

Short communication

The relationship between airborne pollen distribution and the frequency of specific pollen sensitization at two climatically different locations in Switzerland

Thomas Frei^{*a}, Rocco Torricelli^b, Annie Gérard Peeters^a, Brunello Wüthrich^b

^aSwiss Meteorological Institute, Krähbühlstrasse 58, CH-8044 Zürich, Switzerland

^bAllergy Unit, Department of Dermatology, University Hospital, Gloriastrasse 31, CH-8091 Zürich, Switzerland

Received 20 October 1994; revision received 20 April 1995; accepted 26 May 1995

Abstract

Pollen data reported from the two monitoring stations of Locarno-Monti, on the southern slopes of the Alps, and Zurich on the northern slopes of the Alps, for the years 1989–1993 were compared with meteorological data from the corresponding locations and with the prevalence of pollinosis and frequency of specific pollen sensitization in patients with pollinosis. It was so discovered that the recorded quantity of allergenic pollen types (*Alnus*, *Corylus*, *Betula*, *Fraxinus*, *Poaceae*, *Castaneae*, *Olea* and *Artemisia*) south of the Alps is higher by a factor of 2.9 than that north of the Alps. These differences are due to the distinctly milder climate in the canton of Ticino (south of the Alps) showing higher annual mean temperatures, more sunshine duration and less precipitation days with higher amounts of precipitation. The allergological data show additionally that the summer pollinosis, caused by *Castanea* and *Olea*, is probably responsible for the differing prevalence of pollinosis at the two sites. Finally, we can summarize that in Switzerland pollen from *Poaceae*, *Betulaceae* and *Oleaceae* are the most important for pollinosis.

Keywords: Climatic factors; Pollen quantity; Pollen sensitization; Pollinosis prevalence

1. Introduction

As a result of its varying topography, Switzerland has multiple climate regions (Urfer et al., 1979), each with a distinctive vegetation. The climatic difference between the northern slope of the Alps (represented by Zurich) and the southern slope of the Alps (represented by Locarno-Monti) is typical, with the southern slopes experiencing a Mediterranean climate with, for example, its corresponding palm and olive trees, while the northern slopes experience a more central European climate.

Epidemiological investigations have shown that the prevalence of pollinosis on the southern slopes of the Alps (known as Ticino) is higher (15%) than in the rest of Switzerland (10%) (Wüthrich et al., 1986; Schwarzen-

bach et al., 1986; Wüthrich et al., 1994). Recently it has been shown that airborne pollen counts at the two sites are quite different (Peeters et al., 1994). However, there was no direct correlation to epidemiological data concerning the individual pollen types that might be responsible for the differential in pollinosis between the two regions.

The aim of this study, therefore, was the evaluation of which pollen types are responsible for the different seasonal (spring, summer and late summer) pollinosis rates in each area, by using pollen counts and data on the frequency of pollen sensitization from the two sites.

2. Materials and methods

Continuous volumetric sampling was performed using a Burkard 7-day volumetric sampler at both sites. The sampler in Locarno-Monti was maintained at 16 m

* Corresponding author.

above ground on the roof of the local meteorological station. The sampler in Zurich was maintained at 50 m above ground on the roof of the highest building of the University Hospital.

Meteorological data for use in this study were obtained from the Swiss Meteorological Institute, next to both sampling sites.

Allergological data on pollen sensitization rates by skin testing were obtained either from Gilardi et al. (1994) for Locarno-Monti or from Müller (1987) for Zurich.

Relationships were considered significant when $P < 0.05$ by the Chi-square test.

3. Results

The results of the meteorological comparisons and the pollen counts from both sites are shown in Table 1. As the climate on the southern slopes of the Alps is much more gentle, with greater daily sunshine hours, higher temperatures and fewer rain days the amounts of registered pollen are also elevated. Total pollen counts in Locarno-Monti are higher than Zurich by a factor of 2.3, but the pollen counts for the allergic pollens of *Alnus*, *Corylus*, *Betula*, *Fraxinus*, *Poaceae*, *Castanea*, *Olea* and *Artemisia* are even higher, by a factor of 2.9.

Table 2 presents a summary of the pollen counts at the two sites and the corresponding frequency of pollinosis patients. The annual distributions of the pollen at the two sites are shown in Figs. 1 and 2, which show that there are three major differences between the two sites. The first pollen of the year, represented by *Alnus* and *Corylus* appears earlier in Ticino than on the

Table 2

Comparison of pollen counts, frequency of specific pollen sensitization by pollinosis patients and prevalence of pollinosis in Locarno (southern slope of the Alps) and Zurich (northern slope of the Alps)

Season	Pollen	Average annual pollen counts (1989–1993)		Frequency of specific pollen sensitization (% of pollinosis patients)		
		Zurich	Locarno	Zurich ^a (n = 771)	Locarno ^b (n = 503)	P-value (χ^2)
Spring	<i>Alnus</i>	1932	6826	42.5	32.8	NS
	<i>Corylus</i>	1443	4821	47.2	46.7	NS
	<i>Betula</i>	8460	10 821	54.0	46.1	NS
	<i>Fraxinus</i>	5003	6937	30.4	35.9	NS
Summer	<i>Poaceae</i>	3562	3935	81.0	71.6	<0.05
	<i>Castanea</i>	229	25 419	2.7	36.7	<0.05
	<i>Olea</i>	0	633	—	53.9	
Late summer	<i>Artemisia</i>	45	335	28.0	22.6	NS
	<i>Parietaria</i>	3109 ^c	9911 ^c	—	17.9	
	<i>Urtica</i>	—	—	40.0	20.5	NS
	<i>Ambrosia</i>	29	308	—	16.7	
Prevalence of pollinosis (% of corresponding population)				10.0 ^d	15.0 ^e	

Dashes indicate value is not known; NS, not significant.

^aGilardi et al., 1994.

^bMüller, 1987.

^cCombined value for *Parietaria* and *Urtica*.

^dWüthrich et al., 1986.

^eSchwarzenbach et al., 1988.

northern slopes. Correspondingly values are much higher in Locarno-Monti than in Zurich in March. During June and July there is a massive release of pollen by *Castanea* and in part by *Olea*, which is absent in Zurich. Finally, in August and September *Artemisia* and some *Ambrosia* pollen appear, which are nearly absent in Zurich.

The difference in the rate of pollinosis at the two sites is possibly due to the differing seasonal distribution of airborne allergenic pollen, like those of *Castanea* and *Olea*.

4. Discussion

As just described, the prevalence of pollinosis on the northern slopes is quite different from that on the south. Until now the reason for this difference was quite unknown.

In this study we show that the distribution of the allergenic pollen of *Alnus*, *Corylus*, *Betula*, *Fraxinus*, *Castanea*, *Olea* and *Artemisia* is different for the two sites. By grouping these pollen types according to their annual appearance and comparing these data with the frequency of sensitization of patients by specific pollen, it becomes evident that the pollen of *Castanea*, and probably of *Olea*, are of greater importance in Ticino than in Zürich. It has been known for quite a while that

Table 1
Comparison of meteorological data and pollen counts of the two sampling sites

Characteristic	Locarno-Monti	Zurich	Ratio Locarno/Zurich
Meteorological parameter (average 1989–1993)			
Average monthly days with precipitation	9.2	12.6	
Air temperature (°C)	12.4	9.4	
Average monthly sunshine (h)	179	134	
Pollen counts (average 1989–1993)			
Total pollen count	107 086	45 244	2.3
Allergenic pollen counts I (<i>Alnus</i> , <i>Corylus</i> , <i>Betula</i> , <i>Fraxinus</i> , <i>Poaceae</i> , <i>Artemisia</i>)	33 675	20 473	1.6
Allergenic pollen counts II (<i>Alnus</i> , <i>Corylus</i> , <i>Betula</i> , <i>Fraxinus</i> , <i>Poaceae</i> , <i>Olea</i> , <i>Castanea</i> , <i>Artemisia</i>)	59 727	20 702	2.9

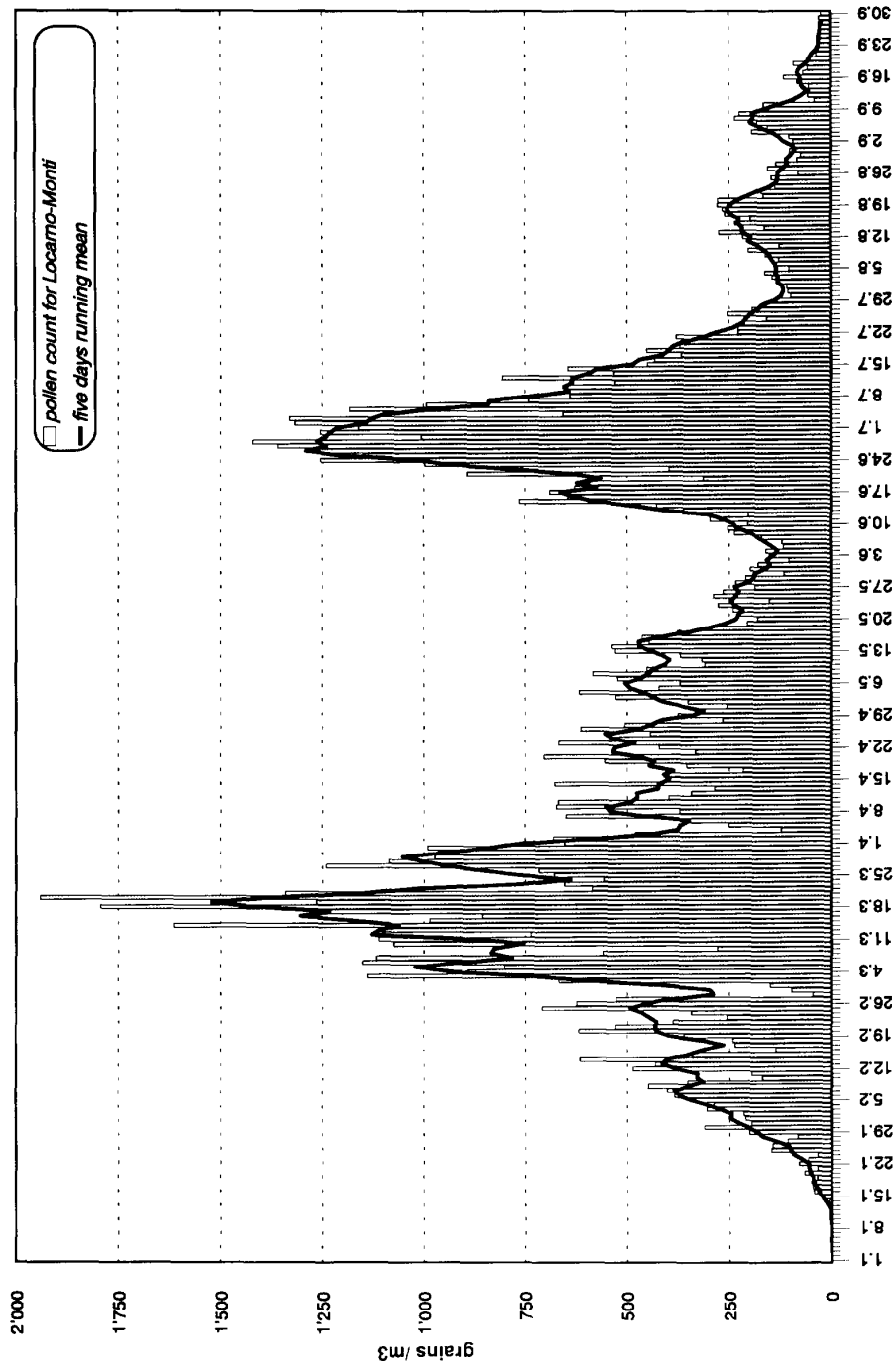


Fig. 1. Pollen concentrations and 5-day running means of the average total pollen counts 1989–1993 for Locarno-Monti.

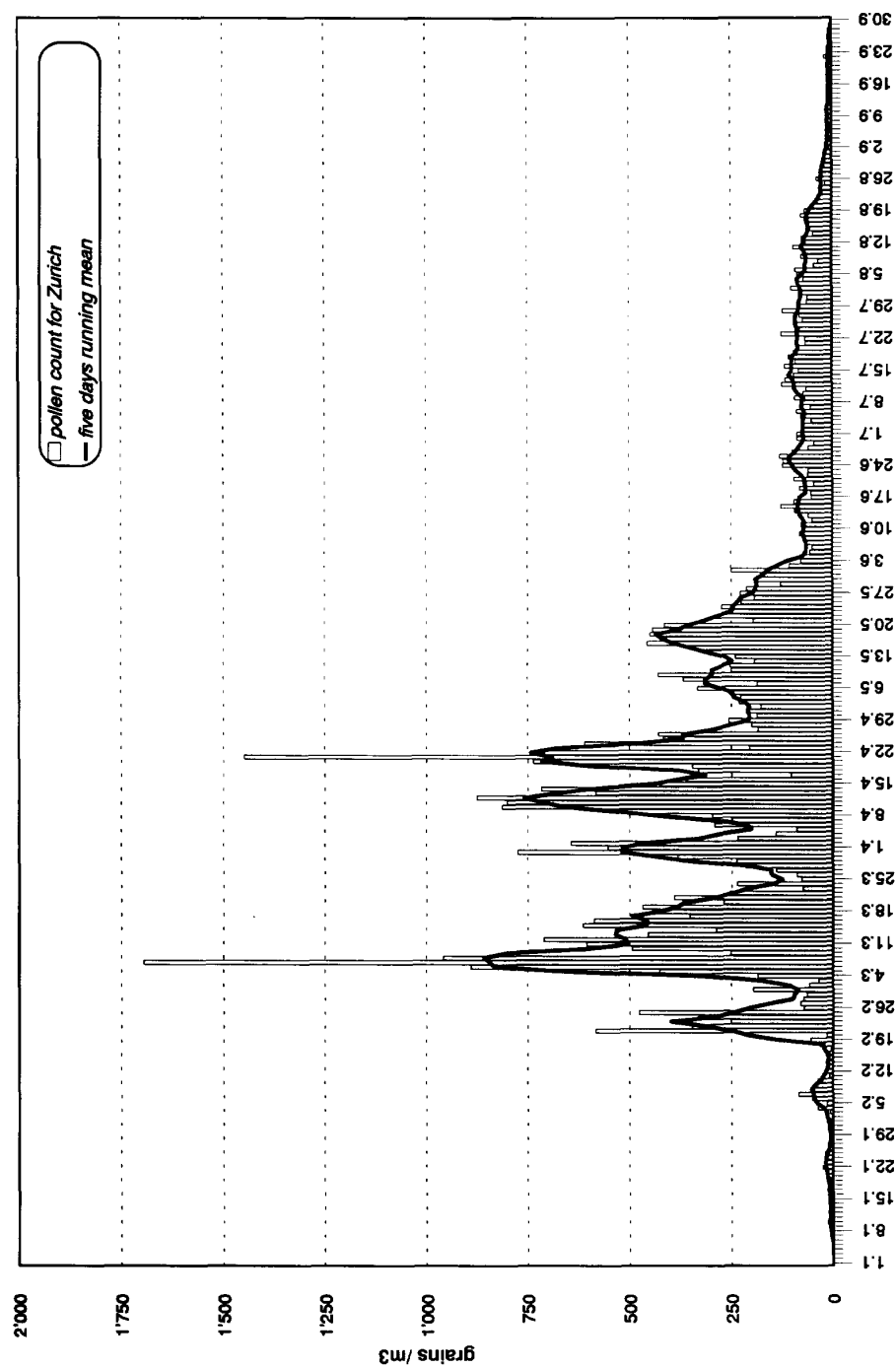


Fig. 2. Pollen concentrations and 5-day running means of the average total pollen counts 1989–1993 for Zurich.

Olea pollen is very allergenic (D'Amato et al., 1983; Liccardi et al., 1994) but it was reported mainly for Mediterranean areas. With regard to the allergenic importance of *Castanea*, there are not as many direct hints as in the case of *Olea*. It was also found that pollen sensitization in Paris to *Castanea* was about 35% (Sutra, 1988) and this finding confirms a role for this pollen in pollinosis. Therefore, we conclude that the difference in the prevalence of pollinosis between the two sites is probably mainly caused by a difference in the summer pollinosis, which is more important on the southern slopes in Switzerland than on the northern. Until now it was generally considered, that the five allergenic pollens of *Alnus*, *Corylus*, *Betula*, Poaceae and *Artemisia* were the most important for the whole country (Helbling et al., 1985; Wüthrich et al., 1983). With this study it becomes evident that for the southern part of Switzerland *Castanea* and the Oleaceae are equally as important and that these pollen must also be included as allergenic in Switzerland.

The data also show that summer pollinosis caused by *Castanea* and *Olea* is more important in Ticino than in the northern part of the country, but the contribution of the Poaceae to summer pollinosis is slightly higher on the northern slopes of the Alps.

Finally, we can summarize that for Switzerland as a whole by far the most important allergenic pollens are those of the grasses. In the case of the other airborne allergenic pollens the situation is different in the north and the south of the country. Independent of individual rank, we can state that the Poaceae and Betulaceae are important for pollinosis in Switzerland and the Oleaceae and *Castanea* are additionally important for Ticino. Besides that, it is important to note that in Ticino the Oleaceae include *Olea*, *Fraxinus excelsior* and *Fraxinus ornus*, whereas in the north the Oleaceae only contain *Fraxinus excelsior*.

References

- D'Amato, G., Liccardi, G. and Melillo, G. (1983) A study on airborne allergenic pollen content of the atmosphere of Naples. *Clin. Allergy* 13, 537–544.
- Gilardi, S., Torricelli, R., Peeters, A.G. and Wüthrich, B. (1994) Pollinose im Kanton Tessin. Eine prospektive Studie in Locarno 1990–1993. *Schweiz. Med. Wochenschr.* 124, 1841–1847.
- Helbling, A., Leuschner, R.M. and Wüthrich, B. (1985) Pollinosis. IV: Welche Pollen sollten in der Allergie-Praxis getestet werden? *Schweiz. Med. Wochenschr.* 115, 1150–1159.
- Liccardi, G., Russo, M., Saggese, M., Lobefalo, G., Noschese, P., Piccolo, A., Visone, A., D'Amato, M. and D'Amato, G. (1994) Clinical significance of allergic sensitization to *Olea europaea* L. pollen in Naples area, Italy. *Aerobiologia* 10, 59–64.
- Müller, M.J. (1987) Zum Sensibilisierungsspektrum von Pollenallergikern. *Med. Diss. Zürich.*
- Peeters, A.G., Frei, T. and Wüthrich, B. (1994) Vergleich des Pollenflugs und der Pollinose-Häufigkeit an zwei klimatisch verschiedenen Standorten in der Schweiz (Zürich und Locarno). *Allergologie* 11, 501–504.
- Schwarzenbach, H.R., Wüthrich, B., Gilardi, S. and Somazzi, S. (1988) Prevalenza della pollinosi nel Cantone Ticino. *Trib. Med. Ticinese* 53, 310–315.
- Sutra, J.P. (1987) Chestnut pollen counts related to patients pollinosis in Paris. *Adv. Aerobiol.* 51, 113–117 (1987).
- Urfer, C., Gensler, G., Ambrosetti, F. and Zenone, E. (1979) Regionale Klimabeschreibungen. Beiheft zu den Annalen der Schweizerischen Meteorologischen Anstalt (Jahrgang, 1978), pp. 247–407.
- Wüthrich, B., Helbling, S., Primault, B., Cour, P. and Duzer, D. (1983) Pollinosis. III. Pollenkalender von Zürich mit den allergologisch wichtigsten Pollenarten. *Schweiz. Med. Wochenschr.* 113, 170–183.
- Wüthrich, B., Schnyder, U.W., Henauer, A. and Heller, A. (1986) Häufigkeit der Pollinosis in der Schweiz. *Schweiz. Med. Wochenschr.* 116, 909–917.
- Wüthrich, B., Peeters, A.G., Schindler, C., Brändli, O. and SAPALDIA-Team (1994) Prevalence of atopy, hay fever and asthma in eight areas of Switzerland (SAPALDIA-Study). *Allergy Clin. Immunol. News Suppl.* 2.