Airborne fungal diversity of Nagbhid (M.S.) India

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Abstract
Airborne fungal spores play a significant role in majority of fungal infections in humans and animals. Outdoor air is the major source of fungal infections in indoor environments. Their concentration in the atmosphere is the result of interaction between biological and environmental factors. The present investigation was carried out at Nagbhid from February 2014 to January 2015 to assess the qualitative and quantitative occurrence of fungal spore during different seasons and months of the year. 30 fungal types and 6 other types were identified out of the total catch of 8239 spores. *Aspergilli* formed the major component of the aerospora constituting 17.27% of the total fungal catch followed by *Cladosporium* (16.40%), *Nigrospora* (8.23%), *Alternaria* (7.60%), Smut spores (6.14%), *Curvularia* (4.38%) and Uredospores (2.32%). Highest fungal counts were obtained in the month of December 2014 and lowest in the month of May 2014. A significant positive correlation was found in fungal counts with temperature, relative humidity and rainfall.

Keyword: Fungal spores, positive correlation, Nagbhid

1. Introduction
Fungal spores have different sources through which they are released in the environment. They are responsible for various diseases in the plants and human beings hence their study is important for treating diseases of the plants and to treat the allergic patient of the particular locality. Human being directly comes in contact with such microbial propagules as they inhale them with air. Air borne fungal spores possibly responsible for allergies [1, 2]. Continuous air monitoring is primary important factor in devising an effective and efficient mode of diagnosis and treatment of allergic diseases [3, 4]. Airborne fungal spores identifying for a number of reasons including assessing the air quality, detection of pathogenic organisms, epidemiological study and study the human health Hazards [5]. Allergies affect immune system by those substances which usually cause no reaction in most individuals. In some cases allergic reactions are very serious and even fatal. But with proper management and patient's education, allergic diseases can be controlled and people with allergies can live normal life. Hence the present investigation was carried out to study atmospheric fungal spores and it variation in different environmental condition. Such study will prove definitely helpful for local allergologists, allergy patients and plant pathologist.

2. Materials and Methods
Location
Nagbhid (or Nagbhir) is a town and a tehsil, itself subdivision of Chandrapur district in the Vidarbha region in the state of Maharashtra, India. It is located 20°35′0″N, 79°40′0″E. Town is a central place between Nagpur-Gadchiroli-Bramhapuri-Chandrapur road links.

Sampling site
Aeromycological survey was carried out at Nagbhid, Dist Chandrapur, for a period of one year from February 2014 - January 2015. Samples were collected twice in a week at three different sites of Nagbhid viz, Govt. Rest house, Shivtekadi, Sulezari.

Sampling method
A standard 75 x 25mm slide was smeared with glycerine jelly leaving only 7mm x 22mm for labelling. Slide was exposed at each site and was removed after 24 hours and a new slide was placed. After exposing the coated slide for 24 hours the tape was carefully removed and placed on the glass slides and mounted in glycerine jelly for microscopic observations. Identification of fungal spores was done with the help of literature and references.
During the period of investigation daily record of temperature, relative humidity and rainfall was noted.

3. Results and Discussion
A total of 36 aerospora types were recorded, of which 30 belongs to fungal spores (73.99%) and 6 to other types (26.01%). Fungal spores belonging to five different groups were observed viz. Mastigomycotina (1 fungal type), Zygomycotina (2 fungal type), Ascomycotina (8 fungal types), Basidiomycotina (4 fungal types) and Deuteromycotina (15 fungal types). The different taxonomic groups to which different fungi belonged was Mastigomycotina (1.19%), Zygomycotina (0.58%), Ascomycotina (2.44%), Basidiomycotina (9.13%) and Deuteromycotina (60.65%) while the other types contributed 26.01% (Fig. 1).

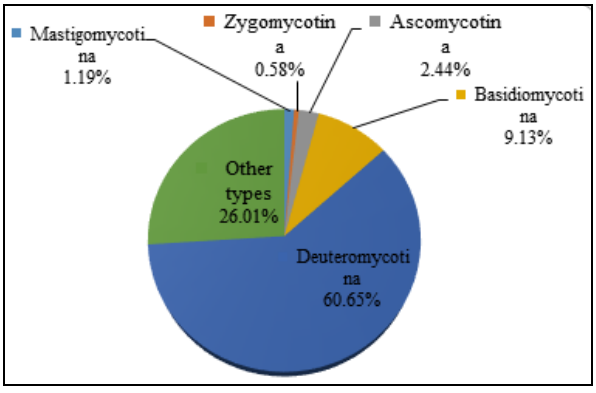

Fig 1: Percentage of different group of aerospora

The dominant fungal spores found were *Aspergilli (includes all round spores)* (17.27%) *Cladosporium* (16.40%),

Nigrospora (8.23%), *Alternaria* (7.60%), Smut spores (6.14%), *Curvularia* (4.38%) Fig. 2).

Ascospores like *Cucurbitaria* and *Didymospheria* are found during winter and early in the summer but the occurrence of most of the other ascospores is probably due to the slight rainfall. July and August recorded heavy rains. During these months most of the ascospores gets settled down and not recorded during the study. Concentration of airborne ascospores increases after rain [6]. Rainfall and high humidity positively affected the spore discharge immediately or delayed. Occurrence of some ascospores like *Cucurbitaria* and *Hysterium* were observed more during summer season. The damp atmosphere due to rain in hot season may be the main reason for the presence of ascospores even in the summer season [7].

Basidiomycotina group is the second dominant group (9.13%), having members like smut spores, basidiospores (coloured/ Hyaline), uredospores and teleutospores. Smut spores were found to be dominant among these group followed by uredospores. These spores were found in almost every month. The concentration of basidiospores was more during rainy season and in early winter. Basidiospores were not found during summer season. This means the occurrence of basidiospores required high humidity with low temperature and moderate rainfall. Hasnain *et al.*, [8] observed the seasonal and diurnal variations of airborne basidiomycetous spore's concentrations (basidiospores, smuts and rust spores) from three major coastal cities viz., Dammam, Jeddah and Jizan in Saudi Arabia. They showed that spores from smuts constituted the highest percentages of all basidiomycetous spores.

Deuteromycotina group (60.65%) was the dominant group observed during the present study. The members of deuteromycetes were trapped throughout the investigation period irrespective of weather conditions. In the imperfect fungi, once the spores are produced, release is often influenced by wind velocity [9]. Aspergilli (17.27%) were the dominant member among this group followed by *Cladosporium* (16.40%), *Nigrospora* (8.23%), *Alternaria* (7.60%) and *Curvularia* (4.38%). Calderon *et al.*, [10] found that Deuteromycetes conidia formed the largest component of the total airborne fungal spore load in the atmosphere of Mexico City, contributing 52% of the spores trapped in an urban-residential area (southern area) and 65% of those in an urban-commercial area (central area).

Aspergilli spores are found more or less similar in every month but their concentration was high during early rainy days. Near Shivtekadi area dumping ground is present where all the household waste as well as municipal waste is dumped. This may be the reason for occurrence of Aspergilli spores in the atmosphere. Padmanabhan *et al.*, [11] carried out survey of airborne fungal spores in a saw mill environment in Palakkad, District Kerala, India and found highest concentration of *Aspergillus* spores in the atmosphere.

The spores of *Cladosporium* were found more during rainy season and mostly in groups. Even a slight rainfall may also found to be responsible for the occurrence of this spore in the atmosphere. Very dry season as well as heavy rain was found to be unsuitable for the production and the liberation of the spores. Though the spores were trapped but their frequency was less during these days. Sreeramulu [12] recorded high number of spores of *Cladosporium* in December. Sreeramulu and Ramalingam [13] observed spore type like *Cladosporium* which were washed off by the first showers of rain; take some time to recover its concentrations to pre-rain level. Rees [14] reported that decline in the conidial number during December and January was possibly due to temperature effect.

Alternaria ranked fourth in the air-borne population of Deuteromycotina spores. *Alternaria* showed peak period during the month of January and lowest during rainy season. Months such as April, May witnessed high temperature (average temperature nearly 35 ^{0}C) with relatively dry air having low humidity. During these months some rainy days were recorded. This may cause the release of these spores in the atmosphere. Though the average temperature was little high during these months, still the concentration of *Alternaria* was found in the atmosphere. These spores reported in large number during November-January [15]. Turner [16] collected 0.8% spores of this genus from the air-spora of Hongkong. Fungi of the genus *Alternaria* are frequent parasites and saprophytes of crop plants, in this number of cereals the greatest concentrations of their spores are noted at the harvest time [17].

Cladosporium was the most frequent fungal spore in both locations viz. urban and rural areas of the North of Portugal, together with *Alternaria* and its concentration was higher during summer whereas *Aspergillus/Penicillium* was more abundant during autumn [18].

Concentration of *Curvularia* spores was maximum in winter and minimum during summer season. Winter months like October November favours the occurrence of such spores. During the winter maximum temperature was recorded as 29 ^{0}C in October while minimum 11 ^{0}C was recorded in January. The maximum relative humidity was recorded as 70% in October while minimum 30% was recorded in January. Winter season also witnessed the unusual rainfall. Occurrence of *Curvularia* was less in some rainy days, though the air consists of enough moisture and humidity but heavy rainfall may settle down the spores. Moisture and humidity have a positive effect on sporulation of *Curvularia* [19]. The most abundant airborne spores are *Cladosporium* and *Alternaria* in Timişoara and Bucharest. *Epicoccum*, *Nigrospora* and *Drechslera* - type spores presented a sporadic distribution throughout the study [20].

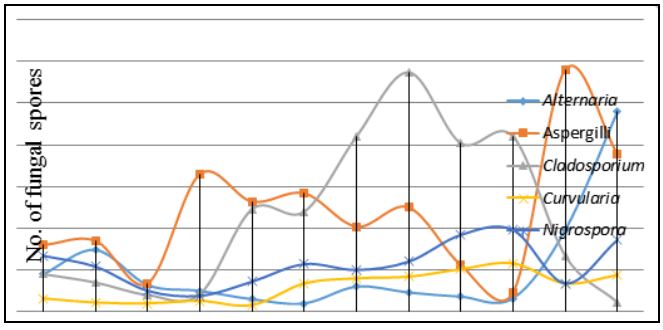

Fig 2: Incidence of dominant fungal spores from Feb 2014 to Jan 2015

Besides fungal spore other types were also recorded from the atmosphere of Nagbhid. Other types includes algal filaments, hyphal fragments, insect /insect parts, trichomes, tracheideal elements, pollen grains and remaining one from the group of unidentified spores. Inclusion of this group was very important to get a clear picture of aerospora.

4. Conclusion

It was concluded from the present study that there was no spore free season as fungal spores have a wide range of spore dispersal mechanism. Temperature, humidity and rainfall were found to have profound effect on its occurrence. Low temperature with high humidity favours the occurrence of most of the fungal spores. Even a slight rainfall is responsible for the occurrence of various types of fungal spores. The dominant fungal spores observed were *Cladosporium*, *Alternaria*, Aspergilli, *Nigrospora* and *Curvularia*. Thus such aerobiological study will be useful for plant pathologist, medical practitioners in respected fields and for forming disease forecasting system of the study area.

5. References

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