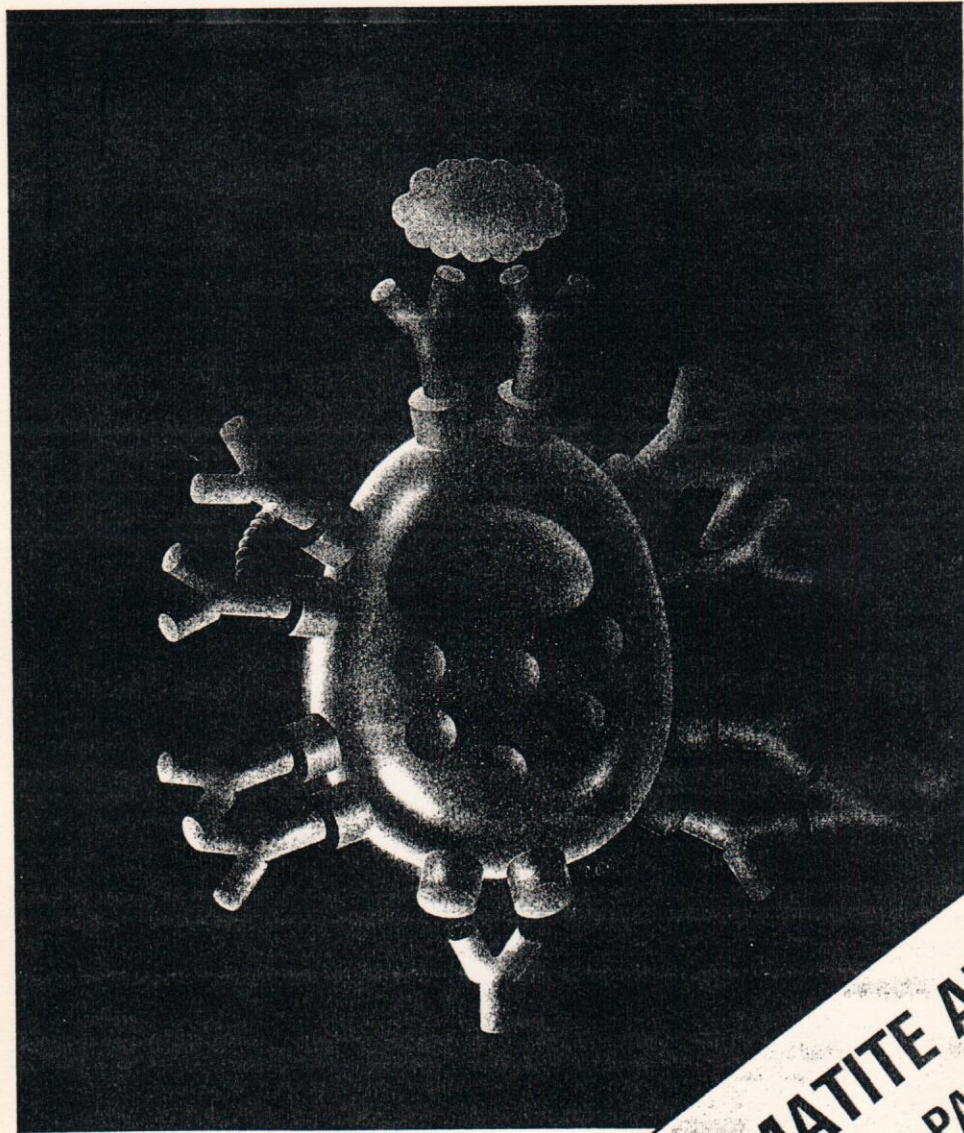


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An aerobiological survey of allergens in al khobar, saudi arabia

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Summary

A nationwide aerobiologic study is in progress in Saudi Arabia using Burkard 7-day volumetric spore traps to determine the major airborne allergens and their seasonal patterns. Eight months readings have been completed at Al-Khobar, an important coastal city on the Arabian Gulf. Pollen levels showed a double season. An autumnal peak reached its maximum in October rising sharply from the low summer values before falling during the short winter then rising again in springtime. Both local and imported flora were represented with chenopodiaceae, grasses and Ambrosia as the most common botanical groups. identification of the most significant individual species is still in progress. Fungal spores also show distinctive seasonal patterns. In descending rank order from the most common genera were Cladosporium, Ustilago, Alternaria, with Chaetomium and Ulocladium as consistent but minor components. Basidiospores and Ascospores represented less than 10% of the total spore population, indicative of the dry nature of the climate. Desert dust added an important irritant to the Saudi atmosphere but a major contaminating factor to the aerobiological material being analysed.

Key words : Aerobiology, Fungal, Spores, *Ulocladium*

INTRODUCTION

The role of various fungal spores and pollen grains as etiologic factors in the elicitation of various allergic manifestation, particularly asthma and rhinitis has been fully established (1). However, these aeroallergens vary in their concentration from place to place and region to region depending upon environmental factors, availability of sources, etc. These aeroallergens also vary in their qualitative composition. Air spora in New Orleans (2) and Auckland (3) have a damp air constituents consisting of basidiospores and ascospores. Basidiospores and ascospores are now known to be cause of some respiratory allergic problems (4,5). A vast majority of the species of the above two classes of fungi still remain to be investigated as potential allergens.

In contrast, members of another class of fungi Deuteromycetes, which mainly consists of dry air constituents, commonly termed as moulds, are dominant in some parts of the world (6,7). The genera of this class are most widely recognized as potential allergens (8).

In the past no comprehensive attempt was made in any part of Saudi Arabia to investigate the environmental cause (s) of respiratory problem, primarily bronchial asthma, despite the clinical evidence of a high number of such diseases. However, an attempt was made to study indoor allergens in the eastern province of Saudi Arabia (9) using a non-volumetric

culture plate method. Variation in techniques in the evaluation of aeroallergens is another factor which affect both concentration level and qualitative identity. Volumetric visual methods tend to provide a picture of all airborne propagules. Therefore, the culture plate technique has a limited capability in the determination of all environmental factors associated with asthma and allergic rhinitis.

The present study is part of a comprehensive allergological research programme being undertaken in various cities of the Kingdom. Aerobiological studies are being conducted for both outdoor and indoor allergens employing both "volumetric visual" and "viable" techniques. The study presents only a part of the information as prevalence and clinical studies are still in progress.

Aerobiological aspects of this study in the Riyadh region have just been completed (10, 11, 12).

METHODS

A Burkard volumetric 7-day recording spore trap was operated on the flat roof of a clinical building, King Fahad University Hospital, Al-Khobar, about 10 meters above ground level (a.g.l) since July 1987. A detailed description of the technique has already been presented (see 10 & 11).

The site is surrounded by residential blocks. The planting and irrigation is common in the area. An airflow rate of 101/min was maintained. Drums were changed weekly and sent back to central aerobiology laboratory at King Faisal Specialist Hospital and Research Centre, Riyadh, for analyses. Because of the heat in the region, which reaches a maximum of 50° C in summer months, a paraffin and 10% mineral oil adhesive was used. The adhesive was found to be slightly more heat tolerant than paraffin-toluene mix-

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ture and compatible with gelvatolphenol mountants. Basic fuschin was incorporated in the mountants, which stains pollen grains for easy identification. Fungal spores remain unstained. Spores were counted in 60 fields/24 hr. period beginning at 0100 hr. Pollen grains, because of low percentage, were counted on a longitudinal traverse. Spores and pollens were converted to cubic meter of air by a formula.

$$\text{Concentration propogules m}^{-3} = \frac{N_T \times A_E}{n \times a \times V_a}$$

Where NT = total number of spores counted in "n" areas (=x)

n = number of field areas counted (= 5 field area)

a = field area, mm² (= 0.15205 mm²)

Va = air volume sampled, m³ (= 0.6 m³)

A_E = total effective area mm² (i.e. long axis of orifice x distance tape moves in 1 hour (= 14 x 2 = 28 mm²))

Appropriate changes were made to accomodate field areas counted for pollen grains. Each alternate hour's counts were added to calculate daily, weekly, monthly mean and based on the above equation, converted to spores/m³. Maximum of peak hourly concentrations of various spores/m³ of air were determined. Percentage of individual type were calculated against the total spores counted.

RESULTS

The result analysed for the first 8 month period revealed the presence of a variety of fungal spores and pollen grains, of both allergenic and without known aller-

genicity, in the atmosphere of Dammam region. Fungal spores present were classified into 27 generic and morphological categories. Amongst them *Cladosporium*, smuts, *Alternaria*, *Ulocladium*, *Chaetomium* constituted the major proportion and became the most prevalent spore types, being presented in. The others constituted less percentage with a few showing sporadic appearance. The names of these minor components are presented in Tables 1 & 2.

Aspergillus and *Penicillium* spores, best detected by viable method, were invisible by high dust deposit on the slide. During the period of low dust deposit they were noted to be present.

Some spores were damaged and broken and therefore presented little diagnostic characteristics to be identified. Hence such spores were grouped together as unidentified and damaged spores.

Pollen grains belonging to 14 different families were recorded pollen from chenopodiaceae, gramineae (grasses), as well as *Ambrosia* were the most common. Identification of common genera and species are still in progress.

Seasonal periodicities for both fungal and pollen grains for 7-8 month period are presented in Fig. 1. Diurnal periodicities with maximum concentration level, at any given time are being analysed.

DISCUSSION

The study, yet to be completed, revealed a number of allergenic species of fungal spores and pollen grains

Table 1. A list of most prevalent airborne fungal genera in Dammam region : data from Burkard spore trap, June-December 1987

	Jun (%)	Jul (%)	Aug (%)	Sep (%)	Oct (%)	Nov (%)	Dec (%)
Cladosporium SPP	18.8	35.3	18.6	31.6	46.2	65.6	53.6
Smuts spores	34.3	32.2	38.0	31.9	17.0	9.1	11.6
Ulocladium SPP	0.2	1.0	0.9	0.4	0.2	0.9	0.9
Chaetomium SPP	0	0.5	1.1	0.4	1.0	0.6	0.4
Alternaria SPP	7.0	2.6	4.5	6.6	2.6	1.9	4.1
Damaged and unknown spores	25.4	21.5	27.2	15.8	18.8	9.6	18.0
Minor constituents	14.3	6.9	9.7	13.3	14.2	12.3	11.4
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 2. Minor components and/or sporadic occurrence of airborne fungal spores in the air of Dammam region, June-December 1987

Conidia	Ascospores	Basidiospores	Others
<i>Aspergillus penicillium</i> SPP	<i>Leptosphaeria</i> SPP	Basidiospores (coloured)	Hyphal fragments
<i>Drechslera</i> SPP	<i>Leptosphaerulina</i> SP	<i>Ganoderma</i> SP	
<i>Helminthosporium</i> SPP	<i>Sporormiella</i> SP		
<i>Nigrospora</i> SPP	<i>Pleospora</i> SP		
<i>Curvularia</i> SPP	<i>Chaetomium</i> SP		
<i>Periconia</i> SPP	<i>Venturia</i> SPP		
<i>Spagazzana sundara</i>	Non-septate ascospores		
<i>Torula</i> SP	Septate ascospores		
<i>Asperisporium</i> SP			
<i>Pithomyces chartarum</i>			
<i>Polythniscium trifolli</i>			

SEASONAL DISTRIBUTION OF FUNGAL SPORES

ALKHOBAR (JUNE to DECEMBER 1987)

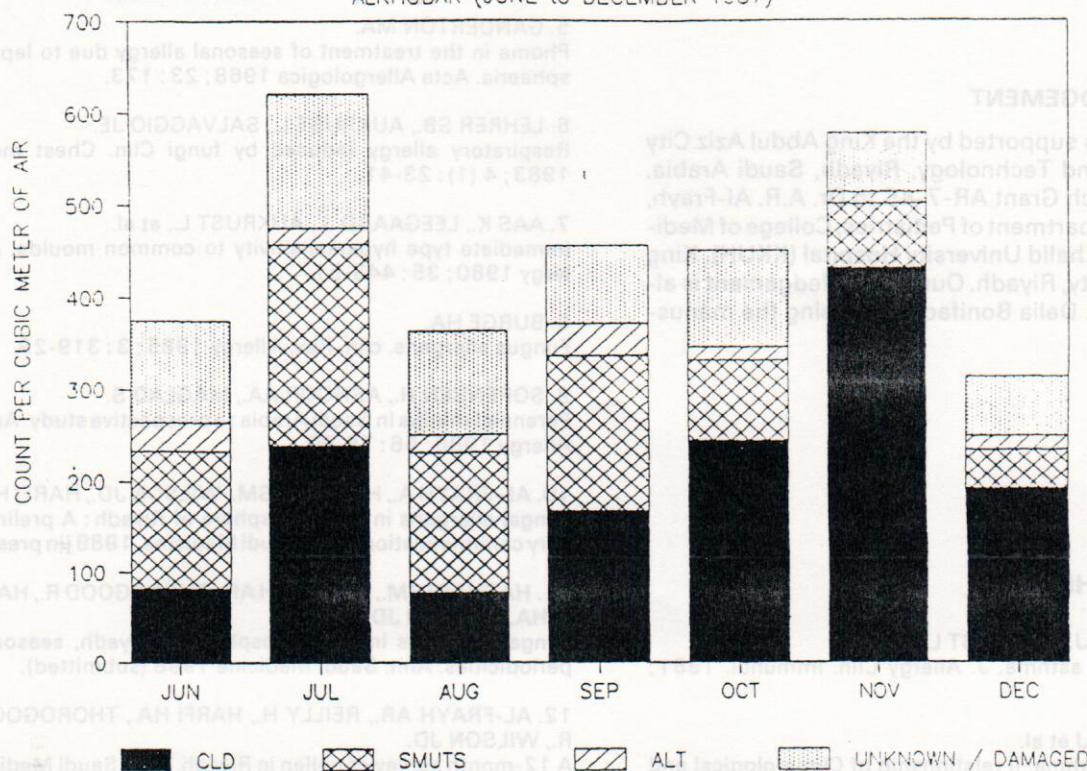


Figure 1 : Seasonal distribution of fungal spores Alkhobar (june to december 1987)

in Damma area. It can be noted that the known allergenic genera constituted higher percentage than those whose allergenicity are either obscured or not known. Though to establish a relationship between these genera and the onset of symptoms will take some time, yet the presence of such aeroallergens are indicative of their potentiality to sensitized individuals if exposed to massive concentration, or to elicit symptoms, in sensitized individuals exposed to even lesser concentration.

Seasonal appearance of these aeroallergens may help to select relevant species on the basis of their concentration level, for skin or other *in vivo* testing. Generally, ground level is considered to be more contaminated than the roof level, therefore it can be expected that allergens at respiratory (nose) level could be higher than evaluated at 10 m a.g.l.

Presence of dry-nature fungi is in agreement with similar surveys in temperate region. Davis (13) used almost a similar method (Hirst spore trap) in Kuwait and identified *Cladosporium* and smuts as 2 major spores in Kuwait atmosphere. *Cladosporium* alone constituted 60% of the total spores which is very closely comparable with our data where *Cladosporium* constituted 65.5% of the total air spora in November 1987 (53.6% in December). Similarly, smuts spores

constituted up to 38% in August 1987 (34.3% in June), were the second most prevalent spore categories in Dammam area. The only available indoor allergen study in the eastern province (see 9) using culture plate method also documented *Cladosporium* and *alternaria*, two prevalent allergenic genera. The limitation of culture plate technique did not reveal smuts spores as they require hosts such as wheat and barley to grow on.

Dammam, being a coastal city with higher relative humidity than Riyadh, has revealed a considerable quantitative variation in aeroallergen concentration. Qualitative variations are also likely to emerge when the full year is completed. Notable differences were found in some basidiospores, *Pithomyces chartarum*, *Polythrincum trifolli* and *Spagazzenia sundara*, the latter being only identified in Dammam area.

Clinical significance of high level of some spore categories in outdoor air, specially several different species of *Cladosporium* and *Alternaria* (both genera have at least 30 different species and a further higher number of strains), as well as presence of rarely reported genus *Ulocladium* from the air, necessitate an extensive *in vivo* and *in vitro* investigation on asthmatic patients, preferably with diagnostic material prepared from local species and strains under local

conditions and climate, to confirm the importance of these allergenic spores as well as of pollen grains, in the respiratory allergic problems in the Kingdom of Saudi Arabia

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