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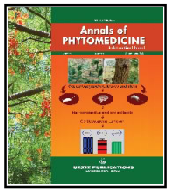

Review Article : Open Access

Spondias mangifera Willd.: A highly healthful turpentines aromatic plant for the management of the seasonal affective disorders

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Abstract

Spondias mangifera Willd. (Anacardiaceae), a plant used in Ayurvedic medicine, commonly known as Amora is a perennial, deciduous, glabrous, large tree with turpentines odor of aerial parts, predominant in the Northeast region of India. Its mango type healthy fruits are acidic, astringent, highly nutritious, full of macro and micronutrients and vitamins, a favorite of the feminine to eat and prepared a variety of items. Root and stem bark of the plant is the rich source of phenolic glycosides which have been pharmacologically investigated for antioxidant, antiwrinkle, antibacterial, antidiarrheal, anticancer, antiulcer, antidiabetic, and hypolipidemic activities by many researchers. The unripe fruits are acidic, carminative, improve digestion, relieves anorexia, and useful in the treatment of diarrhea and constipation whereas ripe fruits are aromatic, sweet, coolant, nourishing, nutritious, and improve strength and immunity. The flavor of fruits are due to the presence of volatile oils (5-Methyl-2-furaldehyde, isopropyl myristate, α-pinene, camphene, α and γ-terpineol, ethyl cinnamate, caryophyllene, isoborneol, γ-eudesmole) which has immense antibacterial, antibiotic and antiviral properties. The lipophilic nature and small molecular weight of volatile oils are probably helpful to inhibit the infective growth of seasonal affective disorder (SAD) virus molecules. This article presents current data on the various phytochemicals of *S. mangifera* accommodating to restrain the virulent growth of SAD and its nutritional importance.

1. Introduction

Hog plum (*Spondias mangifera* Willd., Syn. *S. pinnata* Linn.), belongs to the family Anacardiaceae, in the crop grown in 34 nations across the globe; 12 of these are within its natural area. India's tropical and subtropical areas have a large population of this plant, which may be found in a number of Indian states, including Bihar, West Bengal, and Arunachal Pradesh (Anonymous, 1992). Hog plum's therapeutic qualities have been documented for ages. The medicinal value of components of the plant including leaves, flowers, fruits, and bark has been studied by many researchers. The fruits and bark of the plant have a significant medicinal benefit in the Indian systems of medicine, with their use especially in Ayurveda (Anonymous, 2001). The plant's leaves, flowers, fruits, and bark have cooling and antioxidant properties. The antioxidant, antiwrinkle, antibacterial, anticancer, antidiabetic, and hypolipidemic properties of this plant have been studied by many researchers. This plant has yielded many bioactive chemicals in different chemical groups (Bora *et al.*, 2014). The dark brown color gum is used to fumigate infectious illnesses, such as bronchitis (Benthall, 1993; Valsaraj *et al.*, 1997; Melendez *et al.*, 2006). In addition to serving as a volatile ingredient, the leaves are used to treat earaches with drops of leave juice (Puri *et al.*, 1983). To regulate menstruation, experts have suggested using root bark powders. The herb has many benefits beyond its antibacterial, anticancer, antipyretic, antispasmodic, and antihistamine properties (Acharyya *et al.*, 2010). In India's Northeast area, a common folk treatment for bile duct problems is 20 g of juicy fruit combination of 100 g of jaggery and 1.2-1.6 g of *Piper nigrum* (Nandkarni, 1976). After boiling the fruit in a sugar solution, the quality of the fruit does not change during storage for up to several months. It is used as a cooking and medicinal ingredient in particular formulations (Northrup, 1994). Raw bark has astringent, refrigerant, rubefacient properties and is used as an embrocating for both trabecular and muscly rheumatism. A three-bulb of garlic and bark powder mixture was administered in stomach discomfort in the Majidi region of Hazaribag district for three days (Jain *et al.*, 1977). Equal parts bark juice and *Syzygium cuminii* juice are used for dysentery and diarrhea as a home treatment (Mahanta *et al.*, 2006). Infusions of the root side barks are helpful to treat gonorrhea and menstrual irregularity (Sharma and Udbhid, 2002; Pal and Jain, 2000).

Frequent seasonal changes of temperate and tropical regions are the causes of a number of infectious illnesses. Some of the common human ailments are vulnerable to include common childhood diseases like measles, diphtheria, and chickenpox, as well as fecal-oral diseases such as cholera and rotavirus. Mosquito-borne diseases like malaria and numerous types of allergic and viral infections are also prevalent (Grassly and Fraser, 2006). The *S. mangifera* tree is known for its historical role in traditional medical systems, including

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Ayurveda and Unani, where every component of the plant has been utilized as an herbal remedy to treat such type of seasonal illnesses in the home (Kangilal and Das, 1984; Arif *et al.*, 1984). Most of the phytocomponent of this plant species are fragrant, acidic, and astringent in nature. Although, hog plum is often used in traditional medicine, little scientific research has been conducted on its chemical composition and medicinal efficacy. Before starting the study, the plant was authenticated from Department of Life Science, Dibrugarh University, Dibrugarh, Assam, and a herbarium was submitted with a reference number (DLS/MS/2021/14) for additional recommendation. This article discusses current pharmacological research on the *S. mangifera* plant, regarding the management of seasonal affective disorders as well as several potential avenues for study.

1.1 Taxonomy

Domain: Eukaryotic; **Kingdom:** Plantae; **Subkingdom:** Viridiplantae; **Division:** Tracheophyta; **Infradivision:** Angiospermae; **Class:** Magnoliopsida; **Superorder:** Rosanae; **Order:** Sapindales; **Family:** Anacardiaceae; **Genus:** Spondias; **Species:** Mangifera; **Synonym:** pinnata (Kritikar and Basu, 1975).

1.2 Vernacular name

Different vernacular names for the tree are Bile tree and Hog plum (English), Ambra (Bengali), Amara (Hindi), Bhrigiphalla (Sanskrit), Heining (Nagaland), Kuki (Manipuri), Taito (Mizo), Ambalam (Tamil), Avimamadi (Telegu) (Kritikar and Basu, 1975).

Figure 1: *Spondias mangifera* Willd. Tree (A); Twig, (B); Leaf, (C); Flowers, (D); Fresh bark dorsal side, (E); Fresh bark ventral side, (F); Dry bark dorsal side, (G); Dry bark ventral side, (H); Immature fruits, (I); Fruits showing mesocarp and endocarp (J and K) and Mature fruits (L).

1.3 Morphological description of the plant

This is a terrene coarse-textured, woody, deciduous, perennial tree that reaches a height of 15-18 m and has a straight, columnar trunk with smooth, ash grey bark. When its wood is touched or damaged, it emits a distinctive turpentine-like odor. Though, the plant is at home in hot, humid, low-lying tropics, it may be found at elevations of up to 1800 meters, and its lifespan is between 20 and 30 years. Fertile, well-drained soil suits the tree, but it can not grow well in a variety of inferior soil, even if it is supplied with the proper nutrients (Morton *et al.*, 1987). Several limbs as large as a man's arm may be dug into the ground and if circumstances are right, can sprout roots and grow (Roland *et al.*, 2004). The leaflets are arranged in opposite pairs and the leaves are imparipinnate, or two-lobed. Leaflets are rectangular, inclined at the base, and have whole margins with a blunt apex with a length of 9-13 cm and a width of 2-9 cm. The trunk is a woody character, arborescent lives throughout winter, hard in texture, succulent, and fleshy. Small flowers (3.5 mm long) that are bisexual, pedicellate, actinomorphic, complete, fragrant, and spreading terminal are hypergamous. The plant fruit has succulent, ovoid, 3-6 cm in diameter, and is greenish-yellow in color when ripe (Figure 1). Pulp is soft, acidic, fragrant, semi-woody, fibrous, and full of cavities. It is possible to provide for a household for many months out of the year by planting a single tree (Umadevi and Daniel, 1988; Khare, 2007). For the time being when many admired fruits are unavailable, fruits of this tree are readily available. The plant's bark is silver-grey with a typical, pleasant fragrant wood smell (Hasan and Das, 2005; Narayan and Manandhar, 2002; Arif *et al.*, 2009).

1.4 Economic botany

1.4.1 Culinary uses

It is frequently used as a condiment or in fermentation, fresh (pickles). When harvested from the trees, the unripe fruit juice is highly acidic and serves as the richest source of vitamins. This juice has the added benefit of being a nutraceutical with the potential to be used in the pickle and culinary industries. In countries where the trees are native, it is used to make curries, jams, and other condiments (Arif *et al.*, 2010; Chopra *et al.*,1956).

1.4.2 Cosmetics

Volatile aromatic components from the different spices and herbs have been established to have antibacterial, antifungal, antitumor, anti-inflammatory, and antioxidant activities which are the main intention to prepare cosmetic products (Singh *et al.*, 2016). Essential oils, present in the ripe and unripe fruits of *S. mangifera* are the combination of several fragrant compounds which may be used as a component in cosmetic products. The effect of volatile oil (0.005-0.08‰) of *S. mangifera* fruit peel has been investigated for cell viability. It exhibited no substantial cytotoxic action compared to the control on LPS-familiarized RAW 264.8 cells. It was found that a concentration of 0.082% of the total volatile oil could be harmless for the progress of cosmetic products industries (Li *et al.*, 2020).

2. Phytochemical significance

As demonstrated in Table 1, flowers, fruits, leaves, and bark of *S. mangifera* contain a number of phytoconstituents like saponins, steroids, triterpenoids, fatty acids, acid glycosides, volatile oils, reducing sugars, amino acids, *etc.*

2.1 Triterpenoids and steroids

Several triterpenoid and steroids, including oleanolic acid, *β*-amyrin, *β*-sitosterol, ergosteryl triterpenes 1 and 2, stigmast-4-en-3-one, 24-methylenecycloartanone, and glycosides of sterols were fractionated from the methanol extract aerial portions of the plant (Tandon and Rastogi, 1976; Tapan *et al.*, 2014; Ghate *et al.*, 2018).

Saponins glycosides (echinocystic acid), is the glycoside with a (1 → 5)-β-D-galactopyranosyl (3 → 0)-β-D-xylofuranosyl sugar moiety was extracted from *S. mangifera* root extract and also abundant in white tea was separated using column chromatography (Saxena and Mukharya, 1997).

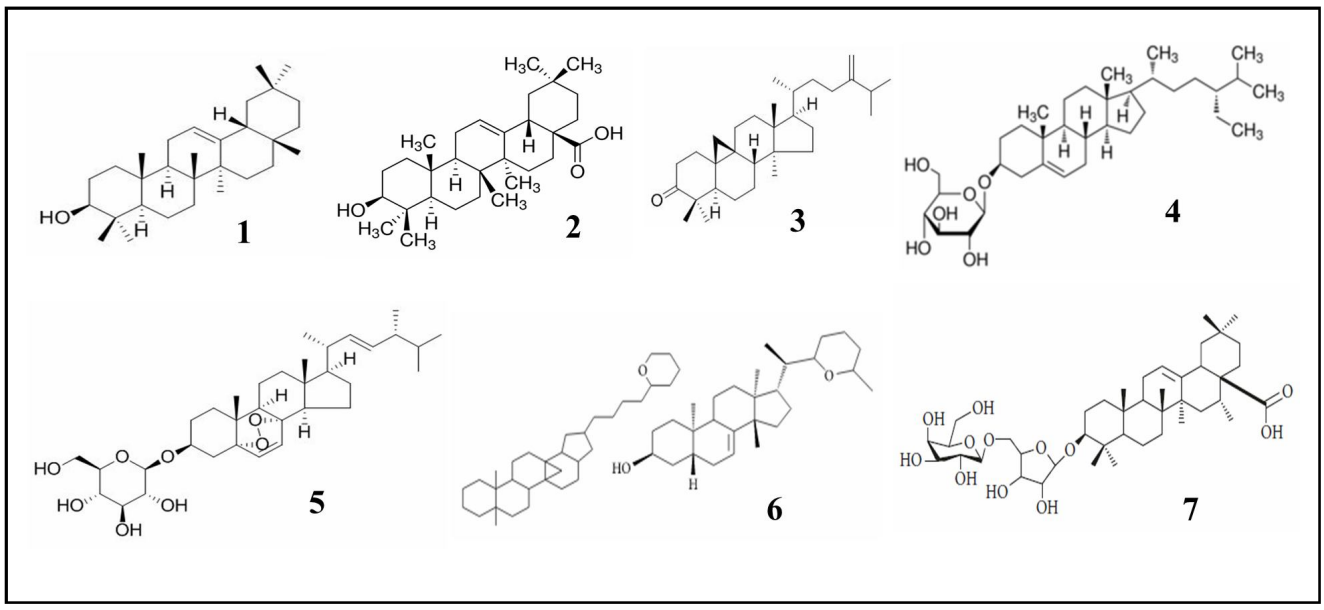

Figure 2: (1-7) Chemical structure of triterpenoids and steroids.

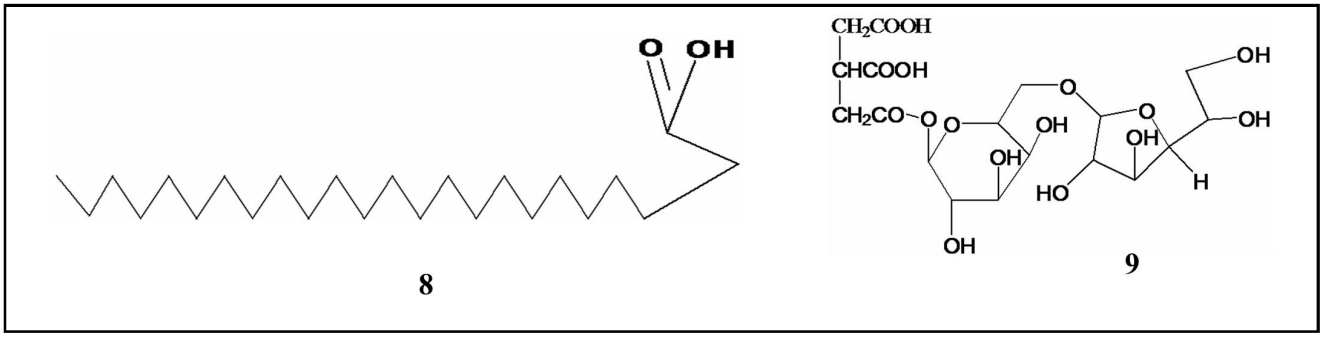

Figure 3: (8-9) Chemical structure of fatty acid and acid glycosides.

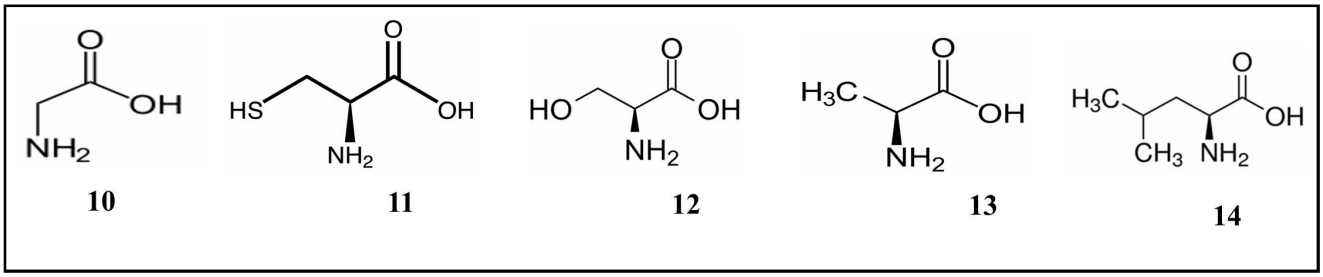

Figure 4: (10-14) Chemical structure of Amino acids.

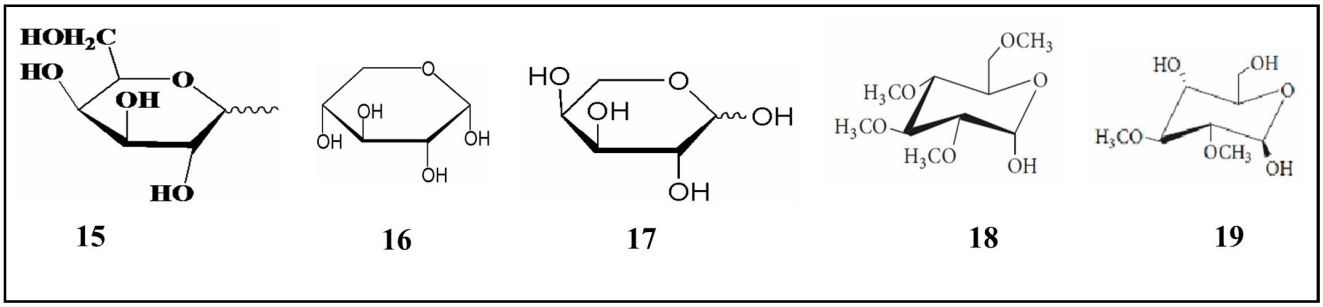

Figure 5: (15-19) Chemical structure of reducing sugars.

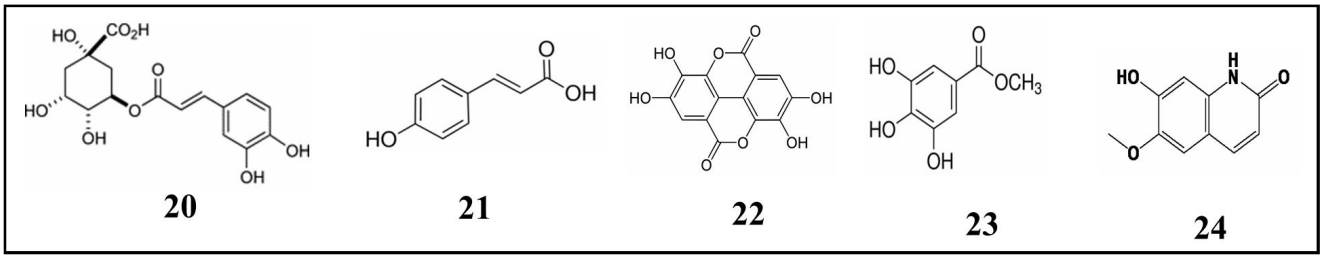

Figure 6: (20-24) Chemical structure of phenolic compounds and quinolines.

2.2 Fatty acid and acid glycosides

Lignoceric acid from aerial part and astringent principle tricarboxylic acid glycoside (propane-1,2-dioic acid-3-carboxyl-β-D-glucopyranosyl-(62 '!12 2) β-D-glucofuranoside) was isolated from the fruits (Singh and Saxena, 1977; Arif *et al.*, 2016).

2.3 Amino acids

The fruits contain 861-1420 mg total amino acids identified as cysteine, alanine, glycine, serine, and leucine, from 100 g of peels. (Arif *et al.*, 2011; Singh and Saxena, 1976; Saxena and Singh, 1977).

2.4 Reducing sugars

The aqueous extract of the fruit has been isolated by several sorts of reducing sugars such as D-galactose, L-arabinose, D-xylose, 2, 3, 6-tri-O-methyl glucose, 2, 3, 4, 6-tetra-O-methyl glucose, 2, 3-di-O-methyl glucose, and 3-O-methyl glucose (Haq and Mollah, 1973).

2.5 Phenolic compounds and quinolines

Carboxylic acids and its esters (gallic acid, chlorogenic acid, salicylic acid, ellagic acid, 6-hydroxy-2,5,7,8-tetramethylchroman-2-carboxylic acid, p-coumaric acid, tetradecanoic acid, hexadecanoic acid, ethyl decanoate, methyl gallate, methyl-14-methylpentadeca

noate, ethyl-3-phenylpropionate), alcohols (cis-3-hexanol, hept-5-en-2-ol, 9,12,15-octadecatrien-1-ol), was discovered in the methanolic fruit and bark extract (Chaudhuri *et al.*, 2015). A quinoline (7-hydroxy-6-methoxyquinolin-2(1H)-one) compound was found in the ethyl acetate bark extract (Tapan *et al.*, 2014; Ghate *et al.*, 2018).

2.6 Volatile oil

Aliphatic alcohols, monoterpene hydrocarbons, and aromatics were discovered to be common compounds of the volatile oil gotten from the fruits. Furfural (17.14%), benzoic acid, ethyl ester (9.05%), α-terpineol (13.09%), γ-terpineol (5.55%), and methyl salicylate (5.88%) were originated to be the main components in the volatile oil of this plant (Li *et al.*, 2020). LC-MS analysis of pale yellow-colored essential oil obtained from the pulp of fruits revealed the presence of aldehydes and ketone (furfural and 6,10,14-trimethyl-2-pentadecanone), aromatic hydrocarbons (1-methyl-4-propane-2-ylcyclohexa-1,3-diene), and isopropyl myristinate as a chief component, followed by the other monoterpenes and sesquiterpenes responsible for flavor (Satpathy *et al.*, 2011; Keawsard *et al.*, 2016).

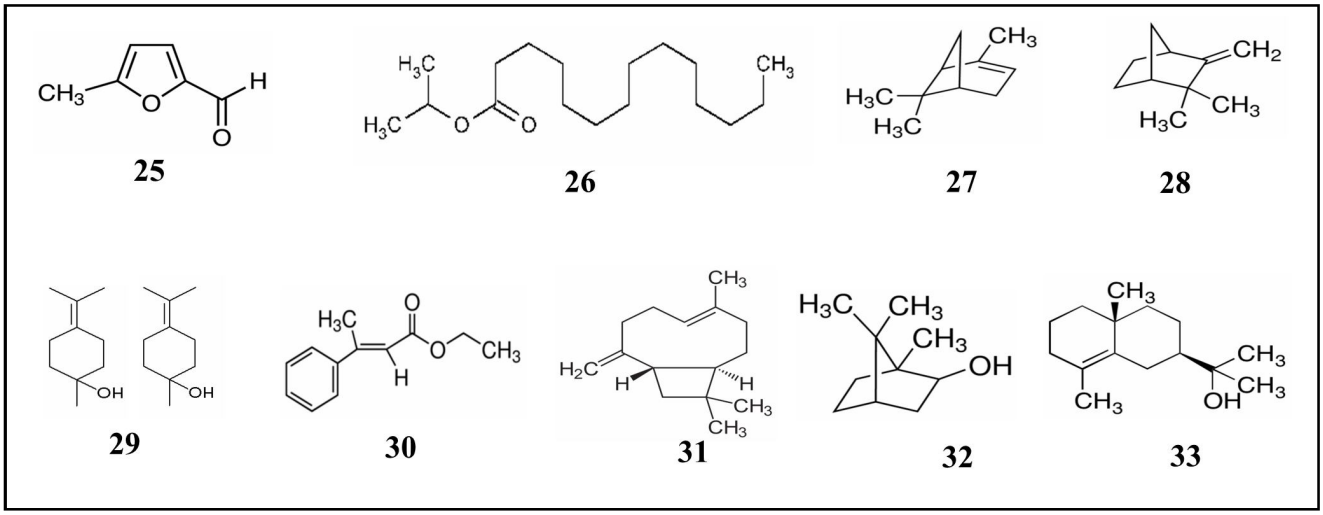

Figure 7: (25-33) Chemical structure of the components of volatile oil.

Table 1: Chemical components present in different parts of *S. mangifera*

S. No.	Name of phytoconstituents	Category of phytoconstituents	Part exploit (nature of extract)	References
1	β-Amyrin	Triterpenoids	Fruit (Methanol)	(Muhammad *et al.*, 2011), (Singh and Saxena, 1977)
2	Oleanolic acid	Triterpenoids	Fruit (Methanol)	(Muhammad *et al.*, 2011), (Singh and Saxena, 1976)
3	24-Methylenecycloartanone	Steroids	Aerial parts (Ethylacetate)	(Muhammad *et al.*, 2011), (Singh and Saxena, 1977)
4	Stigmatist-4-en-3-one	Steroids glycoside	Aerial parts (Ethylacetate)	(Muhammad *et al.*, 2011), (Singh and Saxena, 1977)
5	β-sitosterol β-D-glucoside	Steroids glycoside	Aerial parts (Ethylacetate)	(Muhammad *et al.*, 2011), (Singh and Saxena, 1977)
6	Ergosterol triterpene 1 and 2	Steroids	Bark ($CHCl_3$/MeOH)	(Tapan *et al.*, 2014), (Ghate *et al.*, 2018)
7	Echinocystic acid-3-*O*-β-D-galactopyranosyl(1 → 5)-*O*-β -D-xylofuranoside	Triterpenoids glycoside	Roots (Ethylacetate)	(Saxena and Mukharya, 1997)
8	Lignoceric acid	Fatty acids	Aerial parts (Ethylacetate)	(Muhammad *et al.*, 2011), (Singh and Saxena, 1977)
9	Propan-1,2-dioic acid-3-carboxyl-β-D-glucopyranosyl -(6' → 1")-β-D-glucofuranoside	Acid glycoside	Fruits (Ethylacetate)	(Arif *et al.*, 2016)
10	Glycine	Amino acid	Fruits (Ethylacetate)	(Saxena and Singh, 1977)

11	Cysteine	Amino acid	Fruits (Ethylacetate)	(Saxena and Singh, 1977)
12	Serine	Amino acid	Fruits (Ethylacetate)	(Saxena and Singh, 1977)
13	Alanine	Amino acid	Fruits (Ethylacetate)	(Saxena and Singh1, 977)
14	Leucine	Amino acid	Fruits (Ethylacetate)	(Saxena and Singh, 1977)
15	D-galactose	Sugar	Fruits (Aqueous)	(Haq and Mollah, 1973)
16	D-xylose	Sugar	Fruits (Aqueous)	(Haq and Mollah, 1973)
17	L-arabinose	Sugar	Fruits (Aqueous)	(Haq and Mollah, 1973)
18	2,3,4,6-tetra-*O*-methylglucose	Sugar	Fruits (Aqueous)	(Haq and Mollah, 1973)
19	2,3-Di-*O*-methyl glucose	Sugar	Fruits (Aqueous)	(Haq and Mollah, 1973)
20	Chlorogenic acid	Phenolic compound	Fruits (Methanol)	(Satpathy *et al*., 2011), (Keawsard *et al*., 2019)
21	p-coumaric acid	Phenolic compound	Fruits (Methanol)	(Satpathy *et al.*, 2011)
22	Ellagic acid	Phenolic compound	Fruits (Methanol)	(Satpathy *et al.*, 2011)
23	Methyl gallate	Phenolic compound	Bark (Methanol)	(Chaudhuri *et al.*, 2015)
24	7-hydroxy-6-methoxyquinolin-2(1H)-one	Quinoline	Bark (Ethylacetate	(Ghate *et al.*, 2018)
25	5-methyl-2-furaldehyde	Volatile oil	Fruit (n-Hexane)	(Li *et al.*, 2020)
26	Isopropyl myristate	Volatile oil	Fruit (n-Hexane)	(Li *et al.*, 2020)
27	α-pinene	Volatile oil	Fruit (n-Hexane)	(Li *et al.*, 2020)
28	Camphene	Volatile oil	Fruit (n-Hexane)	(Li *et al.*, 2020)
29	α and γ-terpineol	Volatile oil	Fruit (n-Hexane)	(Li *et al.*, 2020)
30	Ethyl cinnamate	Volatile oil	Fruit (n-Hexane)	(Li *et al.*, 2020)
31	Caryophyllene	Volatile oil	Fruit (n-Hexane)	(Li *et al.*, 2020)
32	Isoborneol	Volatile oil	Fruit (n-Hexane)	(Li *et al.*, 2020)
33	γ-eudesmole	Volatile oil	Fruit (n-Hexane)	(Li *et al.*, 2020)

3. Aspects of pharmacology and medicinal benefits

Scientifically, very limited studies associated with pharmacological activities have been accounted to *S. mangifera*. The pharmacological activities and works interrelated to *S. mangifera* have been outlined in Table 2.

3.1 Inflammation and pain relieving properties

An anti-inflammatory, cytotoxic and antibacterial investigation was performed on essential oils extracted from the fruit peel which has been used as both a medicinal and condiment. Fruit peels volatile oil had a moderate cytotoxic activity on five cancer cells and was particularly effective against five pathogenic bacteria, as shown by minimum inhibitory concentration (MIC) of 16-32 µg/ml. In the experiment, fruit peel essential oil had substantial anti-inflammatory effects at 0.08% on RAW 264.7 cell lines, in which nitric oxide (NO) production was drastically decreased after being stimulated by lipopolysaccharide (LPS). According to these studies on *S. mangifera* fruit peel essential oil, can be verified, its traditional use while it suggests it may give out as a new resource of natural anti-inflammatory and antibacterial compounds for the food and medical sectors (Li *et al.*, 2020). The ethyl acetate fraction of *S. mangifera* bark contained 7-hydroxy-6-methoxyquinolin-2 (1H)-one was tested in lipopolysaccharide enthused murine macrophage model for anti-inflammatory effects. This chemical was able to inhibit the LPS-induced inflammatory mediator production, including nitric oxide (NO), tumor necrosis factor (TNF)-α, IL-1β, and reactive oxygen species interleukin (IL)-6 (Ghate *et al.*, 2018). *S. mangifera* fruit ethanolic extract was researched for its antiarthritis and anti-inflammatory capabilities also and for this study, molecular docking on COX-1, COX-2, and TNF-α was carried out on the active components of the plant (*β*-amyrin, *β*-sitosterol, oleanolic acid, and co-crystallized ligands such as SPD-304). It showed a substantial decrease in arthritis score, paw diameter, TNF-α, and IL-6 compared to untreated mice. The docking findings indicated that residues interact with TNF-α and are an antagonist of TNF-α (Khalid *et al.*, 2021). The rat hind paws showed a decreased swelling when treated with alcoholic extract of *S. mangifera* stem bark at dosages of 75, 150, and 300 mg/kg (Sachan *et al.*, 2011). Methanol and ethyl acetate extract of the stem heartwood of *S. mangifera* were tested for their anti-inflammatory and analgesic activities. In this test, ethyl acetate extract substantially decreased rat paw volume compared to methanol extract in an S.D. rat model of inflammation. Acetic acid persuaded writhing reflex test and formalin persuaded licking test showed significant analgesic properties (Rao *et al.*, 2009). An investigation into the analgesic properties of the ethanol bark extract of *S. pinnata* in the acetic acid test model, analgesic properties were equivalent to the acetylsalicylic acid (20 mg/kg) in

a dose dependent manner. These anti-inflammatory and analgesic investigations results on *S. mangifera* have proven the traditional uses of this plant to be effective, particularly as a pain reliever (Mondal *et al.*, 2021; Panda *et al*., 2009).

3.2 Activity against diarrhoea and ulcers

The methanol extracts of *S. mangifera* bark were studied for castor oil induced diarrhea and ulcer protective effect on indomethacin provoked ulceration in rats. Gastric ulcer was accomplished by orally dosing indomethacin to the rats. The ulcer index of rats' stomachs was estimated. The animals treated with bark extract illustrated an apparent decline of the ulceration effect of indomethacin. The extract was significantly inhibited activity against castor oil-induced diarrhea and subdued the ulcerogenic effect of indomethacin (Arif *et al.*, 2008).

3.3 Aspects of antimicrobial activity

Dilution tests and disc diffusion techniques were used to examine the antibacterial activity of the *S. mangifera* bark resin extract on *Bacillus subtilis*, *Enterobacter sakazakii*, *Escherichia coli*, and *Acinetobacter baumannii*. Gram-positive, bacteria, *B. subtilis* was the most sensitive to the resinous extract. No gram-negative bacteria and fungus (*S. cerevisiae*) were inhibited by the extracts (Gupta *et al.*, 2010). Traditionally, indonesian therapy for bacterial infection utilized the apical leaves of *S. mangifera*. The antibacterial effects of leaf extracts have been explored with regard to leaf orientation. Three leaf locations were obtained (apical, middle, and base leaf), and extracted with 70% ethanol, and antibacterial activities were evaluated using a process of agar diffusion using the *Staphylococcus aureus* (MHA) medium and amoxicillin-based *Pseudomonas aeruginosa* medium as a positive control. The apical location of the leaf had the greatest antibacterial effect against *S. aureus* and *P. aeruginosa* with zones of inhibition of 14.30 and 14.43 mm, respectively. The apical leaves of *S. mangifera* exhibit a greater inhibitory action than any other location (Lallo *et al.*, 2020).

Six different human pathogenic bacterial strains were treated with methanol, ethanol, and aqueous extracts of dry and green leaf extracts of *S. mangifera* in another research. *Enterococcus faecalis* inhibition reached its greatest level when using an ethanolic dry leaf extract (25.00 ± 0.58). *Shigella boydii* were similarly sensitive to dry methanolic leaf extract (25.17 ± 0.44). The green leaf extracts had a greater antibacterial effect against other test species. Aqueous extracts of green leaf inhibited *S. aureus*, the most (11.50 ± 0.76). The ethanol extract of green leaf exhibited the highest antibacterial activity (10.17 ± 0.44) against *Escherichia coli*. In the same way, the methanol extract of green leaf showed the highest antibacterial activity against *Klebsiella pneumoniae* and *Proteus vulgaris*, with (15.50 ± 0.29) and (12.50 ± 0.29) activities, respectively (Jaiswal *et al.*, 2019). The disc diffusion technique was used to assess the antioxidant and antibacterial activities of *S. pinnata* fruit, leaf, and pure compound SP-FD-7 (scopoletin) extracted from the fruit. In all studied bacterial strains, the crude extract fraction of leaf (CFL) demonstrated excellent antibacterial activity (Muhammad *et al.*, 2015).

3.4 Inhibition of oxidative damage

The aqueous fruit extract of *S. mangifera* was reported to have potent antioxidant properties. The scavenging activity against nitric oxide, peroxide and DPPH radicals with high reducing power has been studied (Arif *et al.*, 2011). The methanolic extract of stem bark was investigated for total antioxidant activity, iron-chelating capacity, reducing power, and for scavenging of superoxide anions, peroxynitrite, hydroxyl radicals, hydrogen peroxide, nitric oxide, and singlet oxygen and its correlation with phenolic and flavonoid contents. This report exhibits the potential antioxidant effects of aqueous fruit extract of *S. mangifera*. It has been observed that the methanolic extract of the bark has strong iron-chelating and reducing power. The extract of the bark is an important source of antioxidants and useful in preventing the progress of various diseases related to oxidative stress (Mandal *et al*., 2008; Dasgupta *et al.*, 2017). The antioxidant power from methanolic and aqueous extract of *S. mangifera* root was investigated for radical scavenging of DPPH and nitric oxide, and reducing power ability and analyzed with ascorbic acid as standard. Both the extracts are reported to exhibit impressive antioxidant activity, reducing power as well as nitric oxide scavenging activity which was dependent on the concentration of the extract. The methanolic extract was reported to show more reducing power and scavenging activities (Acharyya *et al*., 2010). The dried leaves extract of ethyl acetate, hexane, and antioxidant properties were evaluated by using multiple models. These extracts exhibited different levels of scavenging activities. All together the ethyl acetate and ethanolic extract sowed high scavenging activity at tested concentrations while hexane extract showed very less antioxidant activity. The reducing power was increased in a dose dependent manner in all extracts. The highest phenolic content was present in the ethanolic extract (27.76 ± 1.11 mg) gallic acids of dried extract, whereas the ethyl acetate extract showed the highest flavonoid content (86.53 ± 1.95 mg) quercetin of the dried extract (Jain *et al.*, 2014). The scavenging of nitric oxide, super oxides, hydrogen per oxides radicals and reducing power of *S. pinnata* bark extract were studied which exhibits potential antioxidant power in comparison to standard ascorbic acid (Hazra *et al.*, 2008).

3.5 Antidiabetic and antilipidemic properties

Diabetes and high cholesterol are two very serious health risks. In addition, these two phenomena are present in the majority of the case studies. In the animal model, diabetic animals are those whose blood glucose levels are above 225 mg/dl. The hypoglycemic properties of *S. mangifera* root and bark extracts were investigated in glucose loaded and alloxan induced hyperglycemic rats using glibenclamide as a reference (Mondal and Dash, 2009). In another experiment, the bark extracts of *S. mangifera* were studied for their hypoglycemic properties in adult wistar rats by using normal glucose loaded, alloxan induced hyper glycaemic albino rats. The reference standard for the activity comparison was 2.5 mg/kg of glibenclamide. In these investigations, the methanol extract proved to be the most effective antidiabetic drug. The traditional medications for diabetes with *S. mangifera* bark described in the article have been justified by these studies. In another experiment, antidiabetic and antilipidemic effects of *S. mangifera* fruit extract were investigated in alloxan induced hyperglycemic animals. The investigated animals were administered with a daily single dose of methanol extract of *S. mangifera* fruit at 0.25 g/kg, 0.5 g/kg, and 1g/kg for 21 days. On the 21st day, the animal was sacrificed and blood was collected. Lipid profiles have been tested. All decreased HDL levels rose substantially in comparison to the control group. In the examined group, the atherogenic index and coronary risk index were lower than the diabetic

control group. This *S. mangifera* fruit has a moderate antidiabetic activity and a high chance of discovering some lead chemicals against hyperlipidemia (Sutradhar *et al.*, 2018). Another experimental model of diabetes was used to study the hypoglycemic impact of the fruit pulp extract of *S. pinnata* in which 120 mg/kg of alloxan monohydrate was administered intra-peritoneally to induce diabetes. After the rats' blood glucose levels before and after alloxanization were tested. Blood samples were taken from rat tails at zero, two, four, eight, and fourteen days following treatment (Mayeedevi *et al.*, 2016). The findings showed that the glucose levels of normal rats with (0.1 and 0.5) g/kg of leaves extract were significantly reduced ($p < 0.05$) at 1, 2, and 3 h related to the control group (Sai *et al.*, 2021). An aqueous bark extract of *S. pinnata* administered as a single dosage to diabetic rats demonstrated excellent effectiveness (Attanayake *et al.*, 2014). The anti-hyperlipidemic activity of methanolic extracts from *S. pinnata* fruit was investigated for its effects on hyperlipidemic rats. Triton-induced hyperlipidemic rats were given an oral dosage of the extract at 100 and 200 mg/kg. Fenofibrate was used as the control treatment. The research has revealed that hyperlipidemia in all triton-induced rats is reflected in their high levels of blood and liver cholesterol, triglyceride, PL, VLDL, LDL, and HDL decrease (Raju, *et al.*, 2017).

3.6 Liver protective effects

An *in vivo* assessment of the hepatoprotective efficacy of methanol and ethyl acetate stem wood extracts was performed on rats treated with CCl_4 induced hepatotoxicity. For the treatment and control groups, the changes in marker phytoconstituents for liver damage (SGOT, SGPT, bilirubin, and ALP) were measured. After administering ethyl acetate extract, biochemical indicators (total cholesterol, blood glucose, LDL-C, and HDL-C) had significantly recovered and were close to normal. There was a clear reduction in SGPT, ALP, SGOT, and total bilirubin. Additionally, CCl_4-treated rats exhibited pathological alterations including centrilobular necrosis and vacuolization that were detected, indicating a greater protective effect in the silymarin and *S. mangifera* treated groups (Ganga-Rao and Jaya-Raju, 2010). Extracts of *S. pinnata* bark obtained *via* Pet. ether, acetone, chloroform, and ethanol were examined. It has been said that the acetone and ethanol extracts help to decrease the levels of serum aspartate-aminotransferase, alkaline-phosphatase, alanine-amino transferase, lactate-dehydrogenase, bilirubin, cholesterol, and malondialdehyde. Reduction in reduced glutathione, superoxide dismutase, catalase, and albumin levels was also seen ($p<0.05$, 0.01), with the greatest effect being observed in the 20 µg/ml dosage group. By reducing DNA damage caused by the induction of ethanol, they also show limited harm to those exposed (Iqbal *et al.*, 2016).

3.7 Cancer fighting properties

In vitro tests on two human cancer cell lines revealed that *S. mangifera* bark methanol extract (MESM) promotes apoptosis (MCF-7). This study tested two cancer cell lines and a normal cell line that was exposed to various doses of MESM and their vitality was measured. The A549 and MCF-7 cells, respectively, exhibited high cytotoxicity towards MESM, with an IC_{50} of 149.34 ± 13.30 and 147.84 ± 3.74 µg/ml. In normal lung fibroblast WI-38 cells, cytotoxicity was absent with an IC_{50} of 932.38 ± 84.44 µg/ml. Studies using confocal microscopy and flow cytometry both confirmed that MESM induces apoptosis in the tumors cell types. Poly-ADP-ribose polymerase cleavage was suggested to occur in the cascade, because of the induction of apoptosis by rising the Bax/Bcl-2 ratio of both cell types, as was discovered in immune blot results (Baban-Ghate *et al.*, 2014). Two types of extracts were made using chloroform and ethanol and then put to the brine shrimp lethality bioassay test. Ethanol extract showed a cytotoxicity LC_{50} of 65 µg/ml and LC_{90} of 160 µg/ml, whereas chloroform extract had LC_{50} and LC_{90} values of 170 and 325 µg/ml, respectively (Das *et al.*, 2011). The effect of biogenic nanoparticles from plants on human cancer cells, colon carcinoma HCT 116, and chronic myelogenous leukemic K562, as well as normal lymphocytes/erythrocytes, are evaluated in another research. In addition, the chemical synthesis of chemically produced ZnONPs (cZnONPs) was also studied. Biogenic nanoparticles were produced from aqueous leaf extract of *S. pinnata* (SpLZnONPs) using a sol-gel technique that used no hazardous chemicals. Our studies revealed that both cancer cell types were susceptible to SpLZnONPs, while cZnONPs were hazardous exclusively to HCT 116 cells. Intriguingly, the results of the DNA laddering pattern and cytomorphological alterations seen in these treated cells were suggestive of the stimulation of both apoptosis and necrosis at the same time. The ability of nanoparticles to inhibit cell proliferation was shown by their effects on cell-cycle clonogenic capacity, distribution, wound curing, and comet tests. Through testing, we have discovered that induced apoptosis is linked to ROS, the trouncing of mitochondrial membrane potential, the externalization of phosphatidylserine, and an increase in calcium levels. Quantification of apoptotic gene expression was done using real-time quantitative PCR and Western blotting. A comparison of SpLZnONPs with cZnONPs in lymphocytes and erythrocytes through mitotic index analysis, MTT, and hemolytic tests showed that the former did not display any adverse effects in these cells while the latter exhibited the toxicity that is often seen in chemicals (Ahlam *et al.*, 2020).

As the information on the bioactive chemicals in *S. pinnata* is reducing, the U87 human glioblastoma cell line has been employed to cram the primary components of the plant and their anticancer potential. The apoptosis caused by methyl gallate in U87 cells was shown to be dose-dependent by flow cytometric investigations. Additionally, this same result was verified by caspase activation throughout the cleavage of endogenous membrane poly (adenosine diphosphate-ribose) polymerase. In adding together to the increase in p53 expression, methyl gallate therapy also caused B-cell lymphoma-2-associated X and BH3 interacting-domain cleavage, along with a concurrent reduction in B-cell lymphoma-2 expression (Chaudhuri *et al.*, 2015).

3.8 Thrombolytic effects

S. pinnata leaf crude extracts were evaluated for their thrombolytic and anti-inflammatory abilities with the use of conventional treatments, such as streptokinase for thrombolytic activity and acetylsalicylic acid for membrane stabilization. One study reports that the ethyl acetate soluble fraction (58.06%) is more effective than the conventional streptokinase and water at causing clot lysis (69.23% and 3.03%, respectively). Ethyl acetate soluble fractionates are also believed to prevent human erythrocyte membrane hemolysis, but the mechanism for this is unknown. These effects were attributed to flavonoid content (132.27 ± 0.25) (Uddin *et al.*, 2016). The non-polar parts of *S. pinnata* fruit exocarp extract were

further partitioned using polar solvents, and each separation was examined for thrombolytic activity. The thrombolytic activity is statistically significant for all fractions (Kawsar *et al.*, 2013).

3.9 Activity against platelet aggregation

The extraction of stem bark powder was performed using hexane, chloroform, ethyl acetate, acetone, and methanol in a series of consecutive processes. The ethyl acetate extract demonstrated inhibitory action against platelet aggregation with IC_{50} values of 0.33 mg and 0.43 mg, respectively, for collagen and ADP. The methanol extract was also shown to prevent platelet aggregation, and its IC_{50} values were found to be 0.26 mg and 0.35 mg for collagen and ADP, respectively (Sivaprasad *et al.*, 2011).

3.10 Anthelmintic effects

Methanol extracts of stem bark and heartwood were tested on the earthworm, *Pheretima posthuma*, for their anthelmintic activities. A 20-40 mg/ml bark extract was less efficacious than a stem heartwood extract for *Pheretima posthuma* and causes paralysis and death (Gangarao and Jayaraju, 2009). The acetone and ethanol extracts of the medicinal herbs have both shown equal anthelmintic effects in comparative research, despite the superior performance of the ethanol extract, then acetone extract (Mondal *et al.*, 2010).

3.11 Laxative and diuretic action

Agar-agar (300 mg/kg) and furosemide (10 mg/kg) were employed as reference standards to assess the laxative and diuretic properties of methanol and chloroform bark extracts of *S. mangifera* in wistar albino rats. Estimated urine levels of Na, K, and Cl were performed using flame photometry and titrimetry. Both methanol and chloroform extracts exhibited laxative and diuretic effects. No substantial action was seen in the petroleum ether extract (Mondal *et al*, 2009).

3.12 Effects against tuberculosis

S. pinnata stem bark was extracted in n-hexane, chloroform, and 80% ethanol. In order to determine the anti-tubercular activity of the chloroform and ethanol extract was put through the proportion method, using lowenstein-Jensen medium with a control of 1, 10, and 100 mg/ml. The reduction in the number of colonies in the extract compared to the control was then calculated by mean. Reports indicate that the extracts are active against the MDR strain of mycobacterium TB, which means they suppress the infection with 100% effectiveness at a dosage of 100 mg/ml. The extract of chloroform reportedly shows greater suppression of *M. tuberculosis* development than that of ethanol (DwijaI *et al.*, 2016).

3.13 Adaptogenic effects

The stress-relieving activities of ethanol extract (EEFSM) and its separated acidic glycoside of fruit *S. mangifera* were assessed. EEFSM was examined for *in vivo* stress relaxing action *via* stress tolerance anoxia, swimming stamina, and cyclophosphamide-persuaded immune suppression paradigm at two dosages of 100 and 200 mg/kg /day and an acidic glycoside at 10 mg/kg /day doses. The blood values for red blood cells (RBCs), white blood cells (WBCs), and various body and organ weights were calculated after cyclophosphamide administration. These studies have shown that EEFSM and acidic glycosides lead to an increased tolerance to anoxia stress, a more extended swimming endurance, and a prolonged stay on the rotarod, and these studies have also demonstrated that such compounds alter the levels of hemoglobin, red blood cells, and white blood cells, in addition to organ and body weights, while ameliorating the effects of cyclophosphamide. The observations of the research specified that the acidic glycoside and extract of the plant had substantial stress-relaxing properties, and thus may be used as adaptogens (Arif *et al.*, 2016).

Table: 2 Pharmacological studies on *S. mangifera*

Pharmacological activity	Plants parts/phyto-constituents used	Assay/inference	References
Anti-inflammatory activity	Essential oil of fruit peel	Significantly inhibition of nitric oxide production persuaded by lipopolysaccharide in RAW 264.7 cell lines at 0.08%. g with IC_{50} value (0.031% - 0.0045%).	(Li *et al.*, 2020)
	Ethyl acetate stem bark extract	Significantly inhibits the production of pro-inflammatory mediator's construction tempted by lipopolysaccharide in RAW 264.7 cell lines.	(Ghate *et al.*, 2018)
	Ethanolic fruit extract	The results showed in *in silico* study, the active constituents of the plant and co-crystallized ligands, SPD-304) residues have a critical binding affinity with COX-1, COX-2, and TNF-α.	(Khalid *et al.*, 2021)
	Bark extract in n-Butanol and ethyl acetate	Significantly reduces the edema tempted by carrageenan (p<0.01).	(Sachan *et al.*, 2011)
	Methanol and ethyl acetate stem heartwood extract	Ethyl acetate extract was significantly reducing the paw edema of rat, whereas methanol extract produced a less significant reduction of paw edema.	(Rao *et al.*, 2009)
Analgesic activity	Methanolic fruit extract	Good analgesic effects tested by acetic acid induced writhing reflex (p<0.05) and formalin-induced licking method (p<0.05).	(Mondal *et al.*, 2021)
	Ethanolic bark extract	The acetic acid induced test showed a dose dependent (50-100 mg/kg; p.o) analgesic effects.	(Panda *et al.*, 2009)

Antidiarrhoeal and ulcerprotective	Methanolic bark extract	Significantly inhibited the activity against castor oil induced diarrhea and subdued the indomethacin ulcerogenic effects	(Arif *et al.*, 2008)
Antimicrobial activity	Resinous extract	The gram+ve bacteria, *B. subtilis*. microorganism are most susceptible to the resinous extract but less effective against the growth of gram-ve bacteria and fungus *S. cerevisiae*.	(Gupta *et al.*, 2010)
	Ethanolic extract of the apical, middle, and basal leaf	Each parts of the leaf has diverse phytoconstituent and the apical leaves have highest inhibitory activity than the other position.	(Subehan *et al.*, 2020)
	Dried and green leaf extracts	The *S. aureus*, *E. coli*, *K. pneumoniae*, and *P. vulgaris* are susceptible to the extract of green leaf.	(Jaiswal *et al.*, 2019)
	Fruits, leaves, and pure compound (scopoletin) isolated from the fruit	Fruits, leaves and pure compound (scopoletin) isolated from fruit showed good antibacterial effects against *S. aureus* and *E. coli.*	(Muhammad *et al.*, 2015)
Antioxidant effects	Aqueous fruit extract	The scavenging activity with high reducing power against nitric oxide, peroxide, and DPPH radicals.	(Arif *et al.*, 2011)
	Methanol stem bark extract	The bark extract of the plant showed potential antioxidant activity.	(Mandal *et al.*, 2008)
	Methanolic extract of root bark	Exhibited impressive free radical scavenging effects, reducing power as well as nitric oxide scavenging effects which was dependent on the concentration of extract.	(Acharyya *et al.*, 2010)
	Dried leaves extract	The ethyl acetate and ethanolic extract sowed high scavenging activity at tested concentrations while hexane extract showed very less antioxidant activity.	(Jain *et al.*, 2014)
Hypoglycaemic and Anti-lipedemic activity	Methanolic root bark extract	The methanolic extract was found to possess promising results comparable to that of the glibenclamide	(Mondal and Dash, 2009)
	Fruit extract	The fruit has a mild antidiabetic property and a good prospect for hyperlipidemic activity.	(Amrita *et al.*, 2018)
	Fruit pulp extract	Hypoglycemic action of the ethanolic extract is better compared to glibenclamide	(Diptimayee *et al.*, 2016)
	Leaves extract	Leaves have prominent hypoglycemic effects in the animal model which its traditional utilization for the treatment of diabetes.	(Sai *et al.*, 2021)
	Aqueous bark extract	Single-dose administration of aqueous bark extracts showed remarkable efficacy in diabetic rats.	(Attanayake *et al.*, 2014)
	Methanol fruit extract	The animals treated with extract at 100 and 200 dose showed effective reduction of biochemical parameters.	(Raju *et al.*, 2017)
Hepatoprotective activity	Stem heartwood extracts	The changed levels of biochemical markers were restored to near normal in the dose-dependent manner (100, 200, and 400 mg/kg) by treating with ethyl acetate extract and a significant decrease in serum enzymes (SGPT, ALP, SGOT) and total bilirubin.	(Ganga-Rao and Jaya-Raju, 2010)
	Stem bark extracts	Prevent the increased serum levels of *Aspartate-aminotransferase, Alanine-aminotransferase, Alkaline-phosphatase, Lactate- dehydrogenase,* cholesterol, bilirubin, and malondialdehyde. Also decrease in reduced glutathione, catalase, superoxide dismutase, and albumin significantly (p<0.05-0.01) in a dose-dependent manner.	(Rahman *et al.*, 2016).

Anticancer activity	Methanolic bark extract	Methanolic bark extract (MESM) showed prominent cytotoxicity to A549 and MCF-7 cells. IC_{50} values of the tested sample were 149.34 ± 13.30 and 147.84 ± 3.74 µg/ml, respectively. No cytotoxicity was initiated in the normal lung fibroblast cell line (WI-38).	(Baban-Ghate *et al.*, 2014).
	Ethanol and chloroform bark extracts	Chloroform and ethanolic fractions of the bark were experienced for cytotoxic potentiality by use of brine shrimp lethality bioassay test. In the case of cytotoxicity of ethanolic extract, LC_{50} was found to be 65 µg/ml and LC_{90} 160 µg/ml while chloroform extract exhibited LC_{50} value of 170 µg/ml and LC_{90} value of 325 µg/ml.	(Das *et al.*, 2011).
	Phyto derived biogenic nanoparticles aqueous leaf extract	Mitotic index study and hemolytic analyses on lymphocytes and erythrocytes evidently revealed the absence of any poisonous effects of SpLZn ONPs in these cells related to the toxicity of the chemically derived cZnONPs, thereby showing the biocompatibility and discerning action of the biogenic nanoparticles.	(Abdul Aziz *et al.*, 2020).
	Methyl gallate from methanolic extract of bark	Methyl gallate treatment persuaded the appearance of p53 and B-cell lymphoma-2-associated X and cleavage of BH_3 interrelating domain with a associated decline in B-cell lymphoma-2 expression.	(Chaudhuri *et al.*, 2015)
Thrombolytic activity	Ethanolic extract with various partitions of the leaves	Among all partitions, ethyl acetate miscible fraction exhibits 58.06% clot lysis as compared to the standard streptokinase and water (69.23% and 3.03%).	(Uddin *et al.*, 2016)
	Ethyl acetate and an aqueous fraction of ethanolic extract of the exocarp of fruit	Statistically significant at (p<0.05 for ethyl acetate and water extracts, p<0.001 for others).	(Manik *et al.*, 2013)
Platelet aggregation inhibitory activity	Fruit powder	The ethyl acetate fractions presented possible platelet aggregation inhibitory effects with IC_{50} values of 0.33 mg and 0.43 mg for antagonists corresponding to collagen and ADP.	(Sivaprasad *et al.*, 2011)
Anthelmintic activity	Methanolic extract of stem bark and heartwood	The bark extract was reported to be less active than the stem heartwood extract at lower concentrations (20-40 mg/ml) leading to paralysis and death of *Pheretima posthuma*.	(Gangarao and Jayaraju, 2009)
	Acetone and ethanol extracts	the superior performance of the ethanol extract, then acetone extract.	(Mondal *et al.*, 2010).
Laxative and diuretic activities	Different extracts of the bark	The methanol and chloroform extracts produced significant laxative and diuretic activities. The petroleum ether extract was lacking any significant activity.	(Mondal *et al.*, 2009).
Anti-tubercular activity	n-Hexane, chloroform and 80% ethanol.	These extracts were reported to be active against the MDR strain of *M. tuberculosis* with 100% inhibition at a concentration of 0.1 g/ml. The chloroform fractions reported showing larger embarrassment against *M. tuberculosis* growth in comparison to ethanol extract.	(Putra *et al.*, 2016)
Stress relaxant activities	Ethanol extract and its separated acidic glycoside of fruit	The research indicated that the acidic glycoside and extract of the plant had substantial stress-relaxing properties and thus may be used as adaptogens.	(Arif *et al.*, 2016)

4. Management of seasonal disease with *S. mangifra*

There is a certain kind of depression that is tied to season changes and begins and appearances at approximately the same time every year. Among those with SAD, the condition normally appears in the autumn and continues throughout the winter. The occurrence of SAD is associated with the occurrence of depression. Symptoms vary significantly depending on the season; they worsen in winter and become better in spring. There is a considerable variation in the severity, features, and pattern of SAD from person-to person. As a rule, most individuals are bothered by symptoms that occur in a relentless nature simultaneously every year. People who are strong in both body and mind are in constant contact with nature (Kamal *et al*., 2017; Ahmad and Ghosh, 2020). Infections, allergies, and ongoing deterioration of tissues and organs produce seasonal illnesses. There is a new kind of illness sweeping the world that cannot be cured with modern antibiotics, therefore herbal medicines may serve as a workable alternative to combat it, because of the least negative effects and lowest toxicity, plants that produce natural remedies are becoming common (Kamal *et al*., 2019). Herbal medicines may resolve the symptoms of problems caused by the virus milder and shorter in duration, thereby reducing the need for outpatient services and antibiotics, the amount of viral shedding, and perhaps even the death rate in some populations. *S. mangifera* is extremely efficient in treating the common cold, especially when used as a decoction. The leaves of this plant may be used to treat influenza, asthma, bronchitis, cough, and cold by mixing honey and ginger with the juice. Decoction of the *S. mangifera* leaves, cloves, and ordinary salt is immediately beneficial for instances of influenza. It is also a boon to the health of the respiratory system, as it facilitates the mobilization of mucus in bronchitis and asthma. The leaves of *S. mangifera* help in colds and flu. Drinking a beverage made from boiled mango blossom and leaf water helps alleviate sore throats. The leaves, roots, fruits, and flowers of various plants have a pungent and turpentines flavor with an important nutritional quality, as well as low-calorie content and high protein, zinc, chitin, fiber, nutrients, vitamins, and minerals, which are all useful in the treatment of the seasonal affective disorder (Shankaran *et al.*, 2006; Andola *et al.*, 2010; Hafizur *et al.*, 2017). The rate of acute diarrhea in certain regions has been shown to be triggered by SAD, which may be seen in increases in rainfall, warmth, and allergens. Diarrhea became less common in the winter months, but it became more common in the summer and in the first rainy season.

In addition to being caused by an illness, changing dietary habits, response to medicine, or seasonal changes, this may also result from a change in water or food (Pinfold *et al.*, 1991). Emblematic home treatment for nausea, indigestion, and diarrhea is to take 10 g of juice from a delicate fruit combined with 50 g of sugar candy and 0.5-0.8 g of black pepper powder (Arif *et al.*, 2009). As shown by its flavonoid content, this extract has antidiarrhoeal effects, since it minimizes the intestinal agitation and hydro-electrolytic discharge prevalent in diarrheal circumstances (Mondal *et al.*, 2021). A well-known, beverage “lolohcemcem, from Bali loloh”, is often available in the tourist town of Penglipuran Bangali. “Lolohcemcem” is made from the leaves of *S. mangifera*”cemcem” or “kedondong” in other languages. This beverage may be beneficial in fighting the infections associated with seasonal affective disorder. Many tribe people consume this beverage every day, to protect themselves from COVID-19 infections (Laksemi *et al.*, 2019). This plant’s fruit contains several volatile oils (5-methyl-2-furaldehyde, isopropyl myristate, α-pinene, camphene, α and γ-terpineol, ethyl cinnamate, caryophyllene, isoborneol, γ-eudesmole) that have many antibacterial and antiviral effects. Because volatile oils are lipophilic and tiny molecules, they may positively affect the ability of viruses to replicate in the body (Yuva *et al.*, 2020; Nupur, 2020).

5. Conclusion

For the physicians and public, the medicine’s side effects in developing nations are of significant concern since it is more expensive day-by-day. Future experiments must be done to fully demonstrate the medical benefits of *S. mangifera*. Farming that is environmentally sound and profitable offers farmers a means of making a living. Extensive research has shown that *S. mangifera* improves endurance, strengthens the immune system, fights inflammation, lowers radiation damage, and relieves seasonal affective disorder. A variety of mental and physical issues may be combated by *S. mangifera*, including an assortment of physiological, chemical, and viral problems. In addition, it also helps to restore compromised physiological and psychological processes to a healthy, natural condition. It is also significant to study more about the developments by which hog plum fruit and its bioactive components indorse human health. A systematic investigation of the literature existing on *S. mangifera* has revealed that it is a widespread medicine for the treatment of diseases among several ethnic groups, Ayurvedic and traditional practitioners. Investigators are discovering the beneficial potential of this plant because it has more beneficial possessions that are not known.

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Conflict of interest

The authors declare no conflicts of interest relevant to this article.

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