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## RESEARCH ARTICLE

### SEASONAL VARIATIONS IN AIRBORNE FUNGAL SPORES OF NAGBHID (M.S.) INDIA

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#### ABSTRACT

Air is mixture of various biotic and abiotic molecules. Biotic molecule includes pollen, fungal spores, insect, insect parts and trichomes etc. These biotic molecules directly inhale by human being along with the air. Fungal spores are known for their ability to cause diseases in plants and also in human being. A survey of air borne fungal spores was carried out for one year from December 2012 - November 2013 to assess the qualitative and quantitative occurrence of fungal spore during different months of the year. 27 fungal types and 6 other types were identified out of the total catch of 7111 spores. Ten fungal types recorded more than 1% of the annual total fungal catch. *Cladosporium* formed the major component of the aerospora constituting 19.42% of the total fungal catch followed by *Aspergilli* (16.58%), *Nigrospora* (8.87%), Smut spores (6.54%), *Alternaria* (6.12%), *Curvularia* (4.42%), Uredospores (2.53%) and *Pithomyces* (2.42%). Highest fungal counts were obtained in the month of August 2013 and lowest in the month of April 2013. A significant positive correlation was found in fungal counts with temperature, relative humidity and rainfall.

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## INTRODUCTION

Study of aeromycoflora is important for disease forecasting 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. Fungal spores are found almost in every seasons because its occurrence is depend on the substrate on which it thrives. Seasonal conditions are also responsible factor for the occurrence of fungal spore. It means fungal spores are the evergreen component of the atmosphere and are now generally recognized as important cause of respiratory allergies. Allergic reaction associated with fungi involves the lower respiratory tract more frequently than does pollen allergies (Lehrer *et al.*, 1983). More than 80 genera of fungi have been associated with symptoms of respiratory tract allergy (Burge *et al.*, 1982; Gravesen 1979). Aerobiological survey has shown that fungal spores are present in atmosphere worldwide. Multiple species may be observed at any time of year. Despite the clinical importance and abundant release of fungal spores, relatively few investigations have focused on relationship between airborne spores and allergic diseases (Homer *et al.*, 1995).

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The aim of present study was to find out the atmospheric fungal spore and its correlation with meteorological parameters. This is the first attempt has been made in this area which will be definitely helpful for allergologists, allergy patients, plant pathologist and other related fields.

## MATERIAL AND METHODS

**Location:** Nagbhid (or Nagbhir) is a town and a tehsil, itself subdivision of Chandrapur district in Nagpur revenue Division 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 December 2012 - November 2013. 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.

## RESULTS AND DISCUSSION

Present study revealed a total of 33 aerospora types, of which 27 belongs to fungal spores and 6 to other types. The total contribution of fungal spores from Nagbhid was 74.77% and other types 25.23%. Fungal spores belonged to five different groups were encountered viz. Mastigomycotina (1 fungal type), Zygomycotina (2 fungal type), Ascomycotina (6 fungal types), Basidiomycotina (4 fungal types) and Deuteromycotina (14 fungal types) (Table 1).

The percentage of taxonomic groups of fungi was Mastigomycotina (1.18%), Zygomycotina (0.51%), Ascomycotina (1.84%), Basidiomycotina (9.69%) and Deuteromycotina (61.55%) while the other types contributed 25.23% during investigation (Fig. 1).

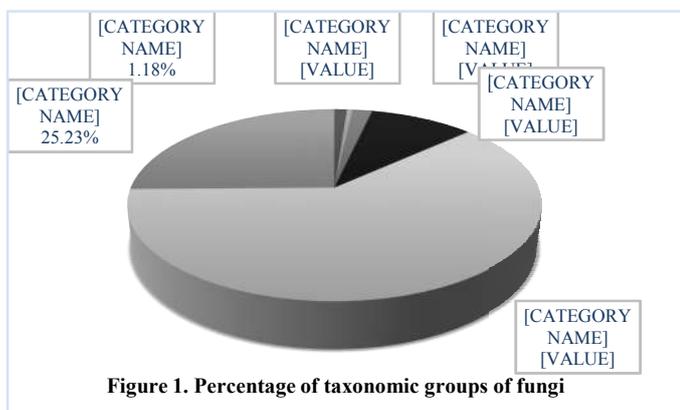


Figure 1. Percentage of taxonomic groups of fungi

The major fungal types recorded were *Cladosporium* (19.42%), *Aspergilli* (16.58%), *Nigrospora* (8.87%), Smut spores (6.54%), *Alternaria* (6.12%) and *Curvularia* (4.42%).

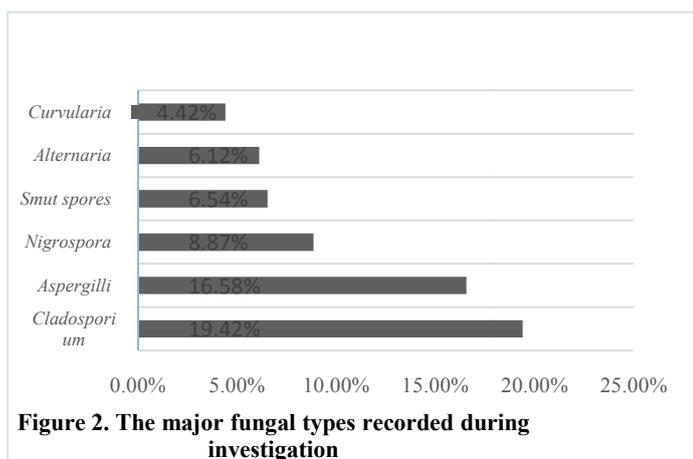


Figure 2. The major fungal types recorded during investigation

*Albugo* was the single representative of the group Mastigomycotina. It was observed more frequently in winter season and early in the summer. Members of Ascomycotina were found mostly

during winter. *Didymosphaeria*, *Pleospora* and *sporomia* were observed even after just a shower of rain. During rainfall most of the spore were settle down and required 1 to 2 hours for their release. Release of ascospores is dependent on occurrence of rainfall, high humidity and low temperature conditions (Dhaware 1982). *Pleospora* was observed even two days after rains. Mane (1978) recorded 0.35% contribution of *Pleospora* and showed that high humidity conditions favoured the occurrence of the spores in the air. Oliveira et al. (2009) at North of Portugal observed spring-autumn spores like *Leptosphaeria*, *Pleospora* exhibited negative correlations with temperature and positive correlations both with relative humidity and rainfall level. Occurrence of some ascospores like *Cucurbitaria*, *Melanospora*, *Didymosphaeria* 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. Among Basidiomycetes, smut spores were the dominant member followed by uredospores, basidiospores and teleutospores.

Smut spores were found throughout the investigation period but their concentration was more during June to September. Pady and Kramer (1960) recorded smut spores throughout the year with maximum number in months of June and July. The concentration of basidiospores was more during rainy season. Ingold (1965) and Hirst (1953) showed that low temperature, moderate to high humidity and rain had direct effect on the occurrence of basidiospores in the atmosphere. Deuteromycetes group dominated the air-spores. Among which *Cladosporium* was the major contributor with 19.42%. The total air-sporastudies of Nagbhid showed that *Cladosporium* rank first followed by *Aspergilli*, *Nigrospora*, *Alternaria*, smut spores, *Curvularia*, etc. All these fungal spores were trapped throughout the investigation period irrespective of weather conditions. The spores of *Cladosporium* 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. The spores of *Cladosporium* have the tendency to liberate in groups mostly because of high production and they are usually trapped on the slides in groups (Kalkar and Mohture, 2011). *Cladosporium* showed more concentration during August to November. *Cladosporium* showed positive relation with rainfall. Among the fungal genera *Cladosporium* dominates the outdoor mycofungal flora all over the world (Pepeljnjak and Segvic, 2003). It was observed that increase in the temperature decreases the concentration of *Cladosporium* in the air. *Aspergill* group ranked second (16.58%) and includes all round spores of *Aspergillus*, *Penicillium*, *Mucor* and *Rhizopus*. Winter season showed more occurrences of these spores followed by rainy season. Bhat and Rajasab (1988) observed the peak concentration of *Aspergilli* during June to September. *Alternaria* (6.12%) were observed in every month. Its concentration was more in January. Derrick (1966) recorded these spores in large number during November-January. Oliveira et al. (2009) showed the dominance of *Alternaria* in north Portugal in almost every month. *Curvularia* spores (4.42%) were recorded throughout the investigation period inspite of variations in its concentration. Concentration of *Curvularia* spores was maximum in early winter and minimum during summer season. Chakraborty et al. (2000) showed that

moisture and humidity have a positive effect on sporulation of *Curvularia. Nigrospora* (8.87%) was found more or less same in number in every month. Winter season favoured maximum concentration of these spores. The dominance of *Nigrospora* was also reported by Ramalingam (1971). Deuteromycetes was found to be the most dominating group in the atmosphere. Satheesh *et al.* (1997) from Kodaikanal, Mohture and Kalkar (2014) from Nagpur also recorded Deuteromycetes members as the chief contributor of spores in atmosphere. The monthly variation of dominant fungal spores showed that the peak period of most of the fungal spores were recorded on the onset of the monsoon season extended upto the early winter (Fig. 3). During monsoon season high humidity and low temperature were recorded. It was observed that such condition with slight rain showering may be suitable for the release of fungal spores in the environment. During winter month slight rainfall were recorded. During these month sudden increase in fungal spores were recorded.

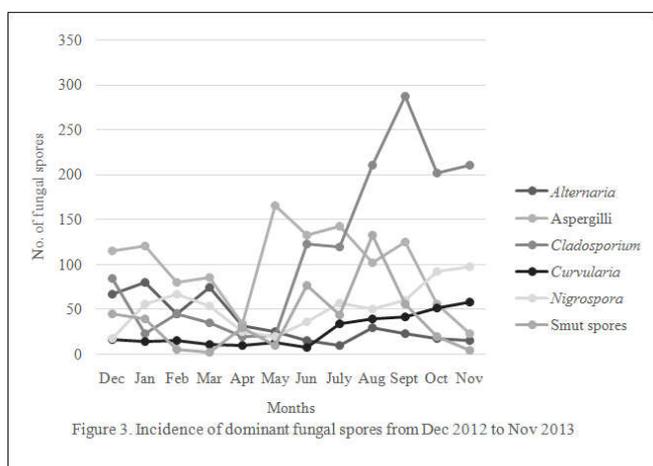


Figure 3. Incidence of dominant fungal spores from Dec 2012 to Nov 2013

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. Thus such aerobiological study will be useful for plant pathologist and for forming disease forecasting system of the study area.

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