

FUNGAL ALLERGENS IN THE ATMOSPHERE OF RIYADH: A PRELIMINARY COMMUNICATION

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ABSTRACT

أجريت دراسات حيوية لتحديد أنواع المستأرجات الفطرية المحمولة بالهواء ولقياس كميتها في الرياض باستخدام أساليب مصيدة الأبواغ الحجمية لبوكارد و صفيحة الترسيب بفعل الجاذبية. كما تم أيضاً تحليل عينات غبار المنازل بحثاً عن الأبواغ باستخدام أسلوب صفيحة التمديد. وهذا التقرير يعرض النتائج الأولية في الأشهر الستة الأولى (١ نوفمبر ١٩٨٦م - ٣٠ أبريل ١٩٨٧م) والتي أظهرت لأول مرة وجود مختلف الأنواع من أبواغ الفطريات في بيئة المملكة العربية السعودية. تراوحت نسبة الطوقيات البوغية بين ١٢.٥% و ٤٠%، والاستيلاغو (مرض فطري في الأعشاب) من ١.٦% إلى ١٢%، والالترناريا من ٤.٤% إلى ٧.٨%، ويولوكلاديم من ١% إلى ٦.٨%، والشاتوميام من ١.٤% إلى ٤.٢%. وشكلت هذه العضويات المكونات الأساسية من الأبواغ الهوائية في الرياض. كما لاحظنا وجود أبواغ (أكزما الوجه) والينوميس وشارتاروم. وكانت من بين المكونات أيضاً الرشاشيات والمكثبات والمستخفيات، والاستمفيليام والأبواغ الدودية والدرستلر، والبليوسورا غير أنها كانت بنسب طفيفة. كما لاحظنا أيضاً وجود الأبواغ القاعدية والأبواغ القريبية. كانت مستعمرات الريزوبس هي الأكثر شيوعاً في مستنبت غبار المنزل.

Aerobiological studies to identify and quantify airborne fungal allergens in Riyadh, Saudi Arabia, were conducted using Burkard volumetric spore trap and gravity-settle plate techniques. House dust samples were also analyzed for spores by dilution plate technique. This communication reports the preliminary 6-month results (1 November 1986-30 April 1987) which revealed for the first time the presence of various types of fungal spores in the environment of Saudi Arabia. *Cladosporium* spp. ranged from 12.5% to 40%, *Ustilago* (smuts) from 1.6% to 12%, *Alternaria* spp., 4.4% to 7.8%, *Ulocladium* spp., 1% to 6.8%, and *Chaetomium* spp., 1.4% to 4.2%. These organisms constituted the major components of Riyadh air spora. "Facial eczema" spores, *Pithomyces chartarum*, were also present. *Aspergillus-Penicillium*, *Torula*, *Stemphylium*, *Helminthosporium*, *Drechslera*, and *Pleospora* were among the minor components. Basidiospores and ascospores were also recorded. *Rhizopus* colonies were the most common in house dust culture.

MeSH KEYWORDS: Allergens

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ALLERGY TO INHALED MATERIAL, such as pollen, chemicals, animal danders, and fungal spores, can provoke bronchospasm in sensitized subjects and significantly influence the prevalence of asthma in selected communities. The prevalence of asthma varies from country to country and ranges from 1.1% to 9.9% in adults, while the prevalence of childhood asthma with wheeze and/or wheezy bronchitis ranges from 9.9% to 33%.¹ Since no statistics of such allergic populations have yet been reported for Saudi Arabia, no comparison of the incidence with other countries is possible at this stage. However, perennial rhinitis with nasal obstruction, sneezing, and watery discharge is common in the Kingdom,² and clinical experience upholds that bronchial asthma is common as well. A formal survey of the prevalence of bronchial asthma is currently being conducted among school children in the Jeddah, Dammam, and Riyadh areas.

Climatic factors may influence the overall levels of airborne microorganisms causing such diseases. Humid climates offer more opportunities for growth of various groups, especially dust mites and fungi. Coastal areas such as Jeddah and Al-Khobar have high humidity compared to Riyadh, and conservatively, a general variation in the prevalence of extrinsic asthma may be hinted. Nevertheless, irrigation and other horticultural techniques in the region of Riyadh provide sufficient moisture for conidial activities in the outdoor environment. Airborne spores of saprophytic microfungi, mainly constituting dry-air spora and having widely distributed genera of aeroallergens such as *Alternaria* and *Cladosporium*, also originate from indoor sources.

While skin testing may help identify these inhaled allergens, details of the range of potential allergens present in any environment under study provide essential background information so the relevant skin test range can be selected. The purpose of this preliminary communication is to assist physicians working in the field of respiratory diseases by identifying these potential local allergens. Although data are far from complete, the total absence of records of fungal spores in the Riyadh atmosphere has prompted release of this preliminary communication to assist clinicians interested in allergy and respiratory diseases in their selection of fungal species for skin testing.

The identification of some species rarely reported from milder climates emphasizes the importance of intense local studies in this area.

Methods

Three methods were used for detecting and isolating fungal spores: (1) Burkard volumetric spore trap sampling; (2) gravity-settle (culture) plate technique; and (3) dust culture by dilution plate and direct culture method.

Burkard Volumetric Spore Trap

A Burkard volumetric 7-day spore trap was mounted approximately 15 m above the ground on the roof of the King Faisal Specialist Hospital and Research Centre in Riyadh. Air at a speed of 10 L/min was drawn through the 2 × 14-mm orifice onto adhesive-coated, transparent tape. The clockwise mechanism of the trap moves 2 mm/h and gives a 48-mm band deposit of airborne particles over a 24-hour period. Each 24-hour segment was mounted onto a glass slide. Identification and counting were undertaken with five random fields for each alternate hour, i.e., a total of 60 fields for each 24-hour period were scanned at a magnification of 600 with field area = 0.152053 mm². Most identifications were conducted at a magnification of ×1500. Appropriate factors were applied to convert the spores per cubic meter of air.

Gravity-Settle Plate Technique

Four different culture media in 100-mm sterile Petri dishes were used: (1) Sabouraud dextrose agar, (2) Sabouraud dextrose agar (modified)-Emmons, (3) Czapek-Dox agar, and (4) potato dextrose agar. Each dish was exposed for 15 minutes, sealed, and incubated at room temperature for 7 days. Colonies were counted on the 6th day and identified according to generic categories and in some cases to species level. Plates were exposed at a series of sites on the grounds of King Faisal Specialist Hospital and Research Centre.

House Dust Culture

Several house dust samples obtained from the houses of allergic patients through the Pediatric Clinic at King Khalid University Hospital were analyzed for the presence of potential allergenic

fungal propagules by the culture methods described above.

Results

The range of species of fungal spores identified by the three methods is presented in Tables 1 through 3. The most frequently identified spores on the Burkard trap samples were *Cladosporium* with daily levels ranging from 12.5% to 40% of total spore counts, *Alternaria* 4.4% to 7.8%, *Ulocladium* 1.0% to 6.8%, *Chaetomium* 1.4% to 4.2%, and the *Ustilago* group 1.6% to 12%. The maximum counts at any hour showed *Cladospor-*

TABLE 1. Fungal spores observed on Burkard spore trap studies.

Organism	Frequency
Conidia	
<i>Cladosporium cladosporioides</i> *	Frequent
<i>Cladosporium herbarum</i>	Frequent
<i>Cladosporium</i> spp.	Frequent
<i>Alternaria</i> spp.*	Frequent
<i>Ulocladium</i> spp.†	Common
<i>Drechslera</i> spp.‡	Common
<i>Aspergillus-Penicillium</i> type*	Occasional
<i>Arthrini</i> sp.§	Rare
<i>Asperisporium</i> sp.§	Rare
<i>Torula</i> sp.‡	Rare
<i>Helminthosporium</i> sp.‡	Rare
<i>Pithomyces chartarum</i> §	Rare
Ascospores	
<i>Chaetomium</i> spp.†	Common
<i>Pleospora</i> sp.§	Rare
<i>Leptosphaerulina</i> sp.§	Rare
<i>Sporormiella</i> sp.§	Rare
<i>Venturia</i> sp.§	Rare
<i>Xylaria-Hypoxylon</i> type‡	Rare
Basidiospores	
<i>Ustilago</i> (smuts) spp.‡	Common
<i>Clavatia</i> sp.§	Rare
Powdery mildews§	Rare
Basidiospores (colored)	Occasional
Other ascospores (unidentified)	Occasional

*Allergenic.

†Allergenicity suspected.

‡Allergenicity obscure.

§No information on allergenicity.

ium reached 6039 spores per cubic meter, *Alternaria*, 366, *Ulocladium*, 183, and *Chaetomium*, 122.

TABLE 2. Fungi isolated in Riyadh using gravity-settle plate technique.

Genus	Frequency
<i>Alternaria</i> spp.*	Frequent
<i>Cladosporium</i> spp.*	Frequent
<i>Ulocladium</i> spp.†	Frequent
<i>Drechslera</i> spp.‡	Common
<i>Penicillium</i> spp.*	Common
<i>Aspergillus</i> spp.*	Occasional
<i>Phoma</i> spp.*	Rare
<i>Mycelia sterilia</i> §	Rare
Yeasts	Occasional
Unidentified colonies	Occasional

*Allergenic.

†Allergenicity suspected.

‡Allergenicity obscure.

§Includes nonsporulating basidiospores and ascospores, some allergenic.

||Frequency based on a total exposure of approximately 200 plates.

TABLE 3. Fungi cultured from samples of house dust in Riyadh.

Genus	Frequency
<i>Rhizopus</i> spp.*	Frequent
<i>Cladosporium</i> spp.*	Frequent
<i>Penicillium</i> spp.*	Common
<i>Aspergillus</i> spp.*	Common
<i>Alternaria</i> spp.*	Occasional
Yeasts	Occasional
Unidentified colonies	Occasional

*Allergenic.

Ascospores and basidiospores, which do not grow readily in vitro, were detectable only on the Burkard trap. *Rhizopus*, the most dominant species identified by culture of domestic dust from all houses sampled, was not detected at all with the two techniques that sampled external air only.

Discussion

Although this study is not the first report on

potentially allergenic fungi in the Kingdom, it is the first, to our knowledge, to examine the Riyadh environment, to compare both indoor and outdoor fungi, and to present data observed with both Burkard volumetric air sampling and gravity-settle plate techniques.

Sorensen et al² reported on indoor fungi from Al-Khobar. Their distribution of species was different from the present study for *Aspergillus*, *Cephalosporium*, *Helminthosporium*, and *Mucor*. However, *Alternaria* and *Cladosporium* emerged as the most common species. In contrast to the Riyadh experience, only rarely detected was *Rhizopus*. One major environmental influence which probably contributes to these differences is humidity, which is high in Al-Khobar, low in Riyadh. This group did not examine external air, but Davies³ ran an older version of a volumetric spore trap in Ahmadi, a new town in Kuwait, for 6 months. He identified *Cladosporium* as the most common spore reaching a maximum level equivalent to 66% of total spores present in the air. *Ustilago*, *Alternaria*, *Helminthosporium*, and general categories of ascospores and basidiospores were also detected. For some species identified, it appears that local irrigation practices may have a profound impact on the levels of such spores.

Of agricultural rather than medical interest is the high level of *Ustilago*, the smuts, which bring

diseases and economic damage to most cereal crops including wheats. Occasionally, spores of *Pithomyces chartarum* were also seen. This organism in other damp climates produces facial eczema, a debilitating disease of sheep.

This is the first in a series which will detail allergens in the external and internal environment of Riyadh, Jeddah, and Dammam. The clinical correlation showing frequency of skin reactivity and the frequency of these airborne fungal spores will be determined during the next phase of the study. Based on spore levels in the atmosphere, skin reactions, and onset of allergic symptoms, a conclusion may be drawn in regard to the importance of these fungi.

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