

Short communication

Gravimetric survey of airborne fungal spores in Milan

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Abstract

Knowledge of airborne viable particles is basic to every study of respiratory allergies and an understanding of airborne fungal spores is particularly useful because they are harder to detect than other inhalant allergens such as pollens, which can be predicted seasonally. The gravimetric method is the simplest way to search for fungal spores.

Keywords: Allergy; Fungal spores; Gravimetric method

1. Introduction

Exposure of a silicon-coated slide is the simplest way to identify airborne fungal spores (Frey and Duric, 1961 p. 295). In different atmospheric conditions gravitating spores fall and stick to the slide. The spores can then be stained and identified under the microscope. This short communication reports the results of a daily survey with the gravimetric method carried out from January to December 1991 in the South of Milan.

2. Materials and methods

A glass slide (26 × 76 mm) coated with Silicon DC 200 (Merck) was placed on a terrace 12 m above ground level, at midday, when the weather is warmest and the frequency of airborne fungi highest. This was done on 5 days per week throughout 1991, except in August when samples were only taken on 5 days (26–

30/8). After 24 h, the slide is covered with Gelatin-bios (Biolife code 1515) and coloured with Saurefuchsin (Merck art. 7629). Spores are counted under a microscope (power 40/0.65 and 160/0.17) in four strips 48 mm long (2 cm² of slide surface). The real number of

Table 1
Slide counts of airborne spores per 2 cm²

Months	Total spore count	Temperature (°C)	Relative humidity (%)
January	610	1+	88
February	467	2	76
March	1357	11	96
April	2301	13	87
May	2032	17	75
June	3816	21	65
July	2447	27	59
August	1408	23	76
September	10 838	22	87
October	5092	14	96
November	2272	9	90
December	429	2	100
Total	33 069		

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Table 2
Airborne fungal spores by gravimetric method in Milan (1991)

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
<i>Cladosporium</i> : 61%												
347	207	829	334	793	2712	1929	925	7877	2787	901	208	19 849
<i>Alternaria</i> : 7.3%												
19	22	53	56	22	77	198	150	943	786	74	34	2434
<i>Epicoccum</i> : 7.1%												
21	7	40	16	21	61	97	140	1161	626	141	27	2358
<i>Monilia</i> : 5.4%												
63	85	76	1187	44	103	35	37	83	74	66	60	1913
<i>Torula</i> : 3.4%												
42	105	89	232	231	96	31	28	30	107	91	65	1147
<i>Fusarium</i> : 2%												
10	2	18	12	131	102	13	7	148	100	137	4	684
<i>Geotrichum</i> : 2%												
—	—	—	79	—	—	—	—	—	—	624	—	703
<i>Mucor</i> : 1.9%												
—	—	—	96	512	49	1	—	—	8	—	—	666
<i>Candida</i> : 1.5%												
6	7	27	63	29	24	—	12	225	58	21	—	472
<i>Ustilago</i> : 1.5%												
—	—	4	29	59	48	5	3	55	314	16	—	533
<i>Drechslera</i> : 1.3%												
6	5	21	18	35	68	43	18	99	82	29	8	432
<i>Rhizopus</i> : 0.9%												
2	—	1	9	—	147	31	—	33	61	21	5	310
<i>Penicillium</i> : 0.7%												
53	4	2	5	10	7	—	—	—	8	12	—	101
<i>Microascus</i> : 0.3%												
1	—	94	13	17	—	—	—	—	4	—	—	129
<i>Stemphylium</i> : 0.3%												
—	—	3	—	75	6	1	5	14	—	—	—	104
<i>Neurospora</i> : 0.2%												
—	4	—	8	—	38	38	—	—	—	—	—	88
<i>Stachybotrys</i> : 0.2%												
31	—	—	5	—	—	2	1	42	—	—	—	81
<i>Tilletiopsis</i> : 0.2%												
—	—	—	—	—	—	—	—	33	—	37	—	70
<i>Filobasidium</i> : 0.19%												
—	—	—	—	—	—	—	64	—	—	—	—	64
<i>Trichophyton</i> : 0.2%												
—	—	6	1	5	2	1	28	8	—	—	4	55
<i>Nigrospora</i> : 0.4%												
2	5	5	11	1	7	3	3	83	8	4	4	136
<i>Micogone</i> : 0.14%												
—	—	—	49	—	—	—	—	—	—	—	—	49
<i>Melanconium</i> : 0.14%												
—	—	—	—	—	48	—	—	—	—	—	—	48
<i>Cephalosporium</i> : 0.14%												
1	1	45	—	—	1	—	—	—	—	—	—	48
<i>Rhodotorula</i> : 0.12%												
—	—	—	—	—	40	—	—	—	—	—	—	40
<i>Petriella</i> : 0.11%												
—	—	5	—	—	33	—	—	—	—	—	—	38
<i>Aspergillus</i> : 0.10%												
—	—	1	4	—	8	—	3	—	4	12	4	36

Aspidia, *Acremonium*, *Ambrosiella*, *Aphanoascus*, *Arthrinium*, *Arthroascus*, *Ascodesmis*, *Bispora*, *Botrytis*, *Capnodium*, *Chalara*, *Chaetomium*, *Coprinus*, *Dydimella*, *Eladia*, *Enthomophthora*, *Eremascus*, *Fusicladium*, *Gaeumannomyces*, *Graphium*, *Hanseniaspora*, *Haplosporella*, *Humicola*, *Monoblepharis*, *Nematospora*, *Papularia*, *Pichia*, *Phoma*, *Rhinocladiella*, *Saccharomyces*, *Scopulariopsis*, *Septonema*, *Synccephalis*, *Thamnidium*, *Trichia*, *Trichocladium*, *Trichothecium* are below 0.09%.

spores identified is the total of the spores found in 2 cm², multiplied by a 0.69 correction factor (The VPPS mod. 2000 Lanzoni S.r.l. Istr. per l'uso p.7).

3. Results

The total number of spores found on slides was 33 069 (Table 1). The spores were of filamentous and yeast-like fungi.

The filamentous fungi (Table 2) included: *Cladosporium*, with 19 849 spores, was dominant (61% of total spores in every season) from March (829 s) to September (7877 s) and October (2787 s).

Other filamentous fungi were: *Alternaria* (2434 s: 7.2%), frequent in warm climates, in the summer from July (198 s) to September (943 s) and October (786 s); *Epicoccum* (2358 s: 7.1%), increasing from July (97 s) to September (1161 s).

The following spores amounted to 2%: *Fusarium* (684 s), fungus flourishing in the temperate seasons, from May (131 s) to September (148 s) and in late autumn (137 s in November); *Geotrichum* (703 s), frequent in April and November, 79 and 624 s, respectively; *Mucor* (666 s), identified in spring (April 96 s and May 512 s); *Rhizopus* (310 s: 0.9%), frequent in June with 147 s; *Drechslera* (432 s: 1.3%), not widely formed in this area, but present all the year round, especially in autumn (99 s in September and 82 s in October); *Penicillium* (101 s: 0.3%), frequent in January (53 s).

There were also frequent yeast-fungi: *Candida* (472 s: 1.4%, 63 s in April, 225 s in September and 58 s in October) present all year round, unrelated to seasonal factors; *Monilia* (1898 s: 5.7%, in April 1187 s), as *M. sithophila* in all the samples; *Torula* (1147 s: 3.4%), present all the year round, especially in May (232 s), and October (107 s).

Among smuts, *Ustilago* (533 s: 1.6%) was present from April and May (59 s) to October (314 s).

Many spores of 39 genera, each accounting for less than 1%, were only found once or twice.

4. Discussion

The allergenic action of aerospores is limited in relation to their amount (Table 2). According to some reports, allergy to moulds amounts to 10% of all allergic reactions and is especially widespread among children as asthma and in adolescence as rhinitis (Andri et al., 1986). The low incidence of moulds in allergy cases might reflect a combination of factors such as low concentration of spores, high specificity of mould allergens (Aukrust and Borch, 1984) and wide variability among strains (D'Amato et al., 1991). This survey illustrates the utility of the gravimetric method; the difficulty of identifying tiny spores such as *Eurotiales*, or asporigene moulds (*Micelia sterilia*) and distinguishing them from dust is still a disadvantage. The great advantage is the fast and detailed identification, even for nonsporulating moulds in pure culture.

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