

Monitoring of airborne pollen and pollen calendar of Cosenza, Southern Italy

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SUMMARY. From May 1986 to May 1989 surveys of airborne biological particles have been performed in the atmosphere of Cosenza, Italy with the aim of monitoring the presence of airborne pollen. The survey station is situated at Arcavacata of Rende, a hilly area 474 meters above sea level, 7 km north-west of the main town. The sampler (VPPS 2000) is located about 20 meters above ground level. The monitoring, performed in accordance with the criteria suggested by the Italian Association of Aerobiology (A.I.A.), enabled the identification of 26 different pollen types. The pollination graphics show: 1) a late winter period in which pollen from trees appears; 2) a spring period with a prevalence of Gramineae, Fagaceae, Oleaceae and Parietaria pollen; 3) a late spring-summer period during which Fagaceae, Pinus and Compositae pollen grains are present; 4) a late summer-autumn and winter period characterized by a drastic reduction of airborne pollen. A study of the calendar reveals, furthermore, that: 1) Gramineae pollen is, amongst those of allergological importance, the most representative; 2) Parietaria is not perennial and is present in modest concentrations; 3) Olea reaches a high peak in June, but not as high as in other southern regions; 3) pollen from arboreal plants is prevalent compared to that of herbaceous plants.

Key words: aerobiology, allergy, pollen

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INTRODUCTION

Pollinosis is the most common allergic disease and the one that has been known longest (Hyde, 1972). It is induced by the allergens of pollen grains in genetically predisposed individuals, who respond to an allergenic stimulation

with an elated synthesis of IgE, due to an alteration in their control mechanisms for the production of these antibodies (Knox, 1979).

A great deal has been learnt about pollinosis over the last few years thanks to solid and increasing contributions from studies of airborne biological particles (Solomon, 1983). The diag-

nosis and therapy of allergies that affect the respiratory tract cannot, in fact, fail to take into consideration the knowledge of the composition of the bio-atmospheric conditions of the patient's place of abode in determining the real aetiological role that the pneumoallergical components can play on the immunological sensitivity of the respiratory tract (Negrini & D'Amato, 1985).

The study of airborne biological particles for allergological purposes, carried out so intensely in our country during the last few years, has allowed us to obtain an almost complete view of the Italian airborne pollens through the compilation of pollen calendars for various areas (D'Amato, 1981). These calendars are most useful to both the allergologist who can adopt suitable therapeutic, pharmacological and immunological measures, and the pollinotic patient who can correlate his symptoms with the periods when allergenic pollen is present in the atmosphere (Kumer, 1984).

In Italy at present, the national network to monitor pollen, is managed by the Italian Association of Aerobiology (A.I.A.) which disseminates pollen information through the Italian teletext (RAI TV channel).

Our centre, together with nine others, belongs to the Apulo-Calabro-Lucana network and the data are gathered weekly by the Faculty of Allergology in Bari which, in turn, transmits the same to the Italian Association of Aerobiology in Bologna.

Considering that observations of airborne biological particles had never been conducted in Cosenza, and more generally in Calabria, we set ourselves the task of studying the pollen present in the atmospheric particulate of the city of Cosenza, recording the seasonal fluctuations and the variations correlated with atmospheric phenomena, in order to compile a calendar of airborne pollen for our zone.

Our aim was to establish the relationship between pollen in the air and respiratory allergies in Cosenza, in order to improve our possibilities in both the diagnostic and therapeutic fields.

Monitoring started in May 1986 and is still in progress.

MATERIALS AND METHODS

The calendar of airborne pollen for the area of Cosenza was obtained through daily surveys which have been performed systematically from May 1986 to May 1989, following the criteria suggested by the A.I.A.

Our survey station is situated at Arcavacata of Rende, a hilly area 7 km north west of the main town 474 meters above sea level on the western side of the Crati Valley (Latitude 39° 21' 25" north Longitude 15° 72' 48" east).

The apparatus used, a VPPS 2000 (Lanzoni), is placed about 20 m above ground level on a terrace of the Department of Ecology of the University of Calabria. The sampling surface was prepared with Melinex tape treated with a solution of silicon in carbon tetrachloride. The tape exposed to sampling was divided into 48 mm sections which were mounted on slides with melted glycerinated gelatin, containing basic fuchsin with a phenolic acid additive.

For the pollen count, performed in a statistical manner, a Zeiss microscope with a CPL-W x optical group and 25 x magnification was used. Monitoring has been systematically performed since May 1986: to each day of sampling corresponds a slide and a card, upon which are noted, for each type of pollen, the number of grains counted on about 200 microscopic fields, and the corresponding number of grains per cubic meter obtained by applying the formula: number of pollen grains by conversion factor.

RESULTS

During these sampling years 26 different species of pollen have been identified (15 arboreal and 11 herbaceous) (Hyde, 1958; Charpin, 1974; More, 1978; Ciampolini, 1981). We have divided the pollen grains identified into 3 groups, in accordance with a decidedly more allergological than botanical criteria (Tab. I):

1) pollen of considerable allergological interest

2) pollen of minor allergological interest

3) pollen encountered occasionally or of merely airborne biological interest (Macchia L. *et al.*, 1985).

Table I. Pollen identified in the atmosphere of Cosenza

1	2	3
Gramineae	Cupressaceae	Amarantaceae
<i>Parietaria</i>	Betulaceae (2)	Juglandaceae
Compositae (1)	Fagaceae (4)	Leguminosae
Oleaceae (3)	Corylaceae (5)	Platanaceae
		<i>Pinus</i>
		Euphorbiaceae
		Tiliaceae
		Umbrelliferae
		Chenopodiaceae
		Plantaginaceae

(1): *Ambrosia*, *Artemisia*, *Taraxacum*;

(2): *Alnus*, *Betula*;

(3): *Olea*, *Fraxinus*, *Ligustrum*;

(4): *Fagus*, *Quercus*, *Castanea*;

(5): *Corylus*, *Ostrya*.

To counterbalance the fluctuation of pollen concentration due to the presence of spasmodic meteorological phenomena such as wind, rain, etc., a 5-day running mean of daily pollen concentration per cubic meter of air was used. The running mean average acts in fact as a mathematical filter giving results that are less influenced by atmospheric conditions, and enables the identification of:

1) a winter/pre-spring period with a prevalence of tree pollen: Betulaceae, Alder, Cupressaceae.

2) a spring period characterised by the simultaneous blooming of Gramineae, *Parietaria*, Fagaceae, Chenopodiaceae, Ericaceae;

3) a third late spring-summer period with the presence of pollen from Oleaceae, Gramineae and Fagaceae.

A rapid progressive decrease of concentration then takes place: the lowest levels occur in August. In September-October there is a slight resumption due to the blooming of Gramineae and *Parietaria* whilst during winter there is a drastic reduction in pollen concentration (Fig. 1).

Thanks to the results obtained Gramineae pollen has to be considered as the most important from the allergological point of view, it being present in the atmosphere for quite a long period of time (March-September) and in high concentration (Fig. 2). These data agree with the results of an epidemiological investigation performed on 2300 allergopathic patients which shows Gramineae in first place with a cutaneous positivity of 36.7% (Tab. II).

In Cosenza, the pollination of *Parietaria* has similar characteristics to those encountered in the atmosphere of Bari, (Macchia *et al.*, 1985), whilst the concentration of pollen grains per cubic meter of air appears decidedly inferior to that of Naples and other coastal areas of southern Italy. In the atmosphere of Cosenza *Parietaria* is present from February to July with a slight resumption in September (Fig. 3). The epidemiological study revealed that the frequency of cutaneous positivity due to *Parietaria* is 20.7%, a value similar to that of other case histories in southern Italy, which brings this pollen in second place after the Gramineae. This noteworthy incidence of positivity with respect to the diffusion of pollen can be explained by taking into account that the case history we examined included the entire province of Cosenza, including centers on the Tyrrhenian and Ionian coasts where *Parietaria* is widely represented (Tab. III).

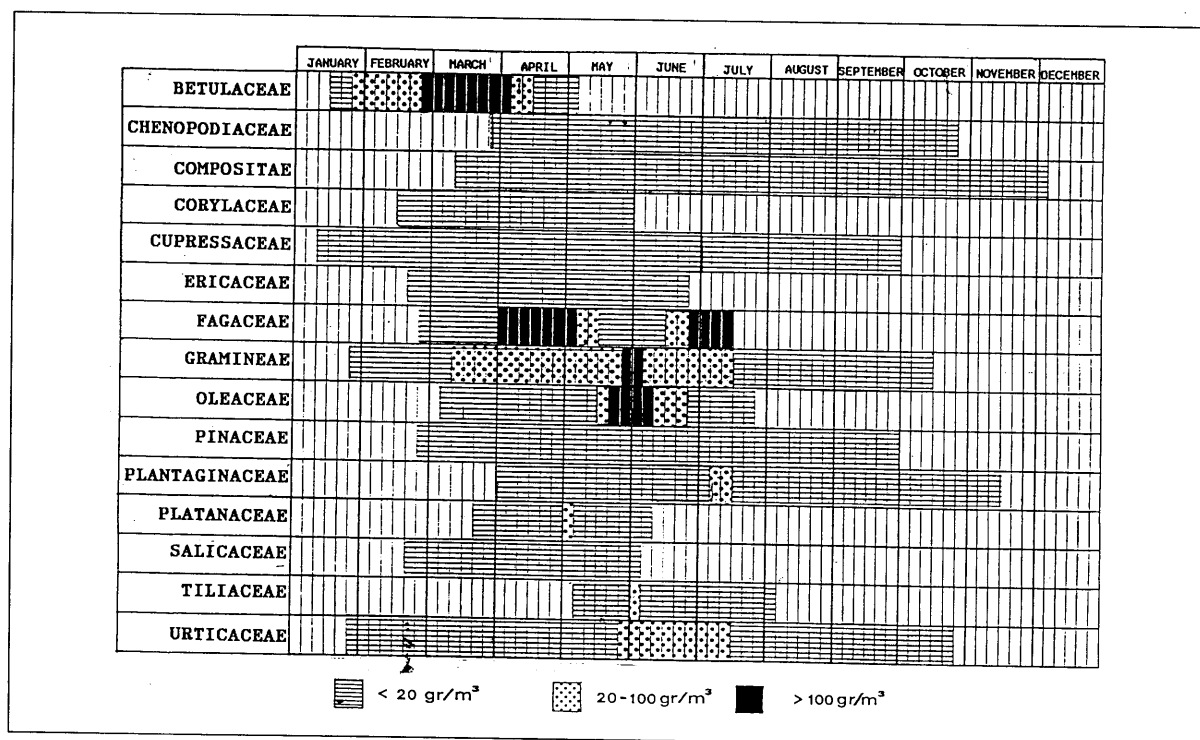


Figure 1. Pollen Calendar of Cosenza, Italy (years 1986-1989).

Table II. Results of skin prick tests over three years (1988-1990): 2300 examined patients, 702 polysensitizations and 838 monosensitizations.

Total positivity: 1540 (66.9%)		Total negativity: 760 (33.1%)	
Cutaneous positivity (monosensitizations)		Major cutaneous positivity included polysensitizations	
Gramineae	305 (19.8%)	Gramineae	788 (36.7%)
Parietaria	167 (10.9%)	Parietaria	400 (20.7%)
Olive	27 (1.8%)	Olive	225 (11.6%)
Compositae	10 (0.6%)	Compositae	122 (6.3%)
Trees	6 (0.4%)		
Dermatophagoides	315 (20.4%)	Dermatophagoides	476 (24.7%)
Others	8 (0.5%)		

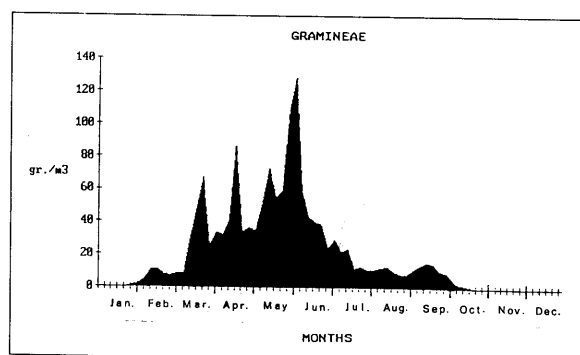


Figure 2. Airborne pollen concentrations of Gramineae at Cosenza, Italy. Five-day running means covering daily observations over three years (1986-1989).

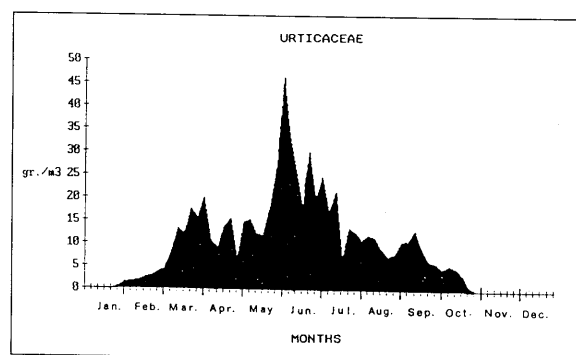


Figure 3. Airborne pollen concentrations of Urticaceae at Cosenza, Italy. Five-day running means covering daily observations over three years (1986-1989).

Table III. Correlation between cutaneous positivity (skin prich test) included polysensitizations and place.

	Cosenza	Ionian coast	North Italy	South Italy	Tyrrhenian coast
Gramineae	487 (39.0%)	29 (32.6%)	88 (36.2%)	54 (32.7%)	50 (26.9%)
<i>Parietaria</i>	218 (17.5%)	20 (22.5%)	59 (24.3%)	48 (29.1%)	55 (29.6%)
<i>Olea</i>	154 (12.3%)	18 (20.2%)	22 (9.1%)	19 (11.5%)	12 (6.4%)
Compositae	88 (7.1%)		26 (10.7%)	6 (3.6%)	2 (1.1%)
<i>Dermatophagoides</i>	301 (24.1%)	22 (24.7%)	48 (19.7%)	38 (23.1%)	67 (36.0%)

As far as the Oleaceae family is concerned, amongst the most widespread allergenic pollen (not only according to the airborne biological surveys but also in terms of cutaneous sensitivity) the pollen of the olive tree is of undoubted importance, even though its period of blooming is brief. High levels such as those that were found in other regions in the south (e.g. Puglia or other parts of Calabria) were not recorded. Blooming is limited to May and June (Fig. 4).

As far as the epidemiological data is concerned, *Olea* ranks third with a cutaneous positivity of 11.6%. Also in this case reference should be made to the geographical variety of the province of Cosenza, which includes zones such as the Plain of Sibari, where the cultivation of olive trees stretches over 13,000 out of 60,000 hectares.

The data regarding the Compositae (Fig. 5) indicate a scarce presence of pollen grains. However, due to their enormous allergenic potential, although present in such modest quantities, they are sufficient to cause the substantial number of cases of cutaneous positivity registered (6.3%).

For the Fagaceae family, the intense pollination season recorded represents the most interesting result of our observation (Fig. 6).

The grains present in April-May were those of Beech and Oak, whereas those present in

June and July were almost exclusively of Chestnut.

These plants are amply distributed over the entire territory surrounding the survey zone and their pollen is present in the atmosphere from April to July, overlapping with the maximum blooming period of Gramineae. The concentration too is noteworthy with average values of 150-200 gr/mc. If we take into account that the concentration of pollen is one of the factors that determine the allergic potential, the results we obtained suggest the necessity, despite the high allergic sensitivity of this pollen, of further research.

The pollen of Alder is present in large quantities from January through April (Fig. 7). Bearing in mind that Betulaceae rank first as the cause of allergies in North Europe, the need imposes itself, also for this pollen, for deeper studies and a possible inclusion of this allergen in basic diagnostic screenings.

The Cupressaceae pollen, whose increasing allergological importance has been emphasized (Tufsi e Coll., 1984) (winter pollinosis with almost constant conjunctival interest), is not widespread in Cosenza area. Pollens of Cupressaceae are present from January through March, their concentration decreases in April-May and increases again in June-July, probably due to the pollination of several *Tuja* species used for ornamental purposes in the numerous parks and gardens in the new part of the city.

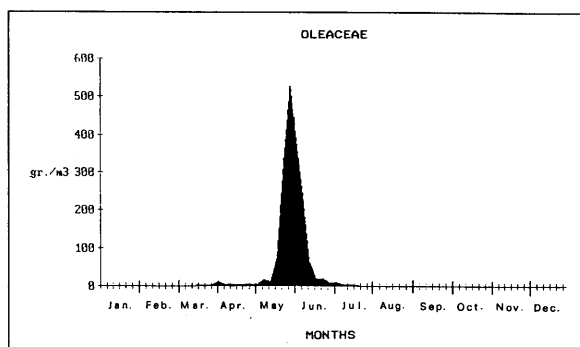


Figure 4. Airborne pollen concentrations of Oleaceae at Cosenza, Italy. Five-day running means covering daily observations over three years (1986-1989).

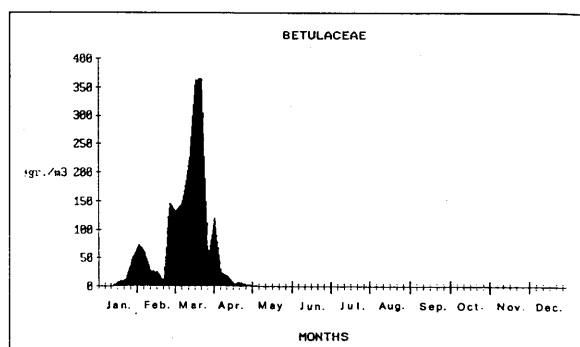


Figure 7. Airborne pollen concentrations of Betulaceae at Cosenza, Italy. Five-day running means covering daily observations over three years (1986-1989).

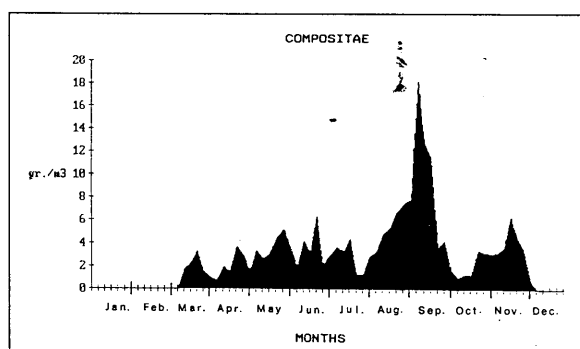


Figure 5. Airborne pollen concentrations of Compositae at Cosenza, Italy. Five-day running means covering daily observations over three years (1986-1989).

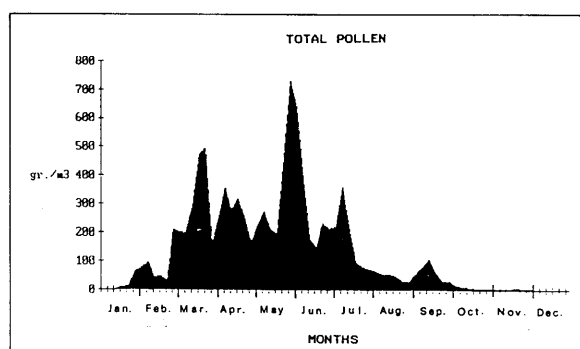


Figure 8. Total airborne pollen concentrations at Cosenza, Italy. Five-day running means covering daily observations over three years (1986-1989).

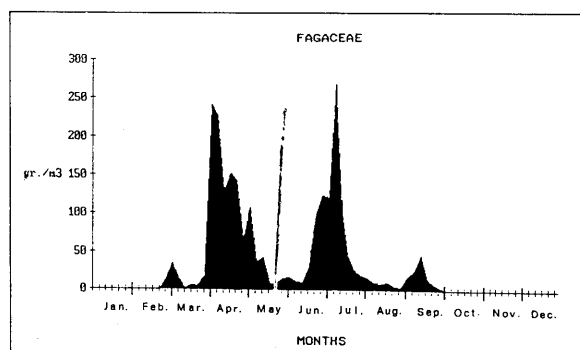


Figure 6. Airborne pollen concentrations of Fagaceae at Cosenza, Italy. Five-day running means covering daily observations over three years (1986-1989).

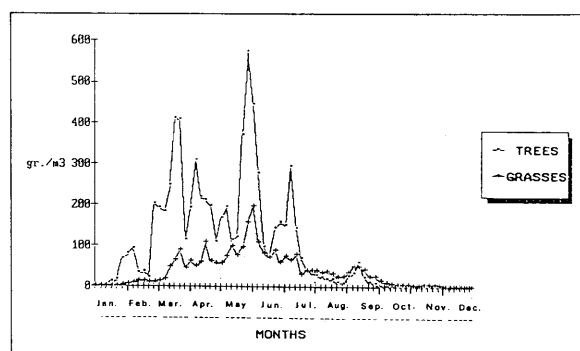


Figure 9. Airborne pollen concentrations of trees and grasses at Cosenza, Italy. Five-day running means covering daily observations over three years (1986-1989).

DISCUSSION AND CONCLUSIONS

The sampling of airborne biological particles, during the years 86-89, placed in evidence amongst the herbaceous plants two main groups of allergenic pollen grains; Gramineae and Urticaceae (*Parietaria*). Amongst the arboreal plants (with net prevalence of herbaceous pollen) Oleaceae (Olive), Fagaceae (Beech) and Betulaceae (Alder) are of particular importance.

The prevalence of Gramineae pollen is however, of highest importance both because of the duration of the period of blooming and the high concentrations, whereas *Parietaria*, although present for many months of the year, shows not very high concentrations. These values are, furthermore, comparable with those recorded in the atmosphere of Bari.

The compilation of a pollen calendar for the city of Cosenza has been enabled thanks to the utilization of the data acquired represents a further aid in the field of prevention, diagnosis and therapy of allergic respiratory diseases.

The results of the monitoring were compared with the results of an epidemiological study carried out by us at the Hospital «Mariano Santo» in Cosenza, aimed at establishing the frequency of sensitivity to various allergens, including pollen, in 2300 subjects resident in the province of Cosenza affected by respiratory diseases and under observation at the allergology out-patients' department of the above hospital during the period 1988-90. All the patients were given skin allergy tests using the prick test.

This epidemiological study fully agree with the data obtained with the airborne pollen monitoring. Therefore, the clinical importance of knowing in a particular territory the concentration of airborne pollen, for each species, appears evident, in order to foresee the seasonal pollen peaks with correct pharmacological

treatment and to establish the concordance between case history data and the possible positivity of specific diagnostic tests.

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