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K Santhi Sirisha

Ph.D. Scholar, Department of Foods and Nutrition, Post Graduate Research Centre, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad, Telangana, India

K Shreeja

Ph.D. Scholar, Department of Foods and Nutrition, Post Graduate Research Centre, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad, Telangana, India

Correspondence

K. Santhi Sirisha

Ph.D. Scholar, Department of Foods and Nutrition, Post Graduate Research Centre, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad, Telangana, India

Rose apple: A systematic review

K Santhi Sirisha and K Shreeja

Abstract

Watery rose apple with scientific name *Syzygium aquem* (Burm Alston) grows in tropical countries. The fruit is pink to red with white flesh which is rose-scented and juicy. Different parts of the tree have antimicrobial, anti-inflammatory, antioxidant properties, analgesic effects, hepatoprotective activity, hence have been used in traditional and folk medicine of various cultures. Fruit and root bark are used as blood coolant, fruit peel is effective in the treatment of ulcers whereas flowers possess antipyretic properties while the seeds are used for curing diarrhea, dysentery. The present paper reviews the origin and distribution, cultivation, uses, nutritional composition, health benefits, pharmacological activity, common usage and value addition.

Keywords: Watery rose apple, nutrient composition, medicinal properties, value addition

Introduction

Syzygium aquem (Burm Alston) belongs to the Myrtaceae family (Morton, 1987) [19] with common names Malabar plum, plum rose, water apple, rose apple in English, “Gulaabijiamikaayalu in Telugu. It is one of the under-utilized fruits which lack recognized orcharding, utilization and value addition. Watery rose apple grows to a height of 6-10 meters. Leaves are opposite, subsessile and oblong to lanceolate. Fruits are white, pink to red in color, juicy, spongy, rose-scented, seeds 2-6 in number (Radha and Mathew (2007) [25]; Wong, (1996) [29]. The fruit is sensitive which can be eaten along with its crispy flesh and skin (Bolarin *et al.*, 2016) [5]. Flowering season is from February to March and fruits mature during May-June. Fruiting is seasonal but there can be two or three crops per year. A single tree bears 18-21 kg of fruit (Whistler and Elevitch, 2006) [28].

Varieties

In the early days, its cultivation was on small scale limited to gardens and was grown mainly in the summer season. With the development of improved varieties and cultivation techniques, its cultivation has been spread to different areas. Varieties like Pink, Big Fruit, Thub Thim Chan, Indonesian Big Fruit, Beg Red and Vietnam White are the commonly grown in Southeast Asia. Pink and Big Fruit varieties are popular with 80 % cultivation.

Origin and distribution

Watery rose apples are native to the Java Sumatra and Peninsular Malaysia, Portuguese traders introduced this into India and East Africa (Panggabean 1992 [24]; Whistler and Elevitch 2005) [28]. It was introduced into Jamaica in 1762, 1825 in Hawaii, 1893 in Ghana, 1896 in Australia, and now widely cultivated in the tropics. Today, it has spread to the Indian subcontinent and the sub-Saharan African regions as well as South America and the warmer parts of America (Morton, 1987; Djipa *et al.*, 2000) [19, 9]. In India, it is cultivated in the states like Andhra Pradesh, Western Ghats, Kerala.

Cultivation

As rose apple is a tropical fruit tree 25-32 °C temperature range is desirable for better growth rate, higher yield and quality produce. Deep, loamy soil is considered ideal for the rose apple but it is not too exacting, for it flourishes also on sand and limestone with very little organic matter. Most rose apple trees are grown from polyembryonic seeds (producing 1 to 3 sprouts). In India, vegetative propagation *i.e.* cutting, air layering is being followed. Constant water supply is needed to maintain soil moisture content which is essential for this crop. Drip irrigation could be the best option while a combination of mulch and basin is also a promising method of irrigation. Depending upon the variety tree start bearing fruits after 2-5 years of

plantation. Harvesting is done by handpicking as the fruits are extremely sensitive. Storage of fruits in a cloth bag in a cool place or pre-cooling at 10-12 °C should be done for extending shelf life.

Nutritive value

Watery rose apple is referred to as low-calorie fruit due to high water content which is approximately 90%. Average chemical composition as reported by Monisha *et al.*, 2018^[18] as calcium (29 mg), potassium (123 mg), sulphur (13 mg),

Vitamin C (24.78 mg), total fat (0.86 mg), iron (0.88 mg) and phosphorus (1.14 mg). Rose apple presents a peel of high fiber content 9.34 g per 100 gm, lipids 4.51 g, carbohydrate 59.25 g and 8.62 g protein, contributing an energy value of 312.07 kcal, vitamin C 292.59 mg and anthocyanins 300.54 mg. (Augusta *et al.* 2010^[3]; Costa *et al.* 2006)^[8].

The following table describes the nutrient composition of watery rose apple as reported by Nallakurumban *et al.* 2015^[20].

Table 1: The following table describes the nutrient composition of watery rose apple as reported by Nallakurumban *et al.* 2015^[20].

S. No	Constituents	Range
1.	Total phenolic contents (mg/100g)	28.80-30.70
2.	Total flavonoids (µg/g)	62.03-62.07
3.	Antioxidant activity (µg/g)	138.4-144.50
4.	Beta carotene(µg/g)	37.21-37.28
5.	Ascorbic acid /vitamin C contents (mg/100g)	13.06-13.08
6.	Moisture (g %)	91.70
7.	Protein	0.31
8.	Fat (g %)	0.29
9.	Ash (g %)	1.24
10.	Crude fibre (g %)	1.37
11.	Acidity (g %)	0.07
12.	TSS (bx)	5.4
13.	pH	4.14
14.	Calcium (mg)	0.64

Health benefits

According to Chinese medical science water rose apple leaves, fruits and seeds are reported to be antipyretic while roots are diuretic. Use of wax apple fruit, in sultry summer, is an excellent choice for quenching thirst, even effective at releasing the sunstroke and removing harmful effects of dehydration proving its usefulness in dispelling summer heat. Salted fruit can help to release the discomfort in the intestine and stomach. The flowers of watery apple are astringent and known for their use in the treatment of fever and diarrhea (APAARI. 2014)^[2].

Common usage and Value addition

It is the commonest shade tree for coffee cultivation especially in Southern Mexico. Widely used in Agroforestry due to wind resistant nature of the species. A yellow colored essential oil extracted from leaves is important in the perfume industry. Due to its shape and striking bloom Ornamental Avenue in urban situations. The wood from the tree is used for firewood, tobacco drying and making baskets, furniture, musical instruments. Rosewater is made by distilling seedless

fruits which is on par with the rose water obtained with the rose petals. (Morton, 1987)^[19]. Tannin is extracted from the bark is utilized for the tanning and dyeing process. The major usage of watery rose apple is in the form of raw fruit but it is also used in the form of juice, jelly and wine-making. It is also used for decorating Chinese cuisine and creative dishes. In the cuisine of Indian Ocean islands, the fruit is frequently used in salads. These can also be cold brewed or distilled to produce a fruit liquor with a unique taste (APAARI. 2014)^[2] Underutilized fruits have tremendous potential for introducing a variety of new products for commercial and nutritional importance and in turn finding their uses in the human diet for high nutritive value (Hiremath *et al.*, 2006)^[10]. Product diversification of these under-utilized fruits would be an effective technological intervention (Choudhary *et al.*, 2006)^[7]. Bolarin *et al.* 2016^[5] reported that rose apple can be used as a good raw material for both fruit juice and wine production on a commercial purpose. Osmotically dehydrated fruits, pickle from raw fruit, wine, squash, ready to serve beverage, jam, from osmoextracted pulp/juice could be prepared. (Markose, 2008)^[17].

Table 2: International synonyms of watery rose apple (Baliga *et al.*, 2018)^[4]

S. No	Name	Language
1.	Wax jambu, java apple, Bellfruit, Water-apple, Watery rose-apple	English
2.	Jambu semarang, Jambu klampok	Indonesian
3.	Jambu air mawar	Malay
4.	Makopa	Filipino
5.	Chomphu-kaemmaem, chomphu-khieo	Thai
6.	Roi	Vietnamese
7.	Bellfruit	Taiwan
8.	Thabyuthabye	Burmese
9.	Pu tao	Chinese
10.	Sitzigiui dzhamboza	Russian
11.	Pomarrosa pomo	Dominican republic
12.	Futo momo	Japanese
13.	Jambubaum	German

14.	Gulav jaamun	Nepalese
15.	Thabyu thabye	Burmese

Table 3: Taxonomical classification of *Syzygium aquem* (Burm Alston)

Domain	Eukaryota
Kingdom	Plantae
Phylum	Spermatophyte
Sub-Phylum	Angiospermae
Class	Dicotyledonae
Order	Myrtales
Family	Myrtaceae
Genus	<i>Syzygium</i>
Species	<i>Syzygium aquem</i>

Table 4: Pharmacological activities of *Syzygium aquem* (Burm Alston)

S. No.	Pharmacological activities	Phyto-constituent	Plant Part	Reference
1.	Antioxidant activity	Phenolic compounds Flavonoids	Leaf	Palanisamy, 2011 ^[22] Islam <i>et al.</i> , 2012 ^[11] Bonfanti <i>et al.</i> , 2013 ^[6] Aggrarwatti and Ramadhania (2016) ^[1]
2.	Antimicrobial Activity	Tannin	Bark	Djipa <i>et al.</i> , 2000 ^[9]
		Riedelin, beta-amyrin acetate, betulinic acid and lupeol	Bark	Kuiate <i>et al.</i> , 2007 ^[13]
		Alkaloid, glycosides, formic acid, tartaric acid, flavonoids, phenolic content and steroids	Fruit and leaves	Levitah, 2014. ^[14]
3.	Anti-inflammatory Activity	Flavonoids myricetin and quercetin-3-O-β-D-xylopyranosyl (1→2) α-L-rhamnopyranosides, Ursolic acid and myricitrin	Leaf	Slowing <i>et al.</i> , 1996 ^[27] Osman <i>et al.</i> , 2009 ^[21] Sharma <i>et al.</i> , 2013 ^[26]
4.	Antidiabetic activity	4-hydroxybenzaldehyde, myricetin-3-O-rhamnoside, europetin-3-O-rhamnoside, phloretin, myrigalone-G, and myrigalone B	Leaf	Palanisamy and Manaharan. 2013 ^[22] Manaharan <i>et al.</i> , 2012 ^[16] , 2013 ^[15] Joubert <i>et al.</i> , 2005 ^[12]

Conclusion

Though watery rose apple is having excellent medicinal properties, its cultivation and processing are limited. Hence, research and development work, awareness to farmers and feasibility for the cultivation and processing must be given due consideration. Fruit and other plant parts can be used for several medicinal purposes.

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