

The importance of hornbeam (*Carpinus* sp.) pollen hypersensitivity in spring allergies

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(Received 27 October 1999; accepted in final form 6 January 1999)

Key words: allergy, *Betula*, birch, *Carpinus*, hornbeam, pollen

Abstract

Hornbeam (*Carpinus* sp.) flowering occurs generally simultaneously with birch anthesis. While birch pollen is known as the major tree-allergen in central and northern Europe, the quantitative and qualitative role of hornbeam pollen in allergy has not been evaluated. In some regions of Switzerland, the annual ratio hornbeam SPI / birch SPI reaches 20–30% on average, and 50–180% some years. The relative importance of hornbeam pollen hypersensitivity has been evaluated in more than 200 patients suffering from spring allergies to pollen during the last five years (1993–1997) in the region of Geneva. Among symptomatic patients during the March–April period, 73.5% were hypersensitive to Betulaceae pollen. Overall, 71.7% of the patients allergic to Betulaceae pollen were found to be sensitive to hornbeam, and 12.5% of the same group of patients were sensitive to hornbeam pollen only. Among this last group, half of the patients, besides allergic rhino-conjunctivitis, were also suffering from asthma. Hornbeam pollen is abundant and appears to have a significative importance in spring allergies. In some cases, specific immunotherapy to hornbeam pollen should perhaps be considered.

1. Introduction

Hornbeam (*Carpinus*) is a member of the family Betulaceae, like birch (*Betula*), alder (*Alnus*) and hazelnut (*Corylus*). Hornbeam trees are abundant all over the Swiss Plateau at low altitudes (Welten and Sutter, 1982). Previous data indicate that in some regions of Switzerland hornbeam flowering occurs simultaneously with birch anthesis and that in some years hornbeam pollen is more abundant in the air than birch pollen (Clot, 1996). While birch pollen is known as the major tree-allergen in central and northern Europe (D'Amato et al., 1992), the role of hornbeam pollen as allergen is not very well established. Previous studies have shown that cross-allergies exist between hornbeam and birch pollen, but also that distinct allergens and sensitivity exist for hornbeam (Dunoyer-Geindre

et al., 1993; Ramirez et al., 1997; Sparholt et al., 1997; Gumowski et al., 1998).

The aim of this work was to evaluate the clinical significance and the importance of hornbeam pollen hypersensitivity compared to that of birch pollen hypersensitivity.

2. Material and methods

Pollen data from the Basle area (1969–1997) and the Geneva area (1979–1984, 1989–1997) were used. Sources of data are Dr. R.M. Leuschner and the Swiss Society for Aerobiology (1969–1992) and the Swiss Meteorological Institute (1993–1997). Data are expressed as daily mean concentrations (P/m³) and Seasonal Pollen Index (SPI: sum of daily mean concentrations) (Mandrioli et al., 1998; Comtois, 1998).

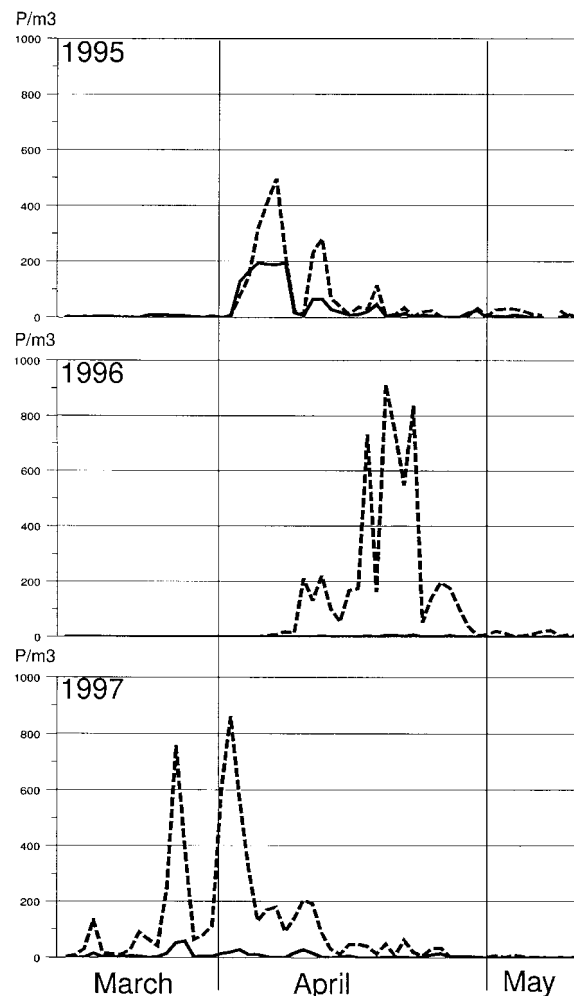


Figure 1. Hornbeam (continuous line) and birch (dashed line) in the air of Geneva: three years example.

Allergic hypersensitivity to birch and hornbeam pollens was studied in 207 patients with early seasonal rhino-conjunctivitis and/or asthma attending the Allergology and Clinical Immunology Department of the Hôpital de La Tour, Meyrin-Geneva, between 1993 and 1997.

Evaluation criteria for hypersensitivity diagnosis: (1) symptoms occurrence and correlation with pollen data and (2) positive prick-test to one or more Betulaceae pollen and (3) presence of specific IgE to suspected pollen and/or positive ocular provocation tests (OPT).

Allergens *in vivo*: Stallergènes-Pasteur® prick-tests at following concentrations: *Betula*, *Corylus* and *Alnus* 100 ST-IR/ml, *Carpinus* 1:20 P/V.

OPT were done using increasing serial dilutions of the involved pollen(s) prepared from lyophilised extracts (max. 50 IR/ml or 1:200 P/V).

Specific IgE tests: Alastat DPC® liquid phase method using standardised birch, hazelnut and alder DPC® allergens. Detection of specific IgE towards hornbeam were done using an "in house" hornbeam pollen extract prepared for the Alastat DPC® method and/or an "in house" ELISA (antigen concentration for coating 1 mg/ml, 100 µl/well).

3. Results

3.1 Pollen records

Hornbeam pollen concentrations detected varied enormously from one year to another. The kinetics of those variations were similar in Basle and Geneva. Airborne pollen presence of hornbeam and birch during the period of the study were found to occur in general simultaneously (Figure 1). In some years, the first hornbeam pollen grains were recorded before birch pollen. The average annual ratio hornbeam SPI / birch SPI was in Geneva of 21.5% (1979–1984 and 1989–1997). In 1983 and 1995, this ratio was even over 50% (Figure 2a). In the Basle region, the same average ratio reached 30.5%. In some years, such as in 1983 and 1995, hornbeam pollen was even more abundant than birch pollen (Figure 2b). During the clinical study period, the average ratio hornbeam SPI / birch SPI was only of 14.7% in Geneva. This was due to three very low hornbeam SPI in 1994, 1996 and 1997, which counterbalanced a very high hornbeam SPI in 1995. In contrast, birch SPI were stable in 1993, 1994 and 1995, and twice more important in 1996 and 1997.

3.2 Epidemiological investigations

Among the 207 patients having allergic respiratory symptoms during the birch and hornbeam flowering, 73.5% ($n = 152$) were found to be hypersensitive to at least one Betulaceae pollen. From this group, 59.2% ($n = 90$) were sensitive to hornbeam and birch pollen. Nineteen patients (12.5%) were sensitive to hornbeam pollen but not to birch: negative skin test and OPT and absence of specific IgE towards birch. Twenty-seven patients (17.8%) were sensitive to birch pollen but not to hornbeam: all tests negative for hornbeam. Sixteen patients (10.5%) were found to be sensitive to other Betulaceae pollen (Table 1). Among the patients

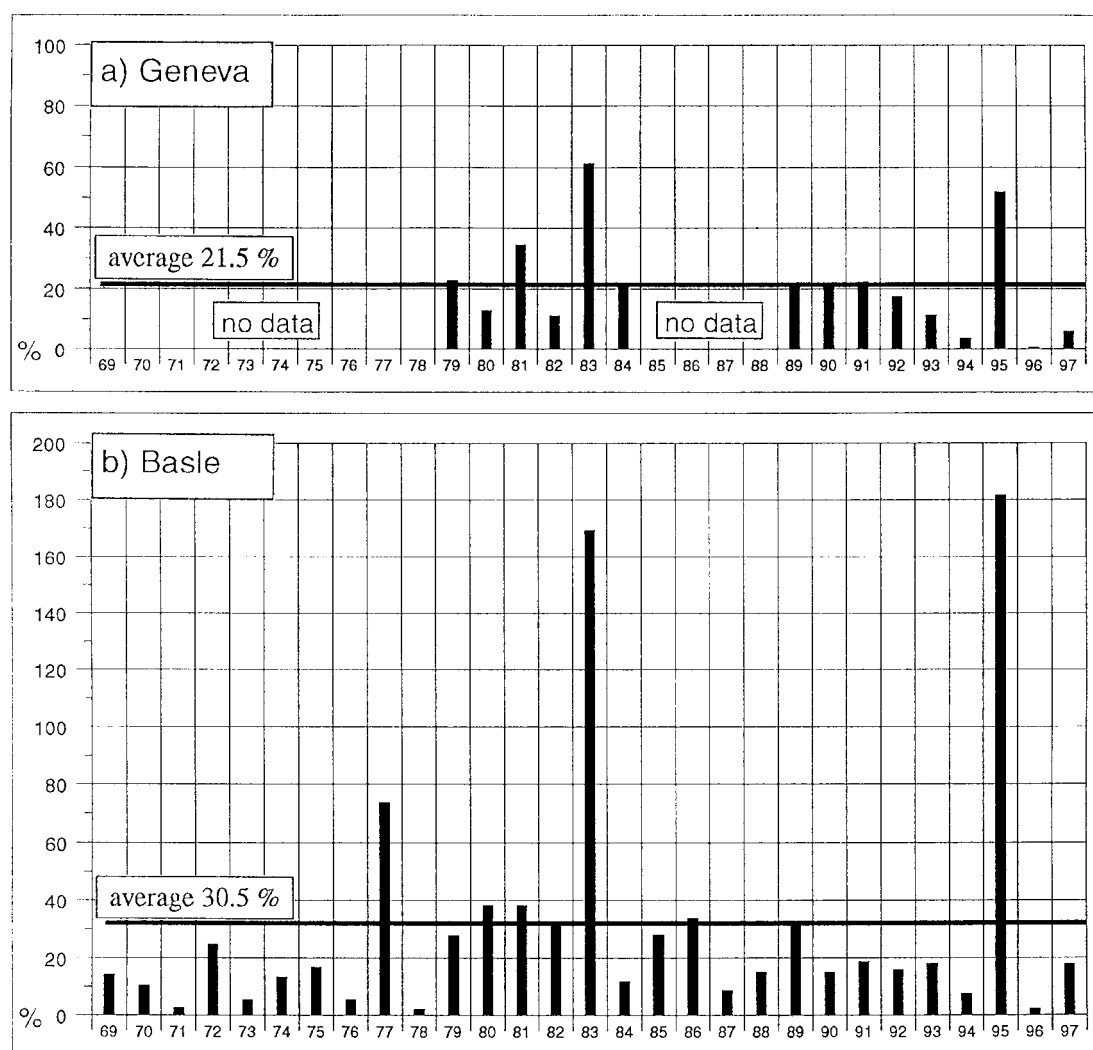


Figure 2. Estimation of relative hornbeam abundance in the air: ratio hornbeam SPI / birch SPI: (a) in Geneva, (b) in Basle.

sensitive only to hornbeam pollen, near 50%, besides being allergic rhino-conjunctivitis, were also suffering from asthma.

4. Discussion

Hornbeam represents in Switzerland an important part of Betulaceae pollen present in the air during spring-time in March and April, while most of hazel (*Corylus sp.*) and alder (*Alnus sp.*) flowerings occur in February. The occurrence of exceptionally high peaks of hornbeam flowering is not well explained. Those variations in hornbeam SPI occurred similarly all along the 250 km of the Jura Mountains and the Swiss Plateau,

thus excluding local or instrumental aberrations and suggesting more the conjunction of meteorological and botanical factors.

Among the recruited pollinic patients who were symptomatic during the March-April period and which were sensitive to Betulaceae pollen, more than 71% were found to be reactive to hornbeam pollens and 59.2% were found to be sensitive to both birch and hornbeam pollen.

While cross-sensitivity between Betulaceae genera is not surprising, there were however 12.5% of Betulaceae sensitive patients who were reactive exclusively to hornbeam pollen with no objectivable response to birch pollen. In contrast, 17.8% of the Betulaceae sensitive patients were sensitive to birch but not to

Table 1. Results of the clinical investigations.

Patients characteristics	Number of patients	%	%
Patients with recorded allergic symptoms during birch and hornbeam flowering	207	100	
Patients hypersensitive to at least one Betulaceae pollen	152	73.5	100
Patients hypersensitive to hornbeam and birch pollens	90		59.2
Patients hypersensitive to hornbeam but not to birch pollen	19		12.5
Patients hypersensitive to birch but not to hornbeam pollen	27		17.8
Patients hypersensitive to other Betulaceae but neither to birch nor to hornbeam pollen	16		10.5

hornbeam pollen. It is also interesting to note that similar observations were made for other Betulaceae pollen present in the studied area, *i.e.* for hazel and/or alder pollens to which 10.5% of the patients were exclusively sensitive.

This preliminary study suggests that the role of hornbeam pollen in inducing allergic symptoms is perhaps underestimated. Two facts could probably explain an underestimation: (1) routine commercial test for hornbeam allergy screening is not available, and (2) the simultaneous occurrence of hornbeam and birch pollen does not allow the recognition of specifically hornbeam pollen induced allergy symptoms. This study also confirms that monospecific sensitivity to hornbeam pollen also occurs. In such cases, the use of cross-reactive allergens, which are thought to be usually sufficient and adequate both for diagnosis and specific immunotherapy of Betulaceae pollens hypersensitive patients (Valenta et al., 1996), might not be effective. Until further studies clarify this assertion, specific hornbeam pollen should be included in spring allergy screening. A specific sensitivity to hornbeam pollen should probably also be looked at in case of unsatisfactory response to a standard birch pollen immunotherapy. Long-term follow-up studies should be undertaken to evaluate the need for a specific immunotherapy to hornbeam pollen.

5. Conclusion

In some regions as at lower altitudes in Switzerland, hornbeam pollen is abundant and appears to have a significative importance in spring allergies, from the quantitative and the qualitative points of view.

Acknowledgements

This work was supported by the Swiss Society of Aerobiology and by a grant from the ADRIA.

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