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MONITORING OF *CLADOSPORIUM* SPORES IN THE EXTRAMURAL AIR ENVIRONMENT OVER POTATO FIELDS

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ABSTRACT

Air monitoring over potato fields was carried out with the help of continuous volumetric Tilak air sampler for two consecutive Kharif seasons of 2002 and 2003, which gave continuous air sampling for atmospheric biopollutants. Spores of *Cladosporium* Link ex. Fr. were recorded with high concentration in the air over potato fields during both the Kharif season. Their contribution to the total airspora was recorded as 27.93% and 30.24% and the maximum monthly mean concentration as 19290/m^3 and 156562/m^3 of air during month of August in both the Kharif seasons respectively. The maximum daily mean concentration (6888/m^3 of air and 5740/m^3) was recorded on 13th September 2002 and 18th August 2003 during Kharif seasons of 2002 and 2003 respectively. The daily weather records of the parameters like temperature, relative humidity and rainfall were also maintained.

This spore type was recorded round the year in the atmosphere as it was most dominant as compared to other spore types in order of their concentration. The significance of these spores as aeroallergen is considered. The present paper deals with the relationship between incidence of *Cladosporium* spores and prevailing weather conditions.

INTRODUCTION

Potato is major vegetable and cash crop of this region of Maharashtra. It is highly productive crop. A short duration crop like potato, produces more dry mater, edible energy and edible protein per unit land and time than any other major crop such as wheat, rice and maize. Aerobiological study over potato field was carried out for first time in this region to find out the chief constituents of the airspora based on the qualitative and quantitative analysis and effect of weather parameters on the occurrence of the airborne fungi.

Spores of *Cladosporium* Link ex. Fr. are regarded as "Universal dominant". Earlier workers from India and abroad also reported this spore type as a dominant type. The allergenic nature of *Cladosporium* spores is also well known. It is one of the major components of airborne biopollutants causing atmospheric biopollution. In the present investigation, an exploration of airborne spores of *Cladosporium* was carried out over potato fields for two consecutive Kharif seasons of 2002 and 2003.

MATERIALS AND METHODS

Air monitoring was carried out by operating continuous volumetric Tilak air sampler (Tilak & Kulkarni 1970) located in the middle of the potato field with its orifice facing the west and kept at a constant height of 2.5 feet above the ground level. Potato (*Solanum tuberosum* Linn.) variety Kufri Jyoti was grown in test field at Diskal, District Satara (Maharashtra). The studies were conducted for two consecutive Kharif seasons (i.e. first season from 11th June 2002 to 26th September 2002 and second season from 15th June 2003 to 30th September 2003). The air sampling was initiated eight days prior to the sowing of the potato crop in the test field and continued for eight days after harvesting of the same crop.

The daily meteorological data of temperature, relative humidity and rainfall was maintained. The spore number, trapped in the sampler, was expressed as number of spores per cubic meter of air. For estimating the spore types, their concentration number and percentage contribution, slides were scanned. The identification of different spore types was based mainly on comparative spore morphology and spore description. The identification of spore types was based on microscopic characters.

RESULTS AND DISCUSSION

During the period of present investigation altogether 84 types of aerobiopollutants were trapped of which 77 belonged to spore type origin, while remaining 7 types belonged to 'other types' comprising of algal filaments, hyphal fragments, insect scales, pollen grains, protozoan cysts, trichomes and unidentified fungal spores. Of the various groups, spore types belonging to the Deuteromycotina (70.11% and 69.99%) contributed highest catches to the total airspora followed by Ascomycotina (15.34% and 15.62%), other types (11.49% and 11.24%), Zygomycotina (2.38% and 2.12%) and Basidiomycotina (0.68% and 1.03%) during Kharif seasons of 2002 and 2003. From the group Deuteromycotina, *Cladosporium* Link ex. Fr. spores were most dominant, which contributed (27.93% and 30.24%) to the total airspora during Kharif seasons of 2002 and 2003 respectively.

The spores of *Cladosporium* are variable in size and shape, ovoid to cylindrical and irregular, dark, subhyaline to pale brown, one or two celled or lemon shaped. The spores are regarded as 'universal dominant' and are most abundant spore type as compared to other airborne spore type in airspora. These spores were recorded with high concentration in the air over potato fields during both the Kharif seasons. The incidence of these spores was recorded separately during this investigation.

Cladosporium spore type was found to be most dominant spore type in air over potato fields. The maximum monthly mean concentration (19290/m^3 of air and 156562/m^3 of air) was recorded during month of August in both Kharif seasons, when there was a record of 22.6°C and 23.9°C average temperature, 76.9% and 72.6% relative humidity and 126 mm and 57.5 mm rainfall respectively. The minimum monthly mean concentration (110194 /m^3 of air and 52010/m^3 of air) was recorded during the month of June in both Kharif seasons, when there was a record of 25.7°C and 25.3°C average temperature, 76.3% and 76.9% relative humidity and 135.4 mm and 94.3 mm rainfall respectively.

The maximum daily mean concentration (6888/m^3 of air and 5740/m^3 of air) was recorded on 13th September 2002 and 18th August 2003 during Kharif seasons of 2002 and 2003 respectively, when

Table 1: Monthwise and seasonal variation of *Cladosporium* spores during two Kharif seasons over potato fields.

Sr. No.		Kharif Season - I				Kharif Season - II			
		June	July	Aug.	Sept.	June	July	Aug.	Sept.
1	Average monthwise percentage contribution	32.44	28.49	23.35	28.08	32.53	32.60	29.57	27.64
2	Monthly percentage contribution	17.41	29.67	30.49	22.43	11.38	30.59	34.26	23.77
3	Monthly contribution (m^3 of air)	110194	187782	192920	141960	52010	139776	156562	108612
4	Total number of spores (m^3 of air)			632856				456960	
5	Contribution to total airspora			27.93%				30.24%	

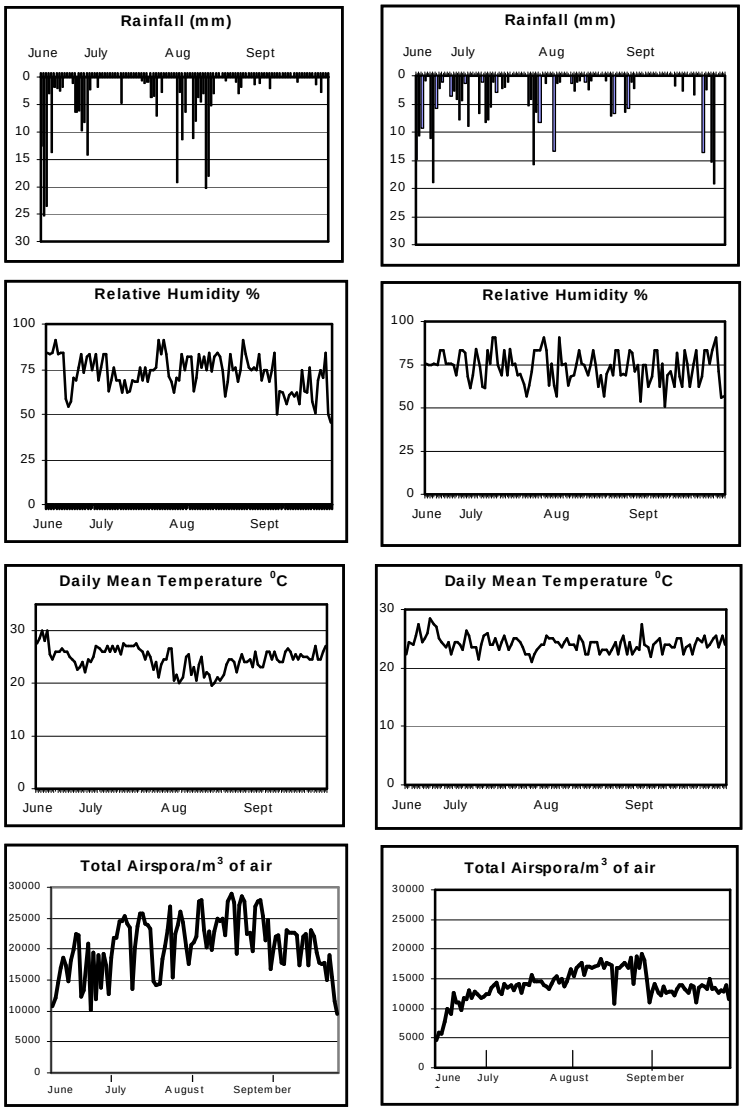

Fig.1: Day to day variation in the total concentration of airspora with meteorological parameters during Kharif season I and Kharif season II over potato fields.

there was a record of 26°C and 22.5°C average temperature, 62% and 75% relative humidity and 1.1 mm and 1.0 mm rainfall (Fig. 1, Table 1). These results are in agreement with the previous reports of Bhagwan & Pande (1985).

The high incidence of the spores of *Cladosporium* in air was due to their capability of producing the spores directly on hypha and copious fruiting ability with passive mechanism of spore liberation. However, the natural and artificial mechanical disturbances and gentle wind currents helped in

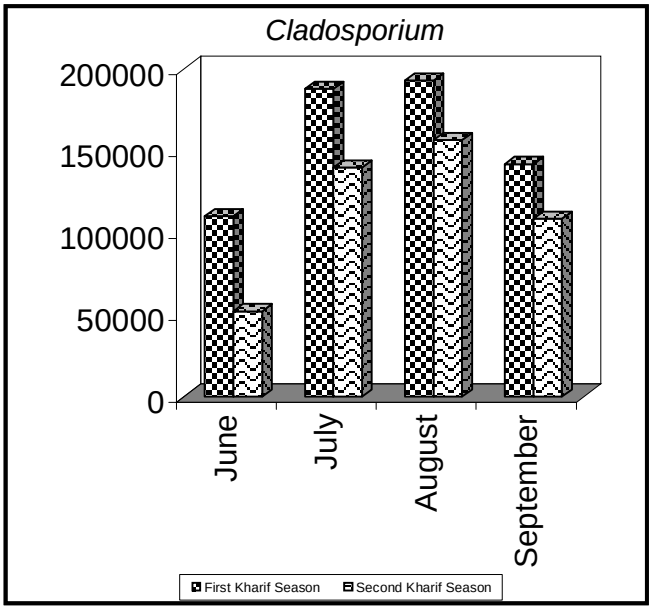

Fig. 2: Monthwise contribution of *Cladosporium* spores.

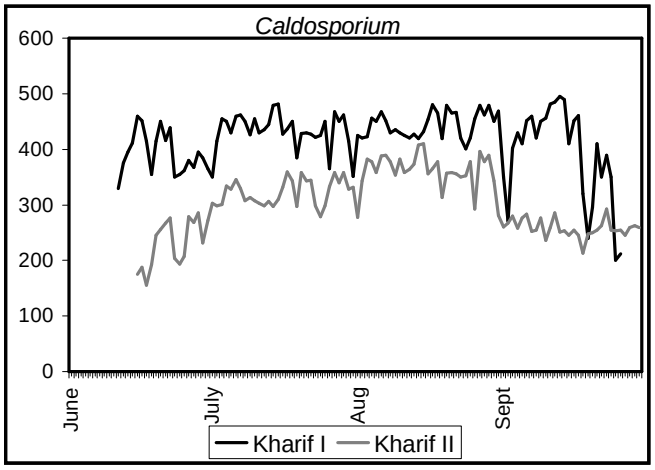

Fig. 3: Daily mean concentration of *Cladosporium* spores during two Kharif seasons over potato fields.

releasing enormous amounts of spores in the air as has been reported by Gregory (1961). High humidity and rainfall are favourable for discharge of conidia in air. Increase in the concentration of the spores was recorded during starting of rainy season, which later decreases due to 'washing off' by rain. These spores occurred continuously throughout the study period. In air, *Cladosporium* spores showed their clumps hence called "conidial units of dispersal". These spores showed considerable variation throughout the period of investigation, the average monthly percentage contribution was in month of June (17.4% and 11.4%), July (29.7% and 30.6%), August (30.5% and 34.3%) and September (22.4% and 23.7%) during Kharif seasons of 2002 and 2003 respectively.

During the period of present study it was evident that high concentration of *Cladosporium* spore type was very common in occurrence, which eventually exhibited a correlation with prevailing environmental parameters like rainfall, high humid conditions, moderate temperature, shedding of the leaves of plants in and around the trapping site, which have profound effect in increasing morphogenesis, sporogenesis, releases and dispersal in the atmosphere (Fig. 2). This is in agreement with previous reports of Rao & Mallaian (1981).

The high incidence of these spores in the air has been frequently reported in India and abroad by various workers as from Japan by Hara & Durham (1939) and Turner (1966), from Australia by Rees (1964), from New Zealand by De-meena (1935) and Dye & Vernon (1952), from Kuwait by Davies (1969), from England by Gregory & Hirst (1957), Gregory (1954), Harvey (1967) and Lacey (1962), from Canada by Pady & Kapica (1956), from Africa by Dransfield (1966) and from West Indies by Meredith (1962).

Fluctuations in the meteorological parameters mostly relative humidity and temperature indirectly affect the concentration of spore load of *Cladosporium*, which is in agreement with Gregory (1973), Meredith (1962), and Shenoi & Ramalingam (1976) (Fig. 3).

The allergenic nature of *Cladosporium* spores is also well known. Agarwal & Shivpuri (1974) recorded *Cladosporium* spores in causing respiratory allergic disorders. It is well documented by earlier workers that exposure to outdoor biopollutants increases the airway responsiveness to the aeroallergens and causes allergy. The present investigation clearly points out the prevalence of large amount of *Cladosporium* spores in the study area, which may be responsible for inducing allergenic reactions to sensitive individuals. Fungal spores were encountered more or less throughout the study period and, thus, in real sense there is no aeroallergenic fungal spore free period in the environment.

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REFERENCES

Agarwal, M. K. and Shivpuri, D.N. 1974. Fungal spores and their role in respiratory allergy. In: Advances in Pollen Spore Research. (Ed). Nair, P.K.K., Today and Tomorrows Printers and Publishers, New Delhi, pp. 78-128.

Bhagwan, K. and Pande, B.N. 1985. Airspora of blackgram field. Proc. 6th Nat. Symp., Life Science. pp. 139-145.

Davies, R.R. 1969. Spore concentration in the atmosphere at Ahmadi, a new town in Kuwait. J. Gen. Microbiol., 55: 425-432.

De-meena, M.F. 1955. A quantitative study of airborne *Cladosporium* spores. Trans. Brit. Mycol. Soc., 49: 121-132.

Dransfield, M. 1966. The fungal airspora at Samuru, Northern Nigeria. Trans. Brit. Mycol. Soc., 49: 121-132.

Dye, M.H. and Vernon, T.R. 1952. Airborne mould spores. A New Zealand Survey, New Zealand J. Sci. Tech., 34: 118-127.

Gregory, P.H. 1954. The construction and use of portable volumetric spore trap. Trans. Brit. Mycol. Soc., 37: 390-404.

Gregory, P.H. 1961. The Microbiology of the Atmosphere. Leonard Hill (Books) Limited, Interscience Publisher, Inc., New York, 1: 205.

Gregory, P.H. 1973. The Microbiology of the Atmosphere. 2nd Ed. Leonard Hill (Books) Limited, Aylesburg U.K. pp. 233.

Gregory, P.H. and Hirst, J.M. 1957. The summer airspora at Rothamsted. J. Gen. Microbiol., 17: 135-152.

Hara, H.J. and Durham, O.C. 1939. Hay fever among Japanese. Studies of atmosphere pollen in Tokyo and Kobe. Arch. Otolar., 30: 525.,

Harvey, R.C. 1967. Airspora studies at Cardiff-III. Hyphal fragments, Trans. Brit. Mycol. Soc., 54: 479-495.

Lacey, M.E. 1962. The summer airspora of two contrasting adjacent rural sites. J. Gen. Microbiol., 29: 485-501.

Meredith, D.S. 1962. Some components of airspora in Jamaican banana plantation. Ann. Appl. Biol., 50: 577-594.
Pady, S.M. and Kapica, L. 1956. Fungi in air masses over Montreal during 1950-1951. Canad. J. Bot., 34: 1-15.
Rao, P.B. and Malaiah, K.B. 1981. Airspora of a blackgram field. Proc. Nat. Conf. Env. Biol., pp. 237-242.
Rees, R.G. 1964. The airspora of Brisbane. Aust. J. Bot., 12: 185-204.
Shenoi, M.M. and Ramalingam, A. 1976. Airspora of *Sorghum* field at Mysore. J. Palynol., 12: 43-54.
Tilak, S.T. and Kulkarni, R.L. 1970. A new air sampler. Experientia, 26: 443-444.
Turner, P.D. 1966. The fungal airspora of Hong Kong as determined by the agar plate method. Tran. Brit. Mycol. Soc., 49: 255-268.