



GUAVA: A TREASURE TROVE IN PLAIN SIGHT

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ABSTRACT

Psidium guajava also called as Apple guava, Lemon guava or Common guava is native to Central America which has been extensively researched and has shown anti-oxidant, anti-microbial and anti-acne properties due to the presence of various flavonoids, tannins, phenolic compounds, etc. This review explores the possible uses of *Psidium guajava* in whole or in parts in the cosmetic industry. Furthermore, this review explores the possible ways this plant can be used in various beauty products, increased efficacy of already existing general formulations and the potential reduction of cost in the manufacturing of the products, due to its widespread availability. Ultimately, this review provides a comprehensive overview of the immense potential of *Psidium guajava* and its various possible uses in the cosmetic industry as a beautifying hero.

KEYWORDS: *Psidium guajava*, Common guava, Cosmetics, Home Remedies, Review.

INTRODUCTION

Guava (*Psidium guajava*) is a plant mainly cultivated in tropical or sub-tropical areas, belonging to the family myrtle (*Myrtaceae*). Though it has been traditionally used as a medicinal plant in some of the cultures, new researches have brought to the light, the immense potential the plant holds in the field of cosmetics. In today's world, people pay a lot of attention to their outer appearance, but the expenses of the products make it harder for it to be accessible to everyone, Guava plant can help us eliminate this problem to a certain extent. The excessive availability of this plant in almost every part of the world and the plethora of phytochemicals it contains, makes it a diamond hidden in the rough. Even though the plant as a whole is a host for phytochemicals, it is the leaves that are most abundant in them.

History

Psidium guajava is believed to be first originated from Mexico and moving forward through to the Central America, Caribbean and the northern part of South America since the year 1526. The colonization of India resulted in the plant being brought to this country.^[1] Though a significant number of guavas are now being grown in Hawaii, it did not reach the shores of Hawaii until the early 1800s.^[2] Over the course of time, this plant has increased its reach, now, it grows in places like California, Costa Rica, Brazil, and Palestine to name a few.

Biological source

Apple guava and Lemon guava (*Psidium guajava*) and guava leaves (*Psidium guajavae folium*) is obtained from the plant of *Psidium guajava*, *Psidium cattleianum*, *Psidium friedrichsthalianum* or *Psidium guineense* belonging to the family *Myrtaceae*. The fruit of guava is oval in shape with yellow to green color on the outside, the flesh on the inside can either be white, pink, yellow, or red with numerous white or yellowish seeds whereas the leaves are yellowish to dark green, oblong-elliptical, with an obtuse to bluntly acuminate apex and rounded to subcuneate base.^[3]

Microscopy

In the year 2013, S. Gopalakrishnan et al. conducted the microscopical evaluation of guava leaves, through this study the following microscopical features of the guava leaf were concluded:

- Shape: Leaves are dorsiventral with prominent midrib. 1.25mm thick, broadly concave adaxial side and smooth semicircular abaxial side.
- Vascular bundle: Broadly bowl shaped vertical-250µm and 1.6mm horizontal. Xylem compact, parallel radial rows thin-walled, less lignified with narrow uniseriate, intervening layers of thick-walled fibres. Metaxylem - 30µm wide. Phloem - 50µm wide, continuous along the lower part of xylem arc. Phloem zone ensheathed wide band of dark tannin filled small compact parenchymal cells.

- Mesophyll: The mesophyll is differentiated into adaxial zone of two layers compact cylindrical palisade cells (70- 100µm in height). Lower part consists of four layers of compact spongy parenchyma. Circular secretory cavities located in lower side.
- Ground tissue: Outer narrow zone of tannin filled parenchyma cells and inner wider circular turgid cells with minute intercellular spaces. Secretory cavities are sporadically seen in the outer part.
- Epidermis: Upper epidermal cells consist of oblong spindle shaped outer layer and 2 to 3 layers of wider

rectangular cells. Lower epidermis is thin with elliptic narrow cells.^[3]

Ethnomedicine

Guava has been used for long time in traditional medicine to treat or maintain several diseases like diabetes mellitus, hyperlipidemia, hyper-cholesterol, digestive issues, etc.^[4] Tea of guava leaves has been used extensively in countries like China and India to treat gastrointestinal problems. Many different countries have used ethnic preparations to treat different medical condition which have been enlisted in **Table-1**.^[5]

Table 1: Ethnic remedies using guava.

Sr. No.	Ailment	Dosage form	Region/Country
1.	Gastrointestinal/Anti-spasmodic/Rheumatism	Oral	India
2.	Diabetes Mellitus/Diarrhea/Antiseptic	Oral/Topical	China
3.	Wound/Anti-bacterial/Gastrointestinal/Anti-inflammatory/Cough	Topical/Oral	Mexico
4.	Gastrointestinal/Wound	Oral/Topical	Brazil
5.	Wound/Astringent	Topical	Philippines
6.	Wound/Anti-bacteria	Topical	Nigeria
7.	Diabetes mellitus/Anti-inflammatory/Anti-bacterial/Cough	Oral/Topical	Pakistan
8.	Gastrointestinal/Anti-bacterial/Pain	Oral/Topical	Bangladesh
9.	Wound/Astringent/Diuretics	Oral/Topical	Southeast Asia

Cosmetic potential

Due to the presence of phenolic compounds like flavonoids and tannins, the extracts of the fruits, peel and the leaf show anti-oxidant as well as anti-microbial property. The anti-oxidant property in cosmetics is highly beneficial and sought after as it can reverse the signs of ageing and prevent several skin diseases like melanoma. The phytoconstituent that is found in abundance is quercetin which has been found to exhibit the most anti-oxidant property. In one study conducted by Kantham, C. et al., he found that the leaf extract of the guava showed anti-androgen property where it substantially downregulated the SRD5A1, SRD5A2 and SRD5A3, inhibiting the synthesis of dihydrogen testosterone (DHT),^[6] the hormone that is responsible for the miniaturization of hair follicles, leading to alopecia and male pattern hair loss. Though the efficacy of leaves is always superior, when it came to anti-microbial property, the fruit extract was found to be most effective. Different parts of the guava plant can be utilized in different concentrations depending upon the effect required and the formulation prepared.

Substitute/Adulteration

There are no direct substitutions of guava so far as it is not being extensively used in the preparation of cosmetics, but as the major component present in the guava plant is quercetin, a flavonoid, which is majorly responsible for the anti-oxidant and anti-microbial property of the plant. Thus, it can be substituted with plants which are also high in the production of this phytoconstituent. One study reported that fennel leaves, dill and onions contain 46.8, 79 and 45 mg/100g of quercetin, respectively,^[7] making them a potential substitute for guava.

When we talk about the adulteration of guava, it is not reported much except for in the food industry, where the guava juice is usually adulterated with sugar syrup, making it less healthy but effectively cutting production cost.

Allied species

Though it is the 'Apple guava' or 'Lemon guava' which are generally referred to as 'guava', there are several different species of guava like Strawberry guava or wild guava that also exist around the world. Some of the different species of guava are given in the **Table-2**.

Table 2: Species of guava.

Sr. No.	Common Name	Scientific Name	Place of Cultivation
1.	Apple guava/Lemon guava	<i>Psidium guajava</i>	India
2.	Strawberry guava	<i>Psidium cattleianum</i>	California
3.	Wild guava	<i>Psidium friedrichsthalianum</i>	Costa Rica
4.	Brazilian guava	<i>Psidium guineense</i>	Brazil

Geographical source, Cultivation and Collection

Guava grows particularly well in areas with distinct winter season instead of deep tropical areas. It is non-selective when it comes to their soil preference and can grow equally well in clayey as well as gravelly soil with a pH range of 4.5-9.4. It requires dry and humid climate with a temperature ranging from 15-30°C and annual rainfall of 40-80in. It grows in places like India, Australia, Brazil, Hawaii, Egypt, Palestine, China, Pakistan, Thailand, Indonesia, Spain, Portuguese, Africa, South America and Central America.^[2]

When guava is cultivated and the guava seeds are prepared for germination, it takes them about 2-8 weeks to germinate properly. The process of germination can be quickened if the seeds are first pretreated with either sulphuric acid or boiled for 5 minutes in water or soaked in room temperature water for 2 weeks. The process of pretreatment softens the seed coat, allowing for the seed to sprout easily and quickly. The seedlings are dug out and transferred to a field when they attain the height of 5-75cm. Since the guava plant has a lot of commercial value, India being its largest producer, the cultivation method is chosen keeping in mind that the fruit yield should be high and the chances that the tree would yield the fruit should also be high. Based on these criterion, vegetative propagation is preferred over the sowing method as it has a higher success rate.

In vegetative propagation, the trees are typically grown from root cuttings. Roots are cut into 12.5-20cm long pieces, after which they are sown 5-10cm deep into the soil and kept moist over a period of time until the roots

eventually sprout. The sprouted seeds are then dug up and sown back into the open field to allow it to grow further. The utilization of this method for cultivation of guava yields no tap root which is essential to keep the tree rooted in place, but as these do not grow, it makes the tree prone to being blown away by a strong gust of wind. Because of this, the most utilized method for the cultivation of guava is Forkert method of grafting.

In the Forkert method,^[8] the seedlings are used as rootstocks, a big enough piece of the bark is removed from the rootstock, to allow the insertion of the bud, in such a way that it is not completely detached but hangs from it like a flap. After the bud has been inserted, the bark flap is put into place and tightly bound back with a suitable material after which the rootstock is cut with the top. After a month, a cut is made halfway above the bud from where the plant is bent over to facilitate the further growth of the bud.^[2] When the bud has gained considerable inches in height, the top part of the rootstock, just above the bud is cut off. If done in the rainy season, the sprouting process of the bud is hastened.

A guava tree begins to give fruits 3-5 years after it is grown (**Fig.1**), which are harvested annually or sometimes twice per year whereas the leaves of the tree can be harvested throughout the year, but the best time for leaf collection is after the fall time when new leaves grow as they yield more phytoconstituents. The guava fruit can be harvested any time of the year depending upon the region, except in May and June.



Figure 1: Guava Tree.

Phytoconstituents

Guava plant, especially the fruit and the leaves, contains various nutrition, polysaccharides, proteins, minerals, vitamins and numerous phytoconstituents. Several researches have been conducted to study the constituents present in different types of extracts. Presence of various secondary metabolites like phenolic acids, flavonoids, triterpenoids, sesquiterpenoids, glycosides, alkaloids and saponins were identified.^[9] The most abundant flavonoids that was identified in the plant was quercetin, which is predominantly responsible for the plant's anti-

oxidant and anti-microbial property. Another phytoconstituent that is abundantly present in the plant is kaempferol, also a flavonoid exhibiting anti-oxidant property. Several common phytoconstituents which are easily available in almost all of the plants were also identified like caffeic acid, gallic acid, rosmarinic acid, etc.

A study conducted by Fathy. M. Soliman et al. analyzed the various phytoconstituents and their concentrations

present in the plant using the Gas Chromatography/Mass Spectrometry (GC/MS) summarized in the **Table-3**.^[10]

Table 3: Phytoconstituents of *psidium guajava*.

Sr. No.	Constituent	Percentage	Extract Type
1.	α -Pinene	1.53	Volatile oil
2.	Benzaldehyde	0.83	Volatile oil
3.	<i>p</i> -Cymene	0.52	Volatile oil
4.	Limonene	54.7	Volatile oil
5.	1, 8-Cineole	32.14	Volatile oil
6.	β - <i>cis</i> -Ocimene	0.28	Volatile oil
7.	γ -Terpinene	0.38	Volatile oil
8.	α -Terpineol	1.79	Volatile oil
9.	β -Caryophyllene	2.91	Volatile oil
10.	α -Humulene	0.77	Volatile oil
11.	Monoterpenes	58.24	Alcoholic/Water
12.	Sesquiterpenes	3.68	Alcoholic/Water

Cosmetic uses

Several research studies have found that guava plant is capable of exhibiting various properties which are useful and desired when preparing a cosmetic formulation, such as anti-oxidant, anti-microbial,^[11] anti-acne, anti-inflammation, etc. There have been several researches conducted which have studied the potential utilization of guava plant in the beauty industry.

One such study conducted by Mota, M. D., et al. found that the guava fruit extract was able to increase the UV protection efficiency of synthetic filters in sunscreen formulations. They found that the guava fruit extract contained photoprotective tannins and flavonoids and showed the absence of coumarins, which acts as a photosensitizer, decreasing the photoprotective activity. When the fruit extract was combined with the synthetic filters in the formulation, it resulted in a synergistic effect and increased the efficacy of the synthetic filters.^[12] This helped to create a formulation where the usage of synthetic filters was reduced, effectively reducing the toxicity and cutting off the cost.

Farmasi, F. conducted a study to investigate if guava extract can be used in the formulation of lip balm. He used the ethanolic extract of the fruit of guava to prepare four different formulations with different concentrations, 2.5%, 5%, 7.5%, and 10%. All these formulations were compared against the marketed preparations. The formulation containing 7.5% concentration was preferred in the preference test but the 10% formulation was found to be most moisturizing.^[13] Its use in the successful formulation of lip balm indicates that it can be used

effectively in the preparation of a moisturizing face cream.

Another study used the ethanolic extract of guava leaves to prepare a face cream for anti-ageing. Due to the high anti-oxidant property of the plant, the formulation was successfully created with a pH that was suitable for the skin with adequate viscosity and stability over the course of 90 days.^[14]

The leaf extract of the plant has been found to exhibit hair promoting properties, especially anti-androgen property,^[6] making it possible for it to be used in the preparation of hair care products to prevent androgenetic alopecia and male pattern baldness.

Adverse effects

Toxicological studies were conducted in rat to see if guava plant manifested any undesired or harmful effect.^[15] The study revealed that there were no adverse effects observed in the rats. From this it can be concluded that unless a person has any allergy, consuming guava in any form should not be risky though more research is required for absolute surety.

Marketed formulations

Given the immense potential of the guava plant in the cosmetic industry, especially the leaves, there are surprisingly very few products in the market which contain guava, and even fewer which contain guava as the 'hero ingredient' in them. In the **Table-3** details have been listed about some of the products available in the market that contain a part of the guava plant as an ingredient.

Table 3: Marketed products containing guava.

Sr. No.	Brand	Dosage Form	Product	Price	Part of the Plant Used
1.	Plix	Cream	Moisturizer	₹419	Fruits
2.	PureSense	Topical Liquid	Toner	₹300	Fruits
3.	Crystalis	Oil	Essential Oil	₹725	Leaves
4.	Plix	Serum	Face Serum	₹499	Fruit
5.	Suyu	Cream	Face Cream	₹400	Leaves

6.	Cantu	Emulsion	Shampoo	₹927	Fruits
7.	Plix	Gel	Cleanser	₹400	Fruits
8.	Genius Herbs	Tablets	Supplement(500mg)	₹260	Leaves
9.	PureSense	Gel	Face Scrub	₹400	Fruits

Home remedies

Guava has been used in the traditional for a long time for relieving problems related to the gastrointestinal tract, blood, etc. Some cultures have also used this plant for treating or improving their skin and hair health. Several home remedies for better skin and hair health have been listed as follows:

1. Anti-acne

The leaves of the guava are either crushed or blended to make a fine paste and applied over the affected area. The anti-microbial property may help to heal and soothe skin and treat conditions like acne, skin irritation and insect bites.

2. Hair Rinse

Guava leaves are boiled in water for a period of time until the water has been infused with it. Once cooled to room temperature, this water can be used as the final rinse during the washing of hair. If used consistently, this can promote hair growth, reduce dandruff and improve overall hair quality.^[16]

3. Hair oil

Guava leaves are boiled in any hair oil of choice like coconut oil, almond oil, etc., until the oil has been properly infused with the leaves. Once cooled down to room temperature, this oil can be incorporated in the daily hair care routine. The anti-oxidant and anti-microbial property of the leaves helps promote hair growth and prevent dandruff.

4. Toner

The leaves of guava can be either soaked for a period of time (5-6 hours) at room temperature or they can be boiled in the water for 15-20 and then cooled to room temperature. This water infusion is then applied to the skin alone or before applying the skincare products or make-up. This helps to reduce acne, soothes the skin and improves the texture of the skin.

CONCLUSION

The study of the plant revealed its tremendous potential in the field of cosmetics. It is perplexing to observe large amounts of literature present that support its utility in the beauty market, yet it is being used very little. Since this plant is present in abundance all over the world and has great potential, it can be used in the cosmetic preparations, allowing the products to be cheap and easily accessible to all.

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