

AIR-BORNE FUNGI IN THE AIR OF BARCELONA (SPAIN). II. THE GENUS *ALTERNARIA*Maria A. CALVO, J. GUARRO, G. SUAREZ¹ & C. RAMÍREZ²¹ Department of Microbiology, Faculty of Pharmacy, University of Barcelona, Spain² Head of the Laboratory of Mycology, Instituto 'Jaime Ferrán' de Microbiología del Consejo Superior de Investigaciones Científicas. Joaquín Costa 32. Madrid-6, Spain

Abstract

The genus *Alternaria* Nees formed one of the more important components of the fungus population of the air at Barcelona (Spain), during a two-year study, from February 1976 through January 1978. Results were based only on studies of colonies obtained by gravity-exposed plates.

The occurrence of this genus was greatly affected by climatic conditions. In general, however, *Alternaria* appeared to prefer warmer weather.

A total of six species of *Alternaria* was identified, of which, *Alternaria alternata* (Fries) Keissler was by far the commonest, representing 71.3 % of all colonies.

Introduction

The members of the genus *Alternaria* Nees are among the most abundant and cosmopolitan air-borne fungi. The importance of the genus in human health and in plant pathology is well known. Research into epidemiology of plant diseases and human allergies such as hay fever and asthma has been carried out by numerous workers, being greatly concerned with that genus (3, 7, 14, 18, 19).

The presence of *Alternaria* species in the air of Barcelona (Spain) was studied during two year and was found to be predominant among four other important genera of fungi. An exhaustive study of the genus was therefore undertaken by the authors of the present paper.

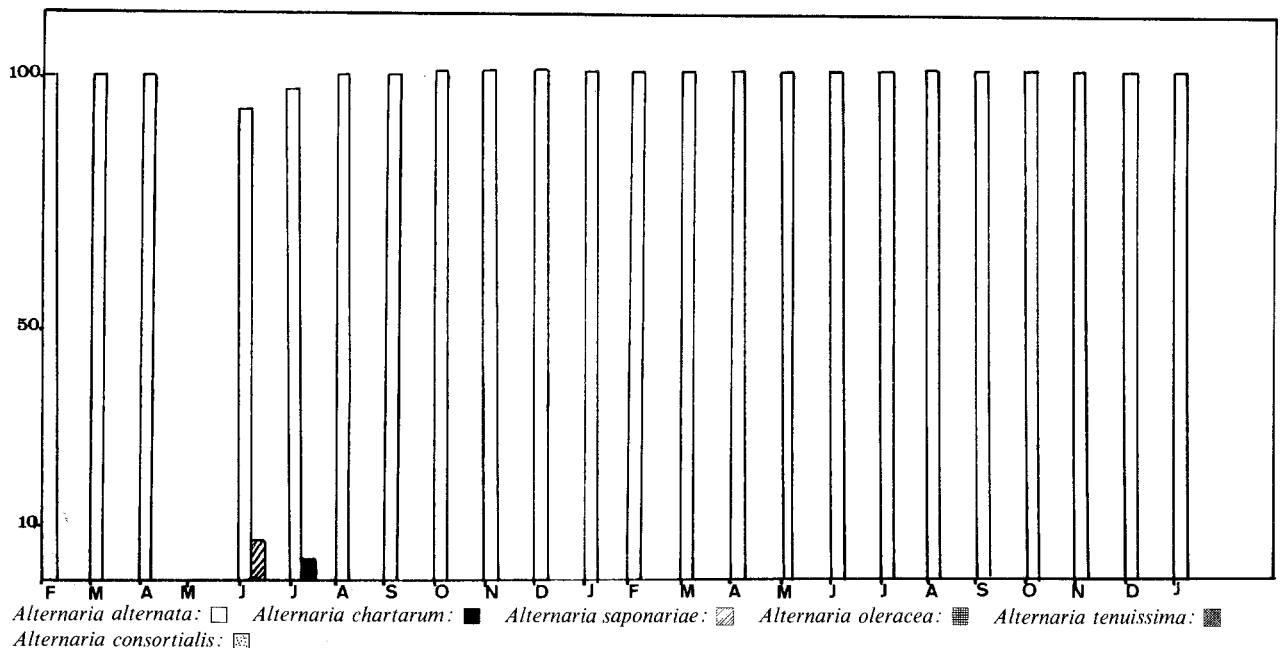


Fig. 1. Monthly percents of species of *Alternaria* collected during the morning sampling hours (8.30-9.30 AM) from February 1976 to January 1978.

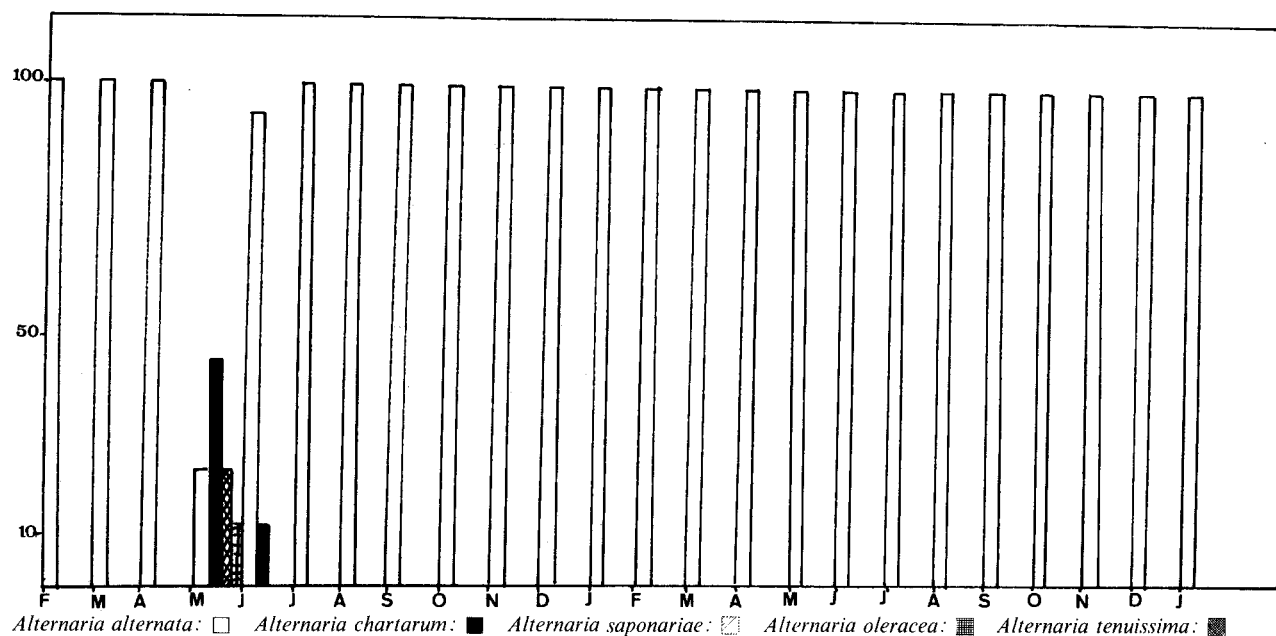


Fig. 2. Monthly percents of species of *Alternaria* collected during the mid day sampling hours (1.30–2.30 PM) from February 1976 to January 1978.

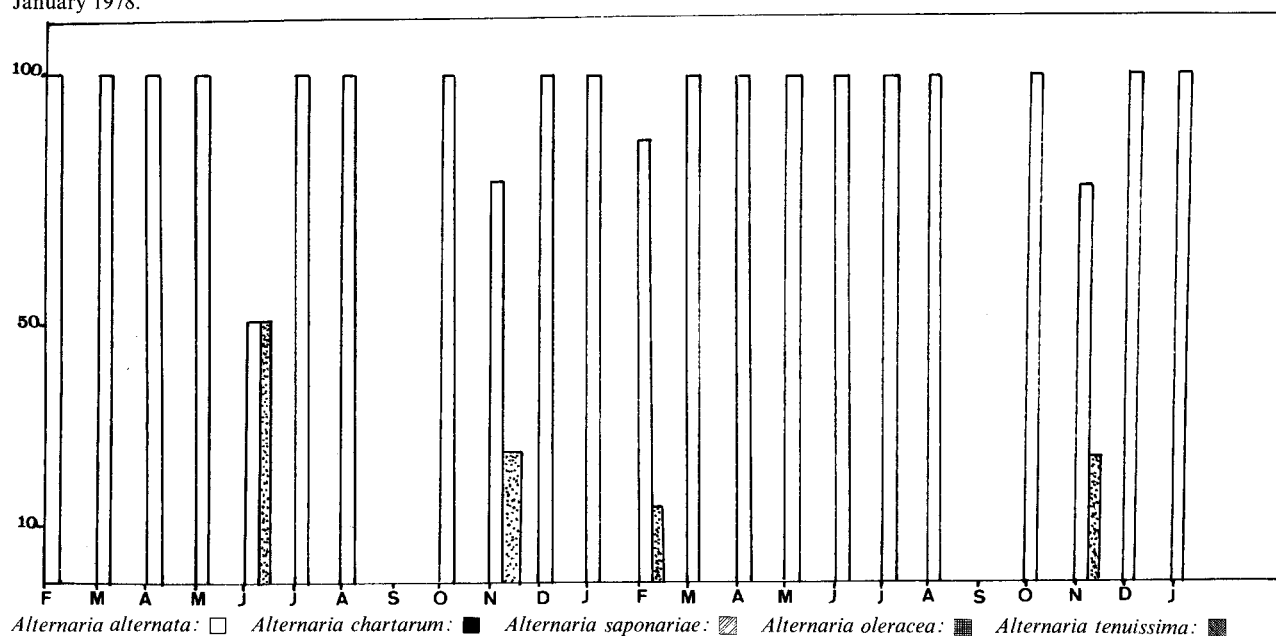


Fig. 3. Monthly percents of species of *Alternaria* collected during the evening sampling hours (10.30–11.30 PM) from February 1976 to January 1978.

Material and methods

An attempt has been made to summarize the data collected on a volumetric basis (4, 5). The culture medium used was 5% malt extract agar as described by Joly (13) in his taxonomic study of the genus *Alternaria*. Three weekly samplings were carried out, in addition to those performed for the general air-borne fungus studies (4, 5). The samples

were collected at three different intervals of the day (morning, mid day, and evening) and at four different sampling areas (at the outskirts, at the University, downtown, and at the maritime area). In order to study the occurrence of *Alternaria* species, colonies were obtained on gravity-exposed plates for 15 minutes and then incubated at 27 °C for 28 days. After that time of incubation the colonies were counted, subcultured and identified to species.

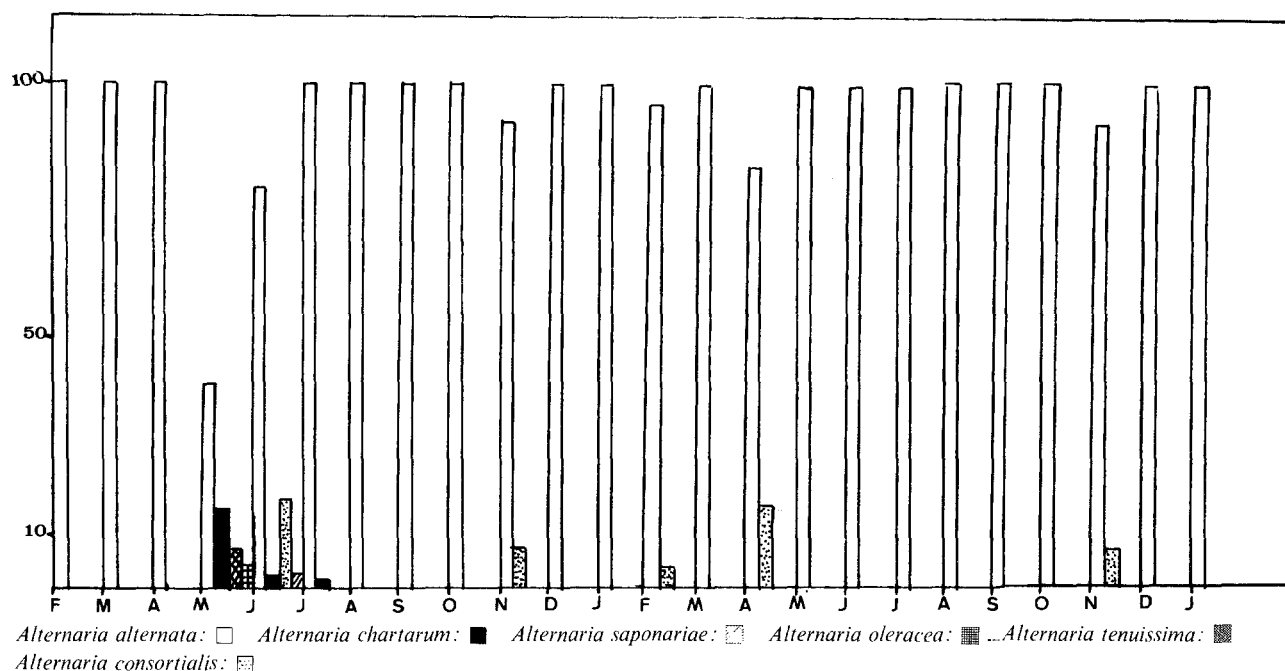


Fig. 4. Monthly percents of species of *Alternaria* collected per day from February 1976 to January 1978.

Table 1. Monthly relative percents referred to *Alternaria alternata*. (1976–1978).

Month	Sampling hour		
	8.30–9.30 AM	1.30–2.30 PM	10.30–11.30 PM
February	100.0	100.0	100.0
March	100.0	100.0	100.0
April	100.0	100.0	100.0
May	0.0	22.2	100.0
June	92.0	93.0	50.0
July	96.9	100.0	100.0
August	100.0	100.0	100.0
September	100.0	100.0	0.0
October	100.0	100.0	100.0
November	100.0	100.0	76.9
December	100.0	100.0	100.0
January	100.0	100.0	100.0
February	100.0	100.0	85.0
March	100.0	100.0	100.0
April	100.0	100.0	50.0
May	100.0	100.0	100.0
June	100.0	100.0	100.0
July	100.0	100.0	100.0
August	100.0	100.0	100.0
September	100.0	100.0	0.0
October	100.0	100.0	100.0
November	100.0	100.0	75.0
December	100.0	100.0	100.0
January	100.0	100.0	100.0

Table 2. Monthly numbers of *Alternaria* spores per cubic meter of air. (1976–1978).

Month	Sampling hour		
	8.30–9.30 AM	1.30–2.30 PM	10.30–11.30 PM
February	4.1	5.5	2.7
March	4.1	12.7	5.5
April	5.5	5.5	2.7
May	0.0	12.5	2.7
June	18.0	22.0	22.1
July	45.7	18.0	22.1
August	36.0	29.1	22.1
September	4.1	9.1	0.0
October	31.8	2.7	6.8
November	5.5	4.1	18.0
December	8.2	8.2	18.0
January	13.8	9.6	18.0
February	22.1	25.0	19.3
March	5.5	22.1	8.9
April	22.1	36.0	13.7
May	27.1	34.6	6.8
June	20.0	29.1	16.6
July	86.0	20.7	111.0
August	35.8	28.8	20.0
September	4.3	9.3	4.3
October	30.7	2.5	6.4
November	5.3	4.0	18.2
December	8.1	8.2	18.5
January	12.9	9.4	17.8

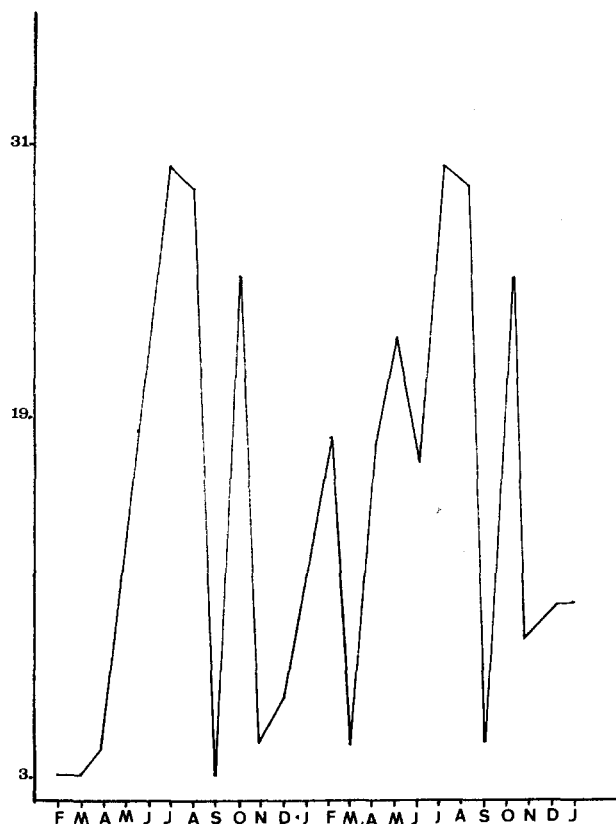


Fig. 5. Average number of spores of *Alternaria* per cubic meter of air for each month from February 1976 to January 1978 collected during the morning sampling hours.

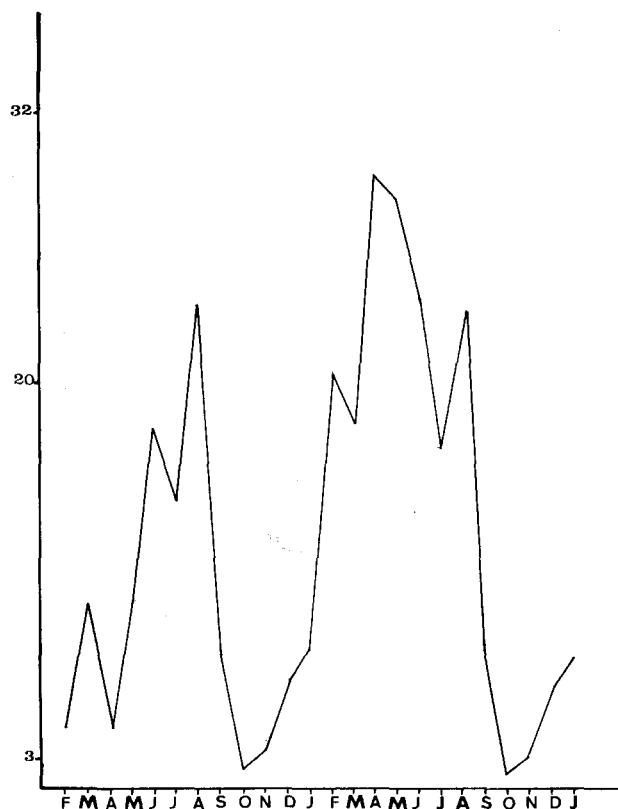


Fig. 6. Average number of spores of *Alternaria* per cubic meter of air for each month February 1976 to January 1978 collected during the mid day sampling hours.

The outstanding features for species identification are the colony diameter, the dimensions and arrangement of conidia, the number of septa and wall ornamentation of conidia, and the morphology of the conidiophore.

Results

The results of the present study are recorded in Tables 1 and 2. They show spore concentration per cubic meter of air, the hour of the day, the sampling area, and the relative values found referred to *Alternaria alternata* (Fries) Keissler, which was by far the commonest species of this genus.

The other *Alternaria* species found in the present study were the following: *Alternaria consortiale* (Thüm) Groves et Hughes, *Alternaria tenuissima* (Fries) Wiltshire, *Alternaria chartarum* Preuss, *Alternaria oleracea* Milbraith, and *Alternaria saponariae* (Peck) Neergaard. *A. consortiale* was always found at the outskirt area in the evening sampling hour (10.30 to 11.30 PM). *A. saponariae*, *A.*

tenuissima and *A. oleracea* were isolated only once. The only strain of *A. saponariae* isolated was collected at the outskirt area in the morning sampling hour (8.30 to 9.30 AM) in June 1976. The unique strains of *A. tenuissima* and *A. oleracea* isolated were found at the University area in the mid day sampling hour (1.30 to 2.30 PM). Two strains of *A. chartarum* were isolated in July 1976, one of them at the University area (1.30 to 2.30 PM) and the other one at the outskirt area (8.30 to 9.30 AM).

Figures 1 to 8 show species distribution along the day and at each sampling area.

Discussion

In determining the members of species of *Alternaria* of the air in Barcelona it soon became apparent that no spores were collected in the morning sampling hour during the month of March 1976 and in the evening sampling hour during the month of September of the same year. The

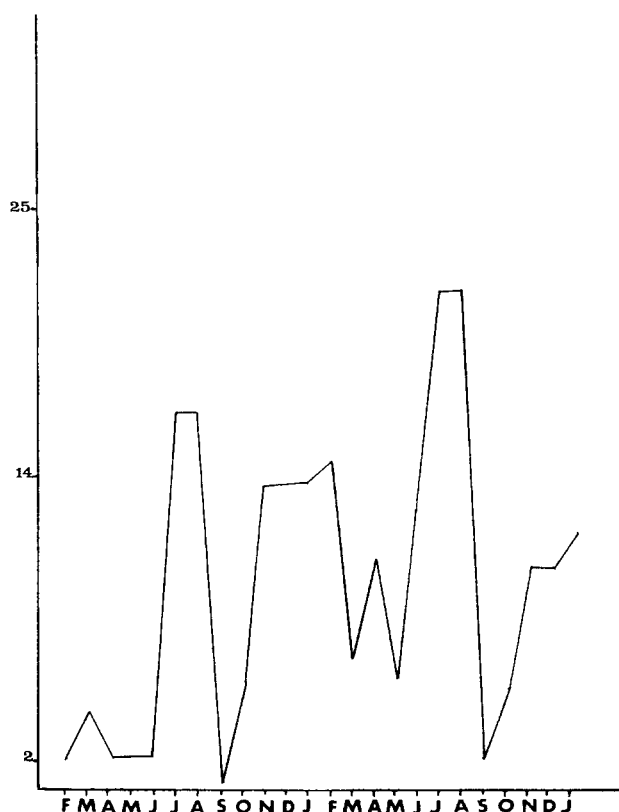


Fig. 7. Average number of spores of *Alternaria* per cubic meter of air for each month from February 1976 to January 1978 collected during the evening sampling hours.

highest peaks corresponded to the months of June and July. These data were in fairly good agreement with those reported by Hyde (12) at Cardiff and with those reported by Kramer *et al.* (15) at Manhattan, Kansas.

Alternaria alternata (Fries) Keissler was the most frequently found species in the air of Manhattan, Kansas (15), followed by *A. cucumerina* (Ell. *et* Ev.) Elliot, and *A. consortiale* (Thüm.) Groves *et* Hughes. Similarly, *Alternaria alternata* (Fries) Keissler was also the commonest species collected by us in the air of Barcelona.

The genus *Alternaria* has been reported in the air by numerous authors. It ranked fourth in number of colonies obtained among air-borne fungi at Alcazar de San Juan, (Spain) (16), third at Madrid (6) and at Cadiz (Spain) (8 and 9), forming 1.9 % of the total counts at León (Spain) (1).

World wide studies on the same subject have been performed by several authors. Feinberg and Little (10)

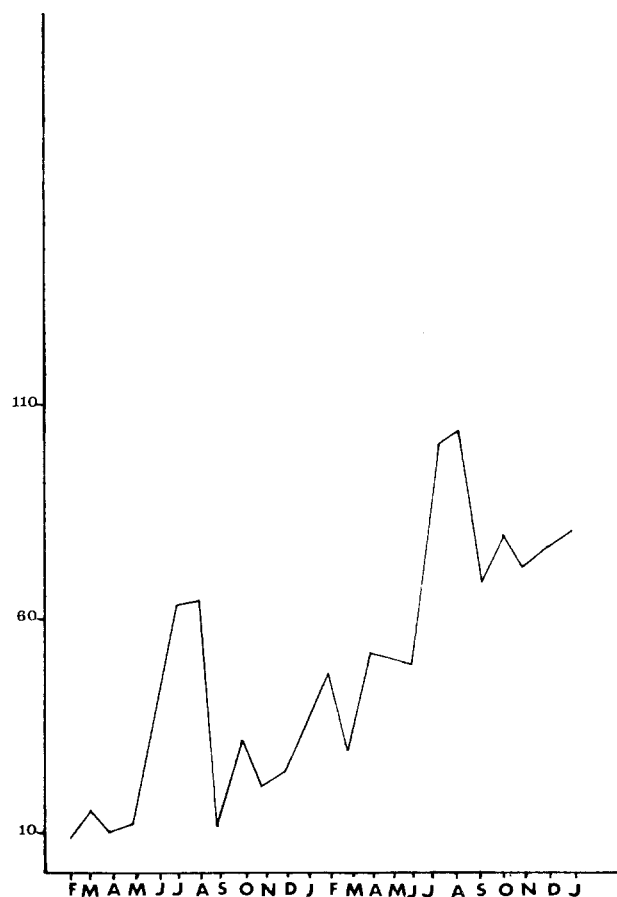


Fig. 8. Monthly average number of all spores of *Alternaria* collected per day for each month from February 1976 to January 1978.

reported the presence of the genus *Alternaria* in the air of Abilene (U.S.A.) from May to December, with the highest peaks in August and September. The highest peaks reported in Copenhagen (11) occurred in August and September, forming 2.6 % of the total colony counts. Ongulana (17) reported a high percent of *Alternaria* spores in the air of Ibadan (Nigeria).

Daily average numbers of colonies of *Alternaria* per cubic meter of air presented in Table 1 show that *Alternaria* followed a definite seasonal trend despite a great day-to-day variation. The highest numbers of colonies were obtained from June to July, with lower numbers occurring in the late winter and early spring, which indicates that *Alternaria* species prefer warmer weather. A clear discrepancy appeared when a comparison was made between our observations in Barcelona (Spain) and those obtained by Sorenson *et al.* (20), which reported the absence of *Alternaria* species at coastal areas in the U.S.A.

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