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Original Research Article

Aspergillus flavus, *Rhizopus stolonifer* and *Mucor* spp. Associated with Deteriorated Mango and Orange Fruits: Occurrence and *In vitro* Susceptibility to Extracts of *Aspidia africana* (Pers.) C. D. Adams (Asteraceae)

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ABSTRACT

A large number of fruits are annually lost due to spoilage by microorganisms, most especially not fungi. This study was undertaken to isolate and identify fungi from spoiled fruits. The fungal isolates from spoiled mango and orange fruits were obtained using standard mycological techniques. Bioactivities of aqueous and ethanol extracts of *Aspidia africana* against fungal isolates from spoiled mango and orange fruits were determined using standard protocol. The fungal isolates obtained were *Aspergillus flavus*, *Mucor* spp and *Rhizopus stolonifer*. The leaf extracts of *A. africana* contained varied concentrations of alkaloids, flavonoids, terpenes, saponins, tannins, cardiac glycoside, phlobatanins and phenolics. The highest mean inhibition zone diameter (IZ) obtained was 16.8 ± 1.3 mm from the plate containing *R. stolonifer* RSCS-04, while the lowest mean IZ (mm $\pm$ S.D) was 9.8 ± 0.2 from the plate containing *R. stolonifer* RSMI-07. Of the 8 fungal isolates tested, 50.0 %, 75.0 %, 100% and 100% were sensitive to 10, 20, 40 and 80 mgmL⁻¹ of ethanol leaf extract of *A. africana*, respectively. The highest IZ (14.3 ± 0.3) and lowest IZ (10.0 ± 0.0) for the aqueous leaf extract was observed in the plate containing *A. flavus* AFMI-03 and *A. flavus* AFCS-03. The Regression coefficients (R^2) values of leaf extract of *A. africana* and diameters of zone of inhibition as exhibited by the fungi ranged from 0.5000 to 0.9872. Application of fungicidal plant extracts especially *A. africana* to mitigate fungal pathogenic invasion of fruits should be considered.

Keywords: *A. africana*, Fungi, Extracts, Mango, Orange, Deterioration.

Introduction

Aspidia africana, hemorrhage plant, is one of about 50 species of the genus *Aspidia* in the family of Asteraceae.¹ *Aspidia africana* is widely distributed across tropical Africa, occurring on waste land of the savanna and forest zone. The plant has been widely reported to have many biological activities and is widely used in African traditional folkloric medicine for treatment of several diseases such as gonorrhea, subcutaneous parasitic infection, abdominal pains, intestinal worms and backache.^{2,3} Its activities against *Plasmodium falciparum*; lactation enhancement capacity of *A. africana* root decoction upon administration on nursing mothers; haemostatic, analgesic and sedative activities have been reported.⁴ Varied chemical compositions of the plants have been reported due to diversity of ecological conditions.

Orange (*Citrus sinensis* L.) is a berry citrus fruit that ranges widely in size and diameter, shape, colour and juice quality, belonging to the family Rutaceae and genera *Citrus*.⁵

The orange fruit consists of vitamins, calcium, iron, magnesium, zinc, phosphorus, potassium, flavonoids and terpenes.⁶

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Orange fruits aid in preventing cold and recurrent ear infection,⁶ proper functioning of immune system and treatment of arthritis, asthma, Alzheimer's disease, Parkinson's disease, muscular degeneration, diabetes mellitus and gallstones.⁷ The fiber in orange reduces a high cholesterol level thereby helping to prevent atherosclerosis. The fibers also help in keeping blood sugar levels under control, which explains why orange can be a healthy snack for diabetic patients.⁸

Mango (*Mangifera indica* L.) is a species of flowering plants belonging to the family Anacardiaceae and order Sapindales.⁹ Mango fruits are highly perishable and contain water, proteins, carbohydrates, fats, sugars, dietary fibers, calcium, copper, phosphorus and vitamins (vitamins E, B₁, B₂, B₃, B₆, B₉, and B₁₂).¹⁰ Depending on cultivar, mango fruit varies in size, shape, sweetness, skin colour and flesh colour which may be pale yellow, gold or orange. Mango fruits help in controlling high cholesterol level and aids in maintaining the alkali reserve of the body. It has also been reported that mango fruits aid good digestion and improve eyesight.¹¹

The association among fruits, microorganisms and human has been long, interesting and developed before recorded history.¹² Fungi colonize fruits as substrate for their growth and the genera *Canidia*, *Saccharomyces*, *Penicillium*, *Aspergillus*, *Mucor*, *Cladosporium*, *Fusarium*, *Talaromyces* and *Neovossoria* are the most frequently isolated microbes from fresh fruits.¹³ During the sequence of post-harvest fruit handling such as transport, storage and marketing before final consumption, microorganisms can affect the fruit quality as well as human health. Fungi as agents of deterioration can invade and cause spoilage of fruits after tissues of the fruit have been damaged by some physical and physiological causes.¹⁴ This study was aimed at evaluating the antifungal activity of leaf extracts of *Aspidia africana* on fungal isolates associated with deteriorated orange and mango fruits.

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Omboon Vallisuta, Suleiman Olimat



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Studies in Natural Products Chemistry Atta-ur Rahman, 2023-05-23 Studies in Natural Products Chemistry Volume 77 covers the synthesis or testing and recording of the medicinal properties of natural products providing cutting edge accounts of fascinating developments in the isolation structure elucidation synthesis biosynthesis and pharmacology of a diverse array of bioactive natural products With rapid developments in spectroscopic techniques and accompanying advances in high throughput screening techniques it has become possible to isolate and then determine the structures and biological activity of natural products rapidly thus opening up exciting opportunities in the field of new drug development to the pharmaceutical industry This book covers the synthesis or testing and recording of the medicinal properties of natural products providing cutting edge accounts of the fascinating developments in the isolation structure elucidation synthesis biosynthesis and pharmacology of a diverse array of bioactive natural products Focuses on the chemistry of bioactive natural products Contains contributions by leading authorities in the field of natural products chemistry Presents sources of new pharmacophores Analytical Techniques for Natural Product Research Satyanshu Kumar, 2015-12-15 Plants are important source of lead molecules for drug discovery These lead molecules serve as starting materials for laboratory synthesis of drug as well a model for production of biologically active compounds Phytochemical processing of raw plant materials is essentially required to optimize the concentration of known constituents and also to maintain their activities Extraction techniques and analytical techniques have played critical roles in phytochemical processing of raw materials Extraction technologies from conventional extraction to green extraction as well as analytical techniques from single technique to hyphenated coupled techniques most frequently used in phytochemistry laboratories are covered in the book *Natural Products from Plants* Leland J. Cseke, Ara Kirakosyan, Peter B. Kaufman, Sara Warber, James A. Duke, Harry L. Briemann, 2016-04-19 2008 NOMINEE The Council on Botanical and Horticultural Libraries Annual Award for a Significant Work in Botanical or Horticultural Literature From medicinal industrial and culinary uses to cutting edge laboratory techniques in modern research and plant conservation strategies **Natural Products Analysis** Vladimir Havlicek, Jaroslav Spizek, 2014-10-13 This book highlights analytical chemistry instrumentation and practices applied to the analysis of natural products and their complex mixtures describing techniques for isolating and characterizing natural products Applies analytical techniques to natural products research an area of critical importance to drug discovery Offers a one stop shop for most analytical methods x ray diffraction NMR analysis mass spectrometry and chemical genetics Includes coverage of natural products basics and highlights antibacterial research particularly important as efforts to combat drug resistance gain prominence Covers instrumental techniques with enough detail for both current practitioners and beginning researchers **Handbook of Research on Natural Products and Their Bioactive Compounds as Cancer Therapeutics** Pandurangan, Ashok Kumar, Anandasadagopan, Suresh Kumar, Alhumaydhi, Fahad

A.,2022-03-18 Many chemotherapeutic agents are available in today s market that are highly effective against a variety of cancer types however the major drawbacks of these chemotherapeutic agents are the many side effects As an alternative to these chemotherapeutic agents there are a number of natural agents that are effective against cancer that have been tested in preclinical and clinical models over the years These natural products must be documented and discussed in order to provide a thorough overview of all the options available for cancer treatment The Handbook of Research on Natural Products and Their Bioactive Compounds as Cancer Therapeutics emphasizes the list of natural agents against all types of cancers and discusses the current state of research in the fields of natural products and their derivatives against cancer in preclinical and clinical models This book also provides insight into the applications of meditation and mindfulness based interventions in clinical and non clinical conditions Covering topics such as cancer therapy antioxidants and flavonoids it is ideal for students research scholars academicians professors scientists oncologists doctors and medical practitioners *Natural Products Desk Reference* John Buckingham,2015-11-18 Written by the team that brought you the prestigious Dictionary of Natural Products DNP the Natural Products Desk Reference provides a concise overview of the key structural types of natural products and their interrelationship A structurally diverse group ranging from simple aliphatic carbon chains to high molecular weight proteins natural p **Marine Natural Products Research in South-East Asia** Lik Tong Tan,Novriyandi Hanif,2025-09-30 This unprecedented volume offers a comprehensive review of marine natural products research across Southeast Asia a region teeming with untapped marine biodiversity It provides an extensive survey of the chemistry and biology of specialized metabolites derived from marine organisms such as sponges tunicates soft corals and marine microbes Highlighting both the scientific advances and critical gaps the book identifies strategic areas for future research and drug discovery initiatives With its regional focus and collaborative insights this edited collection serves as a vital resource for researchers policymakers and industry stakeholders engaged in marine biotechnology and sustainable pharmaceutical development in one of the world s most biodiverse marine ecosystems **Antidiabetic Drug Discovery from Natural Products** Shailendra S. Gurav,Uchenna Estella Odoh,Nilambari S Gurav,Yogesh A. Kulkarni,Rupesh Chikhale,2025-06-16 Antidiabetic Drug Discovery from Natural Products provides up to date and in depth information practical understanding and guidance in a comprehensive systematic and easy to understand manner to scientists researchers and graduate students on important and emerging biochemical topics related to current antidiabetic drug discovery research This book analyzes and studies natural active substances and their medicinal chemistry in preventing and treating diabetes and its complications It covers a wide range of critical issues to assist chemists in the discovery and development of safer more affordable treatments from identifying promising leads from medicinal plants to the extraction and synthesis of bioactive compounds Following an introduction to bioactive chemical compounds from plants with antidiabetic effects the book describes the discovery and extraction of antidiabetic drugs and antioxidants from natural sources It also examines antidiabetic plants before delving

deeper into the chemistry behind major medicinal substances and their derivatives like Mangiferin and Resveratrol discussing both current and prospective uses Covers the history and current trends in antidiabetic natural product research Focuses on each class of natural products and their therapeutic effects on diabetes Analyzes the specific roles of different plant metabolites in the treatment of diabetes *Genetic Resources, Chromosome Engineering, and Crop Improvement* Ram J. Singh, 2011-09-15 Medicinal Plants Volume 6 of the Genetic Resources Chromosome Engineering and Crop Improvement series summarizes landmark research and describes medicinal plants as nature's pharmacy Highlights Examines the use of molecular technology for maintaining authenticity and quality of plant based products Details reports on individual medicinal plants including their history origin genetic resources cytogenetics and varietal improvement through conventional and modern methods and their use in pharmaceutical cosmeceutical nutrition and food industries Explains how to protect plants with medicinal properties from deforestation urbanization overgrazing pollution overharvesting and biopiracy Brings together information on germplasm resources of medicinal plants their history taxonomy and biogeography ecology and biodiversity genetics and breeding exploitation and utilization in the medicine and food industries Written by leading international experts and an innovative panel of scientists Medicinal Plants offers the most comprehensive and up to date information on medicinal plant genetic resources and their increasing importance in pharmaceutical and cosmeceutical industries medicine and nutrition around the world Includes eight page color insert more than 25 full color figures **Drug Discovery and Development** Omboon Vallisuta, Suleiman Olomat, 2015-06-03 It is very important for scientists all over the globe to enhance drug discovery research for better human health This book demonstrates that various expertise are essential for drug discovery including synthetic or natural drugs clinical pharmacology receptor identification drug metabolism pharmacodynamic and pharmacokinetic research The following 5 sections cover diverse chapter topics in drug discovery Natural Products as Sources of Leading Molecules in Drug Discovery Oncology and Drug Discovery Receptors Involvement in Drug Discovery Management and Development of Drugs against Infectious Diseases Advanced Methodology

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Table of Contents Natural Products Research Journal

1. Understanding the eBook Natural Products Research Journal
 - The Rise of Digital Reading Natural Products Research Journal
 - Advantages of eBooks Over Traditional Books
2. Identifying Natural Products Research Journal
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Natural Products Research Journal
 - User-Friendly Interface
4. Exploring eBook Recommendations from Natural Products Research Journal
 - Personalized Recommendations
 - Natural Products Research Journal User Reviews and Ratings
 - Natural Products Research Journal and Bestseller Lists
5. Accessing Natural Products Research Journal Free and Paid eBooks
 - Natural Products Research Journal Public Domain eBooks
 - Natural Products Research Journal eBook Subscription Services

- Natural Products Research Journal Budget-Friendly Options
- 6. Navigating Natural Products Research Journal eBook Formats
 - ePub, PDF, MOBI, and More
 - Natural Products Research Journal Compatibility with Devices
 - Natural Products Research Journal Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Natural Products Research Journal
 - Highlighting and Note-Taking Natural Products Research Journal
 - Interactive Elements Natural Products Research Journal
- 8. Staying Engaged with Natural Products Research Journal
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Natural Products Research Journal
- 9. Balancing eBooks and Physical Books Natural Products Research Journal
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Natural Products Research Journal
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Natural Products Research Journal
 - Setting Reading Goals Natural Products Research Journal
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Natural Products Research Journal
 - Fact-Checking eBook Content of Natural Products Research Journal
 - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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