



Original article

Phytochemical and antimicrobial properties of different plants and *in silico* investigation of their bioactive compounds in wound healing and rheumatism

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ABSTRACT

In the current study the assessment of the antimicrobial and phytochemical properties of *Cassia fistula*, *Musa paradisica*, *Ficus religiosa* and *Murraya koenigii* plants extracts was carried out. The antibacterial potential of these plants extracts was tested against *S. aureus* and *E. coli*. The *Cassia fistula* and *Ficus religiosa* leaves showed the larger zone of inhibition in aqueous and butanolic extract respectively against *Escherichia coli*. *Musa paradisica* and *Murraya koenigii* leaves showed larger zone of inhibition in ethanolic extract against *S. aureus*. Qualitative phytochemical analysis showed the presence of alkaloids, flavonoids, phenols, terpenoids, steroids, glycosides, saponins, carbohydrates, proteins and tannins in all extracts while phlobaphenes, emodin, anthocyanins and leucoanthocyanins were not present in these extracts. Quantitative phytochemical analysis showed the highest alkaloid content in the *Murraya koenigii* leaves. Highest tannin content and flavonoid content was found in *Ficus religiosa* leaves, while highest phenolic content was found in case of *Cassia fistula*. In addition to this antioxidant potential of all the extracts was determined. *Musa paradisica* leaves showed highest antioxidant potential as compared to other plant extracts. *In silico* analysis of bioactive components present in plant extracts was performed by molecular docking. The rutin and Gln from *Musa paradisica* and *Murraya koenigii* respectively, were docked with Glycogen Synthase Kinase 3 beta (GSK-3beta) protein. Quercetin and rutin from *Cassia fistula* and *Ficus religiosa* respectively, were docked with C-reactive protein (CRP). The tested bioactive compounds showed good binding affinity with significant number of hydrogen bonds and can be used as a good alternative of synthetic drugs to treat rheumatism and wounds.

1. Introduction

The production of antibiotics is one of the most effective weapons against microbial illnesses. The need for new medicines has arisen from the evolution of antibiotic resistance by harmful microorganisms. It is important for the production of novel medications with fewer adverse impacts and resistance-building properties. Since ancient times, the plants have been used medicinally, especially in Asia (Seyyednejad et al., 2014).

Any chemical that destroys microbes including bacteria or prevents their proliferation is said to have antibacterial effect. Numerous chemical elements found in medicinal plants have antibacterial properties. These plants are abundant in bioactive molecules, which can be

converted into valuable medicines and other bio-reactive compounds that treat a wide range of ailments. Many compounds found in plant parts are the cause of antibacterial properties (Mamta et al., 2023).

Cassia fistula generally regarded as golden shower tree belongs to the family Leguminosae. To cure rhinosinusitis disease, the *Cassia fistula* is utilized by many tribes. It aids in the management of rheumatism, hemoptysis, itching, leukoderma and gastrointestinal issues. A huge number of investigators from all around the globe have investigated how plant extracts influence microorganisms. Numerous secondary metabolites found in plant including tannins, terpenes, flavones, carbohydrates and others, have been reported to show antimicrobial effects (Sagpute et al., 2014).

There is evidence that the leaves of *Cassia fistula* have anti-

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Phytochemical Investigation And Antimicrobial Properties

**Pankaj Kumar Chaurasia, Shashi Lata
Bharati**



Phytochemical Investigation And Antimicrobial Properties:

An Experimental Text Book on Phytochemical Analysis and Antimicrobial Activity of Mentha Piperita Naveen Gaurav, 2016-05-20 Mentha also known as mint from Greek m nthā Palaeolexicon is a genus of plants in the family Lamiaceae mint family Harley et al 2004 The species are not clearly distinct and estimates of the number of species varies Bunsawat et al 2004 Hybridization between some of the species occurs naturally Many other hybrids as well as numerous cultivars are known in cultivation The genus has a subcosmopolitan distribution across Europe Africa Asia Australia and North America Brickell et al 1997 Mints are aromatic almost exclusively perennial rarely annual herbs They have wide spreading underground and overground stolons and erect square Rose Francis 1981 branched stems The leaves are arranged in opposite pairs from oblong to lanceolate often downy and with aserrated margin Leaf colors range from dark green and gray green to purple blue and sometimes pale yellow The flowers are white to purple and produced in false whorls called verticillasters

Phytochemical Composition and Pharmacy of Medicinal Plants T. Pullaiah, 2023-10-27 This new 2 volume set offers a comprehensive review of more than 80 medicinal plant species providing information on the bioactives and pharmacology of these beneficial plants It describes the structures of the secondary metabolites found in these plants the functions of these compounds in human and plant biology and the biosynthesis of these compounds Each chapter begins with a brief introduction about the species The chapters then delve into the bioactive phytochemicals from the plant along with its chemical structure The published literature on pharmacological activities on that species is comprehensively reviewed A wide array of the biological activities and potential health benefits of the medicinal plant which include antiviral antimicrobial antioxidant anti cancer anti inflammatory and antidiabetic properties as well as protective effects on liver kidney heart and nervous system are given Phytochemical Composition and Pharmacy of Medicinal Plants aims to be valuable source book for scientists researchers industry professionals faculty and students for the development of new and effective drugs from medicinal plants

Phytochemical, antioxidant and antimicrobial activity of Aerva lanta against respiratory and urinary tract infection organisms Prem Jose Vazhacharickal, John Joseph, Saritha S

Janardhanan, 2018-05-24 In the traditional system of medicine the plant is being used as diuretic and anthelmintic antidiabetic expectorant and in the treatment of lithiasis The plant is used for arresting haemorrhage during pregnancy burn healing as an anti inflammatory headache skin diseases to dissolve kidney and gall bladder stones Bacterial pathogens have evolved numerous defence mechanism against antimicrobial agents hence resistance to old and newly produced drugs is on the rise The phenomenon of antibiotic resistance exhibited by the pathogenic minor has led to the need for screening of several medicinal plants for their potential antimicrobial activity In the present study various extracts Aerva lanata were tested against pathogens of UTI RTI Staphylococcus aureus Pseudomonas sp E coli Klebsiella sp Among the organism tested Staphylococcus aureus E coli showed the maximum clear zone with Aqueous extract followed by the Pseudomonas sp

Klebsiella sp phytochemical analysis revealed the presence of sterols saponins glycosides phenols and resins The phytochemicals were separated by paper chromatography and identification based on Rf values Antioxidant array was also carried out and found to possess antioxidant potential This study will aim the clinician to prescribe adequate treatment for urinary tract and respiratory tract infections

The Chemistry inside Spices & Herbs: Research and Development: Volume 2 Pankaj Kumar Chaurasia, Shashi Lata Bharati, 2022-04-27 The Chemistry inside Spices Herbs Research and Development brings comprehensive information about the chemistry of spices and herbs with a focus on recent research in this field The book is an extensive 2 part collection of 20 chapters contributed by experts in phytochemistry with the aim to give the reader deep knowledge about phytochemical constituents in herbal plants and their benefits The contents include reviews on the biochemistry and biotechnology of spices and herbs herbal medicines biologically active compounds and their role in therapeutics among other topics Chapters which highlight natural drugs and their role in different diseases and special plants of clinical significance are also included Part II continues from the previous part with chapters on the treatment of skin diseases and oral problems This part focuses on clinically important herbs such as turmeric fenugreek ashwagandha Indian winter cherry basil Terminalia chebula black myrobalan In terms of phytochemicals this part presents chapters that cover resveratrol piperine and curcumin This book is an ideal resource for scholars in life sciences phytomedicine and natural product chemistry and general readers who want to understand the importance of herbs spices and traditional medicine in pharmaceutical and clinical research

Biotechnological Advances, Phytochemical Analysis and Ethnomedical Implications of Sapindus species Reetika Singh, Bechan Sharma, 2019-11-13 Plants have always occupied a prominent position in the life of every living being Plants are the primary source of food shelter and medicines The global inclination toward herbal medicine has advanced the expansion of plant based pharmaceutical industries to a vast extent The production of traditional medicine at global market has been estimated to touch US 5 trillion by 2050 Some of the useful plant based drugs include vinblastine vincristine taxol podophyllotoxin camptothecin digoxigenin morphine codeine aspirin atropine capsaicin allicin curcumin artemisinin and ephedrine Genus Sapindus is an important economical and medicinal trees distributed over the world Soap nuts contain higher amount of saponin a natural detergent which can be used to clean clothes and hairs Sapindus species possesses various pharmacological properties including antimicrobial antioxidant anti inflammatory anticancer hepatoprotective anti trichomonas activity Extracts of this plant are rich in various phytochemicals and polyphenolic compounds All the pharmacological properties are due to presence of saponins Biotechnological techniques can improve the saponin content thus this chemical content can be produced at large scale and can be used as phytomedicine We hope that this book would be of great use to under graduates postgraduates scientists researchers and faculty members who are studying teaching or working in the field of Biotechnology Phytochemistry and Ethnopharmacology The techniques explained in this book could be of immense use for the researchers working in this area We shall deeply appreciate receiving

any critical comments and suggestions from the readers from the different parts of globe which would help us improve the first edition of this publication

High Performance Liquid Chromatography in Phytochemical Analysis Monika Waksmundzka-Hajnos, Joseph Sherma, 2010-11-08 The powerful efficient technique of high performance liquid chromatography HPLC is essential to the standardization of plant based drugs identification of plant material and creation of new herbal medicines Filling the void in this critical area High Performance Liquid Chromatography in Phytochemical Analysis is the first book to give a comp

An Illustrated guide to Medicinal Plants of East Africa Najma Dharani, Abiy Yenesew, 2022-10-05 Medicinal Plants of East Africa is the first photographically illustrated guide to showcase the most important healing plants of the region The book describes 136 plant species in everyday use in Kenya Tanzania and Uganda Brief descriptions of each species cover that plant s appearance ecology and specific medicinal uses To aid identification more than 600 colour photographs have been included Also included are recipes for remedies to treat a wide range of ailments An easy to understand summary of the science behind the treatments concludes each section Supplementary features Introduction to the medicinal virtues and active ingredients of plants Common methods of preparing medicines from plant materials Summary of ailments and the plants prescribed to treat them Glossaries of medical and botanical terminology and extensive reference lists Medicinal Plants of East Africa will appeal to ethnobotanists health and wellness practitioners travellers and all with an interest in the remarkable healing properties of plants Sales Points Easy ID with supporting colour photos recipes for plant remedies simplifies the science behind the natural medicines accomplished author team

Phytochemical and Pharmacological Investigation of the Family Rutaceae Abdur Rauf, Hafiz Ansar Rasul Suleria, Syed Muhammad Mukarram Shah, 2024-07-05 This new volume provides comprehensive coverage of the family Rutaceae emphasizing its diverse phytochemistry and medicinal uses The volume provides an introduction to the family Rutaceae and then goes on to delineate its phytochemical and pharmacological properties and uses Also addressed are the nutritional clinical and toxicological profiles of the family Rutaceae elaborating on the nutritional value of Rutaceae plants their healthcare and clinical applications and their possible toxic side effects This volume provides an information overview of the Rutaceae family which comprises numerous ornamental as well as economically significant fruit bearing trees with significant phytochemistry and medicinal uses that are important for new drug discovery for pharmaceutical industries The chapters may also direct researchers to isolate extract pure compounds from Family Rutaceae for new and novel drug discoveries

Pharmakognosie - Phytopharmazie Rudolf Hänsel, Otto Sticher, 2006-12-11 Ein Klassiker aktualisiert Auch die 8 vollst ndig neu bearbeitete Auflage liefert unverzichtbares Basiswissen zur Beurteilung pflanzlicher Arzneimittel und beschreibt den Beitrag der Naturstoffforschung zur Entwicklung hochwirksamer Arzneistoffe Ber cksichtigt werden auch die aktuell gebr uchlichen Nahrungserg nzungsmittel und die in Europa verwendeten Arzneidrogen der traditionellen chinesischen Medizin Die ber sieben Auflagen bew hrte Grundkonzeption wurde beibehalten Das Werk informiert umfassend

ber die Bildung des Naturstoffs in der Pflanze bis zur Herstellung von pflanzlichen Arzneimitteln deren chemisch analytische Prüfung pharmakologische Testung und therapeutische Anwendung Es liefert Hintergrundwissen ber Produkte die in der Selbstmedikation tagt glich von Hunderttausenden eingenommen werden Der neue H nsel Sticher ist eine kompakte aktuelle und wissenschaftlich kritische Darstellung der Phytochemie Phytopharmazie Phytopharmakologie und Phytotherapie f r Apotheker rzte und Arzneimittelchemiker sowie ein praxisnahes Lehrbuch der Pharmazeutischen Biologie f r Studierende der Pharmazie

Trihalomethanes: Advances in Research and Application: 2011 Edition ,2012-01-09 Trihalomethanes Advances in Research and Application 2011 Edition is a ScholarlyBrief that delivers timely authoritative comprehensive and specialized information about Trihalomethanes in a concise format The editors have built Trihalomethanes Advances in Research and Application 2011 Edition on the vast information databases of ScholarlyNews You can expect the information about Trihalomethanes in this eBook to be deeper than what you can access anywhere else as well as consistently reliable authoritative informed and relevant The content of Trihalomethanes Advances in Research and Application 2011 Edition has been produced by the world s leading scientists engineers analysts research institutions and companies All of the content is from peer reviewed sources and all of it is written assembled and edited by the editors at ScholarlyEditions and available exclusively from us You now have a source you can cite with authority confidence and credibility More information is available at <http://www.ScholarlyEditions.com>

Biotechnology for Waste Biomass Utilization Prakash K. Sarangi,Latika Bhatia,2022-10-13 This volume focuses on how waste biomass can be transformed into useful biomaterials food and feed fuel and chemicals by using various processes such as chemical physical thermal biological and biotechnological procedures Biomass from biowastes such as agriculture crop residues wood processing residues forest residues food waste industrial waste and municipal solid waste have emerged as potential substrates for bioenergy production This volume explores the key features of biotechnology for waste biomass utilization presenting scientific and technical literature on sustainable waste biomass management as well as for biomass conversion for biofuels chemicals and other new commercial products It discusses a variety of novel biotechnical applications and interventions including microbial fermentation and anaerobic digestion biotechnological modes of xylooligosaccharides production multifaceted utilization of microalgal biomass vermiculture and vermicomposting and more Key features Provides the most recent information about waste biomass utilization for the production of biofuels and biochemicals Shows a wide range of novel technologies in the field of biotechnology towards waste biomass utilization Focuses on the utilization of microbial resources for waste biomass conversion into value added products Explores methods for food wastes and crop wastes conversion into biofuels and biochemicals Provides the scientific information describing various examples and case studies which aid gaining knowledge to researchers and academicians With chapters from eminent researchers who have significant global experience in the field of waste biomass management this volume delivers a wealth of valuable information for researchers involved in bioenergy

utilization It will also be an essential source for academicians researchers economists policymakers and policy analysts

Phytochemistry, the Military and Health Andrew G. Mtewa, Chukwuebuka Egbuna, 2021-03-02 *Phytochemistry the Military and Health* Phytotoxins and Natural Defenses comes as a response to the gap that there has for so long existed between phytochemistry and survival of both service personnel and civilian communities during and after conflicts Armed conflicts cause a lot of devastation to communities and should be avoided as much as it can be possible The devastation is usually evident in service provisions such as Health Education Water and Food among many others Both service personnel and civilians are affected to various degrees Facilities usually end up being physically destroyed with no essential supplies and or having dysfunctional systems Going with untreated wounds communicable and non communicable diseases for weeks with no medical interventions due to the conflicts disease burdens heavily weigh down on communities as well as security personnel To make the situation even more complicated masses of people are forced to migrate for safety and security reasons likely going with diseases along wherever they go In such instances phytochemicals become handy in providing solutions from first aid basic analgesia antimicrobials and the general improvement of health Phytochemicals are known to play a major role in the day to day management of diseases and health There has been much research into their effectiveness as community medicines and as alternatives to conventional drugs However the role that phytochemicals play in the military counterterrorism and security has been overlooked *Phytochemistry the Military and Health* Phytotoxins and Natural Defenses discusses the roles that phytochemicals play as friends and foes in the military including insights aimed to help develop antidotes against phytochemicals and other chemical agents used maliciously as weapons Filling a gap between drug discovery security and emergency medicine this book describes which plants can be categorized for protection and controls which can be helpful in times of conflicts and soon after conflicts in military operations and those that can be used as deterrents and as emergency medicines Carefully designed to show the contribution that phytochemicals play in safety and security this book is useful for researchers regulators and anyone interested in plant chemistry Covers the contribution that phytochemicals play in safety and security Contains insights that will help in the development of antidotes against phytochemical and other chemical weapons Categorizes plants in terms of their usefulness as well as the potential security risks they possess *Evidence-Based Validation of Herbal Medicine* Pulok K. Mukherjee, 2022-07-12 *Evidence Based*

Validation of Herbal Medicines Translational Research on Botanicals brings together current thinking and practice in the characterization and validation of natural products The book describes different approaches and techniques for evaluating the quality safety and efficacy of herbal medicine particularly methods to assess their activity and understand compounds responsible and their probable underlying mechanisms of action This book brings together the views expertise and experiences of scientific experts in the field of medicinal plant research hence it will be useful for researcher who want to know more about the natural lead with their validation and also useful to exploit traditional medicines Includes state of the

art methods for detecting isolating and performing structure elucidation by degradation and spectroscopic techniques Highlights the trends in validation and value addition of herbal medicine with different scientific approaches used in therapeutics Contains several all new chapters on topics such as traditional medicine inspired drug development to treat emerging viral diseases medicinal plants in antimicrobial resistance TLC bio profiling botanicals as medicinal foods bioprospecting and bioassay guided isolation of medicinal plants immunomodulators from medicinal plants and more

Phytochemicals Toshiki Asao, Md Asaduzzaman, 2018-11-07 Phytochemicals provides original research work and reviews on the sources of phytochemicals and their roles in disease prevention supplementation and accumulation in fruits and vegetables The roles of anthocyanin flavonoids carotenoids and taxol are presented in separate chapters Antioxidative and free radicle scavenging activity of phytochemicals is also discussed The medicinal properties of Opuntia soybean sea buckthorn and gooseberry are presented in a number of chapters Supplementation of plant extract with phytochemical properties in broiler meals is discussed in one chapter The final two chapters include the impact of agricultural practices and novel processing technologies on the accumulation of phytochemicals in fruits and vegetables This book mainly focuses on medicinal plants and the disease preventing properties of phytochemicals which will be a useful resource to the reader

Journal of Nano Research Vol. 75 Efsthathios I. Meletis, 2022-09-21 This volume of the Journal of Nano Research contains peer reviewed articles reflecting the practical research results in the synthesis and properties analysis of nanomaterials and nanoparticles for various engineering applications The presented achievements will find practical use in microelectronics corrosion protection waste and water treatment technologies nanomechatronics heat engineering and biomedicine

Plant- and Marine- Based Phytochemicals for Human Health Megh R. Goyal, Durgesh Nandini Chauhan, 2018-11-12 This new book Plant and Marine Based Phytochemicals for Human Health Attributes Potential and Use provides insight with scientific evidence on the use of medicinal plants in the treatment of certain diseases It describes bioactive compounds of marine and plant origin that have been discovered to be advantageous for human health shedding new light on the potential of phytochemicals on human health and contributing to the ocean of knowledge on phytochemistry and pharmaceutical biology In addition the role of plant based pharmaceuticals is also discussed as an example of innovative uses of plant product This book addresses the importance of phytochemicals from plants and marine life It divided in four parts Bioactive compounds in medicinal plants status and potential Plant based pharmaceuticals in human health review Therapeutic attributes of mushroom cereal grains and legumes Innovative use of medicinal plants This compendium will be useful for the students and researchers as well as for industry professionals working in the food nutraceuticals and herbal industries

Traditional Herbal Therapy for the Human Immune System Azamal Husen, 2021-10-27 Drawing on indigenous and scientific knowledge of medicinal plants Traditional Herbal Therapy for the Human Immune System presents the protective and therapeutic potential of plant based drinks supplements nutraceuticals synergy food superfoods and other

products Medicinal plants and their products can affect the immune system and act as immunomodulators Medicinal plants are popularly used in folk medicine to accelerate the human immune defence and improve body reactions against infectious or exogenous injuries as well as to suppress the abnormal immune response occurring in immune disorders This book explains how medicinal plants can act as a source of vitamins and improve body functions such as enhanced oxygen circulation maintained blood pressure and improved mood It also outlines how specific properties of certain plants can help boost the immune system of humans with cancer HIV and COVID 19 Key features Provides specific information on how to accelerate and or fortify the human immune system by using medicinal plants Presents scientific understanding of herbs shrubs climbers and trees and their potential uses in conventional and herbal medicine systems Discusses the specific role of herbal plants that act as antiviral and antibacterial agents and offer boosted immunity for cancer H1N1 virus relieving swine flu HIV and COVID 19 patients Part of the Exploring Medicinal Plants series this book is useful for researchers and students as well as policy makers and people working in industry who have an interest in plant derived medications

Selected Studies in Environmental Geosciences and Hydrogeosciences Amjad Kallel,Maurizio Barbieri,Jesús Rodrigo-Comino,Helder I. Chaminé,Broder Merkel,Haroun Chenchouni,Jasper Knight,Sandeep Panda,Nabil Khélifi,Ali Cemal Benim,Stefan Grab,Hesham El-Askary,Santanu Banerjee,Riheb Hadji,Mehdi Eshagh,2023-12-30 This book gives a general overview on current research focusing on geoenvironmental issues and challenges in hydrogeosciences in the Middle East and Mediterranean region and surrounding areas The book is based on the accepted papers for oral poster presentations at the 3rd Springer Conference of the Arabian Journal of Geosciences CAJG 3 Studies discuss the latest advances in geoenvironmental and hydrogeosciences from diverse backgrounds including climate change geoecology biogeochemistry water resources management and environmental monitoring and assessment It shares insights on how the understanding of ecological climatological oceanic and hydrological processes is the key for improving practices in environment management It is of interest to scientists engineers practitioners and policymakers in the field of environmental sciences including climatology oceanography ecology biogeochemistry environmental management hydrology hydrogeology and geosciences in general In particular this book is of great value to students and environment related professionals for further investigations on the state of earth systems

Ethnomedicinal Plants with Therapeutic Properties V.R. Mohan,A. Doss,P.S. Tresina,2019-02-11 Ethnomedicinal Plants with Therapeutic Properties provides detailed information on locally important medicinal plants discusses the pharmacological properties of selected medicinal plants and looks at the phytodrug aspects of selected plants In 24 important chapters the volume covers ethnomedicine pharmacology and pharmacognosy of selected plants Medicinal plants are an important part of our natural health They serve as important therapeutic agents as well as valuable raw materials for manufacturing numerous traditional and modern medicines The history of medicinal plants used for treating diseases and ailments dates back to the beginning of human civilization Our forefathers were compelled to use

any natural substance that they could find to ease their suffering caused by acute and chronic illnesses wounds and injuries and even terminal illness This volume highlights recent scientific evidence of therapeutic properties of traditionally used medicinal plants in relation to clinical outcomes and remedies for promotion of human well being The authors have endeavored to convey the therapeutic knowledge of ethnomedicinal plants clearly and concisely

Medicinal Plants as Anti-infectives Francois Chassagne, 2022-03-31 Medicinal Plants as Anti infectives Current Knowledge and New Perspectives provides comprehensive and updated data on medicinal plants and plant derived compounds used as antimicrobials in a range of locations such as the Balkans Colombia India Lebanon Mali Pakistan Southeast Asia South Africa and West Africa It also provides an overview on the most recent innovations and regulations in the field of drug discovery from ethnobotanical sources This book will help readers to better appreciate the role of plants and phytomedicines as anti infectives to better assess the health benefits of plant derived products to help implement new methodologies for studying medicinal plants and to guide future researchers in the field Medicinal Plants as Anti infectives Current Knowledge and New Perspectives is a valuable resource for students academic scientists and researchers from the fields of ethnobotany pharmacy medicinal chemistry and microbiology as well as for professionals working in national or international health agencies or in pharmaceutical industries Provides an overview of new methods and tools developed in the field of drug discovery from ethnobotanical sources e g DNA barcoding metabolomics quorum quenching Contains real world insights from experts in the field Presents specific research program results to inspire further research in additional regions

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Phytochemical Investigation And Antimicrobial Properties Introduction

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