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Oleaceae in Trieste (NE Italy): aerobiological and clinical data

Francesca Larese Filon [a,*], Maria Luisa Pizzulin Sauli [b], Loredana Rizzi Longo [b]

[a] *Istituto di Medicina del Lavoro, Università di Trieste, Via della Pietà 19, 34129 Trieste, Italy*
[b] *Dipartimento di Biologia, Università di Trieste, Trieste, Italy*

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Abstract

Oleaceae pollen concentrations in the Trieste area are low (< 10%) compared to the total number of airborne pollen grains, with only one pollination peak at the beginning of June when the Oleaceae concentration reached 62% of the total pollen count in 1992. This peak was due to an exceptionally high pollination of olive trees in 1992, when airborne pollen concentration rose to 1357 pollen grains/m^3 on June 3. Sensitization to *Olea* increased from 1989 to 1993, when it was present in 23.4% of symptomatic patients, but the role of *Olea* in inducing allergic respiratory symptoms is difficult to evaluate because almost all patients were sensitized to other pollens, and in particular to Gramineae: only four subjects were sensitized to *Olea* alone (1.4%). Despite the low Oleaceae pollen counts, this pollinosis is increasing, probably because of increased cultivation of *Olea* in recent years. However, although skin prick test positivity is common in polysensitized patients, its role in inducing sensitization and symptoms is presently less important than that of other pollens.

Keywords: Hypersensitivity; Italy; Oleaceae

1. Introduction

Respiratory allergy to the pollen of Oleaceae has been recognized for many years, being reported mainly from the countries around the Mediterranean sea. In Italy, data have been published from the Liguria region, from Naples, Rome and Bari, with sensitization ranging from 16.8 to 23.1% among groups of atopic subjects (Bosquet et al., 1984, 1985; Macchia et al., 1985; D'Amato et al., 1988; D'Amato and Lobefalo, 1989; Caiaffa et al., 1991; Negrini et al., 1992; Wheeler, 1992; Liccardi et al., 1994, 1995, 1996a). Until now, no data have been collected for Trieste.

Oleaceae are common in the area investigated (Poldini, 1980). The olive tree has been cultivated since ancient times in the more sheltered areas on the south-eastern outskirts and also along the coast. *Fraxinus ornus* L. is widespread in the woodland belt all around the city and in the deciduous oak-woods. *Fraxinus oxycarpa* Willd. is not so common, but is found on the wet plains in the south-eastern part of the area investigated. *Phillyrea angustifolia* L. grows in the Mediterranean maquis. *Ligustrum vulgare* L. is common throughout the territory. *Ligustrum lucidum* Ait. is often planted along the roads. *Forsythia viridissima* Lindl., *Syringa vulgaris* L. and *Jasminum nudiflorum* Lindl. are frequently cultivated in gardens.

In order to evaluate the role of Oleaceae pollen in this area, airborne pollen sampling data (1989–1993) were related to the results of skin prick tests analyzed in a group of subjects with allergic respiratory symptoms in the same period.

2. Materials and methods

The city of Trieste lies on the North-Eastern coast of the Adriatic Sea (Fig. 1), and is surrounded by the steep slopes of the Karst highland (200–300 m above sea

* Corresponding author. Tel.: +39 40 3992312; fax: +39 40 368199.

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level). From the phytoclimatic point of view, Trieste is situated in a transitional position between the Mediterranean and the Eurosiberic regions, and this gives it its unique geomorphology. The climate is sub-Mediterranean, with an average annual temperature exceeding 14°C and an annual rainfall of about 1000 mm (Polli, 1970).

The vegetation is varied (Poldini, 1989). A narrow range of calcareous rocky slopes facing the sea is covered by thermophilic evergreen vegetation (*Ostryo-Quercetum ilicis* Trinaistic, the Illyric–Mediterranean maquis); on the sandstone hills behind the city there are deciduous types of oak (*Seslerio autumnalis–Quercetum petraeae* Poldini), while on the Karst highland the main vegetation is the broadleaved Karst type (*Ostryo-Quercetum pubescentis* (Ht.) Trinaistic), rich in Illyric species.

Pollen was collected each year from February 1st to October 15th using a Burkard spore-trap placed 20 m above ground level on the Bastione Fiorito of San Giusto Castle, in the city centre (Rizzi Longo and Cristofolini, 1987; Rizzi Longo, 1990; Pizzulin Sauli et al., 1992; Rizzi Longo et al., 1992; Larese et al., 1995, 1996). The slides were prepared and the data were interpreted according to the standard method of the Italian Association for Aerobiology.

A total of 1614 patients of both sexes (age range 14–70 years) were enrolled in the study. They came presenting to our clinic consecutively from January 1, 1989 to December 31, 1993, complaining of respiratory symptoms believed to be IgE mediated. The history of all the subjects was taken before clinical examination. Skin prick tests (SPT) were performed with perennial allergens (*Dermathophagoides pteronyssinus* and *Dermatophagoides farinae*, cat and dog dander, *Alternaria*, *Cladosporium* and *Aspergillus*) and pollens (Graminaceae, Compositae, *Parietaria*, Corylaceae–Betulaceae, and *Olea europaea*) produced by Lofarma Allergeni–Milano. Skin reactions were read after 15 min using a millimeter rule. The whealing reaction was compared to the size of a positive histamine control (10 mg/ml) and to a negative control (extraction solution without allergen), and was considered positive when diameter was equal to or greater than 3 mm. Atopy was defined as a positive reaction to at least one common allergen. Seasonal symptoms were defined when symptoms were present only during certain months of the year from January to October.

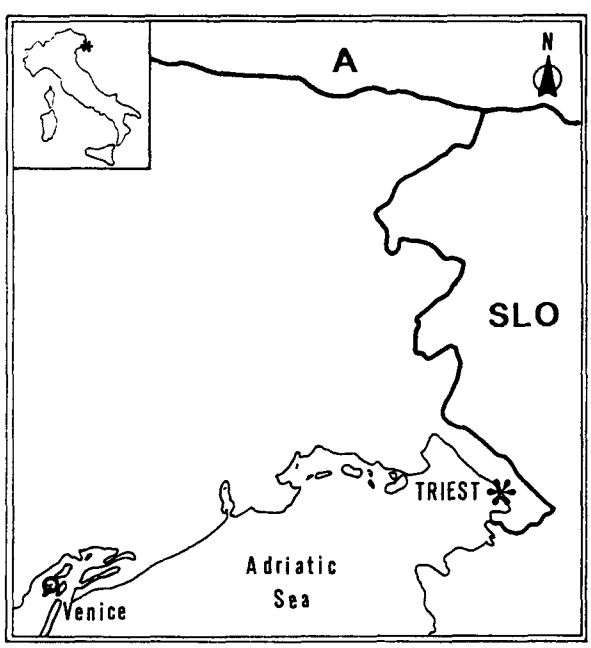

Fig. 1. Simplified map of the investigated area.

3. Results

3.1. Aerobiological features

In the years examined (1989–1993), the airborne pollen content of the city of Trieste began to rise every year in the first week in February (Fig. 2). Pollination peaks occurred in March (830 p/m^3 on 9/3; 850 p/m^3 on 21/3) and May (1231 p/m^3 on 2/5; 1465 p/m^3 on 4/5; 1305 p/m^3 on 5/5; 1095 p/m^3 on 8/5). In early May, the average daily pollen count always exceeded 700 p/m^3. The air pollen level decreased from June onwards, but mean daily values still remained above 100 p/m^3 until the end of August. From September onwards, mean pollen content gradually decreased.

The pollen produced by the Oleaceae represents only a small proportion of the total pollination present in the area under investigation, and is present only from March to June. It usually makes up less than 10% of total airborne pollen content. In the years considered, early June was the only time when the mean pollination curve of the Oleaceae represented a significant proportion of the global pollen curve (almost 50% on 2/6 and 62% on 3/6; this was due to the exceptional pollination of *Olea* which occurred in 1992, with 930 and 1397 p/m^3, respectively (Fig. 3).

The pollination curve of Oleaceae in the single years considered varies to some extent. In 1989 (Fig. 4a) and 1990 (Fig. 4b), pollination patterns were similar, but the amount of airborne pollen was much higher in 1990. The pollen presence was significant between mid-March and mid-June, and the period with the highest pollen level was between the end of April and the first ten days of May, with pollination peaks of 77 p/m^3 in 1989 and 138 p/m^3 in 1990, concurrently with the full flowering of *F. ornus*.

In 1991 (Fig. 4c), pollination of Oleaceae was abundant, lasting until the end of June. There were three pollination peaks, the first in mid-March, with 69 p/m^3,

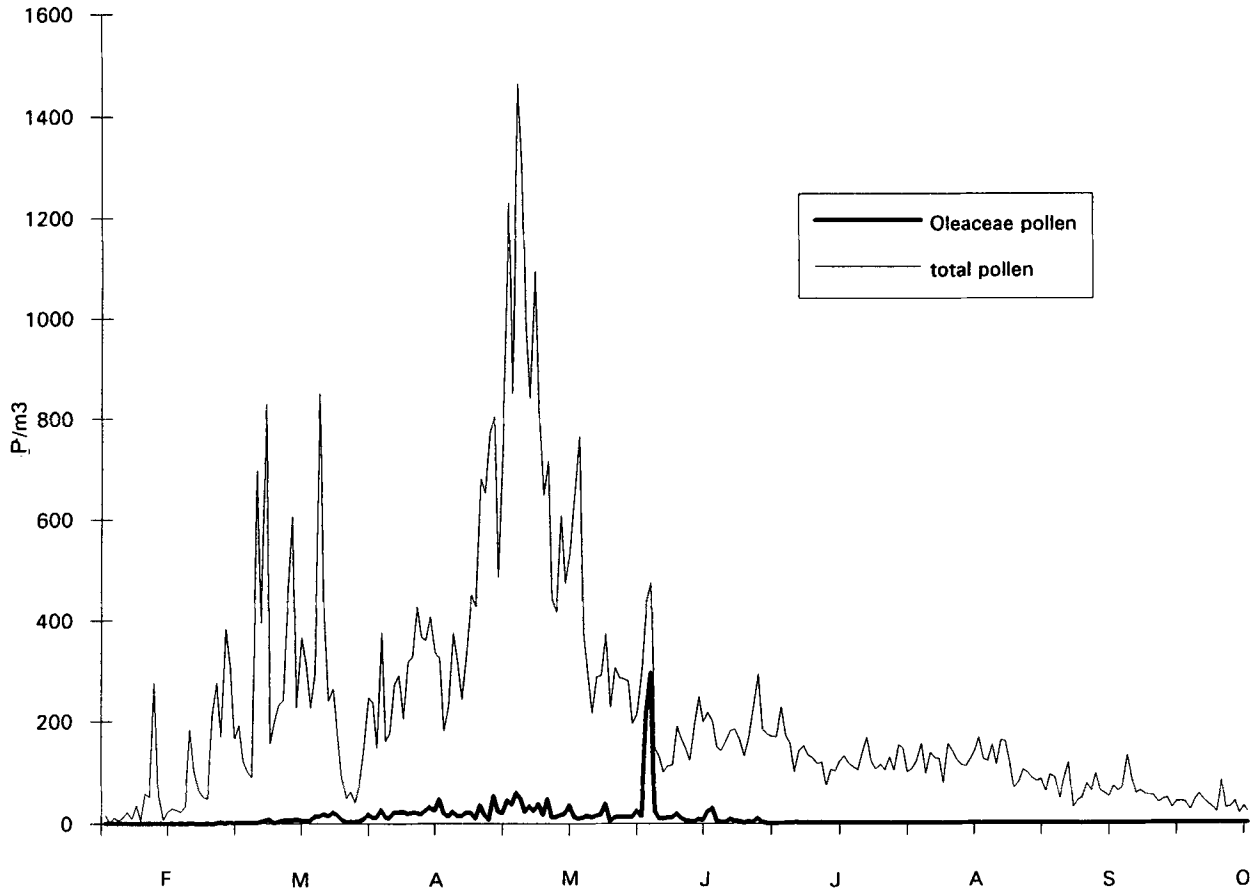

Fig. 2. Pollen daily means 1989–1993.

due to the pollen of *F. oxycarpa*, the second in mid-April, with 161 p/m^3, principally due to the pollen of *F. ornus*, and the third in mid-June, with 147 p/m^3, mostly due to the pollen of *O. europaea*.

In 1992 also (Fig. 4d), the same principal agents were identified, but pollination time was shorter: the count of 31 p/m^3 for *F. oxycarpa* at the beginning of March fell to nothing by the end of June. The pollination period of *F. ornus* was recognizable with peaks of 118–119 p/m^3 on 2/5 and on 11/5. Polination was particularly abundant in mid-June, with a peak of 1421 p/m^3 on 3/6, almost entirely due to the exceptionally high production of *O. europaea* pollen that year (Fig. 3).

The pollen curve in 1993 was anomalous (Fig. 4e): there was only one period of note between the end of May and the beginning of June, with a maximum of 66 p/m^3, principally made up of olive pollen. *F. ornus* flowered late and produced little pollen: it made its first appearance in May and reached a maximum level of just 20 p/m^3 on 11/5.

The taxa which make the most significant contribution to the pollination curve of the Oleaceae are therefore *Fraxinus* and *Olea*. However, the two species of *Fraxinus* present in the Trieste area play a different role. *F. oxycarpa*, which is rarer and flowers earlier, is present at the beginning of the pollen curve and at very low levels. *F. ornus*, commonly found in all the woods surrounding the city, is usually responsible for the pollination peaks.

In the years considered, there was a gradual increase in the pollen count of *O. europaea*. From maximum levels of 10 p/m^3 in 1989 there was an increase to 100 p/m^3 in 1991. As mentioned previously, pollination of *Olea* was extraordinarily high in 1992, with a peak of 1397 p/m^3. This exceptional concentration was accompanied by a correspondingly good harvest: according to official ISTAT figures, 2179 ql of olives were produced that year, compared to a previous yearly average of around 700 ql. It should be noted that in recent years there has been a steady increase in the amount of land given over to olive production in the Province of Trieste, with 31 ha of olive groves in 1992 compared to 18 ha in 1984. Not surprisingly, this increase was accompanied by a corresponding rise in pollination and olive production over the same period. The decrease in pollination and production in 1993 is most probably due to an excessive production in the previous year. As a matter of fact, there is evidence of a year-to-year alternating fluctuation in *Olea* pollen production (Dominguez-Vilches et al., 1993).

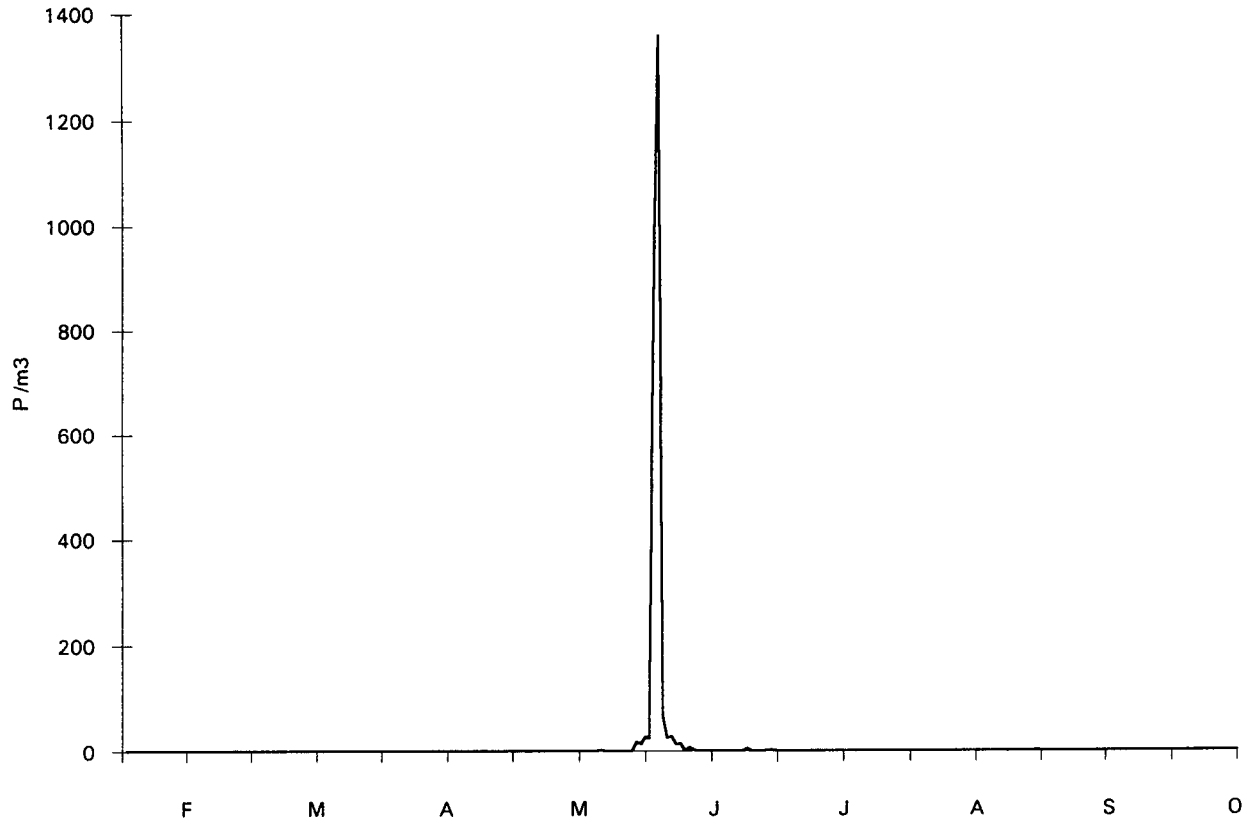

Fig. 3. Exceptional *Olea* pollination in 1992.

3.2. Clinical features

Table 1 summarizes the characteristics of the population studied. The mean age of the 1614 subjects tested was 37 ± 14.9 years and women were in the majority (55.2%). Of the group, 1044 (66.7%) were atopic by SPT (skin prick test) and 285 (17.1%) were sensitized to *Olea europea*. The distribution of SPT sensitization in the atopic patients is reported in Fig. 5. Grass pollen sensitivity was the most frequent positive response, with 58.2% of subjects positive, followed by sensitization to house-dust mites (52.6% for DF and 51% for DP). Positivity to other pollens tested ranged from 27.4 to 32.8%, with percentages higher for Compositae and lower for *O. europea*.

In the years considered, there was an increasing trend towards SPT positivity (Fig. 6). This figure compares *Olea* sensitization to that of Gramineae: the percentage of positive responses to *Olea* increased from 18.5% in 1989 to 35.5% in 1993, while the corresponding figures for Gramineae were 40.9 and 49.5%.

Table 2 shows the characteristics of the subjects with positive skin prick response to *Olea*. Of these 285 subjects, 45.6% were male, the mean age was 33.3 ± 13 years, and 139 had a family history of atopy (48.8%); 121 complained of rhinitis (42.5%) and 164 of asthma (57.5%), often in association with the rhinitis (72.5%). Of this group, 202 (70.9%) had only seasonal symptoms, while the remaining 83 (29.1%) complained of perennial symptoms. Sensitizations associated with *Olea* are reported in Fig. 7. Almost all subjects (92.6%) were sensitized to Gramineae, 57.9% to Betulaceae–Corylaceae, 54% to Compositae, and just over half to house-dust mites (53.3%). Only four cases were monosensitized (1.4%) and complained of rhinitis in May.

4. Discussion

Oleaceae pollen concentrations in the Trieste area are usually low ($< 10\%$) compared to the total number of airborne pollen grains, with year-to-year alternating fluctuation in *Olea* pollen quantities and the occasional pollination peak, such as the one at the beginning of June 1992, when the concentration of Oleaceae accounted for 62% of the total pollen count.

It is well-known that *Olea* pollen can cause allergic respiratory symptoms in sensitized subjects, particularly in the Mediterranean area where this pollination reaches very high levels for long periods (D'Amato et al., 1988; D'Amato and Lobefalo, 1989; Atzei et al., 1993; Ariano et al., 1994; Liccardi et al., 1994). *Olea* sensitization is closely related to sensitization to other plants belonging to the same family which are becom-

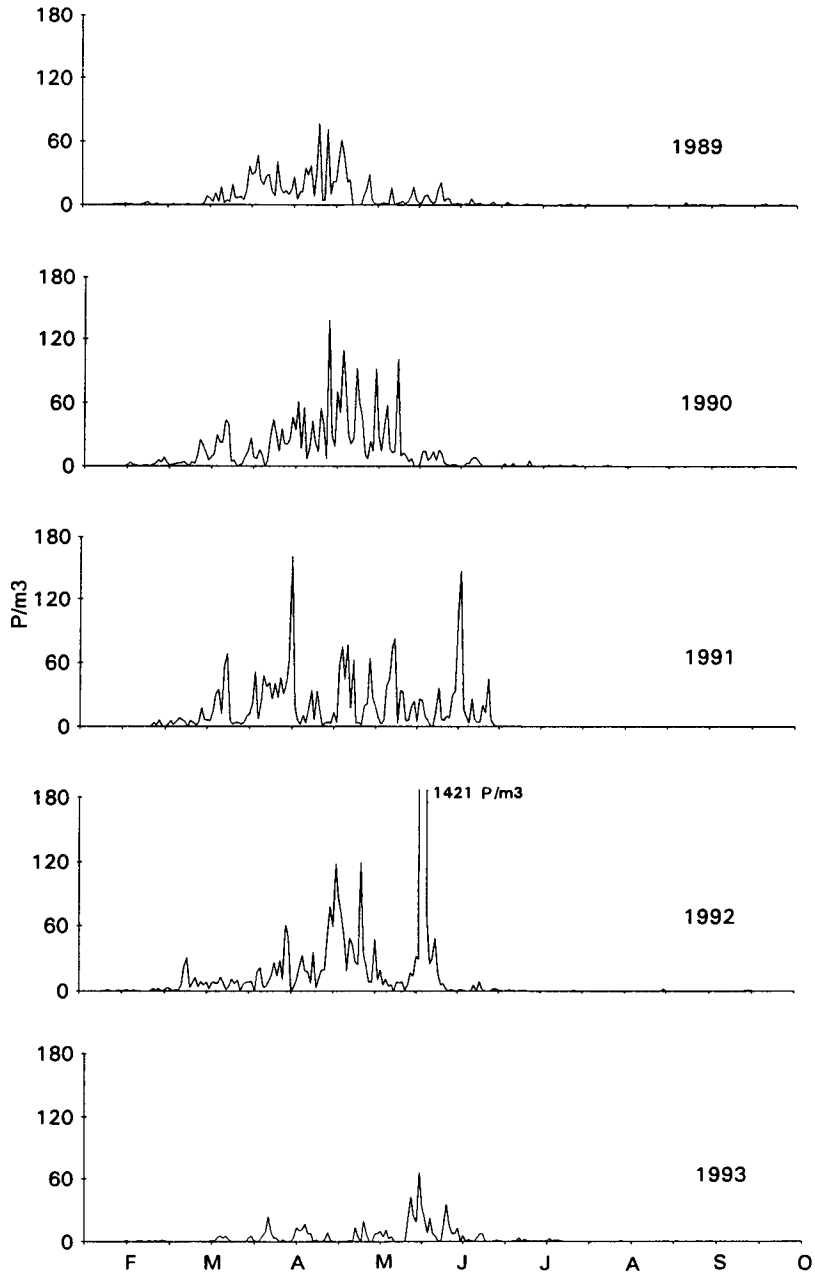

Fig. 4. Oleaceae pollen daily values in the investigated years.

ing increasingly common in northern Italy and in Europe: sensitization to *Fraxinus* and the related symptoms was first described by Lelong et al. (1992) and by Schmid et al. (1992). Guerrier (1993) assessed the role of trees in general, including ash, in inducing allergic respiratory symptoms. According to many authors (Diaz Mateo et al., 1982; Bosquet et al., 1985; Castellana, 1986; Kerneman et al., 1991, 1992; Martin-Orozco, 1994), there is a cross-reactivity between the allergenic proteins of the pollens of certain Oleaceae (*Fraxinus*, *Ligustrum*, *Phyllirea*, lilac) and *Olea*.

Table 1
Characteristics of population analyzed

n	1614
Males, no. (%)	723 (44.8)
Mean age (years ± S.D.)	37.8 ± 14.9
Family atopy, no. (%)	640 (39.6)
Atopy by prick, no. (%)	1044 (66.7)
Asthma[a], no. (%)	905 (56.1)
Rhinitis, no. (%)	709 (43.9)
SPT (+) to *O. europaea*	285 (17.7)

SPT, skin prick test.
[a] Associated with rhinitis in 68% of cases.

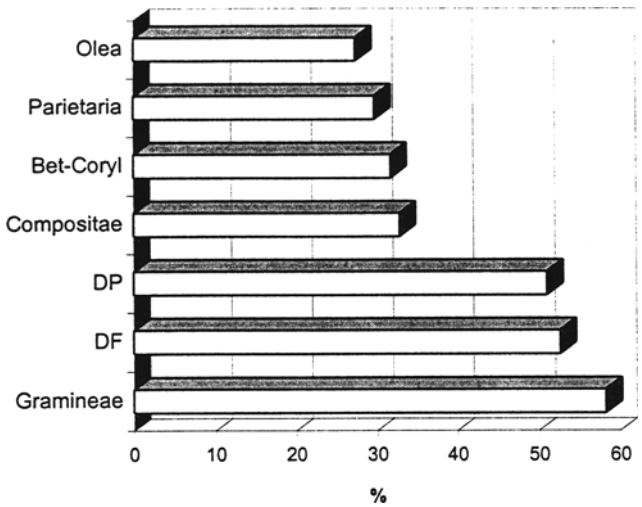

Fig. 5. Percentages of sensitization in atopic patients ($n = 1044$).

In our study, *Olea* sensitization was present in 27.4% of atopic patients with allergic respiratory symptoms: this was slightly higher than that found in other studies done in the Mediterranean area (Macchia et al., 1985; Melillo et al., 1985; D'Amato and Lobefalo, 1989; Fanti et al., 1989); however, very few patients were monosensitized to Oleaceae pollens (1.4%), in accordance with other studies on the subject which found monosenstization prevalences ranging from 1.3 to 12.7% (Cricchio et al., 1987; Atzei et al., 1993; Montane, 1994; Liccardi et al., 1994). In the majority of cases, patients are co-sensitized to various pollens, especially to Gramineae (92.6%), and to house-dust mites, Compositeae, Betulaceae–Corylaceae and *Parietaria*. The high frequency of association of SPT positivity between Oleaceae and Gramineae seems to confirm the findings of Baldo et al. (1992), showing common antigen determinants in olive tree, *Lolium perennis* and *Cynodon dactylon*. However, this proposal is still under discussion and other authors have found different sensitizations associated with Oleaceae, such as *Parietaria* (Cricchio et al., 1987; Liccardi et al., 1994). This would seem to indicate that it is polysensitization that determines SPT positivity also to Oleaceae pollens: the associated species simply reflect the patterns of pollen present in the geographical area considered. The extremely low number of patients with monosensitization to Oleaceae in Trieste could be due to the relatively low levels of airborne Oleaceae pollens in the area.

Table 2
Characteristics of subjects sensitized to *Olea europaea*

n	285
Male, no. (%)	130 (45.6)
Mean age (years ± S.D.)	33.3 ± 13.0
Family atopy, no. (%)	139 (48.8)
Asthma[a], no. (%)	164 (57.5)
Rhinitis, no. (%)	121 (42.5)
Seasonal symptoms (%)	202 (70.9)

[a] Associated with rhinitis in 72.5% of cases.

Allergic respiratory symptoms caused by Oleaceae themselves could be evaluated in monosensitized patients, but there were too few of them to make an analysis worthwhile: the four monosensitized subjects complained of rhinitis in May and symptoms might well be related to the higher concentration of Oleaceae in the air. None had the perennial symptoms reported in Naples by Liccardi et al. (1996a,b, 1997), probably because the concentration of *Olea* grains in the air of Trieste is much lower than in southern Italy. The role of this family of trees in determining allergic respiratory symptoms is presently a minor one in the Trieste area, but in the future, due to the increase in olive tree cultivation, more patients could complain of *Olea*-related symptoms.

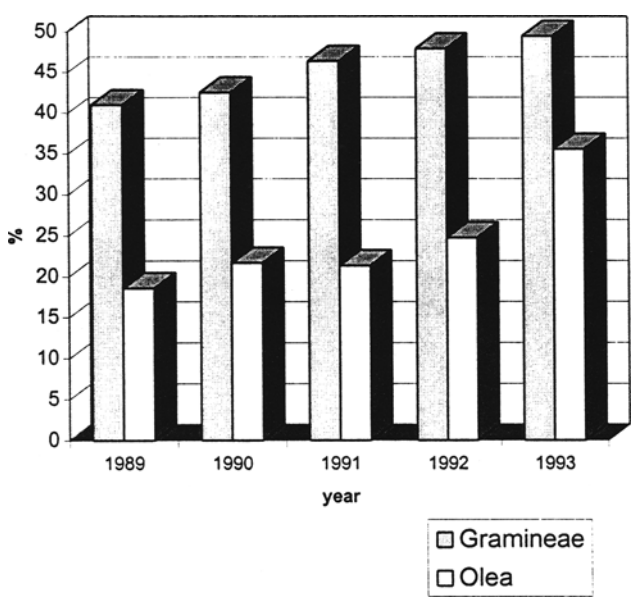

Fig. 6. Skin Prick Test sensitivity in different years.

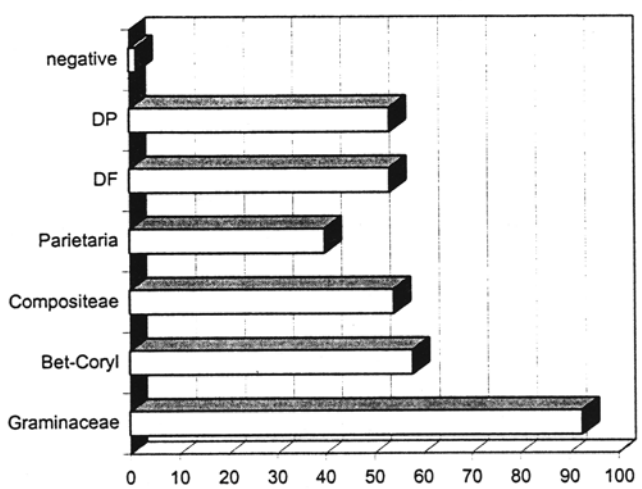

Fig. 7. Sensitizations associated with *Olea*.

It should be pointed out that other studies of sensitization to *Olea* in the Mediterranean area revealed low prevalences of monosensitization (Larese et al., 1992; Atzei et al., 1993; Liccardi et al., 1994); at the same time, the prevalence of SPT positivity was either similar to ours, or lower. This study seems to indicate that the role of Olea pollens is limited compared to that of other plants, even in those regions densely cultivated with olive trees.

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