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Syzygium cumini (L.) Skeels: A review of its phytochemical constituents and traditional uses

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ABSTRACT

Syzygium cumini (*S. cumini*) (L.) Skeels (jambolan) is one of the widely used medicinal plants in the treatment of various diseases in particular diabetes. The present review has been primed to describe the existing data on the information on botany, phytochemical constituents, traditional uses and pharmacological actions of *S. cumini* (L.) Skeels (jambolan). Electronic database search was conducted with the search terms of *Eugenia jambolana*, *S. cumini*, jambolan, common plum and java plum. The plant has been viewed as an antidiabetic plant since it became commercially available several decades ago. During last four decades, numerous folk medicine and scientific reports on the antidiabetic effects of this plant have been cited in the literature. The plant 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. The vast number of literatures found in the database revealed that the extracts of different parts of jambolan showed significant pharmacological actions. We suggest that there is a need for further investigation to isolate active principles which confer the pharmacological action. Hence identification of such active compounds is useful for producing safer drugs in the treatment of various ailments including diabetes.

1. Introduction

The genus *Syzygium* is one of the genera of the myrtle family Myrtaceae which is native to the tropics, particularly to tropical America and Australia. It has a worldwide, although highly uneven, distribution in tropical and subtropical regions. The genus comprises about 1 100 species, and has a native range that extends from Africa and Madagascar through southern Asia east through the Pacific. Its highest levels of diversity occur from Malaysia to northeastern Australia, where many species are very poorly known and many more have not been described taxonomically. Plants of this family are known to be rich in volatile oils which are reported for their uses in medicine[1] and many fruits of the family have a rich history of uses both as edibles and as traditional medicines in divergent ethnobotanical practices throughout the tropical and subtropical world[2]. Some of the edible species of *Syzygium* are planted throughout the tropics worldwide.

2. History and distribution

Syzygium cumini (*S. cumini*) (L.) Skeels is one of the best known species and it is very often cultivated. The synonyms of *S. cumini* are *Eugenia jambolana* Lam., *Myrtus cumini* Linn., *Syzygium jambolana* DC., *Syzygium jambolanum* (Lam.) DC., *Eugenia djouant* Perr., *Calyptranthes jambolana* Willd., *Eugenia cumini* (Linn.) Druce. and *Eugenia caryophyllifolia* Lam. It is commonly known as jambolan, black plum, jamun, java plum, Indian blackberry, Portuguese plum, Malabar plum, purple plum, Jamaica and damson plum.

For long in the period of recorded history, 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. It was long ago introduced into and became

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naturalized in Malaysia. 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[3]. 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.

3. Botany

Jambolan is a large evergreen and densely foliaceous tree with greyish-brown thick bark, exfoliating in woody scales. The wood is whitish, close grained and durable; affords brown dyes and a kind of a gum *Kino*. The leaves are leathery, oblong-ovate to elliptic or obovate-elliptic with 6 to 12 centimeters long (extremely variable in shape, smooth and shining with numerous nerves uniting within the margin), the tip being broad and less acuminate. The panicles are borne mostly from the branchlets below the leaves, often being axillary or terminal, and are 4 to 6 centimeters long. Flowers are scented, greenish-white, in clusters of just a few or 10 to 40 and are round or oblong in shape and found in dichotomous paniculate cymes. The calyx is funnel-shaped, about 4 millimeters long, and toothed. The petals cohere and fall all together as a small disk. The stamens are numerous and about as long as the calyx. Several types, which differ in colour and size of fruits, including some improved races bearing purple to violet or white coloured flesh and seedless fruits have been developed. The fruits are berries and are often obviously oblong, 1.5 to 3.5 centimeters long, dark-purple or nearly black, luscious, fleshy, and edible; it contains a single large seed[4,5]. The plant produces small purple plums, which have a very sweet flavor, turning slightly astringent on the edges of the pulp as the fruit becomes mature. The dark violet colored ripe fruits give the impression the fruit of the olive tree both in weight and shape and have an astringent taste[6]. The fruit has a combination of sweet, mildly sour and astringent flavour and tends to colour the tongue purple.

4. Phytochemical constituents

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[3]. 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[7,8] and also found to have high total phenolics with significant antioxidant activity[9] and are fairly rich in protein and calcium. Java plums are rich in sugar, mineral salts, vitamins C, PP which fortifies the beneficial effects of vitamin C, anthocyanins and flavonoids[10].

4.1. Leaves

The leaves are rich in acylated flavonol glycosides[1] (Figure 1A), quercetin, myricetin, myricitin, myricetin 3-O-4-acetyl-L-rhamnopyranoside[11] (Figure 1B), triterpenoids[12], esterase, galloyl carboxylase[13], and tannin[3].

4.2. Stem bark

The stem bark is rich in betulinic acid, friedelin, epi-friedelanol, β-sitosterol, eugenin and fatty acid ester of epi-friedelanol[14], β-sitosterol, quercetin kaempferol, myricetin (Figure 1C and Figure 1D), gallic acid and ellagic acid[15], bergenins[16], flavonoids and tannins[17]. The presence of gallo- and ellagi-tannins may be responsible for the astringent property of stem bark.

4.3. Flowers

The flowers are rich in kaempferol, quercetin, myricetin, isoquercetin (quercetin-3-glucoside), myricetin-3-L-arabinoside, quercetin-3-D-galactoside, dihydromyricetin[18], oleanolic acid (Figure 1E), acetyl oleanolic acid, eugenol-triterpenoid A and eugenol-triterpenoid B[18].

4.4. Roots

The roots are rich in flavonoid glycosides[19] and isorhamnetin 3-O-rutinoside[20].

4.5. Fruits

The fruits are rich in raffinose, glucose, fructose[21], citric acid, mallic acid[22], gallic acid, anthocyanins[23]; delphinidin-3-gentiobioside, malvidin-3-laminaribioside, petunidin-3-gentiobioside[24] (Figure 1F)[24], cyanidin diglycoside, petunidin and malvidin[25]. 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[24]. 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[26]. One of the variety of jambolan found in the Brazil possesses malvidin-3-glucoside and petunidin-3-glucoside[27]. 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[28].