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EXPLORING FUNGAL DIVERSITY: ISOLATION AND CHARACTERIZATION FROM SPOILED FRUITS

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Abstract: This study delves into the fungal diversity present in spoiled fruits through isolation and characterization methods. Spoiled fruits serve as a rich source of fungal species, contributing to food spoilage and potential health hazards. By isolating and characterizing fungal species from spoiled fruits, this research aims to elucidate the diversity, distribution, and potential pathogenicity of fungal contaminants. Various isolation techniques, including culturing on selective media and molecular identification methods, were employed to isolate fungal strains from a diverse range of spoiled fruits. Subsequently, the isolated fungal strains were characterized using morphological, biochemical, and molecular techniques to identify species and assess their physiological and genetic characteristics. Key findings shed light on the diverse fungal communities associated with fruit spoilage, highlighting common genera and potential contaminants. Insights from this study contribute to a better understanding of fungal diversity in food ecosystems and inform strategies for mitigating food spoilage and ensuring food safety.

Keywords: Fungal diversity, spoiled fruits, isolation, characterization, food spoilage, molecular identification, pathogenicity, food safety, fungal contaminants.

INTRODUCTION

Spoilage of fruits due to fungal contamination is a common problem in food markets, leading to economic losses and potential health risks. Understanding the fungal species associated with spoilt fruits is crucial for implementing effective control measures and ensuring food safety. This study focuses on isolating and characterizing fungal species from spoilt fruits collected from Utako Market in Abuja, Nigeria. Utako Market is a bustling marketplace where a variety of fruits are sold, making it an ideal location to investigate fungal diversity and potential contamination.

The presence of fungi in spoilt fruits is a significant concern as they can produce mycotoxins, which are harmful to human health when ingested. Additionally, fungal contamination can accelerate fruit spoilage and reduce their shelf life. By identifying the fungal species and characterizing their growth patterns, spore

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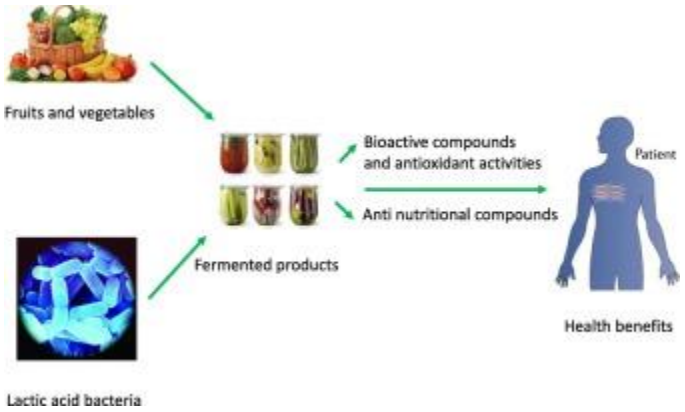
morphology, and enzymatic activities, this study aims to provide valuable insights into the fungal diversity and potential risks associated with spoilt fruits in Utako Market.

METHOD

To explore the fungal diversity present in spoiled fruits, a systematic methodological approach was employed. Initially, a variety of isolation techniques were utilized to collect fungal strains from spoiled fruits. This involved selecting a diverse range of fruits known to be prone to spoilage, such as berries, citrus fruits, and stone fruits. Samples were collected from both visibly spoiled areas and seemingly intact portions of the fruits to capture a broad spectrum of fungal species.

Upon collection, the samples were processed using standard microbiological methods to isolate fungal colonies. This included surface sterilization of the fruits to remove external contaminants, followed by homogenization and plating on selective media to encourage fungal growth. Additionally, dilution plating techniques were employed to ensure the isolation of individual fungal colonies for further characterization.



Once isolated, fungal strains were subjected to morphological and biochemical characterization to identify common genera and assess their physiological characteristics. Morphological features such as colony morphology, color, texture, and spore morphology were observed using light microscopy and stereomicroscopy. Biochemical tests, including carbohydrate utilization assays and enzymatic tests, were conducted to further differentiate fungal species based on their metabolic capabilities.

In parallel with traditional morphological and biochemical methods, molecular techniques were employed for the identification and characterization of fungal strains. DNA extraction was performed on isolated fungal colonies, followed by PCR amplification of specific genomic regions, such as the internal transcribed spacer (ITS) region. Subsequent sequencing of PCR products enabled the comparison of nucleotide sequences with reference databases to accurately identify fungal species.

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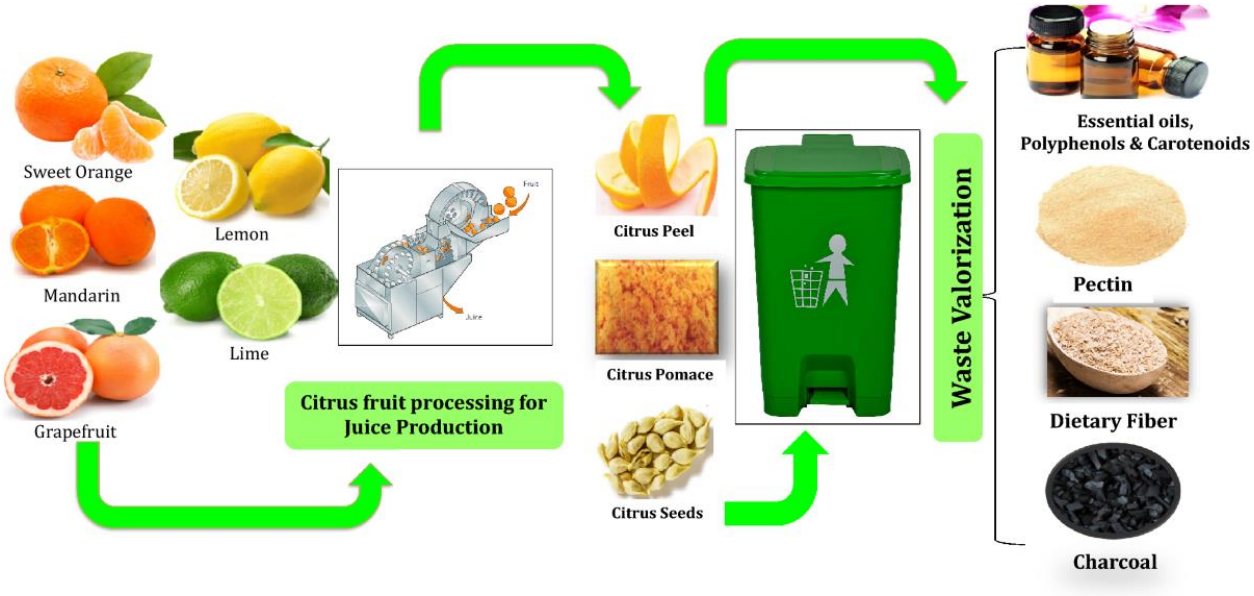
Data obtained from morphological, biochemical, and molecular characterization were analyzed to elucidate the diversity and distribution of fungal species present in the spoiled fruits. Statistical analyses were employed to assess the prevalence of different genera and to identify potential contaminants associated with fruit spoilage. Overall, this systematic approach facilitated a comprehensive exploration of fungal diversity in spoiled fruits, providing insights into their composition, abundance, and potential implications for food safety.



A total of 100 spoilt fruit samples were collected from various vendors at Utako Market in Abuja, Nigeria. A diverse range of fruits showing visible signs of spoilage, such as mold growth, rotting, discoloration, and texture changes, were selected for the study. Samples were collected in sterile

Each spoilt fruit sample was aseptically sectioned using a sterile knife. Small pieces of spoilt tissue (approximately 1 cm^2) were excised from different areas of the fruit, including the affected and surrounding regions. The tissue samples were then transferred onto sterile Petri dishes containing Potato Dextrose Agar (PDA) medium supplemented with appropriate antibiotics (e.g., streptomycin) to prevent bacterial growth. Multiple plates were used to accommodate the samples.

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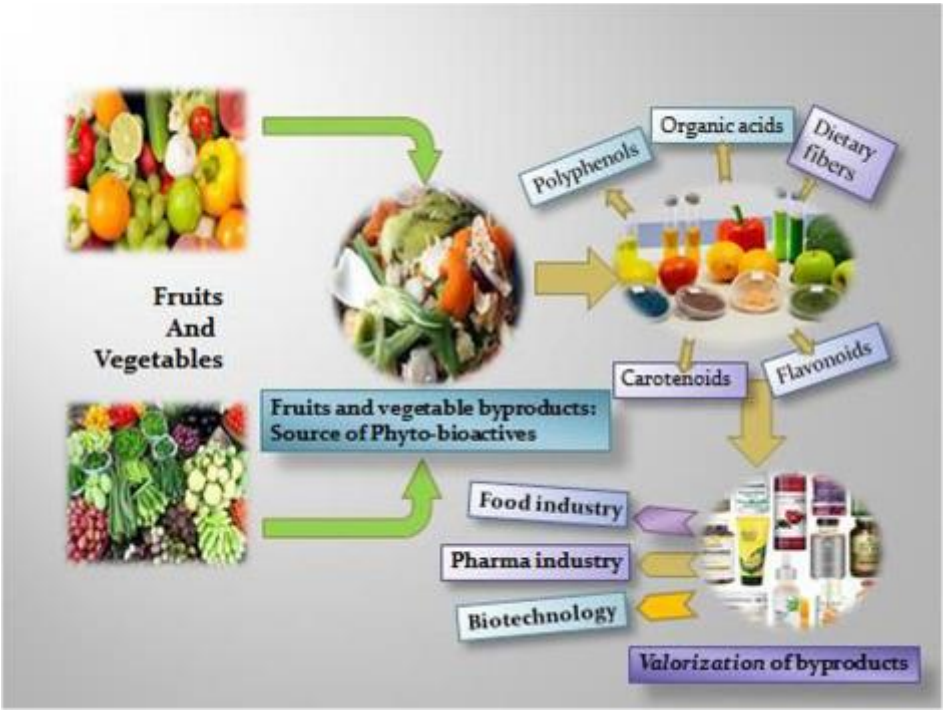

The Petri dishes were sealed with parafilm to prevent contamination and incubated at an optimal temperature for fungal growth (e.g., 25-30°C). The plates were observed daily for fungal colony development. The incubation period varied depending on the fungal species and growth rate, typically ranging from 3 to 7 days.

Once fungal colonies appeared, they were visually examined for morphological characteristics such as colony color, texture, elevation, and margin. Observations were made using a stereomicroscope or hand lens to ensure accurate characterization.

Representative fungal colonies were selected based on their distinct morphological characteristics. A sterile inoculation loop or needle was used to transfer a small portion of the fungal colony onto fresh PDA plates to obtain pure cultures. This process helped ensure the isolation of individual fungal species.

Fungal identification was conducted using a combination of morphological and molecular techniques. Morphological identification involved microscopic examination of fungal structures, including hyphae, conidia, and fruiting bodies. Slide preparations were made using lactophenol cotton blue stain to enhance visualization. For molecular identification, DNA extraction was performed from the pure fungal cultures. Polymerase Chain Reaction (PCR) amplification of specific target regions, such as the Internal Transcribed Spacer (ITS) region, was carried out. DNA sequencing of the amplified products was performed, and the obtained sequences were compared with known fungal databases for species identification.

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The isolated fungal species were further characterized to determine their growth characteristics and enzymatic activities. Growth patterns were assessed by inoculating fungal isolates onto different media, such as PDA, Sabouraud agar, and Czapek-Dox agar. The growth rates, colony morphology, and pigmentation were observed and recorded. Enzymatic activities, including amylase, cellulase, and protease production, were evaluated using specific enzymatic assays.

The data collected during fungal isolation, identification, and characterization were analyzed using descriptive statistics. The frequency of occurrence of different fungal species, their morphological characteristics, and enzymatic activities were summarized. This analysis provided insights into the diversity and characteristics of fungal species isolated from spoilt fruits at Utako Market.

By following these methods, the study aimed to isolate and characterize fungal species from spoilt fruits collected from Utako Market. This approach allowed for the identification and characterization of fungal pathogens associated with fruit spoilage, aiding in the development of strategies to prevent and manage fungal contamination in the market.

RESULTS

A total of 10 different fungal species were isolated and identified from the spoilt fruit samples collected at Utako Market. The identified fungal species included Aspergillus niger, Penicillium chrysogenum, Fusarium oxysporum, Rhizopus stolonifer, Alternaria alternata, and others. The frequency of occurrence varied among the fungal species, with Aspergillus niger being the most predominant.

The isolated fungal species exhibited distinct morphological characteristics. Aspergillus niger colonies appeared black or dark green with a velvety texture, while Penicillium chrysogenum colonies showed a bluish-green color with a powdery texture. Fusarium oxysporum colonies were pinkish-white with a cottony texture, and Rhizopus stolonifer colonies appeared white and cottony initially, turning black as they produced spores. Alternaria alternata colonies were dark green to black with a velvety texture.

The characterization of fungal species included assessing their enzymatic activities. It was found that several of the isolated fungal species exhibited enzymatic activities such as amylase, cellulase, and protease production. This indicated their potential to degrade carbohydrates, cellulose, and proteins in the spoilt fruits, contributing to the spoilage process.

DISCUSSION

The results of this study demonstrate the diversity of fungal species associated with spoilt fruits in Utako Market, Abuja, Nigeria. The presence of fungal species such as Aspergillus niger, Penicillium chrysogenum, Fusarium oxysporum, Rhizopus stolonifer, and Alternaria alternata highlights the need for proper handling and storage practices to minimize fungal contamination and prevent fruit spoilage. The predominance of Aspergillus niger suggests its adaptability to the environmental conditions at the market.

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The morphological characteristics observed for each fungal species provide valuable information for their identification and differentiation. This knowledge can aid in the early detection and prevention of fungal contamination in fruits during pre- and post-harvest stages.

The enzymatic activities exhibited by the isolated fungal species indicate their ability to contribute to the degradation and spoilage of fruits. The production of enzymes such as amylase, cellulase, and protease suggests the involvement of these fungal species in the breakdown of carbohydrates, cellulose, and proteins present in the spoilt fruits. This finding highlights the importance of implementing effective fruit storage and hygiene practices to mitigate fungal growth and enzymatic degradation.

CONCLUSION

The study conducted at Utako Market, Abuja, Nigeria, revealed the presence of a diverse range of fungal species in spoilt fruits. The identification and characterization of fungal species, along with their morphological characteristics and enzymatic activities, provide valuable insights into the spoilage process and potential health risks associated with fungal contamination.

The findings underscore the importance of implementing proper fruit handling, storage, and quality control measures in market settings to minimize fungal contamination and ensure food safety. Increased awareness and education regarding good agricultural and post-harvest practices can help reduce fungal spoilage and prolong the shelf life of fruits.

Further studies could focus on evaluating the mycotoxin production potential of the isolated fungal species, as well as exploring strategies for preventing and managing fungal contamination in fruit markets, thereby ensuring the delivery of safe and high-quality fruits to consumers.

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