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REVIEW ARTICLE

Myrtus communis L. (Myrtle): A comprehensive Review of its Folk uses, Medicinal uses, Historical perspective, Phytochemistry, and Pharmacology

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Abstract

Myrtus communis L. is a bushy, aromatic, ever-green shrub belongs to the family Myrtaceae, which is commonly distributed around the globe. The current review gather important information about its ethno-medicinal uses, historical perspective, phytochemistry, and pharmacology of Myrtle. The review study was designed with the aim to gather information of Myrtle in addition to explore its ethno-medicinal, therapeutic potential, and future research opportunities. In current review, a total of 85 comprehensive research papers were reviewed and collected from various databases such as Google Scholar, Web of Science, Scopus, Research Gate, Science Direct, and PubMed. The results of this review indicate that Myrtle is mostly used for various ailments such as skin, respiratory, gastrointestinal, inflammatory, urinary, cardiovascular, neurological, and microbial infections. The previous literature reported that traditional therapists mostly used it in the form of herbal tea, and powder form. Moreover, Myrtle was reported to have high antibacterial, antifungal, antiviral, antitussive, anti-inflammatory, and anticancer activities. The study also reported that it has a strong antioxidant, cardiovascular, and therapeutic properties. There are a variety of phytochemical compounds reported and isolated in Myrtle plant such as phenols, alcohols, terpenoids, fatty acids, sterols, glycosides, carboxylic acids, flavonoids, and essential oils. The plant need sustainable cultivation, and conservation for its availability in medicinal, and commercial applications. Further, it is recommended, and invite young researchers to carry out further detailed investigation into their possible ethno-medicinal, ethno-pharmaceutical, toxicological, anti-aging, antidandruff, and anti-hair fall on this plant in order to provide reliable knowledge, and discover new drugs with low side effects as linked with modern medicines. The plant need sustainable cultivation, and conservation for its availability in medicinal, and commercial applications.

Keywords: *Myrtus communis*; History; Ethno-medicine; Phytochemicals; Pharmaceutical activities

Introduction

Myrtus communis belong to the family Myrtaceae which consists of 140 genera, and 5800 species (Zhang *et al*., 2008). The plant is native to the Mediterranean territories namely southern Europe, North Africa and along with Middle East. Myrtle as a small evergreen shrub, and people throughout the centuries have valued to this plant, because it possesses medicinal properties along with aromatic compounds, and a symbol of support cultural traditions. Myrtle possess small dark green leaves with leathery texture, it produces white or pale pink flowers, and dark purple berries/fruits (Dietz, 2024; Ullah *et al*., 2022; Ali *et al*., 2017). There are two varieties of Myrtle named *Myrtus communis* var. *italic* and var. *baetica* L. The varieties have similar vegetative characters, but only difference is in colour of the fruit, and size of their leaves (Nuvole *et al*., 1996). However, Myrtle is an evergreen plant distributed in various regions of the world. It mostly occurs in North West Himalaya, Asia, Europe, Africa, America, Australia, and Mediterranean region of the world (Nadkarni, 1989). In Pakistan it is distributed in mountainous areas such as tribal Ex-FATA, Khyber Pakhtunkhwa, Kashmir, and Punjab. In Khyber Pakhtunkhwa it is present in various areas such as Bajaur, Dir, Bunir and Swat etc (Rahim *et al*., 2012; Ali *et al*., 2017; Ullah *et al*., 2022).

Myrtle plant maintains its place in historical records, since ancient times when several cultures recognized its importance. It occupied a special place at the heart of ancient Egypt, because Egyptians regarded this plant as a spiritual, and healing medicine along with religion. The Egyptian priesthood employed Myrtle leaves for religious cleansing ceremonies, and people used its extracts to treat breathing, and urinary problems (Opitz-Kreher *et al*., 2023). In Rome and Greece Myrtle plant held significance position, and people used it as a symbol of love, beauty, and victory. In these areas the medical practitioners i.e., Hippocrates and Theophrastus documented the healing properties of Myrtle, so found that this plant was effective for treating fever, digestive, and skins diseases. The Roman law appreciated Myrtle, because they used the plant in wine, perfumes production, and food flavoring industries (Martinez-Frances *et al*., 2021; Ullah *et al*., 2022). The British male officials received victory honors expressed through crowning them with Myrtle wreaths. Throughout time people have continued to use Myrtle plant both spiritually, and ritually. The Jewish tradition names Myrtle as one of the four special plants necessary for celebrating Sukkot festival. The regional cultures from the Mediterranean region along with the Middle East continue using Myrtle branches as burning incense to cleanse spaces, and prevent adverse energies. The traditional wedding ceremonies in Italy and France include Myrtle since the plant represents love together with fidelity, and prosperity. People use the plant in protective amulets, traditional religious ceremonies, and folk rituals, because of its deep spiritual roots (Dafni *et al*., 2020; Ullah *et al*., 2022).

However, Myrtle served as an essential herb in herbal medicine from medieval times through Renaissance which Islamic, and European medical knowledge centers embraced. The Unani medical system esteemed Myrtle for its capability to create coolness along with its stringent quality, and its ability to assist in wound healing. Therapeutic use of Myrtle received extensive documentation from Islamic scholars including Avicenna, and Al-Razi who described its benefits against gastrointestinal conditions together with improvements for liver performance, and hair development (Schulz *et al*., 2023). People in medieval Europe traditionally used Myrtle to treat respiratory conditions, and stomach problems along with skin afflictions. People valued its essential oil because, it showed antiseptic abilities as well as soothing effects in herbal distillations, and perfume preparations (Schulz *et al*., 2023; Ullah *et al*., 2022). Throughout, different cultures local healers consistently employed Myrtle in many ways to treat various health disorders. The tradition of using Myrtle as medicine exists extensively in Mediterranean, and Middle Eastern folk medicine to treat respiratory diseases that include coughs, bronchitis, asthma, and tuberculosis. The therapeutic properties of Myrtle essential oil function as expectorant medicine which removes mucus to improve respiratory function (Leigh-de Rapper *et al*., 2020). The traditional medicine consumes Myrtle leaves, and berries to make infusions that treat gastrointestinal problems such as diarrhea,

bloating, and indigestion. Myrtle leaves extract represents a traditional remedy for urinary tract infections, because doctors have recommended leaf-infused preparations to address kidney, and bladder issues (Schulthies, 2020; Ali *et al*., 2017).

Myrtle finds broad usage in medical treatments that address both internal diseases, and skin ailments along with wound healing processes. The medicinal properties of Myrtle include antibacterial traits combined with astringent effects as well as anti-inflammatory properties that treat acne, eczema and minor cuts (Nurzyńska-Wierdak *et al*., 2022). The medical practitioners use Myrtle leaf paste as well as poultice to treat open injuries, burn wounds and ulcers, because these treatments reduce infection risk and boost healing times. The cosmetic industry use Myrtle as an essential component in various products of hair, and beauty. The practice of traditional medicine involves applying both extract, and oil from Myrtle plant components to achieve hair growth along with scalp strengthening, and dandruff protection. The antifungal properties in Myrtle plants help keep the scalp healthy, while protecting from seborrheic dermatitis conditions (Ayatollahi *et al*., 2021). Myrtle serves numerous roles in oral care as antibacterial, and astringent components make them a standard part of traditional mouth washing products, and dental products like toothpaste. The people commonly use water infused with Myrtle as a home remedy to treat infections of the gums as well as mouth ulcers, and bad breath. The tannins extracted from the plant lead to tissue tightening, and anti-inflammatory effects which make Myrtle effective for oral hygiene maintenance (Dakkaki *et al*., 2023). The local communities use Myrtle leaves as chewing material to enhance gum health, while they also help improve breath freshness (Dakkaki *et al*., 2023). The plant contains multiple bioactive elements including flavonoids, tannins, phenolic acids, and essential oils which account for its antimicrobial, antioxidant, anti-inflammatory, and antifungal properties (Hou *et al*., 2022; Ali *et al*., 2017).

Moreover, there is a considerable amount of empirical pharmacological research that has confirmed a number of traditional applications of Myrtle by using modem scientific research. The previous studies have confirmed that Myrtle consists of high quantities of flavonoid, and phenolic compounds which have the able to possess great antioxidant capabilities. These plant compounds function as free radical neutralizers, reduce the level of oxidative stress, and to prevent the exposure of cell damage (Akbari *et al*., 2022). The key beneficial properties of Myrtle as cardiovascular protection, and brain health progression. Many researcher has been investigated about the antimicrobial properties of Myrtle, due to the fact that research has proven its effectiveness at combating different bacterial, and fungal infections. The anti-bacterial and antifungal property of its essential oil are due to its major components such as myrtenyl acetate, α pinene and 1,8 cineole (Abd Rashed *et al*., 2021). However, the analgesic, and anti-inflammatory properties of the plant can be used to control arthritis symptoms, and also inflammatory skin diseases with managing gastrointestinal inflammation. The recent research shows that some bioactive elements present in extracts of Myrtle might display toxicity according to cancer cells, thus really playing the role of fighting against cancer (Giampieri *et al*., 2020). The findings about Myrtle derived compounds as potential cancer prevention, and treatment agents need to be further validated through scientific examinations. The insulin sensitivity can be improved, and blood glucose can be controlled by Myrtle extracts. These bioactive polyphenols, and terpenoids of Myrtle which are believed to support traditional use for the treatment of metabolic disorder have been supported by the hypoglycemic properties of Myrtle (Bungau *et al*., 2023).

Myrtle has been used as a medicinal plant, and has some potential therapeutic properties, though research into how it can be applied still needs to be explored. Myrtle extractions should also be standardized with specific compound identification in therapeutic effects with pharmacology, safety, and clinical evaluation tests. Future supply of Myrtle will be supported on account of its ecological value as well as expanding commercial needs for sustainable cultivation methods and conservation strategies to be ongoing (Hardstaff *et al*., 2022; El Mekkaoui *et al*., 2024). This study evaluates Myrtle by investigating its historical, and cultural roots combined with its

traditional medical uses, and chemical profiles along with its pharmaceutical properties. The authors integrate established cultural wisdom with scientific exploration to demonstrate Myrtle worth as a multi-purpose medicinal plant suited for natural medicine, pharmaceutical production, and dermatological applications.

Methodology

This review article provides a comprehensive overview of the folk uses, medicinal uses, historical perspective, phytochemistry, and Pharmacology of *Myrtus communis* L., compiled from a published research papers. The current review included a total of 85 comprehensive research papers were reviewed, and collected from various databases such as Google Scholar, Web of Science, Scopus, Research Gate, Science Direct, and PubMed (Matsehorova *et al*., 2024). The available all publications needed to be in English as per the established language restriction of this review, and employed a keyword search strategy across various databases to identify studies focused on Myrtle plant morphology, local uses, medicinal uses, religious use, history, phytochemistry, and pharmaceutical activities. The review included only scientific publications that were indexed in the provided databases to ensure availability for the scientific world. The study excluded unpublished sources consisting of thesis, reports, and locally available documents, since they remain unavailable to reference (Ng *et al*., 2020). The research data from previous published literature is summarized in four main tables for local names, traditional uses, phytochemistry, and pharmacological activities, and five figures. The IUPAC names and chemical formulas of chemical compounds are conform from various databases i.e., Chem-Spider, and Pub-Chem. The review method focuses on peer-reviewed scientific information which makes this resource a reliable tool for both young researchers, and practitioners who work in natural medicine fields (Secinaro *et al*., 2021).

Comprehensive literature-based information of *Myrtus communis* L.

Plant description

Myrtus communis is a small tree or an evergreen shrub growing up to 2 to 5m tall. Its foliage is dense, and its leaves are aromatic. The leaves are lanceolate, simple, leathery, opposite, have entire margin and glandular dots. The Myrtle produce fragrant white or pale pink flower with many feathery stamens. These flowers bloom in summer as well as in late spring and blooming season is between May and July (Boddy, 2020). The plant bears edible fruits in the form of small berries, dark purple to black colour, mature in late summer or early autumn (Figure 1a & 1b). The barriers are multi seeded and can be cultivated in the Mediterranean region, Southern Europe, Middle East and North Africa, where it is considered to be grand ornamental, aromatic and medicinal plant. Its habitat takes place on rocky slopes, dry woodlands, and even coastal areas. The great cultivation potential of Myrtle is due to its bioactive compounds including flavonoids, tannins and essential oils. Moreover, its leaves flowers, and fruits make the plant to be great pharmacological potential (Giampieri *et al*., 2020; Ullah *et al*., 2022).

The essential oil are extracted from its leaves, and berries are famous for their antimicrobial, anti-inflammatory and antioxidant properties. Traditionally, the extracts of Myrtle leaves have been use in several purpose of Unani, Ayurveda, and Mediterranean folk medicine for treatment of respiratory, digestive, and skin infections. Its stem is found to be filled with fragrant constituent, which has been widely used in perfume, and aromatherapy (Khatib, 2024).

Figure. 1a & 1b: Present Myrtle branch with white flowers and blue barriers or fruits**.**

Vernacular / local names of *Myrtus communis* L.

Myrtle has different names for different areas and cultures, pointing to age and medicinal uses. The vernacular names of *Myrtus communis* are vary according to their regions, where it is frequently used in traditional medicine, and cultural practices. In English it is also known as Myrtle, Bharangi in India, Hubal Aas in Arabic, Tokhami maorood, and Yas in Persians, Mersin in Turkey, Mirto in Italy, and Greece, Myrte in German, and France, and Pakistan it is also known as Manroo in Pashto, Moorya in Punjabi, Maanmoryo in Sindhi language (Table.1; Al-Snafi *et al*., 2024; Baytop, 1999; Rahim *et al*., 2012).

Table 1. Local names of *Myrtus communis* L. across the world

Country / Region	Local Name
Pakistan	Manroo, Moorya, Maanmoryo
British	Myrtle
Saudi Arabia	Hubol Aas
Iran (Persians)	Tokhami maorood, Yas
Turkey	Mersin
Italy	Mirto
German, France	Myrte
Italy, Spain	Mirto

Ethno-Medicinal uses of *Myrtus communis* L

Myrtus communis was previously used as an herbal medicine, traditional healthcare, and various cultural activities. Myrtle is also used by almost 80% population of the modern world, where modern medical facilities

are not available. Though, minimizing the side effects, cost effective and natural healing properties is the safety profile of herbal medicines which makes it different than the synthetic drugs (Barkat *et al*., 2021). Myrtle is a historical plant use as a traditional medicine throughout the Mediterranean, Middle Eastern, and South Asian countries. The most notable among these are Pakistan, Iran, India, Turkey, and Greece (Akbar & Akbar, 2020). There are various diseases reported to be treated by the Myrtle are classified into the following categories such as gastrointestinal disorders, skin conditions, renal, urinary disorders, musculoskeletal disorders, respiratory infections, eye infections, oral infections, parasitic infections, gynecological conditions, ENT-related issues, fever, cancer, and other ailments. The largest percentage was that of gastrointestinal disorders (24%), followed by skin diseases (18%), urinary and renal disorders (13%), muscular and skeletal issues (9%), respiratory diseases (7%), fever (6%), eye infections (3%), oral infections (3%), gynecological disorders (3%), ENT-related issues (1%), and cancer (1%; Figure. 3). The cumulative percentage of the gastrointestinal disorders treated by Myrtle is attributed to its carminative properties as well as digestive stimulant, and antimicrobial activities (Mohammadi *et al*., 2025; Ali *et al*., 2017).

However*, Myrtus communis* has been used by traditional medicinal practitioners throughout the Mediterranean, and Middle East to treat stomach disorders like indigestion, bloating, ulcers, and diarrhea. The several studies have conformed the efficacy of Myrtle leaves, and berries in dealing to intestinal discomforts, and gastrointestinal infections. Some of the studies reported the use of root extracts in the treatment of diarrhea, and dysentery. The parts of the plant used in traditional medicine are leaves, berries, essential oil, roots, flowers, and sometimes the whole plant. The leaves were the most commonly used (42%), followed by berries (25%), essential oil (20%), roots (10%), and whole plant (3%; Figure. 2). The high usage rate of leaves as well as that of essential oil could be attributed to their high concentration contents in flavonoids, tannins, and volatile compounds contributing to medicinal properties (Pinto *et al*., 2021). Further, the leaves and essential oil were used for the treatment of skin ailments and also used for the treatment of cuts, wounds, burns, boils, eczema and fungal infections have been recorded by the traditional healers is Myrtle. The antimicrobial, and astringent actions of these help prevent the infection aftercare. The Myrtle extracts have been identified in ointments, and herbal pastes for wound management. Apart from this, it has an antifungal activity against common skin infection such as ringworm, and fungal dermatitis. Myrtle is also used for the healthy condition of the kidneys, and urinary tract. The leaves and root were most often cited in the literature as having effectiveness in treating such ailments. The Myrtle extracts were used by physician in creating mixtures designed for the treatment of kidney stones, urinary tract infections, and bladder disorders. The plant parts also contain an entire spectrum of phenolic compounds that makes stone in the kidney to dissolve and also improve the overall function of kidneys (Ranaweera *et al*., 2023; Ali *et al*., 2017).

Moreover, the plant has also been used for the treatment of muscle, and skeletal disorders such as arthritis, joint pain, and muscle cramps. Its leaves, and essential oils are the most commonly used in poultices, ointments applied to the skin or infused in carrier oils for massage therapy. The Myrtle products provide relief to inflammation, reduce swelling, and improve mobility of the area. It has also been used in respiratory ailments for cough, asthma, bronchitis, and sinus infections (Prall *et al*., 2020). The additional medicinal uses of Myrtle include treatment of fever, various oral infections, and parasitic diseases. Myrtle leaf extracts are taken as antipyretic herbal teas for the purposes of reducing fever, and enhancing immunity. Traditionally, the antibacterial, and astringent extracts of Myrtle have been applied in dental care using mouth rinses to prevent gum infection, and bad breath for mouth ulcers (Table.2; Giampieri *et al*., 2020).

Furthermore, it is used in traditional medicine in the forms of decoctions, juices, powders, teas, and extracts. The most frequently used powder preparations (30%), decoctions (22%), juices (20%), pastes (19%), teas (6%), and the extracts (3%).Traditionally. Myrtle powders have been used in Unani and Ayurvedic medicines and are mixed

with honey, water and milk before the latter is consumed. The present review reaffirms various ethno-medicinal uses of Myrtle over different regions. This plant is of great value due to its antimicrobial, antioxidant, anti-inflammatory, and diuretic properties, as such, it plays a key role in traditional medicine. Though, ethno-botanical documentation points out the importance of regional variations in plant usage, whereby some cultures tend to use leaves, essential oils, roots, and whole plant extracts. Meanwhile the rising scientific validation of the medicinal effects of Myrtle, it should be a subject for further exploration in pharmacological applications, and modern drug development (Matsehorova *et al*., 2024).

Table 2. Major diseases categories, application and scientific evidence of *Myrtus communis* L.

Disease Category	Traditional Uses / Application	Scientific Evidence / Observed Effects
Respiratory disorders	Used as a decoction or infusion to relieve cough, soothe bronchitis, and treat common colds.	Methanolic and aqueous extracts show dose-dependent antitussive activity (up to 44.2 % inhibition at 300 mg/kg), comparable to codeine phosphate in animal models.
Gastrointestinal issues	Employed for treating gastric ulcers, diarrhea, and dyspepsia.	Aqueous extract significantly reduced ulcer lesions ($p < 0.05$) in indomethacin- and pylorus-ligation-induced rat models at 15–60 mg/kg; demonstrates antisecretory and mucosal-protective effects.
Antimicrobial infections	Applied topically or orally for skin infections, wound care, and to manage microbial gastrointestinal disturbances.	Essential oil and extracts exhibit broad-spectrum antimicrobial activity against Gram-positive and Gram-negative bacteria (e.g., *Staphylococcus aureus*, *Escherichia coli*) and various fungi (e.g., *Candida albicans*).
Anti-inflammatory & analgesic	Used to alleviate joint pain, rheumatism, and general inflammation when taken as a poultice or infusion.	In vivo studies demonstrate significant inhibition of carrageenan-induced paw edema in rats, indicating notable anti-inflammatory and analgesic properties.
Metabolic disorders	Taken as an herbal tea to support digestion and believed to help "balance blood sugar."	Extracts show antioxidant activity (DPPH and FRAP assays) and moderate α-glucosidase inhibitory effects, suggesting potential antidiabetic benefits.
Dermatological conditions	Applied topically for wound healing, minor skin lesions, and as an antiseptic wash.	In vitro and in vivo studies indicate accelerated wound closure in rodent models, increased collagen deposition, and antimicrobial protection at wound sites.
Cardiovascular support	Consumed as a tonic to "strengthen the heart" and manage mild hypertension.	Preliminary studies in animal models indicate hypotensive effects, likely due to vasorelaxant activity of flavonoids present in the leaves.

Urinarytract disorders	Used as a diuretic infusion to help flush urinary tract and relieve minor urinary discomfort.	Diuretic assays in rodents demonstrate increased urine output; antimicrobial properties also help reduce risk of bacterial proliferation in the urinary tract.
Neurological/ nervous System	Employed in folk medicine to calm nervous tension, mild anxiety, and headaches.	Limited studies suggest central nervous system depressant activity in mice, as evidenced by prolonged sleeping time in pentobarbital-treated animals.
Antioxidant& general tonic	Drunk as a regular herbal tea for overall vitality, to reduce oxidative stress, and support immune health.	High total phenolic and flavonoid content correlates with strong antioxidant capacity in DPPH, ABTS, and lipid peroxidation assays.

Sources: (Mohammadi *et al*., 2025; Pinto *et al*., 2021; Giampieri *et al*., 2020; Matsehorova *et al*., 2024).

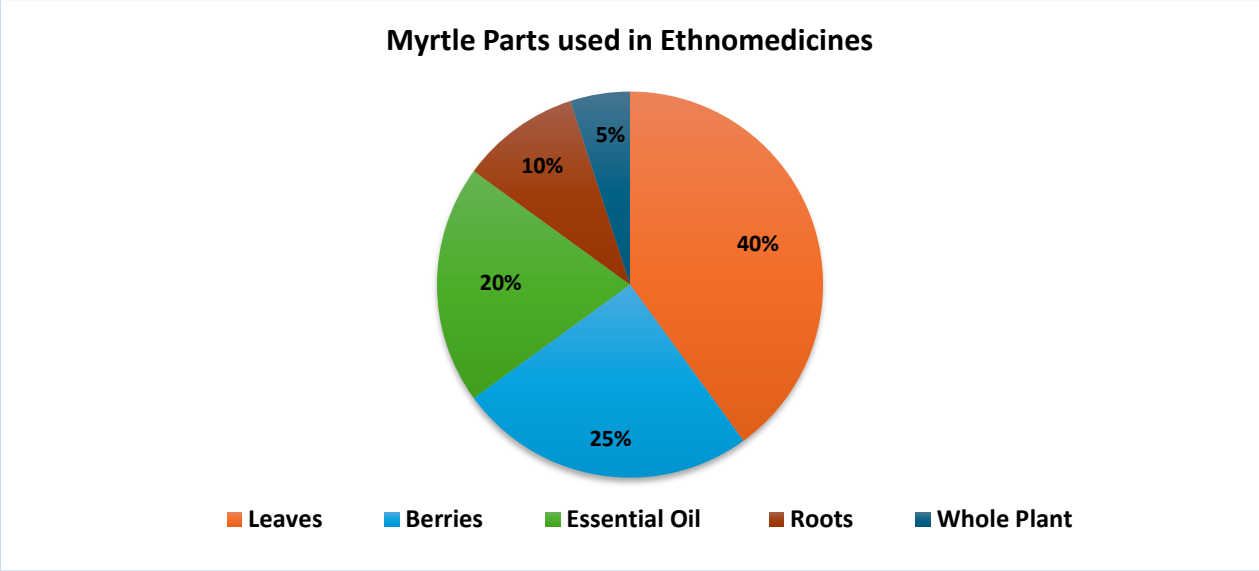

Figure 2. *Myrtus communis* plant parts used in various ethno-medicinal applications.

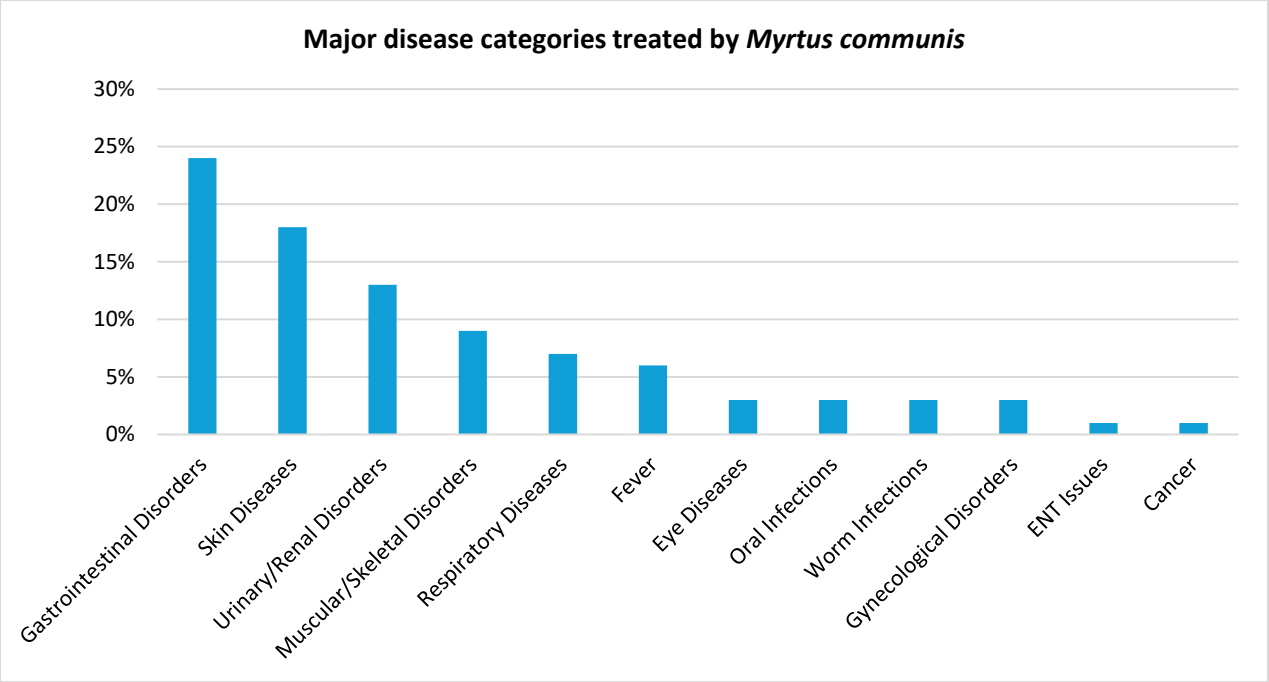

Figure. 3 Present the main diseases traditionally treated by using Myrtle.

Phytochemistry

The demand of herbal medicines has been increased tremendously in the last two decades for which rigorous quality measurements have been undertaken to assure safety, efficacy, and consistency of herbal drugs. The most effective tools for the quality assessment of herbal medicine is the phytochemical evaluation (Mukherjee *et al*., 2022). Also, the identification of the classes of bioactive compounds responsible for medicinal property of herbs, and standardizing herbal formulations for therapeutic use can also be accomplished by such approaches (Paul & Kumar, 2024). Myrtle contains various phytochemicals such as flavonoids, tannin, terpenoid, alkaloid, phenolic acids, and essential oils. It is well known that flavonoids, and tannins are present in leaves and berries having strong antioxidant, anti-inflammatory, and antimicrobial properties. The terpenoids are the major constituents of essential oil extract from Myrtle plant, and responsible for its characteristic fragrance, and antimicrobial activity (Masyita *et al*., 2022; Usai *et al*., 2018).

However, the phytochemical composition of Myrtle contain a high amount of bioactive compounds. The current review reported that a total of 60 compounds are present in Myrtle plant, and out of these 12 classes are volatile organic compounds such as phenols (20%), alcohols (18%), VOCs (15%), terpenoids (14%), fatty acids (7%), sterols (6%), glycosides (5%), carboxylic acids (5%), flavonoids (4%), cinnamic acid derivatives (3%), and nitro compounds (3%).The pharmacological activities of the plant such as antimicrobial, antioxidant and anti-inflammatory effects are due to these compounds. The role of Myrtle in herbal medicine is important with regards to the bio-active molecules that are used in herbal medicine, and also in modern pharmacological drugs (Figure. 5; Table 3; Dabbaghi *et al*., 2023; Shahbazain *et al*., 2022).

The figure.4 presents a comparative analysis of the number of phytochemical studies on Myrtle (dark teal), alongside the number of diseases investigated in these studies (light gray).The India ranks first with about 45 studies addressing 15 diseases, followed by Italy (40 studies, 13 diseases), Iran (35 studies, 14 diseases), and Pakistan (30 studies, 12 diseases). However, Turkey (28 studies, 10 diseases), Greece (25 studies, 9 diseases),

France (22 studies, 8 diseases), and Egypt (18 studies, 7 diseases) complete the list. Overall, a higher volume of studies generally correlates with a wider spectrum of disease coverage (Al-Maharik *et al*., 2023; Rashid, 2021).

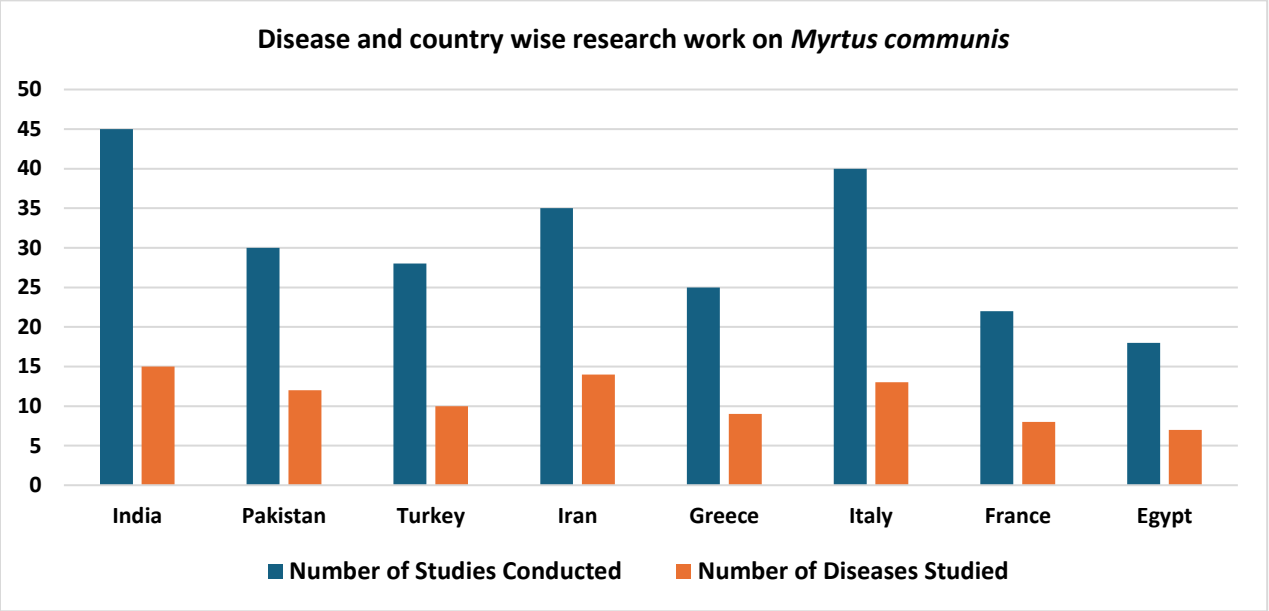

Figure 4. Present research on *Myrtus communis* categorized by diseases and countries.

Gallic Acid in *Myrtus communis* L.

Gallic acid is one of the major phenolic compound of Myrtle plant, where it is found mainly in the leaves and berries. Its IUPAC name as 3, 4, 5 trihydroxybenzoic acid with a chemical formula C_6H_2 $(OH)_3$ COOH. Myrtle has a strong antioxidant, antiviral, and antifungal properties due to gallic acid, which is very important in pharmacological potential of the plant. Although the total phenolic content is very widely determined with different plant extracts, Folin-Ciocalteu assay is usually employed as standard. In topical gallic acid shows anti-inflammatory properties, therefore, it is effective for the treatment of skin conditions. It is also an inhibitor of weak carbonic anhydrase, a cell metabolism, and pH regulating enzyme (Nikolaeva *et al*., 2022).

Tannic Acid in *Myrtus communis* L.

Tannic acid is a bioactive compound present in the leaves, and bark of Myrtle plant. Its chemical formula is $C_{76}H_{52}O_{46}$. It is widely used in the textile industry for dyeing of cotton, and other cellulose fibers, for improving acid dye wash fastness of polyamide fabrics, and for improving chlorine fastness in the textile processing. In addition, tannic acid acts a metal passivation by preventing corrosion of the ferrous materials (Wu *et al*., 2021). It is also used as a natural clarifying agent, as a modifier of bitterness, flavor, aroma enhancer, and as a colour stabilizer in juices, soft drinks, beer and wine production. Tannic acid is medicinally used in treating burns, injuries in extreme cases, and lowered the mortality rate (Baldwin & Booth, 2022). Tannic acid is widely use to remove poisonous from toxic substances such as poisonous mushrooms. It is also an important pharmaceutical ingredient for the preparation of albumin tannate, antihistamines, anti-diarrheal drugs, and cough syrup (Matsehorova & Odyntsova, 2024).

Myrtenyl Acetate in *Myrtus communis* L.

Myrtenyl Acetate is a bioactive compound present in Myrtle plant. Its chemical formula is $C_{12}H_{18}O_2$. Previously, it was popular for its antibacterial activity, and inhibit the growth of bacteria, also possess germicidal effects like the known antibacterial properties. It is confirmed to have antifungal activity, because it inhibits such enzymes which are involved in the metabolism, and growth of fungi (Alyousef, 2021). It is also an antiviral activity against hepatitis viruses, and mild inhibitory activity on HIV replication against HIV-1 reverse transcriptase. However, myrtenyl acetate has cardio protective action, and there is potential for employment as an agent in the treatment of arrhythmia by means of its capability to influence cellular signaling pathways in cardiac tissues (Tian *et al*., 2020).

Catechin in *Myrtus communis* L.

Catechin is present in leaves, and berries of Myrtle plant. Its chemical formula is $C_{15}H_{14}O_6$, and an agent which prevents the conversion of histidine to histamine, the compound which disturbs the immune system. Catechin has the power to reduce allergic reactions, and inflammatory conditions. Additionally, catechin possesses neuro-protective properties, and is therefore a good therapeutic candidate for either cognitive loss caused by HIV, Alzheimer disease, or Parkinson disease. The previous research has suggested that the protective effects of epicatechin, and other catechin flavonoids are mediated against neurotoxic oxidative stress, a feature that is also a major characteristic of neurodegenerative diseases. The epicatechin is effective in crossing the blood brain barrier, is more effective than resveratrol, and able to enhance neuronal survival, and neurotropic factor pathways. Further, (+)-catechin and epicatechin are also monoamine oxidase inhibitors and have the potential for regulation of dopamine, and serotonin levels, therefore, may act as drugs for the treatment of neurodegenerative disorders (Afzal *et al*., 2022).

Sterol in *Myrtus communis* L.

The most important phyto-sterol in Myrtle is β-sitosterol, especially present in leaves, and fruits of the plant. Its chemical formula is $C_{29}H_{50}O$. The element appears as a waxy white powder whose odor is characteristic, and it is hydrophobic in nature. It is well known that β–sitosterol reduces blood cholesterol levels, and is therefore an important ingredient in hypercholesterolemia treatment. It is used for preventing cholesterol absorption in the intestines thereby helping in lipid metabolism regulation. β-sitosterol is used as a part of herbal medicine for management of benign prostatic hyperplasia (BPH), for improvement of urinary flow, and reduction of BPH symptoms enlargement of the prostate (Zio *et al*., 2024; Shahbazain *et al*., 2022; Usai *et al*., 2018).

Flavonoids in *Myrtus communis* L.

Myrtle leaves, and berries are a good source of flavonoids and the chemical formula of flavonoids is $C_{15}H_{14}O_5$. Myrtle acts as an antioxidant due to the presence of flavonoids including afzelechin, quercetin 3-o-β-D xylopyranoside, and quercetin 3-o-α-L-arbinofuranoxide, and it has anti-inflammatory properties. The quercetin flavonoid have antioxidant, antiradical, and iron-chelating abilities. The antioxidant property of it protects the cells from oxidative stress, neurodegenerative diseases, and cardiovascular diseases. Quercetin is often recommended for allergy relief, immune support, and cardiovascular health, because of the ability to stabilize mast cells, and regulate inflammatory responses (Shahbazain *et al*., 2022; Sumbal *et al*., 2011).

Fatty Acids in *Myrtus communis* L.

Myrtle has fatty acids including decanoic acid with chemical formula is $C_{10}H_{20}O_2$), and nonionic acid with chemical formula is $C_9H_{18}O_2$. The antimicrobial activity, and antifungal properties of decanoic acid have been studied extensively, and this has made it one of the key components of essential oils extracted from the plant (Hou *et al*., 2022). Meanwhile, nonanoic acid has the property of herbicide which means it can be used in natural pesticide. These fatty acids are responsible for the protective effect, and therapeutic effect of Myrtle especially the defenses of Myrtle against antimicrobial activity (Dabbaghi *et al*., 2023; Usai *et al*., 2018).

Terpenes in *Myrtus communis* L.

Myrtle is a very rich plant in terpenes, mainly present in this case as an essential oil in the leaves, and berries. The terpenes are limonene with chemical formula is $C_{10}H_{16}$, and linalool with chemical formula is $C_{10}H_{18}O$. They have therapeutic, chemotherapeutic, and antiseptic activities. However, Myrtle also has the other important sesquiterpene, and β-caryophyllene with chemical formula is $C_{15}H_{24}$. These compound has woody, and spicy aroma can be used in cosmetics. Further, it has also anti-inflammatory, and neuro-protective features. Terpineol is classified as a chemical terpenoid that can be found in Myrtle. This compound is used as a muscle spasm reliever, and respiratory drugs being an antispasmodic (Shahbazain *et al*., 2022; Usai *et al*., 2018).

Table 3. IUPAC names of various phytochemicals along with their activities

Phytochemical	IUPAC Name	Activity
Tannic acid	2,3-dihydroxy-5-({[(2R,3R,4S,5R,6R)-3,4,5,6-tetrakisphenyl3,4,5-trihydroxybenzoate({3,4-dihydroxy-5-[(3,4,5-trihydroxyphenyl) carbonyloxy]phenyl}carbonyloxy)oxan-2-yl] methoxy}carbonyl)phenyl 3,4,5-trihydroxybenzoate	Antifungal,Antiviral, Cytotoxicity, Antioxidant
Gallic acid	3,4,5-Trihydroxybenzoic acid	Histidine decarboxylase-inhibitor
Catechin	(2R,3S)-2-(3,4-dihydroxyphenyl)-3,4-dihydro-2H-chromene-3,5,7-triol	Antimicrobial, Antioxidant
(−)-3-O-galloyl-catechin	2-(3,4-dihydroxyphenyl)-5,7-dihydroxy-3,4-dihydro-2H-1-benzopyran-3-yl 3,4,5-trihydroxybenzoate	Anti-inflammatory, Neuroprotective
(−)-3-O-galloylepi-catechin	2-(3,4-dihydroxyphenyl)-4-[2-(3,4-dihydroxyphenyl)-4-[2-(3,4-dihydroxyphenyl)-3,5,7-trihydroxy-3,4-dihydro-,5,7-trihydroxy-3,4-dihydro-2H-1-benzopyran-8-yl]-5,7-dihydroxy-3-(3,4,5-trihydroxybenzoyloxy)-3,4-dihydro-2H-1-benzopyran-6-yl]-5,7- dihydroxy-3,4-dihydro-2H-1-benzopyran-3-yl 3,4,5-trihydroxybenzoate	Antibacterial, Antifungal
Gallicin	3,4,5-trihydroxybenzoic acid	Antimicrobial, Antifungal

β-Sitosterol	17-(5-Ethyl-6-methylheptan-2-yl)-10,13-dimethyl-14,15,16,17-dodecahydro-1H-cyclopenta[a]phenanthren-3-ol	Cholesterol inhibition
Arbutin	(2R,3S,4S,5R,6S)-2-Hydroxymethyl-6-(4-hydroxyphenoxy)oxane-3,4,5-triol	Prevent melanin formation
Leucoanthocyanidin	2-phenyl-3,4-dihydro-2H-chromene-3,4-diol	Anti-inflammatory, Antispasmodic
Limonene	1-Methyl-4-(1-methylethenyl)-cyclohexene	Antibacterial, Antifungal
Linalool	3,7-dimethylocta-1,6-dien-3-ol	Antiseptic, Chemotherapeutic agent
α-Terpineol	2-(4-methylcyclohex-3-en-1-yl)propan-2-ol	Myorelaxant Antispasmodic effects
Quercetin 3-o-β-D xylopyranoside	3-[(2S,3R,4R,5S)-3,4-dihydroxy-5-(hydroxymethyl)oxolan-2-yl]oxy-2-α-L-(3,4-dihydroxyphenyl)-5,7-dihydroxychromen-4-one	Anti-leishmanial, Anti-oxidative,

Sources: (Nikolaeva *et al*., 2022; Wu *et al*., 2021; Alyousef *et al*., 2021; Afzal *et al*., 2022).

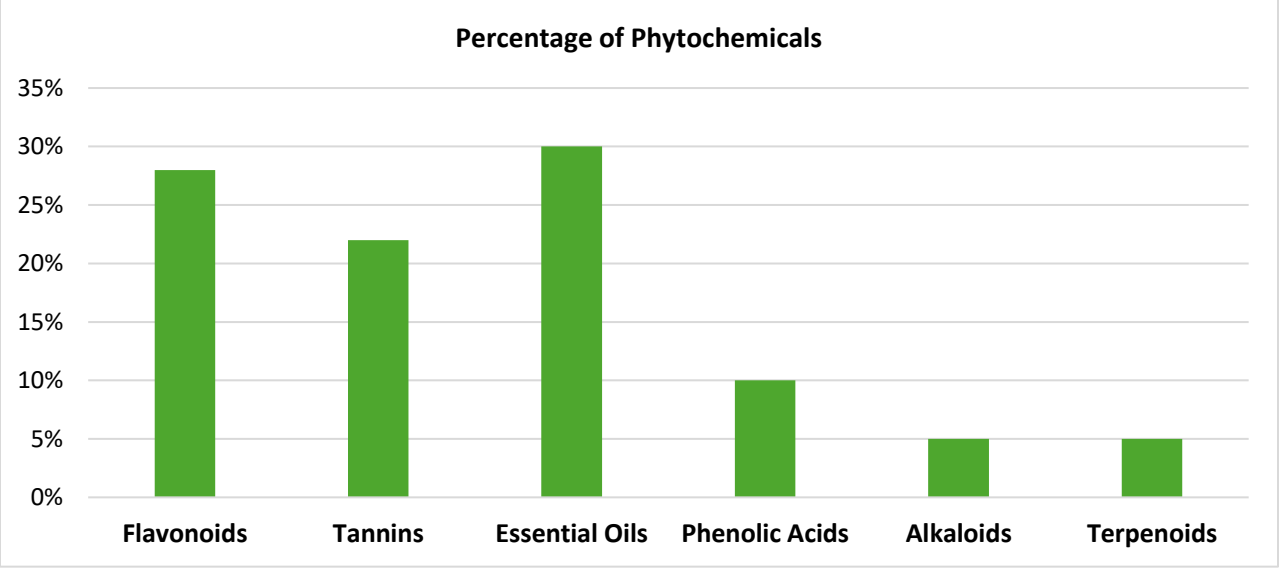

Figure 5. Percentage distribution and number of identified phytochemicals.

Pharmacology

Anti-Diabetic activity of *Myrtus communis* L.

The previous studies proved that Myrtle plant is anti-diabetic property that regulates glucose, and metabolic health of the body. It simply means that it inhibits the actions of the α-glucosidase, and the α-amylase enzymes that cause the synthesis of glucose from the complex carbohydrate. The 50% of aqueous-methanol extract of Myrtle contained two active compounds (−)-3-O-galloylcatechin, and (−)-3-O-galloylepicatechin that inhibited rat intestinal α-glucosidase, and porcine pancreatic α-amylase in a concentration depended manner (Giampieri *et al*., 2020). However, rats were rendered diabetic by a single administration of streptozotocin (STZ), which produced peak blood glucose levels after 24 hours. In order to evaluate the hypoglycemic potential of various Myrtle extracts, diabetic rats were treated with ethanol, aqueous chloroform, ethyl-acetate, hexane, and butanol fractions. The ethanolic extract lowered blood glucose by 70.13%, while the aqueous extract produced a similar reduction of 71.34%.The chloroform extract also demonstrated significant activity, reducing blood glucose levels by 42.23%. The management of the ethyl acetate extract decrease or rise glucose level from 443.0 ± 22.3 mg/dL to a substantially lower concentration, although the reduction was less pronounced than that seen with the ethanol, and aqueous extracts. In contrast, neither the hexane nor the butanol extracts elicited a notable hypoglycemic effect (Table. 4; Alipour & Hosseinzadeh, 2014).

Further, besides in vitro studies are carried out to study the effect of ethyl acetate soluble extract of Myrtle on rat intestinal maltase activity which showed inhibition of rat intestinal maltase activity in a dose dependent manner, and two active compounds which also in vitro confirm reduced rat intestinal maltase, acetic acid activity, and porcine pancreatic α-amylase activity in a dose dependent manner. Therefore, these results show that Myrtle could be developed as a natural agent for type two diabetes treatment (Yaman *et al*., 2020).

Anticancer activity of *Myrtus communis* L.

The extract of Myrtle plant such as methanol, and aqueous extracts have a strong ability of anti-cancer. The cytotoxicity is necessary and dependent on the concentration for the development of chemotherapy drugs. Myrtle berries, seeds, leaves, and essential oils have some undiscovered sources of natural compounds with promising health benefits. For example, crude extracts having an IC50 value below 30 µg/ml are regarded as a potential anticancer agent by American National Cancer Institute. This range for IC50 values for the Myrtle extracts are promising for further studies in the field of oncology (Ibrahim *et al*., 2021; Giampieri *et al*., 2020).

Antitussive activity of *Myrtus communis* L.

Myrtle extracts have demonstrated significant, dose-dependent antitussive effects in animal models. In one study, mice were induced to cough using sulfur dioxide gas, when the methanolic extract of Myrtle was administered orally, it inhibited the cough reflex in a concentration-dependent manner. Precisely, a 100 mg/kg dose produced approximately 28.7 % inhibition of coughing, increasing to 33.9 % inhibition at 200 mg/kg, and reaching 44.2 % inhibition at 300 mg/kg. Though, this antitussive activity approaches that of codeine phosphate a well-known cough suppressant indicating that Myrtle is not merely a mild traditional remedy, but exerts a robust cough-suppressing action comparable to standard pharmacological agents. These findings validate its traditional use for respiratory infections, and support further investigation into its mechanism of action, and potential development as a natural antitussive drug (Abidi *et al*., 2021).

Table 4. Pharmacological activities of the plant, parts used, experimental models, and study designs, tested doses, and key observations.

Pharmacutical activity	Parts used	Model used	Tested dose	Observations
Anti-Bacterial	Leaves	Disc diffusion method by using methanol extract	200-1000µg	Significant antibacterial efficacy against bacteria i.e., *S. aureus, E. coli*, and *P. aeruginosa*
Anti-Bacterial	Essential oil	Diffusion method by using essential oil	10, 25, or 50 mg/ml	Effective against gram positive, and gram negative bacteria
Anti-Bacterial	Roots extract	Zone of inhibition assay against *E. coli* and *P. aeruginosa*	5 mg/ml	Zone of inhibition: 12mm–20mm (*P. aeruginosa*), and 6mm–8mm (*E. coli*)
Anti-Fungal	Leaves and roots extract	Extract activity against *Candida albicans* and *Aspergillus niger*	2 ml	Leaves effective against *Microsporum canis* (12mm inhibition)
Anti-Fungal	Essential oil	Minimum inhibitory concentration (MIC) test	10 mg/ml	*The antifungal activity was expressed by Afzelechin (7 ± 0.3 mm).*
Anti-Fungal	Whole plant extract	Ethanol and aqueous extracts against fungal strains	5 mg/ml	Moderate antifungal activity observed in terpenoids and flavonoids

Sources: (Abidi *et al*., 2021; Ibrahim *et al*., 2021; Giampieri *et al*., 2020; Yaman *et al*., 2020).

Conclusion

The current review reports complete information about the folk uses, medicinal uses, phytochemicals, and pharmaceutical investigation of medicinal plant *Myrtus Communis* for the first time. It is found that this phenomenon shrub had been traditionally used amongst several communities throughout the world for skin, respiratory, gastrointestinal, inflammatory, urinary, cardiovascular, neurological, and microbial infectious diseases. Additionally, this plant is also well known to treat cuts, wounds, burns, boils, kidney stones, and kidney related disorders by local doctors. Though, nearly all parts of the Myrtle plant are used for the treatment of various disorders, so the most popularly used part is leaves, followed by flowers, stem, and roots. The plant are usually used as an herbal tea and powder form. The pharmaceutical investigation shows that the plant has potential of anti-fungal, anti-bacterial, anti-viral, antitussive, anti-inflammatory, and anti-cancer activities. However, the main phyto-chemical compounds are reported in this plant are phenols, alcohols, terpenoids, fatty acids, sterols, glycosides, carboxylic acids, flavonoids, cinnamic acid derivatives, nitro compounds and essential oils. The essential oils of Myrtle are important features which contains various compounds such as myrtenyl acetate, limonene, linalool, and α-terpineol, so have antimicrobial, and sedative properties.

Further, the occurrence of scientific evidence associated to phytochemicals, medicinal, and pharmaceutical uses many gaps is present related to the use of this plant. Firstly, research based evidences of traditional uses are reported by various researchers such as anti-fungal, anti-bacterial, anti-viral, antitussive, anti-inflammatory, and anti-cancer etc. But, there is a need of some experimental study in near future to treat skin, hair fall, dandruff, muscular, antidote, and ENT related disorders. However, there are some pharmaceutical activities are observed in-vivo, and in-vitro. Also, there are additionally clinical studies are necessary to conduct for future discovery of drugs in this plant. The results of various research or experiments in these zones will give definite support for further clinical use of Myrtle plant in modern medicines. There are further phytochemical examination may lead to the extension of therapeutically abilities of *Myrtus communis*. Further, on the basis of current review, we suggest that further detailed research should be carried out on the ethno-medicinal, ethno-pharmaceutical, and toxicological areas of Myrtle. These studies will provide important insight about the preparation of new modern drugs for the treatment of various disorders. Moreover, the plant need sustainable cultivation, and conservation for its availability in medicinal, and commercial applications.

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