

Research Article

Fungal Contamination of some Common Spices

SK Shiva Rani* and Neeti Saxena

Department of Botany, University College for Women, Koti, Hyderabad, India

Abstract

Spices form an integral part of our daily diet, medicine, religious rituals, cosmetics and perfumery. Ajowan, black pepper and fennel are extensively used spices in India. Spices are exposed to microbial contamination during pre, post-harvest and storage period. Seed Mycoflora not only deteriorate the quality of spices but also increase the mycotoxin contamination. Tropical countries like India suffer the losses mainly due to storage fungi. The present investigation deals with the isolation and identification of fungi associated with the ajowan, black pepper and fennel. Seed borne fungi was isolated by employing agar plate technique from both unsterilized and surface sterilized test seed samples. Total 26 fungal species were isolated from the test spices. Seven fungal species viz. *Alternaria alternata*, *Aspergillus flavus*, *Aspergillus niger*, *Curvalaria luntia*, *Mucor sp*, *Rhizopus nigricans* and *Penicillium chrysogenum* were commonly isolated from all the three spice samples. *Aspergillus* constitute a dominant storage fungi represented by 9 species.

Key words: Agar plate technique; Seed Mycoflora; Spices

Introduction

Spices constitute an important group of horticultural commodities which play a significant role in national economy. They are the plant substances from indigenous or exotic origin. According to the International Organization For Standardization (ISO) the term 'Spices and condiments' refer to an aromatic or pungent vegetable substances used for flavouring and also have several commercial uses. Spices includes leaves (coriander, mint), flower (clove), leaf bases (garlic, onion), fruit (red chilli, black pepper), stem bark (cinnamon), rhizome (ginger, turmeric) and other plant parts [1]. They been used as an integral part of our daily diet, medicine, religious rituals, cosmetics and perfumery. Spices are used as a raw material in folk medicine, as an ingredient in drug preparations of traditional medical systems, in

*Corresponding author: SK Shiva Rani, Department of Botany, University College for Women, Koti, Hyderabad, India, mail: shivaranisilamkoti79@gmail.com

Citation: Rani SK, Saxena N (2022) Fungal Contamination of some Common Spices. J Plant Sci Curr Res 5: 014.

Received: December 15, 2021; **Accepted:** January 10, 2022; **Published:** January 17, 2022

Copyright: © 2022 Rani SK, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

pharmaceuticals and as a supplement for dietetic products especially for self medication [2]. The therapeutic activity of spices is due to the presence of tartaric acid, acetic acid, citric acid, succinic acid, gums, pectin, sugars, tannins, alkaloids, flavinoids, glycosides and sesquiterpenes [3,4] Aida oils, oleoresins, ground spices like curry powder, paprika and as a variety of spice mixtures. From last few decades, as there is a definite shift towards traditional/ ethnic medicines and spices form a part of many of the medicinal preparations. The demand for the good quality of the spices has been increased, but the quality of spices is far from being satisfactory due to the postharvest losses [5] stated seed deterioration is one of the basic reasons for the low productivity with annual losses of 25% of the harvested crop. The stored grains deteriorate rapidly and marked changes in quality and quantity are due to invasion of microorganisms and losses caused by them are referred to as biodeterioration [6].

Spices are exposed to microbial contamination during pre and postharvest period [7]. Contamination may also occur during processing, storage, distribution, sale and usage of spices [8]. In spices, most of the microbial populations are probably regarded as commensal residents on the plant and survived drying and storage phases [9]. According to [10] soil and air are the main inoculum source for causing contamination in crude spices in field and reported that fungi are the most predominant contaminants of spices [11] reported that mycoflora of spices like paprika, black pepper, white pepper and ginger was dominated by airborne fungi. Spices are heavily contaminated with xerophilic storage moulds such as *Aspergillus*, *Penicillium* [12-16]. Improper storage conditions provide ideal environment for the rapid colonization by storage fungi and drying on bare ground may results in toxic moulds contamination and mycotoxins production.

Materials and Methods

In the present work is aimed to throw light on the investigation of detailed survey of mycoflora of three spices viz Ajowan (*Trachyspermum ammi* L.) Black pepper (*Piper nigrum* L.) and Fennel (*Foeniculum vulgare* Mill.). Seed samples were collected from the local markets and malls in loose and pack form respectively from the Hyderabad. All the spice samples (12) were packed in transparent polythene bags and transported to laboratory. In the present study agar plate method has been used to isolate seed mycoflora.

Isolation of fungi was done from the unsterilized seeds (untreated) and surface sterilized seeds (treated) with 2% sodium hypochlorite solution by employing Agar plate technique [17]. Potato dextrose medium was used for the isolation of fungi. Inoculated petriplate were incubated at 27°C. Examination of plates were done from the 4th day up to 10th day. Fungi appearing on the seeds and around it were isolated and monospore cultures were raised for specific identification was done by referring relevant literature [18]. Incidence of fungal species is calculated by percentage relative frequency [19,20].

Results and Discussion

Data given in the table, a total 26 fungal species were isolated from the test species viz *Alternaria alternata*, *Alternaria humicola*,

Aspergillus flavus, *Aspergillus fumigatus*, *Aspergillus niger*, *Aspergillus ochraceus*, *Aspergillus sydowii*, *Aspergillus tamaris*, *Aspergillus terreus*, *Chaetomium sp*, *Cladosporium sp*, *Cochiliobolus spicifer*, *Curvularia lunata*, *Drechslera hawaiiensis*, *Fusarium moniliforme*, *Fusarium oxysporum*, *Mucor sp*, *Penicillium chrysogenum*, *Rhizopus arrhizus*, *Rhizopus nigricans*, *Rhizopus stolonifera*, *Trichoderma longibrachiatum*, *Trichoderma viride*. A high percentage frequency of fungi was isolated from unsterilized seeds when compared to surface sterilized seeds. Fungi screened from the test samples belong to ascomycetes, zygomycetes and mitosporic fungi.

On individual basis 15, 17 and 19 fungal species were isolated from ajowan, black pepper and fennel. Seven fungal species viz. *Alternaria alternata*, *Aspergillus flavus*, *Aspergillus niger*, *Curvularia lunata*, *Mucor sp*, *Rhizopus nigricans* and *Penicillium chrysogenum* were commonly isolated from all the three spice samples. Maximum fungal diversity was detected in fennel (12 genera) followed by ajowan and minimum fungal diversity was found in black pepper. It was observed that *Aspergillus* constitute a dominant storage fungi represented by a 9 species.

It was observed that *Aspergillus niger* (28%) showed the maximum percentage of incidence and minimum of *Trichoderma longibrachiatum* (2%) on ajowan seeds. *Aspergillus flavus* was recorded at high percentage on black pepper (26%) and fennel (38%), where as *Fusarium oxysporum* (3%) and *Trichoderma viride* (2%) on black pepper and fennel seeds respectively (Table 1).

21..	Penicillium chrysogenum	18	16	12	10	40	35
22	Rhizopus arrhizus	-	-	22	18	-	-
23	Rhizopus nigricans	-	-	-	-	18	14
24	Rhizopus stolonifera	-	-	-	-	28	18
25	Trichoderma longibrachiatum	10	2	-	-	-	-
26	Trichoderma viride	-	-	-	-	6	2

Table 1: Percentage frequencies of fungi isolated from three spices seed samples by agar plate method.

Discussion

Spices constitute an important fraction of human diet due to its high nutritive value and they also act as good substrates for the growth of toxigenic fungi. Spices are exposed to a wide range of microbial contamination due to poor collection conditions, unpretentious production process, extended drying times and improper storage. In addition, spices can be contaminated through dust, wastewater and animal human excreta in unpacked spices, which are sold in markets and bazaars [21,22].

In the present study 26 fungal species belonging to 12 genera were isolated from the three test samples. Improper harvest, drying, package practices, post-harvest and storage conditions also cause for wide spectrum of fungi. It shows that fungi are predominant contaminants of spices. The unsterilized seed harboured more number of fungi than surface sterilized seed.

The results obtained reveals that maximum fungal species were isolated from fennel, where as Moharram et al., 1989 reported 25 species of *Aspergillus* from *Foeniculum vulgare* and *Pimpinella anisum* seeds collected from local markets of Egypt. Ath-Har et al., studied the mycoflora of *Piper nigrum*, *Coriandrum sativum*, *Capiscum frutescens*, *Cuminum cyminum*, *Foeniculum vulgare*, *Trigonella foenumgraecum* and *Brassica nigra*. *Aspergillus flavus*, *A. niger*, *A. nidulans*, *A. sydowii*, *A. ochraceus*, *Penicillium* and *Rhizopus* spp. were most frequently isolated from the above spices.

The most predominant genus encountered was *Aspergillus* represented by 9 species in the test samples. similar observations were made by [23-25] reported *Aspergillus flavus* and *Aspergillus niger* were dominant in their survey of seed mycoflora from common spices collected from the markets of sultanate of Onam. Climatic conditions of tropical and subtropical countries favour the growth of *Aspergilli* as stated by Pitt [26,27].

In conclusion, the results indicates that though the spices like black pepper, fennel and ajwon are known for their antimicrobial properties and used in therapeutic uses were heavily contaminated by fungi. Seed mycoflora not only deteriorate the quality of spices but also increase the mycotoxin contamination. Improving the storage, post-harvest and processing conditions may help in low risk of fungal contamination.

References

1. Ram Kumar Pundir, Pranay Jain (2010) Comparative studies on the Anti-microbial activity of Black pepper (*Piper nigrum*) and Turmeric (*Curcuma longa*) extracts. Int J Applied Biology and Pharmaceutical Technology 1: 492-501.

Percentage (%) incidence of different species of fungi on spices							
S.No	Name of the fungi	Trachyspermum ammi		Piper nigrum		Foeniculum vulgare	
		US	S	US	S	US	S
1	Alternaria alternata	20	17	20	12	27	18
2	Alternaria humicola	-	-	22	16	27	12
3	Alternaria tenuissima	18	12	-	-	-	-
4	Aspergillus candidus	-	-	12	6	15	10
5	Aspergillus flavus	18	15.5	28	26	40	38
6	Aspergillus fumigatus	23.2	20	16	15	30	26
7	Aspergillus niger	30	28	19	17	22	20
8	Aspergillus nidulans	14	6	8	6	8	6
9	Aspergillus ochraceus	22	16	12	8	10	10
10	Aspergillus sydowii	-	-	10	8	-	-
11	Aspergillus tamaris	-	-	-	-	20	15
12	Aspergillus terreus	16	10	20	10	30	20
13	Chaetomium sp	15	8	15	12	20	12
14	Cladosporiumsp	16	6	-	-	-	-
15	Cochiliobolus spicifer	-	-	-	-	32	26
16	Curvularia lunata	-	-	18	16	36	24
17	Drechslera hawaiiensis	10	8	9	6	12	10
18	Fusarium moniliforme	-	-	-	-	-	-
19	Fusarium oxysporum	8	6	8	3	-	-
20	Mucor sp	22	20	20	15	36	34

2. Weiser HH, Mountney GJ, Gould WA (1971) Practical Food Microbiology and Technology, (2nd Edn). AVI publishing Co, Westport, New York City.
3. Algohary ME, Mahmoud HM, Ali, Hoheida MM (1914) Medicinal plants of North Africa. Pg no: 142-144.
4. Mohamedian KM, Mohamed OSA, Elbadwi SMA, Adam (1996) Effect of feeding *Tamarindus indica* ripe fruits in Brown Hisex chicks . Phytother Res 10: 631-634.
5. Shelar VR (2008) Role of mechanical damage in deterioration of soybean seed quality during storage. A review. Agric Rev Vol 29 3: 177-184.
6. Christensen CM (1957) Deterioration of stored grains by fungi. Annual Review of Phytopathology 23: 108.
7. Hashem M, Alamri S (2010) Contamination of common spices in Saudi Arabia markets with potential mycotoxin- producing fungi. Saudi J Biol Sci 17: 167-175.
8. McKee LH (1995) Microbial contamination of spices and herbs: A review Lebensm Wiss Technol 28: 1-11.
9. Farid M, Toma, Nareen Q (2013) Isolation and identification of fungi from spices and medicinal plants. Res J of Envi Sci 5: 131-138.
10. Kneifel W, Berger E (1994) Microbial criteria of random samples of spices and herbs retailed on the Austrian market. J Food PROT 57: 893-901.
11. Krishnaswamy MA, Patel JD, Parthasarathy N (1971) Enumeration of micro organism in spices and spice mixtures. J Food Sci 8:191-194.
12. Skinjar M, Horvat- Skenderovic T (1995) Ochratoxin A production in dry sausage by *Penicillium verrucosum* var. *Cyclopium*, 38th International Congress of meat Science and Technology, Ferrand, France 4: 831-834.
13. Dimic G, Krinjar , Dosen-Bogic Evic MV (2000) Dance, a potential producer and sterigmatocystin in spices (Croatian). Technol Mes 41: 131-137.
14. Santos Gracia, Iracheta F, Galvan F, Heredia N (2001) Microbiological Survey of retail herbs and spices from Mexican markets. Journal of food Protection 64: 99-103.
15. Romagnoli B, Menna V, Gruppioni N, Bergamini C (2007) Aflatoxins in spices, aromatic herbs, herbs-Teas and medicinal plants marketed in Italy. Food Control 18: 697-701.
16. Abou Donia MA (2008) Microbiology quality and aflatoxinogenesis of Egyptian spices and medicinal plants. Global Veterinaria 2: 175-181.
17. Muskett A (1948) Technique for the examination of seeds for the presence of seed borne fungi. Trans Brit Mycol Soc 39: 74-83.
18. Nagamani A, Kunwar IK, Manoharachary C (2006) Handbook of Soil fungi. I. K. International Pvt Ltd. N Delhi Pg no: 477.
19. Marasas WFO, Burgess LW, Anelich RY, Lamprecht SC, Van Schalkwyk DJ (1988) Survey of Fusarium species associated with plant debris in South African soils. South African Journal of Botany 54: 63-710.
20. Giridhar P, Reddy SM (1997) Incidence of mycotoxin producers on spices from Andhra Pradesh.J. Indian Bot Soc 76: 161-164.
21. Banerje M, Sarkar PK (2003) Microbiological quality of some retail spices in India. Food Res Int 36: 469-474.
22. Schweiggert U, Mix K, Schieber A, Carle R (2005) An innovative process for the production of spices through immediate thermal treatment of the plant material. Food Sci Emerg Tech 6: 143-153.
23. Moharram AM, Abdel Mallek AY, Abdel-Hafez Ali (1989) Mycoflora of anise and fennel seeds in Egypt. J Basic Microbiol 29:427-435.
24. El-Kady S, El- Maraghy, Mostafa EM (1995) Natural occurrence of mycotoxins in different spices in Egypt. Folia Microbiol 40: 297-300.
25. Abdul Kadir E, Elshefie, Tahiya A, Rashid Saif N, Bahry A, et al. (2003) Fungi and aflatoxins associated with spices in the sultanate of onam. Mycopathologia 155: 155-160.
26. Pitt JI (1980) The genus *Penicillium* and its Telomorphic states *Eupenicillium* and *Talaromyces*. Academic Press. New York Pg no: 634.
27. Ath Har MA, Prakash HS, Shetty HS (1988) Mycoflora of Indian spices with special reference to aflatoxin producing isolates of *Aspergillus flavus* IJM 28: 125-127.



- Advances In Industrial Biotechnology | ISSN: 2639-5665
- Advances In Microbiology Research | ISSN: 2689-694X
- Archives Of Surgery And Surgical Education | ISSN: 2689-3126
- Archives Of Urology
- Archives Of Zoological Studies | ISSN: 2640-7779
- Current Trends Medical And Biological Engineering
- International Journal Of Case Reports And Therapeutic Studies | ISSN: 2689-310X
- Journal Of Addiction & Addictive Disorders | ISSN: 2578-7276
- Journal Of Agronomy & Agricultural Science | ISSN: 2689-8292
- Journal Of AIDS Clinical Research & STDs | ISSN: 2572-7370
- Journal Of Alcoholism Drug Abuse & Substance Dependence | ISSN: 2572-9594
- Journal Of Allergy Disorders & Therapy | ISSN: 2470-749X
- Journal Of Alternative Complementary & Integrative Medicine | ISSN: 2470-7562
- Journal Of Alzheimers & Neurodegenerative Diseases | ISSN: 2572-9608
- Journal Of Anesthesia & Clinical Care | ISSN: 2378-8879
- Journal Of Angiology & Vascular Surgery | ISSN: 2572-7397
- Journal Of Animal Research & Veterinary Science | ISSN: 2639-3751
- Journal Of Aquaculture & Fisheries | ISSN: 2576-5523
- Journal Of Atmospheric & Earth Sciences | ISSN: 2689-8780
- Journal Of Biotech Research & Biochemistry
- Journal Of Brain & Neuroscience Research
- Journal Of Cancer Biology & Treatment | ISSN: 2470-7546
- Journal Of Cardiology Study & Research | ISSN: 2640-768X
- Journal Of Cell Biology & Cell Metabolism | ISSN: 2381-1943
- Journal Of Clinical Dermatology & Therapy | ISSN: 2378-8771
- Journal Of Clinical Immunology & Immunotherapy | ISSN: 2378-8844
- Journal Of Clinical Studies & Medical Case Reports | ISSN: 2378-8801
- Journal Of Community Medicine & Public Health Care | ISSN: 2381-1978
- Journal Of Cytology & Tissue Biology | ISSN: 2378-9107
- Journal Of Dairy Research & Technology | ISSN: 2688-9315
- Journal Of Dentistry Oral Health & Cosmesis | ISSN: 2473-6783
- Journal Of Diabetes & Metabolic Disorders | ISSN: 2381-201X
- Journal Of Emergency Medicine Trauma & Surgical Care | ISSN: 2378-8798
- Journal Of Environmental Science Current Research | ISSN: 2643-5020
- Journal Of Food Science & Nutrition | ISSN: 2470-1076
- Journal Of Forensic Legal & Investigative Sciences | ISSN: 2473-733X
- Journal Of Gastroenterology & Hepatology Research | ISSN: 2574-2566
- Journal Of Genetics & Genomic Sciences | ISSN: 2574-2485
- Journal Of Gerontology & Geriatric Medicine | ISSN: 2381-8662
- Journal Of Hematology Blood Transfusion & Disorders | ISSN: 2572-2999
- Journal Of Hospice & Palliative Medical Care
- Journal Of Human Endocrinology | ISSN: 2572-9640
- Journal Of Infectious & Non Infectious Diseases | ISSN: 2381-8654
- Journal Of Internal Medicine & Primary Healthcare | ISSN: 2574-2493
- Journal Of Light & Laser Current Trends
- Journal Of Medicine Study & Research | ISSN: 2639-5657
- Journal Of Modern Chemical Sciences
- Journal Of Nanotechnology Nanomedicine & Nanobiotechnology | ISSN: 2381-2044
- Journal Of Neonatology & Clinical Pediatrics | ISSN: 2378-878X
- Journal Of Nephrology & Renal Therapy | ISSN: 2473-7313
- Journal Of Non Invasive Vascular Investigation | ISSN: 2572-7400
- Journal Of Nuclear Medicine Radiology & Radiation Therapy | ISSN: 2572-7419
- Journal Of Obesity & Weight Loss | ISSN: 2473-7372
- Journal Of Ophthalmology & Clinical Research | ISSN: 2378-8887
- Journal Of Orthopedic Research & Physiotherapy | ISSN: 2381-2052
- Journal Of Otolaryngology Head & Neck Surgery | ISSN: 2573-010X
- Journal Of Pathology Clinical & Medical Research
- Journal Of Pharmacology Pharmaceutics & Pharmacovigilance | ISSN: 2639-5649
- Journal Of Physical Medicine Rehabilitation & Disabilities | ISSN: 2381-8670
- Journal Of Plant Science Current Research | ISSN: 2639-3743
- Journal Of Practical & Professional Nursing | ISSN: 2639-5681
- Journal Of Protein Research & Bioinformatics
- Journal Of Psychiatry Depression & Anxiety | ISSN: 2573-0150
- Journal Of Pulmonary Medicine & Respiratory Research | ISSN: 2573-0177
- Journal Of Reproductive Medicine Gynaecology & Obstetrics | ISSN: 2574-2574
- Journal Of Stem Cells Research Development & Therapy | ISSN: 2381-2060
- Journal Of Surgery Current Trends & Innovations | ISSN: 2578-7284
- Journal Of Toxicology Current Research | ISSN: 2639-3735
- Journal Of Translational Science And Research
- Journal Of Vaccines Research & Vaccination | ISSN: 2573-0193
- Journal Of Virology & Antivirals
- Sports Medicine And Injury Care Journal | ISSN: 2689-8829
- Trends In Anatomy & Physiology | ISSN: 2640-7752

Submit Your Manuscript: <https://www.heraldopenaccess.us/submit-manuscript>