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A REVIEW STUDY ON ETHNOPHARMACOLOGICAL & PHYTOCHEMICAL COMPARISON BETWEEN *SYZYGIUM CUMINI & SYZYGIUM JAMBOS* OF GENUS *SYZYGIUM* (FAMILY: MYRTACEAE).

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ABSTRACT

This article aims to provide detailed information on two species of *Syzygium cumini& Syzygium jambos* from genus *Syzygium* of family Myrtaceae. An extensive search on electronic databases and conference papers was done to come across significant articles on different pharmacological activities with the traditional use of this genus. The presence of various phytochemical constituents have been reported that have significant prominence on the bioactive belongings. Hence, this current review is a detailed outline on the prospective medicinal values from previous studies. However, further exploration on the possible underlying mechanisms with the isolation of more respective active compounds remains under investigation.

KEYWORDS: *Syzygium cumini, Syzygium jambos,* pharmacological activities & phytochemical activities.

1. INTRODUCTION

Over 50% of all modern drugs are of natural product source and they play an significant role in drug development programs of the pharmaceutical industry.[1] The use of herbal medicines worldwide has provided an excellent opportunity worldwide to look for therapeutic lead compounds from an ancient system of therapy, i.e. Ayurveda, which can be utilized for development of new drug. Epidemiological evidence suggests that dietary factors play an important role in human health and in the treatment of certain chronic diseases including cancer.[2,3] The collective role of plants in the treatment of disease is emerged by their employment in all major systems of medicine irrespective of the underlying philosophical premise. Cultivation of medicinal plants with laboratory generated species is taken on the basis of chemical composition and ethnopharmacological investigation.[4]

The genus Syzygium is one of the genera of the family of Myrtaceae that is widely distributed throughout tropical & subtropical regions. The whole plants possess some medicinal values according to ayurvedic, unani & sidha due to presence of volatile oil as well as other bioactive phytoconstituents. The fruit is edible & traditionally used for miscellany medicinal possessions. The present study has been performed to assess the phytochemical & pharmacological properties of two species of this genus. *Syzygium cumini& Syzygium jambos* are extensively known for their ethnopharmacological assets. Different researchs were reviewed from previous studies to carry out this review study.

2. METHODOLOGY

The bibliographic research was performed in the following databases: PubMed, Google Scholar, Scopus, ScienceDirect, Classical text books of Ayurvrda and other compilatory treatises where these databases were searched for relevant studies on about two species of this genus (*Syzygium cumini & Syzygium jambos*) in terms of phytopharmacological information. No limit was placed on the search time frame in order to retrieve all relevant papers. About 134 papers have been reviewed including journal articles and proceedings as well as the reference lists of articles for additional relevant studies.

3. *Syzygium cumini*

3.1 Plant Profile: *Syzygium cumini* (L.) Skeels (Myrtaceae) commonly known as Indian blackberry; commonly known as Black Plum in English, Jamun in Hindi, Jambu in Sanskrit and Jaman in Urdu.[5] It is a large tree distributed throughout South & West asia also in Thailand, Philippines, Madagascar Africa, Caribbean and Tropical America. The tree is commonly grow in damp places and in evergreen forests & planted as an ornamental tree in gardens and roadsides 8. The berries are sweetish sour to taste. The ripe fruits are used for health drinks, making preserves, squashes, jellies and wine.[6] This plant grows up to 30 meters and girth of 3.6 meters with a bole up to 15meters.[7] The plant is

carminative, digestive, antihyperglycaemic, antihelminthic and antibacterial agent also used to cure diabetes, pharyngitis, spleenopathy, urethrorrhoea, ringworm infection, to strengthen teeth and gums,[8,9] biliousness, dysentery, sore throat, bronchitis, thirst, asthma and ulcers.[10] diabetes, constipation, leucorrhoea, fever, gastropathy and dermopathy and to inhibit blood discharge in the faeces.[11-12]

Taxonomical Classification
Kingdom- Plantae
Order- Myrtales
Family- Myrtaceae
Genus- Syzygium
Species- cumini

Synonyms
1. *Eugenia jambolana* Lam.
2. *Myrtus cumini* Linn.
3. *Syzygium jambolana* DC.
4. *Syzygium jambolanum* (Lam.) DC.
5. Eugenia djouant Perr.
6. *Calyptranthes jambolana Willd.*
7. *Eugenia cumini* (Linn.) Druce. and
8. *Eugenia caryophyllifolia* Lam.

3.2 Phytochemical Review

Plant Parts	Phytoconstituents present in *Syzygium cumini*	Reference
Stem Bark	Betulinic acid, ß-sitosterol, friedeanol, epi-friedeanol, eugenin, ß-sitosterol-D-glucoside, Kamepferol-3-0- glucoside	[13-14]
	Quercetin, myricetin, astragalin, and gallic acid.	[15]
Fruit	Malic acid, oxalic acid Gallic acid, tannins, cyanidine and diglycoside glucose, fructose, mannose, and galactose (principal sugar moieties).	[16]
	Ca, Mg, Na, K, Cu and vitamins such as thiamine, riboflavin, nicotinic acid,20	[17]
	anthocyanins, delphinidin, petunidin, malvidin-diglucosides.	[18,19, 20]
Seed	Glucoside jamboline, chlorophyll, fat, resin, gallic acid, ferulic acid guaicol, resorcinol, dimethyl ether, corilaginin, protein, calcium.	[21-22]
	Phenolic such as ellagic acid, gallic acid, caffeic and ferulic acids and derivaties, guaicol, resorcinol dimethyl ether, corilaginin.	[23]
	Monoterpenoids like ß-pinene, terpinene, terpinolene, borbeneol, ß-phellandrene,a-terpineol and eugeno,	[24]
	flavonoid such as rutin, quercetin.11 and ß-sitostero	[25]
Leave	Gallitanins, essential oil (terpenes, 1-limonene and dipentene), monoterpenoid terpinene, terpenolene, borbeneol, terpineol and eugenol, complicated mixture of polyphenol such as gallic acid, methylgallate, kaempferol, ellagic acid, ellagitannin, nilocitin, myrecetin 3-0-D-glucaronopyranoside, 3-0-ß D-glucuronopyranoside and two flavanol glycosides such as mearsetin 2-0-(4"-0-acetyl)-a-L rhamnopyranoside, and myricetin 4"-0-acetyl"-2-0-gallate.	[26-28]
	Sitosterol,betulinic acid, crategolic (maslinic) acid, n-hepatcosane, nnonacosane, n-hentriacontane,n-octacosanol, n-triacontanol and ndotricontanol (by GLC), sugars – glucose, fructose, acidsoxalic, citric ,glycolic acids and aminoacids – glycine, alanine, tyrosine and leucine.	[29]
	Quercetin	[30]
	Oleanolic acid, erategolic acid (maslinic acid) and flavonoids - isoquercitrin, quercetin	[31]
Flower	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.	[32, 33]
	Ellagic acids, isoquercetin, quercetin, kampferol and myricetin	[34]
Root	Myricetin 3-o-glucoside and myricetin 3-o-robinoside.	[35]
Essential oils	*α*-terpeneol, myrtenol, eucarvone, muurolol, *α*-myrtenal, 1, 8-cineole, geranyl acetone, *α*-cadinol and pinocarvone	[36]
	Terpenes, 1-limonene and dipentene.	[37]
	Llauric (2.8%), myristic (31.7%), palmitic (4.7%), stearic (6.5%), oleic (32.2%),linoleic (16.1%), malvalic (1.2%) and vernolic (3%) acids.13 Novel compounds such as 5,6 dihydroxy-3-[(4-hydroxy-6-(hydroxymethyl)-3,5-di[3,4,5-trihydroxy-6-(hydroxymethyl)tetrahydro-2h 2pyranyl)oxy]2-methoxy-10,13 dimethylperhydrocyclopenta [a] phenanthren-17-yl (phenyl) methyl acetate,14 3,15- dihydroxy ? 3 androstene [16, 17-C](6'methyl , 2'-1,3- dihydroxy-1-propene) 4H pyran and 3-hydroxy androstane [16,17-C](6'methyl, 2'-1-hydroxy –isopropene-1-yl) 4,5,6 H pyran.15androstane [16,17-C](6'methyl, 2'-1-hydroxy –isopropene-1-yl) 4,5,6 H pyran.	[38]
	The essential oils isolated from the freshly collected leaf (accounting for 82% of the oil)	[39]

	α-Pinene, camphene, β-Pinene, myrcene, limonene, cis-Ocimene, trans-Ocimene, γ-Terpinene, terpinolene, bornyl acetate, α-Copaene, β-Caryophyllene, α-Humulene, γ-Cadinene and δ-Cadinene	[40]
	Trans-ocimene, cis-ocimene, β-myrcene, α-terpineol, dihydrocarvyl acetate, geranyl butyrate, terpinyl valerate,	[41]
	α-terpineol, β-caryophyllene, α-humulene, β-selinene, calacorene, α-muurolol, α-santalol, cis-farnesol: lauric, myristic, palmitic, stearic, oleic, linoleic, malvalic, sterculic and vernolic acids	[42]
	Unsaponifiable matter of the seed fat was also chemically investigated.	[43]

3.3 Pharmacological Review

Pharmacological Activity of *Syzygium cumini*	**Plant Part**	**Reference**
Antihyperlipidaemic effect	Aqueous extract of pulp	[44]
	Seed kernel	[45]
	Fruit pulp	[46]
	Ethanoilc extract of kernels	[47]
	seeds	[48]
free radical-scavenging and antilipidperoxidative activity	Aqueous seed powder extract	[49]
	Extracts of fruit pulp, seed coat and kernel	[50-52]
Antioxidant effect	Aqueous seed powder extract)	[49, 53]
	Methanolic Leaf extract	[54]
	Methanolic extract of leaves, bark and seeds	[55-58]
Hepatoprotective effect	Ethanolic Pulp extract	[59]
	Alcoholic extract of the pulp	[60]
	Aqueous leaf extract	[61]
	Methanolic seed extract	[62]
Antiarthritic effect	Methanolic seed powder extract	[61]
Antiulcer effect	Ethanolic seed powder extract)	[63]
	Seed kernel extract	[64]
	Fruit extract	[65]
Antiallergic effect	Aqueous leaf extract	[66]
	Aqueous leaf extract	[67]
Antibacterial effect	Aqueous and acetone bark extract	[68]
	Stem, leaf and fruit extracts (Against *Roultella plantikola)*	[69]
	Seed extract (Against multidrug-resistant human bacterial pathogens)	[70]
	Ethyl acetate, petroleum ether and methanolic leaf extracts (Against *Salmonella typhimurium, Bacillus subtilis, Pseudomonas aeruginosa, Staphylococcus aureus and Enterobacter aerogenes)*	[71]
	Acetone, aqueous and ethanolic bark extracts *(*Against *Vibrio cholera)*	[72]
	Aqueous leaf extract *(*Against *Klebsiella sp., Salmonella paratyphi A & B, Citrobacter sp., Proteus mirabilis, Escherichia coli, Staphylococcus aureus, Shigella sonnei, Pseudomonas aeruginosa, Salmonella typhimurium, Shigella boydii, Streptococcus faecalis, Shigella flexneri* and *Salmonella typhi)*	[73]
Anti-inflammatory effect	Ethyl acetate and methanolic seed powder extract	[74]
	Ethyl-acetate and methanolic leaves and seeds extracts	[75,76]
Nephroprotective activity	FIIc, isolated from aqueous pulp Extract	[77]
Antidiarrhoeal effect	Ethanolic bark extract	[78]
	Ethanolic fruit extract	[79]
Central nervous system effect	Methanolic and ethyl acetate seed extracts	[80]
Neuropsychopharmacological	Ethyl acetate and methanolic seed powder extract	[80]

Hypothermic	Chloroform and methanolic fruit extracts	[81]
Antifertility effect	Flowers extract (Oleanolic acid)	[82]
Radioprotective effect	Hydroalcoholic seed powder extract	[83]
	Leaf extract	[84]
	Dichloromethane extract of leaf and Hydroalcoholic seed extract	[85,86]
	Leaf extract	[87]
Chemoprotective	Aqueous and ethanolic SC	[88-90]
Diuretic	Petroleum ether, chloroform, methanolic and aqueous bark extracts	[91]
Cardioprotective	the hydroalcoholic leaves extract	[92,93]
	aqueous suspension of seed extract	[94]
	Methanolic extract of fruit	[95]
Antiviral	Hot aqueous bark extract	[96]
	Aqueous leaves extract	[97, 98]
Ascaricidal	Ethanolic, hexane and ethyl acetate extracts of fruit & leaf	[99]
Antilieshmanial	The essential oil (α-pinene)	[100]
Antinociceptive	Hydro-alcoholic leaf extract	[101]
	Methanolic fruit extract	[102]
Antifungal	Methanolic fruit extract (Against *Fusarium oxysporium, Rhizoctonia solani and Sclerotium rolfsii)*	102
	n-hexane, alcohol and aqueous extracts of different plant parts (barks of stem and roots, fruits and leaves) *(*Against *Ascochyta rabiei*)	[103]
Anti-diabetic	Seeds, fruit pulp whole fruit bark leaves and flowers	[104,105]
Anticlastogenic	Alcoholic seed extract	[106]
Anti cancer	Fruit extract (Ellagitannins)	[107,108,109]

4. *Syzygium jambos*

4.1 Plant Profile: Syzygium jambos Alston (syn. Eugenia jambos L.; Jambosa jambos Millsp.; Jambosa vulgaris DC.; Caryophyllus jambos Stokes) (Family: Myrtaceae) is an evergreen tree. It is native to Southeast Asia. It is a small tree with spreading branches, leaves, simple, opposite, lanceolate, narrowed into short petioles, secondary nerves joined by a prominent looping intramarginal vein. Flowers greenish white in short terminal racemose cymes, stamens many, yellowish white, fruits pale yellow to pinkish white, globose, seeds 1-2, grey in large cavity of the succulent pulp.[110] Due to medicinal properties this plant has some traditional use such as to treat fever, diarrhea, dysentery, rheumatism, sore eyes, asthma, bronchitis, hoarseness.[111] epilepsy, diabetes,[112] herpes simplex type 1 and type 2, vesicular somatitis virus.[113,114] toothache, mouth sores, cough, wound dressing,[115] respiratory disorders, eczema, malaria, and infectious diseases.[116] Other study claimed anesthetic, diuretic febrifuge activity,[117,118] of the plant.

Taxonomical Classification

Kingdom- Plantae
Order- Myrtales
Family- Myrtaceae
Genus- Syzygium
Species- jambos

Synonyms

1. *Eugenia jambos Myrtus cumini* Linn.
2. *Jambosa jambos Syzygium jambolanum* (Lam.) DC.

4.2 Phytochemical review

Plant Parts	Phytoconstituents present in *Syzygium jambos*	Reference
Leaves	Polyphenols, anthraquinones, tannins, and steroids	[118]
	Friedelin (**1**)	[119]
	Amyrin acetate	[120]
	Betulinic acid (**2**)	[121]
	Lu peol	[121]
	Friedelolactone (**3**)	[122]
	Friedelanol (**4**)	[123]
Bark	Polyphenols, anthraquinones, tannins, and steroids	[118]
	Triterpenes and saponins	[124]
	Triterpenoids such friedelin, β-amyrin acetate, betulinic acid, and lupeol	[125]

4.3 Pharmacological Review

Pharmacological Activity of *Syzygium jambos*	Plant Part	Reference
Antifungal activity *(Against T. mentagrophytes* and *T. soudanense)*	Ethyl acetate **extract of the stem bark**	[125]
Antidermatophytic activity	Crude extract and fractions	[126]
Antibacterial activity potential (against sensitive strains of *Staphylococcus aureus, Bacillus subtilis, Enterococcus gallinarum, Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumoniae, Proteus vulgaris, Enterococcus faecium, Salmonella typhi,* and *Vibrio cholera*)	Fruit extracts	[127]
	Bark extracts	[128]
Antibiotic-modulating activity (potentiate the activity of antibiotics on more than 70%of bacteria)of extracts at MIC/2 onmore than 70%tested strains of *S. aureus*	Methanol extracts of bark and leaves	[129,130]
Antimicrobial activity (Minimum inhibitory concentrations for *faecalis* 797.5 µg/mL and *A. hydrophilia 384.6* µg/mL *B. cereus* 182.6 µg/mL and *S. aureus 346.5* µg/mL	Acetone and aqueous extracts from the bark	[131]
Hepatoprotective agent	Methanolic extract of leaf	[132]
Analgesic effects	Hydro-alcoholic leaf extracts	[133]
Anti oxidant ,anti inflammatory, anti diabetic, anticancer, anti ulcer, anti pyretic, cardio vascular diseases, anti hyperlipidimic and neurological disorders like alzheimer's, anti parkinsonism	Extract of fruit, leaf & bark.	[134]

CONCLUSION

Large scale literature study results revealed that the featured plants have potential pharmacological activities against various diseases performed *in vivo* & *in vitro*. The phytoconstituents which are present in the plants are mainly alkaloid, tannin, glycoside, carbohydrate, saponin, steroids and flavonoids which are responsible for the bioactivity. Further significant review is needed to find out the appropriate estimation and revival on pharmacological effect. Chemical investigations are needed to find out the future lead compound to develop drugs. Plant sources are being used for a long time to explore our medicinal sector because of their less side effects and more effectiveness.

CONFLICT OF INTEREST

We have no conflict of interest.

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