

Therapeutic traits of jamun tree: *Syzygium cumini* (Linn.) to combat against covid-19

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Abstract

Jamun tree (*Syzygium cumini* L.) is a precious medicinal plant of the Myrtaceae family which has been used in the traditional medicine of India and the world. Geographical distribution and the botanical description has been reported in this review. Indian Black plum is extensively used in Ayurveda medicine, and it is used to cure cough, cold, asthma, allergic, inflammation and piles. The flower extract of this plant have antimicrobial activities and has about 10 mineral content in XRD analysis in various studies. The most important phytochemical studies of Jamun plum tree originated in 17th century. To date, about 35 components including cyanogenic glycoside, tannins, gallitannins, gallic acid, triterpenoids and essential oil have been extracted from different parts of the plant. With literature study, about the Jamun fruit is against 12 microbes with antimicrobial activity has been reported in the different parts of the black cherry. In general, the results of this study indicate that the Indian black cherry due to the effective phytochemical properties, antimicrobial, anti-inflammatory, antidiabetic, anticancer, anti Leishmaniasis, anti-obese Hepatoprotective, Gastroprotective, anti-viral activities etc., it can be used to boost up the immune system treat of various diseases which can be used as an vital multi target therapeutic medicinal plant especially during this pandemic outbreak which battle against Covid-19 disease.

Keywords: jamun tree, phytochemical activity, anti leishmaniasis activity, antioxidant activity, antidiabetic, hepatoprotective, Covid-19

Introduction

The Herbal plants is having many bioactive compounds for developing drugs for various disease. The research in these medicinal plants may result in the nutraceuticals which are diet supplements. They are the bioactive components to enhance the immune system. Our planet is occupied by various species of plants. According to the scientist about 391,000 species of plants with about 94% of the plants were flowering plants. According to the food and agriculture organization about 50,000 plants are estimated. In which about 17,810 plant species are present in which 30,000 plants are documented. About 2200 species are categorized as medicinal plants growing annually at the rate of 7-15%. These medicinal plants are the base for the open research globally. Many plants were traditionally which are documented in many literatures which has been proved in effective against treatment for various diseases and World Health Organization encourages to explore on it. The seeds are given as effective medicine in the various treatment like Ayurveda, Unani and Chinese treatment for the ailments. In the epic the Jamun fruit is called the "Kala Jamun fruit – The fruit of God". So these medicinal plants are grown to extract the nutraceutical and sold which is also exported throughout the world [7].

Botanical Description: *Syzygium cumini* L.

Taxonomic specificity

One such traditional plant is *Syzygium cumini* famously called as Jamun or Naval Palam [18]. *Syzygium cumini* which belongs to the Myrtaceae family is known for its fruit with various names such as Portuguese plum, black plum, Malabar plum etc. Various parts of the *Syzygium cumini* such as barks, fresh fruit, dried fruits, fruits, seeds and leaves were subjected to research, the Jamun tree has the ability to

grow upto 50-100 feet or 30 meters in height with 3-4 meters girth [3] in 40 years with Bangladesh [28] India, Nepal and Pakistan as its native. The leaves of the Jamun are oblong; ovate with about 7-14 cms in its length as shown in the Figure 1. This summer fruit with its pulp is purple in color with sweet to sour in flavors [29]. It is a seasonally mostly available in the monsoon [36]. The leaf gall of the Jamun tree has more ash values and extractive values of physiochemical parameters compared to the normal leaf of Jamun [35].

The bark of the tree is found to be irregular, splintered and tarnished on the base part of the trunk. The wood is very strong and is used in making furniture, agricultural equipment etc.

Flowers are in the form of bunches with cone shaped calyx and united petals. The flowering will be commenced when the leaves are matured. Accordingly the change their foliage when the leaves shed. These flowers are aromatic nature with about 5mm in diameter. Usually, the flowering take place in march, germination and fruiting in July, vegetative growth in august, seed maturation in September and death in death in October and again vegetative growth in December as the phenogram, the periodic behavior of plants. This periodic behavior results in the various phases of cycles with seasonal changes.

Taxonomic Classification [32]

Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliopsida
Order: Myrtales
Family: Myrtaceae
Genus: *Syzygium*
Species: *cumini*

Synonyms: *Eugenia jambolana*

Distribution

Jamun tree is distributed throughout India in the upper gangetic plains as an evergreen tree especially in the tropical areas as shown in the figure 2. Usually they are cultivated in the banks of rivers, lakes and moist localities for the shade purpose along the roadsides. In 17th century Miller cultivated in England. It was spread to the other countries Thailand, Madagascar, Philippines, Israel, Algeria, California, Ceylon, Malaya, Australia in the figure 3 [18]. All the forest district of south part of the India is grown with the evergreen tree [12]. It is grown in the Thailand, Deccan, Bengal, Philippines Madagascar and also in the streams, damp places in the evergreen forest.

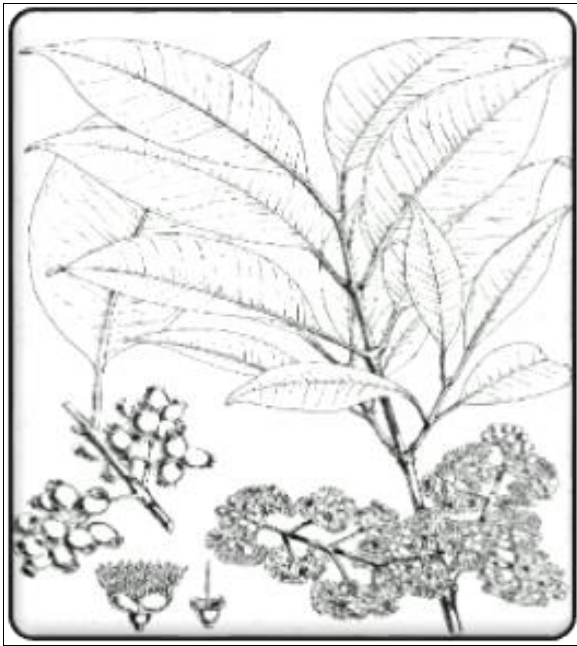


Fig 1: *Syzygium cumuni*



Fig 2: Indian Black plum distribution throughout the Evergreen forest India:

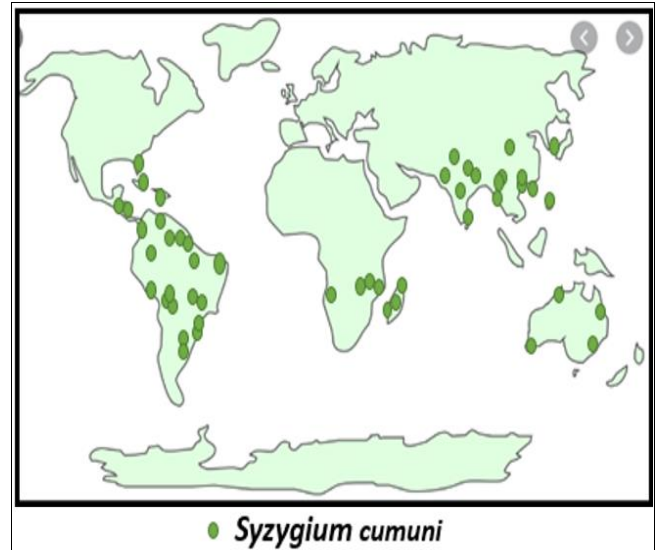


Fig 3: Jamun Tree distribution of *Syzygium cumuni* throughout the world:

Jamun farming and techniques in brief

The high potential ability of the plant or the tree is with deep loam soil of for plant growth. The tree can withstand soil conditions with salinity and waterlogged conditions for its optimum growth. Jamun trees found to be best in dry weather for the fruit setting and for its proper development. Jamun / Naval fruit can be propagated through seed and polyembryony by various ways. The Jamun tree is grown in the propagation method is conventionally and has a good economical results. The Jamun seeds have no dormancy period and can be sowed easily for a better germination. It may take 15-20 days. The farming of the Jamun tree starts with digging of the pit filled with about 75% soil with 25% compost manure. Pit with recommended size 1*1*1 m size. Irrigation of the Jamun trees requires of about 8-10 times throughout a year. The growth of the Jamun tree is expected to be in three phases. The fruiting is induced by the application / spraying of Gibberellic acid GA3 at ppm of 60. The flower of the Jamun tree which has a higher efficiency of the pollen fertility. As usual of the pollination in other plants the Jamun tree flower also through Honey bees and Houseflies etc. In case of absence of this pollination, the traditional method of Hand pollination can be carried out to improve the rate of pollination yet at time there may be a decline in the productivity of fruit set. The ripened fruits are usually handpicked with most care. Almost 80-100 kg of the Jamun fruits are obtained on an average yield. In the room temperature the fruits can be stable for almost 4-5 days and can be refrigerated for many days.

Pharmacological activities

Phytochemical activity

The plants medicinal values are increased as its primary and secondary metabolites are more in amount. The metabolites such as cyanogenic glycoside, tannins, gallitannins, gallic acid, triterpenoids, essential oils etc are identified from the parts of the black plum tree. The stem bark contain the chief bioactive components like Ellagic acid (astringent property), β sitosterol, Quercetin, Myrecetin etc., they also have resin, tannin, gallic acid, various, Phytosterols, carbohydrate with medicinal application with the relief of diarrhea²⁶. The other *Syzygium sp.*, the wax apple has found to have the phytochemical such as Flavanol and its derivate

Flavanoderivate, Anthocyanidine and its derivative proanthocyanidin, Terpenoids and triterpenoids etc [44].

The color of the fruit is obtained by the molecules such as cyanidine and diglycoside. It also has the carbohydrates such as glucose, mannose, fructose and galactose with the mineral of Calcium, potassium, Magnesium, copper, sodium are present. Studies confirm the presence of the B₁, B₂, B₃ vitamin are predominantly present [40].

Antimicrobial activity

According to the recent study the ethanolic extract of the *Syzygium cumuni* has the antimicrobial activity against the Microbes such as *Pseudomonas aeruginosa*, *Bacillus cereus*, *Staphylococcus aureus*, *Escherichia coli*, with active zone of inhibition [20]. The flower of the extract has the anti action on the Microbes such as against *Mycobacterium smegmatis*, *Staphylococcus aureus*, and *Candida albicans* [21]. Also the

alcoholic extract of the bark of *S. cumuni* have antibacterial activity [13]. By the latest studies of analogous results with the seed and leaf extracts of *Syzygium species* also had antimicrobial activity against *Klebsiella sp.*, *Cryptococcus sp.*, and *Pseudomonas sp.* [8]. Similarly the juice or the extract had effect against the pathogens in the enteric gut. It strongly inhibits the pathogens which also affects the skin tissues such as *S. aureus*, *P.aeruginosa*, *S. epidermidis* and *P. vulgaris* [37]. There are also other organism such as *Citrobacter freundii*, *Escherichia coli*, *Escherichia aerogenes*, *Proteus mirabilis* were controlled by the methanolic, acetone and hexane extract of SC where among which highest activity was reported in the methanolic extract [10]. Additionally in Anti-plaque activity, *in vitro* study the bark extract prepared with (1:1) aqueous and methanolic solvent found to overwhelm the plaque and has antimicrobial activity against *Streptococcus mutans* [24].

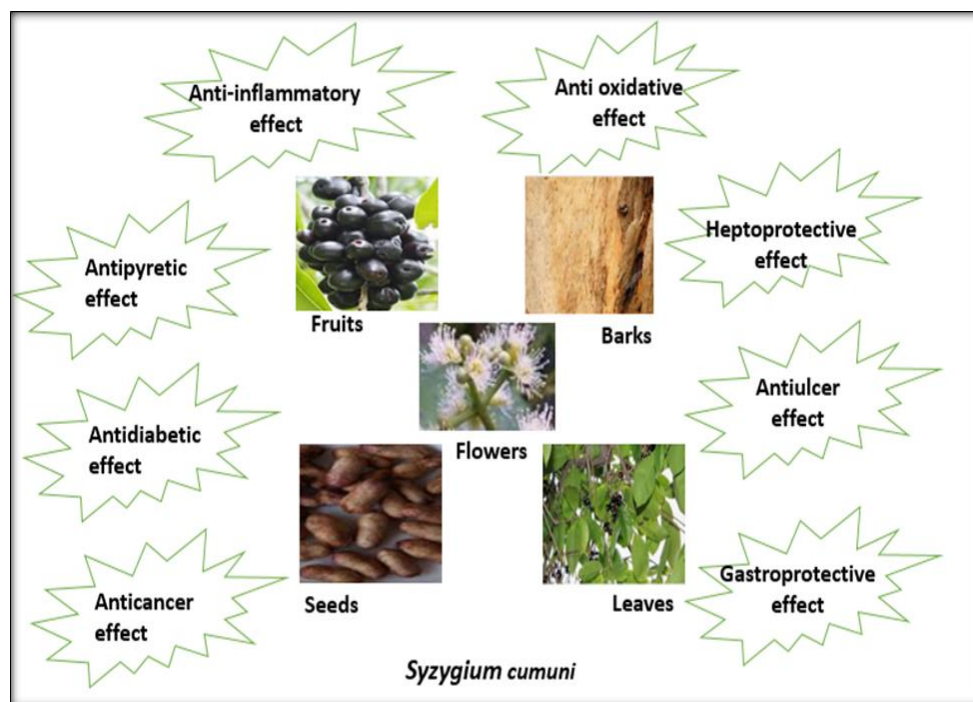


Fig 4: Pharmacological Benefits of *Syzygium cumuni*

Antioxidant and Anti-cancer activities

Jamun fruit has the potential to fight against the cancer. According to the investigation and study [23], four different anthocyanin compounds were isolated which proved to have alcoholic extract has cytotoxic effect against tumor cells especially various tumor cell lines of carcinoma such as MCF7, H460, Hela cells, HEPG2, U251 etc. Various extracts of polar and nonpolar of *Syzygium cumuni* amid which the study proved that the ethanol extract have stronger activity against the leukemia cell lines. The phenolic compounds present in the extract of this plant was found to be more activity for antioxidant and anticancer activity with active molecules such as sitosterol and Kaempferol 7-Omethyl ether [1].

The ethanolic extract of the fruit of three cultivars, in which green cultivar of *Syzygium sp.*, variety was more effective in antioxidant activity than the other cultivars such as the pink and the red one [20]. The SC extract which is high in the anthocyanin were able to reduce the liver damage by antioxidant activity which was proved in CCl₄ induced rats with hepatoprotective properties [40]. The selective

cytotoxicity is generated by the Betulinic acid (Tri terpinoids) which fights against the specific tumours and also the fruit extracts of ethanolic have more potential antioxidant activities such as in ABTS, DPPH, FRAP, TEAC, ORAC, superoxide, hydroxyl, peroxy scavenging assays. According to the research, the old rats fed with the *Syzygium cumuni* showed a significantly less oxidative stress in the brain and improves the learning related memory in the Alzheimer's diseased model rats [31]. The Jamun seed extract (JSE) inhibited the hepatic lipid peroxidation and showed the activity of GST, SOD, CAT while with increasing the level of GSH. The high levels of the antioxidant boost up the immunity in the individual and helps to fight against the various diseases which is associated to have a very decreased incidence of developing Cancer, Cardiovascular disease, diabetics, obesity etc [27].

Hepatoprotective and Gastroprotective activity

The protection of the Liver inflammation, metabolism, secretion and storage activity is increased by the pulp of the Jamun fruit. The liver enzymes of ALT, AST and AP's

serum level were found to be decreased by consuming the Jamun fruit regularly. The seed extract of the SC is evaluated effective against the ulcer. It is administered with the acarbose with 5mg/kg for a recovery of ulcer problems [16]. The patients of Fatty liver are due to the liver enzymes fluctuations where the Jamun fruit can be used which reduces the pain and the inflammation which prevent the Liver cirrhosis condition to death.

Antidiabetic activity

Diabetic condition is very prevalent and a killer disease because of its increased mortality rate. The medicine used to maintain the sugar levels are having side effects which needs an alternative medicine to cure this disease with no side effects [19]. By this, researcher like has explored compounds against the diabetics. One such compound is mycaminose having its activity against the streptozotocin (STZ) induced rats [18]. Also analogous results were obtained by the study done where the stem bark extract has a potential activity of decreasing the glucose content in the blood of the streptozotocin (STZ) induced rats which was seem to be less activity of the standard drug Glibenclamide [38]. It was proved continuous 3 week administration of the Jamun extracts had significant effect against the diabetic control rats. Similarly the study by the ethanolic seed extract on the alloxan induced diabetic rat and found significant decreased in the blood sugar level [33]. A similar study by Sharma *et al.*, produced a hypolipidemic and hypoglycemia effect in the streptozotocin induced diabetic rats for the seed extract with high content of flavonoid.

Anti Leishmaniasis activity

A complex parasite disease is controlled by chemotherapy. Similar effect is a new research area where the *Syzygium cumuni* (SC) extracts had more active compounds like sesquiterpenes, monoterpenes, and other constituents of essential oils which can be further improved for the new drug formulations [2]. Immunomodulatory effect of this SC extract has potential effect on the Leishmaniasis effect.

Medicinal uses and Immune boost up by parts of the Jamun tree

During various pharmacological investigations *Syzygium cumuni* parts of the tree possess various pharmacological properties against the microbes, immunodeficiency diseases, diabetic effects [17], gastroprotective activities and CNS activity. Usually the fruits and vegetables is to decrease the danger for chronic disease like Stroke, cardiovascular diseases and cancer [41]. The bioactive compounds such as phytochemicals, antioxidants, anticancer agents are particularly medicinal plants which has wide range of scope and extreme attention. Also the pharmacological activities such as spasmolytic, antiviral, analgesic, antiulcer were also recorded with various properties [9]. The fruit of the Jamun tree has a sweet taste with an astringent used as a treatment for the chronic diarrhea. The seeds of the fruits were investigated to have good response for the diabetes [40]. The seed Jamun has more protein content and also it has calcium in it [15].

The extract of the Jamun is used to cure the cough, cold and asthma. It also have effect on the skin allergies and acts against the problems of ulcer in the gastrointestinal tract. It has its effect to reduce the inflammation and cures piles. The Bioactive Polyphenolic Compounds of the Jamun is

healing against cancer, diuretic problems, heart problems etc. The regular usage of this Indian black plum extract will increase the low glycemic index of the blood. Also they have rich content of vitamin C and carotenoids [5]. The hemoglobin content of the blood is increased in the anemic patient on consuming the fruit regularly. As this fruit or its extract as more medicinal uses, various researchers has examined it for pharmacological activities.

The leaves of the Jamun tree has medicinal applications such as dermal skin treatments and cure constipation. Jamun tree oil have their properties such as antibacterial [30], antioxidants [11] and antifungal activity [4]. Cardio protective, Antihyperglycemic [22]. Fruits also influence on the curing the problems in Pharyngitis and spleen diseases.

A Study investigated that the compound Gallic acid present in the Jamun fruit is administered in the obese rat which reduces the obesity than that of the individual compound. The repeated dosage of the Jamun syrup can be avoided by preparing the Natural drug delivery system which is nontoxic and to reduce frequent dosage of herbal preparations [42]. According to the USDA Nutrient database, the Jamun leaves has major nutrients in various presents such as 7% of Ash content, 9.1% of Crude protein, 0.19% of Phosphorus, 1.3% of Calcium, 17% of Crude fibre, and 4.3% of Fat.

According to the recent study, the analysis of the flower extract by XRD analysis has the minerals such as Zinc (Zn), Zernike (As), Lead (Pb), Barium (Br), Potassium (K), Calcium (Ca), Titanium (Ti), and Magnesium (Mn), Iron (Fe), Copper (Cu), and Strontium (Sr) with concentration variations in the elements of diversified parts of *Syzygium cumuni*. Also in the FTIR analysis of bark of *Syzygium cumuni* the functional groups such as alcohol, alkenes, benzene, carboxylic acid, ether, aromatic etc [20].

Anti-viral activity

The raw cold and hot aqueous extracts of the bark and the leaves of Jamun tree proves anti-viral activity against the most pathogenic avian virus (H5N1) which controls the contagious disease in the poultry [33]. A viral study investigates that the leaves of the Jamun showed virucidal effect on the goatpox virus (GTPV) and also inhibited its replication [6].

Commercial products of Jamun in Market

Jamun juice are available in the Commercial markets of its various therapeutic uses. Frutech Jamun Juice, Tymon Jamun Juice, Karela Jamun Juice, Sovam Jamun Juice, Improve BROWN Jamun Juice, Herbal Aci Jamun Juice, Pioneer Jamun Juice etc., with varying ranges of volume and prize. Also the seed powders are sold in the markets to cure the kidney problem and also to boost up the immunity. The anthocyanin and anthocyanidine compounds in the Jamun juice are highly instable if not stored in the argon bottles at -20 °C. So the pure compounds were purified and available as Nutraceutical in the markets [12]. In many Ayurvedic formulation the Jamun fruits are also added as a main constituent to benefit against the Obesity.

Jamun booster of Immune system – a battle against the COVID-19

In this pandemic outbreak of COVID-19, individuals of about 3,757,470 are been affected throughout the world with 212 countries with two international conveyances dated on

6th May, 2020 by World Health Organization (WHO). Whereas 1,258,552 cases have recovered in spite of 259,496 of individual's death. The recovery of the fight against the COVID-19 may be by the antiviral agents, supported them through ventilations in the case of severe symptoms prolonged. In the active cases mentioned about 98% of the Covid-19 patient have mild conditions with symptoms it is about 2,190,347 cases. Also Though the WHO emphasis on the preventive measures such as social distancing, using the masks, gloves, washing the hands with soaps and insists to avoid consumption of Alcohol, vaping, smoking which weakens the lung's capacity leads to suffer Acute Respiratory Distress Syndrome (ARDS). It also emphasis in its recent scientific brief reports that the immune system has the innate immunity with the immunoglobulins and the cellular immunity with T- cells when on triggered by the virus/ a pathogen. The response of both immunities together if strong enough will not have severe illness or may have mild conditions. It also stated that there is no research evidence about the efficiency of antibody-mediated immunity to assure the accuracy of so called Immune passport' or 'risk-free certificate, for the recovered patients may be they can have a reinfection/ second infection, WHO cautioned.

The mild conditions / asymptomatic condition may also end up in the spreading up of the infection. With this scenario, the only option left is to boost up the immunity to combat the battle of Covid-19 along with the preventive measures while the new vaccines for SARS-nCov are under clinical trials. By Narayana Health reported on 2020, stated to encounter the novel coronavirus, it is necessary to improve the immune system to resilience the infection. This can be carried out by the intake of antioxidant potent food and always hydrated with fresh juices.

If the immunity is boosted up with regular intake of the medicinal plants. One such immune booster is Jamun, *Syzygium cumini*. With various pharmacological properties mentioned above with Anti-viral activity, there are some nutritional contents such as Vitamin C (14.3 mg/100g), Iron (0.19mg/100g), Calcium (19mg/100g), Sodium (26.2 mg/100g), Potassium (79mg/100g), Magnesium (15mg/100g), Vitamin B3 (0.260mg/100g) and Energy (251kJ) which play the important role in gaining the immunity to the individual when taken regularly as the energy of the fruit is itself is about 3-4 calories. The recent studies showed that keto diet of the rat showed the reduced influenza illness which is rich in vitamin C, B, Zinc etc. The nCov can be stable with the pH 6 at 37 °C as per investigated by Sturman *et al.*, 1990. The acidic and alkaline environment is difficult to withstand in an individual system. The Jamun pulp, seed are 3.84±0.01 and 2.5±0.1 respectively ^[14] which will be against the virus optimum growth pH.

By above literature evidence, Jamun fruits and the tree products in various form can be recommended to improve the immunity to combat the many disease including the Pandemic Covid-19.

Conclusion

Eventhough the Jamun tree is well known for its medicinal properties, the usage of the Jamun tree's various parts are not regularly taken up by the people in their regular diet. This review highlights the importance of using the Jamun fruits, seed, barks, leaves in various forms in the diet or as

syrups available in the markets and also all the studies depicted in the review indicates and recommends to take up in their regular diet of this marvel fruit *Syzygium cumini* (Naval plum) as a better therapeutic medicine for various disease such as diabetic, cardiac, obesity, cancer and related problems especially in today's scenario to battle the Covid-19.

Conflict of Interest

Nil.

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