

Betulaceae and Corylaceae in Trieste (NE-Italy): Aerobiological and clinical data

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Abstract

Airborne pollen produced by Betulaceae and Corylaceae is present in the Trieste area for a long period from January to June, but only in April it does represent a considerable proportion (436 p/m³) of the total pollen count (1193 p/m³). In the years considered (1995–1997), there was a gradual increase in the pollen count of Corylaceae and Betulaceae: from maximum levels of 580 p/m³ in 1995 to 1218 p/m³ in 1997, and the taxon making the most significant contribution to the pollen concentration curve was *Ostrya carpinifolia*.

Sensitization to Betulaceae and Corylaceae was analyzed in 2213 subjects visiting our clinic between January 1st 1995 and December 31st 1997, with allergic symptoms believed to be IgE mediated. Of the group, 1292 (58.4%) were atopic by skin prick test and 328 of them (25.4%) were sensitized to Betulaceae and Corylaceae. Of the 328 subjects, 72.6% were cosensitized to Gramineae, 56.1% to Oleaceae, 42.1% to Compositae, and just over half to house-dust mites (52.1%). Only ten cases were mono-sensitized (3%). Of the subjects sensitized to Betulaceae and Corylaceae, 163 complained of rhinitis (72%) and 110 of asthma (33.6%), often in association with rhinitis; 177 (54%) had only seasonal symptoms. Sensitization to Betulaceae and Corylaceae is high, but its role in inducing allergic respiratory symptoms is difficult to evaluate because almost all patients were sensitized to other pollen types. In conclusion, the role played by this family of trees in determining allergic respiratory symptoms could become increasingly important in this geographical area in the future, if pollen levels continue to rise at their present rates. For the moment, sensitivity to Betulaceae-Corylaceae among the population is present almost exclusively in subjects sensitized also to other pollen types.

1. Introduction

Respiratory allergy to the pollen of Corylaceae and/or Betulaceae is very common in northern European countries, and accounts for 89% of cases of skin sensitization in atopics (Eriksson et al., 1984, 1987). In southern Europe, the role of Corylaceae and Betulaceae in causing allergy may be significant when trees are growing in gardens or near the cities, but levels of skin sensitization are significantly lower (D'Amato, 1989; Spieksma et al., 1986). In Italy,

Negrini (1992) reported this type of sensitization in 7% of atopic patients, in a large-scale study involving 49,660 patients with pollinosis throughout the country; a higher percentage was found by Troise (1992) in Genoa (16%) while other regions scored under 2% (D'Amato and Lobefalo, 1989; Nardi, 1986).

Few data have been published on this type of pollinosis in Trieste, a northern Italian town (Larese et al., 1992), where there can be fairly high levels of Corylaceae and Betulaceae pollen in the air (Rizzi Longo and Cristofolini, 1987) and where natural and

cultivated taxa are frequently present in the urban area and surroundings. *Corylus avellana* L. and *Ostrya carpinifolia* Scop. are widespread in the woodland belt all around the city and in the deciduous oak-woods; *Carpinus orientalis* Mill. is quite common on the sandstone hills behind the city and its pollen is very similar to that of *Ostrya*. *Carpinus betulus* L. is found in only a few areas in humid soil. *Alnus glutinosa* (L.) Gaertner is not so common, but can occasionally be found on the wet plains. Various species of *Betula* are grown in gardens. *Alnus viridis* (Chaix) DC. is not present in this area, but its pollen arrives from the mountains carried by the wind.

In order to evaluate the role of Corylaceae and Betulaceae pollen in this area, airborne pollen sampling data (1995–1997) were compared to the results of skin prick tests analysed 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, and is surrounded by the steep slopes of the Karst highland (200–300 m. a.s.l.). From 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), with a narrow range of calcareous rocky slopes facing the sea covered by thermophilic evergreen vegetation (*Ostryo-Quercetum ilicis* Trinaistic, the Illyric-Mediterranean brush), while on the sandstone hills behind the city there are deciduous types of oak (*Seslerio autumnalis-Quercetum petraeae* Poldini); on the Karst highland, the vegetation is mainly of the broad-leaved Karst type (*Ostryo-Quercetum pubescentis* (Ht.) Trinaistic), rich in Illyric species.

Pollen was collected in 1995, 1996 and 1997, between January 15th and October 15th, using a volumetric Hirst-type 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; Rizzi Longo et al., 1992). The slides were prepared, and the data were interpreted according to the standard method of the Italian Association for Aerobiology.

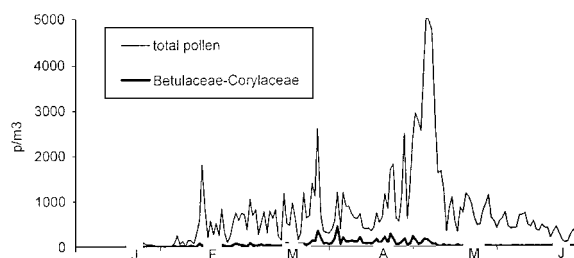


Figure 1. Total and Betulaceae-Corylaceae airborne pollen concentration; daily means 1995–1997.

The study population consisted of 2213 subjects of both sexes (age range 14–70 years) visiting consecutively to our clinic between January 1st 1995 and December 31st 1997 with allergic 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 (house dust mites *Dermatophagoides pteronyssinus* and *farinae*, cat and dog dander, *Alternaria*, *Cladosporium* and *Aspergillus*) and pollen (Poaceae, Compositae, *Parietaria*, Corylaceae-Betulaceae, and *Olea europaea*) produced by Lofarma Allergeni-Milano. Corylaceae and Betulaceae extract consists of equal parts of *Betula pendula*, *Ostrya virginiana*, *Corylus avellana*, and *Alnus incana*. Skin reactions were read after 15 minutes using a millimeter rule. The wheal 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 the diameter was ≥ 3 mm. Atopy was defined as a positive reaction to at least one common allergen. Symptoms were defined as seasonal when they were present only during certain months of the year, from January to October.

3. Results

3.1 Aerobiological aspects

In the years examined (1995–1997), the daily airborne pollen content of the city of Trieste began to rise every year at the end of January; peaks occurred in March (~ 3000 p/m³) and May (~ 5000 p/m³). In early May, the average daily pollen count always exceeded 1000 p/m³ (Figure 1). The airborne pollen level decreased from June onwards, but mean daily values still remained above 100 p/m³ until the end of August. From September onwards, mean pollen content gradually decreased.

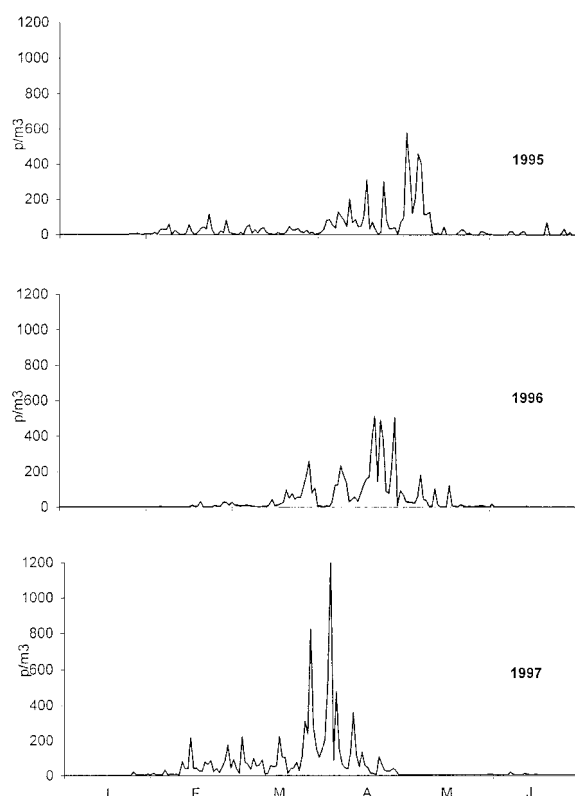


Figure 2. Daily average pollen concentrations, for Betulaceae-Corylaceae, in individual years 1995, 1996, 1997.

Pollen from Corylaceae and Betulaceae is present in the area for a long period from January to June, but only in April does it represent a considerable proportion (436 p/m³) of the total daily pollen count (1193 p/m³). In the individual years considered, the pollen curve of Betulaceae and Corylaceae varies to some extent (Figure 2). In 1995, airborne pollen presence began at the end of January and finished with *Alnus viridis* in June, while in 1996, it began in February and finished earlier in June. In 1997, *Alnus glutinosa* and *Corylus avellana* pollen presence started on January 25th and Betulaceae and Corylaceae finished in April. There was a significant amount of pollen present between February and mid-April.

Alnus glutinosa pollen was present from the middle of January to the middle of April with daily peaks of 56 pollen grains/m³ (p/m³) in 1995 and 133 p/m³ in 1996; *Betula* was present in March, April and May with daily peaks of 58 p/m³ in 1995 and 107 p/m³ in 1996. *Corylus avellana* pollen was present from the end of January to the middle of April with daily peaks of 61 p/m³ in 1995 and 175 p/m³ in 1996.

Table 1. Characteristics of the population of analyzed subjects

N.	2213
male n. (%)	930 (42.0)
mean age (years $\pm$ SD)	39.3 $\pm$ 16.1
family atopy n. (%)	907 (41.0)
atopy by prick n. (%)	1292 (58.4)

Ostrya carpinifolia gave the highest contribution to pollen count with high levels from the end of March to the end of May peaking at 1135 p/m³ in 1997.

In 1995, airborne pollen presence of Betulaceae and Corylaceae was abundant, lasting until the end of June. There were three peaks, the first in mid-February, with 116 p/m³, mainly consisting of pollen of *Alnus glutinosa* and *Corylus avellana*, the second on May 1st, with 580 p/m³, principally due to pollen of *Ostrya carpinifolia*, and the third in mid-June, with 71 p/m³, mostly due to pollen of *Alnus viridis*.

In 1996 too, the same principal pollen types were identified, but the period of pollen presence was shorter. The period of *Alnus*, *Corylus* and *Ostrya* gives daily peaks of 175 p/m³ on March 28th. Airborne pollen concentration was particularly high (with a peak of 511 p/m³) on April 20th, almost entirely due that year to *Ostrya carpinifolia* pollen (463 p/m³).

The pollen curve in 1997 was characterized by an abundance of pollen of Betulaceae and Corylaceae, with a daily maximum of 1218 p/m³ principally made up of *Ostrya*, which made its first appearance in March and reached a maximum level of 1135 p/m³ on April 4th. The taxon making the most significant contribution to the pollen presence of the Corylaceae and Betulaceae was *Ostrya carpinifolia*.

In the years considered, there was a gradual increase in the daily concentration of pollen from Corylaceae and Betulaceae: from maximum levels of 580 p/m³ in 1995, there was an increase to 1218 p/m³ in 1997. As mentioned previously, pollen presence of *Ostrya* was extraordinarily high in April 1997, with a peak of 1135 p/m³.

3.2 Clinical aspects

Table 1 summarizes the characteristics of the population studied. The mean age of the 2213 subjects tested was 39.3 $\pm$ 16.1 years, and women were in the majority (58%). Of the group, 1292 (58.4%) were atopic by

Table 2. Characteristics of the atopic subjects

N.	1292
male n. (%)	623 (48.2)
mean age (years $\pm$ SD)	36.1 $\pm$ 14.5
SKIN PRICK TEST POSITIVITY	
House dust mites (%)	640 (50.7)
Pollen (%)	1012 (78.3)
– Poaceae (%)	685 (53.0)
– Betulaceae and Corylaceae (%)	328 (25.4)

Table 3. Characteristics of subjects sensitized to Betulaceae and Corylaceae

N.	328
male n. (%)	165 (50.3)
mean age (years $\pm$ SD)	36.4 $\pm$ 13.3
family atopy n. (%)	164 (50.0)
asthma* n. (%)	110 (33.6)
rhinitis n. (%)	163 (49.7)
conjunctivitis, pharyngitis, urticaria (%)	55 (16.9)
seasonal symptoms (%)	177 (54.0)

*associated with rhinitis in 71.8% of cases.

SPT (skin prick test) and 328 (25.4%) were sensitized to *Betulaceae* and *Corylaceae* pollen. The characteristics of atopic patients are reported in Table 2. Pollen sensitivity was the most frequent positive response, with 78.3% of subjects positive, followed by sensitization to house-dust mites (50.7%). Positivity to other pollen types tested ranged from 11% to 36.5%, with percentages higher for *Oleaceae* and lower for *Platanaceae*.

Table 3 shows the characteristics of the subjects with positive skin prick response to *Betulaceae* and *Corylaceae*. Of these 328 subjects, 50.3% were male, the mean age was 36.4 $\pm$ 13.3 years, and 164 had a family history of atopy (50%); 163 complained of rhinitis (49.7%) and 110 of asthma (33.6%), often in association with rhinitis (71.8%). Of this group, 177 (54%) had only seasonal symptoms, while the remaining 151 (46%) complained of perennial symptoms. Sensitizations associated with *Betulaceae* and *Corylaceae* are reported in Table 4. Of the 328 subjects, 72.6% were sensitized to *Gramineae*, 56.1% to *Oleaceae*, 42.1% to *Compositae*, and just over half to house-dust mites (52.1%). Only ten cases were mono-sensitized (3%): of these, five complained of

Table 4. Sensitization associated to *Betulaceae* and *Corylaceae* skin prick test positivity (n. 328)

HOUSE DUST MITES	
<i>Dermatophagoides farinae</i> (%)	163 (49.7)
<i>Dermatophagoides pteronyssinus</i> (%)	171 (52.1)
DANDER	
Cat (%)	126 (38.4)
Dog (%)	138 (42.1)
POLLEN	
Poaceae (%)	238 (72.6)
<i>Parietaria</i> (%)	184 (56.1)
<i>Oleaceae</i> (%)	141 (43.0)
<i>Compositae</i> (%)	138 (42.1)
<i>Cupressaceae</i> (%)	112 (34.1)
<i>Platanaceae</i> (%)	107 (32.6)

rhinitis, three complained of asthma (associated in two cases with rhinitis), one had conjunctivitis and one urticaria. Eight reported having symptoms from mid-January to April, while the other two reported perennial symptoms despite absence of sensitization to perennial allergens.

4. Discussion

Betulaceae and *Corylaceae* pollen in the Trieste area is present in the air from January to June with a relevant peak in April, accounting for 30% of the total pollen airborne content in April, with levels increasing over the three years considered.

It is well-known that *Betulaceae* and *Corylaceae* pollen can cause allergic respiratory symptoms in sensitized subjects, particularly in the northern areas of Europe where this airborne pollen presence reaches very high levels for long periods (Eriksson et al., 1984, 1987). In our region the most common airborne pollen type is *Ostrya carpinifolia*, present at high levels in the month of April in the Trieste area. It is an allergenic pollen type that has acquired increasing clinical relevance in Italy over the last few years. Epidemiological data suggest that individuals allergic to *Ostrya* pollen are also allergic to other *Corylaceae* and *Betulaceae* pollen. This cross reactivity may be caused by common epitopes present in the allergens of all the trees belonging to the two botanically related families (Patriarca et al., 1998). Indeed, the biochemical characterization of hop-hornbean pollen, together with

the analysis of the immunochemical cross-reactivity, strongly indicate a high degree of similarity with pollen of other trees of Betulaceae and Corylaceae families, suggesting a common tridimensional structure leading to a cross-reaction within the major allergens from *Ostrya carpinifolia*, *Betula* and *Corylus* (Patriarca et al., 1998).

In our study, sensitisation to pollen of Betulaceae and Corylaceae was present in 25.4% of atopic patients with allergic symptoms: this was higher than that found in other studies done in Italy (Nardi et al., 1986; Troise et al., 1992; Ariano et al., 1994; Negrini and Arobba, 1992) and lower than data for northern Europe (Eriksson et al., 1984); however, in line with other studies, few patients (only 3%) were monosensitized to Betulaceae and Corylaceae pollen (Troise et al., 1992). In the majority of cases, patients are co-sensitized to various pollens, especially to Gramineae (72.6%), and to house-dust mites, Compositae, Oleaceae and *Parietaria*.

The allergic respiratory symptoms caused by Betulaceae and Corylaceae themselves were evaluated in the monosensitized patients, but there were too few of them to make such an analysis worthwhile.

In conclusion, the role played by this family of trees in determining allergic respiratory symptoms could become increasingly important in this geographical area in the future, if pollen levels continue to rise at their present rates. For the moment, sensitivity to pollen of Betulaceae-Corylaceae among the population is present almost exclusively in subjects sensitized also to other pollen types.

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