



Ethnobotanical and Pharmacological Perspectives of Herbal Plants

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First Edition

Editors

Dr. G. Durai Muthu Mani

Dr. S. Jayakumar

Dr. B. Arirudran

Dr. M. Yuvaraj



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Preface

Ethnobotanical and Pharmacological Perspectives of Herbal Plants presents a comprehensive exploration of the traditional knowledge and modern scientific validation of medicinal plants. Ethnobotany acts as a bridge between indigenous healing practices and contemporary biomedical research, while pharmacology provides the scientific foundation to evaluate the efficacy, safety, and mechanisms of herbal therapeutics. This book integrates ethnobotanical documentation, phytochemical analysis, pharmacological screening, and experimental validation to strengthen the scientific understanding of herbal plants.

Recent advancements in phytochemistry, molecular biology, toxicology, plant biotechnology, biomedical sciences, and clinical research have significantly enhanced the credibility and global acceptance of herbal medicine. The systematic study of medicinal plants not only preserves traditional wisdom but also contributes to novel drug discovery and evidence-based therapeutics. Through this volume, we aim to foster scientific curiosity, promote interdisciplinary research, and contribute meaningfully to the expanding body of knowledge in ethnobotanical and pharmacological sciences.

We are very much thankful to **Thanuj International Publishers**, who readily accepted and published this subject, providing us with the opportunity to present our scholarly work to the academic community.

The authors, **Mrs. M. Hemalatha, Dr. Aruna. R, Dr. V. Chitra and Dr. C. Sharmila** have contributed their research expertise and scholarly insights to present a detailed and meaningful account of herbal plants from ethnobotanical and pharmacological perspectives.

The preparation of this book involved extensive laboratory work, including phytochemical screening, extraction procedures, bioassays, and pharmacological evaluations. We gratefully acknowledge the valuable laboratory assistance and technical cooperation of **Mr. M. Samidurai, Mr. G. Elandan, and Mrs. S. Indumathi**, whose dedicated support greatly contributed to the successful completion of the experimental components of this work.

We also extend our sincere gratitude to all colleagues, mentors, and well-wishers whose encouragement and cooperation supported us throughout the preparation of this manuscript.

We hope this book will serve as a valuable reference for students, researchers, academicians, healthcare professionals, and policymakers, and inspire further exploration in the promising field of herbal plant research.

Editors

About Editors



Dr. G. Durai Muthu Mani is currently working as Assistant Professor in the **Department of Biochemistry, SRM Arts and Science College**, Kattankulathur, Chengalpattu District, Tamil Nadu, India. He completed his Ph.D. in Biochemistry from Manonmaniam Sundaranar University, Tirunelveli, Tamil Nadu, India. He obtained his M.Phil. in Biochemistry from Bharathidasan University, Trichy, his M.Sc. in Biochemistry from MIET Arts & Science College, Trichy, and his B.Sc. in Biochemistry from S. ChattanathaKarayalar College of Arts and Science, Tenkasi, Tamil Nadu, India.

He also possesses additional technical qualifications including DMLT (Diploma in Medical Lab Technology) from Tanjavur, and DCLT (Diploma in Chemical Lab Technology) from Kanchipuram, which have strengthened his laboratory expertise and technical proficiency in biochemical and clinical research.

His research specialization focuses on phytopharmacology, hepatoprotective studies, antioxidant research, and medicinal plant biochemistry. He completed his M.Phil. project on “Antihepatic activity of *Phyllanthusniruri*” and his doctoral research on “Hepatoprotective activity of *Euphorbia thymifolia* Linn.” His work primarily emphasizes phytochemical screening, evaluation of bioactive compounds, toxicological assessment, and therapeutic validation of medicinal plants.

He has extensive teaching experience in higher education. He served as a Full-Time Tutor for DMLT at Rajiv Gandhi Paramedical Institute, Thiruvanniyur (05.08.2002 to 30.06.2003), as a Lecturer at King Nandhivarman College of Arts and Science, Thellar (21.06.2004 to 30.04.2005), as an Assistant Professor at Kanchi Shri Krishna College of Arts and Science, Kanchipuram (20.06.2006 to 15.07.2019), and is currently serving as Assistant Professor at SRM Arts and Science College, Kattankulathur (17.07.2019 to till date).

Dr. G. Durai Muthu Mani has published four academic books, namely *Practical Manual of Biochemistry*, *Text Book of Environmental Biology*, *Text Book of Basic Biochemistry*, *Basic and Clinical Biochemistry* and *Mastering Biochemistry*. He has published 12 research papers in reputed national and international journals as first *author*, *co-author*, *contributing author* and *editor*. His publications include phytopharmacological reviews of medicinal plants (2022), hepatoprotective studies of *Euphorbia thymifolia* and *Euphorbia hirta*, antioxidant and antimicrobial investigations, phytochemical screening of medicinal plants such as *Boerhaviadiffusa* and *Zizaniaaquatica*, marine ecosystem studies on pigmented bacteria (2024),

and pharmacological evaluations published in recognized journals including *Systematic Reviews in Pharmacy*, *International Journal of Current Microbiology and Applied Sciences*, *Pharmacognosy Journal*, *International Journal of Zoological Investigations*, and *Drug Development and Industrial Pharmacy* (Taylor & Francis, 2021).

He has authored two book chapters titled “Acute Toxicity of the Ethanolic Leaf Extract of *Euphorbia thymofilia*” published in *Current Trends in Biological Sciences* (2022) and “*Edible Electronics for Smart Technology*” published by IGI Global (2025).

His academic contributions have been recognized with several awards, including the Best Teacher Award (2023) conferred by Scientific International Publishing House, the Best Mentor Award (2025), and annual cash prizes for research publications from 2023 to 2025. He also holds two patents titled “Advanced Lipid Nanoparticle Platforms for mRNA-Based Vaccines and Therapeutics” (2026).

He has actively participated in 13 Faculty Development Programs (FDPs) and successfully completed 10 NPTEL courses. He has presented five research papers in various academic institutions and has delivered invited Chief Guest lectures at KMG College of Arts and Science, Gudiyatham (2022) on “Impact of Genetics in Our Life,” Theivanai Ammal College for Women (2023) on “AI Approaches in Biochemistry,” Annai Theresa College of Arts and Science (2024) on “Scope of Biochemistry,” and National College of Arts and Science (2025) on “Biobrilliance.”

Dr. G. Durai Muthu Mani continues to contribute actively to teaching, research, innovation, and academic development in the field of biochemistry and biosciences, with special interest in medicinal plant research, phytopharmacology, hepatoprotective studies, nanobiotechnology, and molecular biology.



Dr. S. Jayakumar is currently working as a **Head, P.G and Research Department of Biochemistry, SRM Arts and Science College**, Chengalpet - 603203, India, Tamil nadu. The author has contributed two book chapters in reputed edited volumes in the field of Life Sciences. The first book chapter, titled “Advances in Cancer Biology and Molecular Therapeutics,” was published in an edited book by Dr. R. Kumar and Dr. S. Priya, brought out by Academic Press Publishers in 2021. The chapter appears in pages 145–168 and focuses on recent molecular targets and therapeutic strategies in cancer research.

The second book chapter, titled “Herbal and Nanomedicine Approaches in Clinical Biochemistry and Neurobiology,” was published in 2023 in an edited volume by Dr. M. Lakshmi and Dr. K. Aravind, published by Springer Nature. The chapter is included in pages 89–112 and discusses innovative integrative approaches combining herbal bioactive compounds and nanotechnology for disease management.



Dr. B. Arirudran is currently working as an Assistant Professor in the P.G and Research **Department of Biochemistry, SRM Arts and Science College**, Chengalpet – 603203, Tamil Nadu, India. He joined the institution on 04-07-2007 and has 17 years and 11 months of teaching experience at SRMASC, with an overall teaching experience of 20 years. He holds M.Sc., M.Phil., and Ph.D. degrees and has qualified the CSIR-NET examination. He has 8 years of dedicated research experience and serves as a member of the Editorial Board of the *Defence Life Science Journal* and the *Asian Journal of Medicine and Biomedicine*.

His field of research includes Cancer Biology, Molecular Biology, Phytochemistry, and Herbal Medicine, with a strong focus on exploring plant-based bioactive compounds and their molecular mechanisms in disease management. He has published 32 research papers in reputed national and international journals. In addition, he has contributed 2 book chapters in edited volumes and has authored 4 books in the areas of Biochemistry and Life Sciences, reflecting his significant academic and research contributions.



Dr. M. Yuvaraj is currently working as an Assistant Professor in the P.G and Research **Department of Biochemistry, SRM Arts and Science College**, Chengalpet – 603203, Tamil Nadu, India. He joined the institution on 01-07-2019 and has 6 years of teaching experience at SRMASC, with an overall teaching experience of 6 years. He holds an M.Sc. and Ph.D. degree in Biochemistry. His area of research specialization includes Nano-Bio Technology and Cancer Diagnosis based on Omics approaches, including Proteomics, Genomics, and Metabolomics. His research focuses on integrating advanced molecular and nanotechnological tools for early detection and diagnostic applications in cancer biology. He has published a total of 19 research papers in reputed national and international journals, contributing significantly to the fields of cancer diagnostics and nano-biotechnology research.

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A Review of *Abutilon indicum*

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Abstract

Native to the area, *Abutilon indicum*, also referred to as Indian Mallow, is a multipurpose plant species with a wealth of traditional cultural therapeutic use. The existing corpus of research on *Abutilon indicum*'s properties is highlighted in this review, along with its possible therapeutic uses. The plant is well known for having a wide range of biological activity due to its varied phytochemical makeup, which includes polysaccharides, alkaloids, and flavonoids. Research has shown that extracts from *Abutilon indicum* have significant pharmacological benefits, including as hepatoprotective, anti-oxidant, anti-inflammatory, anti-microbial, and anti-diabetic qualities. Its larvicidal, anti-convulsant, neuroprotective, and cognitive-enhancing properties, in addition to its immunomodulatory activities, have drawn interest recently and are natural substitutes for the allopathic treatment that is now accessible.

1. Introduction

The Malvaceae family includes the Indian mallow (*Abutilon indicum*), also referred to as Atibala. It is a well-known medicinal plant with a variety of pharmacological qualities that are attributed to its leaves, roots, and other parts. About 150 annual or perennial herbs and shrubs, as well as subtropical nations in America, Africa, Asia, and Australia, are members of the genus *Abutilon* L. in the Malvaceae family. One of the most well-known plant species, it is used to treat a wide range of human ailments. Three meters is the height. The whole plant or its many parts, including leaves, stems, roots, fruits, and seeds, have long been used for its therapeutic qualities by India's indigenous peoples and tribes. Roots and bark have long been used as diuretics, nervine tonics, anti-diabetics, and aphrodisiacs . Urinary problems were treated with seeds. The seeds were used to alleviate coughs and as a laxative in piles. In order to alleviate physical discomfort, their leaves were typically consumed orally.

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The oblong, serrated, pointy leaves are 1.9 to 2.5 cm long and infrequently lobed into three sections. The stems are separated from the middle upward, and the flowers are yellow. Petioles range in length from 3.8 to 7.5 cm. The length of the stipule is 9 mm. Usually 2.5 to 5 mm long, the stalks are connected at the top and isolated at the axilla. The flower is 2.5 cm in diameter, yellow, and opens in the evening. The sepals are 12.8 mm long, lobed in the middle, and have oval, tapering lobes. The fruit has a noticeable, horizontally spread beak and is a capsule with a lot of hair. The stems are pubescent, robust, branching, and 1-2 meters high. The kidney-shaped, lumpy or somewhat star-shaped, hairy, black or dark brown seeds measure 3 to 5 mm.

Asparagine traces, mucilage, tannins, and organic acids are found in leaves, while sulfates, chlorides, magnesium phosphate, and calcium carbonate are found in leaf ash. Compared to the flower, 72% more quercetin is present in the ethanol extract. Alkaloids, sterols, triterpenoids, glycosides, essential oils, and different amino acids are also present in the leaves. The leaves are used to extract tocopherol and β -sitosterol.

The flavonoids luteolin, chrysoeriol, luteolin-7-o-beta-glucopyranoside, chryceriol-7-o-beta-glucopyranoside, and quercetin-3 work in concert to reduce oxidative stress and liver damage, which is why abutilon indicum leaf extract has a high alcohol content. The o- β -glucopyranoside.

Abutilon indicum

Kingdom	:	Plantae
Order	:	Malvales
Family	:	Malvaceae
Sub Family	:	Malvoideae
Genus	:	Abutilon
Species	:	Abutilon indicum
Binomial name	:	Abutilon indicum

1.1 Leaves :

It helps with arthritis by reducing body discomfort, muscle spasms, and joint inflammation. helps heal ulcers and boils more quickly, lessen swelling, and restore skin texture.inhibits intestinal motility, acting as an anti-diarrheal drug. used as a sedative and demulcent for chest diseases, bronchitis, and coughs. acts as a diuretic and is used to treat urinary problems such as

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urethritis. In Ayurveda, it is regarded as a Rasayana (rejuvenating plant) that boosts vitality and power (Balya). used historically to improve sexual health.

1.2 Stem :

It helps with headaches, muscle weakness, and arthritis by reducing pain and inflammation. Boils are treated with root paste. aids in wound and ulcer cleaning, promotes skin healing, and decreases swelling. inhibits the absorption of glucose and increases the release of insulin, which helps reduce blood sugar. shields the liver from harm. used to treat sinusitis, bronchitis, and coughs (by inhaling leaf juice). acts as a laxative and is used to treat worm-related intestinal discomfort, diarrhea, and dysentery. improves vitality and strength and is used to treat neurological illnesses and overall debility. aids in the treatment of urethritis and other urinary problems.

1.3 Root :

It is used as a diuretic and to treat urinary conditions such as hematuria (blood in the urine), urethritis, and strangury (painful urination). For fevers, root infusions work as a cooling remedy. It is used to treat facial paralysis and is regarded as a tonic that boosts vitality, strength, and vigor. helps reduce pain and inflammation because it has analgesic and anti-inflammatory qualities. used historically to increase sexual vigor. helps treat ailments including joint diseases by supporting the neurological system.

1.4 Flowers:

It provides analgesic effects, relieves sore joints, and lessens inflammation in the digestive and respiratory systems. combats oxidative stress, boosts immunity, and has cleansing qualities. Boils, ulcers, and other skin conditions can be healed with flower paste. serves as an expectorant and bronchodilator for bronchitis and coughs. boosts men's semen and functions as a tonic and even aphrodisiac, giving them more strength and vitality. demonstrates action against a variety of bacteria and fungi, including *S. aureus*, *C. albicans*, and *E. coli*. has modest laxative effects and can aid with diarrhea. used to reduce inflammation in the bladder and promote heart health. helpful for ailments like headaches and facial paralysis.

2. Phytoconstituents:

2.1 Chemical composition of Leaves:

Alkaloids, flavonoids, tannins, saponins, phenolic compounds, terpenoids, carbohydrates, and amino acids are among the many phytoconstituents found in *Abutilon indicum* leaves. Certain compounds such as quercetin, luteolin, beta-sitosterol, asparagine, gallic acid, and essential oils (such as alpha-pinene and caryophyllene) have also been identified, which contribute to the plant's traditional medicinal uses for anti-inflammatory, antioxidant, and antimicrobial qualities.

2.2 Chemical composition of stem:

Numerous significant phytochemicals, such as alkaloids, flavonoids, tannins, saponins, steroids, and phenolic compounds, are found in the stem of *Abutilon indicum*, often known as Indian marshmallow.

2.3 Chemical composition of roots:

Alkaloids, flavonoids, tannins, saponins, steroids (such as β -sitosterol), carbohydrates (such as fructose, glucose, and galactose), amino acids, phenolic compounds (such as gallic acid, caffeic acid, vanillic acid, and p-hydroxybenzoic acid), fatty acids, cardiac glycosides, and sesquiterpene lactones (alantolactone). These substances support its historical medical applications as an antioxidant, analgesic, and anti-inflammatory.

2.4 Chemical composition of flowers:

Flavonoids, alkaloids, saponins, phenolic acids (caffeic, p-coumaric), steroids (β -sitosterol), essential oils (α -pinene, caryophyllene, elemene), amino acids, carbohydrates, and fatty acids are among the phytochemicals found in *Abutilon indicum* flowers and plant parts that contribute to its traditional medicinal uses for inflammation, antioxidant, and antimicrobial properties. Gossypetin-8-glucoside, cyanidin-3-rutinoside, and many glycosides and triterpenes are important substances that were identified.

3. Anti-inflammatory activity of *Abutilon indicum*:

The body's reaction to an injury is considered to be inflammation. It is the body's defensive response to stop harmful chemicals from spreading. The introduction of novel medicinal plants and the development of safer, more affordable, and more effective analgesics and anti-inflammatory medications are imperative. This study's primary goal is to evaluate the *Abutilon indicum* plant's possible anti-inflammatory properties.

Bovine serum albumin was added to plant samples at higher quantities in accordance with established procedures for the protease inhibition assay. Aspirin, a common anti-inflammatory medication, was employed in this investigation. To determine the statistical significance between the groups, a one-way analysis of variance (ANOVA) and Duncan's multiple range test were used to evaluate the data. Results were deemed statistically significant if the p-value was less than 0.05.

4. Anti oxidant activity of *Abutilon indicum*:

It is possible for the DPPH radical to take up hydrogen from an antioxidant. The decrease in DPPH concentration in the test sample is directly related to the level of antioxidant activity. Ascorbic acid, DPPH (1,1-diphenyl-2-picrylhydrazyl), and *A. indicum* extract are necessary.

Ascorbic acid working solutions with concentrations ranging from 5 µg/mL to 3000 µg/mL were produced. Likewise, working solutions ranging in concentration from 5 µg/mL to 3000 µg/mL were made for the extract and its various fractions. Three milligrams of DPPH were dissolved in one hundred milliliters of methanol to form a DPPH solution. 1 mL of the extract and L-ascorbic acid solutions at different concentrations were combined with 1 mL of a methanolic solution (1 ml of 0.2 mM) of DPPH. A DPPH solution containing one milliliter of methanol was used as a control. For thirty minutes, all of the prepared solutions were left in the dark. A UV spectrophotometer was used to test the absorbance of these solutions at 517 nm, making that the measurements were corrected to less than one. As the hydrogen supplied by the antioxidants lowered the DPPH, the hue changed from purple to yellow.

The following formula was used to calculate plant extracts' ability to scavenge DPPH free radicals: % Inhibition = $[(Ac - As) / Ac] \times 100$, where: As stands for the absorbance of the sample, and Ac for the absorbance of the control. This formula measured the plant extract's antioxidant activity by quantifying how much it inhibited or scavenged DPPH radicals.

5. Anti microbial activity of *Abutilon indicum*:

The bacterial suspension was cultured in Mueller-Hinton broth (HiMedia) for 18–24 hours after being standardized according to CLSI guidelines. The turbidity of the bacterial suspension was then matched to 0.5 McFarland solution ($1-2 \times 10^8$ CFU/mL) by adding sterile saline.

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The agar well diffusion method was used to assess the extracts' antibacterial activity. 100 μ L of the plant extract in its various concentrations (200, 400, and 800 mg/mL) was employed in this investigation. The control was 0.2% chlorhexidine. Three duplicates of the study were conducted.

Using 96-well plates and the microbroth dilution method, the MIC of the aqueous alcoholic extract of *A. indicum* was ascertained. The lowest extract concentration that totally stopped bacterial growth after 48 hours of incubation at 37°C was found to be the extract's minimum inhibitory concentration (MIC). A piece of liquid (5 μ l) from each well that showed no growth was extracted, subcultured, and incubated at 37°C for 24 hours in order to determine MBC. MBC was defined as the lowest concentration that, following subculturing, showed no discernible bacterial growth.

Conclusion

The current study used morphological, powder microscopical, and physicochemical examination to determine the qualitative and quantitative diagnostic characteristics of *A. indicum* fruits. Alcoholic and aqueous extracts are abundant in proteins, carbohydrates, flavonoids, phenols, and saponins, according to phytochemical study.

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A Review of *Annona squamosa*

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Abstract

The custard apple, or *Annona squamosa* L., is a significant tropical fruit grown in the West Indies, South and Central America, Ecuador, Peru, Brazil, India, Mexico, the Bahamas, Bermuda, and Egypt. It is a member of the Annonaceae family. The health benefits of custard apple plant leaves have been investigated and are linked to a wide variety of phytochemicals. These substances include phenol-based substances, such as proanthocyanidins, which are made up of eighteen distinct phenolic chemicals, primarily flavonoids and alkaloids. Anticancer, antidiabetic, antioxidant, antibacterial, antiobesity, lipid-lowering, and hepatoprotective properties are among the biological actions of *Annona squamosa* leaves.

1.Introduction

The tropical, endemic species *Annona squamosa* L. (Annonaceae), commonly referred to as the "custard apple," is found in the West Indies, South and Central America, Ecuador, Peru, Brazil, India, Mexico, the Bahamas, Bermuda, and Egypt. According to the Indian Council of Agricultural Research (ICAR), *Annona squamosa* is widely grown throughout 40,000 hectares of land in several Indian states, including Maharashtra, Gujarat, Madhya Pradesh, Chhattisgarh, Assam, Uttar Pradesh, Bihar, Rajasthan, Andhra Pradesh, and Tamil Nadu. Known for its tasty fruits, *Annona squamosa* begins as a young sapling and grows to a height of 8 meters. Its broad, haphazardly distributed branches have thin leaves and brownish or light brownish bark. 50–80% of the custard apple fruit is edible and may be pulped to make juice, and *Annona squamosa* has been used as a natural remedy and in a variety of other culinary uses. For example, its pulp is used as a flavoring agent in ice cream. It has a notable amount of vitamin C (35–42 mg/100 g), as well as significant levels of potassium, dietary fiber, and vitamin B1 (thiamine).

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Numerous minerals, including phosphorus (P), potassium (K), iron (Fe), calcium (Ca), magnesium (Mg), sodium (Na), copper (Cu), selenium (Se), and zinc (Zn), as well as vitamins A, C (ascorbic acid), E, B1 (thiamine), B2 (riboflavin), B3 (niacin), and B9 (folic acid), are found in significant amounts in *Annona squamosa*. Because they support a number of functions, including the maintenance of healthy teeth and bones, muscle contraction and relaxation, blood coagulation, blood pressure regulation, nerve function, immune system health, energy metabolism, and numerous enzymes, these minerals are necessary for a human body to remain healthy.

Annona squamosa

Kingdom : Plantae
Order : Magnoliales
Family : Annonaceae
Sub Family : Annonoideae
Genus : *Annona*
Species : *Annona squamosa*
Binomial name : *Annona squamosa*

1.1 Leaves

May help manage diabetes and prevent weight gain by increasing insulin sensitivity and lowering blood glucose levels. Traditionally used for infections, lice, and as a vermicide (worm killer), it is effective against bacteria, fungi, and parasites. According to an academic publication, it is applied topically to hasten the healing of wounds, ulcers, and insect bites. This herbal remedies guide and an academic review on the subject state that it is used in teas for constipation, diarrhea, and as a respiratory stimulant for colds and coughs. May preserve liver cells and enhance liver health.

1.2 Fruit

White blood cells are strengthened by vitamin C, which aids in the fight against infection. Magnesium and potassium aid in controlling blood pressure and heart muscle activity. Fiber has possible anti-inflammatory qualities and supports regularity and gut health. Antioxidants shield skin cells, while vitamin A promotes collagen for skin suppleness. The fruit and leaves contain antioxidants that may help regulate blood sugar levels. B vitamins, such as B6,

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and natural sugars promote metabolism and fight weariness. Contains substances that combat inflammation and free radicals, such as flavonoids.

1.3 Root

Used to treat stomach problems, dysentery, and diarrhea. applied to a range of wounds and skin conditions. used in the past to treat snake bites and hernias.

2. Phytoconstituents:

2.1 Chemical composition of Leaves:

Rich in antioxidants, flavonoids, and alkaloids, *Annona squamosa* (Custard Apple) leaves have antidiabetic, anticancer, antimicrobial, and anti-inflammatory qualities. Traditionally used for wounds, fever, dysentery, skin problems, and respiratory issues, they may also protect the liver, help control weight, and improve diabetic conditions.

2.2 Chemical composition of Fruits:

While its bioactive compounds exhibit anti-inflammatory, antidiabetic, antimicrobial, anticancer, and hepatoprotective properties that benefit skin, hair, and brain health, moderation is advised due to natural sugars. Its rich nutrients also boost immunity (Vit C), aid digestion (fiber), support heart health (potassium, magnesium), and provide energy.

2.3 Chemical composition of Roots:

Although research frequently focuses on leaves and seeds, *Annona squamosa* roots is traditionally used to treat conditions like diarrhea, dysentery, and even snake bites. Extracts from the plant have the potential to manage blood sugar (antidiabetic effects), fight microbes, and reduce inflammation. These properties are driven by active compounds like alkaloids and flavonoids.

3. Anti oxidant activity of *Annona squamosa*:

Several in vitro tests were used to measure the antioxidant activity. Using stable 1,1-diphenyl-2-picrylhydrazyl (DPPH) radicals, the free radical scavenging abilities of the three extracts of *A. squamosa* leaves and l-ascorbic acid (vitamin C) were assessed in terms of hydrogen donating or radical scavenging capacity. The Griess reaction was used to estimate the amount of nitric acid produced from sodium nitroprusside. The hydrogen peroxide (H₂O₂) scavenging and reducing power characteristics of *A. squamosa* leaf extracts provided additional evidence of the antioxidant activity.

The following formula was used to determine the percentage of free radical activity scavenging:

$$\% \text{ inhibition} = \frac{(\text{Control} - \text{Test})}{\text{Control}} \times 100$$

3.1 DPPH free radical scavenging activity

The DPPH assay involved adding around 10 μL of various concentrations (10–500 $\mu\text{g}/\text{mL}$) of test sample solutions to 190 μL of DPPH (150 μM) in ethanol solution. After that, the solutions were vortexed and incubated at 37°C for 20 minutes. The solvent by itself was seen as "blank." Ascorbic acid (5–250 $\mu\text{g}/\text{mL}$) was employed as the standard to measure the decrease in absorbance of test mixtures (caused by quenching of DPPH free radicals) at 517 nm.

3.2 Hydrogen peroxide (H₂O₂) scavenging activity

In order to assess the extracts' ability to scavenge hydrogen peroxide (H₂O₂), 0.6 mL of a 40 mM H₂O₂ solution was produced in phosphate buffer (pH 7.4) and combined with 0.1 mL of extracts at varying concentrations (10–500 $\mu\text{g}/\text{mL}$). After ten minutes, the absorbance of hydrogen peroxide at 230 nm was measured in comparison to a blank solution that contained phosphate buffer but no hydrogen peroxide. The reference substance was ascorbic acid (5–250 $\mu\text{g}/\text{mL}$).

3.3 Nitric oxide radical scavenging activity

The Griess reaction was used to determine the amount of nitric oxide (NO) produced from sodium nitroprusside [20]. 3 mL of various concentrations (10–500 $\mu\text{g}/\text{mL}$) of *A. squamosa* extracts were combined with sodium nitroprusside (5 μM) in phosphate-buffered saline, and the mixture was incubated at 25°C for 150 minutes. The Griess reagent (1% sulfanilamide and 0.1% naphthyl ethylenediamine dihydrochloride in 2% H₃PO₄) was then added to the samples and allowed to react. At 546 nm, the chromophore's absorbance was determined during the diazotization of nitrite with sulfanilamide and subsequent coupling with naphthyl ethylenediamine. L-ascorbic acid (5–250 $\mu\text{g}/\text{mL}$) was utilized as the positive control, and a similar process was repeated using the appropriate solvent in place of the extract. Every test was run in triplicate.

4. Anti microbial & antifungal activity of *Annona squamosa*:

Since humans have relied on bacterial and fungal sources for these activities, only a small percentage of the 25% to 50% of all medications issued in the United States that have higher-plant origins are meant to be used as

antimicrobials. There is an urgent need for novel antimicrobial and antifungal medications due to the deteriorating state of clinical antibiotic resistance in bacteria and fungi. The antibacterial properties of various *A. squamosa* leaf extracts were tested against two Gram-positive and two Gram-negative bacteria. According to the screening results, methanolic extract exhibited the strongest inhibition against *Escherichia coli* (IC₅₀: 180 µg/mL) and *Pseudomonas aeruginosa* (IC₅₀: 130 µg/mL). All investigated bacterial strains responded favorably to various fruit extracts. Compared to Gram-positive bacteria, these extracts were more effective against Gram-negative bacteria.

Methanol, chloroform, and aqueous extracts of *A. squamosa* leaves were tested using the agar well diffusion method against five different fungus strains: *Alternaria alternate*, *Candida albicans*, *Fusarium solani*, *Microsporum canis*, and *Aspergillus niger*. In the meantime, the lowest inhibitory doses of several extracts were identified. The strongest inhibitory efficacy was demonstrated by the methanolic extracts. According to reports, fresh fruit extracts have promising antifungal qualities. Three ACGs were separated as a result of a bio-assessed guidance study on seeds. Every isolated component exhibited dose-dependent activity against *P. infestans* sporangium and zoospore germination.

Conclusion

Annona squamosa is a complete food and natural remedy since it provides both humans and animals with great nutritional value, including protein, fiber, carbs, and vitamins. High concentrations of terpenes and sesquiterpenoids, as well as the chemical profile of several substances that primarily produce essential oil, are present in it. Glycosides, phytosterols, proteins, carbohydrates, saponins, tannins, alkaloids, phenols, flavonoids, peptides, and acetogenins are some examples of phytochemicals. Numerous bioactivities of extracts, such as anticancer, antidiabetic, antioxidant, hepatoprotective, antibacterial, and lipid-lowering properties, are attributed to these substances. The phytochemical and pharmacological actions make them a necessary and essential component for natural medicine, immune boosters, and health-promoting substances. Phytochemical profiles have been the subject of numerous investigations, although little is known about the presence of proteins, lipids, and carbohydrates.

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A Review of *Cymbopogon citratus*

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Abstract

Lemon grass, or *Cymbopogon citratus*, Stapf, is a popular herb in tropical nations, particularly in Southeast Asia. Aromatherapy makes use of the plant's essential oil. The Greek term "Kymbe-Pogon," which translates to "boat-beard," is where the word "Cymbopogon" originates. Lemon grass, or *Cymbopogon citratus*, Stapf, is a common herb in tropical countries, especially in Southeast Asia. One of this grass's distinctive qualities is its strong lemon aroma, which is caused by the significant amount of citral in its oil. Terpenes, alcohols, ketones, aldehydes, and esters are the primary chemicals found in *Cymbopogon citratus*. Numerous pharmacological activity, including anti-amoebic, antibacterial, antidiarrheal, antifilarial, antifungal, and anti-inflammatory qualities, have been reported for *Cymbopogon citratus*.

1. Introduction

Lemongrass (*Cymbopogon citratus*) is commonly referred to as citronella and is known for its various applications. Belonging to the Gramineae family, its Greek name translates to 'kyme-pogon,' meaning boat-beard. Various communities utilize it as a natural treatment for serious ailments such as hypertension, inflammation, and diabetes. Citronella has gained significant interest due to its wide array of pharmacological properties. Researchers acknowledge its significance in the food, nutraceutical, and cosmetic sectors as a rich source of bioactive compounds.

Flavonoids, recognized as a fascinating category of bioactive compounds found in medicinal plants, offer numerous health advantages such as antioxidant, antiproliferative, antimicrobial, and antimetabolic disorder effects, and are highly concentrated in lemongrass. About 55 species make up the genus *Cymbopogon*, which is native to tropical and semi-tropical regions of Asia and is grown in South and Central America, Africa, and other tropical nations. These are tufted perennial C4 grasses that can be used fresh or dried and powdered. They have a citrus flavor and many stiff stems that grow from a short, rhizomatous rootstock [1–2]. In reference to the flower spike

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arrangement, the name Cymbopogon is derived from the Greek words "kymbe" (boat) and "pogon" (beard).

Lemongrass is a tall, fragrant perennial grass that has been introduced and naturalized all over the world. It is mostly grown in tropical and subtropical areas, especially in South and Southeast Asia. In India, the southern states of Kerala, Karnataka, and Tamil Nadu, as well as portions of Uttar Pradesh, Uttarakhand, and Assam in the north and northeast, are where most cultivation takes place. Warm, humid weather with lots of sunshine and rainfall (250–330 cm per year, uniformly distributed) is ideal for its growth. Although it can thrive at higher elevations in Kerala on poor soils, ideal temperatures are between 20 to 30°C, and elevations between sea level and 900m are appropriate. Assam, Tamil Nadu, Kerala, Karnataka, and portions of Uttar Pradesh and Uttarakhand. Western India is the primary location for the cultivation of East Indian lemongrass (*Cymbopogon flexuosus*). It has spread throughout the world's tropics and subtropics, including South America and Central America, after being introduced.

Cymbopogon citratus

Kingdom : Plantae
Order : Poales
Family : Poaceae
Sub Family : Panicoideae
Genus : *Cymbopogon*
Species : *Cymbopogon citratus*
Binomial name : *Cymbopogon citratus*

1.1 Leaves :

Packed with anti-inflammatory and antioxidant ingredients (phenolic compounds, flavonoids), it helps fight oxidative stress and chronic inflammation. reduces bloating, aids with digestive problems, and may have anti-diarrheal qualities. Minerals and vitamins C and A strengthen the immune system, preventing infections, colds, and the flu. may aid in blood pressure reduction and cholesterol management. Anti-inflammatory qualities, which are frequently administered topically (diluted) or ingested, can reduce physical pain and swelling. has antibacterial and antifungal qualities, making it beneficial for infections and skin conditions like dandruff. assists in weight loss by acting as a diuretic, assisting in the removal of toxins, and increasing

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metabolism may enhance mood and reduce anxiety. contains folic acid, iron, and zinc, which may help produce red blood cells, but further study is required.

1.2 Stem :

Aids in indigestion, gastrointestinal issues, and stomach spasms. lowers body temperature and alleviates cold symptoms by causing perspiration. When applied as an ointment or breathed, it lessens headaches, migraines, and rheumatic joint pain. contains substances used to treat illnesses like ringworm that combat fungus and bacteria. benefits ailments like arthritis by reducing inflammation. The oil used in aromatherapy reduces anxiety and fights weariness. abundant in antioxidants that promote general health and shield cells. may aid with blood sugar and cholesterol management. applied directly on lice, athlete's foot, and skin complexion. widely used as a flavoring in foods, drinks, and teas.

2. Phytoconstituents:

2.1 Chemical composition of Leaves:

The antioxidant, anti-inflammatory, and antimicrobial properties of *Cymbopogon citratus* are attributed to its abundance of phytoconstituents, which include essential oils (citral, geraniol, and limonene), flavonoids (luteolin, apigenin), phenolic compounds (chlorogenic acid, quercetin), terpenoids, alkaloids, saponins, tannins, and steroids. Citral is a significant active ingredient in its oil.

2.2 Chemical composition of stem:

The stems of the lemongrass, *Cymbopogon citratus*, are abundant in healthy phytoconstituents, mainly essential oils that contain citral (geraniol & neral), citronellal, geraniol, and nerol. These compounds give the plant its lemony aroma and have antibacterial, anti-inflammatory, and antioxidant properties. Along with minerals like potassium, iron, and zinc, other important components that contribute to its many culinary and therapeutic applications include flavonoids, phenols, tannins, saponins, alkaloids, sterols, ketones, and sugars.

3. Anti bacterial activity of *Cymbopogon citratus*:

A 5×10^5 CFU/mL was obtained by comparing a suspension of each tested microorganism to the McFarland standard, 0.5. Using sterile cotton swabs and the lawning technique, about 50 μ L of the diluted bacterial suspension was applied to Mueller-Hinton agar plates. The plates were then left to dry for ten minutes. A sterile micropipette tip was used to puncture a well

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with a diameter of 6 mm in the center of each of the four quadrants on each agar plate. Each well in the quadrants received between 100 and 200 μ L of plant extract. Following an overnight incubation at 37°C, the diameter (mm) of the ensuing zone of inhibition was determined. To get more precise findings, the agar well diffusion assay was run in triplicate.

4. GCMS Results of *Cymbopogon citratus*:

Using the Thermo GC-Trace Ultra Version: 5.0, Thermo MS DSQ II, GC-MS analysis of the whole plant extract of *Cymbopogon citratus* was carried out. A DB 35-MS Capillary Standard non-polar column, measuring 30 mm \times 0.25 mm ID \times 0.25 μ m film, is part of the apparatus. Helium is utilized as the carrier gas at a low rate of 1.0 ml/min. The oven temperature was set to 60 °C for 15 minutes and then progressively raised to 280 °C at 3 minutes, while the injector was run at 250 °C. The Willey and NIST libraries were used to identify the components, and their retention indices were compared. The GC-MS equipment was used to identify the constituents, and the findings have been summarized.

Peak	R.Time	Area	Area%	Height	Name
1	.236	142055944	.01	310862	Neric acid
2	.531	108779701	.07	726043	Hexadecanoic acid
3	.303	101269533	.86	1083900	Epoxy-linalooxide
4	.331	90217010	.55	926742	Oleic acid
5	.573	86184884	.43	64512	cyclo[4.1.0]heptan-2-ol,3,7,7-trimethyl(1-alpha,2-alpha,3-alpha)

The above column shows the peak values obtained in the GC-MS results and these compounds can be further studied for their molecular toxicity.

Conclusion

Originally from South India and Sri Lanka, *Cymbopogon citratus* is now widely grown in tropical regions of Asia and America. It contains a variety of phytoconstituents, including terpenoids, flavonoids, phenolic compounds, and essential oils, which may be in charge of the varied biological functions. As a result, we are able to separate a few pure phytopharmaceuticals,

which can then be utilized as lead compounds to create new drugs with potent therapeutic effects. Standardization of extracts, phytopharmacology of various extracts, isolation and characterization of active phytopharmaceuticals, clarification of the mechanism of action of the isolated compounds, and clinical trials of the compounds are all critical to the development of high-quality herbal medicine.

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A Review of *Gymnema sylvestre*

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Abstract

Gymnema sylvestre (Asclepiadaceae), a well-known herb in the Ayurvedic medical system, is referred to as "gurmar" due to its unique ability to breakdown sugar. Among the phytoconstituents that exhibit sweet suppressing activity are gurmarin, a polypeptide, and triterpene saponins called gymnemic acids and gymnemasaponins. In addition to being used for arthritis, diuretics, anemia, osteoporosis, hypercholesterolemia, cardiopathy, asthma, constipation, microbial infections, indigestion, and anti-inflammatory properties, the plant has a wide variety of therapeutic effects and is a good natural treatment for diabetes. Because it improves blood sugar homeostasis, reduces sugar cravings, and encourages pancreatic regeneration, *G. sylvestre* holds promise for the treatment of diabetes. Because the herbal extract lowers blood cholesterol, triglyceride, and body weight and has promising dietary and pharmacological uses, it is employed in dietary supplements.

1.Introduction

With its ethnobotanical applications and phytochemistry, which focuses on a thorough investigation of its phytochemicals and their bioactivities, *Gymnema sylvestre* is a rare herb with noteworthy medicinal qualities. In keeping with current pharmacological and medication development trends, it also examines the facts and potential for its evolution into a modern and effective therapy. In addition, it is a common treatment for many other illnesses and has promising potential for major health issues like obesity, osteoporosis, asthma, and cardiovascular disorders. In addition to regulating sugar homeostasis, the herb is used extensively in a variety of culinary preparations to manage blood cholesterol and obesity. These days, *G. sylvestre* herbal formulations are utilized in tea bags, beverages, confections, and health tablets and supplements.

G. sylvestre is a native herb that is a member of the Asclepiadaceae family's dicotyledonous class. Numerous bioactive compounds can be found in

the plant [8]. It has a long history and is one of the main botanicals used in the Ayurvedic medical system to cure a variety of ailments, from snakebites to diabetes and malaria [9]. Chigengteng, also known as Australian cowplant, Waldschlinge in German, and periploca of the woods in English, is a herb that is grown all over the world.

Natural substances found in a wide variety of plants, saponins are glycosides made up of steroidal aglycones or triterpenoids; the aglycones are referred to as sapogenins. Numerous saponins originating from plants, including ginsenosides, soyasaponins, and saikosaponins, have been shown to have strong anticancer properties. Additionally, certain saponins exhibit pharmacological characteristics, such as anticancer, adjuvant hemolytic, and anticholesterolemic effects. Additionally, it was discovered that diets derived from plants with higher levels of triterpenes are believed to decrease cholesterol. Transgenic plants with changed triterpene levels may be more pest-resistant, while plants with higher saponin content will have better nutritional value.

Tropical and subtropical areas are home to the plant, which is widely dispersed in sections of southern and central India, southern China, tropical Africa, Malaysia, and Sri Lanka. *G. sylvestre* is a slow-growing herb that grows best in humid tropical and subtropical climates and is frequently found on evergreen forest hills. Being a climber, it usually needs assistance to grow. November through December is when the seeds are sown, and September through February is when they are harvested. Because seed germination is challenging due to the low viability of the seeds, root cuttings—which are typically planted in June and July—have become the alternative. Terminal cuttings with three or four nodes are often planted in February or March and have also been utilized for vegetative propagation. Inflorescence is lateral umbel in cymes; follicles are terete and lanceolate, up to 3 inches in height; leaves are opposite, typically elliptic or ovate (1.25–2.0 inch x 0.5–1.25 inch). The corolla has five fleshy scales, is valvate, campanulate, and pale yellow in color. Long, oval, obtuse, and hairy are the calyx lobes. There may be two unilocular carpels, ovule locules, and anther connective tissue developed into a membrane tip.

Gymnema sylvestre

Kingdom	:	Plantae
Order	:	Gentianales
Family	:	Apocynaceae
Sub Family	:	Asclepiadoideae
Genus	:	Gymnema
Species	:	Gymnema sylvestre
Binomial name	:	Gymnema sylvestre

1.1 Leaves :

Aids in managing diabetes by lowering the absorption of sugar and perhaps raising the production of insulin, which helps control blood glucose. Gymnemic acids reduce the desire for sugar by blocking sweet taste receptors.

reduces sugar cravings, suppresses appetite, and may even prevent the absorption of fat, all of which aid in weight loss. may reduce the risk of heart disease by lowering "bad" LDL cholesterol and triglycerides. Because it supports digestive enzymes and has modest laxative effects, it is used to treat constipation, indigestion, and piles (hemorrhoids). has antibacterial, anti-inflammatory, and antioxidant properties that help with infections and arthritis.

Respiratory & Other Uses: Traditionally used to treat urinary tract issues, bronchitis, and asthma.

1.2 Stem :

May improve insulin sensitivity and production, which may help control diabetes and reduce blood sugar. Gymnemic acids can lessen the appetite for sweets by momentarily blocking the tongue's sugar receptors. can aid in improving lipid profiles (increasing good cholesterol, lowering bad cholesterol/triglycerides) and preventing the absorption of fat. Flavonoids and other substances help with metabolic syndrome and arthritis by reducing inflammation and combating oxidative stress. used historically to treat liver problems such jaundice, dyspepsia, and constipation. has the ability to aid with fatty liver and has hepatoprotective (liver-protecting) qualities. shows promise against *Staphylococcus aureus* and other germs.

1.3 Root :

Helps treat diabetes by improving insulin sensitivity, increasing insulin production, and decreasing the gut's absorption of sugar. Gymnemic acid suppresses the taste of sweets, which lowers cravings and aids with appetite regulation. may improve weight loss by lowering lipid (cholesterol/triglyceride) levels and reducing the absorption of fat. has anti-inflammatory qualities for pain and long-term ailments and antioxidants that combat oxidative stress. has the potential to improve heart health by protecting the liver and lowering cholesterol and triglyceride levels. helps eliminate excess fluids and salt, acts as a mild laxative, and aids with digesting (dyspepsia). possesses antifungal and antibacterial qualities that help protect skin and combat some illnesses.

2. Phytoconstituents:

2.1 Chemical composition of Leaves:

Gymnema sylvestre's well-known "sugar-destroying" and anti-diabetic qualities come from its abundance of bioactive chemicals, mainly triterpene saponins such as gymnemic acids (A-D) and gymnemasaponins, which block sweet taste receptors and prevent the absorption of glucose. The polypeptide gurmamin, flavones, anthraquinones, organic acids (butyric, formic, and tartaric), resins, stigmasterol, chlorophyll, and minerals including calcium and magnesium are some of the other important components.

2.2 Chemical composition of stem:

In addition to other compounds like anthraquinones, flavonoids, steroids (stigmasterol), resins, and organic acids (tartaric, formic, butyric), the stems of *Gymnema sylvestre* contain a variety of phytochemicals, mainly gymnemic acids (triterpene saponins) and gymnemasaponins, which give it anti-diabetic and anti-sweetening properties. These compounds all contribute to the plant's traditional medicinal uses, which include glucose regulation, anti-inflammatory, and antimicrobial effects.

2.3 Chemical composition of roots:

Gymnemic acids (triterpene saponins) and gymnemasaponins, the main bioactive substances found in *Gymnema sylvestre* roots, are what provide the plant its well-known anti-sweet and anti-diabetic qualities by inhibiting sugar receptors and encouraging the release of insulin. Gymnemagenin, quereitol, betaine, choline, flavonoids, steroids, terpenoids, and alkaloids are additional important constituents that contribute to its anti-inflammatory, antioxidant, and

other medicinal properties, along with the polypeptide gurmarin, which also inhibits sweetness.

3. Anti oxidant activity of *Gymnema sylvestre*:

Using the agar well diffusion experiment, the antimicrobial activity of the *G. sylvestre* leaf extracts—aqueous, methanol, chloroform, and hexane—was assessed. Sterilized petri dishes were filled with around 20 mL of cooled and molten medium. To look for any signs of contamination, the plates were kept at room temperature for the whole night. For twenty-four hours, the test organisms were cultivated in broth. Lawns were prepared using a 100 mL broth culture of each test organism. A sterile stainless steel cork borer was used to create agar wells with a diameter of 5 mm. The agar plates were divided into five wells.

The wells were labeled A, B, C, D, and E. 10L of aqueous leaf extracts were placed in well "A," 10 μ L of methanol leaf extracts in well "B," 10 μ L of chloroform leaf extracts in well "C," 10 μ L of hexane leaf extracts in well "D," and positive control drugs in well "E." As positive controls, a variety of fungicides and bactericides were employed. At 37°C, the plates with the organisms and leaf extracts were incubated. The plates were checked for zones of inhibition, which show up as a transparent region surrounding the wells. A meter ruler was used to measure the diameter of these zones of inhibition, and the mean value for each organism was noted and converted to millimeters.

4. GCMS analysis of *Gymnema sylvestre*:

A number of *G. sylvestre* solvent extracts were analyzed using GC-MS. A gas chromatography–mass spectrometry (GC-MS) device, specifically the GCMS-QP2010S type, equipped with a fused silica column, was used to conduct the analysis. Helium was used as the carrier gas for the separation process, and its flow rate was kept constant at 1 mL/min. Using a split injector, 1 μ L of *G. sylvestre* ethyl acetate extract was injected into the device. The injector temperature was set to 260°C, and the column's starting temperature was fixed at 80°C. The temperature was gradually increased during the experiment at a pace of 10°C per minute. Column flow rate of 1.00 mL/min, pressure maintained at 65.0 kPa, linear velocity of 36.8 cm/s, total flow rate of 24.0 mL/min, and purge flow rate of 3.0 mL/min were the precise parameters used. By validating relative retention time and mass spectra comparisons with the standard compounds, the identity of the plant extract's main constituents was verified

Conclusion

The ancient Ayurvedic medical system was based on medicinal plants. Herbal remedies are currently becoming more popular in pharmacological applications and as molecular targets for drug development. Humanity is seriously threatened by the growing trend of disease incidence and the problems that come with using commercial drugs. Numerous bioactive substances, including atropine, opium alkaloids, quinine, paclitaxel, alkaloids, and cardiac glycosides (digitalis, ouabain), are found in plants. A viable substitute for producing useful secondary metabolites is the in vitro multiplication of plants in plant tissue culture. As a significant medicinal plant and source of bioactive compounds, *G. sylvestre* requires conservation and propagation. The large-scale generation of such secondary metabolites with medicinal value by cell culture methods and in vitro multiplication of plants with high bioactive content would be highly promising and provide new dimensions to this field of study.

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A Review of *Punica granatum* L

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Abstract

Pomegranates (*Punica granatum* L.) have been used medicinally for a very long time. *Punica granatum* L. and *Punica protopunicas*. The review discusses the pomegranate's botanical characteristics, phytochemical makeup, and several therapeutic uses, such as its antibacterial, anti-inflammatory, and antioxidant qualities. The information gained highlights the potential advantages of chemicals derived from pomegranates in the treatment of various medical conditions. This review clarifies the significance of pomegranates as a useful natural resource for a range of therapeutic approaches and promotes more study to realize their full healing potential. Traditional medicine is becoming more and more popular as a means of helping people regain their health with little side effects. It has several therapeutic uses since it contains important phytochemical components such flavonoids, punic acid, ellagic acid, anthocyanins, ellagitannins, flavones, and estrogenic flavonoids.

1.Introduction

Grown all throughout the world, *Punica granatum* L. is a perishable super fruit. The *P. granatum* plant is indigenous to the Mediterranean region and is classified as a shrub or small tree. The fruit tree, which is planted as a hedge in South Africa, draws a lot of blue birds in the winter and fall. Because of its adaptable nature, *P. granatum* is an alien plant that can thrive in any area where it is planted. Pomegranate, or *P. granatum*, is a plant in the genus *Punica*, which is a member of the family Lythraceae (formerly Punicaceae). *P. granatum* is usually described to as "granaat," "granaatappel," or "bloomgranaat" in Afrikaans in South Africa, "kgarenate" in Sesotho, and "pomegranate" in English.

Numerous bioactive chemicals, as well as nutritional and medicinal benefits, are present in the pomegranate plant and its fruit juice. The plant is useful for its peels, seeds, seed oils, roots, trunk (barks), wood spout, leaves, flowers, and fruit rinds, considering the range of uses for which it has been described. The pomegranate's adaptability allows it to be gathered in many

places and given numerous names. Numerous pomegranates have been documented from Asian nations like China, Georgia, and Afghanistan.

The seeds are used to increase male fertility and treat a number of illnesses, including as diabetes, obesity, cancer, and heart disease. Pomegranates are also used to make cosmetics, such as anti-dandruff creams. Pomegranate plant also possesses anti-inflammatory, anti-ulcer, anti-depressant, diuretic, cardio-protective, antidiarrheal, antioxidant, anti-obesity, and anti-diabetic qualities, according to reports. The ethnomedical applications, pharmacological properties, phytochemistry, and molecular mechanisms of *Punica granatum* L. are compiled and updated in this review paper. This information will be crucial in the future when it comes to drug research and the creation of innovative natural medications to treat a range of illnesses.

Peels of pomegranates are distinguished by their hard pericarp shield, which, when ripe, retains its orange and greenish hue. A thin membrane inside the peel separates the arils, which are covered by the peel. Pomegranate peels comprise 43 percent of the fruit. Peel extracts have long been used as ruminant feed, to treat diarrhea and ulcers, and to prevent the replication of ribonucleic acid (RNA). Pomegranate peels have been found to have a variety of medicinal qualities, including as anti-inflammatory, anti-proliferative, and anti-cancer benefits. Antioxidant properties against breast cancer were studied in fruit peels. Additionally, pomegranate peels contain more than 48 different chemical constituents, including sterols, terpenes, phenolics, alkaloids, anthocyanins, anthocyanidins, tannins, flavonoids, xanthonoids, and proanthocyanidins.

Punica granatum

Kingdom : Plantae
Order : Myrtales
Family : Lythraceae
Sub Family : Punicoideae
Genus : Punica
Species : Punica granatum
Binomial name : Punica granatum

1.1 Fruit peel :

Rich in polyphenols, it protects cells from damage by neutralizing free radicals, which may decrease aging and lower the risk of chronic diseases.

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reduces inflammation and risk factors like hypertension, which helps to improve heart health by lowering blood pressure, cholesterol, and triglycerides.

Bioactive substances reduce inflammation, which helps with allergies and arthritis. Extracts provide skin protection (e.g., against UV rays) and hasten wound healing. Traditionally used for infections and diarrhea, it is effective against a variety of harmful bacteria. may support weight management by controlling blood sugar and fat formation. Traditionally, it has been used to treat constipation (as a purgative), indigestion, and to enhance gut flora. may enhance memory and learning to fight degenerative disorders like Alzheimer's. beneficial for a number of oral conditions, including hyperpigmentation and acne.

1.2 Fruit :

Decreases bad LDL cholesterol, raises good HDL cholesterol, lowers blood pressure, and stops artery plaque accumulation. has strong antioxidants (anthocyanins, punicalagins) that fight oxidative stress; the juice's antioxidant capacity frequently outperforms that of red wine and green tea.

combats inflammation in the body, which is advantageous for ailments like arthritis and overall metabolic health. may aid in the fight against breast and prostate cancers by preventing the development of cancer cells. benefits diabetes and obese people by functioning as a prebiotic that helps control blood sugar, insulin resistance, and intestinal health. can improve cognitive performance and memory. strengthens defenses against bacterial and fungal infections. may increase muscle strength, enhance exercise performance, and slow down aging by supporting mitochondria.

1.3 Leaves:

Rich in polyphenols, they protect cells by scavenging free radicals and lowering oxidative stress. aid in the fight against inflammation, which is advantageous for ailments like immunological diseases and osteoarthritis. alleviate indigestion and diarrhea, enhance gut flora, and calm the stomach. possess antifungal and antibacterial qualities that are beneficial for oral health and infections. reduce blood pressure, enhance lipid profiles, and help control blood glucose. Eczema can be treated using a paste, and extracts have anti-aging and healing properties. When combined with tulsī, pomegranate leaf tea can help soothe coughs and encourage sleep.

2. Phytoconstituents:

2.1 Chemical composition of Fruit peel:

Pomegranate peel, or *Punica granatum*, is high in antioxidants, polyphenols (such as ellagic acid and punicalagins), and fiber. It fights oxidative stress, lowers inflammation, and protects heart and brain health. It has also been used traditionally for wound healing, digestion, and antimicrobial properties, though many of these claims require larger human studies.

2.2 Chemical composition of fruit:

Due to its abundance of antioxidants, anti-inflammatory substances (such as polyphenols and ellagitannins), vitamins C and K, and minerals, *Punica granatum* (pomegranate) fruit has many health benefits. These include lowering blood pressure, improving heart health, preventing cancer, aiding digestion, supporting brain function, and possibly improving exercise performance.

2.3 Chemical composition of leaves:

Pomegranate leaves, or *Punica granatum*, are abundant in antioxidants, phenolic compounds, flavonoids, and tannins. They have anti-inflammatory, antimicrobial, and antioxidant properties and have been used traditionally to treat eczema, digestive problems, coughs, and infections. Research has shown that they may also help manage diabetes, cancer, and cardiovascular health by lowering inflammation and preventing oxidative stress.

3. Anti fungal & anti bacterial activity of *Punica granatum*:

Numerous pharmacological actions, such as antifungal and antibacterial qualities, are linked to *P. granatum*. Gram-positive and gram-negative bacterial strains, including *Candida albicans*, *Pseudomonas aeruginosa*, *Salmonella enteritidis*, *Escherichia coli*, *Staphylococcus epidermidis*, *Staphylococcus xylosum*, *Staphylococcus aureus*, *Bacillus cereus*, and *Lactobacillus sakei* ssp. *Sakei*, *Enterococcus faecium*, *Enterococcus faecalis*, *Enterococcus mundtii*, *Enterococcus sulfureus*, *Lactobacillus plantarum*, *Pediococcus acidilactici*, *Enterococcus casseliflavus*, and *Enterococcus columbae*

An ethanol powdered peel extract has more antimicrobial qualities than aqueous, hydroethanolic, acetone, and heptane peel extracts against gram-positive and gram-negative bacterial species, *Pseudomonas aeruginosa*, and *Staphylococcus epidermidis*, according to research on the microbial activities of the *P. granatum* plant using an agar diffusion assay. An aqueous peel extract was shown to have effective antibacterial capabilities against *Escherichia coli*

using a broth micro-dilution method. The observation showed that bacterial growth was suppressed and decreased as the extract concentration increased.

4.1 Anti oxidant activity of *Punica granatum* using DPPH:

The DPPH (2,2-diphenyl-1-picrylhydrazyl) assay measures the antioxidant activity that stops lipid peroxidation by measuring the DPPH radical's ability to scavenge. With minor adjustments, the DPPH test, which is based on Zhang et al.'s methodology, was used to assess the free-radical scavenging capabilities of PPPE and PAPE. Every day, a 0.06 mM DPPH in methanol solution was made. 50 μ L of PPPE or PAPE (0–0.4 mg/mL) was combined with this solution (2 mL). For half an hour, the mixture was allowed to sit at room temperature in the dark. At 517 nm, the absorbance reduction was observed. The following formula was used to determine the percentage of inhibition:

$$\text{Inhibition} = [(A_0 - AS)/A_0] \times 100$$

where AS is the absorbance of the test compound and A0 is the absorbance of the control reaction, which contains all the reagents except the test compound. The positive control was ascorbic acid.

The graph showing scavenging activity against extract concentrations was used to determine the half-maximal extract concentration (IC₅₀). Every experiment was carried out three times.

4.2 Anti oxidant activity of *Punica granatum* using hydrogen peroxide:

Ruch et al.'s approach was used to assess PPPE and PAPE's capacity to scavenge H₂O₂. By measuring the absorbance at 230 nm, the concentration of the 40 mM H₂O₂ solution made in 50 mM phosphate buffer (pH 7.4) was ascertained. After 30 minutes, the assay mixture's absorption was measured against a blank solution that contained phosphate buffer without H₂O₂ and 500 μ L of varying concentrations of PPPE, PAPE, or a standard ascorbic acid solution (0–200 μ g/mL) along with 1 mL of H₂O₂. The following formula was used to determine the proportion of H₂O₂ scavenged:

$$\text{H}_2\text{O}_2 \text{ scavenged (\%)} = [(OD_{\text{control}} - OD_{\text{test}})/OD_{\text{control}}] \times 100$$

5. Conclusion:

Pomegranates have long been used as a source of herbal remedies and natural medications. The role of medicine has gradually grown all across the world. Nowadays, it is common practice to use plant components or chemical

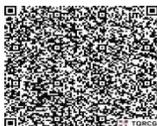
compounds to make pharmaceuticals and nutraceuticals. The purpose of this review is to clarify the medicinal qualities of the *Punica granatum* plant and the development of traditional remedies into modern medicine. *Punica granatum* possesses potent antioxidant qualities. This fruit is rich in punicic acid, alkaloids, ellagitannins, sucrose, anthocyanins, fructose, light organic acids, and other minerals. *Punica granatum*'s genetic composition determines how many soluble nutrients it contains and how it is digested, which helps it draw in its advantageous effects.

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A Review of *Rosmarinus officinalis*.L

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Abstract

The Mediterranean Sea and sub-Himalayan regions are home to the evergreen bushy plant known as rosemary (*Rosmarinus officinalis* L.). In traditional medicine, it has been used as a moderate analgesic and antispasmodic to treat mental anguish, depression, headaches, migraines, sleeplessness, and intercostal neuralgia. The neuropharmacological characteristics of rosemary have been the focus of several studies. It has important antibacterial, anti-inflammatory, anti-oxidant, anti-apoptotic, anti-tumorigenic, antinociceptive, and neuroprotective properties. Significant clinical effects on mood, learning, memory, pain, anxiety, and sleep are also demonstrated. The medicinal qualities of this plant, including carnosic acid, carnosol, rosmarinic acid, and the essential oil, have drawn further attention, according to these references.

1. Introduction

An aromatic member of the Lamiaceae family, *Rosmarinus officinalis*, L. is native to the Mediterranean region. One of the main importers and processors of rosemary is the province of Murcia in southeast Spain. Rosemary is a special spice that is sold commercially as an antioxidant in both the US and Europe. Extracts from rosemary have been used to treat a variety of illnesses because of their antiangiogenic, hepatoprotective, and Alzheimer's disease-treating properties. However, because they stop oxidation and microbiological contamination, they have been utilized in food preservation. As a result, rosemary extract may be able to reduce or even replace artificial antioxidants in food. Rosemary extracts provide a number of technological and consumer benefits as preservatives.

The search for "clean label products" is necessary since customers are worried about the harmful effects of artificial chemicals in food. Because of (a) their synergy with other preservation techniques, (b) their perceived safety, and (c) their unique qualities as antioxidants, antidiabetic, antimutagenic, antitoxigenic, and antibacterial, there is a growing interest in using natural extracts as substitutes for synthetic additives. Rosemary leaves serve as a

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flavorful addition to dishes, and the leaves can also be brewed into teas or utilized as extracts in beverages and flavorings. The significance of rosemary and its derivatives lies in the numerous health advantages offered by this natural ingredient in culinary practices. Research that has been published supports rosemary's role as an antioxidant in food and confirms the health benefits associated with rosemary and its products. Rosemary extracts find extensive applications in the food, pharmaceutical, and cosmetics sectors. It is an essential herb for promoting human health and ensuring food safety, as it acts as an effective preservative.

Rosmarinus officinalis.L

Kingdom : Plantae
Class : Magnoliopsida
Family : Lamiaceae
Sub Family : Nepetoideae
Genus : Rosmarinus
Species : Rosmarinus officinalis.L
Binomial name : Rosmarinus officinalis.L

1.1 Leaves :

The fragrant, needle-like evergreen leaves of *Rosmarinus officinalis*, a Mediterranean shrub, are used in cooking, cosmetics, and traditional medicine for their anti-inflammatory, antimicrobial, and neuroprotective qualities. They contain compounds like carnosic acid and rosmarinic acid that improve memory, digestion, and food preservation. The fragrant volatile essential oils give it a strong scent.

1.2 Stem :

The woody, square, and fragrant stems of *Rosmarinus officinalis* (rosemary) produce fragrant essential oils that are used in cooking, aromatherapy, and traditional medicine for their anti-inflammatory and antioxidant qualities. Fresh, young shoots or woody parts are usually harvested for distillation, necessitating pruning for bushier growth.

1.3 Root :

The roots of *Rosmarinus officinalis*, or rosemary, form a fibrous system that supports the fragrant evergreen shrub. The plant is most prized for its leaves and extracts in culinary, medicinal (antioxidant, anti-inflammatory), and cosmetic applications; however, root rot can be a serious disease, and propagation frequently involves cuttings that quickly develop roots.

2. Phytoconstituents:

2.1 Chemical composition of Leaves:

The bioactive chemicals found in *Rosmarinus officinalis* (rosemary) leaves are rich in essential oils, phenolic diterpenes (carnosic acid, carnosol), and acids (rosmarinic acid, ursolic acid). These molecules vary depending on the location and growth conditions of the plant but are responsible for its antibacterial and antioxidant qualities. The oil's hydrocarbons and oxygenated monoterpenes (cineole, camphor) are important constituents, and extracts produce strong antioxidants including rosmarinic acid and carnosic acid in addition to flavonoids and other acids.

2.2 Chemical composition of stem:

The chemical composition of *Rosmarinus officinalis* (rosemary) stems is rich in terpenes, especially monoterpenes. Major compounds in essential oils frequently include 1,8-cineole, α -pinene, and camphor, along with other advantageous compounds like carnosic acid, rosmarinic acid, and ursolic acid, which contribute to its strong antioxidant and antimicrobial properties, though specific content varies depending on growing conditions.

2.3 Chemical composition of roots:

Similar to its leaves, the roots of *Rosmarinus officinalis* (rosemary) are rich in monoterpenes and oxygenated monoterpenoids, with major compounds frequently including 1,8-cineole (eucalyptol), α -pinene, camphor, and borneol. However, the composition varies greatly by region, climate, and plant part, and contains a variety of hydrocarbons, alcohols, ketones, and fatty acids like n-hexadecanoic acid, which have significant antimicrobial and antimicrobial potential.

3. Anti oxidant activity of *Rosmarinus officinalis*.L:

Antioxidants are essential for the prevention and management of oxidative damage-related illnesses, such as cancer, heart disease, and neurological disorders. Living things invariably produce reactive oxygen species, such as hydrogen peroxide, and free radicals, such as superoxide anion ($O_2^{\bullet-}$) and hydroxyl radical (HO^{\bullet}), as a result of internal metabolic processes or external sources. In biological systems, prolonged exposure to free radicals can result in aging, cell death, and structural and functional damage.

The antioxidant activity of the primary chemicals extracted from rosemary—carnosol, carnosic acid, rosmanol, rosmarinic acid, oleanolic acid, and ursolic acid—was examined in a number of in vitro investigations. The antioxidant activity of these bioactive substances and the essential oil was confirmed using the 2,2-diphenyl-1-picrylhydrazyl technique.

Free radical scavenging capacity (RSC) was used to assess the antioxidant activity of rosemary essential oil (REO). It was examined if REO might scavenge the stable 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical and contribute an electron. As a positive control, α -tocopherol essential oil and methanol solution were combined with DPPH solution. After 60 minutes, the amount of the purple-colored DPPH radical that remained was determined using spectrophotometry at 515 nm. The capacity to scavenge free radicals was computed as follows: $RSC = 100 - 100 * A_{sample}/A_{blank}$, where A_{sample} is the absorbance of the essential oil/reference and A_{blank} is the absorbance of the diluted DPPH solution. Every assay was performed in triplicate, and the average results were taken into account. Using the obtained RSC values, linear regression analysis was used to determine the IC₅₀ value, which is stated in μ l of essential oil per ml and indicates the quantities of the sample needed to produce 50% inhibition of DPPH radical.

4. Anti inflammatory activity of *Rosmarinus officinalis*.L:

The essential oil and physiologically active terpenes, including betulinic acid, ursolic acid, carnosic acid, carnosol, rosmarinic acid, rosmanol, and oleanolic acid, have been shown in several experimental investigations to have analgesic and anti-inflammatory properties. According to reports, they actually had antinociceptive properties, and the strength of each individual triterpene was comparable to that of the nonsteroidal anti-inflammatory medication ketorolac.

Nitrite levels, a stable nitric oxide (NO) metabolite, were measured in cell culture medium using Griess reagent to assess the anti-inflammatory effect of *R. officinalis* n-hexane and ethyl acetate fractions. A 48-well plate containing 1×10^6 /mL of RAW 264.7 cells was incubated for 24 hours at 37°C with 5% CO₂. For two hours, the cells were pre-treated with n-hexane (12.5–100 µg/mL) and ethyl acetate (1.25–10 µg/mL) fractions at non-toxic concentrations. For a further 22 hours, the cells were stimulated with 1 µg/mL of LPS (lipopolysaccharide from *Escherichia coli*). After mixing 50 µL of the obtained culture supernatant with 50 µL of Griess reagent (0.1% N-(1-naphthyl) ethylenediamine dihydrochloride in 5% phosphoric acid and 1% sulfanilamide), the mixture was left to incubate for 10 minutes at room temperature in a dark environment. A microplate reader (Multiskan Ascent, Finland) operating at a wavelength of 540 nm was used to measure the absorbance. A sodium nitrite standard curve was used to determine the nitrite levels in the samples. The positive control was indomethacin (100 µM).

5. Anti microbial activity of *Rosmarinus officinalis*.L:

It is generally more effective against Gram-positive bacteria than Gram-negative ones, *Rosmarinus officinalis* (rosemary) has a broad spectrum of antimicrobial activity due to phenolic compounds like carnosic acid that act against a variety of bacteria, including common foodborne pathogens and antibiotic-resistant strains, by damaging cell walls and membranes. *Staphylococcus aureus*, *Salmonella*, *E. coli*, and multi-drug resistant (MDR) bacteria are all effectively combatted by rosemary extracts. Because Gram-negative bacteria have a more resilient outer cell wall, it is typically less effective against Gram-positive bacteria (such as *S. aureus*). Carnosic acid, carnosol, rosmarinic acid, camphor, and terpenes are important substances that interfere with microbiological processes.

Methanolic extracts were made from air-dried leaves by extracting 4g of powdered leaves with 200 ml of 80% methanol at 60 °C for two days while stirring constantly. The extracts were then allowed to dry completely at 40 °C before being redissolved w/v in methanol to prepare known concentrations.

Conclusion

Plant chemicals that are present in minuscule amounts can now be isolated thanks to the advancements in molecular biology, genetics, and high-accuracy analytical techniques. Thanks to these advancements, it is now feasible to investigate their chemical makeup and therapeutic potential and

alter the molecule to create new, more targeted therapeutic treatments. This work conducted an updated review of *R. officinalis* L., enabling us to highlight the state of the art in research and studies, highlighting the knowledge of the pharmacological actions associated with this plant's ingredients. In vitro and in vivo research on a variety of biological properties, including antioxidant, anti-inflammatory, analgesic, etc., has led to an increase in the therapeutic interest in rosemary. In summary, carnosic acid, carnosol, rosmarinic acid, and the essential oil are the most significant components of *R. officinalis* L. that are pharmacologically active and the primary focus of scientific research. These natural medications can therefore be suggested for preclinical and clinical research in a variety of illnesses and pathological states.

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A Review of Syzygium aromaticum

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Abstract

It has been established that herbal remedies are a valuable source for the discovery of novel pharmaceutical compounds that have been applied to the treatment of severe illnesses. Glycosides, saponins, flavonoids, steroids, tannins, alkaloids, terpenes, and other phytoconstituents have been found to have pharmacological effects in a variety of plant species. Clove, or *Syzygium aromaticum*, is a classic spice with a variety of pharmacological properties that have been used to preserve food. Sesquiterpenes, monoterpenes, hydrocarbons, and phenolic compounds are among the several phytochemicals abundant in *S. aromaticum*. Of the phytochemicals found in clove oil, eugenyl acetate, eugenol, and β -caryophyllene are the most important.

1.Introduction

The use of herbal treatments in the traditional medical system continues to be a significant component of the healthcare system. Because they are natural products, people believe that medical plants are more effective and have less side effects than their synthetic counterparts. This has led to a growing adoption of medicinal plants in recent decades. Approximately 80% of people on the planet currently receive the majority of their primary medical treatment from traditional drugs. Numerous herbal plants contain pharmacological properties such as bactericidal, virucidal, and fungicidal effects; they are employed in food preservation and embalming, and they also have anti-inflammatory, antibacterial, spasmolytic, sedative, analgesic, and local anesthetic properties. According to reports, the phytoconstituents of many plant species, including glycosides, saponins, flavonoids, steroids, tannins, alkaloids, and terpenes, are responsible for their pharmacological actions. Herbal remedies are currently recognized as an essential source for the discovery of new pharmaceutical compounds that have been applied to the treatment of severe illnesses. These discovered phytochemicals are regarded as an exceptional leading compound in the hunt for novel and potent medications.

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Clove, or *Syzygium (S.) aromaticum*, is a dried flower bud that is native to Indonesia's Maluku islands and is a member of the Myrtaceae family. It has lately been cultivated in many locations across the world. The clove tree's commercial parts are its leaves and buds, and four years after planting, the production of flowering buds starts. In the pre-flowering stage, they are then harvested manually or with the aid of a natural phytohormone. Clove is regarded as one of the spices that may be used as preservatives in many foods, particularly in meat processing, to replace chemical preservatives because of their antioxidant and antimicrobial qualities. It's interesting to note that they are commercially used for a variety of medicinal purposes as well as in the perfume industry.

Traditionally, clove essential oil has been used to cure burns and wounds, as well as to ease dental discomfort and treat toothaches and infections. It is also widely used in soaps, perfumes, and as a cleaning agent in histology, and its use has been documented in a number of industrial uses. Traditional Chinese and Indian medicine employ cloves as a warming and invigorating herb. Cloves have been used for ages to treat a variety of ailments, including nausea, vomiting, flatulence, liver, intestine, and stomach issues, as well as to stimulate the nerves. Cloves have been used to treat a variety of illnesses in tropical Asia, including cholera, malaria, TB, and scabies.

Syzygium aromaticum

Kingdom : Plantae
Order : Eudicots
Family : Myrtaceae
Sub Family : Myrtoideae
Genus : *Syzygium*
Species : *Syzygium aromaticum*
Binomial name : *Syzygium aromaticum*

1. Chemical composition and Health benefits of *Syzygium aromaticum*:

Antioxidants, particularly eugenol and flavonoids, which help combat free radicals and lessen oxidative stress, are abundant in cloves and may help lower the risk of chronic illnesses. Cloves contain eugenol, which has strong anti-inflammatory properties that can help lessen pain and inflammation in diseases like arthritis. Cloves have broad-spectrum antiviral, antifungal, and antibacterial properties. Their inclusion in dental care products aids in the fight

against foul breath and gum disease. They aid to relieve indigestion, gas, bloating, and nausea by stimulating digestive enzymes.

Because it numbs pain receptors, clove oil is a well-known natural painkiller that has long been used to treat toothaches and sore muscles.

Cloves may help manage type 2 diabetes because of compounds that may improve insulin action and control blood sugar levels. Manganese, one of the important minerals found in cloves, is crucial for maintaining bone density and forming new bone.

The main active compound in *Syzygium aromaticum* (clove) seeds, eugenol, is abundant along with β -caryophyllene, eugenyl acetate, and α -humulene, which make up the majority of its essential oil. Other components that contribute to its potent antioxidant, anti-inflammatory, and antimicrobial qualities include phenolic acids (gallic acid), flavonoids (quercetin), essential fatty acids (linoleic, linolenic), minerals (potassium, calcium), and other terpenes and aldehydes. The predominant ingredient, eugenol, which frequently accounts for 70–80% of the oil, is what gives it its distinctively strong scent and a variety of medicinal benefits. High concentrations of β -Caryophyllene, a prominent sesquiterpene, contribute to its anti-inflammatory properties. eugenol ester, which is also found in significant quantities. α -Humulene is present in different but significant amounts. It also includes limonene, α -selinene, α -terpinyl acetate, and other aldehydes. It contains salicylic acid, ferulic acid, gallic acid, and caffeic acid. Iron, calcium, sodium, phosphorus, and potassium are all present in high amounts.

2. GC-MS analysis of *Syzygium aromaticum*:

Gas chromatography/mass spectrometry (GC/MS) was utilized to evaluate the chemical makeup of the essential oil from fresh clove flower buds. An Agilent GC system 7890B (Agilent, Santa Clara, CA, USA) with an Agilent MSD 5977B detector and a split/splitless injector was used. The temperatures of the quadrupole and sources were set at 150°C and 230°C, respectively. Helium was used as the carrier gas, and its flow rate was 1.2 mL/min. One microliter of the essential oil dilution (0.01% in hexane; w/v) in splitless mode is used as the injection volume. After being kept at 50°C for one minute, the column temperature was raised at a rate of 5°C per minute until it reached 300°C. Retention periods, retention indices in relation to C5-C18 n-alkanes, and corresponding spectrum peaks found in the published data are used to identify particular compounds.

3. Anti oxidant activity of *Syzygium aromaticum*:

With some adjustments, the methodology proposed by Re et al. was used to determine the antioxidant activity. The ABTS radical used in the test was generated by reacting 5.0 mL of a 3.840 µg/mL ABTS solution with 88 µL of a 37.840 µg/mL potassium persulfate solution. For sixteen hours, the combination was kept at room temperature in the dark. After mixing, it was immediately diluted with ethanol to achieve an absorbance of 0.7 at 734 nm.

30 µL of each concentration of essential oil (200 to 15 µg/mL) and eugenol (90 to 5 µg/mL) were transferred into test tubes with 3.0 mL of the radical cation ABTS in a dark environment. The reaction mixture was then homogenized in a tube shaker, and after 6 minutes, the absorbance of the reaction mixture was measured at a length of 734 nm using a spectrophotometer. The experiments were carried out in triplicate, and the following formula was used to determine the percentage of inhibition (% I) of the ABTS radical cation based on the capture of the free radical:

$$\% \text{ inhibition} = (\text{absorbance of the solution of the ABTS radical} - \text{absorbance of the sample}) / (\text{ABTS absorbance radical solution}) \times 100$$

Additionally, it was shown that the effective concentration, or EC50%, is the sample concentration required to sequester 50% of the ABTS root; an essential oil is deemed active when its EC50% is less than 500 µg/mL.

4. Anti microbial activity of *Syzygium aromaticum*:

Significant antibacterial action against a variety of microorganisms is demonstrated by *S. aromaticum* EO. Due to their lipophilic properties, EOs have the ability to disrupt the membrane structure, causing it to become unstable and leak cellular material, ultimately leading to cell death. Both Gram-positive and Gram-negative bacteria, including *Streptococcus* species and *Staphylococcus aureus*, can be inhibited by *S. aromaticum* essential oil. Gram-negative bacteria include *Salmonella typhimurium*, *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, and *Agrobacterium* spp. Additionally, it works well against yeasts such *Aspergillus* species, *Penicillium*, and *Candida albicans*. Numerous investigations have demonstrated that eugenol and its derivatives have antiviral properties against the herpes simplex virus, various types of flu, and even the initial stage of HIV-1 infection by inhibiting virus replication.

Antibacterial activity on bacterial strains of the Gram-positive *S. aureus* and Gram-negative *E. coli* and *P. aeruginosa* species using the disc-diffusion test. Both eugenol and *S. aromaticum* EO consistently inhibited *S. aureus*

during a 24-hour incubation period. Clove essential oil (EO) has a higher Minimal Inhibitory Concentration (MIC) against *S. aureus* (MIC = 50 µg/mL) than eugenol (MIC = 250 µg/mL). Although eugenol has been reported to be primarily responsible for the antibacterial activity of *S. aromaticum* EO, other phenolic compounds may also be involved.

The phytocomplex, not a single molecule, is the cause of this activity, as indicated by the MIC values found in that investigation. Clove EO inhibited Gram-negative bacteria, such as *E. Coli* and *P. aeruginosa*, less than Gram-positive bacteria, most likely because to the exterior membrane, which acts as an extra barrier to the introgression of EO components.

All things considered, a number of variables can affect an EO's antibacterial action, including the properties of the target microorganism or microorganisms, temperature, pH, antimicrobial drug concentration, and/or the presence of organic matter. Because the antibacterial activity may be diminished or not present at all in in vivo applications of natural substances, the outcomes achieved in vitro should not be equated to those obtained in vivo. The impact of these variables on clove essential oil's antibacterial activity against *E. coli*, *S. aureus*, and *P. aeruginosa* has been assessed. Initially, it was shown that *S. aromaticum* EO's antibacterial activity was twenty times greater at 37 °C. Temperature affects the fluidity of the membrane lipid layer; hence, greater temperatures impair cell membrane function and increase permeability, which in turn raises cell susceptibility to antimicrobial agents. Regarding the presence of organic material, clove essential oil's bactericidal action was maintained, albeit diminished, indicating its potential as an external antimicrobial agent, such as in dentistry or the treatment of skin conditions.

Conclusion

The therapeutic qualities and all of the phytochemical compounds that were separated from *S. aromaticum* are examined in this review. The main components that are derived from the essential oil of cloves are carvacrol, eugenol, thymol, and cinnamon aldehyde. The active ingredient in clove essential oil, eugenol, is generally regarded by the FDA as safe. According to the WHO Expert Committee on Food Additives, humans can consume 2.5 mg of clove oil per kilogram of body weight each day. Clove and its primary ingredients have antioxidant and antibacterial properties from a pharmacological standpoint.

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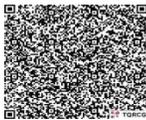
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A Review of *Tamrindus indica*

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Abstract

The Tamarind tree, or *Tamarindus indica* L., is one of the most significant multifunctional tropical fruit tree species in the Indian subcontinent. It is a monotypic genus that is a member of the subfamily Caesalpinioideae of the family Leguminosae (Fabaceae). India, Africa, Pakistan, Bangladesh, Nigeria, and the majority of tropical nations all employ *T. indica* as a traditional medicine. Abdominal pain, diarrhea and dysentery, helminth infections, wound healing, fever and malaria, constipation, inflammation, cell cytotoxicity, gonorrhoea, and eye disorders are among its traditional uses. The plant is said to have antibacterial and antioxidant properties due to its many chemical values and plenty of phytochemicals. All parts of the plant, from the roots to the tips of the leaves, are beneficial to humans.

1. Introduction

Traditional medicine is based on medicinal plants. Conventionally, the utilization of plant preparations as medication sources is founded on customs and knowledge that are essentially passed down orally from generation to generation. There has been a recent surge in medicinal plant research worldwide. Due to their ability to treat a wide range of illnesses, medicinal plants have been utilized in many different systems. Tamarind must have been brought to Asia about the first millennium BC. It has been confirmed that tamarind was cultivated in Egypt by 400 BC, and the Indian Brahmasamhita Scriptures mention it between 1200 and 200 BC. Theophrastus wrote about plants between 370 and 287 BC, and two of his descriptions mention tamarind; his sources were most likely from East Africa.

The evergreen *Tamarindus indica* tree can grow up to 24 meters in height and 7 meters in diameter, making it a moderate to large tree. *Tamarindus*' precise position in relation to its allegedly related taxa will become clearer with the help of the most recent morphologic and genetic investigations as well as further research. With the exception of the Himalayas and the arid western areas, this huge evergreen tree with an extraordinarily

lovely spreading crown is grown virtually everywhere in the nation. The compound, alternating leaves include 10–18 pairs of opposing leaflets. The leaflets are narrowly oblong, measuring 12–32 x 3–11 mm, with fine hairs on the rachis and petiole, and the midrib and net veining are more or less noticeable on both surfaces. Beautiful pale yellow or pinkish flowers in tiny, loose spikes that are roughly 2.5 cm wide. Two bracteoles entirely wrap the flower buds, which fall extremely early; the lower two are minute, the upper three are well developed, and the sepals are four and petals five. The fruit is a velvety, rusty-brown, indehiscent, subcylindrical, 10–18 × 4 cm, straight or curved, with a brittle shell and seeds embedded in a sticky, delicious pulp. The seeds are 3–10, 1.6 cm long, asymmetrical, and have smooth, glossy, firm testa.

Numerous active ingredients, including phenolic compounds, cardiac glycosides, tartaric acid, mucilage and pectin, arabinose, xylose, galactose, glucose, and uronic acid, were found in *T. indica* through phytochemical analysis. Fatty acids and several critical elements, including arsenic, calcium, cadmium, copper, iron, sodium, manganese, magnesium, potassium, phosphorus, lead, and zinc, were found in the ethanolic extract of *T. indica*.

Tamrindus indica

Kingdom	:	Plantae
Order	:	Magnoliopsida
Family	:	Fabaceae
Sub Family	:	Caesalpinioideae
Genus	:	<i>Tamrindus</i>
Species	:	<i>Tamrindus indica</i>
Binomial name	:	<i>Tamrindus indica</i>

1.1 Fruit Pulp :

Contains beta-carotene, flavonoids, and polyphenols, which prevent inflammation and fight cell damage. Good source of B vitamins (brain, nervous system), magnesium (more than 300 body processes), and potassium (heart health). helps relieve constipation since it contains fiber. used historically to treat dysentery and diarrhea. Magnesium and potassium can calm the lining of the stomach and help balance its pH. rich in vitamin C, which boosts immunity. Potassium and polyphenols aid in blood pressure regulation and the reduction of bad cholesterol (LDL). may aid in controlling insulin and blood sugar levels.

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reduces fevers, sore throats, and inflammation (antipyretic). Fights bacteria, viruses, and fungi, and helps with wound healing when applied topically. used for intestinal worm removal.

1.2 Leaves :

Packed with flavonoids, polyphenols, and vitamin C, they cut bad cholesterol (LDL), fight oxidative stress, and promote heart health. stimulate the bile, give fiber to help with digestion and relieve diarrhea and dysentery, and serve as a natural laxative for constipation. used historically to encourage wound healing and combat infections, such as malaria. By preventing the absorption of carbohydrates, it may assist diabetics control their blood sugar levels. have analgesic and antipyretic (fever-lowering) qualities; they are used to treat menstrual cramps and fever. Antioxidants shield the heart, while potassium and fiber assist regulate blood pressure and cholesterol. Anemia is avoided by maintaining red blood cell numbers with iron content.

1.3 Seeds:

Improves gut health, acts as a laxative, and aids in the treatment of intestinal worms, diarrhea, and constipation. includes substances that combat fungus and bacteria and lower oxidative stress, which may help prevent infections and chronic illnesses. shows potential in lowering body pain and inflammation; it is beneficial for musculoskeletal problems and arthritis. enhances glucose metabolism and insulin sensitivity, which aids in the management of diabetes. Because of its mucilage-like qualities, seed extracts (polysaccharides) are utilized in eye drops for dry eyes to preserve the cornea. used traditionally to treat skin diseases and wounds. Good for malnutrition, high in fiber and necessary amino acids. Seed polysaccharides are utilized as sizing agents and thickeners (gum) in textiles and food.

2. Phytoconstituents:

2.1 Chemical composition of Fruit Pulp:

Tamarindus indica fruit pulp has anti-inflammatory, antimicrobial, and fever-reducing properties, making it useful for a variety of traditional remedies. It also contains rich antioxidants (beta-carotene), minerals (magnesium, potassium), and B vitamins, supporting heart health (cholesterol, blood pressure), digestion (laxative, anti-diarrheal), immunity (Vitamin C), and possibly blood sugar management.

2.2 Chemical composition of Leaves:

Tamarindus indica leaves are rich in phytochemicals like flavonoids and tannins, which support heart, blood sugar, and immune health. They are also used traditionally to treat malaria, jaundice, wounds, digestive problems, and fever. The leaves also act as antioxidants, anti-inflammatories, antimicrobials, and antidiabetics, though research is still ongoing.

2.3 Chemical composition of Seeds:

Rich in nutrients and phytochemicals, tamarind (*Tamarindus indica*) seeds have antimicrobial, anti-inflammatory, antidiabetic, and antioxidant qualities. They have also been used traditionally for wound healing, digestive problems, and eye health; extracts from the seeds are used as mucilage in eye drops, and the seeds provide polysaccharides for the food and textile industries. Despite having antinutrients like tannins and phytates, they are a good source of fiber and vital amino acids that support gut health and metabolism.

3.1 Anti oxidant activity of *Tamarindus indica* using DPPH:

0.2 mM of DPPH made with ethanol was completely combined with five distinct extract concentrations. Following a 30-minute incubation period in a dark environment, the absorbance of each concentration was measured at 517 nm. Gallic acid was the standard, and methanol was the control. The following formulas were used to determine the extract's radical scavenging activity.

$$\text{DPPH Scavenging activity (\%)} = \frac{[(\text{Abs control} - \text{Abs sample})]}{(\text{Abs control})} \times 100$$

where Abs sample is the absorbance of DPPH radical + sample (sample or standard) and Abs control is the absorbance of DPPH + methanol.

3.2 Anti oxidant activity of *Tamarindus indica* using FRAP:

The extract's capacity to reduce ferric acid is the main focus of the FRAP assay. The production of the blue complex (Fe²⁺/TPTZ) indicates the reduction of the ferric ion (Fe³⁺) to the ferrous ion (Fe²⁺). To prepare the working reagent, 10 mL of FeCl₃·6H₂O at 20 mM was mixed with 100 mL of acetate buffer at 30 mM and 10 mL of a 10 mM TPTZ [2,4,6-tripyridyl-s-triazine] in 40 mM HCL. Next, 100 µl of the crude extract (100–500 mg/mL) was violently combined with 3 ml of the freshly made FRAP solution. After 30 minutes of incubation at 37 °C, this led to the production of a blue color complex, which indicates that the ferric tripyridyl triazine (Fe³⁺ TPTZ) complex was converted to ferrous (Fe²⁺) ion. At 593 nm, the absorbance was then measured. Calibration was performed using freshly made FeSO₄ working

solutions. Gallic acid equivalents (GAE) in milligrams per gram of dry weight were used to denote each determinate.

4. Anti microbial activity of *Tamrindus indica*:

The agar-well diffusion method was used to ascertain the extracts of *T. indica*'s antibacterial and antifungal qualities. The bacterial and fungal strains were subcultured and kept for 24 to 48 hours at 37 °C in an incubator. A McFarland standard of 0.5 was used to standardize the bacterial isolates. Test tubes of nutrient broth that had been individually inoculated with each microbe were used for this. After a 24-hour growth period, the inoculation test tubes were analyzed using a spectrometer and, if required, corrected with more nutrient broth to reach a McFarland standard of 0.5.

First, the agar plates containing 20 milliliters of nutritional agar were divided into four distinct partitions using markers. Among the four divisions were distilled water as the negative standard, amoxicillin and clavulanate 20/10 mcg (AMC-30) as the positive standard, ethanol extract at 50%, and fresh leaf extract at 100%. The ethanol extract was present at 100% concentration in each of the three divisions that were created from distinct nutrient agar plates. In order to generate a sample for analysis, each bacterium's plates were made in triplicate. The *C. albicans* fungal strain underwent the same procedure.

The spread plate method was utilized to inoculate the agar plates with the standardized colonies of bacteria, and the same procedure was employed for the fungal strain. After that, aseptic agar wells measuring 8 mm in diameter were created for each of the delimited zones, with the exception of the one created for the AMC-30 disks. After measurement, the AMC-30 disks' diameter was determined to be 6 mm. Following inoculation, the plates containing nutrients and Sabouraud's dextrose agar were incubated at 37 °C. Both 24- and 48-hour intervals were used to monitor these plates. For statistical analysis, the zones of inhibition that were detected were measured and tallied.

Conclusion

One usage for tamarind is as a functional food. Numerous chemical compounds were extracted from this and are widely utilized in the textile, medicinal, and feed sectors. Timber is made from tree trunks. Because of its ingredients, it has a sour, sweet, cold, and astringent flavor. Traditional medicines have utilized several parts of the tamarind tree to treat symptoms and illnesses. Given all of the plant's advantages, it may be argued that it is a safe, significant, and human-beneficial medicinal plant.

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A Review of *Trianthema portulacastrum*

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Abstract

Folk medicine and traditional health systems have been shown to be more successful in treating health issues globally, according to recommendations made by the World Health Organization (WHO). An plant used in Ayurvedic medicine is *Trianthema portulacastrum* Linn. Traditionally, *Trianthema portulacastrum* Linn. has been used as a laxative, stomachic, painkiller, and to treat blood disorders, anemia, inflammation, and night blindness. Significant pharmacological effects, including antioxidant, diuretic, analgesic, hepatoprotective, and anticarcinogenic properties, have been shown in laboratory studies on plant extracts. Traditional notions and scientifically proven activities are related. There is scientific proof for both their major and minor components. *T. portulacastrum*'s uniqueness and usefulness are concealed. Modern scientific ideas should be used to overcome such obstacles.

1. Introduction

Tropical America is the native home of the exotic plant *Trianthema portulacastrum*. It is spreading over the majority of tropical nations, including India, Ceylon, and Baluchistan. It is currently found in waste areas, riverbeds, and farmed fields all over India. Particularly during the wet seasons, it is frequently found in a wide range of agricultural and vegetable crops, including mustard, maize, pigeon pea, mung beans, potatoes, onions, cotton, soybean, pearl millet, and sugarcane. This plant is said to exist in two varieties: Lal Sabuni, which is red in color with a crimson stem, leaf margin, and flours, and Svet Sabuni, which is green with a green stem and white flowers.

Despite not being commercially grown, this tropical terrestrial weed is widespread in India because to its invasion of wastelands, riverbeds, and plains. Additionally, it grows on its own in fields that are used for agriculture and vegetable crops, particularly during the wet seasons.

Steroids, flavonoids, lipids, terpenes, carbohydrates, tannins, and alkaloids have all been detected using photochemical screening. The many sections of the plant contain important phytochemical elements. Several phytoconstituents, including steroids, alkaloids, terpenoids, glycosides,

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flavonoids, phenolic compounds, and carbohydrates, were screened for in the methanolic extract.

The plant works as an alexiteric, analgesic, stomachic, laxative, and alterative; it treats piles, ascites, bronchitis, blood-related heart illnesses, anemia, inflammations, and "Kapha."The herb has been utilized in the indigenous system of medicine for the obstruction of the liver asthma, amenorrhea, dropsy, edema, ascites, and beri-beri. The herb's infusion is used as a vermifuge, helps with rheumatism, and is also used as an antidote for alcoholics. Antipyretic, analgesic, spasmolytic, deobstruent, and anti-inflammatory properties are all present in the root. Anemia, edema, and liver and spleen disorders are all advised by the Indian Ayurvedic Pharmacopoeia. When the root is administered to the eye, it treats night blindness, corneal ulcers, itching, and blurred vision.

The root has irritating, abortifacient, and cathartic qualities. Jaundice, stranguary, and dropsy are treated with an infusion of the roots.Ginger is used as a cathartic along with the powdered bitter and nauseating root.The root powder is used as a cathartic in the Philippine Islands. The leaves are used as a diuretic for dropsy and edema. The herb's decoction is used to treat alcoholic poisoning.According to reports, leaves have a diuretic effect, making them helpful in treating ascites and edema.

Trianthema portulacastrum

Kingdom	:	Plantae
Order	:	Caryophyllales
Family	:	Aizoaceae
Sub Family	:	Sesuvioideae
Genus	:	Trianthema
Species	:	Trianthema portulacastrum
Binomial name	:	Trianthema portulacastrum

1.1 Leaves :

Used to treat urinary problems, edema, and dropsy.

has laxative, stomachic, and anti-flatulent (carminative) properties.has anti-inflammatory and analgesic (pain-relieving) properties, making it helpful for diseases including rheumatoid arthritis.prevents hepatotoxicity and shields the liver from harm. used to improve blood health and treat anemia. Antioxidant-

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rich and an effective remedy for alcohol poisoning. has antifungal characteristics. may aid in controlling hypoglycemia and antihyperglycemic blood sugar levels. utilized as a dewormer.

1.2 Stem :

In lab tests, stem extracts have shown strong protective benefits against liver damage, including reversing lipid peroxidation and increasing the activity of antioxidant enzymes. When compared to leaf or whole plant extracts, an ethanolic extract of the stem showed the best defense against oxidative stress caused by gamma radiation in hepatic tissue. The stem (or whole plant extract) is traditionally used as a stomachic to help with digestion and as a laxative to treat constipation.

1.3 Root :

Utilized to treat liver blockages, jaundice, and liver protection in general. used as a laxative, asthma remedy, and cathartic (purgative) for constipation. used to treat general inflammation and rheumatism.

used to treat stranguary (painful urination) and dropsy (edema).

spasmolytic, abortifacient (take with extreme caution), and antipyretic (lowers fever).

2. Phytoconstituents:

2.1 Chemical composition of Leaves:

The vitamin C-rich leaves of *Trianthema portulacastrum*, also known as horse purslane or buxkhapra, are used in traditional medicine for their diuretic, laxative, anti-inflammatory, analgesic (pain-relieving), and liver-protective (hepatoprotective) qualities. They help treat conditions like rheumatism, edema, anemia, and alcohol poisoning, and they may also be used as antioxidants and to control blood sugar levels.

2.2 Chemical composition of stem:

Traditional medical systems use the stem of *Trianthema portulacastrum*, commonly referred to as horse purslane or Bishkhapra, for a number of reasons, including its laxative, hepatoprotective (liver-protecting), anti-inflammatory, and antioxidant qualities. These actions are facilitated by a variety of bioactive substances found in the plant, including phenolics and flavonoids.

2.3 Chemical composition of roots:

Because of their analgesic, antipyretic, and possibly anti-cancer effects, the roots are used in traditional medicine to treat liver problems (jaundice, hepatoprotective), digestive issues (laxative, stomachic for constipation/asthma), inflammation (rheumatism, arthritis), and as a diuretic. However, they can also act as a purgative or abortifacient, so they should be used with caution. Studies show that substances like ecdysterone and flavonoids have anti-inflammatory, antioxidant, liver-protective, and possibly anti-cancer properties.

3. ANTI OXIDANT ACTIVITY OF *Trianthema portulacastrum*:

According to Ilahi et al., the antiradical potential of *T. portulacastrum* weed hydrolysates was assessed using spectrophotometry. In a 96-well microplate, 100 μ L of DPPH radical solution was combined with six distinct hydrolysate concentrations (1, 10, 100, 1,000, 2,000, and 5,000 μ g/mL), and the mixture was incubated for 20 minutes at room temperature. The resulting combination was spectrophotometrically read at 517 nm in comparison to a methanol blank, and the percentage inhibition of each hydrolysate was determined using the following formula:

$$\% \text{inhibition} = (A_{\text{Control}} - A_{\text{Sample}}) / (A_{\text{Control}}) \times 100$$

where the absorbance of the reaction mixture and the DPPH solution is denoted by A_{sample} and A_{Control} , respectively. Plotting percent inhibition against hydrolysate concentration yielded the effective dose of hydrolysate required to neutralize 50% of the DPPH radical solution (IC₅₀).

4. Anti fungal activity of *Trianthema portulacastrum*:

Prepare extracts (such as methanolic, ethanolic, or chloroform) from dried, powdered plant material to test for *Trianthema portulacastrum*'s antifungal activity. Then, employ techniques like agar well diffusion or the Disc Diffusion Method. Put the extract on agar plates that have been infected with fungi (such as *Aspergillus* and *Candida albicans*). The loaded discs should be placed on the infected agar surface. The plates should be incubated (for example, at 25–37°C for 24–72 hours). Zones of inhibition surrounding the extract suggest that it has antifungal properties against the bacteria. Calculate the zone of inhibition, which is the clear region surrounding the disc where fungal growth is inhibited.

Stronger antifungal action is indicated by a bigger zone.

Conclusion

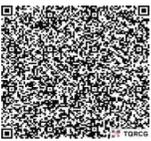
Trianthema portulacastrum has been the subject of numerous scientific publications that highlight its rich phytochemicals (polyphenols, flavonoids like quercetin and rutin), as well as its varied pharmacological activities, which include potent antioxidant and antifungal qualities. These activities are frequently linked to its traditional use in Ayurvedic medicine, with research examining its protective role in cancer models, liver disease, and even the green synthesis of nanoparticles.

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A Review of *Vigna mungo*

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Abstract

In South Asia, *Vigna mungo*, a significant medicinal plant and part of the Fabaceae family, is commonly eaten as food. It is frequently referred to as Maash, Urad daal, and Black Gram. Strangulated bowel syndrome, dyspepsia, constipation, neuropathy, hepatopathy, gastritis, diarrhea, rheumatism, diabetes, and other conditions have historically been treated with it. Alkaloids, flavonoids, saponins, steroids, tannins, phenolic compounds, fatty acids, carbohydrates, amino acids, vitamins, and carotenoids are among the phytochemicals found in *Vigna mungo*. These substances have antioxidant, antibacterial, anthelmintic, anti-inflammatory, and analgesic pharmacological effects both in vitro and in vivo.

1. Introduction

It has long been believed that wild plants are very important. Knowledge about the applications of medicinal plants has been transmitted from one generation to the next following a period of trial and error. Globally, between 35,000 and 70,000 plant species are thought to be utilized in traditional medicine at the moment. Approximately 70 to 80 percent of people worldwide treat illnesses and disorders with traditional medicine. The traditional tenets of medication and diet have encountered difficulties in recent years. In actuality, the concept of "optimal nutrition" is quickly replacing the more conventional notion of "adequate nutrition," which describes a diet that provides nutrients in sufficient amounts to meet particular organic demands. This hypothesis states that particular food items can improve overall health, reduce the chance of developing certain diseases, and advance general welfare. Thus, in their quest to comprehend the various ways that food provides protection to the body, scientists have found a range of bioactive substances known as phytochemicals. The term "functional food," which is often referred to as "pharmafoods," "medifoods," "vitafoods," or "medicinal foods," was primarily inspired by this concept.

It is a pantropical flowering plant that belongs to the Fabaceae family of legumes. There are roughly 150 species in it, many of which are bean variants and include several well-known farmed species. Due to their close kinship,

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some of them were formerly *Phaseolus* species that were reclassified as *Vigna*. Since they are herbaceous legumes that like hot conditions, they do not grow or flourish in temperate climates throughout the winter months. There are seven subgenera in the genus *Vigna*, of which two—*Macrorhynchus* and *Sigmoidotropis*—have been proposed to be distinct. Three of the other five subgenera—*Ceratotropis*, *Haydonia*, *Lasiospron*, *Plectrotropis*, and *Vigna*—are crop species.

With a short growth season spanning 90 to 120 days, this summer pulse crop has a high nutritious content. For vegetarians, it provides an inexpensive source of protein. In addition to being a nutraceutical, it is used in traditional medicine to treat neurological disorders, diabetes, and sexual dysfunction. It is important in cropping systems because it improves soil fertility since symbiotic bacteria in nodules may fix nitrogen. Because of its high nutritional value as mature, dry seeds that contain proteins, vitamins, amino acids, and lipids, it plays a significant role in the human diet.

V. mungo is a bushy, hairy, erect annual plant. It has a well-developed tap root and can grow up to 100 cm in height. It features trifoliate leaves and long twining branches with oval leaflets that range in length from 5 to 10 cm. At the top of the plant is an inflorescence, which is a cluster of 5–6 flowers. The peduncles are lengthy and the flowers are little. Fruit pods are cylindrical, hairy, and have a short-hooked beak. Usually, a pod holds four seeds, but sometimes there is just one. Usually black in color, the seeds have a white hilum. The taproot of this plant divides into branching roots. The small, papilionaceous, bisexual flowers have bracteoles that extend past the calyx and are linear to lanceolate. They come in several clusters and have a yellow hue.

Vigna mungo

Kingdom	:	Plantae
Order	:	Fabales
Family	:	Fabaceae
Sub Family	:	Faboideae
Genus	:	<i>Vigna</i>
Species	:	<i>Vigna mungo</i>
Binomial name	:	<i>Vigna mungo</i>

1.1 Seeds :

An excellent source of complex carbohydrates, fiber, iron, calcium, potassium, magnesium, and phosphorus, as well as plant-based protein. helps prevent plaque accumulation in arteries, lower blood pressure (caused by potassium and magnesium), and lower harmful LDL cholesterol. Bones are strengthened by minerals including calcium, phosphorus, and magnesium, which is advantageous for postmenopausal women and those with shortages. Another health source is Netmeds. According to a healthline article, fiber, resistant starch, and antioxidants like vitexin and isovitexin assist enhance insulin sensitivity and reduce the absorption of sugar. Astringency and fiber aid in the removal of mucus and toxins from the gut, fostering regularity and gut health, according to Happy belly. Increased satiety hormones from high protein and fiber can help with weight loss by promoting fullness and decreasing hunger. includes substances that combat oxidative stress, such as flavonoids and polyphenols. According to a Healthline article, a high folate concentration is essential for prenatal development and lowers the incidence of neural tube defects.

1.2 Leaves :

By blocking prostaglandins, which are used to treat ailments like arthritis, extracts may be able to lessen pain and inflammation. aids in digestion, relieves constipation, and fermentation can lessen substances that produce gas. Traditionally, it has been applied topically and taken internally (as mung bean soup) to calm the body, remove impurities, and lessen skin irritation from cold sores, acne, and pimples. Studies on diabetic models suggest that it could help control blood sugar levels. includes substances that may improve cognitive function as well as antioxidants. used to treat liver conditions (hepatopathy) in traditional medicine.

1.3 Stem :

Black gram straw is a good feed for cattle, particularly in areas where it is a byproduct, because it contains fiber (NDF 54–57% DM) and protein (around 9–17% dry matter). The plant's value as green manure stems from its capacity to fix nitrogen, which enhances soil fertility and structure. Plasters for contusions and ruptures contain plant extracts with analgesic and anti-inflammatory qualities, including possible stem chemicals. acts as a mild laxative and aids in the removal of bile and phlegm. includes substances that guard against oxidative damage. Seed flour with a high saponin concentration can function as a natural soap.

2. Phytoconstituents:

2.1 Chemical composition of Seeds:

Vigna mungo (black gram) seeds are a nutritious pulse used in both traditional and modern diets for general wellness because they are high in protein, fiber, vitamins, and minerals. They also support heart and bone health, help with digestion and weight management, control blood sugar, and provide antioxidants.

2.2 Chemical composition of Leaves:

Because of its flavonoids, *Vigna mungo* (black gram) leaves have anti-inflammatory and analgesic properties that may aid with pain and arthritis. Although study frequently focuses on the entire bean, they are also traditionally used for digestive problems, enhancing skin health (rashes, boils), supporting blood sugar management, and delivering antioxidants, utilizing phytochemicals like phenolics and saponins for general wellbeing.

2.3 Chemical composition of Stem:

Although research frequently concentrates on the seeds, the stems (haulms) of *Vigna mungo* (Black Gram/Urad Dal) contribute to the plant's overall value in agriculture and traditional practices for soil enrichment and livestock nutrition. The stems are rich in protein and fiber, traditionally used as animal fodder or green manure for soil health, and contain compounds with potential anti-inflammatory, antioxidant, and digestive benefits.

3.1 Anti oxidant activity OF *Vigna mungo* using DPPH:

Using the 1,1-diphenyl-2-picryl-hydrazyl test, the sample's capacity to scavenge DPPH radicals was assessed. 2.5 mL of a 0.5 mM methanolic solution of DPPH was combined with an aliquot of 0.5 mL of test sample solution (25,50, and 100 µg/mL) in methanol. After giving the mixture a good shake, it was allowed to sit at room temperature for half an hour in the dark. A UV spectrophotometer was used to measure the absorbance at 517 nm in relation to standard ascorbic acid. The % inhibition was calculated using the formula

% inhibition = $\frac{\text{absorbance of control} - \text{absorbance of sample}}{\text{absorbance of control}}$

3.2 Anti oxidant activity of *Vigno mungo* using SOD:

The Liu et al., technique was used to measure SOD activity. Sample extract (25–100 µg/mL) in water is combined with 1 mL of 50 µM nitroblue tetrazolium (NBT) and 1 mL of 78 µM NADH in 3 mL of 16 mM Tris-HCl buffer to form the reaction mixture. After adding 1 mL of 10 M phenazine methosulfate, the mixture was incubated for 5 minutes at 25 °C. One milliliter of 10 M PMS was added to the mixture to initiate the reaction. For five minutes, the reaction mixture was incubated at 25°C. Standard ascorbic acid was used to absorb and record the color generated at 560 nm. The % inhibition of superoxide ion was calculated using the formula

$$\% \text{ inhibition} = \frac{\text{absorbance of control} - \text{absorbance of sample}}{\text{absorbance of control}}$$

3.3 Anti oxidant activity of *Vigno mungo* using hydrogen peroxide:

The Ruch et al. method was used to measure hydrogen peroxide. Hydrogen peroxide (4 mM) was made into a solution in phosphate buffer (pH 7.4). After adding 0.6 mL of 40 mM hydrogen peroxide to a sample concentration of 10–100 µg/mL, the mixture was assessed at 230 nm after 10 minutes in comparison to a blank solution in phosphate buffer solution without hydrogen peroxide. µmol/g was used to express the content. The % inhibition of hydrogen peroxide was calculated using the formula

$$\% \text{ inhibition} = \frac{\text{absorbance of control} - \text{absorbance of sample}}{\text{absorbance of control}}$$

4. Anti bacterial activity of *Vigno mungo*:

Crude methanolic extracts of *V. mungo* were examined for their cytotoxic and antibacterial qualities. Gram-positive and gram-negative bacteria, two common fungi, and eleven important pathogenic species were tested for antibacterial effectiveness. These microbes include *Shigella boydii*, *S. dysenteriae*, *Vibrio mimicus*, *B. megaterium*, *B. subtilis*, *S. aureus*, *Sarcina lutea*, *E. coli*, *S. paratyphi*, *S. typhi*, and *V. parahemolyticus*. The disc diffusion technique was used for in vitro antibacterial and antifungal screening. A disk containing 30 mg of kanamycin was used as the antibacterial control. The extracts showed antibacterial effectiveness against the majority of the bacterial strains, with an average zone of inhibition of 10–20 mm. The two fungi under investigation are *Aspergillus niger* and *Candida albicans*. The extracts showed good antifungal activity with an average zone of inhibition of 15–19 mm.

Methanolic extracts of *V. mungo* leaves showed minimum inhibitory concentrations (MIC) of 64 mg/ml and maximum activity (19 mm, zone of inhibition) against *Bacillus megaterium*. It was discovered that the stem methanolic extracts exhibited a substantially larger zone of inhibition of 20 mm against *Shigella boydii*, with MIC values of 64 mg/ml. The cytotoxicity test was investigated using the Brine Shrimp Lethality Bioassay, with the LC50 values of standard vincristine sulphate serving as a positive control. With LC50 values of 0.67 µg/ml, 4.52 µg/ml, and 3.25 µg/ml for standard vincristine sulphate, leaves, and stems extracts, respectively, the results showed significant cytotoxicity against *A. salina*.

Conclusion

Research on the pharmacological characteristics, phytochemistry, nutritional makeup, and ethnomedical applications of *V. mungo* was reviewed in this article. It is rich in minerals and nutritious phytochemicals that are responsible for its pharmacological properties including antioxidant, antibacterial, anti-inflammatory activities.

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