

A study on airborne allergenic pollen content of the atmosphere of Naples

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Summary

In this paper we describe the results of volumetric sampling of the airborne allergenic pollen content of the Naples atmosphere. These studies have been carried out continuously since 1 May 1979 until 31 December 1981 utilizing a Burkard volumetric spore trap.

We found that the most important allergenic pollen in Naples air is *Parietaria*, with a very long-lasting period of pollination occurring from March to November. After *Parietaria*, *Gramineae* play an allergenic role frequently in association with the pollen of *Olea*, which is the most important pollen of all the trees in this area.

In the summer/autumn seasons we observed in this area the pollination of mugwort (the unique plant of the *Compositae*) which was found to be of allergenic importance in Naples.

Introduction

Data on the presence and prevalence of allergenic airborne pollens, obtained from aerobiological studies continued for 3 years, makes it possible to draw up a pollen calendar, with the flowering period of the plants, of the area in which the sampling is carried out. The sampling and appraisal of airborne pollens is of particular interest to the clinicians to establish a chronological correlation between the concentration of pollen in the air with the symptoms of the sensitive patients.

Systemic reviews on local or regional airborne pollen counts in Europe, as determined with various methods, include those of Hamilton (1979), Hyde (1959 a,b), Davies (1969), Charpin, Surinyach and Frankland (1974), Leuschner (1974), Bagni *et al.*, (1976, 1977), Mullins *et al.*, (1977), Brown and Jackson (1978), Engström and Nilsson (1978), McDonald and O'Driscoll (1980), Spieksma *et al.*, (1980).

We have studied the seasonal variations in the air content of allergenic pollens in Naples to draw up the pollen calendar of this city.

Materials and methods

Continuous, volumetric air sampling has been carried out by making use of a Burkard 7-day recording spore trap, similar to that of Hirst (1952). The spore trap was placed on the open terrace of Cardarelli Hospital (40°, 51'N; 14°, 15'E) at about 25 m above street level. The hospital is situated on the hill of Naples, with the south-eastern side looking out over the city and bay, and bounded by a densely built-up part, and areas of grassland.

The trap was continuously operated from 1 May 1979 to 31 December 1981, at a suction rate of 10 l/min throughout the period of the investigation. The adhesive tape mounted on the drum (rotating in the trap at 2 mm/h) was changed every week, divided into seven segments 48 mm long, each corresponding to one day of sampling, and mounted on slides. The slides, with adhesive segments, were covered with fuchsin-stained glycerol jelly and with cover glasses. The daily mean concentrations of pollen grains were estimated by means of light microscopy from counts along a single narrow traverse, parallel to the direction in which the tape moved whilst in the trap. Daily counts were converted to a number/m³ of air. Counts were not corrected for variations in the efficiency of the trapping. Pollen deposited in clumps were counted as separate individuals.

The meteorological data was supplied by the Servizio Meteorologico of the Aeronautica Militare di Capodichino.

Results

The sampling and the appraisal has been extended to all airborne pollens caught by the trap (Fig. 1).

The behaviour of the most important allergenic pollens in Naples air (*Parietaria* and grasses) in the three sampling years (from 1 May 1979 to 31 December 1981) is shown in Figs 2 and 3.

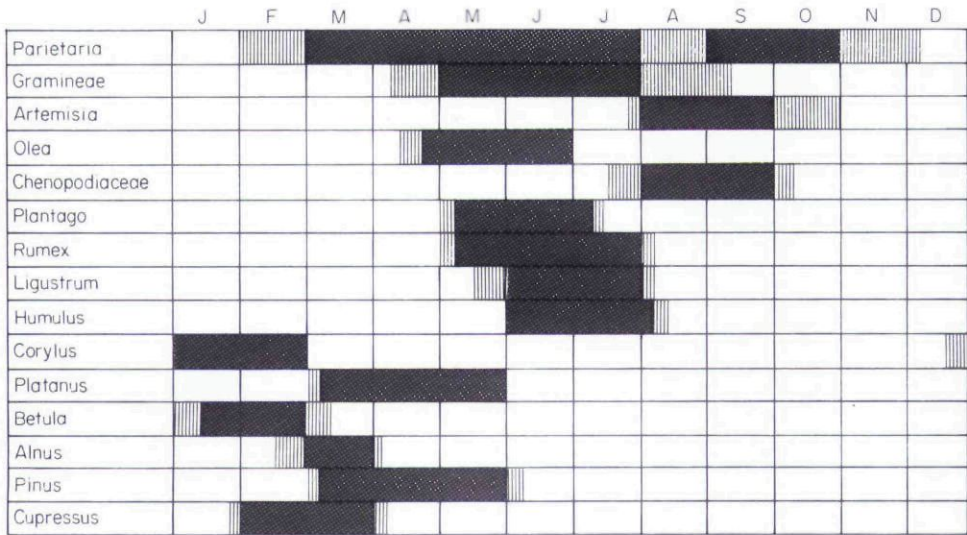


Fig. 1. Pollen calendar in Naples—■ indicates the principal pollen period and ||| the initial and terminal pollen periods.

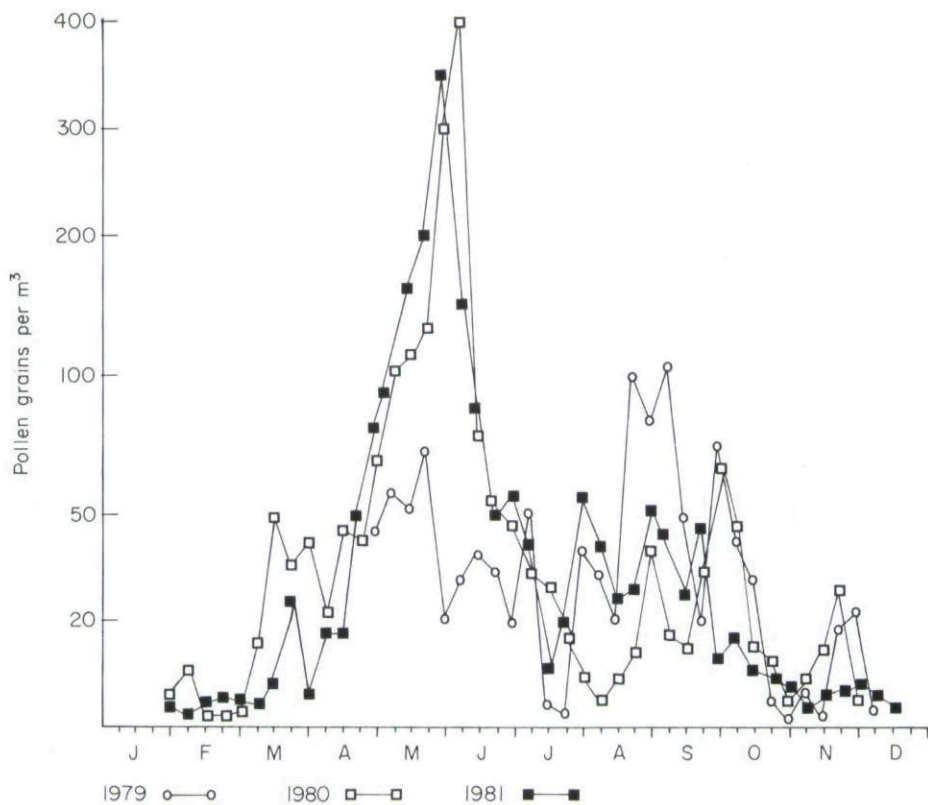


Fig. 2. Changes in atmospheric concentration of *Parietaria* pollen (weekly mean values).

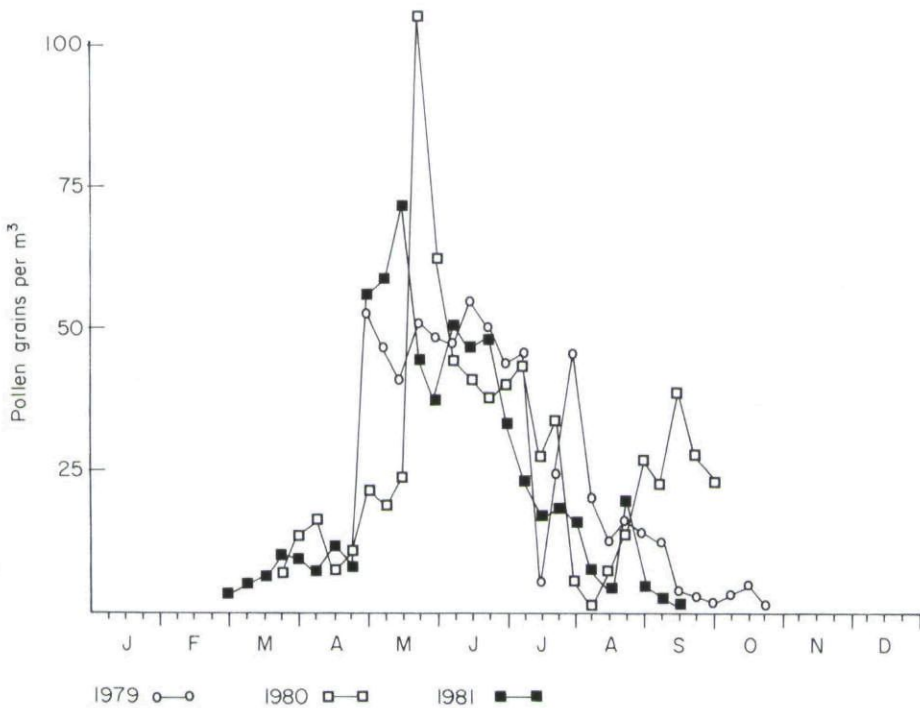


Fig. 3. Changes in atmospheric concentration of grass pollen (weekly mean values).

Parietaria (Fig. 4) has two very long cycles of flowering (Figs 1 & 2). Its pollens (Fig. 5) appear during the initial warming periods in late winter. They persist throughout the spring and summer months, often with a peak coincident with the end of May and the initial days of June (see years 1980–1981). A second, generally lower, peak is often registered during the autumn months and then diminishes slightly to disappear during the cooler months of December and January. During the year 1979 we began sampling on 1 May and we observed the peak at the end of August.

The *Graminaceae* have a shorter pollination season than *Parietaria*, occurring in Spring and Summer. Grass pollens appear in March and have a peak in May (during 1980 and 1981) or in June (during 1979). The peak atmospheric concentration of grass pollen is rarely greater than 100 grains/m³. We have registered a second, lower, peak for grass pollens at the end of July in 1979, in September 1980 and at the end of August in 1981.

Markedly lower concentrations were observed for other pollens. Among the *Compositae* only mugwort reaches concentrations higher than 50 pollen grains/m³ in the last week of August and first days of September. With respect to trees, the most important allergenic pollen is *Olea Europaea*, which reaches the city from the suburban areas that are well away from the city.

Discussion

Naples has a Mediterranean climate, characterized by the mildness of its winters, whose average monthly temperatures do not fall below 5°C (Table 1). The summer dryness is the most typical feature; average temperatures generally exceed 20°C whilst rain is scarce for almost all of June and July. The hours of sunshine are long, exceeding in total 300 monthly hours in July. Rainfall generally exceeds 1 m each year; it falls mainly in two seasons: spring, and especially autumn, separated by the dry months of June, July and early August. The winds blow from various directions (Figs 6 & 7), with a prevalence generally from the south west.

The aerobiological sampling of the pollen content of the Naples air, carried out without interruption from 1 May 1979 to 31 December 1981, led us to identify three pollen seasons: (1) a low winter season, marked by the presence of the pollens of such trees as the birch, hazel, *cupressaceae*, alder, elm and plane. These tree pollens, although produced in large amounts, are of only slight allergological interest; (2) a high spring-summer pollen season of marked allergological interest, dominated by grass pollination; and (3) a summer-autumn season, due to the pollination of herbaceous plants such as mugwort and *Chenopodium*.

A role of its own is played by *Parietaria* (Fig. 4), an *Urticaceae* that is the most important hay-fever-provoking plant in Naples and in southern Italy (Serafini, 1957; D'Amato, Cocco & Melillo, 1979). *Parietaria* grows on walls and under trees and bushes, favoured by the climate, and by the tufaceous, volcanic stones, on which the city of Naples is built.

In an atopic population of Naples city, examined by skin-prick tests, considering all allergens, perennial and seasonal, we found a frequency of sensitization to *Parietaria* of 16–84% in the paediatric age group and of 30–83% in adults (D'Amato et al., 1979) (Table 2).

Fig. 4. *Parietaria officinalis* plant.

Fig. 5. *Parietaria* pollens in different optical sections stained with basic fuchsin. The grain is spheroidal, triplicate and very small (diameter between 12 and 17 μ).



Table 1. Meteorological data recorded in Naples

	J	F	M	A	M	J	J	A	S	O	N	D
1979	94	75	156	103	263	253	394	278	232	179	109	111
1980	80	162	136	171	175	265	310	287	249	165	87	115
1981	147	122	149	209	259	271	305	272	223	176	156	95

Sunshine (h) total for each month

	J	F	M	A	M	J	J	A	S	O	N	D
1979	173	197	75	143	26	48	28	96	65	277	107	153
1980	154	21	117	52	202	16	3	111	29	262	382	171
1981	99	102	35	106	81	35	5	116	165	201	20	102

Rainfall (mm) total for each month

	J	F	M	A	M	J	J	A	S	O	N	D
1979	7.8	9.9	11.6	11.8	17.3	21.5	23.6	22.0	19.8	16.9	11.5	10.0
1980	7.5	8.9	10.1	10.9	14.8	19.5	21.6	24.0	20.8	15.8	11.9	6.7
1981	5.5	6.8	12.6	13.9	16.5	20.3	23.2	24.1	21.2	18.4	10.3	11.0

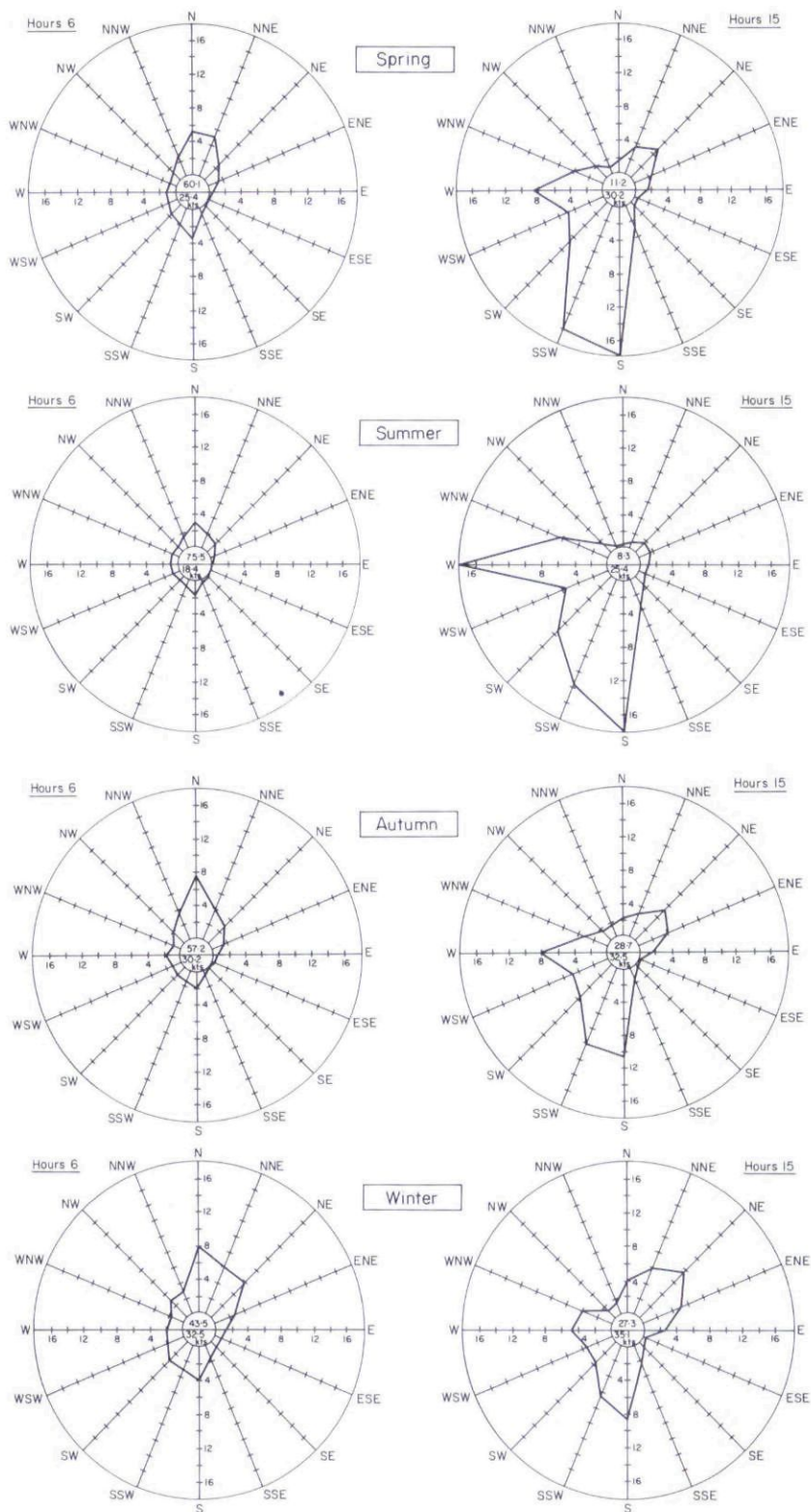
Temperature (°C). Monthly mean values from daily registrations at 06, 09, 12, 15, 18, 21, 24 h.

	J	F	M	A	M	J	J	A	S	O	N	D
1979	8.7	10.0	10.8	10.7	14.5	19.3	19.5	19.8	17.8	15.7	11.4	10.2
1980	8.6	8.4	10.3	9.8	14.1	17.7	19.1	23.0	19.8	14.6	12.9	8.1
1981	6.5	8.0	11.8	12.3	14.4	18.5	19.7	22.2	20.1	18.3	10.4	11.2

Degrees of atmospheric vapour pressure (in place of relative humidity). Mean values of each month registered daily at hours 00–0, 6–12 and 18. (The relative humidity can be considered as a ratio between the effective tension and the tension of saturation of aqueous vapour at the same temperature).

Parietaria has a pollination period spread over 10 months of the year, but especially in spring and autumn seasons (Figs 1 & 2). In 1980 and 1981 *Parietaria* pollen (Fig. 5) reached the maximal atmospheric concentrations in the spring, at the end of May and during the first 2 weeks of June (D'Amato, 1981). During 1979 we began sampling on 1 May and we observed the peak in August. This behaviour is in all probability connected with the weather conditions in July, particularly the high levels of rainfall (28 mm) with intervals of prolonged sunshine (394 h). These meteorological factors have favoured an abundant growth of the plant with the consequent increase of air content of pollens in August.

Grass pollen present in Naples air is at a lower concentration than *Parietaria* and is observed for a more limited period of time (Figs 1 & 3). The mean weekly atmospheric



Figs 6 & 7. Wind direction in Naples. Mean values in each of the four seasons in the years 1979–1981 at 06.00 and 15.00 (Greenwich Mean Time).

Table 2. Percent frequency of allergen sensitization, in two groups of skin-positive atopic patients (962 children and 1400 adults) living in Naples, all tested from January 1976 to May 1978.

Allergens	Positive skin tests		
	Age (years)		P
	3-12	13-35	
Housedust mite	90.64	60.31	<0.001
Housedust	85.80	55.40	<0.001
<i>Parietaria</i>	16.84	30.83	<0.001
Grass pollen	11.75	14.10	N.S.
<i>Olea</i>	4.82	11.62	<0.001
Mugwort	2.81	3.95	N.S.
Animal danders	13.61	15.91	N.S.
Moulds	9.98	11.03	N.S.

concentration rarely reaches 100 pollen grains/m³. The percentage frequency of grass sensitization of our atopic patients is 11.75% in children and 14.10% in adults (Table 2). Frequently, grass pollen hypersensitivity is associated, in atopic patients, with that of *Parietaria*. According to the data of Davies & Smith (1973) when the mean daily concentration of grass pollen grains in the air is 50/m³ or more, all the patients in the area who are clinically responsive to grass pollen experience symptoms. Similar responses have been observed with *Parietaria* too. Days with grass or *Parietaria* pollen counts of 50 or more may be described as 100% symptom days.

After *Parietaria* and *Gramineae* we found mugwort (*Artemisia vulgaris*) to be the third most important herbaceous allergenic pollen in Naples air. Mugwort has its pollination period from August to October (Fig. 1). Of the trees, only *Olea* is of allergenic importance in Naples, frequently associated with sensitization to grasses. *Olea Europaea* has more allergenic importance in other areas to the south of Naples such as *Calabria* and *Puglia* due to its precise climatic requirements, summer dryness and winter temperature. However, the air movement of this pollen from the suburban areas affects the pollen content of the Naples atmosphere even if its plant sources are not directly present in the environment.

Among other tree pollens, hazel (*Corylus*) and alder (*Alnus*) are recorded in very high atmospheric concentration; the first, from January to the end of February has a slight allergenic importance; the second, in February and March, has no allergenic significance.

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