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Isolation And Identification Of Some Fungal Strains Growing On Market Vegetables As Contaminants.

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Abstract

Market vegetables, being rich in moisture and nutrients, provide an ideal substrate for the colonization and growth of diverse fungal communities. From the time of harvesting, transportation, storage and marketing, vegetables are continuously exposed to environmental and handling related factors resulting into their fungal contamination. During present study, three solanaceous vegetables viz; Tomato, Brinjal and Potato sold in the market of Bilaspur were studied for the presence of fungal flora within them, cut pieces of the vegetable samples were grown on the Czapex-Dox media and the fungal isolates grown over culture plates were purified by the method of single colony isolation. The fungi growing on the three vegetables were identified on the basis of their colony characteristics, morphological features and asexual reproductive characteristics. These were identified as *Aspergillus niger, Aspergillus flavus, Aspergillus fumigatus, Aspergillus sulphureus, Penicillium albocoremeum, Penicillium chrysogenum, Trichoderma species, Mucor species, Fusarium solani, Rhizopus species, Alternaria alternate* and *Cladosporium species.*

The study provides baseline data on fungal diversity in market vegetables sold in the city of Bilaspur, Chhattisgarh. Further the findings emphasize the need for improved postharvest handling, hygiene and monitoring strategies to minimize fungal contamination and ensure safety of market vegetables.

Keywords: Solanaceous vegetables, Fungal flora, contamination, postharvest, colony characteristics.

Introduction

The occurrence of fungal contaminants on fresh vegetables has been widely reported across different agro-ecological zones, highlighting the ubiquity of fungi in post-harvest food systems. Early investigations established that vegetables are highly susceptible to colonization by saprophytic and pathogenic fungi due to their high moisture content, nutrient availability, and frequent mechanical injuries during harvesting and transportation (Pitt and Hocking, 2009; Snowdon, 1990). Market environments further exacerbate this susceptibility through prolonged exposure to ambient conditions, repeated handling, and inadequate sanitation (Beuchat, 2002; Olaimat and Holley, 2012).

Numerous surveys conducted in open and retail markets have consistently identified genera such as *Aspergillus*, *Penicillium*, *Fusarium*, *Alternaria*, *Rhizopus*, and *Mucor* as dominant contaminants of vegetables (Bennett and Klich, 2003; Tournas, 2005; Amadi and Adeniyi, 2009). These fungi are not only responsible for visible spoilage but are also associated with the production of mycotoxins, thereby raising concerns about chronic dietary exposure (Marín *et al.*, 2013; Perrone *et al.*, 2014).

A substantial portion of the literature emphasizes fungal spoilage dynamics and post-harvest losses rather than comprehensive contaminant profiling. Research has shown that spoilage fungi can reduce vegetable shelf life by up to 30–50%, with significant economic consequences (Droby *et al.*, 2016). Parallel studies have documented the occurrence of mycotoxins such as aflatoxins, ochratoxin A, and alternariol in contaminated vegetables, underscoring the public health relevance of fungal contamination (Logrieco *et al.*, 2009; Patriarca and Pinto, 2017).

Despite these findings, many studies assess mycotoxin presence without thoroughly characterizing the fungal strains responsible, limiting the interpretability of risk assessments. Additionally, investigations often focus on single commodities or controlled storage conditions, offering limited insight into the diversity of fungi present at real-world market points of sale (Alshannaq and Yu, 2017).

Solanaceous vegetables constitute one of the most economically and nutritionally important groups of crops cultivated worldwide. The family Solanaceae includes several widely consumed vegetables such as tomato (*Solanum lycopersicum*), brinjal or eggplant (*Solanum melongena*), chilli and capsicum (*Capsicum annuum*), and potato (*Solanum tuberosum*). These vegetables are valued for their high content of vitamins, minerals, antioxidants and bioactive compounds, and they form an integral part of daily diets, particularly in tropical and subtropical regions. Due to their soft tissues, high moisture content and nutrient-rich nature, solanaceous vegetables are highly susceptible to microbial colonization, especially by fungi, at various stages from cultivation to postharvest handling and marketing.

Fungal association with solanaceous vegetables being in the field and continues through harvesting, transportation, storage and market display. In the pre harvest stage, fungi present in soil, irrigation water, air and plant debris colonize different plant parts, including roots, stems, leaves, flowers and fruits. Many of these fungi act as plant pathogens, causing diseases such as wilt, blight, anthracnose, leaf spot, and fruit rot, which significantly reduce crop yield and quality. Common field associated fungi of solanaceous crops include species of *Fusarium*, *Alternaria*, *Collectotricum*, *Phytophthora* and *Rhizoctonia*, Environmental factors such as temperature, humidity, rainfall and agricultural practices strongly influence the diversity and severity of fungal infections in these crops.

Postharvest fungal contamination of solanaceous vegetables is an equally serious concern. After harvesting, vegetables are exposed to mechanical injuries, improper handling and fluctuating environmental conditions that facilitate fungal invasion and rapid spoilage. Market vegetables, in particular, are frequently contaminated due to repeated handling, unhygienic storage conditions and exposure to airborne fungal spores. Fungi such as *Aspergillus*, *Penicillium*, *Rhizopus*, *Mucor* and *Cladosporium* commonly colonize harvested solanaceous vegetables, leading to soft rot, watery decay, discoloration and off-odors. These spoilage fungi not only cause significant postharvest losses but also reduce the market value and shelf life of vegetables.

The association of fungi with solanaceous vegetables is of great ecological significance, as these microorganisms play diverse roles ranging from pathogenicity to saprophytism. While pathogenic fungi initiate disease in healthy tissues, saprophytic fungi dominate during later stages of decay, contributing to the decomposition and recycling of organic matter. This sequential colonization reflects a process of fungal succession, where early invaders alter the substrate, making it suitable for subsequent fungal communities.

Understanding this ecological succession is important for interpreting spoilage patterns and microbial dynamics in market vegetables.

From a food safety perspective, fungal contamination of solanaceous vegetables poses potential risks to human health. Several fungi associated with these vegetables are known producers of mycotoxins, such as aflatoxins, ochratoxins, fumonisins and alternariol, which can contaminate edible tissues. Consumption of mycotoxin-contaminated vegetables may lead to acute or chronic health problems, including gastrointestinal disorders, immunosuppression and carcinogenic effect. In addition, opportunistic fungal pathogens present on vegetables may cause infections in immunocompromised individuals. Therefore, the study of fungal flora associated with solanaceous vegetables is crucial not only for plant pathology and postharvest biology but also for public health and food quality assessment.

Despite the importance of solanaceous vegetables, comprehensive studies on the diversity, frequency and succession of fungal communities associated with these crops, particularly under market conditions, remain limited in many regions. Various in climate, geography, cultivation practices, and market infrastructure significantly influence the composition of fungal flora. Detailed investigations into fungal association patterns can provide baseline data essential for developing effective disease management strategies, improving postharvest handling practices and minimizing losses.

In this context, the present study focuses on the fungal association of solanaceous vegetables with an emphasis on their diversity, ecological role and implication for spoilage and food safety. By analyzing the fungal communities present at different stages of deterioration, the study aims to enhance understanding of fungal succession and its impact on vegetable quality. Such knowledge is essential for designing sustainable interventions to improve shelf life, reduce economic losses and ensure the availability of safe and high quality solanaceous vegetables to consumers.

Materials and Methods:

Culture Media: Czapek Dox Agar (CDA) culture media having the given composition was used for the purpose of isolation of fungal flora growing within the vegetables composition, pH, supplements.

All the chemical used were of analytical grade and obtained from various commercial sources.

Collection of vegetable samples: Samples of the three vegetables were collected from Brihaspati market of the Bilaspur city. These were kept in polythene bags, carried to the laboratory and kept inside de freezers to minimize further contamination.

Culture of fungi: Before culturing, samples were cut into small pieces. These were made in the form of paste by using little amount of sterilized water. This was filtered by double layered muslin cloth. The filtrate was used as the source of fungi.

The filtrate was diluted thrice by the method of serial dilution using 0.9% normal saline (NaCl). 0.2ml of third dilution was plated on the petri plates containing Czapek Dox Agar culture media, Plates were incubated at 30ºC continuously for five days. The colonies were counted.

Identification of fungal isolates: The petri plates contained mixture of colonies of various fungal species. These species were purified by the method of simple colony isolation. Identification of these species was made on the basis of their colony characteristics, mycelial structure, conidiophore morphology and the arrangement and structure of conidia (Gilman, 1966; Barnett and Hunter, 1972; Nagmani *et al* 2013).

Results and Discussion:

The findings of the present study reveal a rich and diverse assemblage of fungal species associated with solanaceous vegetables collected from market conditions. Analysis of infected and apparently healthy samples demonstrated that the fungal colonization occurred varying frequencies across different vegetables types and storage period. Identification of the fungal species obtained from vegetables further reveal that these were both pathogenic as well as non-pathogenic in nature. Altogether 09 species of fungi were identified from Tomato, 08 from Brinjal and 06 from Potato.

Table 1

Fungal species collected from solanaceous vegetables sold in market of Bilaspur city.

Sr.No.	Fungal species	Prevalence on the vegetable		
		Tomato	Brinjal	Potato
1	*Aspergillus niger*	+	+	+
2	*Aspergillus flavus*	+	+	+
3	*Aspergillus fumigatus*	+	+	-
4	*Aspergillus sulphureus*	+	+	+
5	*Penicillium albocoremeum*	+	+	-
6	*Penicillium chrysogenum*	+	-	+
7	*Trichoderma species*	+	+	-
8	*Mucor species*	-	-	+
9	*Fusarium solani*	-	+	-
10	*Rhizopus species*	+	+	-
11	*Alternaria alternate*	-	-	+
12	*Cladosporium species*	+	-	-

To study the data presented in Table 1 reveal that *Mucor species*, *Fusarium solani* and *Alternaria alternate* were absent in tomato, while *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus sulphureus*, *Penicillium albocoremeum*, *Penicillium chrysogenum*, *Trichoderma species*, *Rhizopus species* and *Cladosporium species* were found. In brinjal *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus sulphureus*, *Penicillium albocoremeum*, *Trichoderma species*, *Fusarium solani* and *Rhizopus species* were present while *Penicillium chrysogenum*, *Mucor species*, *Alternaria alternate* and *Cladosporium species* were absent. In the sample of potato *Aspergillus fumigatus*, *Penicillium albocoremeum*, *Trichoderma species*, *Fusarium solani*, *Rhizopus species* and *Cladosporium species* were absent while *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus sulphureus*, *Penicillium chrysogenum*, *Mucor species* and *Alternaria alternate* were present.

Colonies of various fungal species were also count for the purpose of analyzing the fungal load on the vegetables. The data has been presented in the table 2.

Table 2

Sr.No.	Fungal species	Number of colonies		
		Tomato	Brinjal	Potato
1	*Aspergillus niger*	12	16	22
2	*Aspergillus flavus*	14	19	24
3	*Aspergillus fumigatus*	15	17	-
4	*Aspergillus sulphureus*	16	15	18
5	*Penicillium albocoremeum*	10	13	-
6	*Penicillium chrysogenum*	16	-	11
7	*Trichoderma species*	18	10	-
8	*Mucor species*	-	-	7
9	*Fusarium solani*	-	14	-
10	*Rhizopus species*	13	17	-

11	*Alternaria alternate*	-	-	12
12	*Cladosporium species*	13	-	-
Total		127	121	87

From the above data presented in table 2 fungal load on the three solanaceous vegetables were calculated to be 127 in tomato, 121 in brinjal and 87 in potato.

In conclusion the present study demonstrates that solanaceous vegetables harbor a diverse and dynamic fungal community as under market conditions. Among various fungi *Aspergillus*, *Penicillium*, *Mucor* and *Rhizopus* were the dominant fungal genera growing on the vegetables. Though, the study reports the presence of a number of fungal species on vegetables, the binding is preliminary in nature. Detailed investigation with regard to the damage, biochemical deterioration, hazards on human health and possible safety measures are needed in future.

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