



"The contributed chapters in the book written by the faculties of science stream in the light of the recent thinking and developments in the field of science and education. Science & Technology is now dominates almost every field of our activities in summary, The faculties (Science stream) of GEMS Arts & Science college have made an excellent attempt to bring about this book *Homo Scientia* covering almost all the important areas from biological sciences to artificial intelligence. Every article has its own merits in both academic and research fronts. I record my grateful appreciation and thanks to the contributors of this book for their untiring efforts."

Dr. Balagopalan Unni



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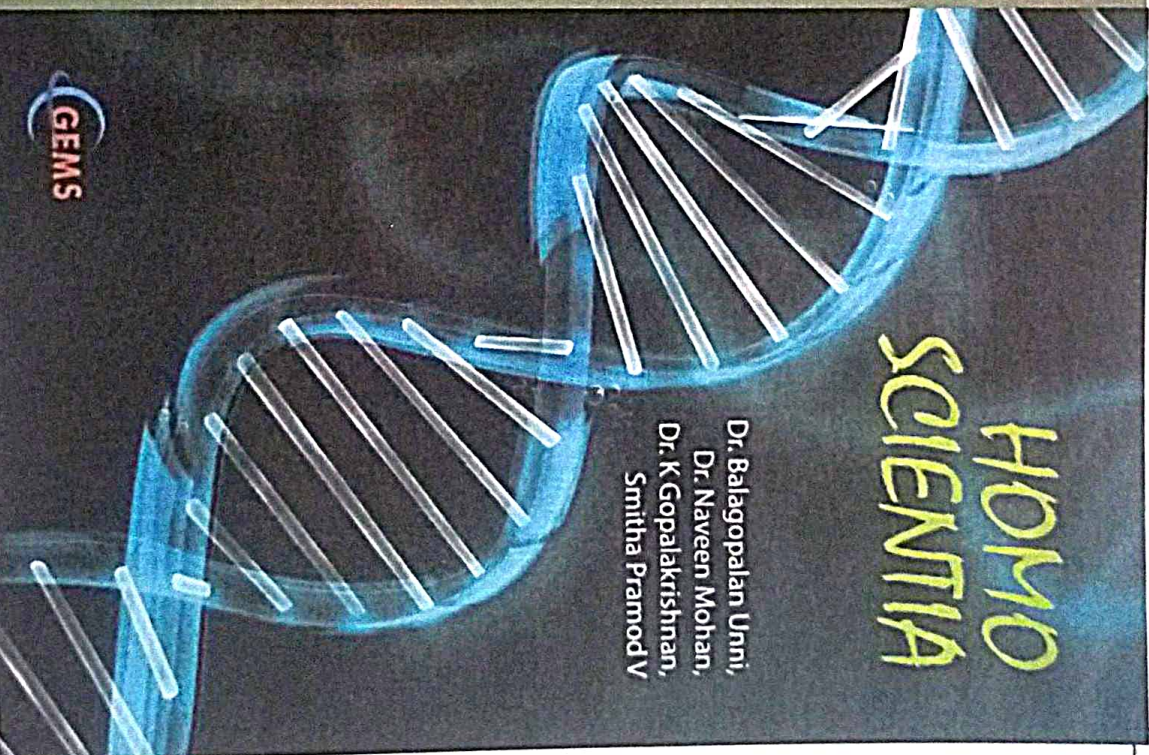


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HOMO SCIENTIA

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Brief Biography

Dr. B.G.Unni, (Balagopalan Unni) Ph.D
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Former Chief Scientist and Area Coordinator (Biotechnology & Biological Sciences) DADD and Fulbright Fellow retired from CSIR service in 2015 after 38 years of research career at CSIR North East Institute of Science & Technology Jorhat Assam. Appointed at Assam down town University as Director-Research in March 2015 and continued up to June 2019 and then re-designated as Adviser Research in August 2019). Back in Kerala, Dr.Unni is appointed as Director Academic & Research at GEMS College of Arts & Science affiliated to University of Calicut from August 2019. Both the positions are on honorary basis to strengthen the institutions in research areas. He did his BSc Biology (1972-74, Ewing Christian College, Alld University), MSc in Biochemistry(1974-76)(Second Rank) and Ph.D in Biochemistry from Allahabad University(1976-80) and PDF in Molecular Biology from Texas A&M University, USA(1988-91). Dr. Unni is specialized in Biochemistry, Molecular Biology, and Biotechnology and well established in his area of research and completed more than 40 years of research in both basic and applied fields of research. Dr.Unni got more than 130 research papers, 190 abstracts, 35 papers in proceedings, 7 patents, 1 technology. 18 chapters in books, edited 3 books and 29 students



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received PhD degrees under his guidance and supervision. Dr. Unni had completed more than 20 projects sponsored by Commonwealth Science Council, London, Ministry of Non conventional Energy Sources, Department of Non conventional Energy Sources Govt of India, North Eastern Council Govt of India, Department of Science & Technology, Department of Biotechnology, Central Silk Board, GB Pant Institute of Himalayan Environment and Development, CSIR and DRDO, Ministry of Defense, Govt of India during his scientific tenure at CSIR NEIST. Dr Unni received- Fulbright Travel Award/ Fellowship (USA) Dr. B.M. Das Memorial Science award, Hebrew University Award , H.R. Cama Memorial Travel Award, COSTED Travel Award, DAAD- fellowship-Germany, Well Mark International Scholarship (USA) & Technology award in life sciences by CSIR, Govt of India . Best Fulbright Alumni Chapter Leader-South Asia Selected by the United States Education Foundation In India (USIEF), New Delhi .Nominated to represent India at the International Fulbright Scholars meet at Marrakech, Morocco- Nominated by United States Education Foundation In India, New Delhi . Dr. Unni is in the editorial board of more than eight indexed journal in the country .Dr.Unni was nominated to various state and central committees such as High power committee for development of sericulture activities Muga, Eri, Tassar and Mulberry in Assam nominated by Governor of Assam, .Expert in the area of non mulberry sericulture, Ministry of Textiles, Advisory Board, Post graduate Biotechnology programme, Academic Council, Assam Agricultural University, Research Council, Central Silk Board, Ministry of Textiles , DBT's Nominee for Biosafety Committee , Vice President SBC (India) Indian Institute of Science Bangalore, Vice President Indian Academy of Neuro-sciences, Member Fulbright Academy of Science & Technology, USA, Board of studies- Botany Nagaland University and Biotechnology Saugar University Madhya Pradesh., Fellow, Indian Academy of Neurosciences & Indian Society of Agricultural Biochemists, Fellow Royal Entomological Society, London UK and Scientific





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Board of Studies Raiganj University (2017----), Member
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Board, North East Cancer Hospital & Research Institute (2017-
-) President, Tea Improvement Consortium, Ltd, Tocklai Assam
(2018-2020) .

Dr.Unni visited USA, Germany, Israel, Jordan, France,
Morocco ,UK, Thailand ,Jordan, Singapore , China and UAE
under various exchange program.





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Preface

I am very happy to learn that, the GEMS Arts & Science College is bringing out a series of books written by the faculty in this academic year. The college is occupying a very important position among the colleges in Kerala, the same way the college is having unique standing in both academic and research fronts too. This is because of the excellent management, faculties and the best performances of the students.. I have full confident that in the course of time, and with the sincere commitment and dedication of the faculties , students and with management , the college will attain high level perfection and excellence and became a model college in the state of Kerala

This book entitled " Homo Scientia" had comprehensive research topics in various aspects in the topics of cyber security, biotechnology, microbiology and geology. A brief description about the cybersecurity, the protection of computer set up such as hardware, software data from several threats have been described in the chapter The best practices for deploying and managing IPS network security tools have been explored. The integration of intrusion prevention system (IPS) solutions, adherence to security policies, regular updates, monitoring and the implementation of incident response procedures are considered to be the essential components of a comprehensive network security framework. The risk management in cyber security, various cyber-attack kinds, malware, and some strategies to tackle these attacks are also explained by the authors. A comprehensive overview of the evolution of computer graphics, exploring the advancements in hardware, software, algorithms, and techniques that have propelled the field from its early pixel-based beginnings to the current state of realism etc also described. Optical character recognition has been extensively investigated in the past few years, and has been proven that high recognition rates can be achieved in specific





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application scenarios using some standard and well-studied methods such as neural network, support vector machine (SVM), etc. The possibility of learning an appropriate set of features for designing optical character recognition (OCR) has been investigated

Biotechnology is an interdisciplinary science using modern technologies to construct biological processes in research, agriculture, formulation of pharmaceutical products and other related fields. The better understanding of advances in plant genetic resources, genome modifications, omics technologies to generate new solutions for food security under changing environmental scenarios etc have been discussed in this chapter. The increasing demand for food had a great impact on the agriculture sector to address the various challenges associated with crop productivity. The tremendous advancement in plant research helps in understanding plant biology for sustainable food security, functional ecosystems, crop improvement and human health. One of the sustainable farming techniques is the use of fertilizer at nano level. Nanomaterials that enhance plant nutrition could be considered as an alternative to the conventional chemical fertilizers. one chapter covered the importance of nano fertilizer to enhance metabolic processes in plants and reviewed the concerns in developing nanotechnological methods in the future. Metabolomics has now emerged as a powerful tool for the comprehensive analysis of metabolites within biological systems. One of the chapters provides a review on metabolomics, encompassing its methodologies, applications, potential impact on personalized medicine ,and discusses further the need for advancements in analytical technologies. The antifungal activity of mangroves, particularly Rhizophora species are one of the main sources for fungicidal compounds due to the presence of high concentration of phenols. The antifungal activity of Rhizophora species has been elucidated, and could be further utilized as biocontrol agents for fungal disease in agricultural crops. One of the chapters discussed the species identification and its impact on economical and ecological level in the species like Nutmeg, one of the important medicinal plants that had a greater attention ,however, it was very difficult to differentiate the sexual identity




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in the seedling stages. But the protein content screening among the studied plantlets had differentiated the sexes in the species as explained by the author.

AI (Artificial Intelligence) or machine intelligence enables farmers to enhance the quality and ensure a quick go-to market strategy for crops, and adoption of these algorithms to improve food industries. Artificial intelligence (AI) has also the potential to revolutionize education, from personalized learning to assessment and grading. Additionally, AI-powered tools can provide greater accessibility to students with disabilities, while also enabling more engaging and interactive content. AI continues to develop and become more prevalent in education, towards responsible and equitable implementation. However the negative and positive part of the AI may also be looked into.

The chapters related to microbiological aspects have also been incorporated in this book. Carbapenem-resistant *A. baumannii* (CRAB), bacteria that cause multi-infections in humans and resistant to multiple drugs too. The study attempted to isolate and characterize the bacterial species from the clinical specimens using biochemical techniques. The enzyme, carbapenemase produced by the bacteria was isolated and determined by different assays. Another study identified the antibacterial, antioxidant and anticancer activities of *Ganoderma lucidum* by various chromatographic techniques. Anticancer activity was also assessed on HeLa cell lines using MTT assay and DPPH assay. In one of the chapters, the author discussed L-asparaginase, one of the widely exploited enzymes for the treatment of acute lymphoblastic leukemia (ALL). Also attempted to isolate and characterize the enzyme from soil samples collected from different locations at Kerala. The study indicated that soils can provide a rich source for L-asparaginase which has got ample application in pharmaceutical industries.

The studies on various geological aspects with respect to different geographical areas in Kerala soil has been included in the book. The vertical geochemical variation and elemental mobility of the lateritic terrain in the Makkaraparamba of Malappuram District, Kerala has been very well investigated. Under extremely oxidizing and leaching conditions, laterite



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soil transformed into a variety of rocks and further developed into stable secondary product in the existing humid tropical and subtropical environments. The hydrogeological conditions in Kumbala- Kaliyar river basin, Kasaragod district, Kerala was assessed by means of Vertical Electrical Sounding (VES). The digital spatial data output of the present study would be much helpful for planning and management of surface and sub-surface water resources of Kasaragod River basin in which the Kasaragod township is centrally located

The contributed chapters in the book written by the faculties of science stream in the light of the recent thinking and developments in the field of science and education. Science & Technology is now dominates almost every field of our activities. In summary, The faculties (Science stream) of GEMS Arts & Science college have made a n excellent attempt to bring about this book "Homo Scientia". covering almost all the important areas from biological sciences to artificial intelligence. Every article has its own merits in both academic and research fronts..I record my grateful appreciation and thanks to the contributors of this book for their untiring efforts.

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ANTIFUNGAL POTENTIALITY OF RHIZOPHORA MUCRONATA AGAINST FUNGAL PATHOGENS ISOLATED FROM PLANT LEAVES

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ABSTRACT

All of the approximately 300,000 species of flowering plants are attacked by pathogenic fungi. However, a single plant species can be host to only a few fungal species, and similarly, most fungi usually have a limited host range. It is commonly recognized that several classes of phytopathogenic fungi can cause relevant yield losses of cereals. Moreover, phytopathogenic can affect cereal grains during storage, rendering them unfit for human consumption by lowering the quality and safety of the derived products. The antifungals comprise a large and diverse group of drugs used to treat fungal infections. Mangroves are one source of fungicidal compounds. In particular, mangrove species of the Rhizophoraceae family have a high concentration and diversity of phenols, which are reported to be effective against different fungal species. The objective of this study is to demonstrate the antifungal potentiality of *Rhizophora mucronata* against some fungal pathogens of diseased plant leaves. The current research indicated the potential of *Rhizophora mucronata* has applications in biocontrol agent of fungal disease in agricultural field.

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INTRODUCTION

The evolution of fungal phytopathogens toward a high degree of specialization for individual plant species may be reflected in the different levels of specialization observed in extant plant-fungal interactions. The establishment of fungal infections in cereals has several consequences, ranging from yield lowering to retarding their nutritive value until the contamination of grains with dangerous mycotoxins. The growth of phytopathogenic fungi in crops is also responsible for the off-flavor formation and production of allergenic compounds. *Aspergillus*, *Fusarium*, and *Alternaria* species are the most important fungi affecting the yield of small grain cereal and causing spoilage of the derived foodstuffs.

Various strategies can be employed for the control of fungal infection, ranging from the adoption of specific agronomic practices to the development of resistant varieties. The chemical control remains now one of the major measures that can be implemented for the reduction of the incidence of plant disease. To this aim, over the past years, numerous chemical pesticides such as benzimidazoles, imazalil, organic, and inorganic sulfur compounds and oxidizing materials have been introduced to control the plant disease. However, the current concern has been raised about their extensive use because of the potential environmental problems, toxicity to humans, establishment of fungal resistant races, and sometimes high cost of such combinations.

The antifungals comprise a large and diverse group of drugs used to treat fungal infections. These agents are usually classified as either systemic or topical, although these divisions are somewhat arbitrary since many may be administered in either way. The mechanisms of action of antifungals include inhibition of fungal membrane and cell wall synthesis, alterations of fungal membranes, effects on microtubules, and inhibition of nucleic acid synthesis. Restrictions on the use of synthetic fungicides have been implemented in the last decade, due to their negative impact on the environment and the rapid emergence of resistant fungal isolates. The antifungals comprise a large and diverse group of drugs used to treat fungal



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infections. These agents are usually classified as either systemic or topical, although these divisions are somewhat arbitrary since many may be administered in either way. The mechanisms of action of antifungals include inhibition of fungal membrane and cell wall synthesis, alterations of fungal membranes, effects on microtubules, and inhibition of nucleic acid synthesis. Restrictions on the use of synthetic fungicides have been implemented in the last decade, due to their negative impact on the environment and the rapid emergence of resistant fungal isolates. Mangroves are one source of these compounds. These woody plants are found in tropical and subtropical intertidal regions, and are able to grow under extreme local environmental conditions including high salinity, extreme tides, strong winds and high temperatures, as well as muddy, anaerobic soils. These stress conditions promote the production of antioxidants such as phenols, which are used to counteract the effect of reactive oxygen species. Importantly, several studies have already reported the antifungal activity of mangrove phenolic extracts. In particular, mangrove species of the Rhizophoraceae family have a high concentration and diversity of phenols, which are reported to be effective against different fungal species. Several pathogenic species are found within the fungal genus *Fusarium*, this includes *Fusarium verticillioides*, the widely distributed causative agent of stalk, ear and root rot in maize. Aside from decreasing grain yield and quality, this fungus produces a variety of mycotoxins that contaminate maize grain, thereby threatening animal and human health. Chemical control of this fungus has b Antifungal extracts from mangrove leaves include alkaloids, flavonoids, fatty acids, quinones, stilbenes as well as terpenoids, triterpenoids and saponines. Mangrove-leaf extracts are nontoxic to humans and are environmentally friendly due to less pollutant produced.

METHODOLOGY

Sample preparation

Mangrove leaves were collected from mangrove forest located in Kadalundi, kozhikode, kerala and Diseased plant leaves (Guava, chilli, garden plant, pea plant, Jack fruit leaf



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and fig leaves) were collected from home location. The leaves were transported to the laboratory aseptically. The samples were excised and subjected to a three- step surface sterilization procedure. The samples were cut into bits (0.5-1.0 cm), washed in running tap water and rinsed in 70% ethanol for 30 seconds then rinsed in Mercury Chloride (3-5%) for 3 minutes. Finally washed in sterile water 3 times thoroughly. Then air dried.

Isolation of fungus

Isolation technique

Isolation of fungal species from plant leaves was done by dipped on Sabouraud dextrose agar by dipping method. The plates were incubated at 25°C for 3-5 days.

Identification of fungus

Fungal staining

As a first step, placed a drop of 70% ethanol on a clean microscopic glass slide and immerse the specimen in the drop of alcohol. Then added one or at most two drops of the Lacto-Phenol cotton blue before the alcohol dries out. After staining, this preparation is now ready for examination. The initial examination was done using low power objective and then Switched to higher power (40X) objective for more detail examination of spores and other structures

Stock culture

The pure spores of fungal isolates obtained by spread were transferred to Sabouraud Dextrose Agar plates under aseptic condition.


Assay of Antifungal Activity

Test organisms

The test organisms used for antifungal activity were obtained from jackfruit leaf, fig leaf, guava leaf and garden leaf and not from pea plant. The pure culture of test pathogens were maintained in SDA plates.



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Preparation Of Mangrove Leaves Extraction

The Mangrove leaves were collected and washed in running tap water. Then leaves were cut into small pieces and shade dried few days. The dry leaves were crushed by using mortar and pestle. Then taken 50ml of distilled water and Petroleum Ether and 5g of mangrove leaf extract and mixed well by using reflex extracting apparatus. After extraction filter using funnel with filter paper.

Demonstration of Antifungal activity

Blotting technique

The antifungal activity of the leaf extracts was determined by blotting technique. Leaf extract were added to SDA at 40°C and 5ml leaf extract were poured (~10ml/plate) each alone in petri plates (90mm in diameter). Five-day-old agar block (5mm X 5mm) bearing the desired fungus growth was transferred into these petri plates. These fungus cultures were incubated at 25±2°C for 3-5 days. Fungus growths were recorded daily.

RESULTS AND DISCUSSION

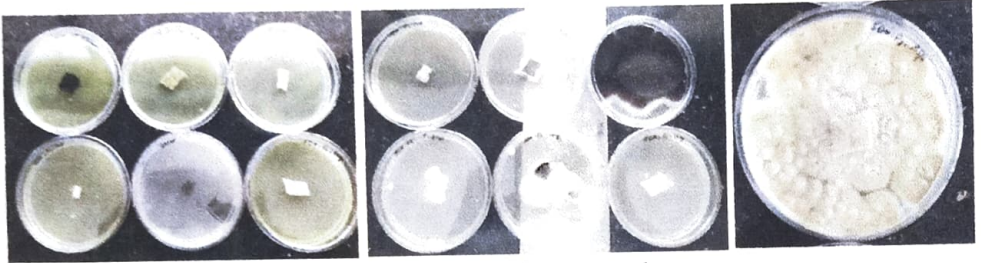
The present investigation was attempted for the isolation of plant fungus pathogen from different plant leaves (jackfruit, chilli, pea, fig, guava and garden plant) were collected from home surroundings. Out of the six isolated plants leaves, jackfruit, fig, guava and garden leaves showed *Fusarium*, *Aspergillus*, *Alternaria* and *Schizophyllum commune* species respectively which were identified by fungal staining . These isolates were then grown in pure cultures.

Rhizophora mucronata are capable of producing antifungal compounds that may be used by plants for defence against plant pathogens. In the present study, antifungal activity of *Rhizophora mucronata* was tested by blotting technique. The in vitro inhibition test was performed according to the plant disease. The ethanolic extract of *Rhizophora mucronata* against *Alternaria*, *Fusarium*, and *Schizophyllum commune* was found growth inhibitory, while the growth of *Aspergillus flavus* was not inhibited and grown in the media containing ethanolic



extract of *Rhizophora mucronata* as presented in figure.. The mangrove leaves possessed good antifungal activity. The antifungal activity may be due to active components which are present in plant extract. The current research indicated the potential of *Rhizophora Mucronata* has applications in biocontrol agent of fungal disease in agricultural field


SDA PLATES WITH MANGROVE LEAF EXTRACT



Before incubation

After incubation




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