

Short Communication

Ragweed (*Ambrosia*) sensitisation rates correlate with the amount of inhaled airborne pollen. A 14-year study in Vienna, Austria

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Abstract

Ragweed pollen have been monitored since 1976 in Vienna. Since 1984, the outdoor patients of the allergy department of the ear-nose-and-throat University Clinic underwent both Skin Prick Test and RAST/CAP test with a standard series of common inhalant allergens, ragweed (*Ambrosia elatior* L.) included. Both the ragweed counts and the number of positive RAST results showed a significant increase by time. Furthermore, a clear correlation between the number of airborne pollen and the percentage of positive RAST/CAP results is evident. The immune-response in the Viennese population of atopic subjects is dependent on the amount of inhaled pollen.

Introduction

Ragweed pollen are known as very potent aeroallergens (D'Amato et al., 1998; Dechamp, 1997; Horak et al., 1981; Jäger, 1991; Lomagno et al., 1984; Perrin et al., 1977; Pizzulin et al., 1992; Pozzi 1989; Torraine et al., 1968). They cause plenty of allergic symptoms in North America, in Eastern Europe in particular in Hungary (Feher and Jarai-Komlodi, 1996, 1997; Jarai-Komlodi and Juhasz, 1994; Juhasz 1994; Juhasz and Jarai-Komlodi, 1996), in France (Charpin et al., 1981; Dechamp et al., 1983; Gueho et al., 1974; Torraine et al., 1968), Italy (Albasser, 1992; Caramiello et al., 1990; Lomagno et al., 1984; Piazza et al., 1992) and a couple of other European countries (Fritz and Zwander, 1982; Horak et al., 1981; Leuschner 1978; Leuschner et al., 1990; Pizzulin Sauli et al., 1992; Pozzi 1989; Pozzi et al., 1992; Yankova et al., 1996). Considerable amounts of ragweed pollen in Eastern Austria led to a monitoring of the development of immune-response to ragweed pollen allergens in Vienna. Pollination period is from mid August to end of September.

The peak appears usually at the beginning of September.

Aim of the study was to explore the relationship between pollen counts and the immunological response in the Viennese population, e.g. to trace the production of IgE- antibodies in allergic subjects compared to the amount of ragweed pollen in the air.

1. Materials and methods

1.1. Pollen sampling

Pollen sampling was performed by means of a volumetric Hirst- type trap (Burkard) from 1976 until 1997. The trap was placed on a flat roof of the ENT-University clinic in Vienna, about 15 m above ground and 192 m above sea level. Daily counts were made using a compound light microscope, objective 40× n.a. 1.0 oil immersion and 10× oculars. Five longitudinal bands, each 200 microns wide have been counted per slide. The result of this count corresponds with the daily mean of particles per cubic meter of air. Trapping has been performed every year from the beginning

Table 1. Development of specific antibodies against ragweed pollen (w1) in a preselected population of patients with suspected inhalation allergy in Vienna

Year	Patients total	Total RAST (CAP) positives	Total RAST (CAP) positives against Ambrosia (w1)	Percentage of RAST (CAP) positives against Ambrosia (w1)	Annual total Ambrosia pollen counts
1976					192
1977					640
1978					68
1979					151
1980					488
1981					351
1982					443
1983					465
1984	378	267	56	20.97	181
1985	294	206	56	27.18	408
1986	358	247	57	23.08	191
1987	390	240	44	18.33	801
1988	452	346	49	14.16	130
1989	455	316	58	18.35	594
1990	486	260	59	22.69	388
1991	569	305	69	22.77	1144
1992	406	194	59	30.41	1869
1993	671	324	92	28.40	1683
1994	742	383	123	32.11	1088
1995	794	392	114	29.08	1090
1996	726	398	133	33.42	1135
1997	577	289	86	29.76	1490

of alder and hazel pollination (January) until end of October or at least until the end of the main ragweed pollination period (mid September).

For statistical evaluation, the annual totals for the corresponding period with the immunological results (1984–1997) have been used.

All ragweed plants which have been met within the past years in Austria, were plants of short ragweed (*Ambrosia elatior* L., = *A. artemisiifolia* L.).

1.2. Patients and immunology

In the outdoor patient's allergy department of the clinic, all incoming patients with suspected inhalation allergy have been skin prick tested with a standard series of inhalation allergens. The same standard series of allergens has been in vitro tested by RAST or CAP method respectively. This series was composed of: birch pollen (t3), grass pollen (g3), mugwort pollen (w6), ragweed pollen (w1), *Cladosporium* spores

(m2), *Alternaria* spores (m6), house dust mite (d1), and cat dander (e1).

A total of 4167 patients had at least one positive RAST result. Positivity was determined according to the international standards, as resulting in RAST class 2 or higher. For the group of those patients, who had at least one positive RAST result, the annual percentage of *Ambrosia* RAST positivity was calculated. The study includes the years from 1984 to 1997.

1.3. Statistics

The correlation between the annual total ragweed pollen counts and the corresponding sequence of years was calculated to express the trend in ragweed pollen abundance in Vienna.

Accordingly, the percentage of RAST positivity to *Ambrosia* pollen was correlated with the sequence of years (1984–97).

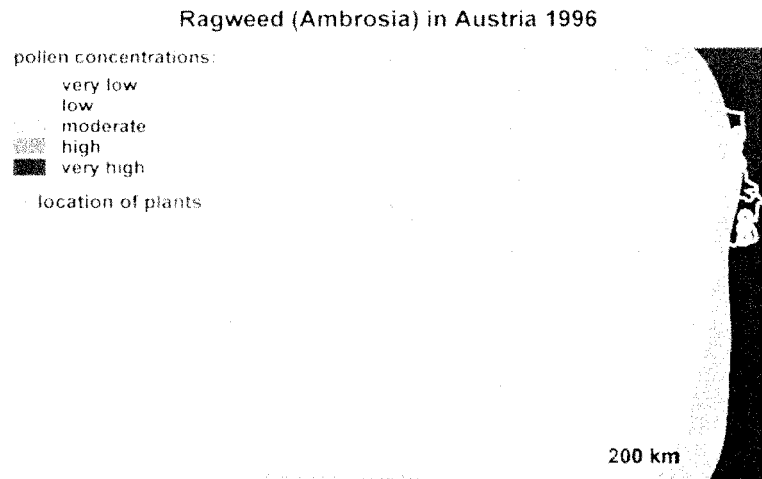


Figure 1. *Ambrosia* pollen concentrations (based on annual total 1996) and places where ragweed plants have been found in Austria 1996. Only the easternmost parts of the country are seriously affected.

Ambrosia pollen in Vienna annual totals 1976-1997

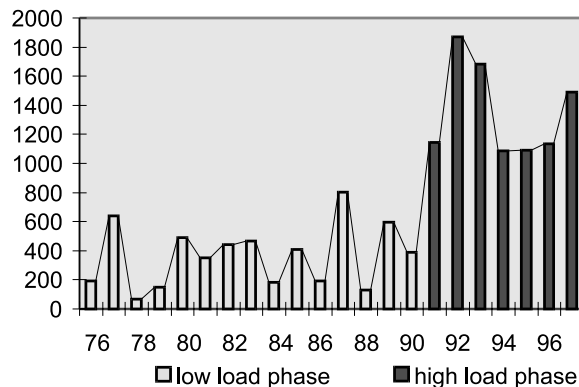


Figure 2. Annual totals of *Ambrosia* Pollen in Vienna 1976–1997.

Finally, a correlation between ragweed pollen counts and RAST positivity was calculated. All calculations were done using the Pearson correlation analysis. An error level of less than 5% was considered to be the level of significance.

2. Results

2.1. Pollen

After a period of comparatively low counts from 1976 to 1990, the annual totals raised to a clearly higher level in the period of 1991 to 1997 (Table 1, Figure 2).

The trend towards higher ragweed pollen counts is significant for this period ($r = 0.7437$, $p < 0.001$).

2.2. Immunology (RAST positivity)

The trend to more positive responses to ragweed pollen allergen (w1) in RAST (CAP) is significant for the observed period 1984-1997 ($r = 0.6945$, $p = 0.003$) (Table 1).

2.3. Interactions

The percentage of positive RAST (CAP) results among subjects who were generally RAST positive against inhalation allergens corresponds well with the changes of ragweed pollen counts ($r = 0.6809$, $p = 0.004$, Figure 3).

3. Discussion and conclusion

No definitive conclusions about the frequency of clinical symptoms can be made with the above mentioned data, but it is very likely that there is a strong correlation between positive RAST results and clinical symptoms.

As ragweed pollen allergens cross-react with mugwort pollen allergens (Hirschwehr et al., 1998; Perrin et al., 1977), a certain degree of uncertainty must be considered.

However, there is evidence that the higher the ragweed pollen count is, the higher the amount of ragweed-pollen antibodies becomes in the blood of

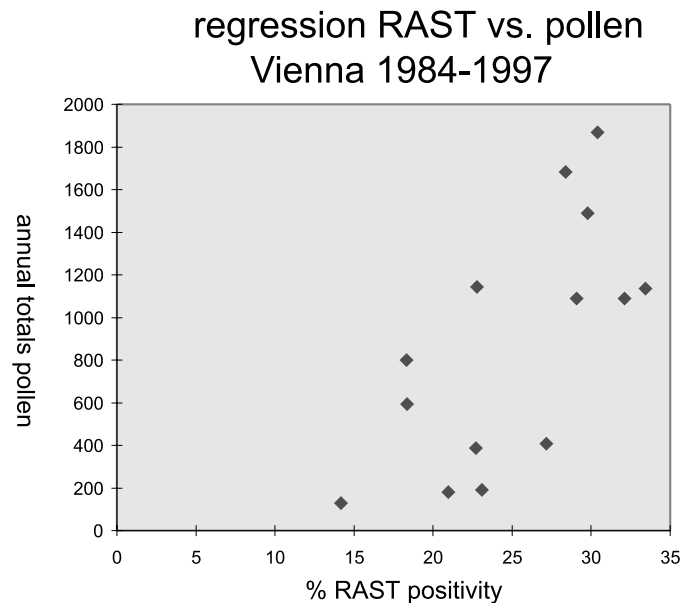


Figure 3. Comparison of ragweed pollen load (annual totals) with the immuno-response in a population of allergic subjects (percentage of RAST positivity) in Vienna 1984–1997.

subjects with inhalation allergy in Vienna. The mean amount of RAST (CAP) positivity in this group was $25.05\% \pm 5.84\%$ for the whole period 1984–97, and raised to more than 30% during the past six years. Should the trend towards higher pollen counts persist, then we must face even higher proportions of ragweed sensitive persons in our region. This is very likely, as we can observe the invasion of the plants from the Eastern stands in Hungary towards Vienna, and new stands in more distant areas in the West. The approaching of ragweed plants is documented in the change of the daytime-distribution of ragweed pollen in Vienna. In the late 80's, ragweed pollen peaked at midnight, whilst during the past six years the peak time shifted to late afternoon / early evening hours. This means that the time for the transport of ragweed-pollen-containing air masses has been reduced and necessarily the main pollen source must be closer to the pollen trap. During the past few years, first single plants have reached Vienna and even areas west of Vienna. The migration velocity of new plant occurrences from East to West was between 6 and 20 kms/year.

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