

Aeromycoflora of Fruit and Vegetable Markets of Bangalore, Karnataka

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Abstract

The Fruit and vegetable markets of tropical countries are the significant source of airborne fungal spores, which are produced during transportation, handling and putrefaction processes. An aeromycological survey was conducted during 2019 to 2020 in Fruit and Vegetable markets of Bangalore city, Karnataka, India. The airborne fungal spores were isolated with the help of gravity petri plate exposure method. More number of airborne fungal samples was isolated from K. R. Market when compared to Russell market, Malleshwaram market, Gangenahalli market. Most frequently isolated aerospora in different fruit and vegetable markets are *Alternaria alternate*, *Aspergillus niger*, *Rhizopus stolonifer*. The high percentage frequency and percentage contribution in K.R.Market was shown by *Rhizopus stolonifer*. The present study helps in identify the cause of fungal spores related problem affecting human health of fruit and vegetable market workers, sellers and buyers.

Keywords: Aeromycoflora, Vegetable Market, Fruit Market, *Aspergillus niger*, Allergens

Introduction

Many air borne prokaryotic and Eukaryotic organisms, as well as particles of biological origin passively float in the atmosphere. The soft rot causing fungi frequently contaminates the fruit and vegetables. Air borne fungi were considered as a key indicator to know the level of air pollution of particular areas under study. Many investigations on the aeromycoflora have been carried out in order to correlate with different type of diseases and allergic disorders in humans, the different kinds of diseases in fruits and vegetable in India [5, 6, 10, 12]. Fungal propagules like spores and hyphae in the ambient air are regularly and continuously inhaled by human beings [1]. The high concentration of fungal spores present in the market environments may lead to cause breathing problems and respiratory diseases in humans and infections to various perishable commodities like fruits and vegetables [2]. The investigation of parasitic aerospora of fruit and vegetable markets may influence on the health of general population working in the market, clients, merchants and so forth. So the present study aims at isolation and identification of different air borne fungi of fruit and vegetable markets of Bangalore city, Karnataka, India

Materials And Methods

Study Area:

The aeromycological survey was undertaken in different vegetable and fruit markets of Bengaluru, Karnataka, India. The different markets are KR market, Gangenahalli market, Shvajinagar market. Malleshwaram market. K.R.Market (Krishna Rajendra Market) also known

as "City Market", is the largest wholesale market dealing with commodities in Bengaluru, India. It is named after Krishna Rajendra Wodeyar, a former ruler of the princely state of Mysore (Figure.1). Ganganagar is one of the neighborhoods of Bangalore. It is in the north of Bangalore and is on the east of NH-7 before Hebbal. Ganganagar is primarily a residential area and busy shopping area (Plate I Figure.1B). Russell Market is a shopping market in Bangalore. built in 1927 by the British and inaugurated in 1933 by Ismail Sait. It is named of the then Municipal Commissioner T. B. Russell (Figure.1A). Malleshwaram is located in the North-Western part of the city and is in close proximity to Yeshwantpur, Rajajinagar, Sadashivnagar, Sheshadripuram and the Kempegowda Bus Terminus and the closest metro station to this place is the Sampige Road, Malleshwaram metro station. Malleshwaram is even famous for its temples and flower markets (Figure.1C).

Isolation Of Fungi:

Sampling of fungal spores was done with the help of gravity Petriplate exposure method containing Potato Dextrose Agar (PDA) medium. The Petri dishes were taken to the selected areas of markets like K.R. market,

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Gangenahalli market, Russel market and Malleshwaram market. The isolation of air borne fungi was done during 2019 to 2020. Samples were taken in the busy hours like 8.30 to 10:30am, 12:30 to 1:30pm and 4:30 to 7:30pm. Three Petri dishes were exposed to the air for 10 min at each area of different markets and brought to the laboratory. The Petri plates containing the airborne spore were incubated for 3 to 7 days in BOD incubator. The percentage frequency and percentage contribution of the total fungal flora were assessed / calculated by the following formula ^[4].

$$\% \text{ Frequency} = (\text{No of observations in which a species appeared} / \text{total no of observations}) \times 100$$

$$\% \text{ Contribution} = \text{Total No of colonies of species in all observations taken together} / \text{Total no of colonies in all the species} \times 100$$

Identification Of Fungal Strains:

The fungal colonial features were studied based on the morphological features of the fungi by using compound microscope. The determination of the morphological structures of fungi was carried out after being mounted in lactophenol and cotton blue stain covered with cover slip. The fungal types were identified and. The species identification was done on the basis of micro and macro morphology; and reverse and surface coloration of colonies grown on the PDA media. The fungi were identified up to genus level and in some cases up to species level ^[3].



Figure.1: A) Vegetable shop present in Russel market with seller; B) different vegetable shops of Gangenahalli Market; C) vegetable shops in Malleshwaram Market along with sellers and purchasers; D) Fruit shops in the K R Market along with purchasers

Results

The present work was aimed at determining the fungal flora, their identification, concentration and diversity on the Fruit and Vegetable markets of Bangalore, Karnataka, India has good number of fungal spores in air. The dominance of

Aspergillus niger, *Alternaria alternate* and *Rhizopus stolonifer* had been frequently isolated in this investigation (Figure.2. A, B, C, D). The high percentage frequency and percentage contribution in Malleshwaram markets was shown by *Rhizopus stolonifer* & *A. niger*. The high percentage frequency and percentage contribution near Russel Market was shown by *Alternaria alternata*. The high percentage frequency and percentage contribution in K. R. Market was shown by *Rhizopus stolonifer* (Table 1).

Sl. No	Name of the Market	Isolate No.	Fungi	Percentage Frequency	Percentage Contribution
1.	Malleshwaram	15	<i>Aspergillus niger</i>	23.07	4.34
2.	Malleshwaram	10	<i>Alternaria alternata</i>	15.38	2.89
3	Malleshwaram	12	<i>Mucorra cemosus</i>	18.46	3.47
4	Malleshwaram	18	<i>Rhizopus stolonifer</i>	27.69	5.21
5	Malleshwaram	10	<i>Rhizopus arrhizus</i>	15.38	2.89
6	Russel	31	<i>Alternaria alternata</i>	30.39	8.98
7	Russel	22	<i>Aspergillus niger</i>	21.5	6.37
8	Russel	26	<i>Rhizopus stolonifer</i>	25.49	7.53
9	Russel	23	<i>Rhizopus arrhizus</i>	22.54	6.66
10	K.R. Market	10	<i>Aspergillus niger</i>	6.2	2.89
11	K.R. Market	24	<i>Aspergillus fumigatus</i>	14.9	6.95
12	K.R. Market	34	<i>Alternaria solani</i>	21.11	9.85
13	K.R. Market	31	<i>Chaetomium globosum</i>	19.25	8.98
14	K.R. Market	18	<i>Mucorra cemosus</i>	11.18	5.21
15	K.R. Market	44	<i>Rhizopus stolonifer</i>	27.32	12.75
16	Gangenahalli	9	<i>Aspergillus niger</i>	52.94	2.60
17	Gangenahalli	2	<i>Rhizopus stolonifer</i>	11.76	0.57
18	Gangenahalli	6	<i>Mucor hiemalis</i>	35.29	1.73

Table.1: Different Fungal colonies isolated from different markets of Bangalore

The genera of airborne fungal spores such as *Alternaria*, *Aspergillus*, *Fusarium* and *Cladosporium* are found throughout the world^[8]. In the present study also the *Alternaria* and *Aspergillus* genera was isolated from fruit and vegetable markets of Bangalore. The spores and fungal propagules were the major components in the fruit and vegetable market of Kolar District, Karnataka. The *Aspergillus* species colonies were highest in both the study area followed by *Penicillium* and least colonies were

observed in *Pestotia* species [9]. In the present study also the most frequently reported fungal spores were *Alternaria*, *Aspergillus*, *Rhizopus* from fruit and vegetable markets of Bangalore.

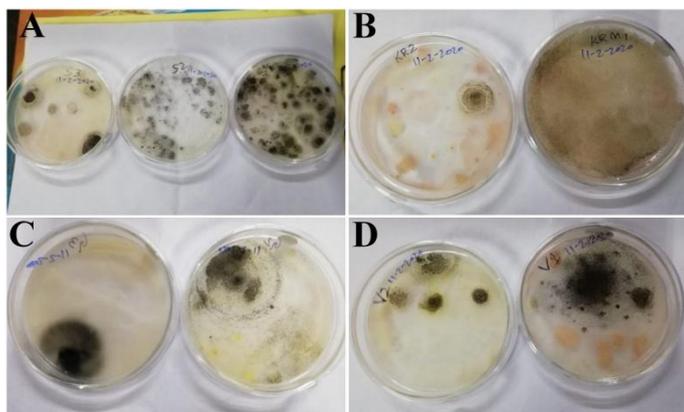


Figure.2: A) different colonies of fungi were isolated from Russel Market; Fig. B) Different fungal colonies were isolated from K. R. Market; Fig. C) Different colonies of fungi isolated from Gangenahalli Market; Fig. D) Different colonies of fungi isolated from Malleshwaram Market

A survey of the atmospheric fungal spores of Malleeswaram vegetable market, situated in the Northern part of Bangalore City, was carried out and 87 different species of fungi distributed in 47 genera and 2 sterile forms were identified. Among the trapped fungi, *Aspergillus*, *Penicillium*, *Fusarium*, *Zygomycetes*, *Alternaria* and *Cladosporium* were the most dominant groups isolated frequently [7]. In the present study also from Malleeswaram vegetable market, four general were isolated and the highest percentage of frequency was shown by *Rhizopus stolonifer*. The Aerospora of Bangalore city market and its relation to occurrence of market diseases was studied by Sulia and Khan [11]. They find out *Aspergillus* has been reported as the dominant spore type in K. R. markets and other environments [11]. In the present study from K. R market the most frequently isolated fungi is *Aspergillus niger*.

Conclusion

The present study clearly shows that there is a need to study the aeromycoflora of vegetable and fruit markets, local storage places, to find out and develop data base of fungal types which can be present in that particular area. Monitoring of fungal spores from indoor and outdoor environments of vegetable and fruit markets of Bangalore city, Karnataka help in post-harvest disease management in it. To find out the status of various types of allergic and pathogenic spores at different places of Bangalore city is important because it causing health hazards to human beings and spoilage of vegetables and fruits in the different markets. The present study strongly supports that the toxigenic fungal pathogens isolated in different fruit and vegetable markets of Bangalore city, Karnataka, India causing air pollution and damaging the health of fruit and vegetable vendors.

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Conflict of Interest

No known conflict of interest.

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