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Anti-Microbial Activity of Psidium Guajava: A Comprehensive Review

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ABSTRACT:

The species of the guava Psidium guajava L. has been under extensive study due to its various applications in medicine as well as primarily its activity against microorganisms. The main bioactive compounds that are known to contribute to its efficacy against several pathogenic microbes including viruses, fungi, and bacteria, include flavonoids, tannins, and essential oils. Studies have shown that leaf, fruit, and bark extracts of the guava tree exhibit powerful inhibitory effects against many Gram-positive and Gram-negative bacteria, such as Pseudomonas aeruginosa, Escherichia coli, and Staphylococcus aureus. The mechanisms of Psidiumguajava disruption of microbial cell walls; inhibition of protein synthesis; and interference with the action of nucleic acids have been incorporated in its antibacterial actions.

P. guajava contains materials that have a high efficacy with low toxicity and may potentially become an alternative in the treatment of infections in the future. It will further be applied in natural medicine, in pharmacy, as well as in food preservation. Further studies are also needed to fully elucidate the mechanisms of action of the active chemicals and to isolate and define them. The crude extracts prepared from the leaves of P. guajava using three different methods showed antibacterial activity. The methanol and water solutions inhibited the growth of all the bacterial tests conducted while the Acetone extraction only proved the presence of colonies of Streptococcus suis and Pasteurellamultocida in places where no growth inhibition areas were present. (Puntawong et al., 2012)

Keywords: Psidiumguajava, *Staphylococcus aureus, Pasteurellamultocida,* antibacterialqualities, Gram-negative bacteria.

1. INTRODUCTION:

In many regions of the world, indigenous culture's view health and medicine inextricably linked to their culture. This is especially true of the study of traditional medical practices. Among the oldest forms of folk medicine still in use are Indian Ayurveda and traditional Chinese medicine. These systems use therapies based on locally produced, naturally sourced pharmaceuticals to improve health and quality of life**.** (Das & Goswami, 2019)

The World Health Organisation states that the greatest place to find a wide range of medications is from medicinal plants. Bioactive substances obtained from medicinal plants are used in traditional medicine by about 80% of people in developed nations. The misuse of antibiotics has led to the development of drug resistance in many pathogenic bacteria that harm human health**.**(Padroacute n Maacute rquez et al., 2012)

Psidium Guajava more popularly known as 'apple of the tropics', the plant has been in traditional folk medicine for treatment of wound, ulcer, toothache, gum boil, and as astringent to bowels and tonic in digestive dysfunctions.(Suvarna, 2009)

This plant, its leaves, is said to have been used in the treatment of numerous sicknesses of cough, diabetes mellitus, diarrhoea and rheumatism. The present study estimated the antifungal and antibacterial properties of the guava leaves by strains of Bacillus subtilis, a Gram-positive bacterial strain; Escherichia coli, a Gram-negative bacterial strain; Saccharomyces cerevisiae, a yeast fungus, and Aspergillusniger, a mould fungus. A very few gram-negative bacterial strains were used.(Das & Goswami, 2019).Methanolic extracts and the aqueous bark of Psidium guajava were discovered to have antibacterial properties.(Abdelrahim et al., 2002)

The evergreen guava (Psidium guajava L.) grows wild in the subtropics and arid regions. Guava leaves are used for tea. Guava leaves, roots and fruit have also been used for the prevention and treatment of diarrhoea and diabetes as a folk medicine and reportedly had an antimutagenic.(Arima & Danno, 2002)Essential oils and extracts from a variety of plant species can regulate both Gram-positive and Gram-negative bacteria that cause food degradation and skin problems**.**(Joseph et al., 2010)**.** Psidium guajava is used for stomach ache and gastroenteritis leaf, root, and bark extracts are used for the treatment of diarrhoea, leukorrhea, cholera, external ulcers, and skin diseases. Guajava polyphenol, which possesses anti-oxidant properties, has been found in guajava leaf extract. There have been reports of antibacterial action in the plant's leaf and flower. The antibacterial ability of P. guajava leaves was examined in the current study against a few clinically isolated and common microbiological cultures. (Nair & Chanda, 2007)

2. PSIDIUM GUAJAVA

Psidiumguajava is a member of the Myrtaceae family. It's a small tree roughly 10 m high with a characteristic thin, smooth, patchy, and shelling dinghy. Guava trees generally have wide-spreading branches. The leaves have an elliptical and round shape with dark green colour and blunt-type apex. The leaves lie opposite each other and retain a short- petiolate with prominent modes. The factory has multitudinous stamens and grabby, whitish petals. Its flowers are between 4 and 6 white colourful corridors of P. guajava L., chemical ingredients, and pharmacological conditioning. The ethnobotanical, phytochemistry and pharmacological conditioning of Psidiumguajava L have 3 petals and white stamens with unheroic anthers. Guava fruits appear veritably fleshy. Their shape ranges from an unheroic globose to an elliptical berry. Their mesocarp is comestible with several small hard white seeds.(Amadike Ugbogu et al., 2022)

The well-known tropical tree Psidiumguajava, sometimes known as guava, is widely planted for its fruit. It is classified under the class Magnoliopsida, phylum Magnoliophyta, and family Myrtaceae. . It has about 133 genera and 3,800 species. The common English word "guava" is extensively used to identify the plant. It is also known as pichi, posh, and enandi in Mexico and America..(Naseer et al., 2018)

According to history, the very first commercial guava plantations were set up at Palma Sola in Florida, circa 1912. Psidiumguajava is an evergreen tree. It can grow six to twenty-five feet tall. Figure 1 shows the leaves, flowers, fruit, seeds, and bark, among other plant elements. Its branches, which are primarily bent, have opposing leaves with tiny petioles that range in size from 3 to 16 cm. The leaves have distinct veins and are broad, with a vivid green hue. The shrub yields fragrant, white blooms with somewhat bent petals. Flowers feature four to six petals, yellow anthers, and insects carry out the pollination process. Guava fruits are small to medium in size and range in length from 3 to 6 cm. When fully ripe, it has a pear-like form and a yellow colour. When fully ripe, it has a distinct, musky scent that is both potent and appealing. Its pulp, which has somewhat yellowish seeds, is a shade darker. Seeds are easily chewable due to their small size. Their number; their regular patterns of arrangement. (Naseer et al., 2018)

3. TAXONOMICAL CLASSIFICATION:

TABLE 1- Taxonomical classification

KINGDOM	**Plantae**
ORDER	**Myrtales**
FAMILY	**Myrtaceae**
SUB- FAMILY	**Myrtoideae**
GENUS	***Psidium***
SPECIES	***Guajava***
BINOMIAL NAME	***Psidiumguajavalinn***

Fig. 1 (a)- Guava Plant

4. MORPHOLOGICAL CLASSIFICATION:

Fig.1 (b) – Guava fruit

TABLE 2- MORPHOLOGICAL CHARACTERISTICS

Tree	**Tiny, multibranched tree that grows 5 to 7 meters tall**
Bark	Thin, smooth, copper-colored.
Branches	Angled downward and quadrangular in shape
Leaves	Evergreen, leathery, short-petioled arranged opposite one another.
Fruit	Light golden hue with subtle pink undertones, 5–10 cm in diameter and weighs 50–200 g, can be round, ovoid, or pear-shaped.

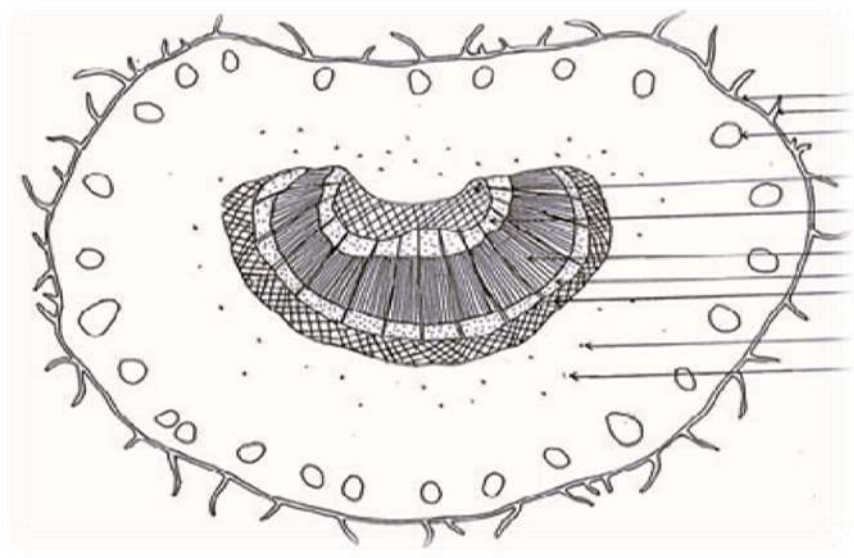


Fig.1 (c): Morphology of Guava leaf

Description of guava leaf:

- Leaves have an irregular shape, varying from oval to elliptical, and measure 7–15 cm in length and 3–5 cm in width.
- The leaf' structure is made up of parallel lines, or veins, that radiate outward from the center axis toward the margins.Clusters of flowers with 4–5 white petals and 250 stamens, each 2–5 cm in diameter, appear on the leaf axils.
- The exocarp, or outer layer, of the fruit is a light golden hue with subtle pink undertones.
- Beside the exocarp lies the mesocarp, which comprises the juicy, pulpy portion of the fruit. The meat has a coarse texture and varies in thickness from 3 to 12 mm, from white to deep pink or reddish.
- Next to the gritty flesh is the endocarp, often known as the centre pulp. The endocarp is not only juicy, but its seeds are stony and have a yellowish-colored tinge.
- Stone cells and parenchyma cells are the two types of cell wall tissues found in the berry's pulpy endocarp. Stone cells composed of lignified woody material are responsible for the characteristic gritty texture of the fruit and are resistant to enzymatic digestion.(Hussain et al., 2021)

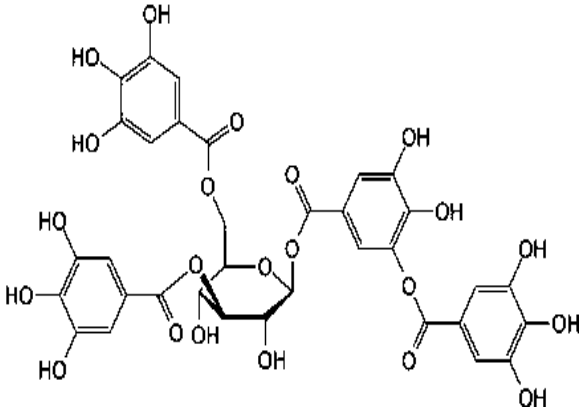
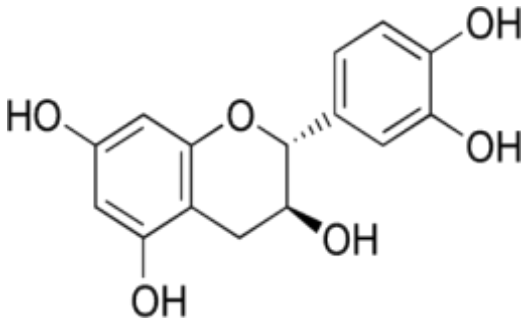
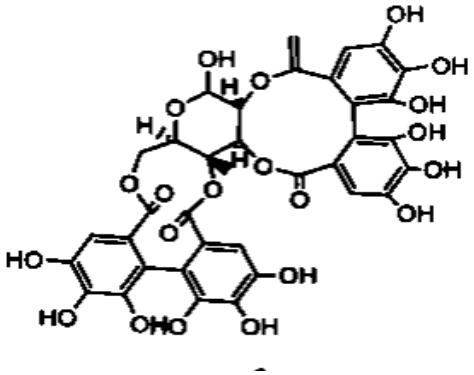
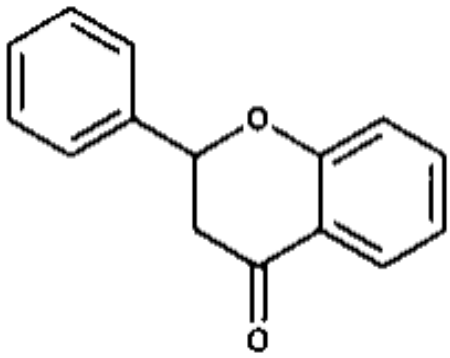
5. DISTRIBUTION:

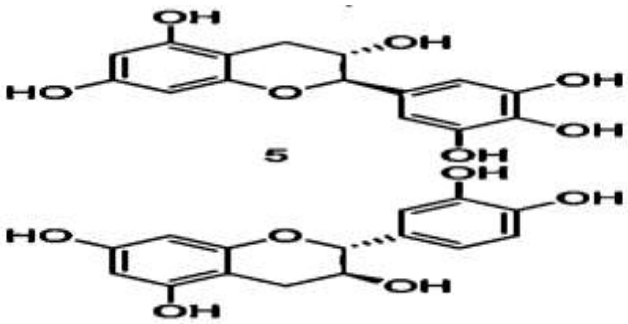
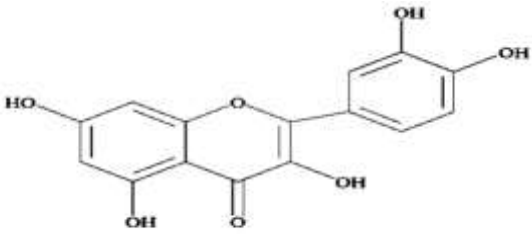
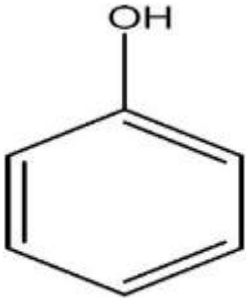
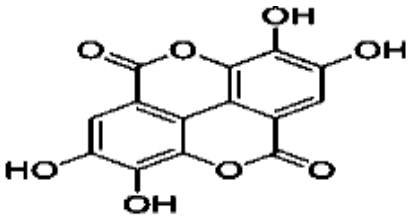
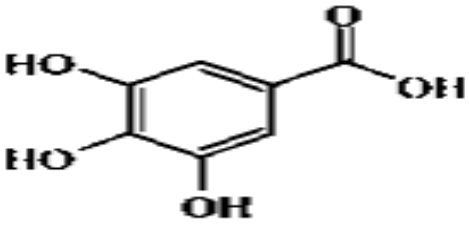
Today, it is grown in Bermuda, Southern Florida, and the West Indies, extending from Trinidad to Cuba and the Bahamas to Brazil.(Shirur et al., 2011)

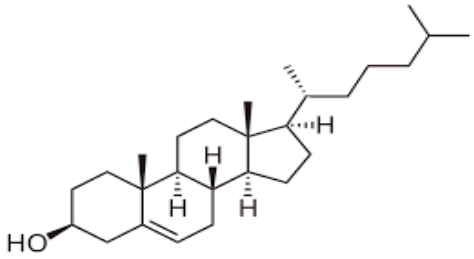
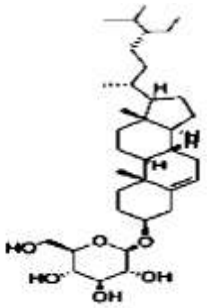
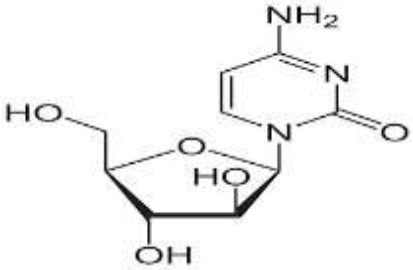
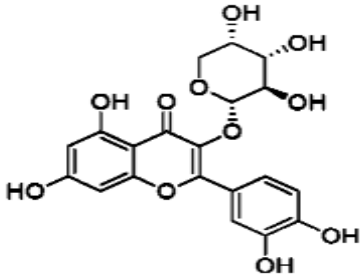
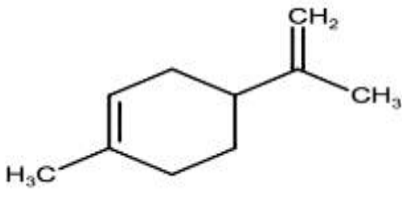
Uttar Pradesh, Bihar, Maharashtra, Assam, West Bengal, and Andhra Pradesh are the major guava-growing states in India.(Kamath et al., 2008)

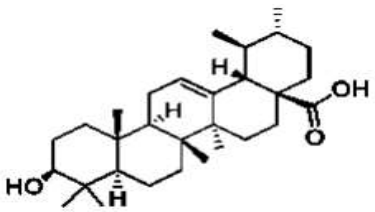
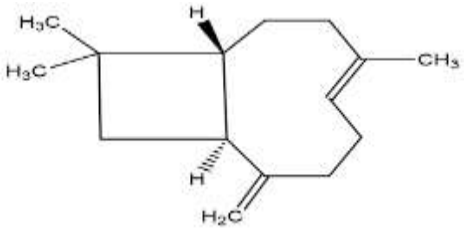
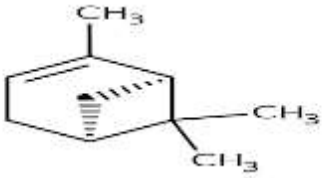
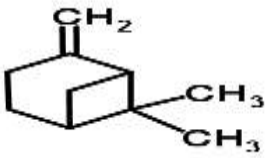
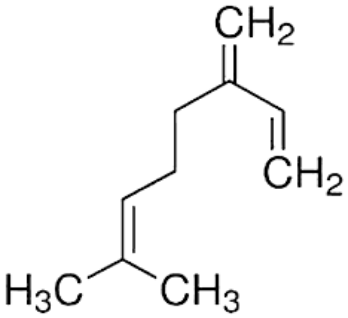
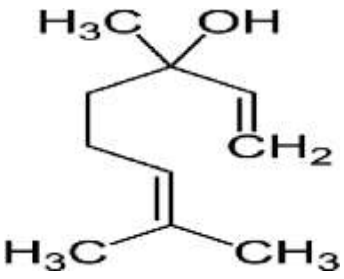
6. PHYTOCHEMICAL CONSTITUENTS:

Table 3- IMPORTANT PHYTOCHEMICAL CONSTITUENTS IN GUAVA LEAF

Sr.no	Constituent	Structure	Reference
1.	**Tannins**		**(Amadike Ugbogu et al., 2022)**
	a) Catechin		**(Amadike Ugbogu et al., 2022)**
	b) Pedunculagin		**(Amadike Ugbogu et al., 2022)**
2.	**Flavonoid**		**(Kareem & Kadhim, 2024)**

a) **Gallocatechin**		**(Amadike Ugbogu et al., 2022)**
b) **Quercetin**		**(Kamath et al., 2008)**
3. **Phenol**		**(Amadike Ugbogu et al., 2022)**
a) **Ellagic acid**		**(Pandhi & Poonia, 2019)**
b) **Gallic acid**		**(Bulugahapitiya et al., 2021)**

4.	**Cholestrol**		**(Shirur et al., 2011)**
a)	**β-sitosterol**		**(Kamath et al., 2008)**
5.	**Arabinoside**		**(Amadike Ugbogu et al., 2022)**
a)	**Guajaverin**		**(Kareem & Kadhim, 2024)**
6.	**Terpenoids**		**(Bulugahapitiya et al., 2021)**

a)	**Ursolic acid**		**(Shirur et al., 2011)**
b)	**β-caryophyllen eterpenoid**		**(Bulugahapitiya et al., 2021)**
7.	**Essential oils**		
a)	**α-pinene**		**(Shirur et al., 2011)**
b)	**β-pinene**		**(Shirur et al., 2011)**
c)	**β-myrcene**		**(Naseer et al., 2018)**
d)	**Linalool**		**(Naseer et al., 2018)**

Chemical composition:

Fruits contain Vitamin C, vitamin A, iron, calcium, Manganese, phosphoric, oxalic and mallic acids, saponins combined with oleanolic acid**.** (Sravani et al., 2021)

α-pinene, β-pinene, limonene, menthol, terpenyl acetate, isopropyl alcohol, longicyclene, caryophyllene, β bisabolene, caryophyllene oxide, β-copanene, farnesene, humulene, selinene, cardinene, curcumene, and mallic acid are all found in leaves. (Sravani et al., 2021)

Terpenes, caryophyllene oxide, and p-selinene are abundant in guava fruit, which may explain some of its sedative properties. There is a greater quantity of flavonoids in guava methanolic extract. Guavas contain 13 alcohols, 41 hydrocarbons, 25 esters, and 9 sweet compounds. Total absorbable solids and titratable acidity are present in the fruit. Guajadial is also present in guava. Guava leaves include α-pinene, limonene, β-pinene, isopropyl alcohol, menthol, terphenyl acetate, caryophyllene, long cycle, and β-bisabolene, which are known to have qualities similar to essential oil painting. The guava leaves also include oleanolic acid. Furthermore, leaves have high concentrations of limonene (42.1%) and caryophyllene (21.3%). (Naseer et al., 2018)

7. PHYTOCHEMICAL SCREENING:

The present study has conducted research to evaluate the antimicrobial properties of the guava leaves essential oils and extracts using methanol, hexane, and ethyl acetate. The extracts were tested against strains of bacteria obtained from seabob shrimp and laboratory culture strains. The guava leaves underwent extraction using a Soxhlet extractor with solvents arranged based on polarity followed by concentration in a rotary evaporator, while the cleavage type doser has been used to extract the essential oils from guava leaves..(Biswas et al., 2013)

A semi-quantitative assessment of the presence of secondary metabolites is made possible by the color intensity of the extracts and/or the appearance of solids in them during the identification processes. (Padroacute n Maacute rquez et al., 2012)

The plant extract was studied to have the secondary metabolites present-alkaloids, terpenes, tannins, saponins, phenols, steroids, phlobatannins, and flavonoids. Quantitative determinations were conducted using accepted techniques for flavonoids, alkaloids, total phenol, tannin, and saponins.(Oluwajobi et al., 2019)

8. ANTIMICROBIAL PROPERTIES:

i]Antibacterial Property**:**

P. guajava leaves have a broad-spectrum antimicrobial action**.**(Arjun Kafle, Sushree Sangita Mohapatra, 2018)Many substances found in guava leaves have antiviral, bacteriostatic, and fungistatic properties. (Naseer et al., 2018)

The extract of guava shows bacteriostatic activity. Antibacterial activity of guava extracts has been shown against both Gram-positive and Gram-negative bacteria, however, Guava has a strong antibacterial effect on gram-positive bacteria and a moderate effect on gram-negative bacterial pathogens. (Naseer et al., 2018)

P. guajava leaves in concentrated liquid form have been shown to have outstanding antibacterial properties against a range of test pathogens. Plant leaf and bark methanolic extracts of P. guajava have high antimicrobial activit**y.**(Kareem & Kadhim, 2024)Leaf extracts in aqueous, chloroform, and methanol can inhibit the growth of some bacteria. P. guajavamethanolic extracts from plant leaves and bark show strong antibacterial properties. While methanol extract exhibits a high minimum inhibitory concentration (MIC), aqueous and ethanol extracts exhibit modest antibacterial activity**.**(Naseer et al., 2018)According to a report, the antibacterial activity of guava leaves is thought to be attributed to flavonoids.(Shirur et al., 2011). Alkaloids and flavonoids are phenolic compounds with a single carbonyl group that binds to soluble and extracellular proteins as well as the cell walls of bacteria to exhibit antibacterial activity(Shirur et al., 2011).

Pseudociolic acid and guajaverine are also responsible for P. guajava'smicrobicidal action. P. guajava has the potential to be used as a medication to combat pathogenic bacteria because of its metabolites, which include cardiac glycosides, saponins, tannins, and alkaloids**.**(Shirur et al., 2011)

Natural products of plant origin have remarkable potential as sources of antimicrobials. This is achieved through inhibition of growth, disruption, and lysis of the microbial cell walls as well as preventing biofilm development, inhibiting DNA synthesis and transcription, inhibiting adenosine triphosphate (ATP) synthesis, inhibiting toxins production, and producing reactive oxygen species (ROS)**.**(Kumar et al., 2021)**.**It has been demonstrated that organic and aqueous extract of guava leaf possesses antibacterial property through its ability to inhibit the growth of antibiotic-resistant strains of clinical isolates of Staphylococcus aureus**.**(Díaz-de-Cerio et al., 2017)

Earlier findings have suggested that, when exposed to phytochemicals, Gram-negative microorganisms are generally less susceptible than Gram-positive ones, and in some cases, even totally resistant. The peptidoglycan layer for gram-positive organisms, however, is gridded and allows more of the extracts to pass through**.**(Biswas et al., 2013)**.**The efficacy of tannins when it comes to inhibiting the growth of E. Coli, Psudomonasareuginosa, S. aureus and other pathogenic bacteria is well-documented. This indicates that Tannin interacts with the cell membrane of bacteria in order to prevent their growth as well as kill them. These are polymers, and have the unique property of protecting plant tissues from bacteria through the lysis of the bacteria's plasma membranes, which in their structures contain about 40% lipids and 60% proteins.Tannins cause hydrogen bonding between cellular membrane proteins and polysaccharides, which causes the proteins to lose their structural integrity. Moreover, because of their affinity for phospholipids, tannins also affect

the structural integrity of bacterial cell membranes so that important metabolites can diffuse across and will affect the action of the bacterial enzyme system.The cell membrane prevents essential nutrients from entering. The inhibition of growth of bacteria and even the cell death will occur through the starvation of the bacteria by preventing entry of food or other available sources of energy, which the bacteria require to synthesize new cellular materials. Extracts high in tannins have an inhibitory effect that also has antifungal properties**.**(Nelce Mailoa et al., 2014)

The role of water and apolar solvents in their mixture show potent activity against drug-resistant *Vibrio cholera* was noted when a methanol extract of guava leaves and bark was incorporated into the study. Because of their broad spectrum of antibacterial activity which comprises antigiardial and antirotaviral activity, P. guajava leaves should be helpful in the treatment of diarrhea caused by many other conditions. The antibacterial activity of guava leaves extracts has been associated with the presence of certain flavonoids. Since Psidiumguajava stem-bark extract shows antiplasmodial effects to some extent due to the possible presence of anthraquinones, flavonoids, seccoirridoids, and terpenoids, it can be used for the treatment of malaria**.**(Barbalho, 2012)

P. guajava leaves extract causes the inhibition of bacteria *Staphylococcus, Shigella, Salmonella bacillus, E.coli, Clostridium pseudomonas.* It is also good for*Infantile rotavirus enteritis*.(Shirur et al., 2011).P. guajava leaves extract act as Anti-plaque agent, treatment of oral ulcer, treatment of cough(Naseer et al., 2018)and in diarrhea**.**(Kumar et al., 2021)The extract / chemical that is responsible for antibacterial activity is given in the table 1.4

TABLE 4: ANTIMICROBIAL ACTIVITY OF *PSIDIUM GUAJAVA*

Sr.no.	part	Chemical Constituent / Extract that show Antimicrobial action	Micro organisms	Reference
1.	**Leaf**	**Benzyl isocyanate (Methanolic Extract)**	***S. aures ,P. AeruginosaC.violaceumS.marcescens***	**(Amadike Ugbogu et al., 2022)**
2.	**Leaf**	**Essential Oil**	***C. lanata, F.chlamydosporum*** ***Enterococcus faecalis,S.aures***	**(Naseer et al., 2018)**
3.	**leaf**	**Methanolic extract**	***Bacillus sp. ,Salmonella sp.***	
	Bark	**1. Methanolic extract** **2. Chloroform extract**		
4.	**Leaf**	**Beta flavanoid compound [quercetin-3-o- alpha-1-arabinopyranoside (guaijaverin)**	***Streptococcus mutans***	**(Shirur et al., 2011)**
5.	**Fruit**	**Lectin**	***E.coli***	
6.	**Leaf**	**Aqueous extract and chloroform extract**	**Mutagenicity of *Salmonella spp& E.coli***	**(Shirur et al., 2011)**
7.	**Leaf and Bark**	**Aqueous mixture and water soluble methanol extract**	**Multi-drug resistant** ***Vibrio cholera***	
8.	**Leaf**	**1. Essential oil** **2. Methanol extract** **3. Hexane extract** **4. Ethyl Acetate extract**	***Staphylococcus aures*** ***Salmonella spp*** ***Ecoli***	**(Arjun Kafle, Sushree Sangita Mohapatra, 2018)**
9.	**Leaf**	**Methanolic extract**	***B.cereus, s.aureus, E.col,*** ***Vibrio cholera, Salmonella typhi, Pseudomonas aeruginosai***	**(Bulugahapitiya et al., 2021)**
10.	**Leaf**	**Methanolic extract and Aqueous extract**	***Salmonella typhimurium,*** ***Streptococcus suis, E. coli*** **and*Pasteurellamultocida***	

11.	**Leaf**	**Acetone extract**	***S. suis*and *P. multocida***	
12.	**Leaf**	**extracts of water and chloroform**	***Salmonella typhimurium*mutagenecity.**	**(Sravani et al., 2021)**
13.	**Leaf**	**aqueous and organic extracts**	***Staphylococcus aureus, Proteus spp.,* and*Shigellaspp***	
14.	**Leaf** **Stem** **Root**	**Aqueous**	**The gram positive bacteria *Bacillus subtilis***	
15.	**Leaf**	**aqueous, alcohol and chloroform extracts**	***Aeromonashydrophila,Shigellasppand Vibrio spp,Staphylococcus aureus, Sarcinaluteaand Mycobacterium phlei***	
16.	**Leaf**	**Aqueous extract, Methanolic extract, chloroform extract**	***Staphylococcus aureus, beta–streptococcus group A***	**(Anand et al., 2016)**
17.	**Leaf**	**γ–terpinene and γ–pinene**	***Propionibacterium***	
18.	**Seeds**	**Pg–AMP1**	**Klebsiella sp. and Proteus sp.**	
19.	**Leaf**	**Methanolic and ethanolic extract**	***E. coli and Salmonella enteritidis.***	
20.	**Leaf**	**Morin-3-o-alpha-L-lyxopyranoside**	***Salmonella enteritidis***	**(Mittal, 2018)**
21	**Leaf**	**Morin-3-o-alpha-L-arabopyranoside**	***Bacillus cereus***	
22	**Leaf**	**Hot water extract methanol extract**	***Arthriniumsacchari, Chaetomiumfunicola strain 48***	
23	**Leaf**	**ethanol extract**	***Trypanosomabrucei***	**(Díaz-de-Cerio et al., 2017)**
24	**Leaf**	**essential oil**	***Toxoplasma gondii***	
25	**Leaf**	**Aqueous extract**	***S. aureus, S. epidermidis, S. typhimurium***	**(Sanches et al., 2005)**
26	**leaf**	**aqueous extract**	***Salmonella typhi* and *Klebsiellapneumoniae***	**(Dhiman et al., 2011)**
27	**root** **leaves**	**aqueous and alcoholic extracts**	***Staphylococcus aureus, Streptococcus mutans, Pseudomonas aeruginosa, Salmonella enteritidis, Bacillus cereus, Proteus spp., Shigella spp., and Escherichia coli***	
28	**Leaf**	**Ethanol extract**	***S. pyogenes,* and** ***P. aeruginosa***	**(Halim et al., 2022)**

ii]Antifungal property:

kaempferol, morin, quercetin, rutin, isoquercitrin, avicularin, gallic acid and chlorogenic acid in flowering plants. These substances are capable of inhibiting the production of glucosamine, known to be a fungal cell development marker and an essential ergosterol in the fungal cell membrane.

Moreover, water-soluble tannins found in the Gels and their compositions are considered storage compounds; they include the inhibition of the synthesis of extracellular enzymes, blocking oxidative phosphorylation and inhibiting the use of substrate.(Kumar et al., 2021)Quercetin, being the foremost and extensively active pharmacological entity present in the flavonoids of GLs, was found to be one of the most prevalent of the GLs flavonoids. Triterpenoids

such as betulinic acid and lupeol have also been associated with ant bacterial and antifungal infections**.**(Kumar et al., 2021)**.** Some of the Antifungal Activity shown by*psidiumguajava*is given in the table 1.5.

TABLE 5- ANTIFUNGAL ACTIVITY OF *PSIDIUM GUAJAVA*

Sr No.	Part	Chemical Constituent / Extract that show Antimicrobial action	Micro organisms	Reference
1.	Leaf	1. Hexane 2. Acetone 3. Methanol	*Trichophytonrubrum, Trichophytontonsurans, Sporothrixschenckii, Microsporumcanis, Cryptococcus neoformans,* *Candida parapsilosis,* *Candida albicans*	(Padroacute n Maacute rquez et al., 2012)
2.	Leaf	Toluene (terpenoidsbetulinic acid and lupeol)	*Colletotrichumcamelliae,* *Fusariumequiseti, Alternaria alternate, curvulariaeragrostidis,Colletotrichumgloeosporioides*	
3.	Leaf	Aqueous Extract	*Trichophytontonsurans, Aspergillusniger, Candida tropicalis*	(Oluwajobi et al., 2019)
4.	Leaf	Hydroethanolic extract	*Candida albicans, Candida tropicalis, Candida krusei*	(Bezerra et al., 2018)
5.	Leaf	Aqueous, ethanolic, acetone	*Candida albicans, Candida krusei, Candida glabrata, Candida dubliniensis*	
6.	Leaf	Gallic acid, catechin, luteolin, quercetin	*Candida albicans, Candida tropicalis*	
7.	Leaf	Quercetin, Guaijaverin	*candida albicans ATCC 90028*	
8.	Leaf	Methanol, Acetone, DMF	*Cryptococcus, Trichosporon*	(Meghana et al., 2021)

9. CONCLUSION:

This particular investigation yielded results which seem to confirm that the guava leaves are powerful microorganisms, both bacteria and anti-fungi. Still, the antibacterial properties of the guava leaves were defence susceptible in the Gram-negative bacteria. The phytochemical content is documented and shows that Guava leaves contain a greater variety of polyphenolic compounds i.e. tannin, flavonoids and phenol. The antifungal and antibacterial properties of the guava leaves may well be related to the active polyphenolic constituents present in them which have been proven to be antimicrobial. Guava leaves not only have an antibacterial effect but also serve as a natural food preservative and are applied in the pharmaceutical sector. Different P. guajava bark extracts have revealed appreciable antibacterial activities. Among all the standard bacteria tested, the maximum activity was shown by the bark extract in methanol solvent. The current study presents published data regarding more therapeutic studies conducted with the Guava leaves (P. guajava) and their pharmacological active ingredients. More broadly al the plants in the chemical system consist macro components like; alkaloids, polyphenolic compounds, saponins, tannins,flavonoids, terpenoids, carbohydrates, lipids, fats', oils and glycosides, amino acids.(Bulugahapitiya et al., 2021)

The therapeutic effects of guava include the repair of damaged cancerous cells as well as a remedy for early skin aging. Numerous fungistatic, bacteriostatic, and significant oxidants are found in the leaves. Quercetin, which is present in its ethyl acetate extract, helps prevent thymus formation and germ infection. Antiviral, anti-inflammatory, antiplaque, antinociceptive, and antimutagenic properties are all present in guava. It can be very beneficial for both illness prevention and therapybecause of these biological properties. Guava ethanolic extract can be used to treat male infertility by increasing the amount and quality of sperm. (Naseer et al., 2018)

Numerous essential oils have had their antibacterial activity evaluated and categorized as strong, medium, or weak. Due to insufficient usage of antibiotics, many bacteria that harm human healthhave drug resistance. In vitro studies in this work, the antimicrobial activity of essential oil from P. guajava fresh

leaves was tested against bacteria and fungi. BothGram-positive and Gram-negative bacteria were prevented fromgrowing by the guava essential oil. While the overall inhibitory effect of the essential oils in this experiment was less activity in fungi. (Padroacute n Maacute rquez et al., 2012)

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