Analysis of ambient airborne mycoflora around Curzon hall campus, University of Dhaka, Bangladesh

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The indoor and outdoor air is an important source of aeroallergens and pathogens. Monthly samplings were recorded during September to November 2018 to investigate the airborne mycoflora concentration in Curzon hall campus, University of Dhaka. The fungal colonies developed in Potato Dextrose Agar (PDA) media were isolated from four different locations in the morning, noon and evening in monthly intervals. A total number of counted fungal colonies were 2,681 in which 924, 928 and 829 colonies were found in the morning, noon and evening time, respectively. Among the identified fungi, *Aspergillus* spp. was one of the most predominant genera in all the stations over the study period followed by *Penicillium* spp., *Alternaria* spp., *Curvularia* spp., *Fusarium* spp., *Rhizopus* spp. and *Trichoderma*. The identified fungi belonged to eight genera under the class Ascomycetes, Zygomycetes and Deuteromycetes. Among the fungal isolates, *Alternaria* spp., *Aspergillus* spp., *Curvularia* spp., *Fusarium* spp., *Penicillium* spp. and *Rhizopus* spp. were previously reported as pathogenic to plants and/or humans and strongly allergenic to human being.

**Keywords:** Mycoflora, Airborne pathogens, Genera, Meteorology.

**INTRODUCTION**

Airborne particles are found everywhere in nature (1). The atmosphere of earth contains airborne viruses, bacteria, protozoa, pollen grains, different propagules and vegetative cells of algae, fungi, lichens, bryophytes and pteridophytes. Microbial quality and quantity of air depends on seasons, time and locations (2). Fungal spores play a significant role in childhood asthma, allergies, mycotoxicity and infections in human and animals (3, 4). About 20% of human population is easily sensitized by normal concentrations fungal spore (up to \(10^6\) spores/m³) and all fungal spores should be regarded as potentially allergenic (5). Airborne fungi are considered as one of the indicators of atmospheric bio-pollution (6). Numerous plant diseases such as rusts, smuts, mildews, leaf spots, etc. are also caused by airborne fungi (7-9).

Occurrence of fungal spores in the air fluctuate in different seasons with the variations in the weather conditions. Warm and dry weather favors the development, sporulation and dispersal of conidia of *Cladosporium* spp., *Epicoccum* spp. and *Alternaria* spp. The highest concentration of conidia of those genera usually occurs at noon and afternoon (2). It can vary with vegetation types. Excessive concentrations of *Alternaria* spp. spores were noted at the harvesting seasons (10, 11). Surveys on these aspects have been made in different countries of the world following impaction or sedimentation method (12-15). The sedimentation method is still quite popular in India and some other countries as it is cheap, simple and recommended by Polish Standards (15-17). Nowadays, people are more concerned about the gaseous and particulate pollution in the atmosphere. But, microbial pollutants are also important as they have severe impacts on human health.

The present investigation has therefore, been undertaken to study the monthly distribution pattern of mycoflora in the air of the Curzon hall campus, University of Dhaka, Bangladesh.

**MATERIALS AND METHODS**

**Sampling areas.** Four locations of Curzon hall campus area, University of Dhaka were selected for the sampling of air borne fungal spores from

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The further developmental studies on the culture media were counted. The isolation was done by transferring a bit or a single spore into the sterile Petri plates containing PDA medium. Pure culture of each fungal isolates was done by dilution plate method and single spore culture technique. Pure cultures were stored at 4°C in slant medium for further studies. The fungal colonies developed on the culture media were examined under microscope and identified based on their morphological structure. Percentage of abundance and frequency distribution of the fungal colonies were calculated by adopting the formula of Pathak (18).

RESULTS AND DISCUSSION

Incidence and percent frequency distribution of fungi during the morning between September 2018 and

| Fungal Genera        | No. of fungal colonies in PDA medium from different locations | (%) Frequency | Mean | Standard Deviation |
|----------------------|--------------------------------------------------------------|---------------|------|--------------------|
| Alternaria           | A 33, B 23, C 36, D 40, Total 132                           | 14.2          | 33   | 7.2                |
| Aspergillus          | A 74, B 87, C 54, D 41, Total 256                           | 27.7          | 64   | 20.5               |
| Curvularia           | A 22, B 32, C 23, D 13, Total 90                            | 9.7           | 22.5 | 7.7                |
| Fusarium             | A 18, B 27, C 22, D 20, Total 87                            | 9.4           | 21.8 | 3.8                |
| Penicillum           | A 46, B 58, C 55, D 61, Total 220                           | 23.1          | 55   | 6.4                |
| Rhizopus             | A 18, B 20, C 16, D 16, Total 70                            | 7.8           | 17.5 | 1.9                |
| Sterile mycelium     | A 8, B 7, C 5, D 13, Total 33                               | 3.7           | 8.2  | 3.4                |
| Trichoderma          | A 6, B 9, C 7, D 14, Total 36                               | 3.1           | 9    | 3.5                |
| **Total**            | 225, 263, 218, 218, 924                                      | 100           | 28.8 | 6.8                |

Sites, A: Zoology department side, B: Fishery department side, C: Dr. Muhammad Shahidullah hall side, D: Fazlul Huq Muslim hall mosque side
November 2018 is presented in Table 1. The table showed that a total of 924 fungal colonies were isolated in the morning out of which the highest number of colonies were Aspergillus spp. (256) followed by Penicillium spp. (220) and Alternaria spp. (132). The lowest numbers of fungal colonies were recorded for sterile mycelium (33).

Table 2 showed the results of fungal isolates at noon. A study in Tehran shows the predominant genus Alternaria, Aspergillus and Penicillium were found in the month of October (Table 4). It was observed that spore contents were allergenic, bad physical condition, tiredness, headaches, vertigo, decrease of concentration, memory and intellectual work ability and so on (17).

Present study revealed that maximum fungal colonies were found in the month of October (Table 4). It was observed that spore contents were

Table 3. Incidence and percent frequency distribution of fungal genera in PDA medium collected in the evening from different locations during September to November 2018

| Fungal Colonies | No. of fungal colonies in PDA medium from different locations | Frequency (%) | Mean | Standard Deviation |
|-----------------|---------------------------------------------------------------|---------------|------|--------------------|
|                 | A | B | C | D | Total |
| Alternaria      | 32 | 21 | 41 | 41 | 135 | 16 | 34 | 9.5 |
| Aspergillus     | 42 | 29 | 18 | 17 | 85 | 10 | 21 | 5.4 |
| Curvularia      | 19 | 27 | 22 | 19 | 87 | 10 | 22 | 3.7 |
| Fusarium        | 17 | 19 | 13 | 13 | 62 | 7.5 | 16 | 3 |
| Rhizopus        | 8  | 5  | 7  | 15 | 35 | 4.2 | 8.8 | 4.3 |
| Sterile mycelium| 6  | 6  | 6  | 12 | 30 | 3.6 | 7.5 | 3 |
| Total           | 191| 211| 208| 219| 829| 100| 26.1| 5.4 |

Sites, A: Zoology department side, B: Fishery department side, C: Dr. Muhammad Shahidullah hall side, D: Fazlul Huq Muslim hall mosque side.

Table 4. Climate factors and total number of fungal colonies

| Month | Temperature (°C) | Relative Humidity (%) | Total Fungal Colony |
|-------|------------------|-----------------------|---------------------|
|       | Maximum | Minimum | Mean | Maximum | Minimum | Mean | Morning | Noon | Evening |
| September | 32.7     | 25.3     | 29   | 83.4     | 52.9     | 68.15 | 255     | 269 | 248 |
| October  | 32.6     | 24.6     | 28.6 | 70.7     | 49.7     | 60.2  | 135     | 341 | 367 | 368 |
| November | 28.8     | 18.6     | 23.7 | 74.6     | 47.1     | 60.85 | 25      | 297 | 292 | 213 |

A total of 928 fungal colonies were recorded from four different locations. Out of 928, the highest number was recorded in case of Aspergillus spp. (239) followed by Penicillium spp. (221) and Alternaria spp. (146). Moreover, Trichoderma spp. (29) was the lowermost in number of colonies.

Table 3 showed the frequency of fungal isolates found in the evening. A total of 829 fungal colonies were recorded from four selected locations. Out of 829, the highest number was recorded in case of Penicillium spp. (207), followed by Aspergillus spp. (188) and Alternaria spp. (135). Here, Trichoderma spp. (30) was the lowest in number of colonies.

Abdullah et al., (2019) shows that, at Malnicherra tea estate of Sylhet district, Aspergillus fumigatus showed the maximum percentage followed by Aspergillus flavus, Curvularia interseminata, Aspergillus niger (19). A study in Tehran shows the predominant genus identified in air was Penicillium (34.88 % of total airborne fungi) during the study period (20). Epidemiological studies showed that high concentration of microorganisms in the air can causes comparatively less in the month of September. It might be due to high temperature and humidity. In addition, high rainfall leads to decrease the fungal colony as continuous waterfall usually washes out the spores. Another study revealed that, Alternaria, Aspergillus and Penicillium were found in higher concentration during dry winter seasons (21). Vegetation types, warm and dry weather always attribute to development, sporulation and dispersal of fungal colonies in the ambient air. The identified fungi belonged to eight genera under the classes of Ascomycetes, Zygomycetes and Deuteromycetes. Among the different genera of fungi, Alternaria, Aspergillus, Curvularia, Fusarium, Penicillium and Rhizopus were reported as pathogenic to plants and/or humans and were proved to be strong allergen to human being.

CONCLUSION

Among the eight identified fungi, Aspergillus was one of the most prevalent genera in all the four locations over the study period. Presence of fungal
spores in the air varied from month to month because of the variation of weather elements. This study contributes to our understanding of airborne spores and their distribution pattern in the Dhaka University campus. Regular monitoring of airborne fungi can be helpful in the prevention of fungal allergic diseases and related complications especially in over-crowded area in Dhaka city.

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