Quantitative and qualitative studies were made of the fungi of the air in Barcelona City. The genera *Cladosporium* and *Alternaria* formed two of the most important components of the fungus population studied during a two-year period running from January 1976 through January 1978. *Penicillium* species formed the 16.3% of the total colonies while *Aspergillus* species represented only the 2.8%. The occurrence of these genera was greatly affected by climatic conditions. An attempt was made to summarize the data of various kinds of fungi on a volumetric basis. Most of the fungi reported here have been identified as far as genera.

Une étude qualitative ainsi que quantitative a été réalisée sur la population fongique présente dans l'atmosphère de la ville de Barcelone. Les genres *Cladosporium* et *Alternaria* constituent les moisissures les plus importantes quant à leur présence parmi la population fongique étudiée durant la période de deux ans comprise entre le mois de Janvier 1976 et le mois de Janvier 1978. Le genre *Penicillium* représentait le 16.3% de la totalité des colonies isolées, tandis que le genre *Aspergillus* ne représentait que le 2.8%. La présence d'espèces de ces genres était largement influencée par les conditions climatologiques. Les données sur la présence des différents genres de moisissures ont été établies sur une base volumétrique. La plupart des moisissures identifiables l'ont été jusqu'au genre.

**Introduction**

Aerobiological investigations of pathogenic fungi, particularly of dissemination and concentration of fungus spores, are valuable in understanding the epidemiology of allergies and pulmonary diseases. Previous workers have reported studies on the fungus population of the air in Barcelona (Alemany-Vall, 1 and Frouchtman, 9), in Madrid (Canto et al., 6), in Léon (Aller et al., 2), in Cádiz (Diaz-Rubio et al., 7 and 8), and in Alcázar de San Juan (Morales et al., 12). However, it seemed desirable to undertake quantitative and qualitative studies in a more exhaustive way in order to obtain a large body of data with the purpose of establishing a mycological calendar in the various parts of Spain. This calendar could be very useful to medical doctors in their diagnostics on allergies and pulmonary diseases.

The purpose of the present work has been to correlate the fungus population of the air in Barcelona with the high degree of incidence of allergies and pulmonary diseases the year around, and to provide additional information on the fungi obtained in the two-year sampling period (1976–1978). An attempt has been made to summarize the data of the various kinds of fungi on a volumetric basis. Owing to the large number of samples that were taken and to the problems involved in culturing and subculturing, particularly of those colonies which were nonsporulating, it was not possible to identify all fungi, and in most of the work reported here they have been identified as far as genera.

**Material and Methods**

The present work was carried out over a 24-month period in Barcelona City which is located at the NW of Spain, enjoying a typically mild mediterranean climate. The number of spores of the air was estimated by the volumetric spore trap method (Bourdillon et al., 4), using a modification of the Bourdillon's apparatus in which spores entering a narrow orifice, directed into the wind, were impacted on a sterile Petri dish containing a proper sterile culture medium. This device permitted to know the volume of air passing per minute into the apparatus. The culture medium em-
Table 1. List of fungus genera most frequently found.

<table>
<thead>
<tr>
<th>Genus</th>
<th>% of total colony counts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cladosporium</td>
<td>34.6</td>
</tr>
<tr>
<td>Penicillium</td>
<td>16.3</td>
</tr>
<tr>
<td>Alternaria</td>
<td>7.1</td>
</tr>
<tr>
<td>Aureobasidium</td>
<td>6.6</td>
</tr>
<tr>
<td>Aspergillus</td>
<td>2.8</td>
</tr>
<tr>
<td>Phoma</td>
<td>1.0</td>
</tr>
<tr>
<td>Mucor</td>
<td>0.7</td>
</tr>
<tr>
<td>Arthrinium</td>
<td>0.4</td>
</tr>
<tr>
<td>Botrytis</td>
<td>0.2</td>
</tr>
<tr>
<td>Rhizopus</td>
<td>0.1</td>
</tr>
<tr>
<td>Fusarium</td>
<td>0.1</td>
</tr>
<tr>
<td>Trichoderma</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Employed was 2% malt extract agar, which proved to be quite efficient in previous experiments (Calvo et al., 5).

Three plates were exposed daily for 4 minutes each at four different sampling areas of the city: at the outskirt (A.Z.), at the University (B.Z.), at the downtown zone (C.Z.) and finally at the maritime zone (D.Z.). The flow rate was of 20 liter per minute. The plates were incubated during seven days at 27 °C. Counting and pure culture isolation of fungi were performed after a period of incubation for further identification. Those colonies which were nonsporulating after 30-day incubation period were considered as 'mycelia sterilia'.

Table 2. Monthly average concentration of spores per cubic meter at the four sampling zones.

<table>
<thead>
<tr>
<th>Month</th>
<th>A zone</th>
<th>B zone</th>
<th>C zone</th>
<th>D zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>February</td>
<td>77.9</td>
<td>115.6</td>
<td>92.5</td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>102.4</td>
<td>59.6</td>
<td>37.5</td>
<td>83.7</td>
</tr>
<tr>
<td>April</td>
<td>155.4</td>
<td>107.5</td>
<td>54.6</td>
<td>71.2</td>
</tr>
<tr>
<td>May</td>
<td>198.3</td>
<td>148.7</td>
<td>63.5</td>
<td>136.2</td>
</tr>
<tr>
<td>June</td>
<td>198.0</td>
<td>172.5</td>
<td>287.5</td>
<td>126.0</td>
</tr>
<tr>
<td>July</td>
<td>190.8</td>
<td>132.9</td>
<td>270.0</td>
<td>185.0</td>
</tr>
<tr>
<td>August</td>
<td>174.9</td>
<td>261.2</td>
<td>287.5</td>
<td>135.0</td>
</tr>
<tr>
<td>September</td>
<td>237.4</td>
<td>104.9</td>
<td>120.0</td>
<td>103.7</td>
</tr>
<tr>
<td>October</td>
<td>339.9</td>
<td>231.8</td>
<td>198.5</td>
<td>161.2</td>
</tr>
<tr>
<td>November</td>
<td>295.4</td>
<td>286.2</td>
<td>314.2</td>
<td>319.4</td>
</tr>
<tr>
<td>December</td>
<td>315.8</td>
<td>296.2</td>
<td>355.6</td>
<td>260.0</td>
</tr>
<tr>
<td>January</td>
<td>346.2</td>
<td>373.1</td>
<td>284.0</td>
<td>290.0</td>
</tr>
<tr>
<td>February</td>
<td>381.6</td>
<td>281.2</td>
<td>512.5</td>
<td>306.2</td>
</tr>
<tr>
<td>March</td>
<td>313.3</td>
<td>277.1</td>
<td>179.1</td>
<td>275.6</td>
</tr>
<tr>
<td>April</td>
<td>265.7</td>
<td>275.0</td>
<td>381.5</td>
<td>337.5</td>
</tr>
<tr>
<td>May</td>
<td>340.4</td>
<td>247.7</td>
<td>142.5</td>
<td>294.0</td>
</tr>
<tr>
<td>June</td>
<td>245.4</td>
<td>211.8</td>
<td>258.7</td>
<td>200.0</td>
</tr>
<tr>
<td>July</td>
<td>234.9</td>
<td>212.4</td>
<td>25.0</td>
<td>156.9</td>
</tr>
<tr>
<td>August</td>
<td>220.0</td>
<td>300.3</td>
<td>60.7</td>
<td>140.3</td>
</tr>
<tr>
<td>September</td>
<td>320.2</td>
<td>150.1</td>
<td>50.3</td>
<td>110.3</td>
</tr>
<tr>
<td>October</td>
<td>350.4</td>
<td>320.2</td>
<td>70.3</td>
<td>120.3</td>
</tr>
<tr>
<td>November</td>
<td>310.3</td>
<td>321.4</td>
<td>150.2</td>
<td>161.2</td>
</tr>
<tr>
<td>December</td>
<td>315.4</td>
<td>320.2</td>
<td>170.4</td>
<td>240.5</td>
</tr>
<tr>
<td>January</td>
<td>340.3</td>
<td>334.2</td>
<td>180.3</td>
<td>280.9</td>
</tr>
</tbody>
</table>

Fig. 1. Monthly average values of spore numbers per cubic meter of air at the four sampling zones: ----- = A zone; --- = B zone; - - - - = C zone; - - O - - = D zone. Abscissa: Months of the year.

Results

A total of 10,438 plates were exposed during the two-year sampling period and 202,241 colonies were identified as far as genera. The average viable spore concentration of the air in Barcelona City was about 236.2 spores per cubic meter.

Table 1 shows the list of genera most frequently encountered at the four sampling zones with indication of the percentage of the total colony counts.

Table 2 shows the monthly average concentration of spores per cubic meter in the four sampling zones.

Figures 1 and 2 show the spore number values for each zone and the total values respectively.

Figures 3 and 4 show the monthly average concentration