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Syzygium cumini (Jamun) its medicinal uses

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Abstract

Syzygium cumini is a smooth and famous tree, about 8 to 15 meters high with white branch lets and reddish young shoots. Leaves are opposite, shiny and leathery, oblong-ovate to elliptic or obovate-elliptic, 6 to 12 centimeters long, the tip being broad and shortly pointed. In Unani the kernel (*Khasta-e-Jamun*) used for the treatment. A lot of pharmacological work has been scientifically carried out on various part of *Syzygium cumini* but some other traditionally important therapeutically uses are also remaining to proof till now scientifically. It has astringent, carminative, stomachic, diuretic, anti-diabetic, anti-diarrheal, anti-inflammatory, radio-protective, gastro-protective, antioxidant, anti-allergic, anti-cancer, anti-bacterial, cardio-protective properties etc. The various chemical constituents present in Seeds yield glycosides, a trace of pale yellow essential oil, fat, resin, albumin, chlorophyll2, an alkaloid- jambosine³, gallic acid, 1-galloylglucose, 3-galloylglucose, quercetin and elements such as zinc, chromium, vanadium, potassium and sodium.

Keywords: *Syzygium cumini*, *Mizaj*, *Khasta-e-Jamun*, diabetes, *Badal*, studies

Introduction

Syzygium cumini is a smooth and famous tree, about 8 to 15 meters high with white branch lets and reddish young shoots. Leaves are opposite, shiny and leathery, oblong-ovate to elliptic or obovate-elliptic, 6 to 12 centimeters long, the tip being broad and shortly pointed. Panicles are borne mostly from the branch lets below the leaves, often being axillary or terminal, about 4 to 6 centimeters long. Flowers are small, numerous, scented, pink or nearly white, in clusters, without stalks, borne in crowded fascicles on the ends of the branch lets. Calyx is funnel-shaped, about 4 millimeters long, and 4-toothed. Petals cohere and fall all. Stamens are numerous and about as long as the calyx. Fruit is oval to elliptic, 1.5 to 3.5 centimeters long, dark purple or nearly black, luscious, fleshy and edible with a sweet astringent taste; containing a single large seed.

Origin and Distribution: Widely distributed throughout India- Sub-Himalayan tract, Assam, Burma to Malaya and Peninsular India. Found throughout the Philippines, planted, and in many regions spontaneous. Also occurs in the Indo-Malayan region generally [1,-3, 5, 13, 15-17].

Taxonomical Classification: Botanical classification of *Syzygium cumini* Kingdom: Plantae, Class: Angiosperms, Order: Myrtales, Family: Myrtaceae, Genus: *Syzygium* Species: *cumini* [5, 13].

Vernacular name [1-10]:

Hindi	:	<i>Jaman, Jamun</i>
Sanskrit	:	<i>Jambo, Raj jambo</i>
Bangali	:	<i>Kalajaam</i>
Unani	:	<i>Jaman</i>
Eng	:	<i>Jamol, Jambul, Java Plum</i>
Latin	:	<i>Syzygium cumini</i> L.

Botanical Name : *Syzygium cumini* L.

Unani Description of *Syzygium cumini* L. [1-4, 7-11, 13, 14]: It is very famous and big size tree in India. The fruits of this plant are edible. The seeds of the fruits called kernel (*Khasta-e-Jamun*), which is used in diabetes and leaves & barks are also used in Unani system of medicine.

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Parts used (*Azja-e-Mustemil*): Leaves, bark, fruits, kernel (*Khasta-e-Jamun*).

Temperament (*Mizaj*): Cold & Dry in 2nd.

Action (*A'afal*): *Muqawwi-e-Meda wa Jigar Har* (Tonic for Hot Stomach & Liver), *Moharrik Ishtha* (Appetizer stimulant), *Qabiz* (Constipant), *Musakin-e-Hararat* (Analgesic).

Action (*Istemaal*): *Taqwiyat-e-Meda wa Jigar*, *Mushtahi* (Appetizer), *Ishal-e-Safrawi wa Damwi ko band karta hai*, *Ziabetees* (Diabetes).

Main action (*Naf-e-Kkas*): Habis Ishal, *Muqawwi-e-Meda* (Tonic for Stomach).

Side effect (*Muzir Asrat*): *Nfakh* (Dispersion) *aur Der-e-Hazm* (Delay in digestion).

Antidote (*Musleh*): *Kalimirch* (*Piper nigrum*) and *Namak* (*Sodium chloride*).

Substitute (*Badal*): *Chhota Bade ka Badal hai* (Small is substitute of bigger).

Compound formulations (*Murakkab*): Sirka (vinegar)

History: Widely distributed in cultivation in all over India. It is also Found throughout the Philippines, planted, and in many regions spontaneous. Probably of prehistoric introduction from Malaya. Also occurs in the Indo-Malayan region generally.



Jamun Plant's branch



Jamun

Folkloric ^[1-12]:

- In the Philippines, decoction of bark given internally for dysentery. Bark decoction also used as an anemia.
- Diarrhea: Liberal amounts of the fleshy portion of the fruit. Decoction of the bark used as a gargle or mouthwash for gingivitis and mouth ulcerations.
- Fresh juice of the bark given with goat's milk for diarrhea in children. Bark decoction as an astringent wash for wounds.
- Ripe fruit is astringent and considered an efficient remedy for diabetes. Decoction of leaves and bark also used for the same purpose, but the ripe fruit is considered the best.
- Pulverized dried seeds also used for diabetes. Powdered seeds and root-bark used for diarrhea.
- In India, seeds used for diabetes. Bark used for diarrhea, dysentery, and spongy gums. Poultice of leaves used for skin complaints. Powdered seeds also used for menorrhagia.
- In Unani medicine, seeds used as liver tonic, to enrich the blood, strengthen the teeth and gums, and as lotion to remove ringworm of the head. Fruit is used as astringent in bilious diarrhea; used as a gargle for sore throat and as lotion in tinea-capitis.
- Vinegar prepared from juice of the ripe fruit used as stomachic, carminative, and diuretic. Juice of leaves, alone or with other astringents, used for dysentery. Bark used for sore throats, indigestion, appetite loss, leucorrhea, bronchitis, asthma, ulcers and dysentery.
- In Brazil, leaves and fruits used to treat infectious diseases, diabetes and stomachaches.

Ethno-pharmacological Uses: One of the most popular fruits in the Philippines. Ripe fruit is eaten outright. Juice can be made into wine; used in the manufacture of red wine. Fruit is a good source of calcium and a fair source of iron. In Malaya, vinegar is made from the juice of the unripe fruit [1-6, 12-14, 23].

Chemical Constituents: Seeds yield glycosides, a trace of pale yellow essential oil, fat, resin, albumin, chlorophyll2, an alkaloid- jambosine3, gallic acid, ellagic acid, corilagin and related tannin,3,6-hexahydroxydiphenoylglucose and its isomer 4,6- hexahydroxydiphenoylglucose, 1-galloylglucose, 3-galloylglucose, quercetin and elements such as zinc, chromium, vanadium, potassium and sodium. Unsaponifiable matter of seed fat contains β -sitosterol. Phytochemical screening of the seeds yielded alkaloids, proteins and amino acids, flavonoids, phenols, glycosides, saponins, tannins, steroids, triterpenoids. Study of seeds yielded neither alkaloid nor enzyme, but an abundance of starch and tannin. Proximate analysis showed: Moisture 8.0, starch (diatase) 41.4, crude fiber 2.3, pentosans 2.1, protein 6.3, ash 2.9, dextrin 2.1, and tannin 6.0 [35, 38, 42, 59, 61].

Pharmacological Action: *Syzygium cumini* considered astringent, carminative, stomachic, diuretic, anti-diabetic, and anti-diarrheal. Studies have shown anti-diabetic, anti-inflammatory, radio protective, gastro-protective, antioxidant, CNS depressant, anti-allergic, anti-cancer, antibacterial, cardio-protective properties.

Studies Prove

- **Antioxidant / Tannins / Fruits:** Study isolated tannins from the fruit of *Syzygium cumini* and suggests the use of the fruit as a significant source of natural antioxidants.
- **Antioxidant / Fruit:** Study showed a significant correlation between extract concentration and percentage of free radical inhibition or lipid per oxidation. Authors suggest the antioxidant property of the fruit skin of *Syzygium cumini* may come in part from the antioxidant vitamins, phenolics, tannins and anthocyanins present in the fruit [15].
- **Anti-Diabetes / Bark:** Animal study of aqueous extract from *Syzygium cumini* bark showed stimulation of development of insulin positive cells from the pancreatic duct epithelial cells.
- **Anti-Diabetic / α -Glucosidase / Seed Kernels:** Study of *Syzygium cumini* seed kernel extracts *in vitro* and in Goto-Kakizaki (GK) rats showed inhibition of α -glucosidase as a possible mechanism for its anti-diabetic effect [17].
- **Phytochemicals:** Investigation on a Tropical Plant, *Syzygium cumini* from South India: Phytochemicals screening of extracts of *Syzygium cumini* seed revealed alkaloids, amino acids, phytosterols, saponins, steroids, tannins and triterpenoids. These phytochemicals probably explain the plants medicinal properties [18].
- **Anti-inflammatory / Seeds:** The study on SC extracts established the anti-inflammatory activity of the *Syzygium cumini* seeds [19].
- **Radioprotective:** Study evaluated the influence of a seed extract of *Syzygium cumini* (Jamun) on mice exposed to different doses of GAMMA-radiation: SCE treatment protected mice against

radiation sickness and mortality against all doses and showed an increase survival [20].

- **Gastroprotective:** The gastroprotective effect of tannins extracted from duhat (*Syzygium cumini* Skeels) bark on HCl/ethanol induced gastric mucosal injury in Sprague-Dawley rats: The study suggests the tannins extracted from SC have gastroprotective and anti-ulcerogenic effects [21].
- **Red Wine Source:** Study prepared a red wine from the anthocyanin-rich fruit of *Syzygium cumini* through fermentation using wine yeast [22].
- **Depressant Central Nervous System Activity:** Animal study of seed extract of *Syzygium cumini* showed dose-dependent depressant effect of locomotion attributed to the presence of saponins [24].
- **α -Amylase Inhibition / Anti-Hyperglycemic / Seeds:** Study of 11 medicinal plants showed *Syzygium cumini* seeds with strong inhibition of α -amylase activity. Crude ethanolic and aqueous extracts reduced glycaemia of diabetic rats. The bark showed anti-hyperglycemic activity on oral glucose tolerance testing. Seed extract yielded betulinic acid and 3,5,7,4'-tetrahydroxy flavanone. The compound showed high α -amylase inhibitor activity, but the inhibitory activity of the individuals compounds needs further testing and verification [25].
- **Anti-Cervical Cancer:** Study of *Z cumini* extract showed inhibition of growth and induction of apoptosis in HeLa and SiHa cervical cancer cell lines in a time- and dose-dependent manner [26].
- **Anti-Allergic:** Study of on the aqueous leaf extract of *Syzygium cumini* showed the main components to be hydrolysable tannins and flavonoids. Results showed inhibition of paw edema, edema induced by histamine, prevention of mast cell degranulation and consequent histamine release in Wistar rat peritoneal mast cells. The findings demonstrate an anti-allergic effect; the anti-edematogenic effect is attributed to inhibition of mast cell degranulation [27].
- **Prophylactic Anti-Septic Effect:** Study concluded that treatment with *S. jambolanum* has a potent prophylactic anti-septic effect not due to a direct microbicidal effect but rather, associated with a recruitment of activated neutrophils to the infectious site and to a diminished anti-inflammatory response [28].
- **Antibacterial / Glucoamylase Inhibitor / Anti-Diabetic / Seeds:** Study of ethanol extract of seeds of *Syzygium cumini* showed moderate to good antibacterial activity against *E. coli*, *B subtilis*, *P aeruginosa* and *S. aureus*. It also showed to be a potent inhibitor of glucoamylase and suggests a hypoglycemic function in type-2 diabetes that may be independent of functioning B-cells [29].
- **Cardio protective:** Study of a methanolic extract of *Syzygium cumini* seeds on isoproterenol-induced myocardial infarction in rats confirmed a cardio protective effect [30].
- **Radio protective:** Study demonstrated *Syzygium cumini* (jamun) extract protected mice against radiation-induced DNA-damage and inhibition of radiation-induced free radical formation may be one of the mechanisms of radioprotection [31].

- **Randomized, Double-blind, Double-Dummy, Controlled Diabetic Trial / No Anti hyperglycemic Effect:** Results showed significant reduction in patients treated with glyburide, with no changes in those treated with *Syzygium cumini* tea. The tea and extracts prepared from leaves of *S. cumini* were shown to be pharmacologically inert, showing no anti hyperglycemic effect [32].
- **Anti-Vibrio Cholera Activity:** Study investigated the ethanol extract of leaf of *Syzygium cumini* against *Vibrio cholerae* serogroups Ogawa and Inaba. The EEL effectively inhibited the growth of both serogroups, with fragmentation of genomic DNA. Results showed potential growth inhibitory activity against multi drug resistant Vibrios, and suggests a potential for effective candidates to combat cholera [33].
- **Fruit-Pulp Activity against Fluoride-Induced Toxicity:** Study evaluated the ameliorative effect of *Syzygium cumini* fruit extract in male albino mice against fluoride exposure. Results showed revitalization of steroid genesis and spermatogenesis, with ameliorative potentials in male sex related toxicology, with reclamation of spermatogonia and interstitial tissue after jambul extract treatment [34].
- **Antioxidant Study / Fruit Pulp, Kernel, Seed Coat:** *Syzygium cumini* (Jamun) pulp ethanol extract (PEE), kernel ethanol extract (KEE), and seed coat ethanol extract (SCEE) showed high degree of phenolic enrichment. An alcoholic extract was evaluated for antioxidant potential against DPPH, hydroxyl radical scavenging activity, peroxide radicals, and lipid per oxidation [35].
- **Diuretic / Bark:** Study evaluated the diuretic activity of various extracts of bark of *S. cumini* in Wistar albino rats. Results showed the methanol and aqueous extracts possess diuretic activity as evidenced by increase in total urine output, significant increase in excretion of sodium and potassium [36].
- **Anti-Diabetic / Mycaminose / Seed:** Study of isolated compound mycaminose and AE and ME of *S. cumini* seeds against STZ-induced diabetic rats showed anti-diabetic effects with significant reduction ($p < 0.05$) in blood glucose [37].
- **Immuno-modulatory / Seeds:** Mastan *et al.* suggested the methanolic extract of seeds possesses promising immuno-modulatory activity. In a haem agglutination reaction and delayed type hypersensitivity response in rats induced by Sheep RBC, there was a significant dose-dependent increase in total WBC, neutrophils and lymphocytes. (Immuno-modulatory activity of methanol extract of *S. cumini* seeds. / Mastan *et al.* / Pharmacogyonline, 2008,3,895-903) [38].
- **Biosorbent / Leaves:** Study reports the adsorption capabilities of *S. cumini* leaves for crystal violet and eosin B using batch adsorption method. Adsorption of crystal violet was endothermic while that of Eosin B was exothermic, both spontaneous at all temperatures [39].
- **Anti-Breast Cancer / Fruit Pulp:** Study evaluated various concentrations of methanolic extract of fruit pulp for *in-vitro* cytotoxicity activity against MCF-7 cells using MTT assay. Cell viability was inhibited to different extents by different concentrations of the extract [43].
- **Antimicrobial Cancer / Fruit Pulp:** Study of various extracts of stems and leaves showed antibacterial activity against all tested bacteria. Maximum zone of inhibition was seen against *routella plantikola*. It also showed maximum inhibition against fungal strains *Penicillium chrysogenum* and minimum inhibition against *Candida albicans* [44].
- **Cuminoside / Cardio protective / Antidiabetic / Seeds:** Study evaluated the hypoglycemic and hypolipidemic activity of *S. cumini* seeds in normal and NIDDM in rats. Study isolated an active principle, Cuminoside, which caused significant reduction in FBS in diabetic rats, significant reduction in total cholesterol, LDL, ALT, AST, and LDH, together with improvement in HDL levels. Results suggest cuminoside has cardio protective potential and Antidiabetic activity.
- **Protection against Diabetes Induced Ulcerogenic Stimuli / Seeds:** Study evaluated the protective effect of *E. jambolana* alone and in combination with Acarbose in T2D rats exposed to models which caused ulcerogenic stimuli. Results suggest the concurrent administration of *S. cumini* and Acarbose at low doses may have prevented the development of diabetes induced ulcerogenic stimuli by decreasing gastric oxidative stress and providing a direct gastro protective action. The low dose combination may have provided a synergistic ulcer protective effect [45].
- **Anti-Inflammatory / Leaves:** Study of methanol extract of leaves showed the SC leaf had remarkable acute (carrageenan, histamine, and serotonin induced rat paw edema) and chronic (cotton pellet induced rat granuloma) anti-inflammatory actions in the tested rodent models.
- **Anti-inflammatory activity:** Study evaluated ethanol extract of leaves for anti-inflammatory activity and bioactive compounds. Bioactive compound tannins at concentration of 100 µg/ml showed 99.50% inhibition of heat-induced protein denaturation compared with standard aspirin at 89.26%. In HRBC membrane stabilization activity, tannins at 1 mg/ml showed 82.94% protection of HRBC membrane, compared to standard diclofenac at 70.41% [46].
- **Effect of Prolonged Treatment with S. cumini on Salivary Glands:** Study evaluated the effects of prolonged treatment with *S. cumini* sheet aqueous extract on the structure of cells responsible for secretory process in parotid and submandibular salivary glands of spontaneously diabetic mice. Results showed structural alterations in the salivary glands of mice with nuclear and cytoplasmic atrophy and occurrence of inflammatory cells and elevated blood sugar levels [47].
- **Antihypertensive / Leaves:** Study evaluated the *in vivo* potential antihypertensive effect of hydro alcoholic extract of *Syzygium cumini* leaves in normotensive Wistar rats and spontaneously hypertensive rats (SHR), and *in vitro* effect on vascular reactivity of resistance arteries. Results showed reduction of blood pressure and heart rate of SHR probably due to the inhibition of arterial tone and extracellular calcium influx [48].
- **Anti-diabetic activity** of *Syzygium cumini* and its isolated compound against streptozotocin-induced diabetic rats / A. Kumar*, R. Ilavarasan, T. Jayachandran, M. Deecaraman, P. Aravindan, N.

- Padmanabhan and M. R. V. Krishan / Journal of Medicinal Plants Research Vol. 2(9), pp. 246-249, September, 2008 [49].
- **Platelet Effect / Protection from Oxidative Damage / Leaves:** Study evaluated the *in vitro* effects of *S. cumini* incubation on platelets from patients with diabetes, to test its efficacy as potential adjuvant therapy. Results showed in SC activity counteracts oxidative damage by improving platelet function through augmented membrane fluidity and Na⁺/K⁺ ATPase activity, as well as functionally enhancing the antioxidant system by increasing NO levels, SOD, and TAC. SC supplementation may have a preventive and protective effect in oxidative damage progression associated with diabetes mellitus and its complications [50].
 - **Protective Against Mitochondrial Dysfunction:** Study evaluated various extracts of *S. cumini* and *Bauhinia forficata* on oxidative and mitochondrial parameters *in vitro*, as well as protective activities against toxic agents. The major chemical constituent of *S. cumini* was rutin. *S. cumini* reduced DPPH radical more than *B. forficata*, and showed iron chelating activity. Both partially prevented lipid peroxidation. *S. cumini* was effective against mitochondrial swelling induced by Ca²⁺. Results suggest *S. cumini* might represent a therapeutic option for treatment of diseases associated with mitochondrial dysfunction [51].
 - **Chemo preventive / Anti carcinogenic / DMBA-Induced Skin Papillomagenesis:** Study evaluated the protective effect of *S. cumini* seed extract against peroxidative damage contributing to skin carcinogenesis in Swiss albino mice. Results suggest an anti carcinogenic effect during DMBA-induced skin papillomagenesis that is mediated through alteration of antioxidant status [52].
 - **Radioprotection / Seeds:** Study the effect of a seed extract of *S. cumini* in normal as well as in tumor bearing mice against gamma radiation-induced cellular damage in biological tissues. Results suggest the seed extract has protective effects against radiation induced cellular damage and biological alterations which may be attributed to the scavenging of free radicals and antioxidant properties. Author suggests the seed extract may be used in combination with radiation to protect against oxidative stress and mitigate the side effects of radiation to normal tissues [53].
 - **Biosorbent / Seed:** Study reports on a very low cost biosorbent from *S. cumini* seeds for treatment of hexavalent chromium from contaminated waters [54].
 - **Antibacterial / Dental Caries / Leaves:** Study investigated the *in vitro* antibacterial activity of leaves of *S. cumini* against *Streptococcus viridans*, *S. mutans*, *E. coli*, *P. aeruginosa*, *S. aureus*, and *B. subtilis*. Aqueous, methanolic, hexane and EA extract of leaves exhibited antimicrobial activity against dental caries causing strains. Results suggest a potential phytomedicine source to cure dental caries [55].
 - **Hepato-protection / Seed:** Study of an aqueous extract of *S. cumini*'s seed powder on hepato-protection in STZ-induced diabetic rats showed a dose-dependent protective effect [56].
 - **Sustained Release Matrix Tablets / Anti-Diabetic:** Study reports on the formulation of Metformin HCl sustained release matrix tablets using *S. cumini* as a release rate retarding agent which is also Antidiabetic in nature by means of wet granulation method. The Antidiabetic activity was evaluated with alloxan model of experimental rats. Results suggest that the *S. cumini* extract acted as a good release rate retarding agent and showed promising additive Antidiabetic activity with Metformin [57].
 - **Nephroprotective / Seed:** Study evaluated the Nephroprotective effect of an aqueous extract of *S. cumini* seed in diabetic Wistar albino rats. High dose seed extract and standard oral hypoglycemic drugs showed significant decrease in creatinine and urea levels. The seed powder extract showed significant Nephroprotective effect [58].
 - **Staining Capability / Seed:** Study evaluated the staining capability of aqueous and ethanolic extracts from *S. cumini*, *C. blumei*, *S. pallida* and *B. vulgaris* as dyestuffs on different fungal species. Results showed the extracts have capability to be alternative biological stains to Lactophenol cotton blue in staining *Aspergillus niger* and *Penicillium chrysogenum* [59].
 - **Antioxidant / Leaf Gall Extracts:** Study evaluated leaf gall extracts for antioxidant activity using DPPH, nitric oxide scavenging, hydroxyl scavenging and FRAP methods. In all methods, the methanolic extract showed the higher antioxidant potential than standard ascorbic acid. The antioxidant activity correlated with the high content of total polyphenols/flavonoids of the methanol extract [61].
 - **Anti-Leishmanial Activity / α -Pinene / Essential Oil:** Study evaluated the effects of essential oil and its major component α -pinene on *Leishmania amazonensis*. Study showed α -pinene was effective against *L. amazonensis* promastigote forms, with 50% inhibitory concentration (IC₅₀) of 1.7 μ g/mL. The anti-leishmanial effects were mediated by immunomodulatory activity as evidenced by increased in phagocytic and lysosomal activities. (Rodriguez *et al*, 2015).
 - **Biogenic Synthesis of Silver Nanoparticles / Antimicrobial Leaves:** Study reports on the synthesis of silver nanoparticles using *Syzygium cumini* leaf extract. The synthesized nanoparticles showed effective antimicrobial activity against pathogenic bacterial species [60].
 - **Anti diarrheal Activity / Seed:** Study evaluated the anti diarrheal activity of aqueous extract of *S. cumini*'s seeds in mice in a castor oil induced diarrhea model and charcoal meal test. Results showed the extract exhibited significant and dose-dependent anti diarrheal effect attributed to anti motility and anti-secretory effect. (Shamuwar *et al.*, 2012) [62].
 - **Anti-Hyperglycemic / Anti-Hyperlipidemic / Seeds:** Study of *S. cumini* seed extract showed anti-hyperlipidemic and hypoglycemic activity in alloxan induced diabetic mice. SC significantly ($p < 0.05$) reduced serum glucose, TC, TG, LDL, VLDL, and increased HDL. LD₅₀ was found to be 1000 mg/kg. No toxic symptoms were observed at 150 and 250 mg/kg doses [63].
 - **Homeopathic Tincture in Diabetes:** Study evaluated the remedial effects of homeopathic mother tincture of *Syzygium jambolanum* on metabolic disorders of STZ-induced diabetic male albino rat. The homeopathic

- tincture of *S. jambolanum* showed therapeutic effect on metabolic disorders and oxidative injuries in STZ-induced diabetic rats ^[64].
- **Comparative Antioxidant Activity:** Study evaluated methanolic extracts of seeds, leaves, fruit pulp of *S. cumini*. Results showed the total phenolic and flavonoid content in leaves is higher than the pulp and seed extracts. A linear correlation was shown between total phenolic content and antioxidant activity ^[65].
 - **Antidiabetic / Seeds:** Various active constituents in the seeds of *S. cumini* help control glucose homeostasis through its effects of different pathways of the hyperglycemic process viz., insulin mimetic and insulinotropic effect. It acts as an anti-diabetic by stimulation of insulin release from beta cells or by lowering glucose absorption in the intestine, hepatic glucose production, and boosting sensitivity of insulin by enhancement of peripheral glucose uptake and utilization, activation of nuclear PPAR- γ ^[66].
 - **α -Amylase Inhibitors / Seeds:** Aqueous extract of *S. cumini* seeds and *Psidium guajava* leavers showed higher inhibition against porcine pancreatic α -amylase among medicinal plants studies. LC=MS study of seed extract of *S. cumini* yielded betulinic acid and 3,5,7,4'-tetrahydroxy flavanone. The inhibition was non-competitive in nature ^[67].
 - **Improvement in Metabolic and Ovarian Parameters in Obese Female Rats with Malfunctioning of the Hypothalamus-Pituitary-Gonadal Axis:** Study evaluated the effects of a hydroethanolic extract of *S. cumini* leaves in female reproductive impairments in an obese model of neonatal L-monosodium glutamate injection. Results showed the reversibility of the reproductive dysfunctions seen in MSG female rats through ethno pharmacological treatment. It expands the use of HRESc as a prominent tool to treat metabolic and reproductive disorders. Study also provided novel evidence that without a functioning hypothalamus-pituitary-gonadal axis, metabolic improvement is ineffective for estrous activity, but critical for ovarian follicle health ^[68].
 - **Protective Effects of Polyphenols Rich Extract on Oxidative Stress-Induced Diabetes / Leaves:** Study evaluated the anti-diabetic effects of a novel polyphenols-rich extract (PESc) from leaves of *S. cumini* in rats with alloxan induced diabetes. Results showed *in vitro* and *in vivo* antioxidant activities of PESc obtained from leaves. Results suggest myricetin, quercetin, and gallic acid compose a phytocomplex with poorly understood synergistic mechanisms. Results suggest the potential use of the novel polyphenol-enriched extract from leaves as a source of Antidiabetic products ^[69].
 - **Effect of Season on UV Absorbing Property / Sunscreen Potential / Leaves:** Study evaluated the effect of season on UV absorbing property of *S. cumini* leaves collected in summer, winter, autumn, and rainy seasons. Results showed the acetone extract of leaves of rainy season had maximum UV absorbing property. Polyphenol content of the leaves was also high during the rainy season. Study suggests the acetone extract of *S. cumini* leaves of rainy season may be used as anti-solar agent in preparation of sun screen lotions ^[70].
 - **Effect of Seed Powder on Pancreatic Islets of Alloxan Diabetic Rats:** Study of an ethanolic extract of seed powder of *S. cumini* increased body weight and decreased blood sugar level in alloxan induced diabetic albino rats. The extract feeding showed definite improvement in the histopathology of islets. Significantly, the drop in blood sugar to normal levels after extract feeding was not elevated when the extract was discontinued for 15 days. Results suggest the effect may be curative rather than palliative. Improvements in islet histopathology and glycogen localization suggest the same ^[71].
 - **Antioxidant / Leaves:** Study investigated the antioxidant activity of various *Syzygium cumini* leaf extracts using DPPH radical scavenging and ferric-reducing antioxidant power (FRAP) assays. Results showed the ethyl acetate fraction showed stronger antioxidant activity than others. HPLC data showed the leaf extracts contained phenolic compounds, such as ferulic acid and catechin, which are responsible for their antioxidant activity. There was a significant linear relationship between antioxidant potency, free radical scavenging ability and the content of phenolic compounds in the leaf extracts ^[72].
 - **Antibacterial / Antioxidant / Neuro-protective / Stem:** Study evaluated the antibacterial activity, antioxidant activity, and neuro-protective ability of aqueous and alcoholic extracts of stem of *S. cumini*. Results showed antibacterial activity of aqueous and alcoholic extracts of stems; the alcoholic extract showed maximum activity against *B. amyloliquefaciens* and *S. aureus*. A methanolic extract showed higher level of antioxidant activity compared to the aqueous extract. Neuro-protective activity was observed on rat pheochromocytoma (PC)-12 cell line by giving neurotoxic shock using 6-hydroxydopamine. The ethanolic extract showed maximum number of viable cells, i.e., 75% compared to aqueous extract at 50% ^[73].
 - **Elimination of Deleterious Effects of DMBA-Induced Skin Carcinogenesis / Seed:** Study evaluated the inhibition of tumor incidence by hydro alcoholic extract of *S. cumini* seed in mice on two-stage process of skin carcinogenesis induced by single application of DMBA. A significant improvement in impairment was seen in measures of reduced glutathione, superoxide dismutase, among others. Results suggest possible chemo preventive property against DMBA induced skin carcinogenesis in mice ^[74].
 - **Anti-Hyperlipidemic / Seeds:** High cholesterol diet fed diabetic rats exhibited significant increase in serum cholesterol, triglycerides, LDL, VLDL, and high density lipoprotein. Treatment with seed extract significantly decreased TC, LDL, VLDL, atherogenic index, and significantly increased the HDL, HDL ratio in Hyperlipidemic rats. The Anti-Hyperlipidemic activity may be due to the presence of alkaloids, flavonoids, phenols, saponins, tannins (gallic acid and ellagic acid) and triterpenoids ^[75].
 - **Vasorelaxant Effect Mediated by Inhibition of Calcium Channels / Leaves:** Study evaluated the ability of hexane extract and chloroform fraction of SC leaves in promoting vasorelaxation on resistance arteries rings. Results suggest *S. cumini* acts as a vasorelaxant agent and interferes with the responsiveness of vascular smooth muscle cell,

probably acting on regulation of intracellular Ca²⁺ levels through voltage operated calcium channels [76].

- **Anti-Inflammatory on Chemo taxis of Human Neutrophils:** Study evaluated an aqueous seed extract of *S. cumini* for anti-inflammatory properties using neutrophils chemo taxis as a model system. Results showed significant inhibition of neutrophils chemo taxis towards a bacteria-derived chemo attractant (f-met-leu-phe). Results suggest the seed extract has potential to elicit anti-inflammatory effects [77].
- **Thrombolytic / Seeds:** Study evaluated the thrombolytic potential of an ethanol seed extract of *Syzygium cumini*. The ethanol seed extract exerted 34% clot lysis from clotted blood in thrombolytic activity test compared to standard streptokinase and control at 79% and 3%, respectively [78].

Availability: Wild-crafted.

Seasonal fruiting.

Extracts and tinctures in the cyber market.

Conclusion

Syzygium cumini is an easily available plant. The fruits being lot of potent pharmacological activities. The plant belongs to family Myrtaceae, which has given us many important medicinal plants like *S. caryphyllifolium*, *S. jambolana*, *S. obovatum*, *S. obtusifolium*, *S. cumini* etc. Hence it not be wrong to state that still a lot has to be worked upon this important plant. Apart from this, old traditional texts like Unani, Ayurveda, mention the protective role of *Syzygium cumini* on important body organ like kidney, digestive etc, many of which are scientifically proven. It contains almost all the properties of pharmaceutical care designed like Astringent, carminative, stomachic, diuretic, anti-diabetic, anti-diarrheal. Studies have shown anti-diabetic, anti-inflammatory, radio protective, gastro-protective, antioxidant, CNS depressant, anti-allergic, anti-cancer, antibacterial, cardio-protective etc. In developing countries like India, one must fully explore this important medicinal plant which might provide us some important "leads" in near future.

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