. 5, pp. 825–827, 2009.

66. B. K. Panda, V. J. Patro, and U. S. Mishra, "Comparative study of anti-pyretic activity between acetone and ethanol stem bark extracts of *Spondias pinnata* (Linn.F) Kurz," *Chemical and Biological Sciences*, vol. 1, pp. 26–32, 2014.
67. M. K. Manik, S. M. Islam, M. A. Wahid et al., "Investigation of in vitro antioxidant, antimicrobial and thrombolytic activity of the exocarp of *Spondias pinnata* (Anacardiaceae)," *Canadian Chemical Transactions*, vol. 1, no. 3, pp. 191–201, 2013.
68. S. Das and B. De, "Evaluation of Angiotensin I-Converting Enzyme (ACE) inhibitory potential of some underutilized indigenous fruits of West Bengal using an invitro model," *Fruits*, vol. 68, no. 6, pp. 499–506, 2013.
69. S. Mondal, G. K. Dash, S. Acharyya, D. K. Brahma, and S. Bal, "Studies on diuretic and laxative activity of bark extracts of *Spondias pinnata* (Linn. f) Kurz," *Pharmacognosy Magazine*, vol. 5, no. 19, pp. 28–31, 2009.
70. <https://images.app.goo.gl/dd7Cd52CYvFKHTk6>
71. <https://images.app.goo.gl/RexycH6MQumhirC29>