

PHYTOCHEMISTRY OF JAMUN (SYZYGIUM CUMINI, MYRTACEAE) AND MEDICINAL PROPERTIES

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Keywords: Jamun; traditional medicine; phytochemicals; antioxidants; antibacterial, antidiabetic, cardioprotective, hepatoprotective, antiinflammatory, radioprotective, cytotoxic; NF- κ B, COX, TNF- α and wound healing.

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Summary

This chapter introduces to the reader traditional uses of Jamun in the treatment of various human ailments. The emphasis of the chapter is on taxonomic position, distribution, scientific and colloquial nomenclature, phytochemistry, traditional medicinal uses, and recent developments in various preclinical and clinical research of different parts of Jamun. At the end of the chapter, the conclusions give the whole summary of the chapter's contents. Jamun or *Syzygium cumini* (family Myrtaceae) is valued for its sweet fruits and medicinal properties. Jamun is native of India, Bangladesh Ceylon, Pakistan, and Myanmar. Traditionally, Jamun is considered sweet, sour, astringent, acrid, refrigerant, carminative, diuretic, and digestive. Ayurveda prescribes Jamun in the treatment of arthritis, obesity, asthma, bowel spasm, stomach pain, flatulence, diabetes, and dysentery. Jamun is effective in treating fever, leucorrhea, piles, wounds, stomachache, and gastric, dental, skin, and urinary disorders. Several scientific studies have demonstrated that Jamun acts as an antioxidant, antidiabetic, antiallergic, antiretinitis, antipyretic, antidiarrheal, antinociceptive, anticancer, antiobese, antihyperlipidemic, anti-inflammatory, antimicrobial, cardioprotective, gastroprotective, immunomodulant, hepatoprotective, wound healing, diuretic, anthelmintic and radioprotective agent. These medicinal properties of Jamun are due to the presence of alkaloids, anthraquinones, catechins, cardiac glycosides, flavonoids, glycosides, steroids, phenols, tannins, and saponins and numerous bioactive phytochemicals synthesized by its roots, stems, leaves flowers, fruits, and seeds. The beneficial effect of Jamun on various important organs and tissues is due to its ability to increase glutathione, glutathione peroxidase, catalase, and superoxide dismutase and reduce lipid peroxidation and DNA damage triggered by different toxicants, and ionizing radiations. At the molecular level, Jamun activates PPAR α , PPAR γ , fatty acid, and glucose metabolism and suppresses NF- κ B, IL-6, COX-1, COX-2, ICAM-1, CXCL2, iNOS, TNF- α , and Bax. Despite several salubrious effects, Jamun induces adverse effects in certain conditions, which can be neutralized by consuming common salt and *Piper nigrum*.

1. General Introduction

Plants have been used to treat different human ailments since the advent of human civilization. In India, the history of the use of plants and natural products for the treatment of different diseases is more than 5000 years old. The Atharva Veda mentions

the use of 50 plants and the Ayurveda is considered an offshoot of Atharva Veda. Ayurveda gives a detailed description of the medicinal uses of several plants/natural products. Plants are a rich source of medicines and the medicinal properties of plants are due to their ability to synthesize numerous secondary metabolites. The number of phytochemicals synthesized by plants is approximately 326,000 out of which 195,000 are pharmacologically active and have great potential as a future medicine. Seventy-five percent of modern medicines have been derived either directly from plants/natural sources or have contributed immensely to their chemical synthesis.

Plants/natural product-derived molecules have been instrumental in the treatment of cancer, infectious, psychiatric, tropical, immune, kidney, and inflammatory diseases. Synthetic chemical drugs, including antibiotics and cancer chemotherapeutics, are associated with the development of therapeutic resistance. The plant/natural products may be helpful in this regard. The interest in natural products has seen a resurgence due to economical reasons and lesser toxic implications when compared to synthetic drugs. There are a vast number of plant/natural products that remain unexplored for therapeutic purposes. The importance of natural products in drug discovery becomes evident from the fact that the FDA approved 547 drugs derived from natural products or their derivatives in the year 2013. Therefore, natural products will continue to play a crucial role in the discovery of newer medicines in the future.

2. Profile of Jamun

To facilitate understanding in different circles, scientific and common, the scientific names and common names are listed in Table 1.

Scientific names	Common names
<i>Syzygium cumini</i> (L.) Skeels,	Indian blackberry,
<i>Syzygium jambolana</i> (Lam.) DC.,	Black plum, jambolan,
<i>Syzygium jambolanum</i> DC.,	java plum, purple plum,
<i>Syzygium caryophyllifolium</i> (Lam.) DC.,	Malabar plum,
<i>Calyptanthus oneillii</i> Lundell,	Jambul, jamblang,
<i>Calyptanthus jambolana</i> Willd.	Damson plum,
<i>Eugenia cumini</i> Druce,	Duhat plum,
<i>Eugenia caryophyllifolia</i> Lam.,	Jambolan plum,
<i>Eugenia jambolana</i> Lam.,	Rose-apple or Portuguese plum (in English)
<i>Eugenia djouat</i> Perr. and	
<i>Myrtus cumini</i> L.	

Table 1. Names of Jamun- scientific and common

Likewise, the names of Jamun in different Indian languages are given in Table 2.

Names in different languages of India	
Language	Name(s)
Assamese	Jamu or kala jamu
Bengali	Kala jam
Gujrati	Jambu, and jaambu
Hindi	Jamun, jaman duhat or jam
Kannada	Nerale hannu, jambuneral, jumnerale, nainerale, jambuva, naayinaeral and neeram
Malayalam	Gnaval, naga, naivil, palamper, perinnaralnjara, njaval, perin-njara, and naval-pazham
Manipuri	Gulamchat or jam
Marathi	Jam, jaman, jambul, rajale, rajjambula and thorajambula
Mizo	Hmuipui or Lenhmui
Oriya	Jamkoli
Pali	
Prakrit	Jambulo, and jammulo
Punjabi	Jaman
Sanskrit	Jambu, jambuphalam, phalendra, raja-jambuh, mahaskandha, or meghamodini
Tamil	Areconitamaram, arugadam, arukatam, caccanam, cattuvalam, nampu, neretu, kavarkalimaram, turavam, and turkolum
Tangkhul	Chomshathei
Telugu	Goyya-pandu, jam-pandu, jamba, jambu, naredu and raacahnaeredu
Urdu	Jaman, jamun and poast jamun

Table 2. Names of Jamun in Different Indian Languages

Furthermore, the names in other countries are listed in Table 3.

Country	Name(s)
Brazil	Azeitona, jambol, jambulao, jamelao and jalao
Cambodia	Pring bai
Cook Islands	Ka'ika and pistati
Cook Islands (Aitutaki)	Paramu
Fiji	Kavika ni India and jammun
France	Jamélongue, jambolanier, jamelongier, faux-pistachier and jamelon-guier
Germany	Jambolanapflaume, rosenapfel and wachsjambuse
Guam	Duhat

Indonesia	Duwet and jamblang
Italy	Pomo della malesia
Jamaica	Damson plum
Jamaica	Indian blackberry
Japan	Madan
Kenya	Msambarau and mzambarau
Madagascar	Rotra
Malaysia	Jambolan, jambulana, jiwat and obah
Myanmar	Thabyay-hypyoo
Nepal	Jaamun, kaalo jaamun, phanir, jaambu and jamunaa
New Caledonia	Jamelonguier
Palau	Mesekerrak and mesigerak
Philippines	Duhat and lomboi
Portugal	Jamboleiro and jambolão
Spain (Spanish)	Sitsigiui dzhamboza in Russia, Guayabo pesgua and yambolana
Sri Lanka	Jambu, jambul, madan and naval
Surinam	Koeli, jamoen and druif
Sweden	Jambolanäpplein
Tanzania	Msambarau and mzambarau
Thailand	Lukwa, ma-ha, hakhiphae, and wa
Tibet	Dza mbu, dzam-bu, and ka ka dz mbu
Uganda	Msambarau and mzambarau
Venezuela	Guayabo pesjua and pesjua extranjera
Vietnam	Va in Laos; Trâm môc, and voi rung
West Indies	Jambol

Table 3. Names of Jamun in different other countries

3. Botanical Description

Jamun has been classified scientifically (Taxonomy) into

Kingdom: Plantae;

Division: Magnoliophyta;

Class: Magnoliopsida;

Order: Myrtales;

Family: Myrtaceae;

Genus: *Syzygium*; and

Species: *cumini*.

Jamun abundantly grows in the Indian subcontinent including India, Pakistan, Bangladesh, Myanmar, Ceylon and Madagascar. It grows well in loamy, deep and well-drained soils. Jamun has been introduced into different parts of the world including the United States of America for its fruits and timber. It is also grown in Algeria, California, Israel and West Indies.



Figure 1. The whole tree of Jamun, *Syzygium cumini* in its natural habitat.

Jamun is a fast-growing tree, which becomes fully grown in 40 years and reaches up to a height of 100 feet (30 m). It may spread up to 36 feet (11 m) with a trunk diameter of 2-3 feet (0.6-0.9 m) (Figure 1). It forks into multiple branches at a short distance from the ground and its stem bark is rough, cracked, flaking, and discolored at the lower end and becomes smooth and light gray at higher levels (Figure 2). The leaves are opposite, 2 to 10 inches (5-25 cm) long, 1 to 4 in (2.5-10 cm) wide, oblong-oval or elliptical in shape, blunt or tapering to a point at the apex (Figure 3). The young leaves are pink colored and become leathery, glossy, dark green above, lighter beneath, with yellowish midrib when fully matured having a turpentine smell (Figure 3). Jamun flowers during March-April, which are scented, 1 to 4 inches long (2.5-10 cm) in clusters of a few or 10 to 40 round to oblong in shape, 1/2 inch (12-7 mm) wide with funnel-shaped 0.16 inch (4 mm) long and toothed calyx. The petals are 4 to 5 united as a small disk (Figure 4). The flowers are greenish-white at first and become rose pink later. The Jamun bears fruits in clusters during summer and ripens in June-July. The cluster may contain a few fruits to as many as 10 or even 40 in number. The fruits are round to oblong in shape and the size varies between 1/2 to 2 inches (1.2 to 5 cm). The fruits are initially green-colored and turn from light to dark purple or even black-colored once fully ripened (Figure 5). The fruits of Jamun taste sweetish sour and eating Jamun fruits tends to color the tongue purple. Jamun seeds are oblong, whitish purple that turns brown after drying (Figure 6).

The Jamun tree is considered holy by Hindus and Buddhists and is commonly planted in the compounds of Hindu temples. Jamun is dear to Lord Krishna and the leaves and fruits of Jamun are offered to Lord Ganesha (Elephant God) during worship; in addressing this diety a Sanskrit Shloka even refers to Him as a lover of Jamun fruit essence (*Jamboo phala saara bhakshitam*).

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Biographical Sketch

Ganesh Chandra Jagetia finished his Ph.D. in 1980 and was awarded Research Associateship by the Indian Council of Medical Research, New Delhi, India. He joined Kasturba Medical College, Manipal University, Manipal, India as an Assistant Professor to set up the Department of Radiobiology in the year 1982 and served in different capacities and became Professor in the year 1991 and a Departmental Chair in the year 2001. Prof. Jagetia moved to Mizoram University, Aizawl, India in Feb. 2007 to set up the Department of Zoology and served in various capacities as Departmental Chair and Dean of the School of Life Sciences. During his Academic career prof. Jagetia worked as a postdoctoral researcher at Stanford University, USA and the Universitäts Klinikum Essen, Germany. He was twice visiting professor at the MD Anderson Cancer Center, USA. Prof. Jagetia received visiting Scientist Award from Gesellschaft für Forschung, Munich, Germany, Marie Curie fellowship from the Commission of European Communities, Belgium and Visiting Professorship from the Japan Society for Promotion of Science, Tokyo, Japan. He served as the Academic Editor of PLoSOne, and Associate Editor for ISRN Toxicology, and the International Journal of Complementary and Alternative Medicine, USA. His main focus of research has been translation research on radioprotection, cancer treatment and wound healing using natural products. Prof. Jagetia Mentored numerous postgraduate students and also trained 25 Ph.D. students for their Doctoral degrees. He has published more than 250 research articles in various national and international journals and 35 book chapters. Prof. Jagetia has reviewed more than 100 research articles for various national and international journals and chaired sessions and delivered invited talks at several national and international conferences. He served as president of the Mizoram University Teacher's Association (MIZUTA) and is a life member of several scientific bodies.