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Nutritional, Pharmaceutical and Ecological Significance of Subtropical Fruit Tree Loquat *Eriobotrya japonica* Thunb. Lindley a systematic review

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Abstract

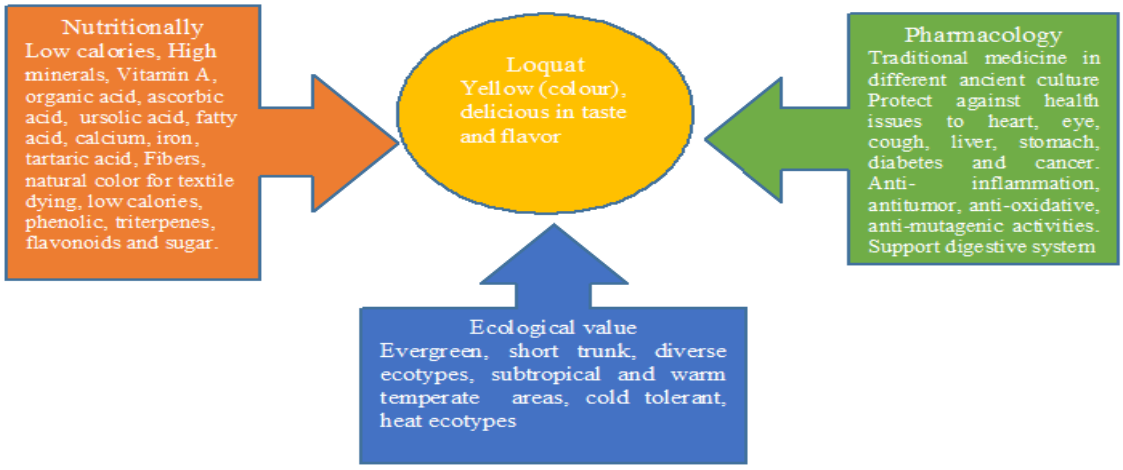
Eriobotrya japonica (Thunb.) Lindl. is a small tree species and member of the flowering plant family of *Rosaceae*. The fruits of loquat are in most demand in public due to nature of delicious, tasty, and rich in various important nutrients. Originally, loquat was considered native to China and is now commercially growing in many parts of other countries, Spain, Australia, and Central Europe, including Pakistan. The bioavailability of the active compounds in loquat for human health is developing a key interest among researchers to increase its cultivable areas to meet the demand of the food and pharmaceutical industrial sectors on a large scale. However, in recent years the productivity of Loquat also influenced due to rapid changes in climatic changes, environmental pollution and global warming. The purpose of this systematic review was to investigate and analyze the research activities carried out in past on the nutritional, pharmaceutical and ecological properties of loquat to increase its cultivation. The findings would be helpful for academia, researchers working on the loquat especially for loquat industries.

Keywords: Bioactivity; ethno botany; phenolic compounds; pharmacology; pollution

Abbreviations

Ej=*Eriobotrya japonica;* **DMBA=**Dimethylbenz[a]anthracene; **EPPO**= European and Mediterranean Plant Protection Organization; **GA3**= Gibberellic Acid; **GB**= glycine betaine; **GOP**= Government of Pakistan; **HCl**= Hydrochloric acid;

Graphical abstract



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1. Introduction

Loquat nowadays widely grown commercially on worldwide scale, including Pakistan for its fruit. China and Spain remains are the chief exporting country of Loquat fruit [1]. The loquat is also cultivated more than 30 countries [2] which includes Turkey, India, Japan, Pakistan, Chile, Brazil, Guatemala, Greece, Israel, Italy, Morocco, Portugal and the United States. Marchese, *et al.* [3] studied Loquat 20 accessions from the Sicily. There are few studies have been carried out on the fruit quality, size, delicious in taste and have many economic and medicinal and ecological value and can get good market return of Loquat [4-7]. Chinese plum, Japanese medlar or Japanese plum are also the familiar name of loquat [8]. The flowering of loquat in three diverse ecotypes of Sichuan from summer and mature at June was surveyed by Jiang *et al.*, [9].

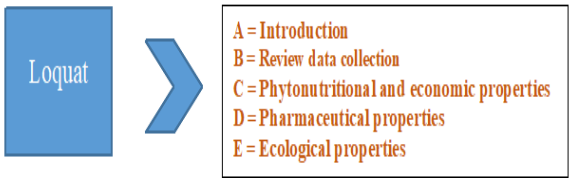
The different parts of Loquat extracts contain many bioactive compounds. The cultivation, production and processing of loquat playing promising and supportive role to Loquat industry. The warm and temperate climate favor its cultivation and adaptation in many countries. In recent years the identification of the biological compounds are receiving more attention among researchers. The nutritional and pharmacological active compounds in different loquat extracts was focused [10]. The fruit seeds help in natural colorant for textile dyeing [11]. In another study the five different fruit cultivars were evaluated for their commercial values using sensory analyses instrument. The loquat fruit production has both positive and some negative economic impact. The high production of Loquat in Italy was studied by means of cost benefit analysis [13].

Loquat industry in Pakistan is at minor scale and can be increase as some parts of the country provide suitable climatic conditions for its cultivation. The production and cultivation area of Loquat can be increased by high quality of genotype and cultivar growing around the world. There is a need to increase its cover cultivation, and production in subtropical region due to high income. This review explore and analyzed the nutritional and pharmaceutical potential of Loquat. This review also focused on the ecological factors influenced on the germination of Loquat. In recent years the demand for commercial cultivation of Loquat is increasing to meet the demand of different food sectors. This review aims to highlights the urgent needs of loquat for 1) nutritional status 2) traditional use in pharmacology and 3) ecological factors influencing on the growth of Loquat.

2. Review Methodology

The literature cited in this review was targeted from the scientific research journal published in between 1999 to 2025 years. The relevant literature surveyed for the published data on Loquat employing English data base, Google, PubMed, Google Scholar and MDPI using different keywords such as ecology, pharmacology, nutrition, fruit, and environmental pollution consequences. The selection of these data bases was due to availability of high quality scientific academic research papers with good impact factor. The articles do not meet the search criteria and found in duplicate nature were removed. The Boolean operators likewise "loquat AND environment" loquat AND ecology" loquat AND pollution, loquat AND nutrient and loquat NOT genetic materials was used to narrow the relationships between results and refine the search from all data bases.

Design of study



The particular focused journals were *Acta Horticulturae, American Journal of Chinese Medicine, Archive of Pharmacology Research, Biochemical Systematics and Ecology, Biological and Pharmaceutical, Bioscience Biotechnolofy and Biochemistry, Bulletin, Journal of Ethnopharmacology, Chemical and Pharmaceutical Bulletin, Cytokine, Food Chemistry, Food Reviews International, Journal of Pharmacy and Pharmacology, Life Science, Phytomedicine, Scientia Horticulturae* were browsed for digging deeper into the relevant literature from 1999 until July 2025. The research articles publication was examined individually and deleted the duplicate papers. The best efforts and care was taken on finding an updated article on Loquat. The inclusive data and information was selected according to the scope and title of the review. The total number of 520 literature documents was yielded. Among all of them finally 122 research articles were selected for eligibility for detailed analysis and included in the reference list. This helped in understanding about the loquat cultivation, ecology and pharmaceutical potential.

3. *Botanical description of Eriobotrya japonica Lindl.*

Loquat is nowadays cultivated for more than 2000 years across the globe [14]. The loquat fruits possess a relatively high antioxidant activity was found in different cultivar of loquat 'El Buenet', 'Algerie' and 'Claudia' offered wider choice to grower in Italy [15].

Fig.1. Loquat fruit (a), seed (b), fruit and seed (c) from Pakistan (Photo by Muhammad Shafiq).

Loquat nowadays is cultivating commercially worldwide being have high economical, and medicinal potential (Fig. 1). Therefore, a survey of scientific literature regarding topics related to the loquat with the help of English data base was conducted (Table 1). The gathered information can provide a better understanding for the increase of Loquat cultivation area according to the demand of global economic market. The isolation and identification of new beneficial compounds from Loquat provided a new insights of advancement of research published in recent years. The findings might be helpful for pharmaceutical and food industries. Additionally, the drug formation from the natural product will support to pharmaceutical industries.

Table 1. *Botanical description of Loquat*

Taxonomic tree	Domain:Eukaryota>Kingdom:Plantae>Phylum:Spermatophyte>Sub-Phylum:Angiospermae> Class: Dicotyledone> Roder:Rosales>Family: Rosaceae> Genus: Eriobotrya> Species: *Eriobotrya japonica*
Chromosome number	2n=34
Common name	Australia-bibasse; Chinese- biba, luju, pi ba; English Loquat, zapote de Japón (Spanish), ameixa do Japao (Portuguese), luju (Chinese), lokwat (Maylay and Indonesian), French – barbassier, Portuguese-ameixieira-do-Japao, Germany-Japanische Mispel, Indonesia-lokat, Italy-nespolo del Giappone, Japan, bipa, Netherlands-japaanse Thailand-lokhwot
Botanical name	*Eriobotrya japonica* Lindl
EPPO	*Eriobotrya japonica*
Plant type	Broad leave – Perennial – seed propagated – Tree - Woody
Habit	Tree
Canopy	Upright canopy rounded in shape.
Stem colour	Greyish
Flesh	Loquat produces yellowish flesh and whitish flesh fruits.
Leaves	Simple and alternate arrangement
Climate	subtropical and warm temperate
Flowers	Bisexual
Fruit	Fruit are pomes, oval to round
Propagation	May be propagated by seed. Cuttings and marcottage is also possible.
Soil	Well drained soils, fertile loamy.
Distribution	Cultivated throughout South East Asia and across the globe such as Brazil, China, India, Iraq, Israel, Italy, Japan, Pakistan, Spain, and Turkey.
Diseases / Pathogenicity	The fungal pathogens likewise fire blight reported in Florida. Leaf spots due to *Anastreph suspensa*,
Insect pest	Caribbean fruit fly, aphids, beetles, weevils, caterpillars, nematodes
Fertilizers	Nitrogen, phosphate may be applied.
Pharmacology	Useful for treatment of inflammatory, tumor, diabetic activity.
Biochemical compounds	A quality loquat fruit may have 12% total soluble solids content along with the acidity level in the range of 0.3–0.6%.
Other properties	The products are jam, jellies, juice and wine are industrially produced.
References: [16-.25].	

4. Phytonutritional and Bioactive compounds

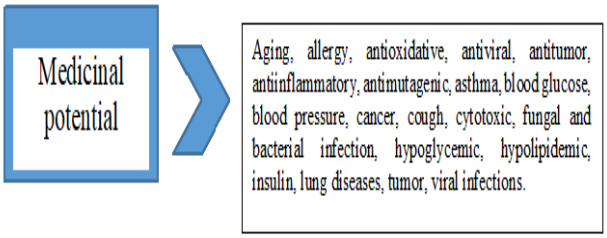
The entire Loquat is rich with many nutritional value. Table 2 shows the nutritional and bioactive compounds present in Loquat. The demand this tropical fruit has steadily increased and demand is expected to remain high in the upcoming years [26]. Fruits are rich in vitamins, minerals, total soluble solids, total phenolic content and phytocompounds play a major role in developing immunity [27-28]. The leaves of Loquat have also rich characteristics of antioxidant with key components of Methylchlorogenic acid and polyphenolic [29-32]. The analysis of chemical nature of many compounds provide a better understanding about their different biological activities. The effect of hot water extract of loquat on alcoholic and nonalcoholic fatty liver impairment was recorded *in vitro* studied [33]. In addition, the fruit and flower of loquat recorded rich in sugars, starch, organic acids, and minerals [34-36]. The fruit flesh and cultivars identified the phenolic and 15 known flavonoids compounds [37-39].

Table 2: *Phytochemical constituents from peel, flower ,fruits and leaves of Eriobotrya japonica.*

Parts of the plant	**Bioactive compounds extracted and identified**	**References**
Leaves	An antioxidant flavonoids and chlorogenic acid.	[40]
Leaves	Corosolic acid.	[41]
Leaves	Sesquiterpene glycosides	[42]
Ej	Cinchonain Ib	[43]
Ej	Characterization of antioxidant compounds	[44]
Ej	Euscaphic acid	[45]
Ej	11β-Hydroxysteroid dehydrogenase 1 inhibiting constituents.	[46]
Ej	Tormentic acid	[47]
Leaves	Flavonoids and phenolic compounds	[48
Leaves	Triterpene acids	[49]
Ej	Proteins, carbohydrates, fats, vitamins and minerals.	[50]
Fruit	Soluble solids content	[51]
Entire plant (Ej)	phenolics, carotenoids, triterpenic acids, and organic acids	[52]
Loquat juice	Phenolic content	[53]
Loquat waste	Production of α-amylase	[54]
Fruit	vitamin C	[55]
Fruit	rich in carbohydrates	[56]
Frit and seeds	Alkaloids, glycosides and flavonoids.	[57]
Ej culture	Contains a great number of pentacyclic terpenoids	[58]
Leaf	Triterpene acids	[59]
Leaves	triterpenoic acids	[60

5. Pharmaceutical properties

This study reveals that Loquat plant in use for the treatment of different diseases. Scientific studies has reported for the development of modern drug from Loquat. The different parts e.g. fruit, seed, and roots of Loquat used as medicine traditionally particularly in Asian and some European countries (Table 3). Numerous studies documented the benefits of loquat traditional medicine in different cultural region. The leaves of loquat were also used for determining Tissue Factor activity [61]. The dried leaves of loquat has been traditionally used to treat various diseases such as cough, inflammation, skin diseases, diabetes and [62]. Loquat leaves are using in Chinese herbal medicine to treat cancer, fungal infections, and antiinflammation [63]. There are different types of lung diseases developed due to pulmonary inflammation [64]. The leaves of loquat validate the potential of many anti-inflammatory to control diseases [65].



E. japonica traditionally used by human beings for the treatment of asthma, blood pressure, cancer, cough, gastrointestinal, lung and respiratory diseases (Table 3).

Table 1: Medicinal relevance of Eriobotrya japonica (Ej).

Plant parts	**Treatment**	**References**
Ej	Diabetes, hyperlipidemia	[66]
Leaves	Anti-inflammatory	[67]
Ej	Successful in suppression of blood glucose level.	[68]
Seed	Inhibited fatty liver	[69]
Leaves	To treat pulmonary inflammatory diseases in human beings.	[70]

Ej	Suppresses DMBA induced breast cancer (animal model).	[71]
Ej	Modulated cytokines in normal tissues.	[72]
Leaves	treatment of chronic inflammatory diseases.	[73]
Ej extract	Proved to be efficacious against diabetes, persistent bronchitis, allergic cough	[74]
Ej extract	The anticancer efficacy.	[75]
Leaves	Hypotriacylglycerolemic and antiobesity properties.	[76]
Loquat syrup	in Chinese medicine used for soothing the throat.	[77]
Leaves	lung disease treatment particularly, in China and Japan.	[78]
Leaves	The leaves of loquat used on the skin care for prevention of skin disorder and provided a valuable evidence that its applications is good as cosmetics for health benefits.	[79]
Ej	Respiratory functions	[80]
Seed	Reduce production of sputum	[81]
Leaf	Fever and vomiting. Effective against antibacterial activities	[82]
Leaf	Allergic rhinitis symptoms	[83]
Seeds, leaves, fruit	An obesity	[84]
Laves	Anti-arthritic activities	[85]

6. Responses to ecological factors

Loquat is successfully thrive in subtropical environment. The growth and development of loquat faces some significant ecological problems in some region. Loquat under favorable environmental condition consider model crop. In summer season the release of bud dormancy responded differently to deficit irrigation [86]. The loquat fruiting habit variation from a province Sichuan of China in three different ecological zones was evaluated [87]. The northern Sicilian coastline represent the main production area due to favorable soil and climatic conditions for loquat [88]. The contents of sorbitol and the changes in their enzymes activities during the fruit development of Loquat varieties 'Baili' and 'Jiefangzhong' was studied [89]. The higher sorbitol content in the young fruit of 'Baili' was recorded.

a. Response to seed dormancy

The loquat seeds has some dormancy issues likewise some other plant species. There are different types of techniques used to overcome this problem. The moist chilling and Gibberellic Acid (GA_3) applications displayed the release of an endogenous dormancy for germination of loquat seeds [90].

b. Response to temperature and climate change

*I*n recent years the climatic conditions and increase in temperature affected the growth of loquat. These changes brought up changes in fruit quality and reduction in growth and development of loquat. The quality of loquat fruit decreases due to physical changes during storage at room temperature [91]. The development of loquat fruit were found damaged at below 27°F temperature [92]. The pollen grain viability in loquat variety 'Dawuxing' was delayed at low temperatures of 5°C [93].

c. Response to chemical treatment

The chemical treatment favor the growth of Loquat. The soaking of loquat seed at 375 mg/L iron chelated gave 100% germination [94]. The seeds of Loquat cultivars namely Algerie, Bianco Dolce were pretreated with 1% HCl. The treatment showed the highest germination in cultivar 'Bianco Dolce' [95]. The treatment of cupric sulfate at 2.5 mg L-1 increased rate of seed germination of *E. japonica* cv. 'Jiefangzhong' by 3.69%, and at 7.5 mg L-1 and 12.5 mg L-1 decreased by 10.14 and 17.05%, respectively [96].

d. Response to breeding program

Badens *et al.* [97] suggested a application of a breeding programs for Loquat with the help of biotechnology that can benefits in Mediterranean climates conditions.

e. Response to fertilizer and plant growth regulators

Fertilizers application enhance plant growth and development. The treatment of balanced fertilizers produce better yield and high level may leads to decline. Loquat trees received different types of fertilizers to promote crop yield. The treatment of four doses 0, 25, 50, 100 ppm of naphthalene acetic acid/gibberellin, benzylaminopurine /cytokinin / auxin, gibberellic acid as growth regulator was found favorably effective during for seedling growth of Loquat [98].

f. Response of loquat fruit quality to glycine betaine (GB)

Glycine betaine is a natural compound found in plants. GB play an important role in maintaining

biochemical process in plant [99]. The application of different level of glycine betaine treatments (1, 5, 10, 20 mmol L^{-1}) effectively reduced internal browning of loquat fruit 'Jiefangzhong' [100].

g. Response to water scarcity

Researchers have investigated the water scarcity effects on plant growth. Water scarcity in plants influenced on physiological and biological functions. Drought stress limits plant growth and metabolic function [101]. The Loquat cultivar 'Marchetto' when treated with three water regimes (One-third of the plants were irrigated to reintegrate 100%; a second group of plants with 66%, a third group irrigated with 33% of the water consumed) for growth and biomass portioning behaved as a moderately tolerant species to water deficit [102].

7. Conclusion

Loquat has proven many nutritional, medicinal and ecological benefits worldwide. In present studies the accumulated scientific evidences cited from the different research articles published showed a very promising results on the nutritional and pharmaceutical properties of different parts of ever green Loquat (leaves, stem, fruit, seeds, roots) for human beings since last thousands of years. Loquat fruit is an economically famous plant species with many characteristics due to its appealing yellow in color, delicious, tasty, and low in calories and high minerals and vitamins. It is native to China and spreading to Pakistan, Spain, India, Lebanon, Mediterranean basin, Central Europe, Japan, Turkey, and Australia and traditionally utilized in various socio economic cultural sectors for the treatment of different ailments likewise cancer, stomach, cough, diabetes and liver since ancient times. However, new technical application tools is required to increase the cultivation of Loquat for pharmaceutical and food processing (jams, jellies, marmalade, juices) industrial sectors. Loquat prefers to grow in well drain soil. The loquat plant species showed promising drug development and more clinical studies are required. This review bridges traditional knowledge with modern pharmaceutical understanding. There is a need to find new phytochemical compounds for the benefits of the human beings. Loquat possesses many bioactive compounds such as alkaloids, sugar, and more research is required for the food, pharmaceutical, food technology and loquat industry.

Author Contributions

Muhammad Shafiq: original draft writing, validation, methodology, data collection, **Muhammad Zafar Iqbal**: supervised and **Mohammad Athar Tariq**: critically review the manuscript.

Conflicts of interest / Competing interests: No conflict of interest.

Availability of data and material: The data have been reviewed depending on the survey of literature.

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