

Plant Profile, Phytochemistry, And Pharmacology of Syzygium Cumini: A Review

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Abstract— Traditional medicine is used by more than half of the world's population and one of the key roles of traditional medicine is the utilization of plant extract and active ingredients, among them, *Syzygium cumini* is commonly known as java plum (" Indian blackberry "), Jamun, black plum, and Malabar plum, a plant of the family Myrtaceae. Plant parts such as leaves, stems, fruit, seed, and bark have been reported for possessing antihyperglycemic, hypolipemiant, anti-inflammatory, cardioprotective, and antioxidant activity. It is used for the treatment of ulcers, asthma, dysentery, thirst, biliousness, sore throat, and bronchitis, another user is a good blood purifier. Screening of leaves, seeds, fruit, and stem bark shows the presence of cyanogenic glycosides, essential oil, tannins, flavonoids, alkaloids, phenols, anthocyanin, steroids, terpenoids, resin, saponin, and cardiac glycosides. This review focus on the detail of geographical distribution, physicochemical parameter, phytoconstituents, and pharmacological properties of *Syzygium cumini*.

Indexed Terms— *Syzygium cumini* diabetes, Indian blackberry

I. INTRODUCTION

A plant-derived medication is regarded as the first defense system in sustaining health and battling disease and plants are still the primary sources of new therapeutic drugs. *Syzygium cumini* is one of the traditional medicinal plants available worldwide. The seeds have been reported to have each flavonoid ripe fruit of *S.cumini* sweet mildly sour and astringent flavor. Medicinal plants in the Unani system are commonly for the treatment of diabetes mellitus and are extensively used by the masses in India for the treatment of anti-HIV, oxide scavenging, and free

radical scavenging, anti-fertility, anorexic-genic, radio protective activities.

1.1. Geographical distribution - The United States Department of Agriculture brought the tree to Florida in 1911, and it is now widely planted in tropical and subtropical climates around the world. The jamun is native to India, Burma, Ceylon, and the Andaman Islands (Zeven and de Wet, 1982), and can be found growing up to 1300 metres above sea level in the Indian plains Punjab, Haryana, Uttar Pradesh, Maharashtra, Gujarat, Madhya Pradesh, Bihar, Chhattisgarh, Jharkhand, Karnataka, Tamil Nadu, and Andhra Pradesh are some of the places where it is growing as a wild or semi-wild plant. It is originally from India, and is widely distributed in Asian countries such as Malaysia, Thailand, Philippines, Myanmar, Sri Lanka, and Andaman, Islands. From the Indo-Gangetic plains in the north to Tamil Nadu in the south, it is widely grown. *Syzygium cumini* has been brought to the Pacific and Indian Ocean islands, as well as Australia, Hong Kong, and Singapore. This species is propagated both by seed and vegetative method.

1.2. History –

S. cumini is commonly known in India as Indian black plum, Java plum, Indian blackberry, and jamun. It is known as jam- bavam in Sanskrit, which means it was widely diffused in ancient India. According to tradition, Goddess Jambodini (the heavenly mother) resided for a long time near the Jambo river. She enjoyed eating the fruits of the *S. cumini* trees that grew along the river's edge. According to Indian mythology, all Devas, Asuras, and Nagas worshipped Jambodini with fervour in order to achieve salvation. Ancient mining experts believe that the presence of *S. cumini* in a particular location indicates the presence of gold mines in the area. Using this indicator, they

discovered a gold mine on the banks of the Jamboo River and struck high-quality gold, which is especially suitable for manufacturing exquisite ornaments (Rajasekharan et al. 2005).

In ancient Indian culture, tree worship was a common practise. In the southern region of India, this practise is still alive, and some temples designate their trees, known as sthalavriksha (tree of sacred place), to be affiliated with the temple's deity. Jambu (*S. cumini*) of the Jambukeswara temple in Thiruchirapalli (Tamil Nadu), Tirunelli (*Phyllanthus emblica*) of the Tirunelli temple in Wayanad (Kerala), and Mula (*Bambusa bambos*) of the Aaranmula Parthasarathi temple in Pathanamthitta are only a few examples (Kerala).

Telgu : neredu chettu
Urdu: jaman
Panjabi : jamalu
Malayalam: naval
Mizo: hmuipui lenhmui
Assamese jamu kala jamun

Table-1
Scientific classification, vernacular name and local name of *syzygium the cumini*

Scientific classificatio	Vernacular name	Local name
Kingdom:	Srilanka:	Marathi:
Plantae	Jambola.	Jambhul
Division:	Malaysia:	English
Angiospermae.	Jambulana, Ambulant	Javaplum,black plum
Subclass:	Philippines:	Gujarat: Jamba
Rosidae.	Dhut (Tagalog Bisoya), Lomboi (Ilocano)	Subclass: Rosidae.
Order:	Laos: VA	Hindi: Jamun
Myrtales		
Family:	Thailand: was (central), hakhiphae Chiang (Rai).	Tamil: Nagai
Myrtaceae		
Genus:	Combodia	Nepali:
<i>syzygium</i>	pring bai	kaalo,jamun , jaamu, jamunna, phanir, kanada:
Species:		nerale, neril,
<i>S.cumini</i> (L.)		neeralu, neerala
Skeels		Manipuri: jam

1.3 Morphology of *syzygium cumini* –

S. cumini is a large, densely foliaceous, evergreen tree with a light greyish-brown thick bark and a partially deciduous tree with medium to large polyembryonic fruit species (Chase and Reveal, 2009). The leaves are evergreen, 5 to 18 cm long, oblong-oval or elliptic, and opposite. In clusters of 4 to 5 joined petals, the sessile whitish-yellow flowers with funnel-shaped calyx emerge. Flowers bloom in February and March, followed by fruits between May and July. Berries with 1 or 2 to 5 white or green seeds, oblong to ovoid-oblong, dark purple colour. *S. cumini* has rudimentary seeds as well (Morton, 1987; Stephen, 2012). Jamun seeds are tenacious, multicotyledonous, and have many embryos (Swamy et al., 1999, Thoke et al.2011).



Stem Bark



Leaves



Fruit



Fruit



Ripened Fruit



Seeds

Figure 1. parts of *S. Cumini* (*L.*)

1.4. Nutritional information –

The whole plant of *Syzygium cumini* is edible and is used as food. The pulp and seeds of the tree are beneficial in the treatment of diabetes, while the tree's leaves are beneficial in the treatment of tooth and gum problems. Gingivitis is prevented by the tree's bark,

which is also helpful against worm infestation in the body. The fully ripe fruit is eaten fresh and can be processed into jam, sherbet, jellies, juice, or turts, A dialysis patient can freely consume 5-6 pieces of Jamun .100 gm of the fruit contain 79mg of potassium making it kidney-friendly fruity.

The major part of the fruit is water (80.80%), ash(0.70%), protein (0.81%) and sugar (12.70%), acidity(0.63% as sulphuric and 0.88% as malic. The fruit also contains 8.30 - 15.00 mg of calcium, 35.00 mg of magnesium, 15.00 - 16.20 mg of phosphorus, 1.20 -1.62 mg of iron, 26.20 mg of sodium, 55.00 mg of potassium, 0.23 mg of copper, 13.00 mg of sulfur,8.00 mh of chlorine, 8. I.U of vitamin A, 0.01 - 0.03mg of thiamine, 0.009 - 0.01 mg of riboflavin, 0.20 -0.29 mg of niacin, 5.70 - 18.00 mg of ascorbic acid,7.00 mg of chlorine and 3.00 mcg of folic acid per100 g of edible portion (Poatilet al., 2012)

II. BIOLOGICAL INVESTIGATION

Neumerous *Syzygium* species were mentional in traditional literature of material media and Ayurveda for the treatment of various disorder and disease conditions. Moreover, the plant species has been reported for varies pharmacological activities and are listed in table 2.

Table - 2

Biological investigation of plant from *syzygium cumini*

Sr.no used	syzygium species	part Reported activity
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<i>Syzygium aqueum</i>	Bark, Leaf, Root
Astringent , Anthelmintic, Anti-oxidant	
<i>Syzygium aromaticum</i>	Flower bud,
Flavouring agent, Spice	
	Leaves
Antioxidant, Acetylcholinesterase, Alzhimers Disease	
<i>Syzygium australe</i>	Leaves
Anti-microbial activity	
<i>Syzygium .corynanthum</i>	leaves, flower, fruit and seed
Antibacterial activity	
<i>Syzygium cyclophyllum</i>	Bark, Leaves
Antimicrobial	
<i>Syzygium cumini</i>	Leaves, Flower, Fruit,
Anti-hyperglycemic, Gingivitis,Anti-inflammatory	
	Seed ,Root
Antifungal diuretic, astringent	
<i>Syzygium curanii</i>	Fruit, leaves
Antihypertensive	
<i>Syzygium hodgkinsoniae</i>	Fruit ,Seed, & Bark
Leaves Antibacterial	
<i>Syzygium Guianese</i>	Leaves, Bark, & Seed
Antifungal. Antibacterial, Mollus	
<i>Syzygium guehoi</i>	Leaves. Bark, Fruit
Antimicrobial	
<i>Syzygium gambleannum</i>	Seeds
Antifungal, Antibacterial	
<i>Syzygium francisii</i>	Bark, Fruit, Seeds, Leaves
Antimicrobial	
<i>Syzygium jambos</i>	Fruit,Flower, Seeds
Antipyretic,Anaesthetic	
<i>Syzygium maire</i>	Fruit
Antioxidant Activity	

<i>Syzygium malaccense</i>	Seeds,Root,Leaves Bark
Astringent, Antibiotic	
<i>Syzygium moorei</i>	Leaves
Antimicrobial	
<i>Syzygium oleosum</i>	Fruit , Leaves
Antifungal, Antioxidant	
<i>S.Samarangense</i>	Fruit,
Antioxidant, Diuretic, Abortifacient, Febrifuge	
	Leaves
Fewer, Diarrhea, Diabetic, Cough, Headache ,Bark	
Antimicrobial, Treat wound	
Antihyperglycemic, Spasmolytic	
<i>Syzygium smithii</i>	Leaves,Seeds &Fruits
Antimicrobial, Preservative	
<i>S.stocksii (duthie)gamble</i>	Leaf
Antimicrobial	
<i>S. tranocorium gamble</i>	Leaf
Arthritis, Dibetes ,Hypoglycemic	
<i>Syzygium wrightii</i>	Fruit, Leaves &Fruit
Antimicrobial Activity	
<i>S. zylanicum (L.)</i>	Leaves
Antioxidant	
<i>Syzygium xerampelinm</i>	Bark Fruit
Antimicrobial Activity	
<i>S.guineense (wild)Dc.</i>	Root, Leaf
Antimicrobial	

III. PHYTOCHEMICALS

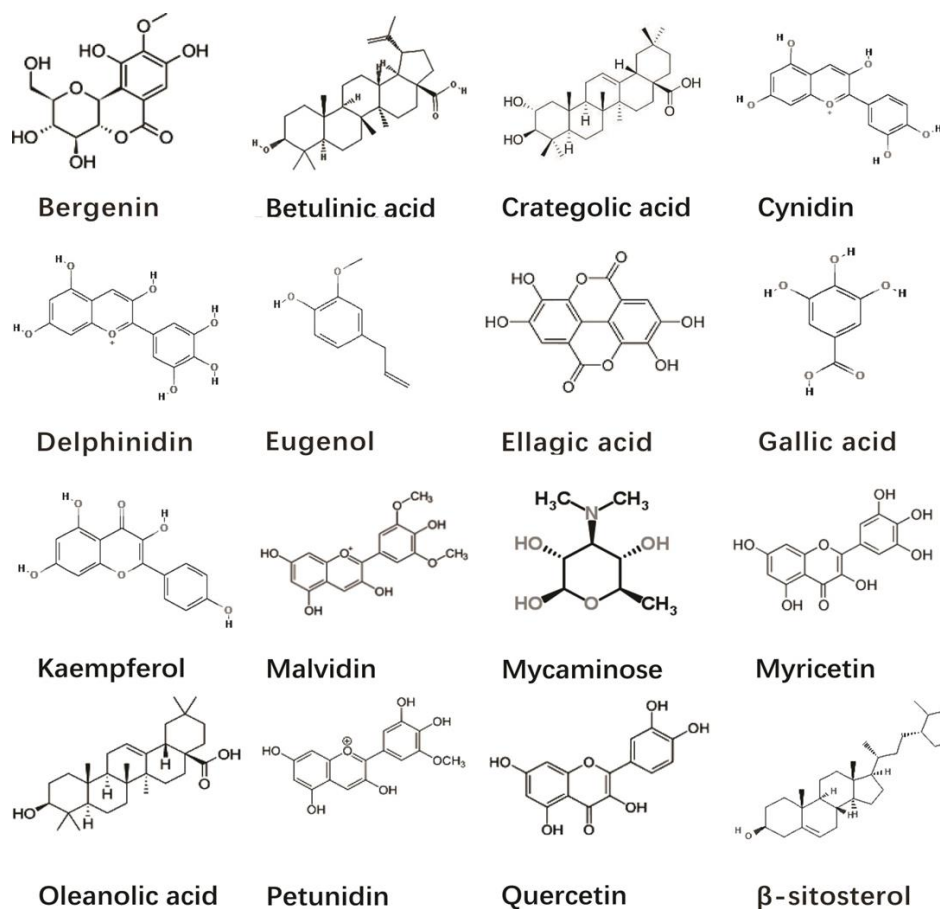
Several chemical have been identified from seeds of *syzygium cumini (L.)* and are listed in table 3.

Table-3
Phytochemical Constituents in Different Parts of *Syzygium cumini*

Part	Chemical constituent	Reference
Edible	Vitamin C, vitamin A, riboflavin, nicotinic acid,	Sharma and Seshadri (1955)
Pulp	choline, folic acid, raffinose, glucose, fructose, maleic acid, gallic acid, cyanidin glycoside, cyanidin diglycoside, petunidin, malvidin, delphinidin-3-gentiobioside, and malvidin-3-laminaribioside	Anonymous (2002) Teixeira et al. (2006)
Seed	Gallic acid, glycoside jamboline, jambosine, triterpenoid B, pentacyclic triterpenoid (friedelin), tannins, ellagic acid, β -sitoterol, gallitanins, terpenes (1-limonene, dipentene), corilagin, 3,6- hexahydroxydiphenylglucose, 4,6-hexahydroxydiphenylglucose, 1-galloylglucose, 3-galloylglucose, quercetin, and elements such as zinc, chromium, vanadium, potassium, and sodium	Bhatia and Bajaj (1972, 1975)Anonymous (2002) Jagetia and Baliga (2002) Ravi et al. (2004) Evans (2007)

		Kokate et al. (2008)
Bark	Gallic acid, Eugenia triterpenoid B, ellagic acid, pentacyclic triterpenoid (betulinic acid), pentacyclic triterpenoid (friedelin), resin (myricetin), phytosterol (β-sitosterol, myricyl alcohol), eugenin, epi-friedlanol, friedelanol, quercetin, kaempferol, myricetin, gallic acid, ellagic acid, flavonoids, and tannins	Bhatia and Bajaj (1972,1975) Bhargava et al. (1974) Anonymous (2002) Yogeswar and Sriram (2005) Ivan (2006) Evans (2007) Kokate et al. (2008)
Flower	Oleanolic acid, Eugenia triterpenoid A, Eugeniatriiterpenoid B, pentacyclic triterpenoid (Friedelin), tannins, ellagic acid, flavanols (isoquercetin, quercetin, kaempferol, myricetin, myricetin), 3-L-arabinoside, dihydromyricetin, and quercetin galactosides	Bhatia and Bajaj (1972) Subramanian and Nair (1972) Anonymous (2002) Kokate et al. (2008)
Leaves	Gallitanins, terpenes (1-limonene, dipentene), sesquiterpenes (cadalane type, azulene type), acylated flavanol glycosides, myricetin, myricetin 3-O-4-acetyl-L-rhamnopyranoside, galloyl carboxylase, esterase, betulinic acid, crategolic (maslinic) acid, n-hepatcosane, n-nonacosane, n-hentriacontane, n-octacosanol, n-triacontanol, and n-dotricontanol	Gupta and Sharma (1974) Anonymous (2002) Jagetia and Baliga (2002) Timbola et al. (2002) Kokate et al. (2008)
Roots	Flavonoid glycosides, isorhamnetin 3-O-rutinoside	Vaishnava et al. (1992) Udayan et al. (2006)

Fig.2 structure of some Chemical e important phytochemical present in different part of jamun , *Syzygium cumini*



IV. PHARMACOLOGICAL PROPERTIES

4.1. Antimicrobial and Antiviral Activities

The antibacterial activity of *S. cumini* leaf extract was reported by Oliveira et al. (2007). MICs *The main oil constituents were α -pinene (17.53%), α -terpineol (16.67%), and allo-ocimene (13.55%). The oil of *S. cumini* demonstrated strong inhibition activity against the tested bacterial strains, such as gram-positive bacteria, *Bacillus subtilis* ATCC 6633, *S. aureus* ATCC 6538, and *Sarcina lutea* ATCC 9341, and gram-negative bacteria, *Escherichia coli* ATCC 8739, *P. aeruginosa* ATCC 9027, *Agrobacterium tumefaciens* ATCC 1593-2, and *Pectobacterium carotovorum* subsp. *carotovorum* ATCC 39048 (Elansary et al. 2012).*

4.2. Anticarcinogenic effect

In Vitro Studie

S. cumini fruit extracts high in anthocyanins were tested in a series of breast cancer cells for their antiproliferative potential. MCF-7 and MDA-MB-231 breast cancer cells were suppressed by the extracts in vitro, however MCF-10A, a kind of normal breast cell, was the least effective (Li et al. 2009). Fruit extract suppressed the proliferation of MCF-1, PC-3, and A2780 cells, which was further validated by Yadav et al. (2011). The plant's pulp, seed, and peel extracts all induced apoptosis in human breast (MCF-7) and prostate cancer (PC-3) cells, with the pulp extract being the most potent of the three extracts.

4.3. Immunomodulatory activity

Immunomodulatory activity of seed extract of *S. cumini* was investigated. The delayed-type hypersensitivity (DTH) reaction and humoral antibody titers in rats were observed to increase in a dose-dependent way. In rats, the therapy raised the overall number of white blood cells, neutrophils, and lymphocytes (Mastan et al. 2008). This According to the study, *S. cumini* seed extract has the ability to stimulate the body's hematopoietic system, implying that the plant could be used to treat a variety of diseases. During radiation therapy or chemotherapy, patients develop immune-deficiencies.

4.4. Radioprotective effect

One of the most common cancer treatment options is radiation therapy. However, one of the biggest

disadvantages of this treatment is the damage it does to normal tissues nearby. A good radioprotectant is one that protects normal tissues without jeopardising radiation's anticancer potential. In radiation and nuclear medicine, such agents are in high demand. Several research groups looked into the radioprotective effects. Effects of *S. cumini* on various systems Using a micronucleus assay, the leaves of *S. cumini* were tested for radioprotection. The cells were obtained from healthy donors' blood samples and subjected to in the presence and absence of leaf extract to -irradiation *S. cumini* was discovered to have Micronuclei production in lymphocytes is reduced.

4.5. Treatment of Retinitis

Priya et al. (2013) investigated the binding affinity of five anthocyanin compounds from the *S. cumini* fruit peel with the X-linked retinitis pigmentosa (RP2) gene (a mutant of this gene causes loss of vision in humans) and identified cyanidin 3,5 diglucoside with the lowest G score (-12.62 kcal/mol) as an inhibitor that could be used to treat retinitis pigmentosa in humans.

4.6. Anti- allergy

Allergy is an abnormal reaction of the body to an allergen that is ingested, injected, inhaled, or comes into touch with the skin. This condition necessitates the development of an innovative, safe, and successful treatment. The aqueous extract of SC leaves (25-100mg/kg, p.o.) reduced rat paw edoema produced by 48/80 (allergenic chemical), histamine, and 5-HT, according to a study. The extract, on the other hand, had no effect on platelet aggregating factor-induced paw edoema.⁽¹⁾

4.7. Anti- Diarrhoea and Dysentery

Jamun (*Syzygium cumini*) is utilised in traditional medicine in its entirety, including seeds, fruit, leaves, flowers, and bark. Seeds were used by Charaka. Diarrhoea, and leaf decoctions As an astringent, bark should be used. Sushruta gave the instructions. Internal fruit consumption in obesity, vaginal fruit consumption colds, discharges, and menstrual problems Intrinsic bleeding requires an infusion. The bark has a distinctive flavour, astringent; dosages (56-112 ml) of its juice are administered diarrhoea, dysentery, and other persistent gastrointestinal problems menorrhagia. Bark decoction is a method of extracting the essential oils from the tree.

Mouthwashes and gargles that are effective in the treatment of dental caries Gums that are spongy, stomatitis, and a relaxed throat mouth and other disorders additionally, bark is used for skin rashes.^{2,3}

4.8. Antipyretic activity

Chloroform extracts from dried seeds showed antipyretic activity, Sharma et al and Dr. Mahapatra studied methanol extracts from *Syzygium* seeds. The seed extract is administered intraperitoneally to rats at a dose of fifty thousand grams per kg of active pyrexia compared to that induced by yeast.

4.9. Cardioprotective activity

In a study conducted by Herculano et al., the hydro-alcoholic extract from the fruits of *S. cumini* was evaluated for its antihypertensive and vasorelaxant effect. Its findings revealed that the extract caused hypotension and had antihypertensive properties. (4) This finding supports the use of the plant's fruits as a cardioprotective agent.

4.10. Antihyperlipidemic Activity

In their investigation, Kasiappan et al found that oral administration of an ethanolic extract of *E. jambolana*-kernel (100mg/kg body weight) has antihyperlipidemic effect in streptozotocin-induced diabetic rats.⁽⁵⁾

4.11. Antianaemic activities

The antianaemic activity of *S. cumini* aqueous seeds extract has been reported. The seed extract of *S. cumini* was found to increase total haemoglobin levels in a study.⁽⁶⁾

4.12. Antioxidant Activity

Banerjee et al. (2005) according the inhibitor activity of the fruit skin of *S. cumini*. Zhi-Ping et al. (2008) investigated the antioxidant activity of *S. cumini* leaf extracts exploitation the DPPH atom scavenging and metallic element reducing antioxidant power (FRAP) assays. Shrikanta et al. (2015) found higher levels of resveratrol and polyphenol (gallic acid) and high antioxidant activity in Jaumun seeds (*S. cumini*)

4.13. Cardioprotective Activity

Atale et al. (2013) investigated the cardioprotective properties of *S. cumini* methanolic seed extract (MSE) in diabetic in vitro conditions and found that MSE

inhibited the production of reactive oxygen species (ROS) in glucose-induced cells, implying that Glucose-induced stress is protected from cardiac cells. A hydroalcoholic extract of *S. cumini* was shown by R. M. Ribeiro et al. (2014) to be effective. The antihypertensive effect was most likely attributable to the suppression of arterial tone and extracellular calcium influx, since leaves reduced blood pressure and heart rate in spontaneously hypertensive rats. The antihypertensive effect of a single oral administration of hydroalcohol extract from the fruits of *S. cumini* (EHSCF) was demonstrated by Herculano et al. (2014) in spontaneously hypertensive rats.

4.14. Antifertility Activity

Various extracts of *S. cumini* (= *E. jambolana*) seed were studied for their postcoital contraceptive activity and teratogenicity effect by Sarita et al. (2012). From 10 to 18 days of pregnancy, seeds extracts in petroleum ether, ethyl acetate, and ethanol were given orally at doses of 200 and 600 mg/kg body weight. Rats treated with ethyl acetate seed extract showed a significant abortifacient activity (97.07 percent) at 600 mg/kg body weight, but no developmental damage or teratogenicity.

4.15. CNS Protective Activity

Kumar et al. (2007) tested the CNS activity of ethyl acetate and methanol extracts of *S. cumini* seeds on albino mice in rota rod and actophotometer at doses of 200 and 400 mg/kg. Both extracts had a lot of CNS action.

4.16. Anti-Leishmania and Molluscicidal Activity

The hexanic extract of *S. cumini* leaves (IC₅₀ of 31.64 g/ml) showed potential antileishmanial activity against stationary-phase promastigotes of *L. amazonensis* and murine macrophages (T. G. Ribeiro et al. 2014). *S. cumini* essential oil and its major constituent, -pinene, have significant anti-Leishmania activity modulated by macrophage activation, with acceptable levels of cytotoxicity in murine macrophages and human erythrocytes, according to Franca et al. (2015).

4.17. Antinephrotoxic Activity

Adikay et al. (2010) investigated the nephroprotective effects of an ethanol extract of *S. cumini* fruits (250 and 500 mg/kg orally) on albino rats suffering from cisplatin-induced nephrotoxicity (6 mg/kg

intraperitoneally). *S. cumini*'s nephroprotector activity was determined by measuring blood urea nitrogen, serum creatinine, serum total proteins, urinary protein, and lipid peroxidation in the kidney. Cisplatin increased the amount of a serum marker, increased protein excretion in the urine, decreased creatinine clearance, and increased renal MDA. The effects of cisplatin were significantly reversed in animals given an ethanol extract of *S. cumini* fruits in a dose-dependent manner.

V. CONCLUSION

The traditional use of Jamun is mentioned in Ayurveda and it has tremendous health benefits against various diseases. *Syzygium Cumini* contains many phytochemicals in its seeds like jambolin and some organic acids. The leaves and bark are also full of secondary plant substances. Phytochemicals are useful in treating various health issues as discussed above. Various value-added products can be prepared from fruit as discussed above. Ultimately, we could say that *Syzygium Cumini* is a real therapeutic tree and its fruits can be marketed for the production of various processed food products.

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