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Review Article

Exploring the Therapeutic Potential of Syzygium cumini

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ABSTRACT

A fruit-bearing tree with botanical and medical significance, Syzygium cumini is another name for Jamun. This abstract summarizes its traditional usage, phytochemistry, pharmacological actions, and botanical description. A native of the Indian subcontinent, the Syzygium cumini is an evergreen tree of modest size. Ovoid, dark purple to black fruits are tasty and astringent when ripe; the plant has glossy, dark-green foliage and pinkish-white blossoms. 'Phytochemical studies have shown that the plant contains essential oils, tannins, polyphenols, and flavonoids, among other beneficial components.' Its antioxidant qualities are due in part to the anthocyanins and ellagic acid it contains. The pharmacological activity of Syzygium cumini have been studied and found to include anti-diabetic, antioxidant, anti-inflammatory, and antimicrobial actions. Because of their capacity to lower blood glucose levels, the fruit and other plant components have been investigated for their possible use in diabetes management. It is useful for preventing diseases caused by oxidative stress because of its antioxidant characteristics.For ages, Syzygium cumini has been a part of traditional medicine. It is suggested for management of diabetes and its complications in Ayurveda and traditional Indian medicine. Traditional medicine has long made use of this plant's bark, leaves, and fruit to alleviate a wide range of symptoms, from skin problems to diarrhea and dysentery. People eat this fruit because it has health advantages and nutrients.

INTRODUCTION

India is fortunate to have both a extended history of traditional medicinal practices and a diverse array of plant and animal life that can support the herbal remedies used in these practices. Herbs and minerals are key components of Ayurveda, Siddha, and Unani, three of the most well-known Indian medical systems. Across its fifteen agroclimatic zones, India is host to 47,000 different types of plants, 15,000 of which are considered medicinal. Researchers should investigate the possibility of plants as a substitute for synthetic pharmaceuticals when none are available that are safe, according to

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WHO(1980).[1] Jamun and Jambul in Asia and Jamelao and Jambolao in Brazil are local names for the Syzygium cumini (L.) Skeels tree, which is a member of the Myrtaceae family. The tree has a wide distribution in Asia and the Americas, and it is famous for its therapeutic properties.portions (2, 3). Its degree of diversity rises as one travels from Malaysia towards northeastern Australia. Many people think of S. cumini when they think of popular species to grow. In addition to the Indian subcontinent, this tree can be found in certain parts of Nepal, Sri Lanka, and Indonesia. This tree became a native in Malaysia after being brought there a long time ago. [4] Pharmacological studies have shown that the components of S. cumini, a popular traditional medicinal herb, have hypoglycemic, antibacterial, and antiHIV effects. The numbers 5.8 Various traditional medical systems have made use of various plant components, including bark, leaves, fruit, and seeds.The leaves have several medicinal uses, including the treatment of leucorrhoea, stomachaches, fever, dermopathy, constipation, reduction of radiation-induced DNA damage, inhibition of blood discharges in the feces, and more.the eleventh Traditional Indian medicinal practices such as Siddha, Ayurveda, and Unani make use of S. cumini fruits for a variety of purposes, including those of an astringent, antiscorbutic, diuretic, antidiabetic, spleen enlargement[13,14], chronic diarrhea treatment, and stomachic.[15] If you're experiencing bleeding piles or any kind of liver problem, you should try eating jamun fruit.references 16 and 17 This massive evergreen tree has thick, greyish-brown bark. Wood from this tree is long-lasting, pale, and ringed narrowly. Clusters of a few to tens to forty-five of the greenish-white, fragrant flowers are often carried on the panicle by the branchlets that lie beneath the leaves. The plant is characterized by its unique purple fruits, which have a sweet flavor.[4] Myricetin, quercetin, and betulinic acid are just a few of the phenolics found in S. cumini's leaves, which also contain a number of alkaloids, terpenoids, lignins, and other phytochemical components. (3, 18, 19) The desire for food products that promote health has been on the rise among consumers globally. As a result, in 1989, Dr. Stephen L. DeFelice came up with the phrase "nutraceuticals," a combination of nutrients and medications.[20] Dosages of these supplements can be higher than those of regular foods. [21] Several herbal plants have their therapeutic qualities recorded in ancient Indian texts, and these mixtures have proven to be beneficial in treatment of various ailments. Hence, demand for medicinal plants has skyrocketed to fulfill the rising demand for producing and exporting contemporary medications. Cultivating uprooted medicinal plants is the usual method for meeting this requirement. [22]

SYNONYMS :

Pakistan - Jaman Telugu - Jambuvu West Indies - Jambol Thailand – Lukwa [23-[25]

Botanical Discription:

S. cumini: Trees of this species grow to a height of 30 meters in parts of India and Oceania, and 12 to 15 meters in Florida, USA. They typically have a trunk diameter of 0.6 to 0.9 meters and a wide crown that reaches up to 11 meters.

Bark:

varies in texture from rough and cracked to flaky and discolored at the base of the trunk to smooth and light-grey as it ascends.[26]

Flowers:

flower heads emerge first from clusters of five to six centimeters in length and breadth, held aloft on gnarled, aged twigs that extend from under the leaves; tiny, numerous, fragrant white blooms (hypoanthium) that are around 7 mm long and

topped with a cup-shaped, 3 mm wide and long; a calyx that is joined into a cap by four white, rounded, concave petals that are over 2 mm in length; Numerous threadlike filaments that are 5 mm long and white or pinkish in color; a pistil that contains an inferior ovary; a large number of small, robust ovules; and a white, 6- to 7-mm long style.

Fruits:

In most years, they appear between May and June and look like big berries. The fruits typically appear in groups of four to twenty. But on a flowering plant, not every fruit ripens at the same time. The fruit is a cluster of berries that are either ovoid-oblong or elliptical in shape. There are a lot of them, and they're arranged in clusters. Astringency, sweetness, and a hint of sourness characterize the ripe fruit. Both vitamin A and vitamin C are abundant in it.

Seed:

The seeds found in the center of each berry are very astringent and slightly bitter. They are around 1 to 2 centimeters long, and occasionally there are 2 to 5 angular, seeds that are compressed into what looks like one large seed. A faint green coloration is found on the cotyledons. Seeds aren't suitable for long-term storage because of their stubborn character and limited shelf life. [10]

PHYTOCHEMISTRY :

"Phyto" means "plant" in Greek. The human body benefits from phytochemicals in many different ways, and there are many different families of these substances. Potentially protecting humans from numerous ailments are phytochemicals. Plants contain compounds called phytochemicals, which have protective or disease-preventive effects but do not have any nutritional value. The Syzygium cumini fruit is rich in Although oxalic acid is also present in minor quantities, malic acid accounts for the majority of the fruit's acidity (0.59 weight percent). Tannins and gallic acid are responsible for the fruit's astringency. What gives the fruit its purple hue is the presence of cyanidin diglycosides. A small percentage of fruits contain fructose, but a larger percentage contain fructose and sulfuric acid.Gastose, fructose, mannose, and glucose are the four main sugars. In trace amounts (mg/100g), the following mineral elements were detected in edible pulp: Ca, 15, Mg, 35, P, 15, Fe, 1.2 (ionisable Fe, o.1), Na, 26.2, K, 55, Cu, 0.23, S, 13, and Cl. It is possible to detect the following vitamins in 100g of edible pulp: vitamin A at 80 IU, thiamine at 0.03 mg, riboflavin at 0.01 mg, nicotinic acid at 0.2 mg, vitamin C at 18 mg, choline at mg, and folic acid at µg. The seed contains a variety of compounds, including chlorophyll, tannins (19%), albumen, glucoside jamboline, a new phenolic compound, resin, a little amount of pale yellow essential oil, and a minor amount of fat. Ellagic acid, gallic acid, caffeic acid, ferulic acid, guaicol, resorcinol dimethyl ether, corilaginin, and other phenolic chemicals are included in this. Their amounts average between 1% and 2%. Seeds are an excellent source of protein and calcium.Monoterpenoids such as eugenol, ß-pinene, terpinolene, borbeneol, ß-phellandrene, and rutin, as well as flavonoids such as quercetin and rutin. Syzygium cumini is another plant whose seeds contain ß-sitosterol. Oil from Syzygium cumini included 2.8% lauric acid, 31.7% myristic acid, 4.7% palmitic acid, 6.5% stearic acid, 32.2% oleic acid, 16.1% linoleic acid, 1.2% malvalic acid, and 3% vernolic acid. Strange compounds such as 5,6-dihydroxy-3-[(4-hydroxy-6-(hydroxymethyl)],trihydroxy 6-(hydroxymethyl)-3-hydroxybenzophenone-17-yl (phenyl) [a] tetrahydro-2-(2-h2pyranyl)oxy2-Methoxy-10,13-dimethylpedihydrocyclopenta methyl acetate [15, 16], and androstene [16, 17-C].(two-hydroxy-1-propene, six-methyl bis) The

compounds 4H pyran and 3-hydroxy androstane [16,17-C](1-isopropene-1-yl, 6'-methyl, 2-hydroxy) pyran-5, 4-, 6-hydrogen. Syzygium cumini has four compounds in its stem bark: betulinic acid, ß-sitosterol, friedelin, epi-friedelanol, and an epi-friedelanol ester that is new to science. one of the genisteins. Astragalin, gallic acid, quercetin, myricetin, kaempferol-3-o glucoside, and ß-sitosterol-D-glucoside are also present. [27-41]

Structure of some isolated phytoconstituents :

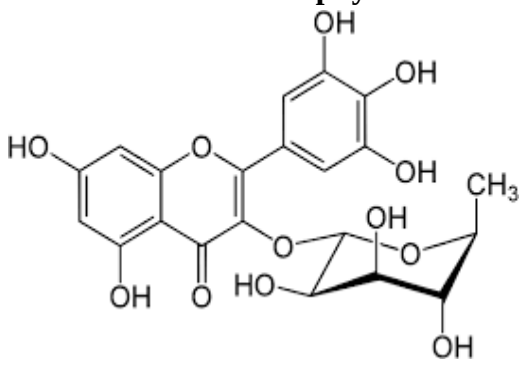

Fig no. 1. Myricetin 3-O-(4”- acetyl)-a-L-rhamnopyranosides.

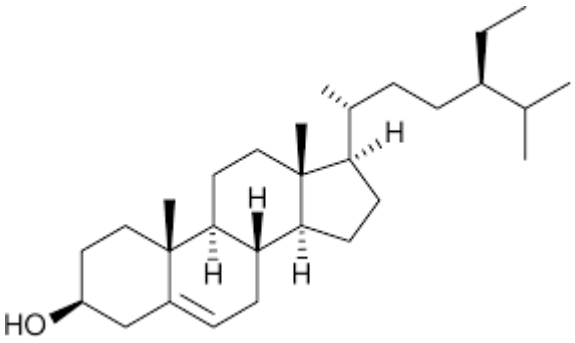

Fig no.2 ß-sitosterol

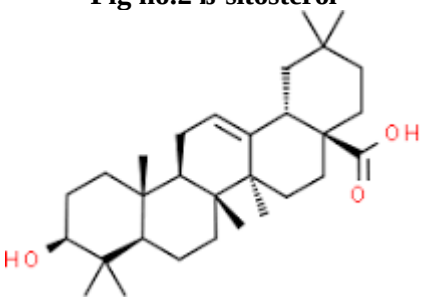

Fig no.3 Oleanolic acid

PHARMACOLOGICAL ACTIVITY:

Anti- Diabetic activity:

Due to its high incidence, morbidity, and mortality, diabetes is quickly overtaking cancer and cardiovascular illnesses as the third leading cause of death for humans. [42]Serious side effects are linked to the oral hypoglycaemic medications that are currently utilized in antidiabetic therapy. Accordingly, research into novel anti-diabetic medicines with therapeutic efficacy and absence of these adverse effects is of the highest urgency.[43] As a result, many research have looked at the possibility of various Syzygium cumini (L.) components having an antidiabetic effect. In 2007, Singh and Gupta investigated how an ethanolic S yzygium cumini (L.) (Linn) seed powder extract affected the pancreatic islets of alloxan-diabetic rats. After giving diabetic albino rats an ethanolic extract of Syzygium cumini (L.) seeds, researchers saw a significant decrease in their blood sugar levels caused by alloxan. In addition, the histology of islets improved significantly, according to the investigations. Additionally, they noted that after blood sugar levels returned to normal following extract feeding, they did not rise again after 15 days of not taking extract. [44] In 2008, Kumar et al. isolated and identified the alleged antidiabetic compound from Syzygium cumini (L.) seeds [SC]. They isolated mycaminose from SC seed extract and studied its anti-diabetic properties on rats treated with streptozotocin (STZ). Their results showed that mycaminose considerably reduced blood glucose levels in rats that were stimulated with STZ ($p<0.05$). Finally, they showed that the isolated chemical mycaminose had anti-diabetic effects in rats that had been induced with STZ. [45]

Anticancer activity:

On a global scale, cancer poses a threat to public health. After the discovery of podophyllotoxin, a cytotoxic compound found in Podophyllum peltatum (Berberidaceae), in 1947, researchers started looking for more plant-based anticancer medications. [46] There has been a lot of interest in studying plant extracts and compounds produced from plants for potential anticancer benefits ever since vinblastine and vincristine, which are antileukemic drugs from Catharanthus roseus (Apocynaceae), quickly gained popularity. [47]

Antioxidant:

When it comes to disease prevention, foods that are high in antioxidants are crucial. Banerjee et al. used a battery of tests to prove that fruit skin had antioxidant properties. A DPPH radical scavenging assay, an assay for lipid peroxidation using egg yolk as the lipid rich source, an assay for hydroxyl radical scavenging based on the benzoic acid hydroxylation method, and an assay for superoxide radical scavenging based on the photochemical reduction of nitroblue tetrazolium (NBT) in the presence of a riboflavin light -NBT system were all covered. Antioxidant vitamins, phenolics or tannins, and anthocynins may all contribute to the fruit's protective skin's antioxidant capabilities. [48]

Anti-inflammatory activity:

The anti-inflammatory efficacy of an ethanolic extract of S.cumini bark was studied by Muruganandan et.al. Mice at doses ranging from 10–125 µg/kg.i.p. showed no signs of toxicity to extract. Without irritating the stomach mucosa, this research proved that S. cumini bark extract effectively reduced inflammation throughout all stages. [49]

Antiviral:

A need for a less harmful solution has arisen as a result of the discovery of new viral infections brought about by environmental change. We used the CPE reduction assay to determine the virucidal, pre- and post-exposure potential of cold and hot water extracts of SC's bark and leaves against H5N1, an exceedingly infectious avian influenza virus. In both the virus yield reduction experiment and the egg-based in ovo assay, we found that the virus was completely suppressed by the hot and cold aqueous bark and leaf extracts, respectively. The H5N1 virus was successfully inhibited by both the cold (43.5 CC50/EC50, or select index) and hot (248 EC50) water extracts of the bark. [50] Both the goatpox and buffalo pox viruses were discovered to be inhibited by the water-based leaf extract [51-52]

Gastroprotective Activity :

Rats with stomach ulcers caused by aspirin, pylorus ligation-ethanol, or a 2-hour cold restraint stress were the subjects of an investigation by Chaturvedi et al. about the efficacy of an ethanolic extract from the seeds of E. jambolana. It is possible that Eugenia jambolana's protective effects against ulcers are the result of its actions on offensive and defensive elements simultaneously. Eugenia jambolana's antioxidant qualities are one reason for its efficacy.[53]

CNS Activity:

A number of Syzygium cuminii Linn seed extracts, fractions, and subfractions were investigated for their sedative and anticonvulsant effects by De Lima et al. Focus on the actions of mice. The hydroalcoholic extract had a hypothermic impact and also showed anticonvulsant effects in pentylenetetrazol and maximal electroshock convulsions when taken orally. Subfractions of ethyl acetate increased the latency and duration of pentylenetetrazol's first convulsion. Some of the active components in S. cuminii have anticonvulsant effects in addition to central depressive ones. [54]

Antiallergic Activity :

In the allergic pleurisy model, the inhibition of eosinophil accumulation is likely caused by an impairment of CCL11/eotaxin and IL-5 production, while the edematogenic effect of Syzygium cumini stems is believed to be caused by an inhibition of mast cell degranulation and of histamine and serotonin effects (Britto et al.).[55]

Antihistamine activity :

When compared to histamine-induced pedal edema, methanol extract of dried seeds, when given intraperitoneally to rats, was active, according to Mahapatra et al. [56]

Antipyretic activity :

Research conducted by Mahapatra et al. demonstrated that rats administered 50 mg per kg of methanol extracts of dried seeds were able to prevent yeast-induced pyrexia. Similarly, Chaudhari et al. discovered that chloroform extracts of dried seeds have antipyretic properties. [57]. [56]

Antihyperlipidemic :

Activity In around 40% of people with diabetes mellitus, abnormalities in lipid profiles manifest as one of the disease's most common complications. Kasiappan et al. showed that the gold standard for treating hyperlipidemia in streptozotocin-induced rats was an oral dose of 100 mg/kg body weight of glibenclamide, derived from the ethanolic extract of E. jambolana-kernel.[58]

Antispasmodic activity:

A pilot study by Dhawan et al. indicated that an ethanol-water(1:1)extract of the aerial sections had no effect on the spasms generated by guinea pig ileum compared to acetyl choline and histamine.[59] In their study, Mokkhasmit et al. determined that guinea pig ileum was actively affected by ethanol water (1:1) with 0.01 gm per ml of dry bark. [60]

Traditional uses:

The medicinal properties of S. cumini have made it a prized herb in Siddha, Ayurveda, and Unani medicine. Traditional Indian medicine makes use of the whole plant. The most important parts, nevertheless, are the leaves and bark. The bark is bitter, sweet, astringent, and anti-helminthic in Ayurvedic medicine. It also helps with sore throats, asthma, bronchitis, biliousness, dysentery, ulcers, and blood impurities. The Unani system of medicine makes use of several plant parts, including ash from leaves to fortify teeth and gums, seeds to treat diabetes and other kidney problems, and bark to speed up the healing process after cuts and scrapes. According to Siddha, Jamun has thermoregulatory, haematinic, and semen-promoting properties. Traditional medicine practitioners in Madagascar utilize jambolan seeds to weaken diabetic problems. Women in Surinam traditionally utilize the leaves to alleviate vaginal swelling, postpartum vaginal discharge, and unpleasant odors.I have read [61,62] For diarrhoea, Charaka made decoctions from the seeds, leaves, and fruits; as an astringent, he utilized the bark. Obesity, vaginal discharges, and menstruation abnormalities were all treated internally with fruit by Sushruta, while intrinsic hemorrhage was treated with a cool infusion.[63] Chronic diarrhea, dysentery, and menorrhagia are treated with 56-112 ml doses of the astringent juice extracted from the bark. A decoction of the bark can be used as a gargle or mouthwash to alleviate sore gums, stomatitis, a relaxed throat, and other oral disorders. Bark is also applied to skin irritation.The bark is utilized for coloring fishnets, tanning, and dyeing [64]. The Ayurvedic tradition states that this tree's bark has a variety of medicinal uses, including treating ulcers, biliousness, dysentery, sore throats, asthma, bronchitis, and digestive issues. It is also astringent to the bowels and acts as an anthelmintic.[65] The Diarrhea

caused by blood is treated with a mixture of jambu, amra, and amalaka leaf juice, goat milk, and honey.[63] To manage diabetes, the juice of the leaves is given orally. You take the juice first thing in the morning with a glass of milk. To alleviate indigestion, one can consume fresh leaf juice orally.[66] The juice of ripe fruit, when reduced to syrup, makes for a delicious beverage. An effective astringent for persistent diarrhoea and a helpful syrup for spleen enlargement can be made from the mature fruit.To alleviate acidity, treat diabetes, and soothe stomach ulcers, a hot water extract of dried fruits is utilized [67].Syzygium cumini seed ethanolic extract reduced alloxan-induced diabetes in rats [68].If you're suffering from diarrhoea, dysentery, an enlarged spleen, or low urine production, try taking a card containing powdered seed and mango kernels. The seed also has antimicrobial properties. [70]

CONCLUSION

Syzygium cumini, commonly known as Jamun, is a remarkable botanical species with multifaceted significance. Its botanical description as a medium-sized evergreen tree with dark purple to black, sweet, and astringent fruits makes it easily recognizable. This unique plant is endowed with a diverse array of phytochemical compounds, including polyphenols, flavonoids, tannins, anthocyanins, and ellagic acid. These compounds contribute to its remarkable pharmacological activities, which have been extensively studied and hold great promise for various applications. Syzygium cumini's pharmacological properties include potent anti-diabetic effects, where it has demonstrated the ability to regulate blood glucose levels, making it a valuable asset in the management of diabetes. The traditional uses of Syzygium cumini, deeply embedded in Ayurveda and traditional Indian medicine, are a testament to its historical importance. It has been employed for centuries to address a variety of ailments, from gastrointestinal issues like diarrhea and dysentery to skin conditions. Moreover, the fruit of this tree is not only nutritionally rich but also a source of medicinal benefits.

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