



A REVIEW ON SYZIGIUM CUMINI

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ABSTRACT

India is the treasure of the medicinal plants many therapeutic properties of the medicinal plant along with the vegetables and fruits is mentioned in the ancient literature. It's unfortunate not to have scientific evidence to those literature. The present paper is an attempt to provide the review of the scientific evidence of on such plant *Syzygium cumini* a complete profile is presented in the present article.

Key words:

Syzygium cumini, Kala Jamun

INTRODUCTION:

“Traditional medicine is the sum total of knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures that are used to maintain health, as well as to prevent, diagnose, improve or treat physical and mental illnesses.”

WHO and its Member States cooperate to promote the use of traditional medicine for health care. A country like India is much suited for development of drugs from plants. India is a home for about 45,000 medicinal plant species which are used in treatment of various human ailments in India and all over the globe. It is estimated that about 80,000 species of plants are utilized in some form or other by the different systems of Indian medicine.¹

TAXONIMICAL CLASSIFICATION:

Kingdom: *Plantae*

Subkingdom: *Viridaeplantae*

Infrakingdom: *Streptophyta*

Division: *Tracheophyta*

Subdivision: *Spermatophytina*

Infradivision: *Angiospermae*

Class: *Magnoliopsida*

Superorder: *Rosanae*

Order: *Myrtales*

Family: *Myrtaceae*

Genus: *Syzygium*

Species: *Syzygium cumini* (L.)²

SYNONYMS:

Eugenia cumini (L.) Druce

Eugenia jambolana Lamk.

Jambolifera sinensis Spreng.

Myrtus cumini L.

Syzygium cumini Skeels

Syzygium jambolanum (Lam.) DC.²

COMMON NAMES:

English – Black plum, black plum tree, Indian blackberry, jambolan, jambolan plum, Java plum, Malabar plum, Portugese plum

Hindi – duhat, jam, jaman, jamun

Burmese - Thabyay-hypyoo

Filipino – duhat, lomboy

French – jamélongue

Japanese – duvet, jamblang

Khmer – pring bai

Lao (sino-tibetan) – va

Malay – jambulan, jambulana, jiwat, obah

Nepali – jamun

Sinhala – jambu, jambul, madan, naval

Swahili – msambarau, mzambarau

Tamil – naval
 Thai – hakhiphae, wa
 Vietnamese – trâm mộc, vô rung
 Trade name – jamun³

BOTANICAL DESCRIPTION:

Fruits ovoid-oblong or elliptical berries, numerous, crowded in clusters, almost stalkless along twigs at the back of leaves; often curved, green at first, turning pink and then finally purple-black, 1-2.5 cm (max. 5) long; pulp greyish-yellow, white or pale violet. The seed in each berry is strongly astringent and slightly bitter, 1-2 cm long; sometimes 2-5 angular, irregularly shaped seeds are compressed together into a mass resembling a single seed. Cotyledons are pale green.⁴

HABIT:

Jambolan is a large evergreen and densely foliaceous tree mostly found in South Asia. *S. cumini* is one of the most widely distributed trees of India, occurring in the major forest groups except in the very arid regions. It is present in both moist and dry situations, occurring in the tropical wet evergreen forests, tropical semi-evergreen forests, tropical moist deciduous forests, littoral and swamp, tropical dry deciduous, tropical dry evergreen, subtropical broadleaved hills, and subtropical pine forests.⁵

HABITAT:

Syzygium cumini (L.) Skeels is one of the best known species and it is very often cultivated. For long in the period of recorded history, the tree is known to have grown the tree is known to have grown in the Indian sub-continent, and many others adjoin regions of South Asia such as India, Bangladesh, Burma, Nepal, Pakistan, Sri Lanka and Indonesia.⁶

HISTORY:

In southern Asia, the tree is venerated by Buddhists, and it is commonly planted near Hindu temples because it is considered sacred to Lord Krishna. The plant has also been introduced to many different places where it has been utilized as a fruit producer, as an ornamental and also for its timber. In India, the plant is available throughout the plains from the Himalayas to southern India.⁶

STANDARDS:

Extractive value:

Alcohol soluble extractive-14%W/W
 Water soluble extractive-22%W/W
 Petroleum-ether soluble-28%W/W
 Chloroform soluble extractive-36%W/W

Loss on drying-4.02%W/W

Ash values:

Total ash-4.8%W/W
 Water soluble ash value-3.2%W/W

Acid-insoluble ash value-1.2%W/W⁷

PHYTOCHEMICAL DETAILS:

Jambolan is rich in compounds containing anthocyanins, glucoside, ellagic acid, isoquercetin, kaemferol and myrecetin. The seeds are claimed to contain alkaloid, jambosine, and glycoside jambolin or antimellin, which halts the diastatic conversion of starch into sugar and seed extract has lowered blood pressure by 34.6% and this action is attributed to the ellagic acid content. The seeds have been reported to be rich in flavonoids, a well-known antioxidant, which accounts for the scavenging of free radicals and protective effect on antioxidant enzymes and also found to have high total phenolics with significant antioxidant activity and are fairly rich in protein and calcium. Java plums are rich in sugar, mineral salts, vitamins C, which fortifies the beneficial effects of vitamin C, anthocyanins and flavonoids.⁸

Leaves

The leaves are rich in acylated flavonol glycosides, quercetin, myricetin, myricitin, myricetin-3-O-4-acetyl-L-rhamnopyranoside, triterpenoids, esterase, galloyl carboxylase, and tannin.⁹

Stem bark

The stem bark is rich in betulinic acid, friedelin, epifriedelanol, sitosterol, eugenin and fatty acid ester of epi-friedelanol, sitosterol, quercetin kaempferol, myricetin, gallic acid and ellagic acid, bergenins, flavonoids and tannins. The presence of gallo- and ellagi-tannins may be responsible for the astringent property of stem bark.¹⁰

Flowers

The flowers are rich in kaempferol, quercetin, myricetin, isoquercetin (quercetin-3-glucoside), myricetin-3-L-arabinoside, quercetin-3-D-galactoside, dihydromyricetin, oleanolic acid, acetyl oleanolic acid, eugenol-triterpenoid A and eugenol triterpenoid B.¹¹

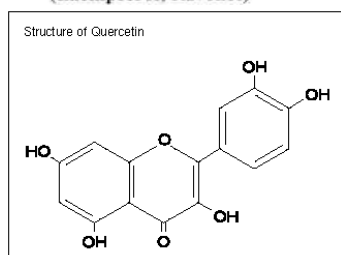
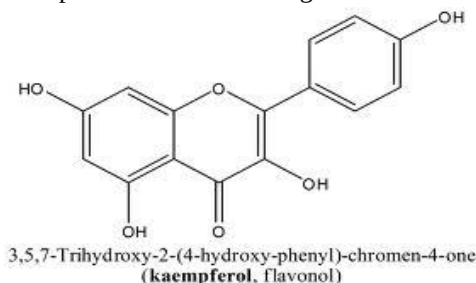
Roots

The roots are rich in flavonoid glycosides and isorhamnetin 3-O-rutinoside.¹¹

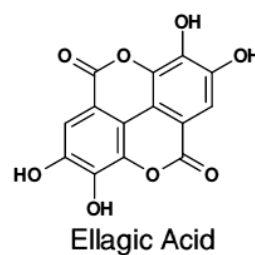
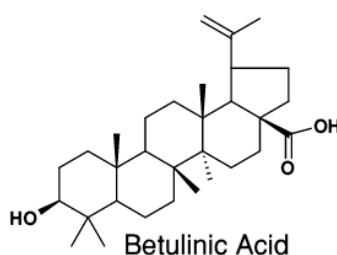
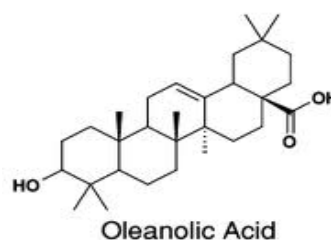
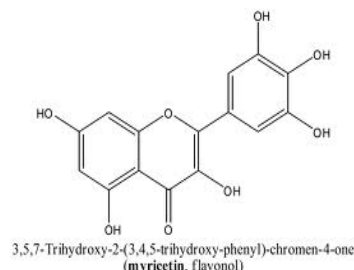
Fruits

The fruits are rich in raffinose, glucose, fructose, citric acid, mallic acid, gallic acid, anthocyanins; delphinidin-3-gentiobioside, malvidin-3-laminaribioside, petunidin-3-gentiobioside, cyaniding diglycoside, petunidin and malvidin. The sourness of fruits may be due to presence of gallic acid. The color of the fruits might be due to the presence of anthocyanins. The fruit contains 83.70-85.80 g moisture, 0.70-0.13 g protein, 0.15-0.30 g fat, 0.30-0.90 g crude fiber, 14.00 g carbohydrate, 0.32-0.40 g ash, 8.30-15.00 mg calcium, 35.00 mg magnesium, 15.00-16.20 mg phosphorus, 1.20-1.62 mg iron, 26.20 mg sodium, 55.00

mg potassium, 0.23 mg copper, 13.00 mg sulfur, 8.00 mg chlorine, 80 I.U. vitamin A, 0.01-0.03 mg thiamine, 0.009-0.01 mg riboflavin, 0.20-0.29 mg niacin, 5.70-18.00 mg ascorbic acid, 7.00 mg choline and 3.00 mcg folic acid per 100 g of edible portion. One of the varieties of jambolan found in the Brazil possesses malvidin-3-glucoside and



petunidin-3-glucoside. The peel powder of jambolan also can be employed as a colorant for foods and pharmaceuticals and anthocyanin pigments from fruit peels were studied for their antioxidant efficacy stability as extract and in formulations.¹²



PHARMACOLOGICAL PROPERTIES:

Different parts of the jambolan especially fruits, seeds and stem bark possess promising activity against diabetes mellitus and it has been confirmed by several clinical and experimental studies. Antidiabetic activity of various parts of jambolan in diabetic animals have been reported. Tea prepared from leaves of jambolan was reported to have antihyperglycemic effect. The stem bark of the plant could induce the appearance of positive insulin staining cells in the epithelia of the pancreatic duct of treated animals and a significant decrease in blood glucose levels was also observed in mice treated with the stem bark by oral glucose tolerance test. Many clinical and experimental studies suggest that, different parts of the jambolan especially fruits and seeds possess promising activity against diabetes mellitus. Despite tremendous advancements have been made in the field of diabetic treatments, several earlier investigations have been reported from the different parts of jambolan with antioxidant, anti-inflammatory, neuro-psychopharmacological, anti-microbial, anti-bacterial, anti-HIV, antileishmanial and antifungal, nitric oxide

scavenging, free radical scavenging, antidiarrheal, antifertility, anorexigenic, gastroprotective and anti-ulcerogenic, behavioural effects and radioprotective activities.¹³

Gastroprotective and Anti-ulcerogenic- Gastric mucosal damage was induced in 68 Sprague-Dawley rats by oral gavage administration of HCL / ethanol solution. For examination, three group were formed, a negative control, an omeprazole group and a tannin group. Microscopic examination using Best's Ulcer Staging Index showed that tannins had a very significant decrease in gastric mucosal damage. Studies for amount of gastric damage also been carried out it shows lower stomach free radical concentration in rats fed with a dose of 20gm tannins/kg of rat.¹⁴

Anti-inflammatory- Ethanolic extract of *Syzygium cumini* bark has been reported to possess antiinflammatory activity against histamine, serotonin and prostaglandin. For this study inflammation was induced by individual autacoids insult, Histamine (1mg/ml), serotonin (5-HT, 1mg/ml), Bradykinin (0.02mg/ml) and prostaglandin

(PGE2, 0.001mg/ml) was used as inflammogens. When injected in rat paw, ethanolic extract showed anti-inflammatory effects in histamine, PGE2 and 5-HT induced rat paw oedema. While there was no significant inhibition of oedema volume in bradykinin induced rat paw oedema at any dose level. Other result of experiment also showed the above effect of ethanolic extract of bark against carrageen, kaolincarrageen and formaldehyde induced oedema and cotton pellet granuloma tests in rats.¹⁵

Hypoglycemic-Defatted seeds and water-soluble fibers from seed showed hypoglycaemic activity in alloxan induced diabetic rats. Quantitative determinations showed that *Syzygium cumini* seeds contained 40% of aqueous soluble gummy fibers and 15% of aqueous insoluble fibers. The result of experiment showed that defatted seeds and aqueous soluble gummy fibers from seed significantly lowered the blood glucose level and improved glucose tolerance. Aqueous insoluble fibers do not have significant hypoglycemic activity. Oral administration of ethyl acetate and methanol extracts of *Syzygium cumini* (200 and 400mg/kg) showed significant decrease in blood sugar levels. The isolated compound from *Syzygium cumini*, mycaminose at a dose level of 50mg/kg also showed significant decrease in blood sugar levels. Oral administration of *Syzygium cumini* bark extract at dose of 300mg/kg body weight exhibited antidiabetic activity by significantly lowering blood glucose in rats.¹⁶

Hypolipidaemic-Alcoholic extract of seeds lowered lipid in serum and tissues in alloxan diabetic rats. Hypolipidaemic effect of ethanolic extract was also evident from fall in total serum cholesterol / HDL cholesterol ratio, serum LDL cholesterol level and lowering activity of HMGCo-A reductase. Also, histopathological studies of liver, pancreas and aorta in alcoholic extract treated diabetic groups of rabbit revealed almost normal appearance. The alcoholic extract of seed showed better response in reducing tissue damage in diabetic rat brain in compare with the aqueous extract. The results of both extracts were better than glibenclamide (600 µg/kg).¹⁷

Antianaemic- Aqueous extract of seed cause increase in total haemoglobin, prevents lowering of body weight and lowering of free radical formation in tissue.¹⁸

Antibacterial- Essential oil present in the leaves of *Syzygium cumini* showed better antibacterial activity. Leaf extract showed activity against *Escherchia coli* and *Staphylococcus aureus*.¹⁹

Antioxidant- Methanolic extract of *Syzygium cumini* seed kernel lowering the increased oxidative stress involved in pathogenesis and progression of diabetic tissue damage. This activity was observed when an increase in levels of plasma glucose, vitamin-E, ceruloplasmin, lipid peroxides and a decrease in levels of vitamin-C and glutathione

observed in diabetic rats, recover back to the normal levels after treatment with *Syzygium cumini* seed kernel extract. Histopathological studies also promise its protective effect on pancreatic β -cells. Methanolic extract of *Syzygium cumini* seed kernel also lowering the thiobarbituric acid reactive substance (TBARS) and increased in reduced glutathione (GSH), superoxide dismutase (SOD) and catalyse (CAT).²⁰

Radio-protective- Radio-protective activity was studied on radiation induced sickness and mortality in mice exposed to 10GY γ - irradiation. Leaf extract of *Syzygium cumini* delayed the onset of mortality and reduced symptom of radiation sickness, provided protection against GI death and bone marrow death, thus increasing the survival percentage. The effect of leaf of *Syzygium cumini* was also studied on the alteration in the radiation induced micronuclei formation in the cultured human peripheral blood lymphocytes, which demonstrated that the extract protects against radiation-induced damage.²¹

TOXICOLOGICAL DETAILS:

The hematologic parameters are important of the studies toxicity; therefore, the hematopoietic system is extremely sensible the activities of toxic agents, mainly those with mutagenic or cytotoxic potential, resulting in qualitative or quantitative alterations, transitory or permanent and that they can limit the use of medicines. To confirm the lack of toxicity of *Syzygium cumini*, a histologic study was carried out. Microscopic examination of the selected organs (liver, lungs, kidneys, stomach, intestine, heart and pancreas) did not reveal any treatment-related effects showing that the observed elevations in some biochemical parameters might actually be artefactual in nature. the hydroalcoholic extract of *Syzygium cumini* does

not produce acute toxic and/or chronic effect when administered orally, but does present acute toxicity when administered via intraperitoneal route.²²

CLINCIAL UTILITY:

Anti-diabetic activity- Oral administration of ethyl acetate and methanol extracts of *Syzygium cumini* (200 and 400mg/kg) showed significant decrease in blood sugar levels. The isolated compound from *Syzygium cumini*, mycaminose at a dose level of 50mg/kg also showed significant decrease in blood sugar levels. Oral administration of *Syzygium cumini* bark extract at dose of 300mg/kg body weight exhibited antidiabetic activity by significantly lowering blood glucose in rats.²³

Anti-bacterial activity- *Syzygium cumini* seed extracts prepared in methanol and ethanol was evaluated for anti-bacterial by disc diffusion and broth dilution assays. Both extracts exerted a broad spectrum of bacteriostatic action

against different gram-positive and gram-negative bacteria. Their minimum inhibitory concentration (MIC) against susceptible organisms ranged from 154-656 µg/mL. Highest total activity was registered by the ethanol extract against *Staphylococcus epidermis*. Zone of inhibition obtained in case of methanol extract of *Syzygium cumini* seeds at 110mg/mL and *V. cholera* was of identical diameter. This means that methanol extract is 2.27 times more potent than the ethanol extract against these organisms.²⁴

Antioxidant activity- The anti-oxidant activity of *Syzygium cumini* leaf extracts was investigated using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical-scavenging and ferric-reducing antioxidant power (FRAP) assays. The different solvent used for extraction of extract that are methanol, water, ethyl acetate, chloroform and *n*-hexane fractions amongst this. Tannins extracted from *Syzygium cumini* fruit showed a very good DPPH radical scavenging activity and ferric reducing/antioxidant power. The effective activity dose for anti-oxidant activity is about 500 µg.²⁵

Vibriocidal activity- The extract of *Syzygium cumini* effectively inhibits the growth and activity of various microorganisms. The extract is active with the concentrations ranging from 200-1000 µg/mL. High value of MIC may indicate a lower efficacy or the potential of the organisms for developing resistance against the bioactive compounds.²⁶

Inotropic and Chronotropic effect- cumulative administration (936.55 µg/mL) of the ethanolic extract of *Syzygium cumini* seed relaxed (55%) of the rat uterus smooth muscle against 22.36 mmol/L of potassium chloride (KCl) induced smooth muscle contraction. Also, the inotropic and chronotropic effects of the extract using Langerdorff's isolated heart perfusion method are reported. Upon addition of 4 mg/mL of Sc to the isolated heart, there was significant increase in the number of beats in the isolated heart (42.85%). This effect continued even upon the addition of 8 mg/mL of Sc, where the heart rate increased two-fold (60%). The possible mechanism behind this would be the extracellular K⁺ promoting the influx of Ca²⁺ into the cell. Extracellular potassium ion influences the ATP sensitive potassium channel which leads to an increase in the intracellular potassium ion concentration. This prevents the hyper polarization of the cellular membrane thereby increasing the cytosolic calcium and by further cell signaling cascades, muscle contraction takes place. The relaxation produced by Sc might possibly act via these signaling pathways.²⁷

Central nervous system activity- Ethyl acetate and methanolic extract of *Syzygium cumini* seed were undergone for investigating its central nervous system activity (CNS) of albino mice in rotarod and

actophotometer at the dose level of 200 mg/kg and 400 mg/kg. Both the extract inhibited significantly CNS activity. The ethyl acetate and methanol extracts of *Syzygium cumini* seed at the dose level of 200 and 400 mg/kg administered orally exhibited significant reduction of activity compared with the control group of animals. This study established CNS activity in *Syzygium cumini* seed.²⁸

α-Amylase inhibitors- The aqueous extract of *Syzygium cumini* seeds showed higher inhibition against the porcine pancreatic α-amylase. The α-amylase inhibitors were isolated and were identified as betulinic acid and 3,5,7,4'-tetrahydroxy flavanone.²⁸

Anti-nociceptive activity- The analgesic potential of *Syzygium cumini* leaf extracts using hydroalcoholic solvent was assessed in rats. Hot plate and formalin tests were used to estimate cutaneous nociception whereas measurements of forelimb grip force were done to assess muscular nociception under normal and inflammatory conditions. In the hot plate test, *Syzygium jambos* extract produced a significant increase in the withdrawal response latencies in a dose-dependent manner (10-300 mg/kg i.p.). the extract (100-300 mg/kg i.p.) significantly reduced pain scores in all phases of the formalin test with an analgesic efficacy.²⁹

Anti-inflammatory activity- Significant anti-inflammatory activity was observed in carrageenan (acute), kaolin-carrageenan (subacute), formaldehyde (subacute)-induced paw oedema and cotton pellet granuloma (chronic) tests in rats. The extract did not induce any gastric lesion in both acute and chronic ulcerogenic tests in rats. The extracts of *Syzygium cumini* seed possessed varying degree of anti-inflammatory activity when tested at various doses. The methanol extract at the dose of 400 mg/kg showed high significant anti-inflammatory activity at 4h, where it caused 62.6% inhibition, as compared to that of 5 mg/kg of diclofenac sodium.³⁰

Chemopreventive activity- *Syzygium cumini* seed extract can possibly play an important role as a chemopreventive agent against oxidative stress and genomic damage. Aqueous and ethanolic extracts of *Syzygium cumini* seed extract showed significant protective effects against hydroxyl radical induced strand breaks in pBR322 DNA. The *in vivo* experiments with aqueous *Syzygium cumini* seed extract showed significant protective effects against chromosomal damage induced by the genotoxic carcinogens URE and DMBA. Biochemical assays registered significant inhibition of hepatic lipid peroxidation and increase in GSH level and activity of GST, SOD (superoxide dismutase) and CAT (catalase).³¹

Anti-fungal activity- Aqueous, ethanol and *n*-hexane extracts from leaves, fruit, root-bark and stem-bark of

Syzygium cumini (L.) Skeels were tested for their antifungal activity against *Aschochyta rabiei* (Pass.) Lab., the cause of blight disease of the chickpea (*Cicer arietinum* L.) Different concentrations namely 1,2,3,4,5% of both

aqueous and the two organic solvents extracts were used in this study. Aqueous extracts of all the four test plant parts, namely leaves, fruit, stem-bark and root-bark showed significant antifungal activity.³²

Table No: I

Sr. No.	Plant Name	Activity	Plant Part	Method Of Extraction	Animals	Dose	P Value	References
1	<i>Syzygium cumini</i>	Gastroprotective effect	Seeds (tannins)	Ethanol	Rats	20g/kg	<0.01	Ramirez R.O. et al (2003) ³³
2	<i>Syzygium cumini</i>	Radioprotective effect against γ -irradiation	Leaves	-	Mice	20mg/kg 30mg/kg 40mg/kg	-	Ganesh C.J. et al (2003) ³⁴
3	<i>Syzygium cumini</i>	Hypoglycaemic Effect on body weight	Seeds	Ethanolic	Male wistar strain albino rats	25mg/kg	<0.001	Singh N. et al (2006) ³⁵
4	<i>Syzygium cumini</i>	Central nervous system activity	Seed	Ethyl acetate Methanol	Albino mice	200mg/kg 400mg/kg	<0.01	Kumar A. et al (2007) ³⁶
5	<i>Syzygium cumini</i>	Diuretic effect	Leaves	-	Rats	2.5%	-	Dr. Ayur (2008) ³⁷
6	<i>Syzygium cumini</i>	Anti-plaque effect	Bark	Aqueous Methanol Methanol-water (1:1)	In vitro	260g/ml 120g/ml 380g/ml	-	Dr. Ayur (2008) ³⁸
7	<i>Syzygium cumini</i>	Anti-diabetic Anti-oxidant	Pulp	Aqueous	Female wistar rats	100mg/kg 200mg/kg	<0.001	Rekha N. et al (2008) ³⁹
8	<i>Eugenia jambolana</i>	Histological effects on liver	Seeds	Ethanolic	Male albino rats	100mg/kg 200mg/kg	<0.002	Sadaf R. et al (2009) ⁴⁰
9	<i>Syzygium cumini</i>	Effect on salivary glands in diabetes	Whole plant	Ethanol Aqueous Dichloromethane n-butanol	Nod mice BALB/c mice	200mg/kg	<0.001	Silva A. et al (2009) ⁴¹
10	<i>Syzygium cumini</i>	Modulatory effect in diabetes	Peeled seeds	Petroleum ether Chloroform Acetone Methanol Aqueous	Wistar albino rats	100mg/kg	<0.001	Mamta F. et al (2009) ⁴²
11	<i>Eugenia jambolana</i>	Hepatoprotective	Seeds	Ethanolic	Male albino rats	100mg/kg 200mg/kg 400mg/kg	<0.05	Sisodia S.S. et al (2009) ⁴³
12	<i>Syzygium cumini</i>	Antifungal	Leaves Fruits Root-bark	Aqueous Ethanolic n-hexane	Chick pea	1% 2% 5%	-	Jabeen L. et al (2010) ⁴⁴

			Stem-bark					
13	<i>Syzygium cumini</i>	Chemoprevention of in vivo genomic damage and oxidative stress	Seeds	Aqueous Ethanolic	<i>In vivo</i>	-	-	Arun R. et al (2010) ⁴⁵
14	<i>Eugenia jambolana</i>	Hypoglycaemic	Seed kernels	Aqueous	Adult male swiss albino rats	3.62mg/ml	<0.05	David E. et al (2010) ⁴⁶
15	<i>Eugenia jambolana</i>	Anti-inflammatory	Leaves	Ethanolic	Albino wistar rats	200mg/kg	<0.05	Kota P.K. et al (2010) ⁴⁷
16	<i>Eugenia jambolana</i>	Anticancer, Chemopreventive and Radioprotective	Peels Seeds Leaves	Crude Methanolic hydroalcoholic extract dichloromethane	Breast cancer cells Swiss albino mice (colon cancer cells) mice	100µg/ml 25mg/kg 30mg/kg	- - -	Manjeshwar S.B. (2011) ⁴⁸
17	<i>Eugenia jambolana</i>	Anti-hyperlipidemic	Fruit pulp	Ethanolic	Male albino rats	200mg/kg	<0.05	Bilal R. et al (2011) ⁴⁹
18	<i>Eugenia jambolana</i>	Anti-ulcer	Leaves	Gum acacia suspension	Male wistar rats	250mg/kg	<0.01	Vidya S. et al (2011) ⁵⁰
19	<i>Eugenia jambolana</i>	Anti-atherosclerotic	Fruit pulp	Aqueous	Male wistar albino rats	15mg/kg	<0.001	Tanwar R.S. et al (2011) ⁵¹
20	<i>Syzygium cumini</i>	Anticancer and anti-bacterial	Fruits	Ethanol	<i>In vitro</i>	-	-	Yadav S.S. et al (2011) ⁵²
21	<i>Eugenia jambolana</i>	Anti-inflammatory Analgesic	Stem bark	Petroleum ether Ethyl acetate Methanol	Male Albino Wistar rats Male Swiss albino mice	500mg/kg 200mg/kg	<0.01 <0.05	Sudeep V.H. et al (2011) ⁵³
22	<i>Syzygium cumini</i>	Protection against fluoride induced toxicity (ameliorative effect)	Fruit pulp	Centrifugation	Male albino mice	0.25ml/12 hrs (5days)	<0.05	Ahmad K.R. et al (2012) ⁵⁴
23	<i>Eugenia jambolana</i>	Hypoglycaemic Hypolipidemic	Fruits seeds	Ethanolic	Adult albino rats	200mg/kg 200mg/kg	<0.05 <0.05	Bhavana S. et al (2012) ⁵⁵
24	<i>Eugenia jambolana</i>	Cholestasis	Fruits	-	Mice	100mg/kg	-	Dunipudi A.C. et al (2012) ⁵⁶

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