

Loquat: An Unexplored Phytochemical Repository

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Abstract—*Eriobotrya japonica*, is a subtropical evergreen tree commonly known as loquat. This is a highly valued medicinal plant in Japan and China. The various phytochemicals like phenols, flavonoids and other antioxidants that impart the medicinal properties in this plant, vary in their composition and concentration in different plant parts. Loquat fruit and leaves have high concentrations of vitamin-A, ascorbic acid, calcium, iron, manganese, potassium, and pharmacologically active constituents are kaempferol, ursolic-acid, oleanolic-acid, tartaric acid, quercetin, amygdalin, etc. It also possesses several pharmacological properties, including anti-inflammatory, anti-tumor, antioxidative, antimutagenic and anti-diabetic activity etc.

INTRODUCTION

Loquat (*Eriobotrya japonica* Lindl.) is a subtropical evergreen perennial fruit tree originated in southeastern China. It has been cultivated for more than 2000 years and is now commercially cultivated in more than 30 countries worldwide, including Japan, Turkey, Italy, Spain, Brazil, etc. In India, it grows at all levels up to 5,000 ft (1,500 m). Loquat fruits are often used as food and their skin can be peeled and eaten [1]. They are often combined with other fruits. Loquat fruit and leaves have high concentrations of Calcium, Phosphorus, Iron, Potassium, Vitamin A and Ascorbic Acid [2]. Loquat fruit is delicious and is a good resource for dietary phenolic. Loquat is a plant with high medicinal value since different organs have been used historically as folk medicines for thousands of years. Loquat extracts have been used for the treatment of cough, chronic bronchitis, inflammation, diabetes, and cancer in Chinese folk medicine. The harvest season of loquat in China lasts from the end of April to the middle of June when the market is short of fresh fruit [3], so loquat fruit usually has a high market value. But loquat fruit are susceptible to decay, moisture and nutritional losses during their postharvest life. The quality of loquats, including color, flavor, aroma and chemical compounds etc., are highly dependent on the ripening degree at harvest. In general, high quality loquat fruit have soluble solids content (SSC) >12%, moderate titratable acid (TA) from 0.3 to 0.6% [4] and low flesh firmness. The isomeric pentacyclic oleanolic acid (OA) [5] and ursolic acid (UA) [6] are predominant triterpenoids found in *E. japonica* leaves [7].

Loquat is native to China. Many good loquat cultivars also originated in China and Japan. It has become a commercial fruit of Australia, U.S.A. Hawaii, France and India. Loquat is highly preferred fruit for kitchen gardens in Punjab. It is also being grown on a small scale in the orchards at Amritsar, Gurdaspur Hoshiarpur and Patiala districts [8,9]

Origin and availability of Loquat in India

It originated from China, later spread widely in India. A Purdue horticulture (Horticulture & Landscape Architecture College of Agriculture) [10] article explains that at least 14 varieties of loquat are cultivated in India; all vary in their quality, size, shape, acidity, sweetness, flesh consistency and toughness of skin. Some of the regions cultivating loquats are Uttar Pradesh (bagpat, merath), Delhi, Punjab (Ludhiana), Himachal Pradesh, Assam, Maharashtra, and a few of the hill stations in the south. U.P. occupies the first position as far as area under loquat is concerned.

BOTANICAL DESCRIPTION

Botany:

Loquat belongs to family Rosaceae and sub-family pomaceae. The fruit is pome with bold seeds. The trees are evergreen, spreading and growing. A full grown tree may attain a height of 7-8 meters. The leaves are large and densely located at the ends of shoots. Shape of leaf is lanceolate with dentate margins [11].

Leaves: Are somewhat crowded towards the end of the stout, woolly branchlets, large, alternate, sub sessile, stiff, coriaceous, elliptic, lanceolate to obovate, lanceolate in outline, 21-32 cm in length, with remotely toothed to sharply dentate margins; dark, glossy, green above and rusty-tomentose below; base green, obtuse or narrowed into a very short, stout, woolly, stipulate petiole [11].

Flowers: fragrant, 1.2 cm broad, borne in woolly panicles, 10-20 cm long; calyx composed of 5 small, imbricate, acute teeth; corolla has 5 oblong, ovate-clawed petals, white in colour and delicate in texture; stamens 20; pistils 5, joined towards the base.

Fruits: fruits borne in clusters, commonly round, oval 2.5-8 cm in length, pale yellow to orange, somewhat downy on the surface; skin about as thick as that of a peach, but slightly tougher; flesh firm and fleshy in some varieties, melting in others, the colour ranging from almost white to deep orange, juicy and with sub acid flavour; Each fruit contains from one to ten ovules, with three to five being most common. The fruits are the sweetest when soft and orange. The flavour is a mix of peach, citrus and mild mango.

Seeds: 4-10, brownish, oblong, 0.5-1 cm long. The seeds contain amygdalin and fatty oil [12]

Flowering and Fruiting: The flowers appear in the autumn or early winter, and the fruits are ripe in late winter or early spring. The Chinese groups with large, pyriform, deep orange fruit, which can be kept for 1-2 weeks, and the Japanese group with small, slender, light-coloured fruit, maturing early and having a shorter shelf life.

Climate and Soil: [13]

Loquat has adapted well to the harsh climate of North India. Loquat requires sandy loam soil, which is rich in organic matter and has a good drainage system. It is performing well in tropical climate and lower hills, where temperature rarely falls below 0°C. It cannot tolerate severe frost in winter. It is tolerant to drought and heat. It likes warm and dry climate at fruit ripening time. Loquat grows well on fertile clay loam soils. It can be grown in loam as well as on sandy loam soils. Waterlogged conditions are harmful to the plants. For loquat farming, the well prepared land is required. To bring the soil to a fine tilth, leveling is required followed by 2-3 deep ploughing.

Spacing: Use plant to plant spacing of 6-7m.

Sowing depth: 1m deep planting is done

Method of sowing: Propagation method is used.

Fruit Maturity and Harvesting:

Plants start bearing after three years of age. Fully matured and well coloured fruits with TSS above 9% should be harvested. All the fruits in a cluster almost ripen uniformly. While harvesting a small portion of the shoot should also be harvested with sharp secateurs. Separate the clusters as A and B grade. The culled fruits of poor quality may be sent to be local/small market.

Nutrition Information [14]

- Loquat fruit is low in sodium, fat and is cholesterol free.
- It is very rich in Vitamin A and provides about 51% of the daily value per 100 grams.
- The fruit contains a good amount of dietary fiber as well as the minerals potassium, iron, manganese, copper and phosphorus.

- It is low in calories and provides only 47 calories per 100 grams.
- Loquat is rich in polyphenolic flavonoid antioxidants like chlorogenic acid, neo chlorogenic acid, epicatechin, coumaric acid, ferulic acid etc. It also contains high levels of the B complex vitamins, niacin and pyridoxine

Loquat fruit (<i>Eriobotrya japonica</i>), Fresh, Nutrition Value per 100 g. (Source: USDA National Nutrient data base)		
Principle	Nutrient Value	Percentage of RDA
Energy	47 Kcal	2.4%
Carbohydrates	12.14 g	9%
Protein	0.43 g	2%
Total Fat	0.20 g	1%
Cholesterol	0 mg	0%
Dietary Fiber	1.70 g	4%
Vitamins		
Folates	14 µg	3.5%
Niacin	0.180 mg	1%
Pyridoxine	0.100 mg	8%
Riboflavin	0.024 mg	2%
Thiamin	0.019 mg	2%
Vitamin A	1528 IU	51%
Vitamin C	1 mg	2%
Electrolytes		
Sodium	1 mg	0%
Potassium	266 mg	6%
Minerals		
Calcium	16 mg	1.6%
Copper	0.040 mg	4.5%
Iron	0.28 mg	3.5%
Magnesium	13 mg	3%
Manganese	0.148 mg	6.5%
Phosphorus	27 mg	4%
Selenium	0.6 µg	1%
Zinc	0.05 mg	0.5%

CULINARY USES: Wash loquats in cold water before consuming to remove any surface dirt or pesticide residues. Its flesh just underneath the skin is rather sweeter than its central tart pulp. Skin can be peeled easily. Peeled fruits are eaten fresh or may be mixed with other fruits like banana, mango, and orange sections in salads or fruit cups. The fruits commonly used to make jam, jelly and chutney, wine and are often served poached in light syrup. Firm, slightly immature fruits are best for making pies or tarts.

MEDICINAL USES [15 -18]

Fruits: The flesh promotes the secretion of body fluids and eliminates thirst. Loquats are highly recommended in cases of excess uric acid, kidney stones, kidney failure, and gout. This is due to their effectiveness as a diuretic by increasing the production of urine and promoting the elimination of excess uric particles as well as its low protein and high mineral content. Loquat helps decongest the volume of an enlarged liver (hepatomegaly) and also reduces ascites that are followed by liver degeneration. The regular consumption of loquat proves somehow effective in cases of Chronic liver diseases as: Cirrhosis, Hepatitis, Fatty degeneration of the liver. Regular consumption of loquats in cases of common cold is highly beneficial.



Leaves: The tender leaves are used for various types of coughs but the underside is usually prepared by rubbing the hairs off so they do not irritate the throat. Leaves are used for the treatment of diabetes mellitus, skin diseases and are used as a folk medicine for the treatment of chronic bronchitis, coughs, phlegm, high fever and ulcers. A traditional therapy uses the leaves to treat Cancers in Japan. An infusion of the leaves, or the dried, powdered leaves, may be taken to relieve diarrhea and depression and to counteract intoxication from consumption of alcoholic beverages. Loquat leaf's oldest reported benefit is the reduction of skin inflammation and when Loquat leaf is used in topical cream, it can combat edema and histamine-induced skin contraction. Leaf poultices are applied on swellings. Leaf should not be used for cough caused by cold.



Flowers: Flowers have 5 sepals, 5 petals, 20 stamens and 5 pistils joined at the base. Shape of the fruit varies from round to pyriform. Flesh firm and melting. The colour of pulp varies

from whitish to deep orange. The seed size and number varies from fruit to fruit and cultivar to cultivar. Ovary is 5 celled with 20 ovules. Some ovules abort and only 2 to 5 ovules turn to develop into seeds in a fruit. Seeds are bold and have brown tasta. The edible portion is thalamus just like other pome fruits.



Other Uses:

Loquat is a delicious summer fruit. It contains 60 to 70 percent pulp depending upon the cultivar and 15-20 percent seed. The pulp is composed of 88% water, 0.6% proteins, 9.6% carbohydrates, 0.5% minerals, 1.0% fibre and 55% IU vitamin A. Some preparations like Jam, Jelly and squash are made from the pulp. It is consumed as a fresh fruit. The colour of epicarp usually ranges between yellow-red. The fruit tastes sweet and sour with good flavour.

Nutraceutical and Antioxidant property:

The antioxidant capacity of Loquat plant were evaluated using the Trolox equivalent antioxidant capacity (TEAC) and ferric reducing antioxidant power (FRAP) assays, and their total phenolic content was measured by the Folin-Ciocalteu method. The strong correlation between TEAC value and FRAP value suggested that the antioxidants in this plant possess free radical scavenging activity and oxidant reducing power, and the high positive correlation between antioxidant capacities and total phenolic content. Loquat shows very high amount of antioxidant property and is a potential source of natural antioxidant[19]. Seed extract also shows antioxidant activity[20]. Loquat contain significant amounts of secondary plant metabolites, including carotenoids, flavonols, anthocyanins, and procyanidins. These minor dietary compounds have been postulated to play a key role in humans as antioxidants, by preventing reactions produced by oxygen and nitrogen reactive species during the progression of different human pathologies. The antioxidant activity is measured by the Randox spectrophotometric kit. Trolox (Sigma) was used as a reference antioxidant, antioxidant activity was expressed as Trolox equivalents. It is concluded that it is recommendable to incorporate loquat in the diet to benefit of his high antioxidant activity [21].

Toxicity of seeds

The loquat fruit seeds contain many toxic alkaloids like cyanogen-glycosides which when consumed can cause serious, life-threatening symptoms like vomiting,

breathlessness, and death. Therefore, children may advise avoiding chewing seeds and adults should supervise them while eating. Avoid chewing the seeds[22].

CONCLUSION

Plants are well known and have possible source of curing ailments from the time of immemorial. In recent years, ethnobotanical and traditional uses of natural compounds, especially of plant origin received much attention as they are well tested for their efficacy and generally believed to be safe for human use. The present review shows the Nutraceutical and Antioxidant property of *Eriobotrya japonica* which is very helpful for researcher.

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