

Variation in pollen concentration of the most allergenic taxa in Poznań (Poland), 1995–1996

Alicja Stach

Allergic Diseases Diagnostic Center, University of Medical Sciences, Poland
(e-mail: ambrozja@man.poznan.pl; fax: +48 61 8520671)

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Abstract

The airborne pollen concentration of the four most frequent and most allergenic taxa in Poland; *Alnus*, *Betula*, Poaceae, and *Artemisia* at Poznań in the years 1995–1996 has been analyzed, using a Hirst-type volumetric spore trap. The appearance of the earliest pollen producing taxa was observed as early as January and February, which is relevant information for people subject to allergies in the Poznań region, where Spring usually begins in March. The periods of high and very high pollen concentration of individual taxa have been compared for the two years.

Introduction

Aeropalynologic monitoring, using the gravimetric method with the application of a Durham trap was started in Poznań in 1992. In 1995, measurements were started of pollen and some sporomorphs concentration using a Burkhard trap. The chief long-term goal of this research is to construct a pollen calendar and to establish a forecasting pollen concentration model of the most frequent and allergenic taxa in Poznań and Wielkopolska.

The aim of the study is to compare the seasonal fluctuations of concentrations of the four most allergenic taxa in Poznań during the two years under study. The numbers of days with high and very high pollen concentrations within the critical period are also shown.

Material and methods

Poznań is the capital of Wielkopolska, an agricultural region situated in mid-western Poland. According to Bartkowski (1970), Poznań is located in an area of western circulation. However, the region is open to continental climatic influences. Winds from the west predominate, mainly from W and SW directions.

Mean annual temperature in Poznań (for the years 1951–1990) was 8 °C (Wos', 1994). Mean precipitation in the same period was 528 mm and mean annual number of hours of actual insolation in the years 1966–1980 was 1,524 hours (mean annual 24-hour insolation was 4.2 hours).

In the near neighbourhood of the trap are tree-lined streets and small parks with: *Acer platanoides*, *A. pseudoplatanus*, *Aesculus hippocastanum*, *Betula pendula*, *Fraxinus excelsior*, *Platanus hispanica*, *Populus alba*, *P. nigra*, *Quercus robur*, *Sorbus aucuparia*, *Tilia cordata* and small patches of grass and ruderal vegetation.

Pollen counts have been taken with Burkhard 7-day volumetric trap (Hirst, 1952). The device was mounted about 36 m above the ground, at about 72 m above sea level, in an old district of compact tenement-houses in the city center. Co-ordinates: latitude N 52°24'34", longitude E 16°55'20". Melinex tape was covered with adhesive mix of glycerine, vaseline, liquid paraffin and toluene. The tape was cut into 7 straps; for slide mounting gelvatol was used. Daily readings were taken for 12 vertical straps (Airborne Pollens and Spores, BAF, 1994). The data were prepared using STATISTICA™PL software (StatSoft Polska), Grapher 2.0 and presented graphically using along the IAA guidelines (Comtois, 1998).

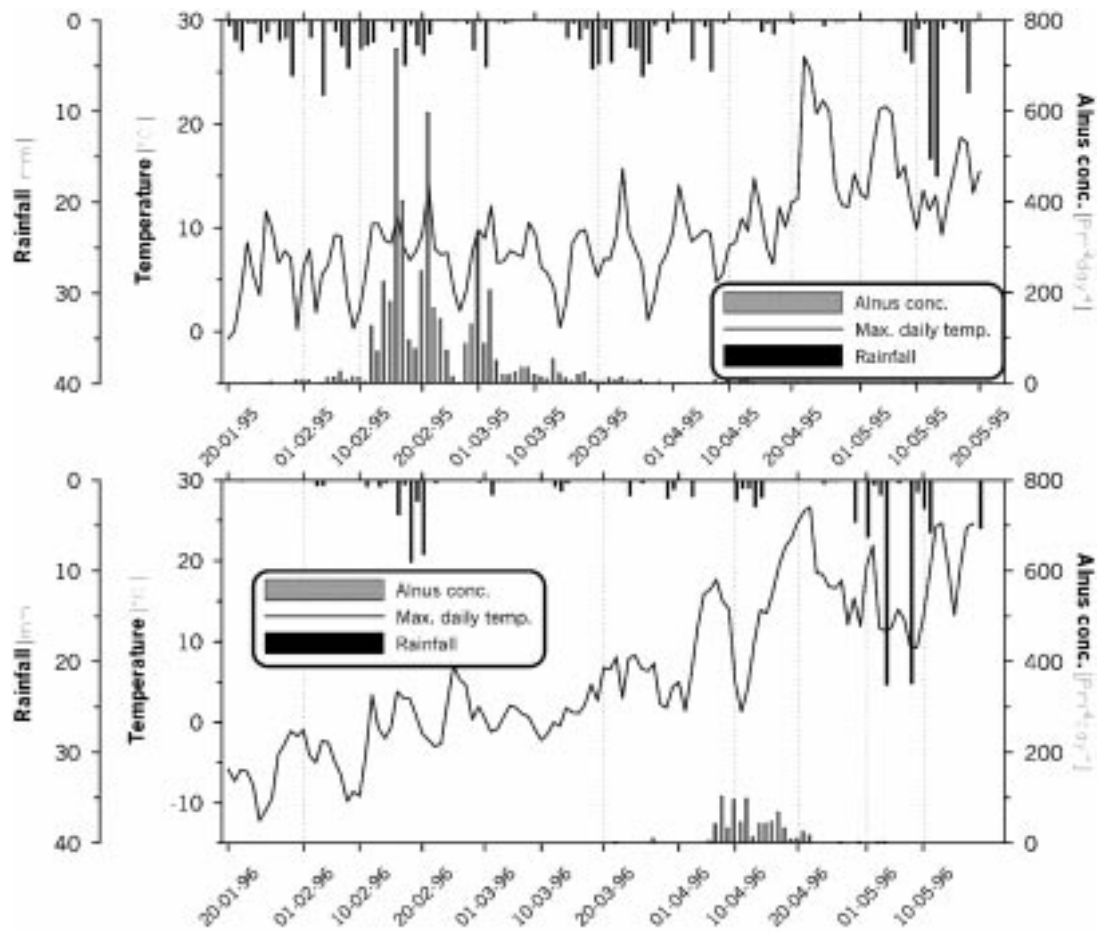


Figure 1. Pollen concentrations of *Alnus* in Poznań, 1995 and 1996 and selected weather elements.

Table 1. Selected values characterizing pollen season in 1995 and 1996 in Poznań

Taxa	Year	Duration (days)	Seasonal Pollen Index (pollen grains)	Main pollen period (days)	Days with concentration $>50 \text{ Pm}^{-3}\text{day}^{-1}$	Days with concentration $>100 \text{ Pm}^{-3}\text{day}^{-1}$
Alnus	1995	80	4612	30	19	12
	1996	42	793	20	7	1
Betula	1995	66	5488	15	19	9
	1996	71	12747	14	26	12
Poaceae	1995	125	5234	58	28	17
	1996	126	3942	68	23	10
Artemisia	1995	66	1603	32	32	3
	1996	55	1778	24	13	7

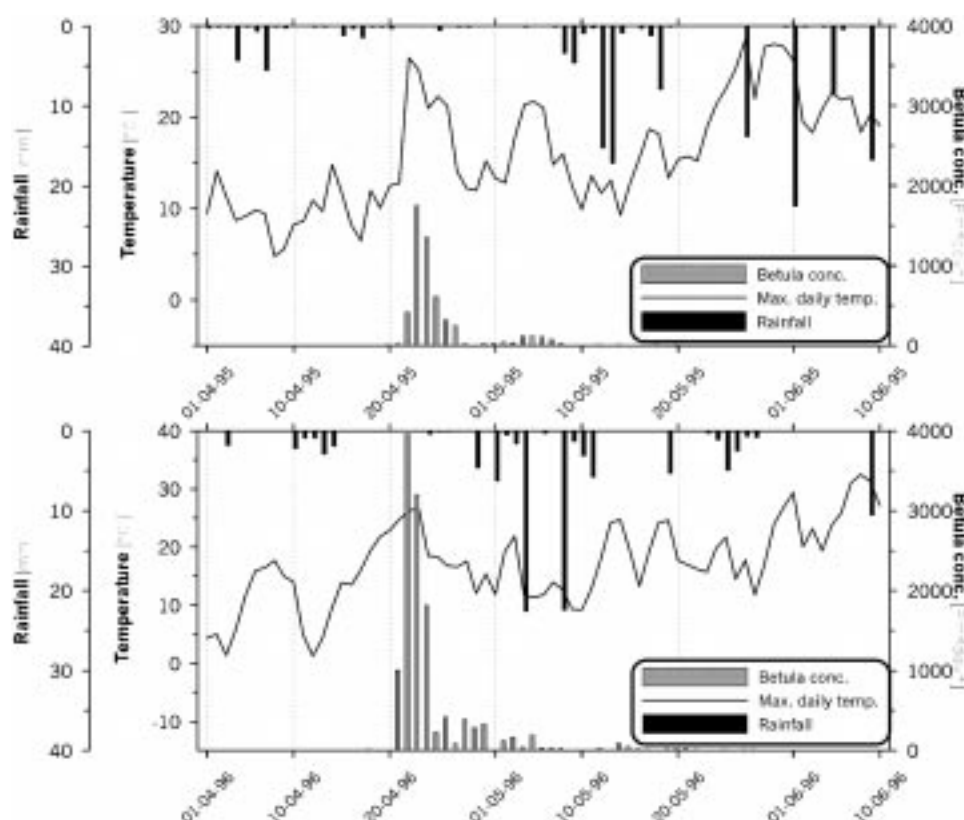


Figure 2. Pollen concentrations of *Betula* in Poznań, 1995 and 1996 and selected weather elements.

Results and discussion

During the two years of analysis, 55 taxa were registered. The concentrations of the four most frequent and most allergenic taxa in Poland: *Alnus*, *Betula*, *Poaceae*, and *Artemisia* (Obtułowicz et al., 1991; Obtułowicz, 1994; Szczepanek et al., 1995) are shown with regard to selected weather elements.

In 1995, the first pollen grains of alder (*Alnus*) were recorded as early as January 26, and in 1996 on March 18. *Alnus* pollen is considered a serious cause of allergy in Europe (D'Amato, Spieksma, 1990; Spieksma, Frenguelli, 1991). In 1995, annual sum of daily average concentrations was 4612 pollen grains, i.e., six times more than in the next year (Figure 1). The maximum of daily concentration of alder pollen was seven times higher in 1995 than in 1996 – on February 16 it reached $738 \text{ Pm}^{-3}\text{day}^{-1}$. In 1996 the main pollen period of alder was noted during 30 days in Poznań, while in the previous year only during 20 days. Pollen concentrations above $50 \text{ Pm}^{-3}\text{day}^{-1}$ were observed on 19 days in 1995 and during 6 days in

1996, while concentrations above $>100 \text{ Pm}^{-3}\text{day}^{-1}$ were recorded 12 and 1 days, respectively (Table 1). The influence of weather conditions on pollen concentration was noted in 1995 on February 17, 18, 24, and 25 (Figure 1). Then rapid decreases in the pollen concentration occurred because of cool and wet days. *Betula* pollen is the most frequent and the most allergenic in North and Central Europe (D'Amato, Spieksma, 1990; Vik et al., 1991). The first grains of birch (*Betula*) pollen were recorded on April 16 in both years in Poznań. The peak of pollen concentration occurred in both seasons, as in previous years (Stach, 1996) between April 21 and 27. The maximum daily concentration for 1996 was recorded on April 22 ($3,958 \text{ Pm}^{-3}\text{day}^{-1}$) and was 2.2 times higher than in 1995 ($1,751 \text{ Pm}^{-3}\text{day}^{-1}$ – April 23). In 1996, the annual total of pollen grains was 2.3 times higher than in 1995. In both years during the period of maximum concentration, maximum daily temperatures up to 25°C were recorded, with daily means of 20°C . In both years during the peak period no rainfall was recorded. The influence of rain on the concentration

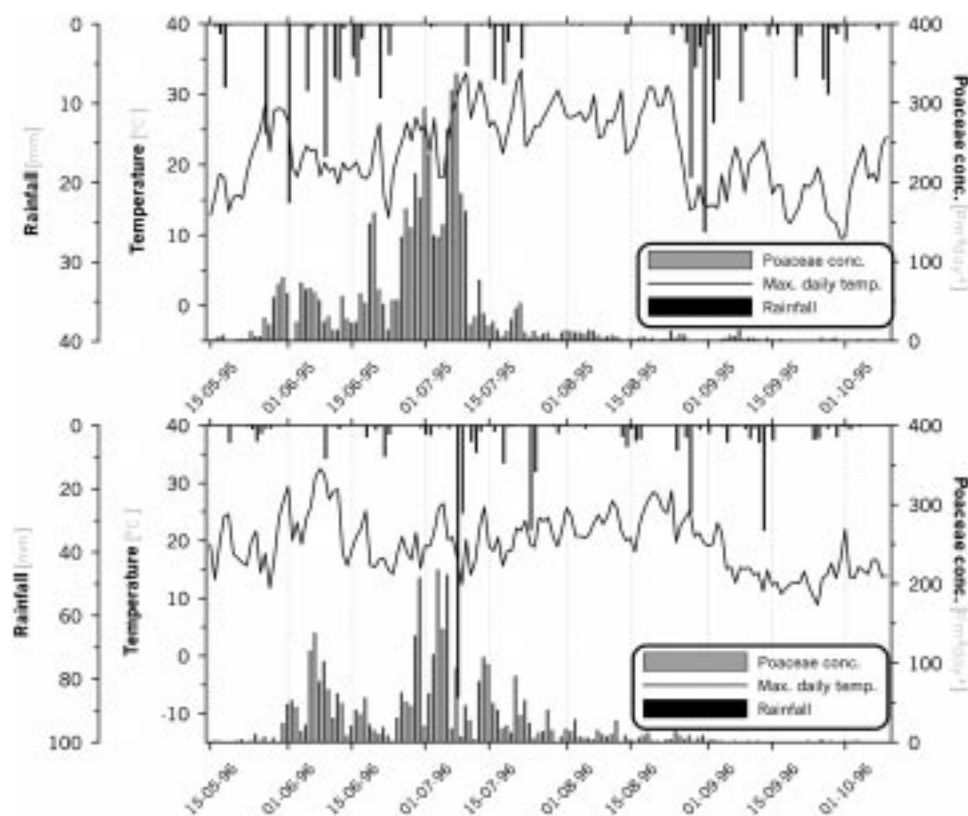


Figure 3. Pollen concentrations of Poaceae in Poznań, 1995 and 1996 and selected weather elements.

of birch pollen is clearly shown in Figure 2. In 1995, birch pollen was registered on 66 days, while only 15 days made up the main pollen period. Similar values were recorded in 1996 (Table 1).

Poaceae pollen is a cause of allergy in considerable part of Europe (Weeke and Spieksma, 1991; Emberlin et al., 1993). In Poland many patients suffer allergy to grass and cereals pollen (Obtułowicz et al., 1990; Samoliński et al., 1996; Rapiejko, 1996). Studies carried out in Poznań and Wielkopolska confirm these observations (Silny et al., 1997; Siatecka et al., 1998). In Wielkopolska, 66% of the area is under farming. 72% of the crops constitute cereals, i.e., rye, Polish triticale varieties, wheat, oats, barley, and *Dactylis glomerata* grown for seed, 8% are meadows and pastures.

Slight differences were found in the time of appearance of grass (Poaceae) pollen grains in Poznań (Figure 3). In 1995, the first pollen grains were recorded in April, yet in both years regular occurrence was observed between May 10 and 20. In both cases, grass and cereals pollen was present for 121 days (main pollen period for 56 days in 1995). The maximum daily

concentration in 1995 was recorded on July 8 ($337 \text{ Pm}^{-3}\text{day}^{-1}$), and in 1996 – July 4 ($218 \text{ Pm}^{-3}\text{day}^{-1}$). In 1995, concentrations exceeded $100 \text{ Pm}^{-3}\text{day}^{-1}$ for 17 days, and the concentration was higher than $50 \text{ Pm}^{-3}\text{day}^{-1}$ for 30 days. Between June 24 and July 15, almost no rainfall was recorded and the maximum temperature only fell below 20°C for one day. The summer of 1996 was cold and rainy. Concentration $>100 \text{ Pm}^{-3}\text{day}^{-1}$ were recorded in 1996 for only 10 days (Table 1).

In Poland, as in many European countries (D'Amato and Spieksma, 1990; Spieksma and Von Wahl, 1991), the pollen of mugwort (*Artemisia*), is a cause of allergy. In Wielkopolska weeds-related allergic reactions were most frequent for mugwort pollen (Silny et al., 1997; Siatecka et al., 1998).

A two-week difference in appearance of mugwort pollen was noted on July 20 in 1996 in the comparison with 1995, July 5 (Figure 4).

In 1995, 90% of mugwort pollen occurred during 32 days, and in 1996 during 24 days. The cause of differences are most probably associated with the colder summer in 1996 than in 1995. The maximum tem-

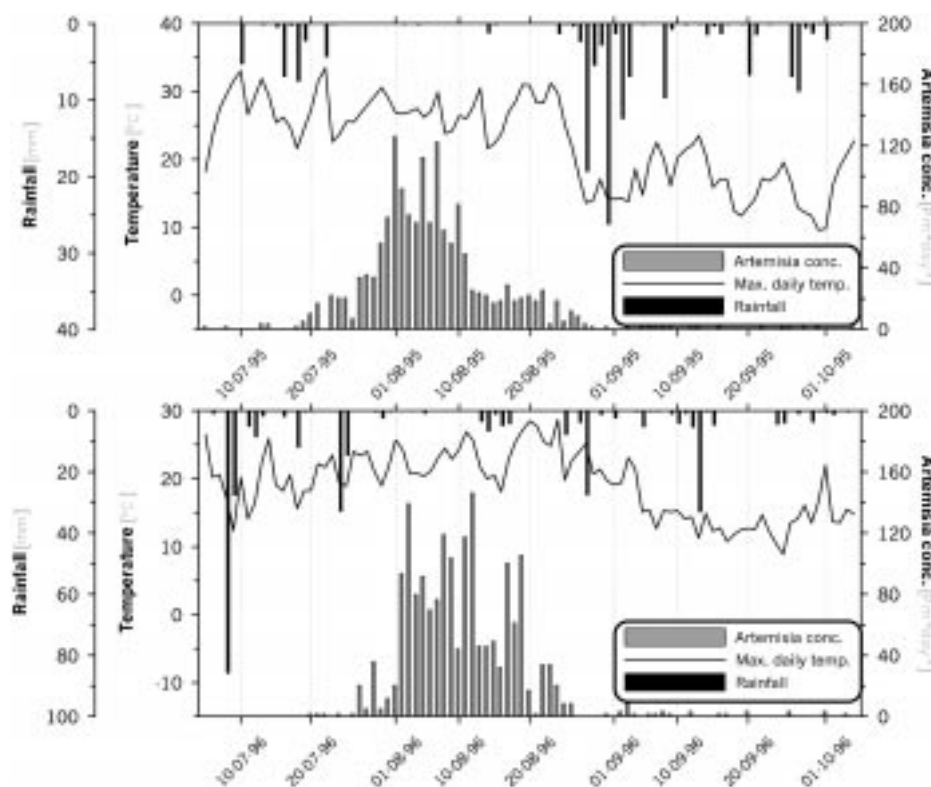


Figure 4. Pollen concentrations of *Artemisia* in Poznań, 1995 and 1996 and selected weather elements.

perature in July and August did not exceed 28 °C. In 1996, however, a maximum temperature above 30 °C was recorded. The lower occurrence of pollen in 1996 was additionally triggered by rainfall during the seven days of intensive *Artemisia* pollen production.

Conclusions

The results of two years' observations (the first of their kind for this location) allow us to conclude that:

- Alnus* and *Artemisia* display distinct difference in the periods of pollen concentration associated with meteorological factors. The very early appearance of alder pollen in 1995 was related to the exceptionally mild and short winter of 1994/95.
- In the two years under study, no difference was found in the occurrence of pollen of taxa blooming in late spring and summer, as exemplified by *Betula* and *Poaceae*.
- In 1995, out-patients of the Allergy Disease Diagnostic Center were exposed to high levels of pollen concentration for 78 days, i.e., 1/5 of the

year. This study is a first attempt to help them through pollen production periods.

- The significant divergence in the dates of alder pollen occurrence and concentration and the registered amounts of alder pollen in Poznań in 1995 and 1996 shows that it is necessary to undertake a large scale information campaign addressed to society at large. In January and February, in the case of mild winters, watering eyes, running noses or coughing may be caused by reactions to hazel and alder pollen. The research results aeropalinologic monitoring should be started in western Poland as early as mid-January, not March.

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