



PHYTOCHEMISTRY, PHARMACOLOGY AND MULTIFERIOUS ACTIVITY OF PSIDIUM GUAJAVA.

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Abstract:

Psidium guajava (Myrtaceae) is an herbal medicinal plant mostly found in Asia. The various chemical constituents are found in different parts of the plant. The plant *Psidium guajava* is traditionally used for food as well as folk medicines. This *Psidium guajava* plant has been widely used in Ayurveda also. Pharmacologically it is an Antidiarrhoeal, Antibacterial, Anti diabetic, Antitussive, Anti inflammatory, Antioxidant, Anti cancerous, Spermatoprotective, Analgesic, Antimalarial, Antipyretic, also this plant shows Inotropic effect, Immunomodulatory activity and Wound healing activity. As *Psidium guajava* plant has great usefulness so it should be cultivated, conserve and further research should be conducted for human well being. This article focused on pharmaco-chemical properties of *Psidium guajava* with the pharmacological and traditional uses of *Psidium guajava*.

Keywords- *Psidium guajava*, Peru, Traditional uses, Pharmacology, phytochemistry

1. INTRODUCTION

Psidium guajava (Linn.) belonging to family *Myrtaceae*, is a common tropical plant various traditional usage. *Psidium guajava* is known as 'gava' or 'the apple of the tropics'. (Toma M and Luchian V, 2019) The different parts of this plant have different medicinal properties. This plant used not only as food but also as folk medicine. (Gutierrez RM et al., 2008) The cultivation of guava is comparatively easy as it thrives in a variety of soils and grown in different climatic conditions; the fruits are seasonable and borne fairly in a short period. Due to the different applications, guava plants are planted in India. Although they are found in almost all states, Maharashtra, Bihar, Assam, Uttar Pradesh, Andhra Pradesh and West Bengal are the important cultivators of this plant. (Daswani G, et al, 2017) *Psidium guajava*, which is also distributed in South America, Africa, Asia and Europe, Based on archaeological evidence. It

is known as Peru since pre-Columbian time and has been used widely. *Psidium guajava* is mainly found in South America, South India, Sri Lanka, West Africa, South Africa, South East Asia, Hawaii, Pakistan, Bangladesh, and Egypt, etc. This plant also grown by many other countries having a tropical and subtropical climate (Saleh and Al-Mariri, 2020).

Many pharmacological studies have demonstrated the ability of this plant to exhibit Antidiarrhoeal, Antibacterial, Anti diabetic, Antitussive, Anti inflammatory, Antioxidant, Anti cancerous, Spermatoprotective, Analgesic, Antimalarial, Antipyretic, also this plant shows Inotropic effect, Immunomodulatory activity, Wound healing activity, hepatoprotective, anti-allergy, antimicrobial, antiulcer, cytotoxic, antispasmodic, cardioactive, anticough activities, supporting its traditional uses. (Ugbogu EA, et al 2022)

The *Psidium guajava* fruit contains vitamin A, C, iron, calcium and phosphorus. The fruits have more vitamin C as compared to orange fruit. The fruits also contain saponin, quercetin, flavonoids oleanolic acid, lyxopyranoside, arabopyranoside, and guaijavarin. Ascorbic acid (vit C) and citric acid are the main ingredients of guava that shows anti-mutagenic activity. (Naseer S, et al 2018)

2. PLANT PROFILE

2.1. Taxonomical Classification: (Chaudhary N and Tripathi S, 2014)

Table 1: Taxonomical Classification of *Psidium guajava* (Linn.)

Kingdom	Plantae
Division	Magnolioph
Class	Magnoliopsida
Subclass	Rosidae
Order	Myrtales
Family	Myrtaceae
Subfamily	Myrtoide
Tribe	Myrteae
Genus	<i>Psidium</i>
Species	<i>guajava</i>

2.2. Vernacular names: (Kanmylall and Demole1996)

English: Common guava, yellow guava, apple guava

Sanskrit: Perala, Amruta- phalam, Amarata falam.

Hindi: Amrut, Goya-pandu, Lalpeyara.

Tamil: Koyapalam, Koyya.

Malayalam: Palamper.

Marathi: Peru, Jamba.

Gujrati: Jamrukh.

Nepal: Amuk.

Assami: Madhuria.

Arabi & persian: Amrud, Amrut, Punj.

2.3. Traditional Uses: (Naseer et al., 2018, Godebo A et al., 2017, Martha R et al., 2008)

Table 2: Traditional Uses of *Psidium guajava* (Linn.)

Sr. No	Organized Part	Description
1	Leaf	Used to control, manage, and/or treat a plethora of human ailments.
2	Seed	Are used in the treatment of gastric ulceration to produce gastro protective effect.(Shady NH, 2022)
3	Stem and Bark	Stem, Bark and also root-bark are used for astringent. Bark gives febrifuge, antiseptic activity.
4	Leaves	The young leaves of the guava tree in decoction, it has been used for spasms, fevers, worms, diabetes, rheumatic pain, wounds, ulcers and toothache and astringent. They have high antibacterial activity to inhibit the growth of <i>S. aureus</i> , <i>Bacillus</i> and <i>Salmonella</i> bacteria. Ethanolic extract of <i>Psidium guajava</i> leaves gives antidiarrheal activity. (Shah D et al., 2020.)
5	Fruits	Fruits (Unripe) are indigestible, causes vomiting and fever. Fruits also used for laxative, dysentery, gastroenteritis, and diarrhea.
6	Roots	It is used to treat dysentery, gastroenteritis, and diarrhea also.

2.4. Morphological Characters

Psidium guajava plants roots are deep and the root system is branched with quite superficial. Roots have no distinct taproot. The stem of this plant is rigid, woody and having a branches; the bark is in light to reddish brown colors, thin, smooth and always flaking. The leaves of *Psidium guajava* are oval to oblong or elliptic, simple, having length 9-12 cm, bright green in color, also having short petiolate and width is 4.5-7 cm. Laminas prominent veins and pubescent on the underside with.

The leaves have entire margins, oil glands that release a pleasant fragrance, a common feature of all plants of Myrtaceae. The petiole is hairy; showing a groove on the upper surface, with short 0.6-0.8 cm in length and 0.2-0.3 cm in diameter. The flowers are 1-3, white, large and fragrant that grows in the leaf axils; they are pedicel late, bracteates, complete and hermaphrodite. Corolla contains 5 petals, 5 Calyx, sepals and pale-yellow anthers, Gynoecia contain 4-5 carpels as well as inferior ovary. The fruit contains many-seeded berry and consists of a fleshy pericarp in addition to seed cavity with pulp. (Toma M and Luchian V, 2019)

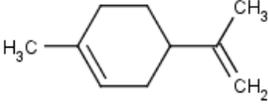
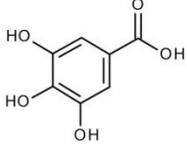
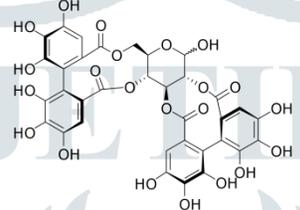
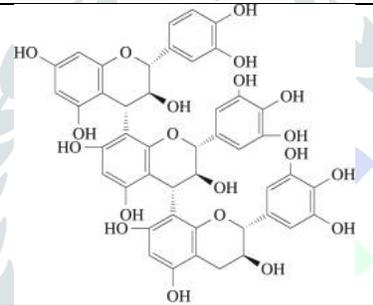
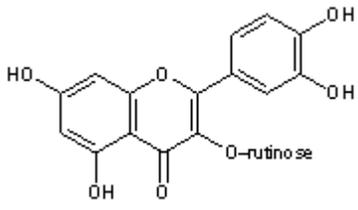
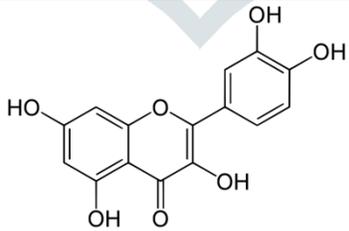
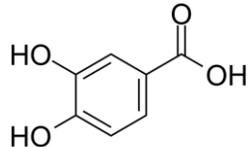


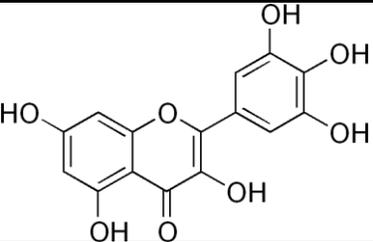
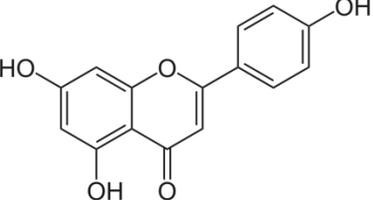
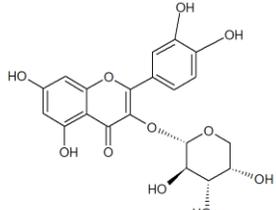
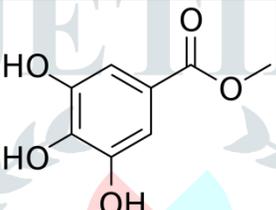
Fig 1. Leaves, Stems and fruits of *Psidium guajava*

3. PHYTOCHEMICAL INVESTIGATION:

There are various constituents are found in guava plant like, arabinose, araban, arjunolic acid, arabopyranosides, aspartic acid, D-galactose, ascorbigen, D-galacturonic acid, guajavanoic acid, guajiverine, linoleic acid, tannins, psidiolic acid, palmitoleic acid, polyphenols, myristic acid, pectin oleanolic acid, quercitrin, quercetin, ursolic acid and terpenes. (Kaur M, 2018) Also this contains Limonene, 1, 8-Cineole, Benzyl alcohol, Linalool, trans-p-Mentha-2,8-dien-1-ol, Chrysanthenone. (Tousif MI et al, 2022) Bioactive phytochemicals present in *Psidium guajava* plants shown in table 3. (Ugbogu EA, et al 2022, Tousif MI, e al., 2022)

Table 3. Bioactive phytochemicals present Psidium guajava plants (Ugbogu EA, et al 2022, Tousif MI, e al., 2022)

Sr No	Name of compound	Structures	Pharmacological Activity
1	Limonene		Antitumor, antiviral, anti-inflammatory, antibacterial, anticancer activities
2	Gallic Acid		Anti-inflammatory, Antifungal Activity
3	Pedunculagin		Antidibetic Activity
4	Prodelphinidin dimer isomer		Antioxidant Activity
5	Rutin		Antitumor, Antimicrobial, Antidiabetic activitie
6	Qucrotine		Antioxidative, Antihypertensive, antimicrobial, Antidirrheal Activity.
7	Protocatechuic acid		Antioxidative, Neuroprotective, Antiatherosclerotic activity

8	Myricetine		Cardioprotective activities
9	Apigenin		Anticancerus Activity
10	Guaijaverin		Antimicrobial Activity.
11	Methyl Gallate		Antileishmanial, antioxidant, anti-inflammatory, antimicrobial and antitumor Activities.

4. PHARMACOLOGICAL ACTIVITY:

Table 4. Pharmacological Activity of *Psidium guajava* plants

Pharmacological Activity:	Descriptions	References
Antidiarrhoeal Activity	<p><i>P. guajava</i> leaf aqueous extract (PGE) (50-400 mg/kg) produced dose-dependent and significant activity of rats and mice against diarrhea induced by castor oil, inhibited intestinal transit, and delayed the gastric emptying, like atropine (1 mg/kg), PGE also produced dose-dependent & significant antimotility activity, and caused dose-related inhibition of castor oil-induced enteropooling in the of rats and mice animals. Similar to loperamide (10 mg/kg), PGE dose-dependently and significantly delayed the diarrhoea induced by castor oil, decreased the frequency of defaecation, and reduced the severity of diarrhoea in the animals.</p> <p>The ripe fruit is laxative, so used to relief constipation and however, the unripe fruit is mostly used as an astringent and anti-diarrheic while when taken in large uantity causes indigestion, vomiting and feverishness condition</p>	Mittal et al., 2020, Sanda KA et al., 2011
Antibacterial Activity	<p><i>P. guajava</i> leaf is used to study the antibacterial effects of leaves extracts of Guava. These extracts were treated against <i>Pseudomonas aeruginosa</i>, <i>Salmonella typhi</i> <i>Staphylococcus aureus</i>, and <i>Escherichia coli</i>. The activity was found that Ethanol extract was shown maximum activity against <i>S. typhi</i> with zone of inhibition 18mm and lowest activity against <i>S. aureus</i> with zone of inhibition 10mm. Chloroform</p>	Garode AM and SM Waghode., 2014

	extract was exposed maximum activity against <i>S. typhi</i> with zone of inhibition 12mm and lowest activity against <i>S. aureus</i> and <i>E. coli</i> with zone of inhibition 10mm.	
Anti diabetic Activity	The action of PGE and PGAg NPs on pancreatic and liver cells were indicated by the histopathological findings. The all doses of PGE and PGAg NPs gives a good effect, while PGAg NPs showed a more encouraging out-come. As per result the produced PGAg NPs have strong antidiabetic effect because of their increased surface area and decreased nanoparticle size.	Bharathi DR., 2022
Antitussive Activity	Antitussive activity include water infusion from <i>P. guajava</i> leaf extract decreases the frequency of coughing induced by capsaicin aerosol. These guava leaf extract could be used as a cough remedy. Also leaves are boiled together with lemon grass to make a decoction is very effective for cough and treatment of trachea bronchitis.	Sanda KA et al., 2011
Anti-inflammatory Activity	The <i>P. guajava</i> Linn. Leaf and bark tannin fraction have significant anti-inflammatory by In-vitro models. The tannin (gallic acid) rich fraction of leaf and bark of the <i>Psidium gvajava</i> , showed significant percentage wound protection at the tested concentration. This extract containing tannin rich fraction was found to be more effective in stabilizing the RBC membrane against hypo tonicity induced by hemolysis as compared to tannin rich portion in the control of inflammation, tannin fraction may inhibit inflammation in acne.	Chamakuri SR, 2015
Antioxidant Activity	The feasibility of spray drying for the production of standardized <i>P. guajava</i> leaf extracts contain rich source of phenolic compounds and show antioxidant capacity. The antioxidant activity exhibit through four in vitro principles, namely 2,2'-azinobis (3-ethylbenzthiazoline-6-sulfonic acid) (ABTS) radical scavenging, ferric reducing antioxidant power (FRAP), 1,1-diphenyl-2-picrylhydrazyl radical (DPPH) scavenging activity, and oxygen radical absorption capacity (ORAC). The strong antioxidant capacity and the physicochemical properties of the spray-dried <i>P. guajava</i> extracts used as a natural antioxidants in various food, pharmaceutical, and cosmeceutical products.	Maurette RV., et al 2018
Anti cancer activity	The <i>P. guajava</i> leaves can disturb a number of signaling pathways which was connected to carcinogenesis, and also they are a source of potential medicinal substances for both cancer prevention as well as the cancer treatment.	Ryu NH et.al., 2012
Spermatoprotective activity	The <i>P. guajava</i> leaf ethanolic extract has a protective impact on sperm toxicity related to gossypol and also rising the male fertility, due to the presence of abundant natural antioxidant constituents.	Akinola OB et. al., 2007
Wound healing activity	Wound repairing, and random succession of occasions, is started by enhance of harm to the tissues. An encouraging jolt may come about because of the arrival of a few variables by injuring of tissues. Cutaneous injuries also repair to joined by a medical and requested grouping of organic occasions beginning with wound conclusion and	Rao CS and Durga AR., 2015

	renovating of harmed tissue as well as advancing to the repair.	
Analgesic activity	The <i>P. guajava</i> leaves aqueous extract possesses analgesic and anti-inflammatory properties. The methanol, hexane, and ethyl acetate solvent extracts of <i>Psidium guajava</i> leaves (20,100,500 and 1250 mg/kg) exhibited mostly dose-dependent antinociceptive effects in chemical and thermal tests of analgesia	Mittal et al., 2020, Sanda KA et al., 2011
Antimalarial Activity	The <i>P. guajava</i> leaves are used in the treatment of fever. The extract is also used in steam treatment for malaria. The stem bark extract contained flavonoids, seccoirridoids, anthraquinones, terpenoids etc. It was found to be effective for the treatment and/or prophylaxis of malaria	Nundkumar N and Ojewole JA, 2002
Antipyretic Activity	The leaves of <i>Psidium guajava</i> with methanol extract exhibited an antipyretic Activity.	Olajide OA., 1999
Inotropic effect	The extract of <i>P. guajava</i> leaves acts as depresses myocardial inotropism action.	Conde Garcia EA, 2003
Vaginal Disorder	The decoction extract of the guava leaves are recommended for fouterine haemorrhage. This decoction is also used to wash vaginal and uterine problems, and mainly used where an astringent preparation is desired.	Ticzon, R, 1997.
Immunomodulatory activity	<i>P. Psidium guajava</i> Extract produces immunomodulatory activities	Kaileh M, 2007

5. CONCLUSION:

Psidium guajava documented to possess numerous medicinal properties has been extensively researched for various pharmacological properties. The various laboratory studies and clinical trials studies provide a strong scientific base supporting ethnobotanical or ethnopharmacological. In addition, as guava propagates easily and thrives in all climatic environments, it is widely available for medicinal use as well as commercial applications.

Although the review discussed a single plant parts with multiple benefits has been advantages. In addition, it is preferable to limit the variety of plants suggested for cultivation so as not to overwhelm the individuals maintaining the backyard nurseries. The extensive use of guava for multiple health benefits for Indian rural communities. The given study also concluded that, Microscopic analyses shows growth and development of guava follow the dimensions of the leaf, stem and petiole, as those of its origin places.

Guava possesses Antidiarrhoeal, Antibacterial, Anti diabetic, Antitussive, Anti inflammatory, Antioxidant, Anti cancerous, Spermatoprotective, Analgesic, Antimalarial, Antipyretic, also this plant shows Inotropic effect, Immunomodulatory activity and Wound healing activity. Due to these biological activities it can be quite helpful for the preventions and treatments of diseases.

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