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Syzygium cumini : An overview

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ABSTRACT

Aim of this article briefly focus on the potential phytochemicals and pharmacological activity of Syzygium cumini. Various parts of plant including seeds, bark, leaves and fruits had been studied and investigated for various pharmacological properties. The phytochemicals like malieic acid, oxalic acid, gallic acid, tannins, cynidin glycoside, oleanolic acid, flavonoids, essential oils, betulinic acid, friedelin have been reported for significant, antianaemic, gingivititis, antidiarrhieal, antipyretic, antibacterial, antineoplastic, anti-inflammetry, hypoglycemic, gastro protective and hypolipidemic properties. Further investigations exploring possible use of these phytochemicals as pharmacological agents are warranted. This is an attempt to compile and documented information on different aspect of Syzygium cumini pharmacological properties and highlight the need for research and their potential development.

Key word: *Syzgium cumin*, Tannins, Flavonoids, Essential oils, Phytochemicals.

INTRODUCTION

Syzgium cumini Linn. (synonym *Eugenia jambolan* Linn.) is a very large evergreen tropical tree belonging to the family Myrtaceae [1] the plant is also mentioned in literature as Jamun, synonym as black plum or jambolan, botanical name the plant are very well known for their pharmacological properties science ancient age . The native home of the *Syzgium* is India and East Indies. It is found throughout in India up to an altitude of 1800 meters and its habitat starts from Myanmar and extended to Afghanistan. This plant is also found in other countries like Thailand, Philippines, Madagascar [2], extensive work were carried out on plant of *Syzygium cumini* for their pharmacological properties. The medicinal value is due to presence of malic acid [1, 2], oxalic acid [1] gallic acid, tannins [3, 4]. Various works on tannin, flavonoids essential oil and betulic acid was reported to have diverse pharmacological activities like gastroprotective, antiulcerogenic [3, 4], antibacterial [33], anti-infective [11-15], antimalerial [16]. Potential phytochemical of *Syzgium cumini* are discuss in this article, Further, a brief introduction to

chemistry and pharmacological investigations reported on phytochemicals of *Syzgium cumini* is presented.

Fig 1. *Syzgium cumini:* (a) leaf, (b) Flowering phase, (c) Small tall plant before flowering, (d) Fruiting phase, (e) Mature fruit, (f) Mature Tree

Medicinal use of *Syzgium cumin*

Syzgium cumin belongs to family Myrtaceae, which records the occurrence of taxonomically informative molecules, namely malic acid, oxalic acid, gallic acid, betulic acid, tannins, flavonoids and essential oil. Review detailing the chemical constituents of the *Syzgium cumin* have been reported several researcher. The widespread uses of *Syzgium cumin* in traditional medicines have resulted in considerable chemical analysis of the plant, and active principles which attribute the plant its medicinal properties have been identified and isolated (Table 1 and 2). The entire plant is used in the traditional medicine; however the leaves and stem bark is mentioned to be most powerful part.

The Concerns of Researchers

The widespread use of *Syzgium cumin* in traditional medicine reflects its pharmacological importance. The edible pulp of plant forms 75% of the whole fruit. Various mineral and vitamins were reported like Ca, Mg, P, Fe, Na, K, Cu, S, Cl, vitamin C, vitamin A, riboflavin, nicotinic acid, choline and folic acid. Glucose and fructose are the principle source of sweeteners in ripe fruit with no trace of sucrose [1]. Maleic acid is the major acid (0.59% of the weight of fruit) [1, 2]. Small quantity of Oxalic acid has been also reported [1]. Tannins mainly Gallic acid is

responsible for the astringency effect of the fruits [1, 2, 3]. The astringency activity is due to efficiency to combine with tissues and proteins and precipitate them. Tannins are also efficient for gastroprotective and antiulcerogenic activity [3, 4]. The purple colour of the fruit is due presence of one or two cyanidin diglycosides [1, 2].

Table 1: Presenting various chemical constituents of plant *Syzgium cumin.*

Chemical Compound	Plant Part	References
Vitamin C	Edible pulp	1
Vitamin A	Edible pulp	1
Riboflavin	Edible pulp	1
Nicotinic acid	Edible pulp	1
Choline	Edible pulp	1
Folic acid	Edible pulp	1
Glucose	Edible pulp	1
Fructose	Edible pulp	1
Maleic acid	Edible pulp	1
Gallic acid	Edible pulp, Seed, Bark	1, 3, 4, 5
Cyanidin glycoside	Edible pulp	1, 4
Glycoside Jamboline	Seed	1, 6
Triterpenoids	Flower	1, 4
- Oleanolic acid	Flower	1, 4
- Eugenia-triterpenoid-A	Flower	1, 4
- Eugenia-triterpenoid-B	Flower, Seed, Bark	1,4,5
- Ellagic acid	Stem Bark	1,2,9
- Pentacyclic triterpenoid- Betulinic acid	Stem Bark	1,2,9
- Pentacyclic triterpenoid- Friedelin	Flower, Seed, Bark	1,4,5
Tannins	Flower, Seed	1,4,5
Gallitanins	Seed, Leaves	1,4,5
Essential Oil	Seed, Leaves	1,4,5
- Terpenes	Seed, Leaves	1,4,5
- 1-limonene	Seed, Leaves	1,4,5
- Dipentene	Seed, Leaves	1, 33
Sesquiterpenes	Leaves	1,2,9
- Cadalane type	Leaves	1,2,9
- Azulene type	Leaves	1,2,9
Resin	Stem Bark	1,2,9
- Myricetine	Stem Bark	1,2,5
Phytosterol	Stem Bark	1,2,5,6
- B-sitosterol	Stem Bark	1,2,5,6
- Myricyl alcohol	Stem Bark	1,2,5,6

Table 2: Presenting Pharmacological activities attributed to plant *Syzgium cumin.*

Activity	References
Gastroprtective	23
Antiulcerogenic	23
Anti-inflammatory	25
Hypoglycemic	24, 26
Hypolipidaemic	28
Antianaemic	29
Antibacterial	31, 1
Antioxidant	29,30
Radio-protective	30, 33, 34

The cyanidin diglycosides belong to the category of anthocyanidins (flavonoids) and their glycosides. The aglycone mixture obtained by the hydrolysis of the diglycosides contains petunidin and malvidin. The sugar part is mainly glucose, galactose is probably present, but there

is no pentose or rafinose. Cyanidin diglycoside are sap pigments and the actual colour depends on the pH [3]. The waxy component of the fleshy pericarp contains a sterol (m.p. 135^{o}C) essential oil. The major component appears to be triterpene hydroxyl acid, oleanolin caid ($C_{30}H_{48}O_3$) and melting point (298-300^{o}C) [1, 2]. Oleanolic acid is classified into β -amyrin group of triterpenoid [3].

Flower of plant contains Oleanolic acid and other three triterpenoids also reported in the flowers are acetyl oleanolin acid (0.3%) melting point (260-262^{o}C), Eugenia- triterpenoid A (0.5%) and Eugenia triterpenoid B (0.3%). Flowers also contain ellagic acid (0.01) [1]. Ellagic acid arises from lactonization of hexa-hydroxdiphenic acid during chemical hydrolysis of tannins [4].

The plant seeds are rich in protein and calcium. The seeds contain tannins (19%), ellagic acid, gallic acid (1-2%). A glycoside- Jamboline, starch, Myricyl alcohol in the unsaponified fraction of seeds and a small quantity (0.05%) of pale yellow essential oil (specific gravity^{20}: 0.926, $[\alpha]^{D}$ - 5.42^{o}) are also present. [1-6].

The plant leaves contain an essential oil with pleasant odour. The oil contains terpenes, 1-limonene and dipentene (20%), sesquiterpenes of cadalane type (40%), and sesquiterpenes of azulene type (10% or less). Yield and physical characteristics of the oil varies according to the season of collection. This essential oil is reported to be responsible for the antibacterial activity of the leaves [1, 33].

Stem bark contains pentacyclic triterpenoid betulinic acid (m.p. 306-310^{o}C) [1, 2]. Betulinic acid [9] is a naturally occurring triterpenoid, which has demonstrated selective cytotoxicity against a number of specific tumor [10-11] and active against a verity of infectious agent like HIV [11-15], malaria [16], immunomodulatory and the inflammatory [17]. A plant sterol B-sitosterol is found in almost all part of plant [1, 2]. It has same chemical structure with cholesterol. It has much beneficial pharmacological activity like anti-inflammatory and lowering blood cholesterol [17, 18]. Friedelin [1, 2] ($C_{30}H_{50}O$, m.p. 256-260^{o}C) is also a pentacyclic triterpenoid found in plant. Plant bark also contains substance which is an ester of epi-friedelanol ($C_{30}H_{51}OH$) with a fatty acid ($C_{27}H_{55}COOH$). It also contains tannins (10-12%) gallic acid, ellagic acid [5] and resin myricetin are also reported [1, 5].

Pharmacological activities of *Syzgium cumini*

Gastroprtective and Anti-ulcerogenic - For the above study, 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 [23].

Anti-inflammatory- Ethanolic extract of *Syzgium cumini* bark has been reported to posses anti-inflammatory 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 (PGE_2, 0.001mg/ml) was used as inflammogens. When injected in rat paw, ethanolic extract showed anti-inflammatory effects in histamine, PGE_2 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 [24]. Other result of

experiment also showed the above effect of ethanolic extract of bark against carrageen, kaolin-carrageen and formaldehyde induced oedema and cotton pellet granuloma tests in rats [25].

Hypoglycemic-Defatted seeds and water soluble fibers from seed showed hypoglycaemic activity in alloxan induced diabetic rats. Quantitative determinations showed that S*yzgium 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 [24-26].

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 HMG-Co-A reductase. Also histapathological studies of liver, pancreas and aorta in alcoholic extract treated diabetic groups of rabbit revealed almost normal appearance [27]. 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 extract were better than glibenclamide (600 µg/kg) [28].

Antianaemic- Aqueous extract of seed cause increase in total haemoglobin, prevents lowering of body weight and lowering of free radical formation in tissue [29].

Antibacterial- Essential oil present in the leaves of *Syzgium cumini* showed better antibacterial activity [31]. Leaf extract showed activity against Escherchia coli and Staphylococcus aureus [1].

Antioxidant- Ethanolic extract of *Syzgium 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 *Syzgium cumi* seed kernel extract. Histopathological studies also promise its protective effect on pancreatic β-cells [30]. Ethanolic extract of *Syzgium cumini* seed kernel also lowering the thiobarbituric acid reactive substance (TBARS) and increased in reduced glutathione (GSH), superoxide dismutase (SOD) and catalyse (CAT) [29].

Radio-protective- Radio-protective activity was studied on radiation induced sickness and mortality in mice exposed to 10GY γ- irradiation. Leaf extract of *Syzgium 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 [30-33]. The effect of leaf of *Syzgium 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 [34].

CONCLUSION

There is still a wide scope for exploring different aspect of *Syzgium cumini*. Discrepancies remain about the habit of the plant. Work cited in the article of phytochemical and promising pharmacological activities are widely distributed in medicinal plant of *Syzgium cumini* and it revealed the importance of herbal and ayurvedic pathway for effective treatment of various disease considering its tremendous potential pharmacological activities. Animal studies enlighten on antianaemic, gingivititis, antidiarrhieal, antipyretic, antibacterial, antineoplastic, anti-inflammatory, hypoglycemic, gastroprotective and hypolipidemic activities of phytochemicals.

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