5. Europäisches Pollenflugsymposium

Pollenforschung ohne Grenzen

Zum nahen Beginn der Pollensaison berichten internationale Referenten des 5. Europäischen Pollenflugsymposiums der Stiftung Deutscher Polleninformationsdienst, das am 8. September 2000 in Wien statt fand, über die Bedeutung der Pollen-Grenzwert-bestimmung.

Threshold concentrations of pollen and spores: Roundtable discussion Prologue

The threshold value of a biological process means the minimum level of a factor that activates it, under defined and specific conditions. Allergy is not an exception and allergic subjects develop clinical responses only when the ambient allergen load rises above the threshold level. Knowledge of such a level is of prime importance for the patients: they have to know when and where they become responsive to such ailing factors.

If the determination of a threshold level is so complex, is it reasonable to attempt to establish it? This was the main issue of the roundtable discussion.

Determination of pollen threshold levels that elicit allergic responses is a complex task that depends on the combined effects of several factors: patients, allergens, time and duration of exposure and the environmental quality.

Patients: Allergy responses depend very much on the physiological condition of the subjects. Irritation of a patient´s respiratory system may provoke a clinical response at much lower allergen concentrations that would normally provoke a response in an „average person". In addition we must also account for the fact that different clinical responses have different thresholds.

Time: Patients respond differently when exposed to a high pollen load for a short time than when exposed for a long period to a low allergen concentration. Moreover, allergy responses depend not only on the pollen load of one species but also on the concomitant presence of additional airborne allergens and of various environmental parameters.

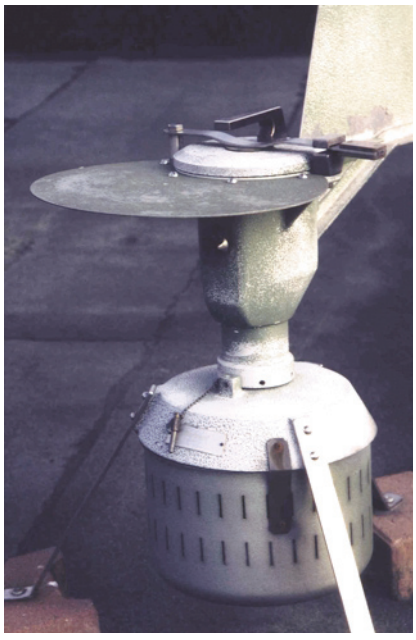
Allergens: Pollen counts are not always sufficient for expression of allergen load. The allergen content of pollen varies with the species but also with the genetic composition of local populations.

Environmental factors: The allergen content of pollen depends on the quality of the plant habitats, on the season of the year but also on earlier exposure of the plants to environmental pollutants. Threshold levels may be shifted by changes in the level of air pollution and by the prevailing atmospheric conditions (pressure, temperature, relative humidity etc.).

Determination of threshold values for the allergenic effects of airborne pollen became a controversial issue. Some scientists are definite in their position that such a definition is impossible and any provided figure will be incorrect. Others are not deterred by the complexity of the issue and acknowledge the urgent need for such a definition. They emphasize the essentiality of such a knowledge for the patients and the advantages that it would give them.

Why is the determination of the threshold so important?

- It can be used as the standard measure for delineation of the boundary between clean and safe air and polluted air with allergenic airborne pollen.



Ob in Frankreich, Italien oder Israel – die Burkard Pollenfalle dient zur Messung der Pollenkonzentration.

- It should be used for warning allergic patients against an intrusion of high pollen loads.
- It should serve as proof for legal action required for reduction of environmental pollen pollution.
- It should serve as a solid basis and a guideline for consultants.
- Knowing the threshold is important for selecting the proper medical treatment of allergic people. Each of the patients should know exactly when the airborne pollen load exceeds the critical level, and act accordingly.

In spite of the enormous variations in almost each of the mentioned parameters, attempts were made to define threshold values. For example it is accepted that the concentrations of pollen that evoke clinical responses are much lower for olive or for grasses (10–50 grains/m^3 air) than for cypress and birch (~200 grains/m^3 air). However, there is some deception in the presentation of such figures. While the cited pollen concentrations were recorded at the regular monitoring stations, the responding patients were probably exposed to a completely different milieu of allergens and during different periods of time. Indeed, an attempt that was made in a Kibbutz in Is-

rael to circumvent such biased information (based on daily reports of the patients that live in the Kibbutz and on pollen counts taken near their home) suggests that the threshold values of the common plant allergens are set at much lower values, already at a pollen concentration of 1–5 pollen grains/m³ air.

Differences in responses among the patients are striking. Sensitive patients develop clinical symptoms at extremely low pollen concentrations, sometimes even before the standard monitoring systems record the presence of such pollen in the sampled air.

Still, the majority of allergic patients respond to airborne allergens only when the concentrations are rather high (> 50 pollen grains/m³ air). Similar results were reported for olive and for *Parietaria*. In spite of the objections for the use of such figures, they still may serve as a starting point for determination of more accurate threshold concentrations.

Some of the described variability is genuine. However there is no doubt that some of it results from the discrepancy between the actual concentration of pollen in the inhaled air and the concentrations recorded by the pollen monitoring stations. People move around, walk under the shade of the street trees, lay on the garden lawns etc. Such patients are probably exposed to a different composition and to different concentrations of allergens. Determination of meaningful threshold concentrations must be based on the exposure and response of individual patients.

Allergic subjects should be warned only when the reported pollen counts pass their critical values, informing them that they are prone to develop clinical responses.

Threshold for pollination of agricultural crop plants

Threshold values are not only of concern for allergy patients, but have important economic aspects by setting the baseline for an efficient pollination of major crop plants such as olive, avocado, almonds, carobs or melons and tomatoes, that eventually determine their fruit yield.

What should be done?

- Development of practical personal pollen and spore traps. This should be an urgent goal for aerobiologists and allergologists. Only such tools will enable us to reach a meaningful correlation between the load of airborne allergens and allergy responses.
- Development of unbiased methods for monitoring allergy symptoms. This should enable the establishment of a genuine correlation between individual responses and ambient pollen concentrations.
- Standardization of the present methods that are currently used for evaluation of threshold concentrations.

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Variability in threshold pollen concentration

Variability in threshold pollen concentrations depends on the following factors:

- 1. Priming time, meaning the period of two to three weeks between appearance of pollen grains in the atmosphere and appearance of clinical symptoms. For grass pollen allergy such symptoms are usually at the nasal level. In patients allergic to *Parietaria* there is high frequency (50–70%) of asthma or its equivalent symptoms (cough etc.). By using bronchial provocation tests with methacholine we find in these *Parietaria* sensitive patients high levels of bronchial hyperreactivity.
- 2. Pollen species. Clinical symptoms of grass and olive pollen allergy appear when pollen concentrations reach levels of more than 40–50 pollen grains per m³ air. The *Parietatia* threshold is lower, i.e. approximately 30 grains per m³.
- 3. Contemporaneous presence of air pollution (ozone and respirable particulate) can act as triggers of inflammatory reactions and they can also reduce the threshold level of airway reactivity to allergens delivered by pollen grains.

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Threshold concentration of olive pollen grains

In the study of phenomena linked to pollination in plants of agricultural interest, particular attention has been given to understand the trend of pollen release and capture. For several years olive has been the focus of our studies due to its economic importance in the Mediterranean area, as well as interest in the problems associated with autosterility, characteristic of the various cultivars grown in olive producing areas.

Italienische Pollen-Studien könnten für die Oliven-Industrie wichtig sein.

The research on olive (1, 2, 3) has attempted to construct models for forecasting flowering time and quantity of pollen captured in the atmosphere. The aim of the research is to use the information to verify the possibility of using the pollen variable for forecasting the harvest of species of great economic interest in the European Community.

To deal with the problems related to the values of pollen registered, a different method was used that breaks down the overall information contained within the Ip value (daily pollen/m³) and defines the importance of the quantity of pollen in relationship to the entire pollination period.

In this context, the dependence of annual olive production on the pollen

data is expressed as nine variables, eight of which express the quantities of pollen for a 5-day period, starting from the first day that pollen appears and the ninth variable expresses the tail. The PLS method was used to analyze the data. The statistical model clearly indicates that the final fruit yield increases when the quantity of pollen is greater in the second part of the emission period, while it is less when pollen emission is greatest in the first fifteen days.

The interpretation of the results suggest that the phenologies of the pollinating cultivars and those to be pollinated must be contemporaneous. The best results seem to occur when maximum pollination is concentrated in the second part of the pollination period, whereas the results are less satisfactory if the pollen is released too early.

The experimental data were compared with those randomly collected in the same experimental field during the last ten years. The EPP (effective pollination period) values are recorded for each cultivar with respect to the different phenological trends.

References

1. **Fornaciari M, Galan C, Mediavilla A et al.** Aeropalynological and phenological study in two different olive mediterranean areas: Cordoba (Spain) and Perugia (Italy). Plant Biosystems 2000; 134: 199–204.
2. **Fornaciari M, Pieroni L, Ciuchi P et al.** A statistical model for correlating airborne pollen grains (Olea europea L.) and some meteorological parameters. Agricoltura Mediterranea 1997; 127: 134–7.
3. **Fornaciari M, Pieroni L, Ciuchi P et al.** A regression model for the statt of the pollen season in Olea europea L. grana 1998; 37: 110–3.

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The use of different thresholds in pollen information reports

One of the main aims of the Spanish Aerobiology Network (REA) is the dissemination of atmospheric pollen data through the media. The information has to be understood by the public and should be used correctly, therefore the results should be presented in the simplest form. The use of pollen thresholds permit us to categorize the pollen concentrations in the air. However, one of the main problems is the definition of different thresholds (low, moderate, high) and the establishment of categories for different pollen species. It is not the same to establish categories for grasses and for arboreal species.

One way of solving such a problem is to determine the number of pollen grains per cubic meter of air that is necessary to cause symptoms in allergic people. However, this is not easy and it is only possible for some species and for some sites. From the allergological point of view, only two categories should be used: the no risk category and the threshold of risk. That means that once a certain number of pollen grains is present in the air, patients with pollinosis are susceptible to suffering clinical symptoms. This value can be complicated if we take into account that the threshold of symptoms varies from one place to another. In our presentation, we discussed the thresholds for different pollen types common in REA reports.

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Association of indoor airborne mould spores with respiratory diseases and allergic sensitization

Indoor mould spores – in addition to pollen – play an important role in increasing allergy prevalence. There is rising evidence that indoor exposure to mould is associated with an impairment of health. Components of mould spores are thought to affect the respiratory tract, irritate mucous membranes and induce infections and allergies. However, the underlying mechanisms are currently unclear.

In a prospective cohort study we determined the concentration of mould spores in the surroundings of 180 premature and atopic risk newborns (LARS - Leipzig Allergy Risk Children Study). Clinical outcome was estimated by self-administrated parent questionnaires. Specific IgE-antibodies and cytokine production of T-cells were measured.

Species of *Penicillium* and *Aspergillus* were found to be main indoor sources, while higher outdoor levels were seen for *Cladosporium* and yeasts, with a significant seasonal maximum in summer. Mould exposure was associated with species depending health effects. We found a significant correlation between the incidence of respiratory tract infections and indoor exposure of *Penicilium* spores. Moreover *Penicilium* exposure was associated with eczema. Asthmatic symptoms, such as wheezing, correlated significantly with the concentration of *Cladosporium*. On the other hand, *Aspergillus* exposure was associated with allergic rhinitis or related symptoms. Ad-

Leipziger Epidemiologen prüften die Rolle von Schimmel bei der Entstehung von Allergien.

ditionally, we observed increased levels of specific IgE against birch and grass. The investigation of T-cell cytokine production showed a significant suppression of TH1-cytokines (IFNγ, TNFα, IL-2) by *Aspergillus* exposure. However, the capacity to produce IL-4 was not altered. *Penicillium* and *Cladosporium* spores did not affect investigated cytokine production by T cells.

Indoor mould exposure was a risk factor for several diseases. There were no significant associations between total spore concentration or reported dampness and visible mould. Measurement of fungal spores and a differentiation by genera and species gave more information for a risk assessment of mould exposure. General immunosuppressant properties of specific secondary metabolites like mycotoxins and volatile organic compounds, produced especially by *Aspergillus* or *Penicillium* demonstrate the possibility of a non-specific effect on the immune system by fungal exposure.

This example should demonstrate the important role of biological aerosols, especially the role of spores for the development of allergic and airway diseases.

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Epidemiology of asthma and rhinitis due to grass pollen allergy

We studied the prevalence of asthma and rhinitis in the population of Perugia, Italy. A random sample of 1048 subjects completed a questionnaire and 796 (76%) underwent skin prick tests with eight common aeroallergens (grass, *Parietaria*,

olive, cypress, house dust mite and cat, dog and rabbit dander). The prevalence of asthma was 5,1% and rhinitis 14,3%. Positive skin tests were found in 21,9% of total subjects, in 58% of asthmatic and in 65% of rhinitic subjects. Grass had the highest prevalence of positivity and was found in 45,7% of all positive skin tests, in 62,4% of subjects with allergic asthma and in 57,8% with allergic rhinitis. When asthma and rhinitis were present concomitantly, symptoms of rhinitis developed before those of asthma in 64,3% of cases and the two diseases started simultaneously in the others. Spring symptoms tended to start in March/April in rhinitic and asthmatic subjects, peaking in May for rhinitis and in June for asthma.

In conclusion, rhinitis is three times more frequent than asthma. It develops before asthma in 2/3 of cases, and rhinitic seasonal symptoms tend to start one month earlier than asthmatic symptoms. The differences may be due to different nasal and bronchial thresholds for sensitization to grass pollen and for onset of seasonal symptoms. In order to establish pollen threshold concentrations for asthma and rhinitis, a prospective multicentre study is required, the results of which might provide some insight into improving management of respiratory allergies.

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Threshold of allergenic risk with pollen in France

Every week the RNSA documents pollen and clinical data as well as the meteorological forecast. The pollinic data are collected with 40 pollen traps (Burkard or Lanzon) distributed throughout France and analyzed every two hours.

The clincal data are collected from forty clinicians (one per site), who send a weekly bulletin to the RNSA. In this questionnaire we interview them on the frequency of pollinosis cases they see in comparison to the last week. Also they quantify the effect of pollinosis on eyes, nose and lung.

With these data, we index the allergenic risk. This index ranges from 0 to 5 (5 = very high allergenic risk, 4 = high allergenic risk, 3 = medium allergenic risk, 2 = low allergenic risk, 1 = very low allergenic risk and 0 = no risk). This index depends on the taxa, the main taxa and the total of taxa of the location of the pollen trap in the city, on the location of the city in the country, on the season and on the clinical incidence.

In France we now have more than fifteen years of experience with the allergenic risk index which permits us to predict the threshold of allergenic risk for the main pollen responsible for symptoms.

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