

Monitoring pollinosis and airborne pollen in a Rome university

Maria Grilli Caiola*, Anna Mazzitelli, Enrico Capucci & Alessandro Travaglini

Dipartimento di Biologia Università di Roma "Tor Vergata", Italy

(*author for correspondence: Dipartimento di Biologia, Università di Roma "Tor Vergata", Via della Ricerca Scientifica, 1, 00133 Roma, Italy; Phone: 06-72594344; Fax: 062023500; E-mail: grilli@uniroma2.it)

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Abstract

Pollen allergies and airborne pollen were monitored at the University of Rome "Tor Vergata" in 1999 in order to determine the concentration and the quality of airborne pollen belonging to allergenic plants in relationship to the prevalence of pollen allergies. Airborne pollen was monitored by volumetric trap while data on allergies were collected through a questionnaire distributed to the University personnel belonging to various working categories. Meteorological data were obtained through a daily monitoring carried out by a meteorological station while plant anthesis identification was done at the Herbarium of the University. Results indicated that prevalent allergies were due to Gramineae, Urticaceae and Oleaceae pollen. Many subjects suffering from allergies did not know the responsible allergen(s) and more than half of the allergic subjects stated to have allergic relatives. Data on pollen monitoring and prevalence of allergies, collected in the same geographical area, were found to be in accordance with each other, with the exception of the case of Cupressaceae/Taxaceae plants, whose pollen was found in high concentration although no case of allergy due to this pollen was established.

Introduction

In recent decades allergies due to pollen or other plant parts have highly increased throughout the world (Knox et al., 1998; Von Mutius, 1998; Ong et al., 1995). The survey "European Allergy White Paper" (Anonymous, 1997) reports the percentage of affected individuals in the various European countries, the increased asthmatic allergies in children (Gassner et al., 1996), the monitoring activity carried out in various countries as well as the socio-economic costs that the EC has to meet for allergy diagnosis, therapy and loss of productivity due to absence in the work places.

However, some difficulties exist in comparing data from different sources. In fact allergic individuals often adopt remedies which are suitable for viral or bacterial infections instead of allergies; also it is often the case that diagnosis is made without a previous specific diagnostic test.

Patients whose symptoms are not considered serious enough, are not admitted to hospital thus, while data calculated on patients admitted in hospital are reliable, those which are not recorded by law or have not been accurately recorded cannot be included in a statistical analyses. Therefore, correlations between allergic symptoms and environmental factors, as airborne pollen, need to be further investigated.

Airborne pollen monitoring is carried out by air sampling, pollen identification and count. In Italy the Italian Association of Aerobiology (AIA) runs this service. Data on airborne pollen reported by the various stations for different years and by different authors, often differ significantly in terms of pollen type and its concentration in the air.

One way to make the data obtained from pollen monitoring trap and pollen allergies more reliable is to monitor the pollen together with the manifestation of pollen allergies in a particular area, during the

period of allergenic plant anthesis in parallel with the meteorological course, especially in terms of temperature, rain and relative humidity.

In this respect, studies have been undertaken in some regions (Ballero, 1983; Franchi et al., 1984), but only in a few cases they were carried out by recording all of the previously listed parameters. It is often the case that one or more instruments to monitor the climate close to the pollen sampling area are lacking, or that sometimes data on allergies are taken from the literature or for sites which are far from the pollen sampling station (Hruska and Telloni, 1996). Latium, when compared to other Italian regions, has a high population density, large uncultivated areas and a high number of vehicles (Grilli Caiola, 1996). In addition it has a high biodiversity, having about 50% of the native cormophytes of the national territory (Anzalone, 1984, 1994, 1996). A high biodiversity means a high percentage of allergenic species, which grow, flower and pollen release in uncultivated areas. Since 1996, a new station has been operating at the Biology Department of the University of Rome "Tor Vergata" (Travaglini et al., 1996). This station is connected to a meteorological station and to a herbarium where allergenic species are collected and their anthesis spectra recorded.

Two monitorings were carried out, contemporaneously, at the University of Rome "Tor Vergata" in collaboration with the School of Science and Medicine. The first involved monitoring of airborne pollen through the mentioned station, the second involved the distribution of a questionnaire to the University personnel belonging to various categories (students, professors and researchers, technicians) in April–May 1999.

Materials and methods

Questionnaire

A questionnaire was distributed to students, professors, researchers, technicians and administrative employees of the School of Science and Medicine of the University, in April and May 1999.

The questionnaire was divided into two parts: the first, elicited general information on the individual as sex, age, job, time spent at work, distance from home, presence of allergic factors at home (animals, carpets, air-conditioner), the use of chemicals and drugs, smoking-habit, family members

showing allergic symptoms, if any. The second part, elicited information on whether the allergic symptoms were related to season, the responsible allergen to be selected from a list, the mode of establishing the diagnosis, (clinical symptoms, prick test and so on). Responses were elaborated by Microsoft Excel and SPSS programs.

Pollen monitoring

Airborne pollen monitoring was carried out by means of a volumetric trap (Hirst, 1952), VPPS 2000 by Lanzoni, located on the roof of the Biology Department building of the University of Rome "Tor Vergata". The total concentration of pollen and the percentage of pollen belonging to different families of plants was collected between April 15 and May 15, 1999.

Floristic and anthesis spectra

Floristic census was made on the area of the University and Exsiccata were identified and collected in the Herbarium of the Botany Laboratory. The anthesis spectrum of each identified species was monitored starting from the appearance of the first open flower on the plant until the end of anthesis.

Meteorological data

Meteorological data for the same period were obtained from the meteorological station CAE. Sp 200, automated and equipped with pluviometer, thermohygrometer, anemometer and radiometer (Travaglini and Grilli Caiola, 1996).

Results

The subjects

1131 questionnaires were collected, 446 from males (39.4%) and 685 from females (60.6%). 50.5% of the subjects were between 19 and 29 years of age, 25.0% between 30 and 39, 17.9% between 40 and 49, and only 6.6% were over 50.

Most of the subjects who filled out the questionnaire had been working at the University for more than one year, mainly in offices and did not attend the stabularium.

In Figure 1 the different categories of the subjects are reported.

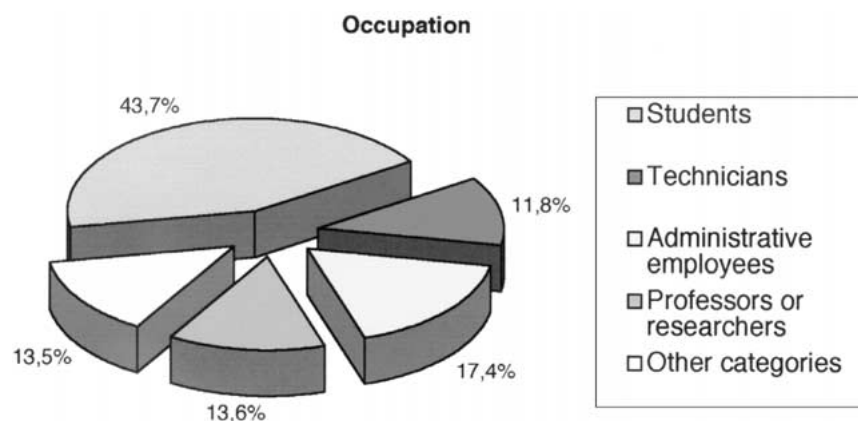


Figure 1. Distribution of the surveyed sample (1131 subjects) according to their occupation.

525 out of 1131 interviewed (46.4%) live between 0 and 15 km from the site where the pollen trap was installed.

Subjects showing allergic symptoms

The subjects who stated to have had one or more allergic symptoms were 609 (53.8%), whereas 46.2% stated never to have suffered from allergies.

54.5% of allergic subjects stated to have allergic relatives, whereas 45.5% did not.

Among the 609 subjects showing allergic symptoms, 448 (73.5%) were examined by a doctor: allergologist, family doctor or other specialists (Figure 2).

Out of the 448 subjects who were examined by a doctor, only 315 (70.3%) got a diagnosis of allergy, either from the allergologist (74.9%) or from the family doctor (25.1%). As shown in Figure 3, in the latter 315 subjects, the allergy was due to pollen only, in 29.2% of the cases, to pollen plus other allergens, in 24.4% of the cases and to other allergens only, in 38.4% of the cases. Diagnosis for the remaining 7.0% was not available.

The diagnoses of allergies were based on the Skin Prick Test (SPT) for 70.2% of the subjects, on analysis of the clinical symptoms for 47.0%, on IgE dosage for 19.0% and spirometry for 9.8% of the subjects. These percentage values were calculated on the basis of multiple answers and therefore the sum is more than 100%.

Among the subjects with a diagnosis, 217 subjects knew the responsible allergens. The most frequently diagnosed allergens are reported in Figure 4, where it is shown that the highest number of allergies are due

to Gramineae, dust, Urticaceae, Oleaceae, Compositae, Platanaceae, Salicaceae Pinaceae, Betulaceae and Fagaceae. The percentage values showed in Figure 4 were calculated on the basis of multiple answers and therefore the sum is more than 100%.

Among the subjects that have a diagnosis based on SPT, 59.3% of them suffers from allergy due to Gramineae, 29.4% to Urticaceae and 16.3% to Oleaceae.

Another datum concerns the percentage of subjects (46.6% of the allergic subjects, i.e. 284 subjects) living within the capture radius of the trap (~15 km). Among these, 48.1% (164 subjects) suffer from pollen allergy (Figure 5) and 72 of them have reported to have symptoms in spring, due to the presence of Gramineae, Oleaceae and Urticaceae pollen (Figure 6).

The highest number (67.3%) of patients with a diagnosis of allergy suffer from allergy in spring, 18.4% in summer, 13.0% in autumn, 8.6% in winter and 21.3% has continuous symptoms. The latter group is composed by subjects suffering from pollen and other allergens (6.1%), from pollen only (1.7%) and from other allergens except pollen (14.0%).

Out of the 1131 subjects interviewed in the present study, 15.0% were allergic to pollen. Figure 7 shows the percentages of allergies of the whole sample.

Pollen spectra

The analysis of pollen spectra in April-May 1999 indicates that May 1999 was the month with the highest amount of airborne pollen (Figure 8). Prevalent pollen grains were from Gramineae, Oleaceae, Fagaceae. Urticaceae, Pinaceae Cupressaceae-Taxaceae and Plantaginaceae pollen were present in lower amounts

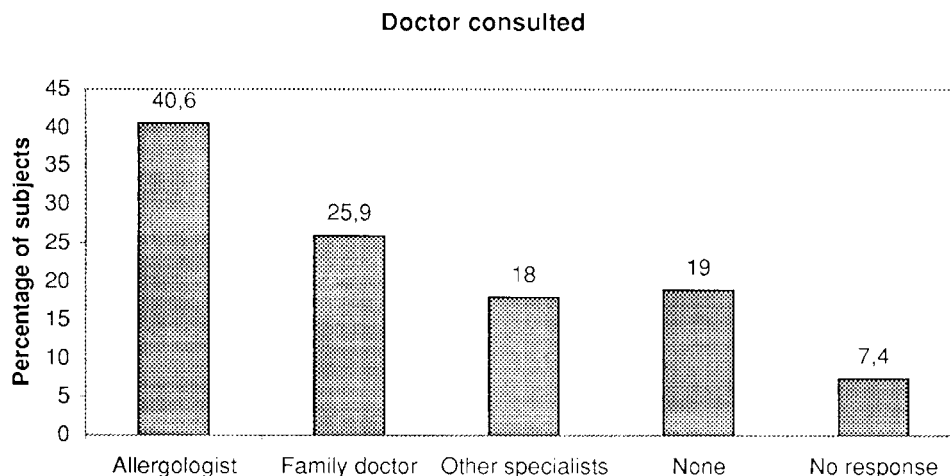


Figure 2. Doctors consulted by the allergic subjects surveyed.

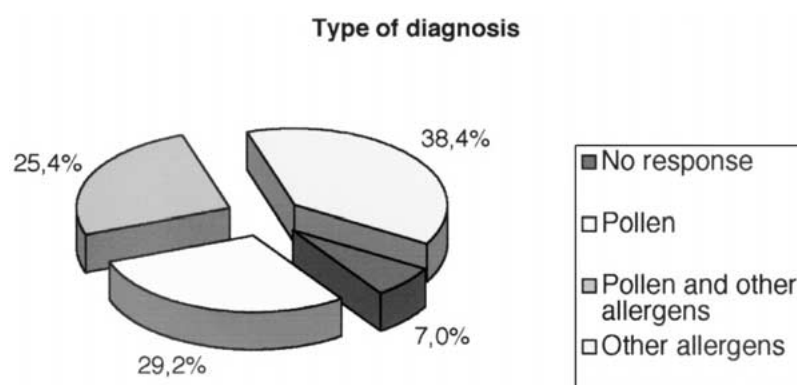


Figure 3. Distribution of the type of diagnosis among the 315 subjects with a diagnosis of allergy.

(Table 1). In 1999 the maximum blossoming period of Cupressaceae/Taxaceae was in February and March, while that for Plantaginaceae was June.

Floristic and anthesis spectra

152 species belonging to 106 genera and 36 families were collected during the floristic census carried out in April–May 1999 in the area of the University of Rome “Tor Vergata” (approximately 600 ha).

Table 2 reports the allergenic plants flowered, the number of species per family and the maximum pollen concentration registered.

Among the 152 monitored species, Gramineae is the allergenic family with the highest number of native flowered species spread over a vast area of the University campus.

Climate

Figure 9 reports temperature values (°C) and rainfall (mm) in April–May 1999. Monthly average temperature was 13.0 °C and 19.0 °C, respectively; rain was 107.0 and 29.6 mm, with 11.0 and 4.0 rainy days. Wind speed average was 3.3 and 1.4 km/h with maximum wind speed (30 km/h) on several days, prevalently coming from SW in April and from W–SW in May.

Discussion

The collected data suggest that familiarity in allergy cases is an important component, being the atopy prevalent in 54.5% of the subjects.

Data obtained from the questionnaire on the diffusion of pollen allergies are close to those reported in

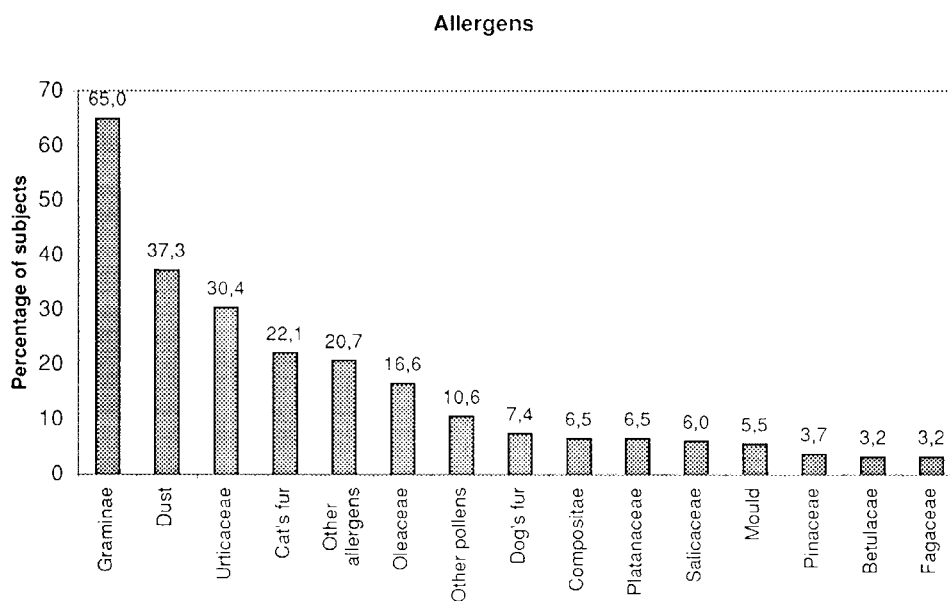


Figure 4. Prevalent allergens diagnosed by a doctor, among the 217 subjects who know their allergens.

Type of diagnosis in the 164 subjects living within 15 Km from workplace

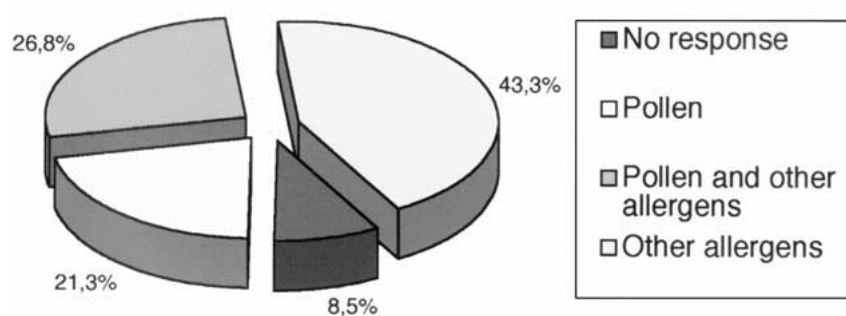


Figure 5. Distribution of the type of diagnosis among the allergic subjects living within the capture radius of the pollen trap (164 subjects).

Allergens among the 72 allergic subjects who live within 15 Km and suffer from symptoms in spring

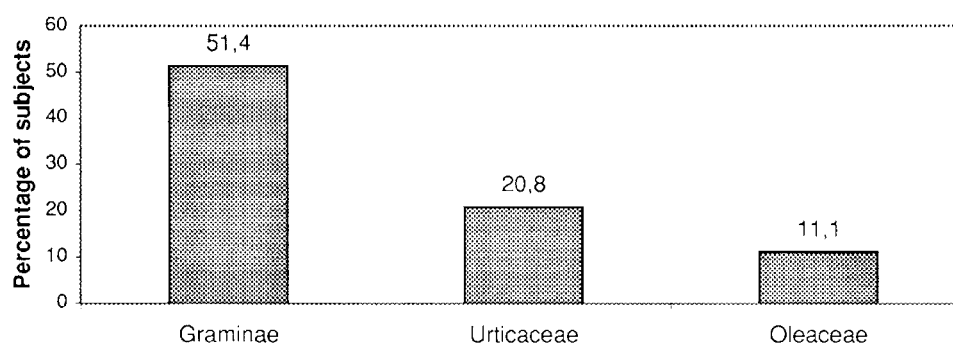


Figure 6. Prevalent allergens among the 72 subjects showing symptoms in spring and living within the capture radius of the pollen trap.

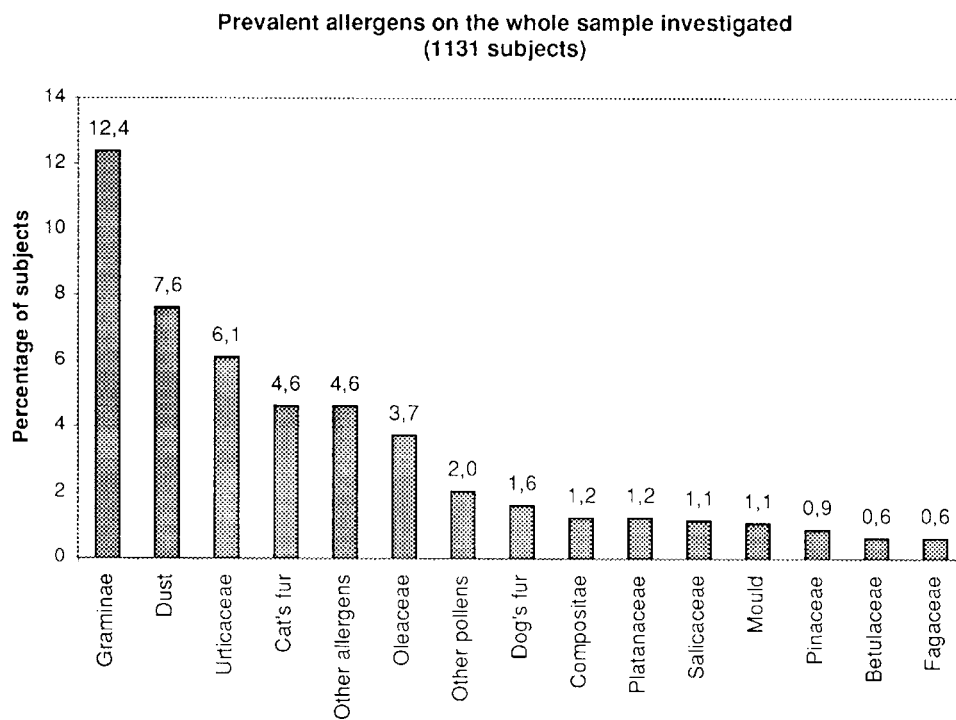


Figure 7. Diagnosed allergens among the total sample (1131 subjects).

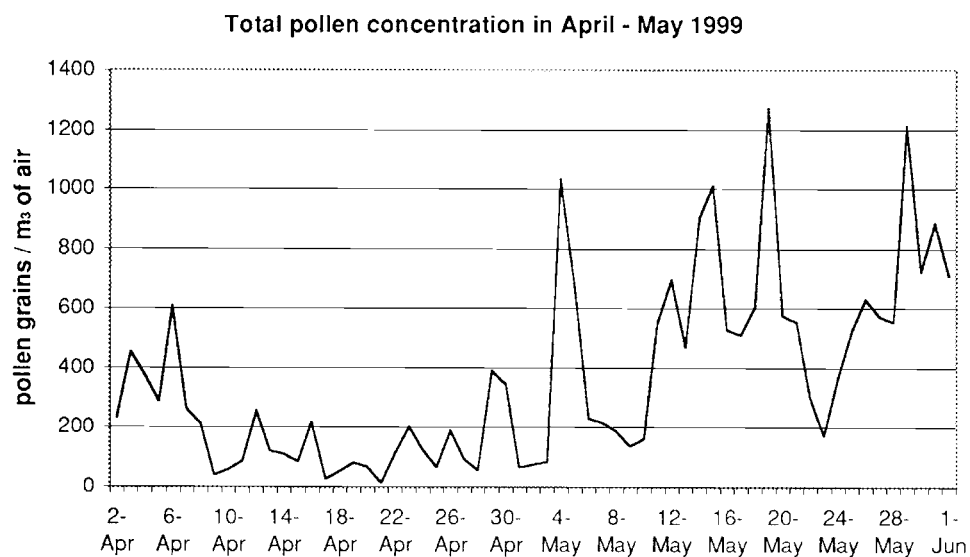


Figure 8. Total pollen concentration at Tor Vergata, Rome, in April-May 1999.

Thermo-pluviogram

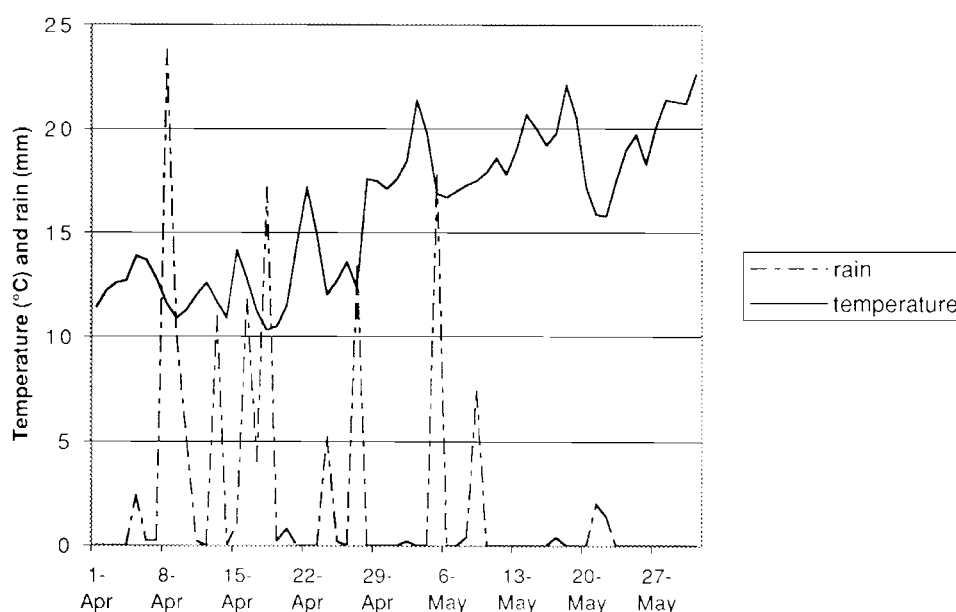


Figure 9. Rainfall and temperature trend during April–May 1999.

Table 1. Monthly concentration of pollen grains belonging to the plant families bloomed during April and May 1999 at Tor Vergata.

Family of plants	Average concentration	
	April	May
Betulaceae	1	0
Compositae	1	1
Corylaceae	41	9
Fagaceae	18	120
Graminae	9	147
Oleaceae	8	118
Plantaginaceae	1	2
Urticaceae	42	44
Cupress/Taxaceae	11	6
Cheno-Amarantaceae	0	2
Polygonaceae	1	5
Euphorbiaceae	2	1
Platanaceae	19	0
Aceraceae	1	0
Pinaceae	5	87
Other pollens	8	5
Total	176	552

other European countries as France (Vervloet et al., 1991) for subjects 20–68 years of age, and Hungary (Kadocsa and Bittera, 1993), for subjects 5–75 years of age.

The comparison of the present data to those previously reported for Latium, emphasizes that the percentage of allergies diagnosed by Skin Prick Test (SPT) due to Gramineae pollen are lower than those found by Errigo et al. (1991), while the percentage of allergies due to Oleaceae and Urticaceae pollen are higher. Also percentage of cutipositive persons due to Gramineae and Urticaceae pollen for Latium reported by Quarantino et al. (1994) and Papa et al. (1994) were lower than those found by Errigo et al. (1991). The differences registered for the same area (Rome) suggest that many factors could influence the diffusion of allergies and monitoring. According to Luscri (1996) among allergies due to tree pollen and diagnosed by SPT in Rome, 44.8% were due to Olive pollen, and 14.8% to Cupressaceae/Taxaceae pollen. While the data on Olive pollen are high, those on Cupressaceae/Taxaceae pollen are new and interesting. Patients allergic to Cupressaceae/Taxaceae pollen are not present in this survey nor in previous works (Errigo et al., 1991). This could be due to the lack of information or to the absence of the allergen

Table 2. Families, number of species and maximum pollen concentration at anthesis in April and May 1999 in the area investigated.

Family of plant	Number of species	Pollen grains/m ³
Fabaceae	26	
Asteraceae	18	
Graminae	15	600
Cruciferae	11	
Caryophyllaceae	8	
Borraginaceae	5	
Scrophulariaceae	4	
Euphorbiaceae	3	
Liliaceae	3	
Geraniaceae	3	
Convolvulaceae	2	
Labiatae	2	
Malvaceae	2	
Polygonaceae	2	
Papaveraceae	2	
Rosaceae	2	
Ombrelliferae	2	
Urticaceae	2	100
Campanulaceae	1	
Dipsacaceae	1	
Guttiferae	1	
Linaceae	1	
Oleaceae	1	800
Orchidaceae	1	
Oxalidaceae	1	
Primulaceae	1	
Resedaceae	1	
Rubiaceae	1	
Fagaceae	2	500

for the Skin Prick test. In recent years allergy to Cupressaceae/Taxaceae pollen has not only increased in eastern countries (Miki-Hirosige et al., 1994), but also in the Mediterranean area (Barletta et al., 1998) and in the Roman hills (Luscri et al., 1996). In addition, Cupressaceae/Taxaceae pollen allergens have been identified and immunologically localized (Miki-Hirosige et al., 1994; Taniguchi et al., 1995) in many genus and species of the Cupressaceae/Taxaceae family.

A significant correlation was found between allergic symptoms due to pollen, the concentration of airborne pollen, anthesis spectra and meteorological data.

The highest percentage of patients with pollen allergy feels the symptoms in spring or in winter-spring, since these periods have the highest airborne pollen concentration (Travaglini et al., in press).

The floristic census and the phenological observations carried out during the epidemiological investigation show Gramineae to be the most represented allergenic blooming family with 15 species. This fact is in accordance with the prevalence of subjects suffering from Gramineae pollen.

In April, the abundant rain and the high frequency of rainy days can explain the low concentration of airborne pollen in the atmosphere. This can also explain the discordance between the number of subjects suffering in spring (212) and those stating to suffer from symptoms in the period of distribution of the questionnaire (92). Instead in May the high average temperature favoured anthesis of many grasses and the scarcity of rain recorded and the moderate winds favoured the release transport and suspension of airborne pollen.

Other data concern the diagnosis of allergies: only 448 out of 609 (73.5%) allergic subjects consulted a doctor, and only 40.6% of them have consulted a specialist. 315 subjects have a diagnosis of allergy, but only 217 know their allergens. These data confirm the necessity to obtain more information on allergies in general and on pollinosis in particular, and to collect more data on the incidence of this pathology on a local as well as on a national scale.

Therefore the present study allows to draw conclusions not only on the correlation between airborne pollen and allergies monitoring, but also on air pollen composition and, most of all, on allergic pollen. This confirms the validity of the forecast of pollinosis based on monitoring airborne pollen, allergenic flowering plants and meteorological information. Signalling the first pollen in the air can help people sensitive to pollen to adopt measures to reduce the symptoms.

For these reasons pollen monitoring at the University of "Tor Vergata" will continue, and more surveys on allergies are going to be carried out in the future.

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