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UNVEILING THE THERAPEUTIC ATTRIBUTES OF *SYZYGIUM CUMINI*: A COMPREHENSIVE REVIEW.

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Abstract: Jamun, also referred to as *Syzyzium cumini*, has deep cultural and traditional medical value. Its extensive dispersion in different areas has made its investigation for medicinal uses easier. The information that is currently available about *S. cumini* is summarized in this review, including its pharmacological activities, traditional uses, phytochemical components, global distribution patterns, and historical origins. *S. cumini* has been valued for its many medical benefits for generations; conventional treatments focus on specific ailments. Analyses of phytochemicals have revealed a multitude of bioactive substances, including as quercetin, ellagic acid, and anthocyanins, which support its many pharmacological activities. To help guide future investigations and applications of *S. cumini's* therapeutic potential in modern medicine, this comprehensive study aims to gather the body of knowledge now accessible on the topic.

***Index Terms*: *Syzygium cumini*, traditional medical value, therapeutic potential, bioactive substance.**

INTRODUCTION.

As a member of the Myrtaceae family, *Syzygium cumini* also known as "Brahaspati" in Sanskrit, it is also known by the name Portuguese plum, Malabar plum, Java Plum, Black plum, jamun, Indian blackberry, Naval, Jambool and jambu[1]. The *Syzygium cumini* tree grows to a height of 8 to 15 meters, along with young reddish shoots and white branchlets. The opposite, glossy, leathery leaves are oblong-ovate to elliptic or obovate-elliptic, measuring 6 to 12 centimetres in length, with a broad, short point at the tip. Panicles are typically 4 to 6 cm long, borne largely from the branchlets beneath the leaves. These branchlets are frequently axillary or terminal. The tiny, many, fragrant flowers are borne in dense fascicles at the tips of the branchlets and are pink or almost white in color. They do not have stalks. The calyx is four millimeters long, funnel-shaped, and has four teeth. All the petals fall in unison. The calyx is roughly the same length as the many stamens. Fruit has a single, large seed and is oval to elliptic, 1.5 to 3.5 centimeters long, dark purple or almost black, delicious, meaty, and tasty with a sweet, astringent taste[2]. In Indian circumstances, it is available seasonally from May to July. It has been reported that this plant's leaves, seeds, and bark all have therapeutic qualities. It works wonders for treating diabetic mellitus, ulcers, nitric oxide scavenging, free radical scavenging, antioxidant, antibacterial, antifungal, antimicrobial, anti-HIV, and radioprotective measures[3]. This review describes mainly on the therapeutic potential of jamun plants and their applications in the treatment of various diseases.

2. HISTORY & DISTRIBUTION.

Originally from India, *Syzygium cumini* is now planted around the world in both tropical and subtropical climates. The tree adjusts to the soggy, swampy, and clammy conditions. It is able to withstand periods of extreme drought and flooding. It is a tree that grows quickly and can reach heights of more than 100 feet in the right climate. It grows 600 feet above sea level in the tropics. For this plant, the ideal soil pH range is 5.6 to 6.0 (acidic). Because it is revered by Krishna and the fruits and leaves are used to worship Lord Ganesha, it is typically planted close to Hindu temples[4].

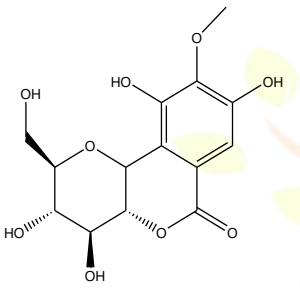
The tree has been known to grow for a considerable amount of recorded history throughout the Indian subcontinent and many other adjacent parts of South Asia, including Bangladesh, Burma, India, Nepal, Pakistan, Sri Lanka, and Indonesia. It was brought to Malaysia a very long time ago, and it got naturalized there. The tree is revered by Buddhists in southern Asia, and because Lord Krishna is said to love it, it is frequently planted next to Hindu temples. Additionally, the plant has been imported to numerous locations where it is used for its timber, as an ornamental, and as a fruit producer. The plant grows across the plains of India, extending from the Himalayas to the southern regions[5].

3. BOTANICAL CLASSIFICATION[6].

- Kingdom: Plantae
- Subkingdom: Tracheobionta
- Super division: Spermatophyta
- Division: Magnoliophyta
- Class: Magnoliopsida
- Superclass: Rosidae
- Order: Myrtales
- Family: Myrtaceae
- Genus: Syzygium
- Species: cumini

4. PHYTOCHEMICAL CONSTITUENTS.

Alkaloids, anthroquinone glycosides, flavonoids, tannins, saponins, phenols, cardiac glycosides, terpenoids, phytosterols, steroids, and amino acids were found in all extracts of the ethanol extract of Jamun stem bark, leaf, seed, and fruit pulp, with the exception that anthroquinones were missing from the extracts of the pulp and seed while terpenoids and phytosterols were absent from the leaf[7].



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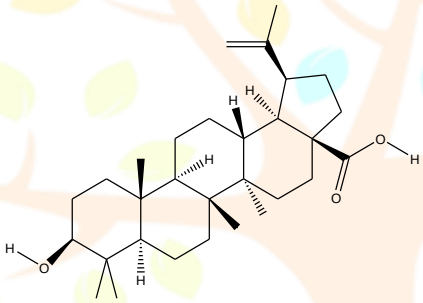

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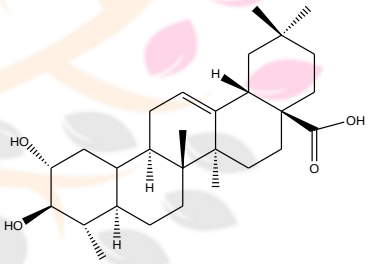

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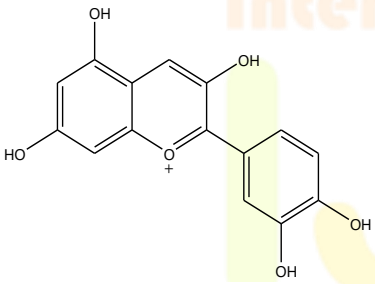

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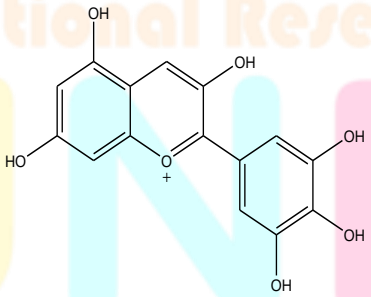

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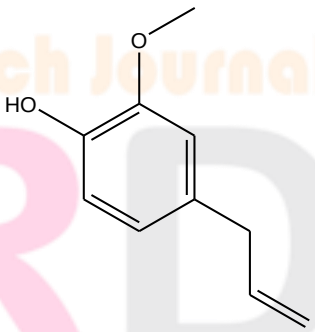

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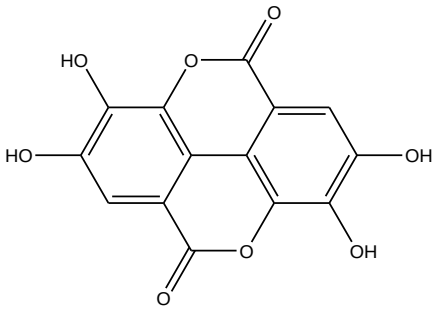

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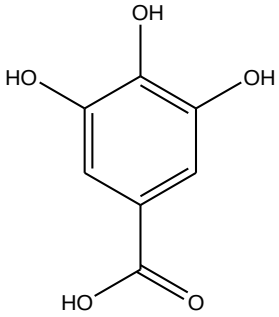

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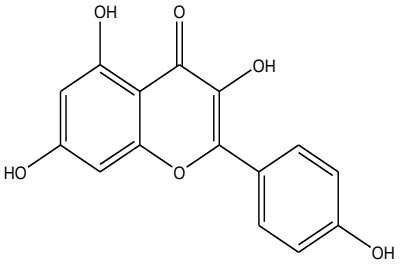

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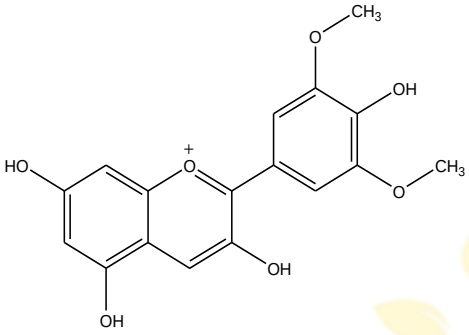

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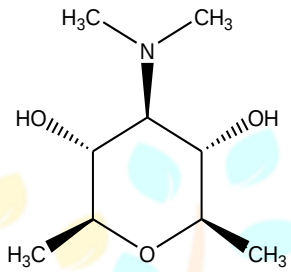

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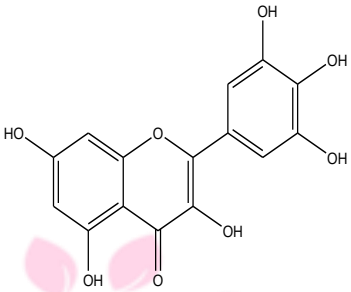

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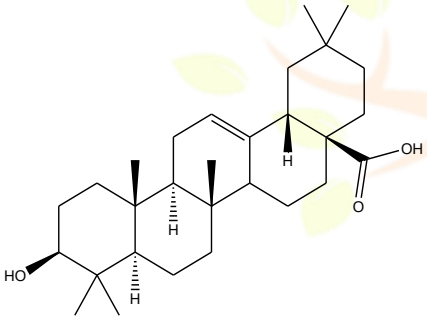

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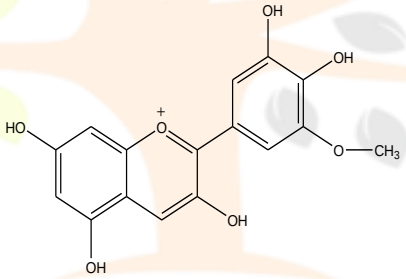

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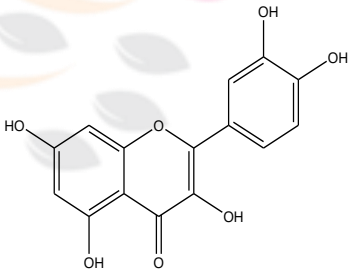

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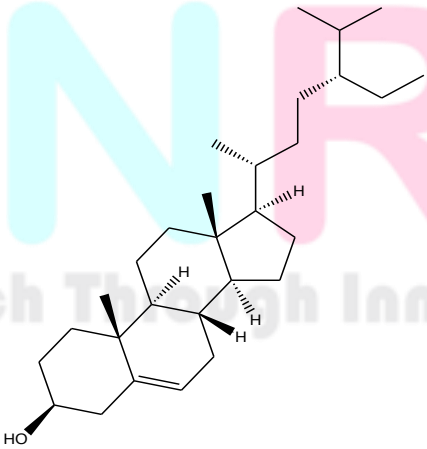


β-SITOSTEROL

Fig. 1. chemical structures of a few significant phytochemicals found in various jamun, *Syzygium cumini*, sections.

Table 1: list of phytochemicals present in Jamun Plant Parts[8],[9],[10],[11],[12].

Sr. No	Plant parts	Chemicals presents
i.	Seeds	Comprise constituents such as Corilagin, 3,6-hexahydroxydiphenoylglucose, 1-galloylglucose, Jambosine and Quercetin.
ii.	Stem	Contain components such as Fried Elin, Friedelan-3- α-ol, Betulinic acids, β-sitosterol, Kaempferol, β-sitosterol-D-glucoside, Gallic acid, Ellagic acid, Gallotannin, Ellagitannin and myricetin.
iii.	Flower	Contains compounds like Ellagic acids, Myricetin, Quercetin, Kaempferol, Isoquercetin, and Oleanolic acids.
iv.	Fruit pulp	Abounds in various compounds including Anthocyanins, Delphinidin, Petunidin and Malvidin-diglucosides.
v.	Essential oils	Cosnsist of elements like α-Terpineol, Myrtenol, Eucarvone, Muurolol, α -myrtenal, 1,8-cineole, geranyl acetone, α-cadinol and pinocarvone.
vi.	leaves	Abound in various substance including β-sitosterol, Betulinic acid, Mycaminose, Crategolic acid, Heptacosane, n-nonacosane, n-hentriacontane, n-octacosanol, n-triacontanol, n-doctricontanol, Quercetin, Myricetin, Myricitrin and Flavonols glycosides like Myricetin 3-0(400-acetyl)- α L-rhamnopyranoside.

5. TRADITIONAL USE.

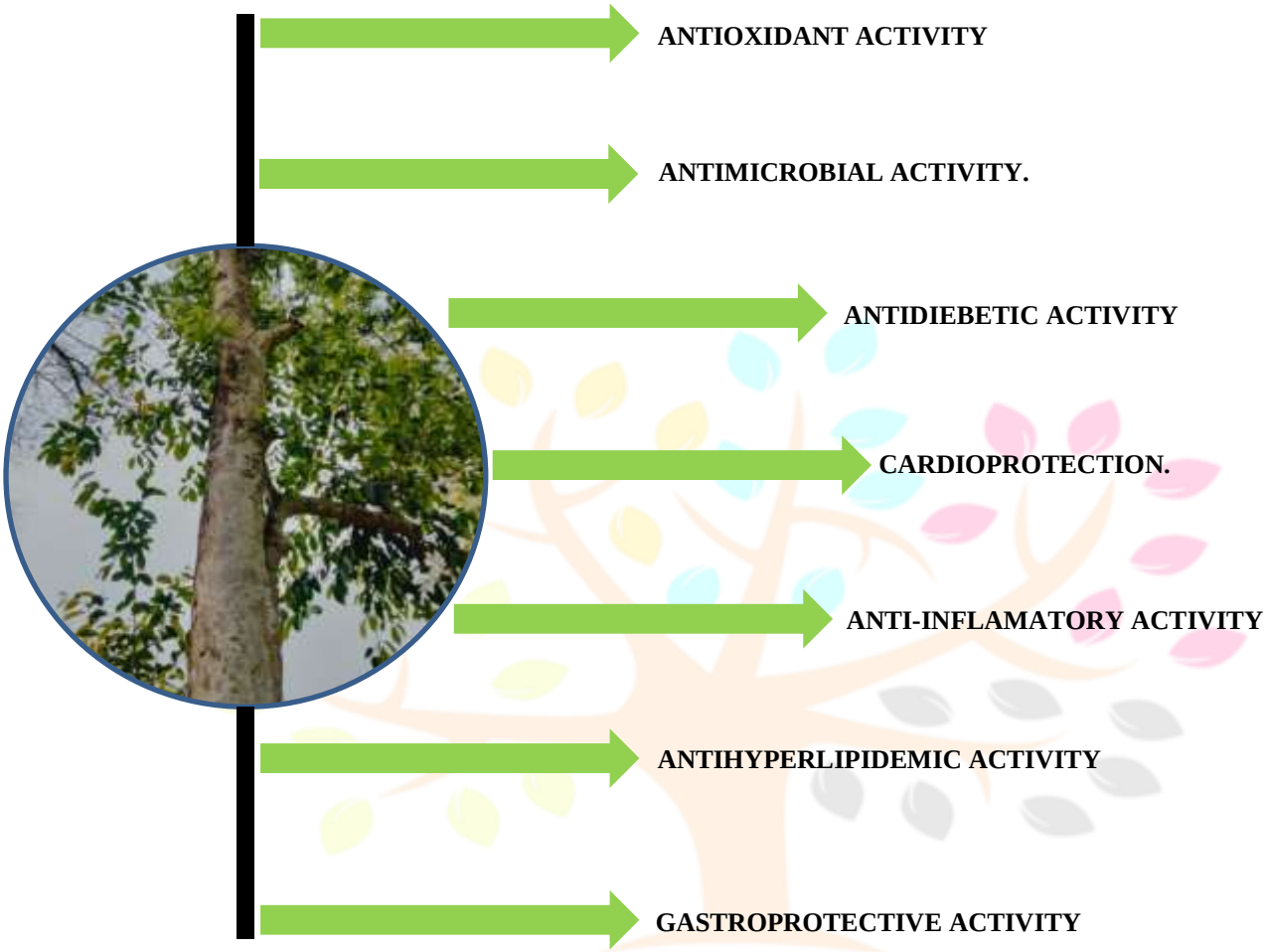
Jamun is used in many traditional medical systems, including homeopathy, Ayurveda, Unani, and Siddha. Jamun's pharmaceutical history is distinguished by the prescriptions Charkha and Sushruta wrote for treating a wide range of illnesses, including diarrhea, obesity, vaginal discharge, menstrual problems, hemorrhage, etc[13].

Table 2: Traditional uses of *Syzygium cumini* (Region- wise).

Region	Parts used	Mode of use	Reference
Paraja tribe(odisha)	Bark	Dysentery can be treated by taking paste orally along with water.	14
Lakher and Pawi in Mizoram, India	Fruit and stem bark	To treat diabetes, fruit infusions or a powdered bark and fruit mixture are used.	15
India	Root	Taken twice a day on an empty stomach to treat diarrhoea and dysentery.	16
Madagascar	Seeds	Consuming seeds is a useful treatment for reducing the effects of diabetes.	17
Nepalese, Lepchas and Bhutias in northeast India	Stem bark	For two to three weeks, decoction is given orally three times a day to treat diabetes.	18
Brazil	Leaves	Tea made by infusing or distilling leaves, which is consumed orally to treat diabetes.	19
Kani tribals in Southern India	Leaf and fruits	Leaf juice is consumed orally, often combined with honey or cow's milk. Diabetes is treated by oral consumption of fresh fruits.	20
Sinhal(Sri lanka)	Bark	In Ayurvedic medicine, bark decoction is used to treat diabetes mellitus.	21
Surinam	Leaves	After giving birth, women use leaves to constrict their vagina.	22
Malayalis in South India	Seed	For three months, a paste made with momordica charantia leaves and cassia auriculata blossoms is given orally once day.	23
Philippines	Bark	The bark is used to treat diabetes.	6

6. PHARMACOLOGICAL ACTION OF *SYZYGIUM CUMINI.*

Menstrual problems, diarrhoea, vaginal discharge, obesity, and haemorrhage can all be treated using *Syzygium cumini*. It is known that *S. cumini* has anti-inflammatory, anti-tumor, antioxidant, and antidiabetic effects in its fruit, seed, bark, leaves, pulp, and skin[24]. In numerous in-vitro contexts as well as animal models, there is proof of their chemopreventive,antipyretic, cardioprotective, and hepatoprotective properties. Studies have demonstrated that efforts are being made to combat bacterial infections, inflammation, diabetes, and obesity[25]. Below are details about the documented pharmacological activities of S. cumini.



- ANITOXIDANT ACTIVITY.

Antioxidants are essential nutrients that have the capacity to shield the organism from oxidative stress brought on by free radicals[26].

Toluene, ethyl acetate, acetone, and water were the various solvents used to fractionate the SC leaf extract. These fractions capacity to scavenge free radicals and behave as antioxidants was studied. The acetone extract fraction produced the best results out of all the fractions[27].

The Radical scavenger capacity (RSC) of SC was determined using the DPPH (2, 2-diphenyl-1-picrylhydrazyl radical) experiment. These values were compared with those of synthetic and natural antioxidants after the RSC were calculated using the second order rate constants, k2. The k2 value of SC was determined to be 15.60 L/mol g s in menthol at 25°C, indicating its potent antioxidant characteristics[28].

- ANTIMICROBIAL ACTIVITY.

S. cumini fruit ethanol extract exhibited antibacterial and antifungal properties against every tested bacterium. Using ciprofloxacin for the bacteria and amphotericin-B for the yeasts, the antibacterial and antifungal susceptibility test showed MICs of 1.0 µg/ml and 0.25 µg/ml, respectively[29]. The most effective hydroalcoholic extract against candida krusei was found in the leaves of *Syzygium cumini*. The inhibition zones have a range of 8.3 ± 0.3 mm to 14 ± 0.3 mm. Furthermore, a multi-resistant strain of Staphylococcus aureus was shown to be active.[30].

- ANTIDIEBETIC

Many people worldwide suffer from diabetes, and Indians are particularly vulnerable to the disease. Although diabetes was not common in ancient times, the Ayurvedic pharmacopeia emphasizes the antidiabetic value of jamun, whose seed powder is thought to reduce high blood sugar levels. For almost 130 years, people in the Western world have used jamun as a blood sugar management medication; yet, the outcomes of clinical investigations have been inconsistent. Some patients showed good response to the medication, while others showed no response at all [31]. In addition to the edible components like fruits and seed powder, *S. cumini* leaves can dramatically lower blood and serum glucose levels in animals with diabetes in an experiment[32]. *S. cumini* seed extract (200 mg/kg) and the prescription drug metformin together significantly reduced hyperglycemia in streptozotocin-induced diabetic mice[33].

- CARDIOPROTECTION.

In the case of *S. cumini*, Wistar rats that were spontaneously hypertensive and normotensive were used to assess the hydroalcoholic leaf extract. The research investigation's conclusions showed that the extract lowered both heart rate and blood pressure. The most likely mechanism of action was proposed to be the suppression of arterial tone and the extracellular calcium influx[34]. Similarly, giving Wistar rats an hour's notice before doxorubicin therapy for the next fifteen days at an ethanol extract of jamun seed powder protected cardiac tissues from the cardiotoxicity of doxorubicin[35]. Additionally, it has been found that the methanol seed extract of jamun protects H9C2 cardiomyoblasts against the stress that glucose causes[36].

- ANTI-INFLAMATORY ACTIVITY.

The ethanolic extract of *S. cumini* bark was used to investigate the bark's anti-inflammatory qualities. The extract showed no toxicity in mice at doses between 10 and 125 g/kg .i.p. This study shown that *S. cumini* bark extract possesses potent anti-inflammatory qualities against different stages of inflammation without posing a risk to the stomach mucosa[37].

- ANTIHYPERLIPIDEMIC ACTIVITY.

Anomalies in lipid profiles are a common consequence of diabetes mellitus, which affects around 40% of the population. An ethanolic extract of E. jambolana kernel (100 mg/kg body weight) showed antihyperlipidemic efficacy on streptozotocin-induced diabetic rats, with glibenclamide acting as the reference drug[38].

- GASTROPROTECTIVE ACTIVITY.

The impact of ethanolic extract of E. jambolana seed on stomach ulcers caused in rats by aspirin, pylorus ligation-ethanol, and two hours of cold restraint stress was investigated by Chaturvedi et al. Eugenia jambolana may have an ulcer-preventive effect because of its effects on both defensive and offensive variables. Eugenia jambolana's antioxidant characteristics support its action[39].

7. CONCLUSION.

Herbal remedies for various human illnesses have been referenced in Indian literatures such as Ayurveda. Jamun, usually referred to as *Syzygium cumini*, is a plant with a variety of pharmacological properties. Its many parts, including the bark, leaves, fruits, and seeds (kernel), have therapeutic properties. The jamun is rich in antioxidants, polyphenols, flavonoids, minerals, vitamins, and phytochemicals. These priceless natural ingredients are used extensively throughout the world as folk medicine to alleviate illnesses. The results of several studies that were included in this study demonstrated the plant Jamun's major health benefits. Studies using undefined or crude S. cumini extracts have shown a variety of advantageous properties, and these results strongly suggest further investigation into the defined/purified elements of S. cumini. The majority of pharmacological research is done on rats, however human beings must also be used to investigate the pharmacological potential of various plant sections.

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