

## Fungal Spore Diversity and Abundance in Five Areas in Ibadan, South West, Nigeria

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### ABSTRACT

**Background:** Airborne fungal spores may pose as a potential high risk of fungal-related health problems in humans, animals, and plants which necessitated the need to constantly monitor the presence and diversity of fungi spores in the atmosphere regularly. This study aims to investigate diversity and abundance of airborne fungal spores across multiple locations for two years in Ibadan, South West, Nigeria.

**Subjects dan Method:** Study descriptive cross-sectional are used to investigate diversity and abundance of airborne fungal spores across multiple locations. The variable in this study were Airborne fungi spores diversity sampled monthly from five different locations in Ibadan, Oyo State, South-West Nigeria for two years using the open plate sedimentation method with the petri dishes of Dichloran-glycerol 18 (DG-18) and Potato Dextrose Agar (PDA) media. Monthly Meteorological parameters were equally taken during the duration of sampling. The data were collected and graphical presented using histograms.

**Results:** A total of 39 fungal species were identified throughout duration of study. *Aspergillus* and *Penicillium* were the most abundant fungi genera isolated while few *Zygomycetes*, *Ascomycetes*, and *Basidiomycetes* were found. Rainy season period favours high number of fungi in the atmosphere. The highest abundance of fungal spores was recorded in June and July while lower fungi concentration was recorded between December and February.

**Conclusion:** the study revealed the most dominant and abundant spores belong to the genera *Aspergillus*, *Penicillium*, and *Fusarium*. The results show the need for people suffering from fungi sensitivity and allergies to be well informed.

**Keywords:** fungi, health, Ibadan, airborne.

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### BACKGROUND

Air is an important channel for transporting and dispersal of biological particles such as fungi. Fungi are ubiquitous microorganisms that can be found everywhere. The aerodynamic sizes of fungi determine the depth of their penetration and deposition in the human respiratory tract, which has a serious

health influence (Górny and Dutkiewicz, 2002). The abundance of airborne spores clearly reveals the geographical, seasonal, and location differences. Distribution of airborne spores also varies with time of the day. Therefore, dispersal of pathogens such as fungi and bacteria in air can be of serious health issue (Balasubramanian et al., 2011).

Airborne fungal spores are allergenic in nature and found in high magnitude in the atmosphere (Salvi et al., 2001; Recer, 2004, Corden et al. 2003). Studies have been done to determine the abundance of aerospores in different countries (Juozaitis et al., 1997; Subai, 2002; Herrero et al. 2006). Past investigations showed the relationship which exists between fungal exposure and several health problems. For instance, when fungal spores are inhaled, they cause adverse health effects in individuals predisposed to allergic diseases (Baxi et al., 2016).

Among other factors, dew point and temperature also influence the spore type found outdoors (Troutt and Levetin 2001). Reports from temperate regions showed that fungal spores found outdoors peak in mid to late summer and later decrease during winter season. Spores of *Alternaria*, *Cladosporium*, and *Epicoccum* have been reported to be most abundant during afternoons of low humidity, on the contrary, hydrophilic spores peak during the early morning of high humidity such as spores of ascospores and basidiospores (Michel et al., 2013). Pulimood et al. (2007) also reported that *Alternaria* is common in dry and warm climates. It has been established that the concentration of airborne microbes exhibits diurnal, topological, and seasonal variations. Their quantity and quality also vary with location, time of the day, and year. (Balasubramanian et al., 2011). Existentially, indoor and outdoor fungi are known to cause harmful health effects such as; which include irritation, allergies, fungal infections and toxic effects. (Bush and Portnoy, 2001; Ren et al., 2001; Epstein and Fan. 2001).

Data obtained from aerobiology studies can assist in the assessment of health hazards of a particular place, warning signs to allergy sufferers, and can be useful to monitor indoor and outdoor air quality, which is valuable in human and animal health. In

Nigeria, aerospore studies have been conducted by researchers (Ayanbimpe et al., 2010; Essien and Aina, 2014; Kome and Victor, 2017; Ogunlana, 1975; Wemedo et al., 2012 and Njokuocha and Ukeje, 2006). Aero mycology study of Ibadan city which ranks as the largest city in West Africa has not been studied in recent times except for the study done by Ogunlana in 1975. This study aims to investigate diversity and abundance airborne fungal spores including the weather parameters that affected it across multiple locations for two years in Ibadan, South West, Nigeria.

## SUBJECTS AND METHOD

### 1. Study Design

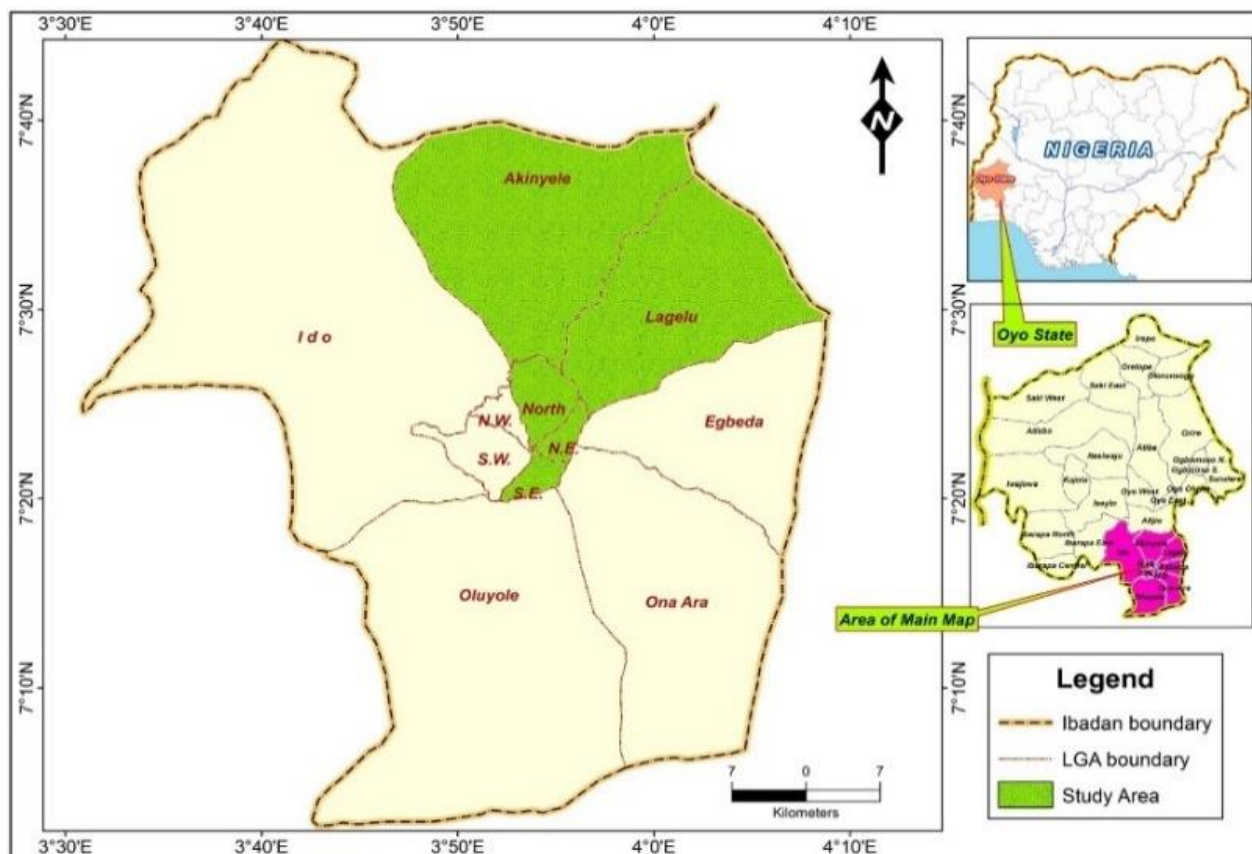
Study descriptive cross-sectional are used to investigate diversity and abundance of airborne fungal spores across multiple locations namely Mokola, Iyana Church, Beere, Bodija and Moniya for 24 months between May 2014 and April 2016. Open plate sedimentation method with petri dishes of Dichloran-glycerol 18 (DG-18) and Potato Dextrose Agar (PDA) media for sampling airborne fungal spore was used.

### 2. Population and Sample

Airborne spores were sampled on a monthly basis for 24 months between May 2014 and April 2016 at five locations in Ibadan, South-west Nigeria. Five different locations spread across various parts of Ibadan, Nigeria, namely Mokola, Iyana church, Beere, Bodija and Moniya were selected for the study (Figure 1). The locations were chosen because of the various human activities going on at such places which include: school, market, residential area. The open plate method was used for sampling by opening sterile plates containing Dichloran glycerol 18 (DG-18) and Potato Dextrose Agar (PDA) before noon on the days of sampling. Plates were opened at human height (1 m above foot level) for ten minutes and then re-

covered. Samples were collected in triplicate and later taken to the Mycology Laboratory of the Department of Botany, University of Lagos, and thereafter incubated at room temperature (28-31°C) for between 3 to 5

days. Growth was then monitored and colony count was done. Point of sampling was the same throughout the period of sampling in all five locations for the duration of the study.



**Figure 1. Map of Ibadan showing the study locations**

### 3. Study Variables

The study variable was airborne fungal in the different sampling locations namely Mokola, Iyana church, Beere, Bodija and Moniya.

### 4. Operational Definition of Variables

**Airborne fungal spores:** are tiny spores produced by fungi in the atmosphere for reproduction purpose.

### 5. Study Instruments

Prepared media (The open plate method was used for sampling by opening sterile plates containing Dichloran glycerol 18 (DG-18) and Potato Dextrose Agar (PDA) before noon on the days of sampling.) were used to

collect fungi spores in triplicates on a monthly basis. Morphological identification of fungi was done by observing the growth, texture and pigmentation on culture plates. The identities of these fungi were further ascertained by comparing them with confirmed representatives of different species in relevant texts such as Alexopolous et al. (2007) and Ellis et al., (2007). The percentage frequency at which each fungus was observed was calculated as the number of fungus observations divided by the total number of colonies of fungi from all sites.

The meteorological parameters which affect the growth of fungal spores was recor-

ded too. The highest rainfall was recorded in the months of May (170.1 mm), August (174.4 mm), and October (184.4 mm). The second year (2015) recorded the least amount of rainfall during the period of sampling. The months of Feb (35.4°C), Mar (35.4°C), and April (36.1°C) 2016 recorded high atmospheric temperature, while August (27.6°C) 2014 recorded the lowest temperature. August 2015 (88%) had the highest relative humidity. December 2015, (67%) recorded the lowest relative humidity percent throughout the period of sampling. The highest wind speed was recorded in July 2015 (9.2), while the lowest was in December 2014 (5.1).

## 6. Data Analysis

Fungi colony counts data from Mokola, Iyana Church, Beere, Bodija and Moniya were collected and graphical presented using histograms.

## 7. Research Ethics

Ethical clearance is not needed for this particular type of study.

## RESULTS

Airborne fungal spore abundance changed seasonally during the two-year study period. Irrespective of the location, spore abundance was more during the rainy season and fewer spores were recorded during the dry months (November to February). The study locations were selected based on populations and the kind of activities that go on their daily (figure 1). The most abundant fungi were *Penicillium*, *Aspergillus*, and non-sporulating fungi. These organisms were found in all locations and seasons (Table 1).

At Mokola, twenty five different fungal spore types were recorded for the period of sampling in Mokola, Ibadan. Dominant fungal spores were *Aspergillus niger* (12.1%), *Aspergillus fumigatus* (7.8%), *Paecilomyces variotii* (6.9%). *A. niger* was observed

throughout the period of sampling (figure 2).

For Iyana Church location, Twenty four (24) different spore types were isolated and identified. The most dominant fungal spore during sampling period are *Aspergillus niger* (12.2%), *A. flavus* (7.0%), and *A. fumigatus* (9.9%). Other fungal contributors include *Penicillium citrinum* (4.0%), *Trichoderma viride* (3.7%), *P. funiculosum* (2.8%), *Fusarium subglutinatum* (2.6%), *Paecilomyces variotii* (6.0%), *Rhizopus oryzae* (2.3%), *P. notatum* (4.0 %), *Mucor sp.*, (2.8%) *P. oxalicum* (6.9 %) (Figure 3).

Twenty three (23) different fungal spore types were isolated from Moniya location. The dominant isolates fungal spore include *Aspergillus niger* (11.9%), *Penicillium citrinum* (8.2%), *A. tamari* (7.3%). *Aspergillus versicolor* (1.3%), *Penicillium simplicissimum* (1.8%), and *Phoma eupyrema* (1.6%) recorded lower spore count throughout the period of study (Figure 4).

In Beere, Twenty four (24) different fungal spores were isolated from the atmosphere. Dominant fungal spore types include those of *Aspergillus niger* (8.4%), *Penicillium simplicissimum* (8.0%), *A. flavus* (7.6%). The following fungi recorded a lower number of spores during the duration of sampling: *Cladosporium herbarium* (0.2%), *Rhizopus sp.*, (3.1%), and *Sistotrema brinkmanii* (1.5%). *Aspergillus niger* (8.4%) occurred throughout the year while *Trichoderma viride* (3.9%), *A. versicolor* (4.7%), *Fusarium verticilloides* (2.7%), *Penicillium citrinum* (5.6%), *P. oxalicum* (4.3%), *A. fumigatus* (5.5%), *A. tamari* (5. %), *A. aculeatinus* (4.0%) and *T. harzanium* (5.4%) were also dominant during the period of sampling (Figure 5).

At Bodija, twenty-three (23) different fungal spore isolates were recorded from the atmosphere for the period of sampling. The spores of fungi that were most abundant at

this period included those of *Aspergillus niger* (15.9%), *A. flavus* (10.1%), *P. notatum* (7.6%) fungal spores were present in higher abundance in the atmosphere throughout the sampling period. Spores of *Curvularia lunata* (0.6%), *Mucor sp.* (1.0%), and *Absidia sp.* (0.8%) had lower spore abundance (Figure 6).

Higher numbers of fungal spores were recorded during the rainy season (May-October) than other months. For Bodija, the dominant spore was *A. niger* (15.9%). For Moniya, the months of May, June, July, September, and October recorded higher fungal counts than the other months of the year. Other fungal spore types identified include but are not limited to *Penicillium*

*oxalicum* (4.1%), *Aspergillus ochraceus* (4.2%), *P. notatum* (5.5%), *Fusarium verticilloides* (3.21%), *Trichoderma harzanium* (2.2%), *Paecilomyces variotii* (4.2%), *T. viride* (1.6%), *P. funiculosum* (6.4%), *Neurospora crassa*. Iyana Church location had reductions in fungal spore counts in December, January through February. For Mokola, *A. aculeatinus* (6.5%), *Trichoderma viride* (4.6%), *A. flavus* (5.1%), *A. tamari* (3.5%), *P. citrinum* (5.0%), *Fusarium subclunatum* (4.6%), *Aspergillus japonicas* (2.2%), *Pere-niporia koreana* (2.2%), *Neurospora crassa* (5.1%), *F. verticilloides* (3.27%). The fewest spores were recorded from *Curvularia lunata*, *Rhizopus sp.*, and *Trichoderma harzanium*.

**Table 1. List of fungi recorded on both media in different locations throughout the sampling period and percentage occurrence**

Characteristic	Category	Frequency	Percentage	
<b>Fungal species in Beere</b>	<i>Aspergillus aculeatus</i>	56	4.03	
	<i>Aspergillus flavus</i>	106	7.64	
	<i>Aspergillus fumigatus</i>	77	5.55	
	<i>Aspergillus niger</i>	117	8.43	
	<i>Aspergillus ochraceus</i>	62	4.47	
	<i>Aspergillus oryzae</i>	23	1.66	
	<i>Aspergillus tamari</i>	70	5.04	
	<i>Aspergillus terreus</i>	53	3.82	
	<i>Aspergillus versicolor</i>	66	4.76	
	<i>Bacteria/Yeast-like</i>	32	2.31	
	<i>Cladosporium herbarium</i>	4	0.29	
	<i>Fusarium verticilloides</i>	38	2.74	
	<i>Neurospora crassa</i>	17	1.22	
	<i>Paecilomyces variotii</i>	57	4.11	
	<i>Penicillium citrinum</i>	79	5.69	
	<i>Penicillium notatum</i>	92	6.63	
	<i>Penicillium oxalicum</i>	61	4.39	
	<i>Penicillium simplicissimum</i>	112	8.07	
	<i>Rhizopus sp</i>	44	3.17	
	<i>Sistotrema brinkmannii</i>	21	1.51	
	<i>Trichoderma asperellum</i>	59	4.25	
	<i>Trichoderma harzianum</i>	76	5.48	
	<i>Trichoderma viride</i>	55	3.96	
	<i>Unidentified colonies</i>	11	0.79	
	<b>Fungal species in Moniya</b>	<i>Aspergillus tamari</i>	96	7.35
		<i>Penicillium notatum</i>	72	5.51
		<i>Aspergillus flavus</i>	83	6.35
<i>Paecilomyces variotii</i>		55	4.21	

Characteristic	Category	Frequency	Percentage
<b>Fungal species in Moniya</b>	<i>Neurospora crassa</i>	23	1.76
	<i>Aspergillus niger</i>	156	11.94
	<i>Aspergillus versicolor</i>	17	1.30
	<i>Trichoderma viride</i>	92	7.04
	<i>Rhizopus oryzae</i>	71	5.43
	Bacteria/Yeast-like	27	2.07
	<i>Phoma eupyrema</i>	21	1.61
	<i>Trichoderma harzanium</i>	29	2.22
	<i>Penicillium funiculosum</i>	84	6.43
	<i>Aspergillus terreus</i>	34	2.60
	<i>Penicillium citrinum</i>	108	8.26
	<i>Fusarium verticilloides</i>	42	3.21
	<i>Aspergillus fumigatus</i>	76	5.81
	<i>Penicillium simplicissimum</i>	24	1.84
	<i>Aspergillus ochraceus</i>	56	4.28
	<i>Trichoderma viride</i>	22	1.68
	<b>Fungal species in Iyana Church</b>	<i>Penicillium oxalicum</i>	54
<i>Aspergillus penicilloides</i>		57	4.36
Unidentified colonies		8	0.61
<i>Absidia sp</i>		47	2.77
<i>Aspergillus aculeatinus</i>		76	4.48
<i>Aspergillus aculeatus</i>		32	1.89
<i>Aspergillus flavus</i>		120	7.08
<i>Aspergillus fumigatus</i>		169	9.97
<i>Aspergillus niger</i>		225	13.27
<i>Aspergillus ochraceus</i>		59	3.48
<i>Aspergillus terreus</i>		68	4.01
Bacteria/Yeast-like		34	2.01
<i>Curvularia lunata</i>		83	4.90
<i>Fusarium subglutinatum</i>		44	2.60
<i>Mucor sp</i>		48	2.83
<i>Neurospora crassa</i>		27	1.59
<i>Paecilomyces variotii</i>		102	6.02
<i>Penicillium citrinum</i>		69	4.07
<i>Penicillium funiculosum</i>		48	2.83
<i>Penicillium notatum</i>		69	4.07
<i>Penicillium oxalicum</i>		117	6.90
<i>Penicillium simplicissimum</i>		78	4.60
<i>Phoma sp</i>		13	0.77
<i>Rhizopus oryzae</i>	39	2.3	
<i>Trichoderma harzanium</i>	52	3.07	
<i>Trichoderma viride</i>	63	3.72	
Unidentified colonies	13	0.77	
<b>Fungal species in Mokola</b>	Unidentified colonies	14	0.85
	<i>Fusarium subglutinatum</i>	76	4.6
	<i>Fusarium verticilloides</i>	54	3.27
	<i>Aspergillus fumigatus</i>	129	7.8
	<i>Penicillium oxalicum</i>	44	2.66
	<i>Penicillium simplicissimum</i>	33	2
	<i>Aspergillus niger</i>	200	12.1
	<i>Aspergillus japonicus</i>	37	2.24
<i>Rhizopus sp</i>	26	1.57	

Characteristic	Category	Frequency	Percentage
Fungal species in Mokola	<i>Aspergillus penicilloides</i>	63	3.81
	<i>Curvularia lunata</i>	15	0.91
	<i>Aspergillus flavus</i>	85	5.14
	<i>Trichoderma harzanium</i>	32	1.94
	<i>Aspergillus aculeatinus</i>	109	6.59
	<i>Aspergillus tamari</i>	59	3.57
	<i>Penicillium funiculosum</i>	72	4.36
	<i>Paecilomyces variotii</i>	115	6.96
	<i>Penicillium notatum</i>	85	5.14
	<i>Neurospora crassa</i>	85	5.14
	<i>Penicillium citrinum</i>	84	5.08
	<i>Penicillium pinophilum</i>	41	2.48
	<i>Aspergillus terreus</i>	42	2.54
	<i>Pereniporia koreana</i>	43	2.60
	<i>Trichoderma viride</i>	76	4.60
Fungal species in Bodija	Bacteria/Yeast-like	34	2.06
	<i>Absidia sp.</i>	11	0.89
	<i>Aspergillus aculeatinus</i>	45	3.63
	<i>Aspergillus flavus</i>	126	10.18
	<i>Aspergillus fumigatus</i>	56	4.52
	<i>Aspergillus niger</i>	198	15.99
	<i>Aspergillus oryzae</i>	63	5.09
	<i>Aspergillus penicilloides</i>	58	4.68
	<i>Aspergillus sydowii</i>	64	5.17
	<i>Aspergillus tubingensis</i>	41	3.31
	<i>Curvularia lunata</i>	8	0.65
	<i>Fusarium subglutinatum</i>	33	2.67
	<i>Fusarium verticilloides</i>	52	4.20
	<i>Mucor sp.</i>	13	1.05
	<i>Neurospora crassa</i>	32	2.58
	<i>Paecilomyces sp.</i>	50	4.04
	<i>Penicillium citrinum</i>	84	6.79
	<i>Penicillium funiculosum</i>	42	3.39
	<i>Penicillium notatum</i>	95	7.67
	<i>Rhizopus oryzae</i>	69	5.57
	<i>Trichoderma asperellum</i>	29	2.34
	<i>Trichoderma harzianum</i>	38	3.07
	Bacteria/Yeast-like	26	2.10
Unidentified colonies	5	0.40	

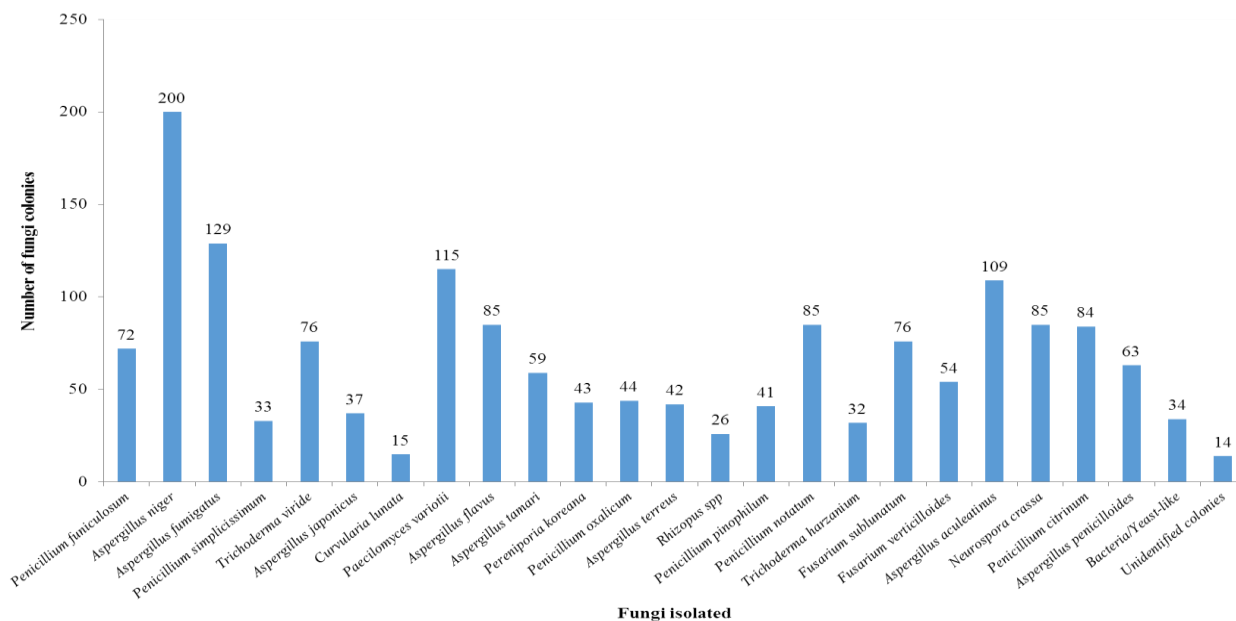
## DISCUSSION

Aeromycological survey of the environment is necessary to establish the distribution and diversity of fungal spores present in the atmosphere and which factors favour their distribution. The information in this study can be useful for allergy sufferers which can help them plan how long they stay outside and relevant for those in the agricultural sector to prevent crop damage by fungi,

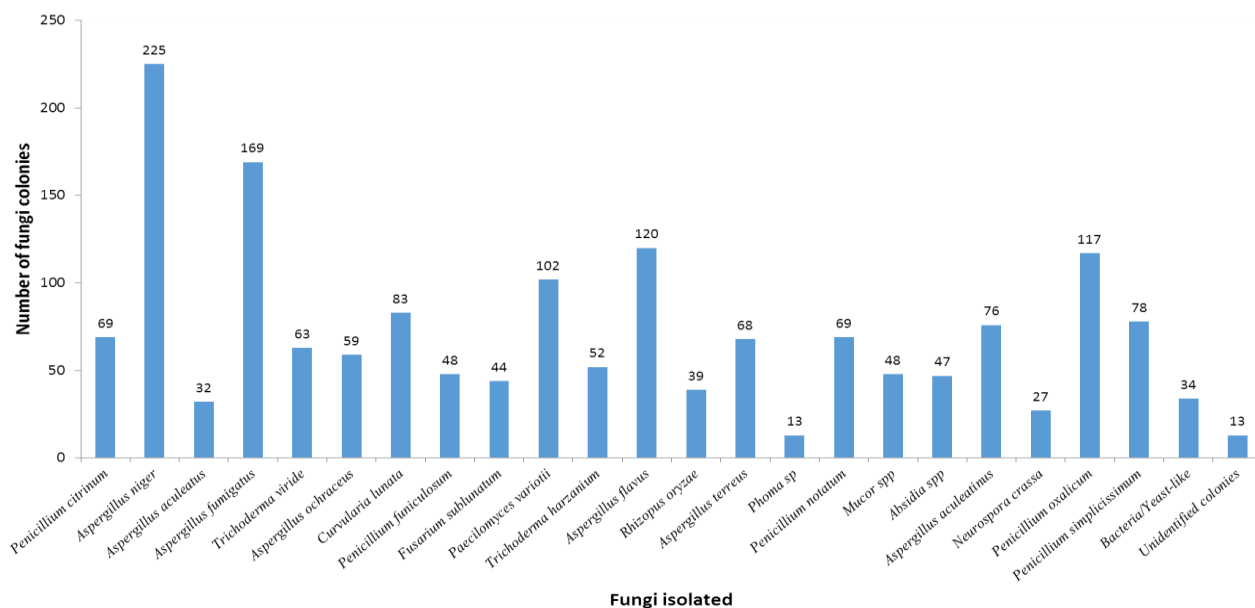
especially *Aspergillus flavus*, *Fusarium verticilloides* which have been implicated as plant pathogens. In the present study, the fungal species of Basidiomycetes and Ascomycetes were the most abundant fungal spores monitored from all locations. In addition, human activities and location were responsible for the abundance of these fungal spores in different locations. The results presented in this study agree with

Abdel Hameed et al., (2009) who recorded similar observations in their study of the diurnal distribution of airborne bacteria and fungi in the atmosphere of Helwan area, Egypt. There were fewer number of fungal spores isolated in Iyana Church location due to the fact that less activities was going on in

this area. The high number of fungal spores isolated from Bodija location could be attributed to both the high movement of people daily n the place and the kind of activity going on in the place being a popular market in Southwest Nigeria.

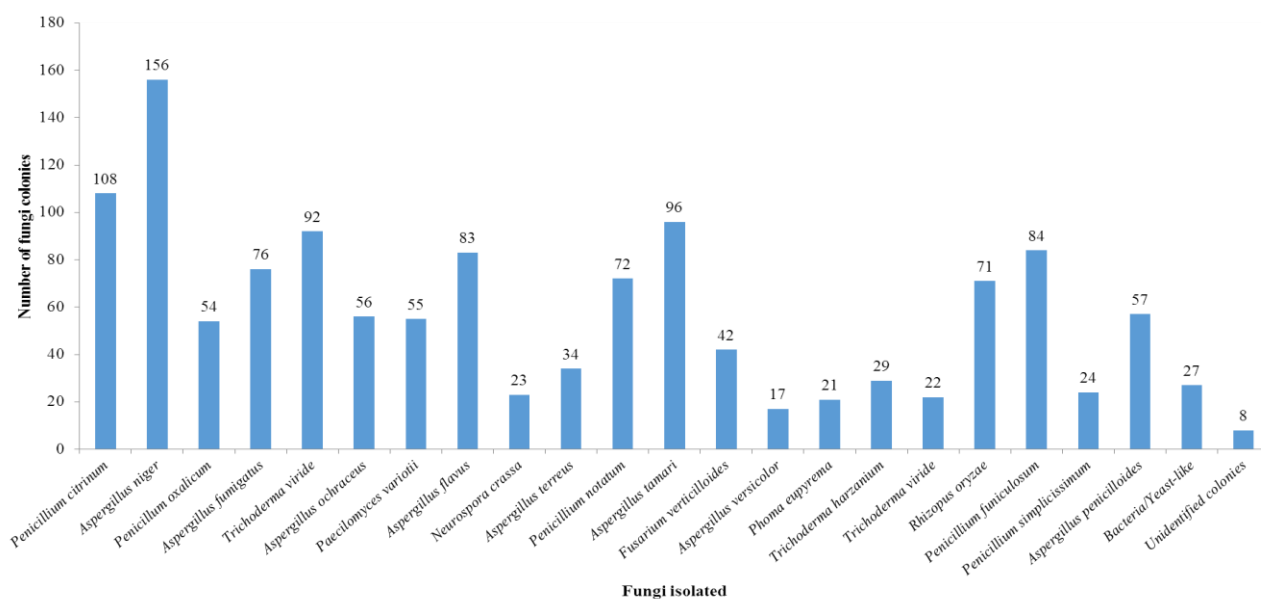


**Figure 2. Frequency of fungi isolated in Mokola, Ibadan.**

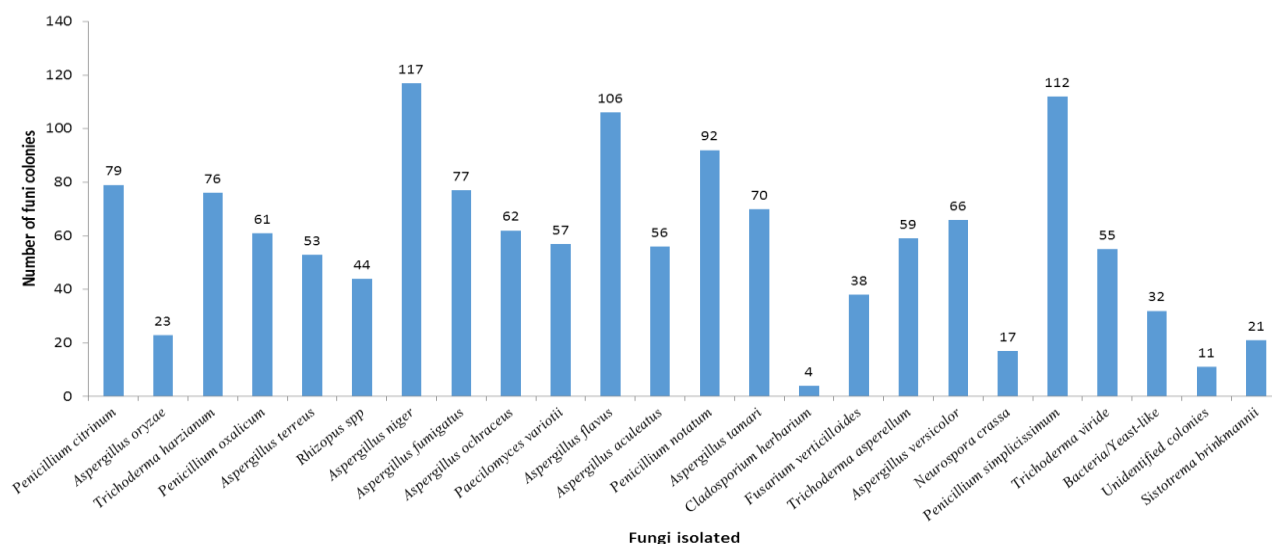


**Figure 3. Frequency of fungi isolated in Iyana church, Ibadan**





**Figure 4. Abundance of fungi isolated in Moniya, Ibadan**



**Figure 5. Frequency of fungi isolated in Beere, Ibadan.**

The abundance of fungal spores during the period of sampling revealed an increase in the months of May, June, and July which are all periods of high rainfall in Ibadan. This is in agreement with the work of Odebode et al., (2020) who investigated the airborne spores of Lagos, southwest Nigeria and reported an increase in fungal spores during the rainy season months of April, May, June, and July. In similar studies done in other parts of the world, the presence of fungal spores in the atmosphere was shown

to vary according to seasons due to their sensitivity towards meteorological factors (Almaguer et al. 2012). Various combinations of atmospheric factors also affect the distribution of aerospores in the atmosphere and this was also observed in this present study. July was wind season in Ibadan and high fungal spores are recorded in the atmosphere. The high number of *Aspergillus*, *Penicillium* spores found in the environments could be due to the fact that they discharge their spores by a mechanism con-

trolled by the action of water on the basidium or ascus and to the high rate of spore dispersal which is also important in their allergenic characteristics. This phenomenon also explains their abundance almost throughout the duration of the present study. Rivera-Mariani and Bolaños-Rosero (2012), in their study explained that rainfall of high intensity could clean the atmosphere by forcing down suspended spores, which further emphasizes the relative abundance of these spores during the rainy season for the two years study. There is a strong positive correlation between fungal spores and average relative humidity. An increase in rainfall and relative humidity was accompanied by an increase in fungal spore abundance.

Abundant airborne fungal spore was consistently recorded during wet months than dry season months. Previous studies have also shown that relative humidity and temperature are important factors that trigger fungal spore production and abundance in the air (Crandall and Gilbert, 2017; Manstretta and Rossi, 2015). Quintero et al., (2010) in their study also affirmed that the presence of fungal spores everywhere was their high ability to release large concentrations of spores daily. The occurrence of toxin producing fungi such as those of *Aspergillus flavus* and *Fusarium verticilloides* in the environment should be a cause for concern due to the potential risk of mycotoxin contamination in all locations (Ayanbimpe et al., 2010). Otokunefor and Victor, (2017) in their work on microbial air quality in Port Harcourt, Nigeria, also reported that the effect of human activity on microbial load. They also observed higher microbial loads at locations with high human activity.

Observations in this investigation are similar to those of Ogunlana (1975), who recorded similar trends in fungi abundance

with high fungal spores in October and a gradual decrease till December, after which an upward trend. Furthermore, he identified more *Fusarium sp.* During the months of July and August, and the same was noted for *Aspergillus* and *Penicillium sp.* was isolated throughout the year and appears to be of common occurrence. In our study, the same trend was observed for *Aspergillus* and *Penicillium spp.* which were identified throughout the year although in varying proportions. The occurrence of new species like *Paecilomyces variotii*, *Trichoderma asperellum*, *Sistotrema brinkmanii*, *Penicillium simplicissimum* have been confirmed in this study.

Overall, this study has contributed important aerobiological information about fungal spores present in Ibadan, Southwest Nigeria. It has been estimated that human beings inhale about 14m<sup>3</sup> of air per day on the average (Kabir et al., 2016), thus the potential impact air quality has on human life quality cannot be overstated. Most of these airborne fungal spores can cause or trigger hypersensitivity reactions which include asthma. Previous studies have also confirmed that a positive correlation exists between spore levels and higher temperatures (Rodriguez-Rajo et al., 2005; Erkara et al., 2008). The fungi isolated in all locations include *Penicillium sp.* and *Aspergillus sp.* These fungi have been identified as opportunistic pathogens in humans and often are involved with clinical manifestations of allergy, rhinitis, asthma, and conjunctivitis (Schwab and Straus, 2004). Ezike et al., (2016) in their work also found *Alternaria* spores in the atmosphere of Abuja during the rainy season. Zhu et al. (2016) found that fungal spores are responsible for 45% of organic carbon released into the air at night, and almost half of that released during the day in a coniferous forest in Japan. He further pointed out that these spores, which are

emitted from the vegetation, can influence climate by changing cloud arrangement and radiative balance. Karra and Katsivela (2007) in their work opined that fungus spores are more resilient than bacteria and viruses due to the fact that they can withstand dehydration and UV radiation. Essien and Aina (2014) in their work reported the presence of fungal spores in the atmosphere of Anyigba, Kogi State and also Odebode et al., (2020) also reported the abundance of fungi spores in different locations in Lagos, State, Nigeria thus affirming their presence in different locations and the effect of local vegetation on their abundance.

The limitation in this study are monthly sampling and the use of open plate method. In conclusion, the most dominant and abundant spores belong to the genera *Aspergillus*, *Penicillium*, and *Fusarium*. These spores are more abundant in the months of June, July, and August during the two years of investigation. Moreover, the combination of both methodologies (culture-based and visual identification by direct microscopy) is effective for a better knowledge of the fungal biodiversity in the atmosphere. This study creates a reference point for public awareness of fungal spore dispersal for the benefit of both plant and human health. It is the first study to investigate a two-year *aeromycoflora* in Ibadan, Nigeria.

#### **AUTHOR CONTRIBUTION**

All the authors have contributed significantly for the analysing data as well as preparing the final manuscript.

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#### **CONFLICT OF INTEREST**

The authors declare no conflicting interests in this study.

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