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International Journal of Current Research
Vol. 6, Issue, 11, pp.10081-10085, November, 2014

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

SEASONAL VARIATIONS IN THE AEROMYCOFLORA FROM SEMIURBAN AND URBAN SITES AT NAGPUR (M.S.), INDIA

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ARTICLE INFO

Article History:
Received 24th August, 2014
Received in revised form
16th September, 2014
Accepted 05th October, 2014
Published online 30th November, 2014

Key words:

Aeromycoflora,
Semiurban area,
Urban area,
Climatic conditions.

ABSTRACT

An outdoor survey of air borne fungal spores was conducted at two different sites at Nagpur, India viz., semiurban (site I) and urban (site II), during February 2006 to January 2007 using Rotorod air sampler. Aeromycoflora was observed throughout the year but their percentage of occurrence varies due to meteorological factors. A total of 56 fungal types were recorded from a total catch of 65,480 spores/m^3 of air from site I. The percentage of taxonomic groups of fungi was Ascomycotina (1.71%), Basidiomycotina (8.16%) and Deuteromycotina (90.13%). Among them, *Cladosporium* (34.21%) was the most dominant fungal type followed by *Alternaria* (20.25%), *Nigrospora* (12.87%), Aspergilli (6.96%), *Curvularia* (5.74%) and Smuts (4.98%).While from site II, 46 fungal types were recorded from total 34,720 spores/m^3. Four major groups namely Mastigomycotina (0.27%), Basidiomycotina (12.23%), Ascomycotina (1.99%), Deuteromycotina (85.51%) were observed. The major fungal types in the order of dominance were *Cladosporium* (33.15%), *Alternaria* (21.36%), *Nigrospora* (8.90%), Smuts (8.89%), Aspergilli (6.13%) and *Curvularia* (4.95%). The occurrence of fungal spores was correlated with climatic conditions. An attempt was made to forecast atmospheric fungal concentration in the study area.

INTRODUCTION

Today everywhere because of the industrialization and urbanization atmosphere is polluted. It consists of number of pollutants and of course biopollutants as well. A change in the environment causes the release of various types of biocomponents in the atmosphere. This results in the increase of various allergic disorders. Fungal spores predominates the other biocomponent in the air-spora. Many of the air borne fungal spores are the significant potential source of allergen. Many air borne fungal spores are responsible for allergic diseases. Gregory (1973) found out the direct relation of fungal spores with allergic disorders.

The role of air borne fungi is well established as aeroallergen (Agrawal and Shivpuri 1974, Lacey 1991). According to Pouli and Bessot (1987) and Singh and Malik (1992), the symptomology of the allergic patients is associated with bioerosols such as pollen grains, fungal spores, mites, insect parts, fragments and animal biomass. Continuous air monitoring is important in devising an effective and efficient mode of diagnosis and therapeutic treatment of respiratory allergy (Hyde 1969). Aerobiological studies conducted in different parts of India have provided information on the various components of aerospora (Sreeramulu and Ramalingam 1966, Shivpuri and Agarwal 1969, Vittal and Krishnamoorthi 1981, Bhat and Rajasab 1988, Sharma 1990, Ramalingam and Jyoti Nair 1994, Singh *et al*., 2004). The systematic study on air borne spores in the atmosphere of Nagpur city was done by Kalkar and Patil (1994), Gore and Patil (1989), Kalkar *et al*. (1998), Kalkar and Mohture (2013). Nagpur city is thickly populated with many industries and also has good vegetation. Various agricultural lands are now converted into residential land. So the change in the environment occurs from last seven to eight years in semi-urban as well as in urban areas and hence the present work has been taken up. Such studies will be helpful for allergologists, allergy patients, plant pathologist and other related fields.

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MATERIALS AND METHODS

Sampling site: Aeromycological survey was carried out at Wanjra, a semi-urban area and Agronomy department, an urban area, Nagpur for a period of one year from February 2006 to January 2007.

Site I: Wanjra (Semiurban) – Village area with agricultural farms as well as small scale industries.
Site II: Agronomy department (Urban) – This is the area in the Central- Western part of the city in Agricultural University area. It consists of agricultural farms, multistored buildings,

residential complexes, roads including national highways with avenue trees.

Sampling: Sampling was done by Rotorod sampler. Sampler was kept nearly 25 feet above the ground level and daily data was collected.

Collection of data: On sampling surface rods of the sampler, transparent cello tape of an approximate size was applied. The cello tape on the arms was coated with melted petroleum jelly.

Preparation of slides: After exposure the tape was carefully removed and placed on the glass slides and mounted in glycerin jelly for microscopic observations.

Identification: It was done with the help of standard literature and reference slides.

Meteorological parameters: During the period of investigation daily record of temperature, relative humidity and rainfall was noted.

RESULTS AND DISCUSSION

Aeromycological survey from site I (Wanjra) pertains to total 56 fungal spore genera representing 3 major groups i.e. Ascomycotina (1.71%), Basidiomycotina (8.16%) and Deuteromycotina (90.13%) (Fig.1).

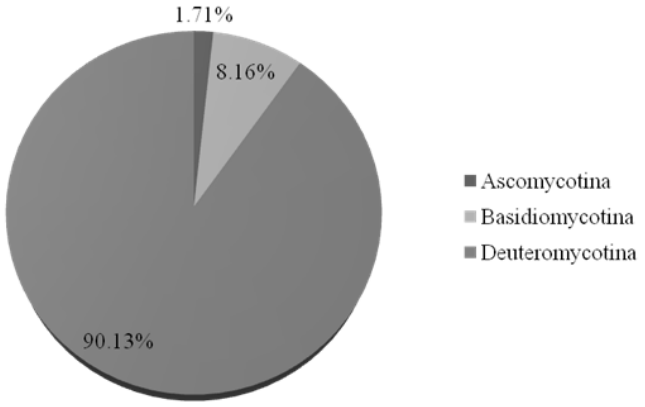

Figure 1. Percentage of different groups of aerospora from site I (semiurban)

During investigation Mastigomycotina members were not found. While from site II (Agronomy department) total 46 fungal spore types representing 4 major groups i.e. Ascomycotina (1.99%), Basidiomycotina (12.23%), Deuteromycotina (85.51%) and Mastigomycotina (0.27%) were observed (Fig.2). During investigation total of 65,480 spores/m^3 were trapped at Wanjra while 34,720 spores/m^3 were trapped at Agronomy site. Semi-urban site showed comparatively more spore count than the urban site. Kasprzyk and Worek (2006) surveyed airborne fungal spores in rural and urban sites for consecutive two years and found that the total seasonal sum of all the spores was higher in the countryside than in the city. Of the 56 fungal spore types recorded from site I, 14 belonged to Ascomycotina, 4 to Basidiomycotina and 38 to Deuteromycotina. The Deuteromycotina group (90.13 %) formed the bulk of air-spora. Of the total aeromycoflora the major contributing genera in the order of dominance were *Cladosporium* (34.21%), *Alternaria* (20.25%), *Nigrospora* (12.87%), Aspergilli (6.96%) and *Curvularia* (5.74%) (Fig.3). The Basidiomycotina contributed 8.16 %, represented by Basidiospores, Teleutospores, Smuts and Uredospores.

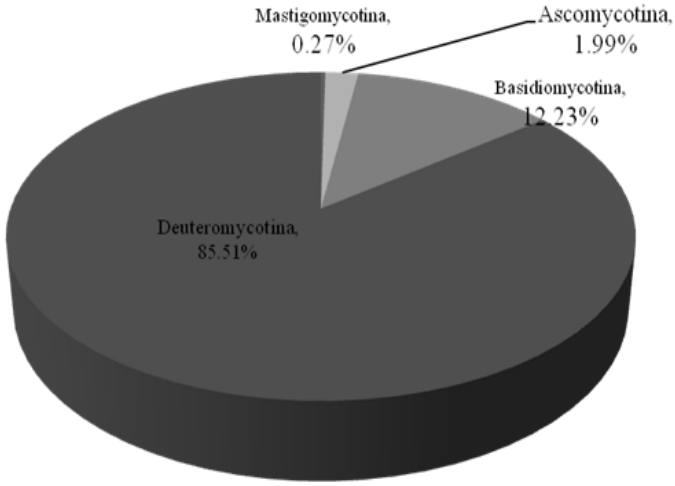

Figure 2. Percentage of different groups of aerospora from site II (Urban)

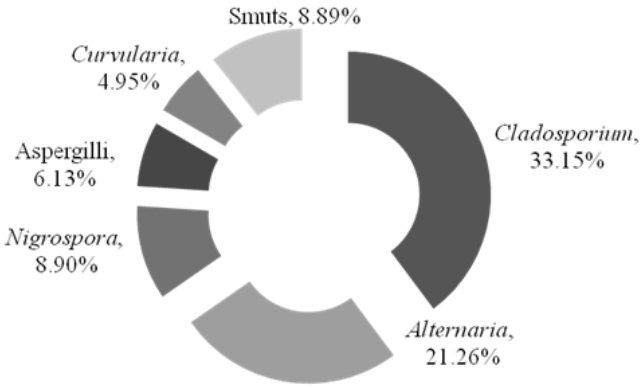

Figure 3. Percentage of dominal fungal spore types from site I (semiurban)

The Ascomycotina accounted for 1.71 % of the total count. While from site II out of 46 fungal spore types, 1 belonged to Mastigomycotina, 11 to Ascomycotina, 4 to Basidiomycotina and remaining 30 to Deuteromycotina. Of the total aeromycoflora the major contributing genera in the order of dominance were *Cladosporium* (33.15%), *Alternaria* (21.36%), *Nigrospora* (8.90%) smuts (8.89%), Aspergilli (6.13 %), and *Curvularia* (4.95%) (Fig.4). Spores of *Cladosporium, Alternaria, Epicoccum, Helminthosporium* species were predominate during dry weather, especially when it is windy this observation is supported by Solomon and Platts-Mills (1998). Calderon *et al*. (1997) 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). Among the most common spore types, *Cladosporium* and *Alternaria* showed a marked seasonal periodicity with significant differences in

concentration (P<0.05) between the dry and wet seasons. Maximum conidial concentrations were found during the end of the wet season and the beginning of the cool, dry season (October–December). During investigation unusual rainfall was recorded in the month of March and April. A sudden rise in most of the fungal spores was recorded during this period. Monthly variation of dominant fungal spores from site I and II was studied during the study period (Fig.5 and Fig.6).

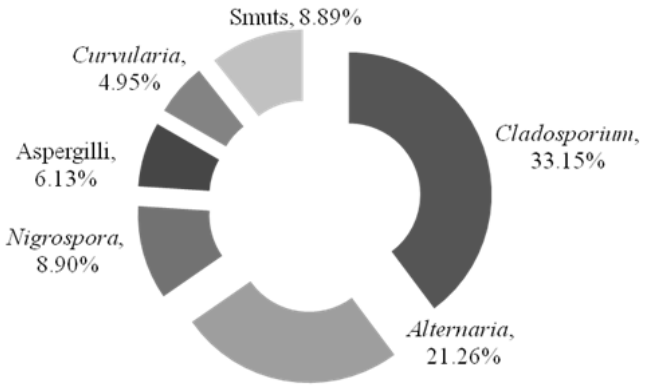

Figure 4. Percentage of dominal fungal spore types from site II (Urban)

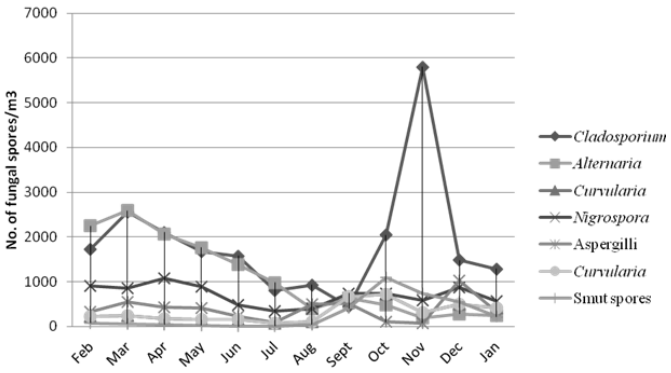

Figure 5. Monthly Variation of dominant fungal spores from site I during Feb 2006-Jan 2007

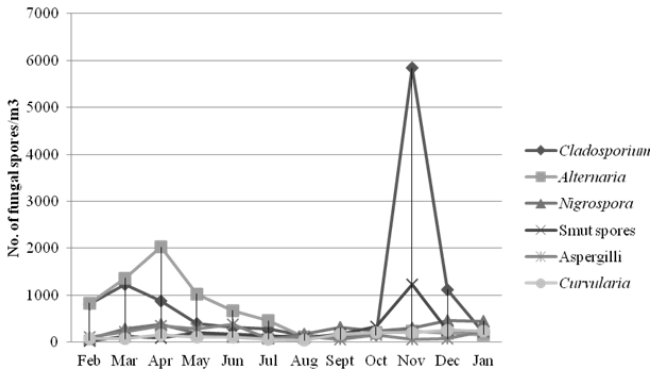

Figure 6. Monthly Variation of dominant fungal spores from site II during Feb 2006-Jan 2007

During investigation period Deuteromycetes members were the chief contributor of spores in atmosphere, similar result were recorded by Satheesh *et al*. (1997), Agashe and Sudha (1997). In Deuteromycetes, *Cladosporium* was found to be dominant followed by *Alternaria* in both sites. These observations were supported by Majumdar and Bhattacharya (2000), Devi *et al*. (2002), Vittal and Krishnamoorthy (1981), Arora and Jain (2003), Dahia and Gupta (2003), Sabariego *et al*. (2000), Hurtado *et al*. *(*1989). *Cladosporium* was found more in wet than in dry air (Harvey 1970). The present work supported the earlier findings. Their number was suddenly increased even after very little rainfall. *Cladosporium* was found in highest number during November and lowest in September. *Alternaria* was caught throughout the investigation period. This may be due to its occurrence as a saprophytes as well as leaf spot parasite on various crops noted in the study area. This was supported by the observations of various workers (Shrivastva and Shukla 1990, Datta 1993, Reddy and Reddy 1996). The prevalence of *Alternaria* was in dry days with relatively stronger wind. The concentration of *Alternaria* was maximum during March and minimum during November. *Cladosporium* was the most frequent fungal spore in both locations viz. urban and rural areas of the North of Portugal, together with *Alternaria*; its concentration was higher during summer whereas *Aspergillus/Penicillium* was more abundant during autumn (Oliveira *et al*., 2009).

A spore of *Bispora* occurs throughout the year in semi urban area (site I) while in urban area these spores are absent in some month. Harriet and Burge (2002) reported the favourable condition for the liberation and distribution of this spore is high humidity and low temperature. Prabhudesai *et al*. (2006) reported *Bispora* is dominant spore type in monsoon season at Goa. *Nigrospora* was found more or less in same number in every month. April favoured maximum concentration and July the minimum. Meredith (1961) at Jamaica observed variation in the number of spores of *Nigrospora* and showed their relevance with rainfall and humidity. Spores belonging to *Aspergillus, Penicillium, Mucor* and *Rhizopus* were counted and grouped under a single category 'Aspergilli' as they are similar in appearance. The more occurrences of 'Aspergilli' in site I was may be due to the municipal waste. Its peak was observed during December in site I and in site II they show similar occurrence from February to June. Bhat and Rajasab (1988) observed the peak concentration of 'Aspergilli' during June to September. Minimum number of these spores was observed in the month of November.

The abundance of *Curvularia* may be due to its saprophytic nature. Martinnez-Giron *et al*., (2004) also reported the presence of several types of air borne spores like *Alternaria, Aspergillus, Cladosporium, Epicoccum and Curvularia*. During the period of investigation the spores of *Didymosphaeria* were recorded in the air from February to September at both the sites. It was observed in air after rainfall and humid conditions. Meredith (1962) at Jamaica observed its appearance regularly between midnight and morning. Spores like *Leptosphaeria, Pleospora were* found in rainy days. These ascospores were observed in less number but their appearance was seen even after little rains. It clearly indicates that dry atmosphere showed the absence of these spores while wet weather condition showed their increase in number in the air. The concentration of air borne ascospores increases after rain which was found to be associated with high humidity and low temperature (Dhaware 1982). The present report supports the earlier finding. Dye and Vernon (1952) reported that the spores of *Pleospora* are general in their distribution in New Zealand.

Oliveira *et al*., (2009) observed spring-autumn spores like *Leptosphaeria, Pleospora* exhibited negative correlations with temperature and positive correlations both with relative humidity and rainfall level. They also showed that although fungal spores are ever-present component of the atmosphere throughout the year but their concentration oscillates widely with meteorological data. Basidiospores (Col/Hya.) were maximum during February in site I. Decrease in the spore frequency in rainy days was observed and increase in the spore count was recorded when rain was stopped. Occurrence of basidiospores with low temperature, moderate to high humidity and rains support the findings of Ingold (1965) and Hirst (1952).

Smuts were reported at both the sites as they are pathogenic to the crops in the field. Pady and Kramer (1960) recorded smut spores throughout the year with maximum number in months of June and July. Similarly uredospores were also encountered more or less in both sites this may be due to the occurrence of uredospores in air coincides with the infection of cereals and grasses. *Albugo* was the only one member representing the group Mastigomycotina. *Albugo* was found in site II only. It lives as parasite on the leaves of many plants mostly causes white rust of Crucifers and also on Amaranthaceae. The occurrence of aerospora in semiurban area was more as compared to the urban area. A comparative study of aerospora by Hamilton (1959), Barkai Golan and Glazer (1985), Davies (1969), Long and Kramer (1972) showed that the occurrence of aerospora in urban area was less as compare to the rural area. The occurrence of fungal spores in any locality varies with seasons. Hot, humid and cold seasons of Nagpur were found suitable for the growth of different types of fungi. Such aerospora studies gives clear picture of diversity of fungal spores in atmosphere and its relation with climatic changes. It is thus helpful for forecasting fungal spores in air as well as in solving allergy cases in human beings.

REFERENCES

Agashe, S.N. and Sudha, P. 1997. Studies on seasonal periodicity of air borne fungal spores in Bangalore city. *Proc. Of 5th international conference of aerobiology* Bangalore 1994: 32 – 37.

Agrawal, M.K. and Shivpuri, D.N. 1974. Fungal spores: Their role in respiratory allergy. *Advances in pollen spores Res.*1:78-128.

Arora Anil and Jain, V.K. 2003. Fungal aerospora of Bikaner (Rajasthan). *Indian J. Aerobiology,* 16 (1 & 2): 1 – 9.

Barkai- Golan, R and Glazen, I. 1985. Airborne fungi in Eilate and Tel-Hasomer. *Isreal. J. Allergy*, 33:324-345.

Bhat, M.M. and Rajasab, A.H. 1988. Airspora of a commercial location of Gulbarga, *Indian J. Aerobiol.*, 1: 59 – 65.

Calderon, C., J. Lacey, A. McCartney and I. Rosas. 1997. Influence of urban climate upon distribution of airborne Deuteromycetes spore concentrations in Mexico City. *International Journal of Biometeorology*, 40 (2): 71-80.

Dahiya, P. and Gupta, R. 2003. Aeromycoflora of Rohtak city, Haryana. *Indian J. Aerobiology,* 16 (1 & 2): 46 – 50.

Datta, T.R. 1993. Certain aerobiological studies in relation to the incidence of allergic diseases at Gwalior (M.P.), Ph.D. thesis, Jiwaji University Gwalior.

Davis, R.R. 1969.Spore concentration in the atmosphere of Ahmadi: A new town in Kuwait. *J. Gen. Microbiol*., 55: 425-432.

Devi, N., Bhar, B. and Sharma, G.C. 2002. Aerospora of semi-urban area of Guwahati. *Indian J. Aerobiology,* 15 (1 & 2): 20 – 30.

Dhaware, A.B.1982. Aerobiology at Udgir Ascospores. *Proc. Nat. Cong. Env. Biopole. Aurangabad.*: 55-57.

Dye, M.H. and Vernon, T.R. 1952. Air borne mould spores: A newzealand survey. *Newzealand J.sci. Tech*, 34: 118-127.

Gore, S.G. and Patil, G.V. 1989. Air spora of Nagpur in relation to climatic factors. *Proc Spl. Ind. Geo, conf.* Poona: 39-37.

Gregory, P.H. 1973. The microbiology of the atmosphere. *2nd Ed. plant science Monograph, Leonard Hill books* London: 251.

Hamilton, E.D. 1959. Studies on the aerospora. *Acta Allergol.*, 13:143-175.

Harriet and Burge, A. 2002. An update on pollen and fungal spore's aerobiology. *J. allergy and clinical Immunol*., 110:544-552.

Harvey, A.V. 1970. Air-spora studies at Cardiff, III – *Trans. Brit. Mycol. Soc.*, 54: 251 –254.

Hirst, J.M. 1952. An autometric spores traps. *Ann. Appl.Bio*., 39: 257-265.

Hyde, H.A. 1969. Aeropalyology in Britain: an outline. *New phytol*., 68:579-590.

Ingold, C.T. 1965. Spore liberation. Clarendon press, Oxford: 210-220.

Kalkar, S.A. and Mohture, V.M. 2013. Occurrence of *Curvularia* spores in the atmosphere of semiurban and urban area at Nagpur (M.S.) India. *Bionano Frontier*, 6 (2): 302-305.

Kalkar, S.A. and Patil, G.V. 1994. Air borne biocomponents in the air of Nagpur. *Indian J. Aerobiol.*, 7: 1-7.

Kalkar, S.A., Ashok A. and Patil, G.V. 1998. Aeroallergens at Nagpur. *The Botanique* 11: 52-55.

Kasprzyk, I. and Worek, M. 2006. Airborne fungal spores in urban and rural environments in Poland. *Aerobiologia*, 22 (3): 169-176.

Lacey, J. 1991. Aerobiology & Health, role of air born fungal spores respiratory diseases. *In frontiers in mycology, Honorary and General Lectures from fourth inter mycological congress, Regenbugg Ed. D.L. Hawks worth*: 157-185.

Long, D.L. and Kramer, C.L. 1972. Air spora of two contrasting ecological sites in Kansas. *J. Allergy Clin. Immunol.*, 49:255-266.

Majumdar Manas Ranjan and Bhattacharya Kashinath 2000. Aeromycoflora at the foot hills of eastern Himalaya. *Indian, J. Aerobiology,* 13 (1 & 2): 14 – 19.

Martinnez-Giron R, Ribas-Barcelo A, Garcia-Miralles MT, Lopez-Cabanilles D, Tamargo-Pelaez ML, Torre-Bayon C, Fernandez L. 2004. *Diagn Cytopathol*, 30(6):381-5.

Meredith, D.S. 1961. *Botryodiplodia theobroma pat. Nigrospora Sp*. In the air of Jamaican Banana plantaion Nature, 190: 555-557.

Meredith, D.S. 1962. Some components of aerospora in Jamaica, banana plantation *Ann. Appl. Biol*., 50:577-594.

Oliveira, M., Ribeiro, H., Delgado, J.L. and I. Abreu I. 2009. The effects of meteorological factors on airborne fungal

spore concentration in two areas differing in urbanisation level. *Int J Biometeorol*., 53(01):61-73.

Pady, S.M. and Kramer C.L. 1960. Kansas aeromycology VII. *Phytopath*., 50:332-334.

Pouli, G. and Bessot, J.E. 1987. Mite allergy. In: Highlights in Asthomology (Eds). *Michel, E.B., J. Bosquet and Godard Springer. Verlag Pub.*: 316-321.

Prabhudesai Mangala P., Hiremath K.G. and Bhat D.J. 2006. Pollen & fungal spora of Miramar Beach area- Goa. *Indian J. Aerobiol.*, 19 (1): 37-41.

Ramalingam, CGK and Jyoti Nair. 1994. Comparative study of the airspora urban complex in Hyderabad over a period and its significance. *Geophytology*, 23:343- 347.

Reddy. R.R. and Reddy, P.R. 1996. Aerobiological survey of Vikarabad. *Indian J. Aerobiol*., 9 (1 & 2): 9 – 13.

Sabariego S, Diaz de la Guardia C, Alba F. 2000 May. The effect of meteorological factors on the daily variation of air borne fungal spores in Granada (southern Spain), *Int J Biometeorol*, 44(1):1-5.

Satheesh, R., Rao, G.R. and Nair, P.K.K. 1997. An aerobiological study of fungal spores of Kodaikanal, India. *Proc. of 5th International Conference of Aerobiology* Bangalore, 1994: 13 –17.

Sharma, S.B. 1990. Aerobiological studies of the urban & rural areas of Bangalore Ph.D. Thesis Bangalore University.

Shivpuri, D.N. and Agarwal, M.K. 1969. Studies on allergic spores of Delhi, *Indian J. Allergy*, 44: 204 –213.

Shrivastva, S.K. and Shukla D.S. 1990. A volumetric investigation of airspora of Balrampur city. *Ind. J. Aerobiology*, 3 (1 & 2): 26-31.

Singh, D, B.K. Dutta and A.B. Singh 2004. Studies on seasonal and annual variations in the atmospheric pollen and fungal spores of Greater Silchar Assam, *Indian J. Aerobiol*., 17:1-11.

Singh, A.B. and Malik, P. 1992. Pollen aerobiology and allergy an integrated approach. *Indian J. Aerobiol.*, 5 (1 & 2): 1-19.

Solomon, W., Platts-Mills, T. 1998. Aerobiology and inhalant allergens. In: Middleton E Jr, Reed CE, Ellis EF,Adkinson NF Jr, Yunginger JW, Busse WW, eds. *Allergy principles and practices. 5th ed. St. Louis:Mosby*: 367-403.

Sreeramulu, T. and Ramalingam, A. 1966. A two year study of the airspora of paddy field near Visakhapattanam *Indian J. Agricult. Sci.*, 36: 111-132.

Vittal, B.P.R. and Krishnamoorthi K. 1981. Airspora of an Agricultural farm in Madras, India. *Grana,* 20: 61 – 64.

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