EAN EAS Symposium

Meeting of the European Aeroallergen Network and the European Aerobiology Society

Siegfried Jäger Symposium

10th – 11th November 2014
Van Swieten Saal
Medical University of Vienna

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Meeting of the European Aeroallergen Network and the European Aerobiology Society

Dr. Siegfried Jäger Symposium

Program and Abstracts

EAN
European Aeroallergen Network

EAS
European Aerobiology Society

10th – 11th November 2014
Van Swieten Saal
Medical University of Vienna
Vienna, Austria

In memory of Dr. Siegfried Jäger

Foreword

It is a great honor and pleasure for the organizing committee and research group "Aerobiology and Pollen Information" (Department of Otorhinolaryngology, Medical University of Vienna) to welcome researchers from all over Europe and beyond in Vienna to the EAN EAS Meeting and the Siegfried Jäger Symposium. The Meeting represents a great opportunity for researchers to exchange ideas and further advance the discipline. Interdisciplinary approaches are essential and of special interest in the field of aerobiology that interferes with medicine, allergology, botany, meteorology and informatics systems to name a few of them.

At the same time it promotes to strengthen bonds between EAN data suppliers, to build new co-operations and to join the European Aerobiology Society (EAS) Meeting. Therefore, the meeting comprises the EAS general assembly, the establishment of the EAN board and EAN Quality Control. We are proud to present a scientific program of high quality in addition and to have won over speakers who will present diverse topics in the interplay of different research core areas.

This come-together takes place in honor and memory of Siegfried Jäger, who left us too early in September 2014. It is thanks to him that the European Aeroallergen Network (EAN) came into existence. Owing to his diplomatic skills and efforts the community grew and became stronger and stronger. The Siegfried Jäger scholarship shall keep his memory as excellent scientist and bridge-builder. The scholarship shall be awarded to a young scientist for promising research in the field of aerobiology and shall enable the winner research stays in three European centers of aerobiological research.

We are convinced that it will be an enjoyable meeting and that Vienna´s historical flavor and vibrant cultural life will make your stay a memorable scientific and personal experience. This is the opportunity to share our memories, to strengthen the bonds in our community and to bring co-operations forward, which will be our guiding light into the future.

The Organizing Committee
Uwe Berger
Katharina Bastl
Maximilian Kmenta
Marija Prentovic
Medical University of Vienna
Department of Otorhinolaryngology, Head and Neck Surgery
Währinger Gürtel 18-20
A-1090 Vienna, Austria

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ABSTRACTS

POLLEN MONITORING I

A cluster analysis of airborne pollen sampled in Istanbul

Franziska Zemmer

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Background
Airborne pollen sampled between 28.01. and 08.12.2013 with a 7 day Hirst-type pollen trap in Büyükçekmece, Istanbul was statistically analyzed using cluster analysis to identify and visualize seasonal pollen spectra.
Cluster analysis is a way to investigate the unbiased, multivariate relationships between parameters, without necessarily undertaking a pre-reselection of data (Schulte et al, 2008). When dealing with airborne pollen types, for instance, a dendrogram shows which pollen types are airborne at the same time (phenological relationships).

Method
Out of 273, 240 days of the data population were evaluated. Pollen that amounted to >1% of the total annual count were included in the analysis. This way the dataset was reduced from 38 to 21 variables. Four clusters were selected by choice in order to reflect seasonal patterns and grouped by means of the Pearson correlation function. Within a cluster a coefficient close to one reflects simultaneous pollen-presence in the air. The cluster analysis was verified by means of a frequency analysis.

Results
The dendrogram yielded the following clusters: winter (January-end of March): *Alnus*, *Fraxinus*, *Cupressus*; spring (April): *Salix*, *Platanus*, *Acer*; (April-May): *Quercus*, *Betula*, *Morus*; early summer (May-June): Poaceae, Pinaceae, Oleaceae, *Plantago*, indeterminatae; Late summer–autumn (July-November): *Artemisia*, Amaranthaceae (former Chenopodiaceae), *Ambrosia*, Urticaceae (*Parietaria*), *Xanthium*, Cannabaceae.

Discussion
Cluster analysis is a quick tool to combine pollen types in groups reflecting their main seasonal presence in the air. It delineated four hay fever periods in Istanbul over the course of a year, whereby, in general, the first half of the year is dominated by tree pollens; pollen of grasses, olive and pine characterize the middle of the year, while the second half of the year is governed by weeds. The relevance of could be increased by rising the ratio of the annual total to a higher percentage thus further reducing the number of species in the dendrogram. Here we present statistically supported practical results for the use of allergy sufferers as well as for practitioners. However, one has to be aware of the fact that this is only a qualitative tool and does not provide information on the actual atmospheric concentration of pollen.

References:

Schulte F, Lingott J, Panne U, Kneipp J. 2008. Chemical characterization and classification of pollen. Analytical Chemistry. 80, 9551–9556.

The influence of roof traps location on the level of airborne pollen concentration

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The amount of pollen in the trap clearly depends on the localization of the trap. According to aerobiological monitoring standards, pollen traps must be mounted on the roof making sure that adjacent buildings or obstacles would not impede the flow of air and take into consideration the influence of nearest vegetation sources. The aim of our research was to find out the differences in amount of airborne pollen, collected in the tree traps located on the same roof.

Airborne pollen was collected 2012 by using three Hirst spore traps in Šiauliai (Lithuania). The study was performed with the major airborne allergenic pollen types in Lithuania: *Acer*, *Aesculus*, *Ambrosia*, Apiaceae, *Artemisia*, *Betula*, *Carpinus*, Chenopodiaceae, Cupresaceae, *Fraxinus*, *Picea*, *Pinus*, *Plantago*, Poaceae, *Populus*, *Querqus*, *Rumex*, *Salix*, *Tilia*, *Ulmus*, Urticaceae. Main pollen season and seasonal pollen index (SPI) was calculated with the 95% range. Differences in pollen concentration between traps were tested by using Student's t-test. Meteorological data (wind direction, speed, temperature) were provided by Lithuanian Hydrometeorological Service.

The differences of pollen amounts fixed in the traps range from 20 to 100 percent. The latter is obtained in the case when one of the traps does not count pollen at all. The statistical analysis of counted pollen in the traps shows the absence of statistically significant differences. Wider results discussion will be provided in the presentation.

Sampling height in the view of pollen information

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Background

Sampling height has an equivocal affect in the view of pollen information service: on the other hand we need data for general situation, independent on the local vegetation, and on the other hand we need data for exposure zone at the ground level. In order to give more generalized pollen information, e.g. recommendations of EAN suggest sampling at rooftop level. In Finland measurements made at rooftop level show different magnitude for allergenic tree and herbaceous plant pollen: birch (*Betula spp.)* pollen concentrations (daily average) may rise up to over 20000 grains/m^3 while grass (Poaceae) pollen concentrations rarely exceeds 200 grains/m^3. One reason for this is sampling height.

Methods

Effect of sampling height was assessed using data of three separate sampling campaigns:
1) Sampling at the rooftop and ground level 200 m apart from each other (Univ. Turku campus, 1982-83)
2) Three separate ground level samplings at rural area (Tuorla; approx. 10 km SE from Univ. Turku; grass pollen in 27 Jun - 20 Aug in 2014) vs. rooftop sampling at urban area (Univ. Turku campus). The ground level sampling sites represent different grass habitats (field, forest and coastal) within a same area.
3) Two rooftop samplings, at 15 m and 9 m from ground level, horizontally 100 m apart from each other. The lower roof had a local pollen source, an elm (*Ulmus glabra*) tree, nearby. The higher sampler was situated on rooftop above tree canopy level.All pollen samples were counted using stratified random sampling of microscopic fields in order to achieve bihourly and diurnal mean concentrations.

Results

At the rooftop level grass pollen concentrations are prominently lower than at ground level: on the average the daily pollen counts are 4.4 times higher measured in the same urban area (University campus). On the peak days this difference rose up to 10 - 14-fold. The same phenomenon was observed in rooftop-urban sampling vs. the Tuorla rural ground level samplings. However, in this data the local vegetation with different grass plant quantities and flora affected strongly on the counts. The mean daily pollen counts varied from 2.6 to 7.8-fold versus the rooftop. It is notable that some days this difference was much higher: e.g. 440 pollen grains/m^3 at Tuorla coast site versus 11 at University rooftop (38-fold), and 978 grains/m^3 at Tuorla forest site versus 63 at University (15-fold). Correlation between rooftop-ground level grass pollen daily counts did not alter much while studied ground level 200 m or 10 km apart. At the campus area the correlation was 0.66, 10 km further correlations varied from 0.59 to 0.64.
While studied tree pollen concentrations at rooftop-ground levels their difference remained low.

Birch pollen counts raised 1.6-fold and elm counts 1.5-fold from rooftop to ground level. Effect of local vegetation became obvious in samplings at the two rooftops. Elm pollen counts were 1.8-fold higher in the lower sampler, near the elm tree. Birch pollen counts did not alter significantly, but only 4.7% increase at the higher sampling.

Conclusions
Sampling from lower sites, near the local sources increases pollen counts in generally. Herbaceous pollen as grasses could be informed generally righteous from rooftop level. However, strong local variation is not shown at roof level, and should be taken into account while planning modeled local pollen information. For tree pollen, sampling above the tree canopy level is well validated; sampling at ground level does not give additional information for tree pollen.

Relationship between pollen and town – results of a study from Humpolec, Czech Republic

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Background

Around or approx. 10% to 30% of adults and as many as 40% of children suffer from allergic rhinitis, of which the most common cause is pollen. Half of the world´s population live in towns with certain attributes, which can aggravate and worsen pollen allergy even. One from the main risks of urban living in relation to allergy sufferers is the high concentration of people on places where they can be exposed by high levels of allergenic pollen. Air pollution, invasive and non-native exotic species, which are „new" for our bodies and allergic species in urban vegetation and its inappropriate management are all other probable effects contributing to increasing pollinosis in towns. For basic information, a net of pollen monitoring stations across Europe provide data on concentration of airborne allergenic pollen. In the most cases, also in large towns, only one seven day volumetric spore trap of Hirst type normally operates. But towns contain a lot of different urban environments which are characterized by different urban structures and influenced by their typical vegetation. Due to this fact, it is essential to observe towns by having more than one pollen trap to provide an insight into distribution of pollen across towns and its impact on human health.

Material and methods

Gravimetric method was chosen for observation of pollen flight situation over the whole pollen season 2011 in a small town in the Czech Republic (Humpolec). Six traps were placed approx. 3 meters above ground level in six different urban environments: historical centre, block of flats, detached houses, agricultural grounds, industrial zone and the village of Plačkov. Each trap contained a sticky slide which was changed weekly and protected against rain by a roof. Vegetation mapping with information about presence or absence of plants, which were presented by pollen in slides, were provided on accessible areas around every trap. Pollen data from 6 sites were compared with each other and with adjacent vegetation.

Results

The six gravimetric traps accumulated pollen grains of 53 different pollen types, the most – 48 types – in the area of detached houses and the least – 39 types – in the area of the block of flats. Pollen types were divided into three groups: 1) Pollen types with sporadic occurrence; e.g. Cyperaceae, Juncaceae, *Aesculus*, Brassicaceae, Apiaceae. 2) Pollen types with more or less uniform occurrence in all sites; e.g. *Corylus*, *Salix*, *Fagus*, *Pinus*. 3) Pollen types with possible local dependence; e.g. *Alnus*, *Juglans*, *Fagopyrum*, Urticaceae. From all observed environments, the largest allergological risk comes from the industrial zone with ruderal vegetation, under dominance of allergological significant taxa e.g. *Artemisia*, Urticacaea or pioneer tree *Betula*.

Conclusion

1) Substantial differences in distribution of pollen across towns have already appeared in a relatively small town as in Humpolec. 2) The necessity for a more detailed insight into the topic of distribution of pollen within urban areas can be supported by monitoring pollen with multiple traps. 3) Experts within the different fields of specialisation e.g. aerobiologists, allergologists, botanists, ecologists and architects must be included in the process of urban planning and therefore help with the elimination of existing allergologically high risk circumstances in towns.

Monitoring airborne pollen using next generation DNA sequencing

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Introduction
Pollen monitoring is relevant to inform patients suffering from pollen allergies and for allergy research. The current method relies on microscopic evaluation of slides, is labour intensive, and allergenic relevant species like grass pollen cannot be identified to genus level. In this study we present a new method for identification and semi-quantification of airborne pollen using next generation DNA sequencing.

Methods
Airborne pollen were collected on 4 May 2013, 26 May and 17 July 2012 using a Burkard pollen sampler. DNA was extracted from the pollen on the strip. Subsequently a fragment of the chloroplast gene trnL was amplified using PCR. The PCR product was sequenced using an Ion Torrent platform, which allows individual sequencing of the DNA fragments from the mixed sample. All reads from the Ion Torrent data were aligned (blasted) to a local install of the NCBI database. The hits to sequences of the same genus were pooled. Some sequences aligned to more than one genus leading to groups of genera.

Results
The relative abundance of species determined by the sequence reads and the relative abundance of species identified by microscopic counts of the 3 days under study were comparable. While microscopic analysis cannot discriminate grass pollen from different grass species, the DNA reads could identify at least 34 grass sequences. The relative abundance of these grass sequences differed between the samples of the 3 days.

Discussion
The DNA identification method appeared to be superior to microscopic identification for grasses since it identifies the grasses to genus level or into groups of genera. Furthermore, the DNA identification method is efficient and has the potential for development into a high-throughput method for pollen monitoring.

The effect of climate change on *Fagus* pollen counts (1982 – 2014) at two German monitoring sites

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Introduction

Aim of the present study was to look for the effect of climate change on airborne *Fagus* pollen load at two monitoring sites far apart from each other (Northwest Germany and Bavaria Alps). Central aspects were time and amount of pollen deposition. The investigation focused on *Fagus* because of its cross reactivity with *Betula*, great variation in pollen catch from year to year and the prevalence of one species (*F. silvatica*).

Methods

Sampling was done with BURKARD traps (HIRST type) between 1982 and 2014. Light microscopy (obj. 25x, oil immersion) of samples delivered daily means of pollen grains / m^3 air. Based on these data 9 days running means were calculated to create diagrams for comparison. The two monitoring sites are 620 km apart from each other and differ in altitude (alpine site Oberjoch: 1050m, Delmenhorst in northwest Germany: 10m above sea level), surroundings (Oberjoch: hillslope with grazing land and forests – dominated by *Picea*; Delmenhorst: city centre in a flat region, 70 km to Northsea coast) and climate. There were two reference periods to compare pollen season of both sites: 1982-89 and 2004-14.
Seasons beginning is defined as the day, when pollen count oversteps 1% of the annual total; season ends when 99% of the annual total is passed. So seasons length covers 98% of the annual total.

Results

During the whole period of observation (Oberjoch: 1982-89 and 1995-2014, Delmenhorst: 1982-1991 and 1993-2014), at both sites annual totals show a positive linear trend but varied to a great extent from year to year. Years with high annual totals are separated by up to three or even four years with low or very low totals. Since 2007 there is regular synchronization of annual totals at both sites. In 1999 and 2000 *Fagus* behaved quite different at both sites.
At both sites *Fagus* pollen season reached its average peak during the first period (82-89) 11-12 days later than in the second period (04-14). At Delmenhorst pollen season in the first period started 15 days later and ended 11 days later. Concerning Oberjoch the correspondent shift was 14 and 16 days. The day of overstepping the 50% threshold of annual total was 10 days earlier in the second period at Delmenhorst, 12 days earlier at Oberjoch.
For Delmenhorst the average of daily maximums of temperature from 1st March to the end of June was calculated: 15,0°C for the first period, 17,4°C for the second.
At Delmenhorst pollen season reached its average peak in both periods 15 – 16 days earlier than in Oberjoch. The shift concerning the mean onset of pollen season in the first period was only 4 days, in the second period 5 days. At Delmenhorst season ends 18 days earlier in the first period and 13 days earlier in the second period.
As to the mean length of the season the biggest shift was to be observed at Delmenhorst: season became 4 days longer (32->36 days). At Oberjoch the season shortened by 2 days (46->44 days).

Conclusions

Counting more *Fagus* pollen at Oberjoch is mainly due to larger local sources near the monitoring site. High annual totals require a synchronized high output of pollen by most of the trees. *Fagus* trees need - similar to *Picea* - some years of recreation to gather enough nutrients for flowering and fruiting on a high level. The positive linear trend of annual totals resp. the higher mean total in the second period of both sites possibly could be explained by higher concentration of carbon dioxide and therefore shortened time of regeneration as well as more pollen production in years of strong flowering. Differences in time of pollen immission between Delmenhorst and Oberjoch are obviously due to differences in climatic conditions, esp. temperature and precipitation, before and during flowering. The fact that *Fagus* pollen season at Oberjoch is longer in both periods is due to far distance transport of *Fagus* pollen from other climatically favoured regions to Oberjoch before local sources become active.

Temperature increase stimulates early and extended ragweed flowering in Ukraine

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Background

Ambrosia is found in every region of Ukraine but it characterized by substantial distribution at Ukrainian South and East. The most affected areas are Donetsk, Zaporizhzhia, Mykolaiv, Kherson, Kirovograd and Dnepropetrovsk regions. Clinical trials show children are more sensitized to ragweed pollen than adults in Ukraine. The sensitization rate is from 7 to 21% depending on the region with higher sensitization in more affected areas.

Method

Pollen collection was done by gravimetric sampling in Vinnitsa for years 1999 and 2000. From 2009 to 2013 research used volumetric methods employing a Burkard trap placed at a height of 25 meters above the ground on the roof of a Vinnitsa Medical University building. Study was conducted in Poltava, Donetsk, Dnepropetrovsk, Odessa and Sympheropol in a year 2010. Air sampling was performed with the Burkard spore trap in these cities. Samples were taken from the March 1 until October 1 for all years of study and for all pollen monitoring sites. Vinnitsa and Poltava located in the Forest-Steppe zone of Central Ukraine, other cities lie in the Steppe zone occupying the South and the South-East of Ukraine.

Results

The greatest ragweed pollen count was usually seen during the third ten day period of August and for the first or second ten day period of September corresponding with the photoperiod of this plant which is considered to be the dominating factor for the ragweed pollen formation. These two periods of the top *Ambrosia* pollination are registered in Vinnitsa for the years 1999-2000 and for the years 2011-2013. Peak in other Ukrainian cities was recorded at the periods mentioned for year 2010 as well. The highest ragweed activity was seen from August, 22 till August, 29 for different seasons in Vinnitsa. The latest maximum of this period was observed in a year 2010 on August, 29 in Odessa. Seasonal peak occurred in Vinnitsa at the same day on August, 25 for years 2011 and 2012.
The second period of raised *Ambrosia* pollen concentrations occurs after September, 5 for every year. However, the autumn concentration increase tends to be shifted to the later period. The earliest second increase was registered on September, 2 2010 in Dnepropetrovsk and on September, 5 in Vinnitsa for the year 1999. The latest one was recorded on September, 18 in the year 2012 in Vinnitsa. Its value exceeded that seen during the usual seasonal highest activity of ragweed at the end of August (200 p.g./m^3 on September, 18 versus 100 August, 25, 2012) in Vinnitsa showing the season extension due to the warm weather.
However, for years 2010 and 2013 rapid rising of the ragweed pollen count was seen for the second ten-day period of August, almost two weeks earlier than the usual one. The value of this unusual peak exceeded the meaning of common seasonal maximum on August, 27 2010 (102 p.g./m^3 versus 76 p.g./m^3) in Vinnitsa. Year 2013 was characterized by significant pollen count increase to 82 p.g./m^3 on August, 11. But annual pollen peak exceeded this value and constitute 92 p.g./m^3 on August, 27 2013. Conversely, ragweed pollen concentrations were not significant in Vinnitsa for September, 2013.

The hot summer of year 2014 provoked the earliest ragweed pollen count increase in comparison with other years of observation. It occurred on August, 6 and it was determined by migrating fraction of *Ambrosia* pollen recorded in the ambient air of Vinnitsa city at around 9 p.m.
The most recent data revealed abundant ragweed pollination till September, 10 2014, which can be comparable with seasonal peak values. It can be evidence of the *Ambrosia* pollen season elongation.
The daily ragweed pollen distribution analyses revealed two fractions of *Ambrosia* pollen grains responsible for the daily count increase in the ambient air of Vinnitsa. The local pollen fraction is seen at afternoon and the migrating one is registered from 9 p.m. to 1 a.m. from 2012 and every year of observation at the peak days. As it was shown before, this fraction can be originated at the well-known *Ambrosia* inventories occupying the South-East of Vinnitsa region.

Conclusion
The changing pattern of ragweed pollen count fluctuation is seen in Vinnitsa during the last 4 years. The fact of early ragweed pollen count increase for the first and for the second ten-day periods of August and elongation of the pollen season during September can reflect the impact of global warming on the ragweed pollination. This data is important for the proper allergy forecasting and *Ambrosia* season control.

POLLEN MONITORING II

Diurnal patterns of allergenic airborne pollen at a city motorway in Berlin, Germany

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Background

The objective of the study is to find out if there are characteristical patterns of airborne pollen load in the course of a day at the city motorway A 100 in Berlin. Measurements were carried out with a Burkard trap in 2012 and 2013. Daily samples were analyzed with regard to two-hours-average values. The results of the seasonally averaged diurnal patterns of *Betula*, Poaceae (including *Secale*) and *Artemisia* are presented.

Results

In 2012 *Betula* pollen load in the air concentrated on the second half of the day (10 a.m.-12 p.m.) with maximum values about noon (12 a.m.-2 p.m.). In the next year there was a rather uniform occurrence throughout the day and the midday peak was missing.
Poaceae pollen mainly flew from 8 a.m. to 8 p.m. in 2012 and from 10 a.m. to 10 p.m. in 2013 respectively. In both years maxima were detected in the afternoon (2-6 p.m.). Lowest values were found in the night and in the morning (12 p.m.-8 a.m.).
In both years main time of *Artemisia* pollen occurrence was between 6 a.m. and 2 p.m.. 30% (2012) and accordingly 23% (2013) of the mugwort pollen count fell upon the interval from 8 to 10 a.m.. In the remaining time of the day (2 p.m.-6 a.m.) concentrations were clearly lower.

Conclusions

The study shows for both Poaceae and *Artemisia* pollen good congruencies between the years; concerning *Betula* there are differences.
As the monitoring site was rather distant from local pollen sources the diurnal patterns do not directly reflect the times of pollen release, but additionally all processes involved in removing pollen from the anthers and carrying them to the trap.
At the city motorway and perhaps other places with a similar urban environment allergic persons suffering from grass and/or mugwort pollen might be advised to avoid the above-mentioned main times to be outside or to air the room, for example. As regards *Betula* the results do not allow a recommendation.
Because of the relatively short monitoring period of two years and due to characteristics of every single day and individual threshold values the results should only be seen as trends.

Czech Pollen Information Service – 23 years of operation

Ondřej Rybníček

Czech Initiative for Asthma, Czech Republic.

The Czechoslovak Pollen information Service (PIS) was established in 1992 with the first Burkard 7-day volumetric pollen trap operating in Brno. In 1993 we witnessed the split of Czechoslovakia. Since that time there exist Czech PIS and Slovak PIS. Currently the Czech PIS operates 12 Burkard 7-day volumetric pollen traps with 11 traps that are in operation every year. Czech pollen stations are distributed quite well all over the country. The only problem is a missing pollen station in the South Bohemia after the operation in the town of Písek was stopped several years ago. Results of 23 years of pollen monitoring of birch, grasses, mugwort and ragweed in the Czech Republic, specifically in the towns of Brno, Praha and Ústí nad Orlicí will be presented.

Pollen, its impact on pollen allergy sufferers and the influence on pollen information

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More than 10% of the population in Austria suffers from pollen allergy and an increasing trend is still observed over whole of Europe. Scientific based pollen information is an essential support for pollen allergy sufferers and helps to improve quality of life as well as to keep symptoms at a minimum and to limit costs in the health sector. The relationship between the occurrence of pollen in the air and the symptom load in the population is an important factor to know for forecasts, research and medical treatments. Pollen data is gathered by the local pollen information networks and was requested from the European Aeroallergen Netwerk (EAN; https://ean.polleninfo.eu). The symptom load is calculated based on the data entries of pollen diary users (Patient´s Hayfever Diary; www.pollendiary.com). It is shown that this relationship is not as simple as assumed, because higher pollen loads do not automatically infer higher symptom loads. The symptom load index gives insight into the burden caused during different flowering seasons (birch, grasses and ragweed), reveals the considerable impact of allergen content in the air (Bet v1 and Phl p5) and indicates together with phenology monitoring pollination that might be overlooked with pollen counts alone. Furthermore, individual users react differently. Thus, pollen information should be tailored to individual pollen allergy sufferers and adapt to their actual status. This challenge can be addressed by recently developed services like the personal pollen information and the symptom load map or by services to-be-developed e.g. symptom models (in comparison and addition to pollen dispersal models). The findings emphasize the interdisciplinary research in aerobiology and strengthen the fluent passages to related fields including medicine.

Defining the ragweed pollen season in Northern Italy

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Background

Defining the pollen season is one of the most important tasks in aerobiology. The most crucial step in carrying this out is the choice of the criteria to be followed. According to some authors, the criteria to be used should be the ones which are best suited to the aim of each aerobiological survey. The decision also varies as a function of the pollen type under study and the particular features of the sampling site involved. The aim of our work is to analyse the ragweed pollen season obtained by applying various criteria in two different infested areas in Northern Italy: the North-Western Milan area (one of the zones most infested by ragweed in Europe), and the city of Parma and its surroundings (an emerging infested zone), which present very different levels of airborne ragweed pollen.

Methods

Daily average pollen concentrations were collected at two sites: the towns of Legnano and Parma, from 1996 to 2013. Both stations are connected to the Italian Monitoring Network on Aerobiology (R.I.M.A.®) and the European Aerobiology Network (E.A.N.). The pollen counts were performed according to the standard methods of the Italian Aerobiology Association (A.I.A.). Pollen data were collected by volumetric spore trap of Hirst design. The amount of Ambrosia pollen recorded annually during the flowering period of Ambrosia (July-October) is presented as "Annual Ambrosia Pollen – AAP", and the daily average ragweed pollen concentrations are expressed as particles per cubic meter of air (P m^{-3}). For each station and for each year, the AAP, the start and the end of the pollen season and its length (i.e. number of days) were assessed according to the criteria proposed by various authors (Galan, 1995; Jäger , 1196; M. Lejoly-Gabriel & R. M. Leuschner; 1983).

Results

Legnano (L) presented very high levels of ragweed pollen (average AAP= 4496), whilst Parma (P) presented lower levels (average AAP= 292). The season's length according to Galan (L= 58, P= 66) was significantly longer than those according to Jäger (L= 36, P= 44) and Leuschner (L= 32, P= 38) in both stations. Apparently, despite the lower daily ragweed pollen concentrations, the season's length always seemed longer in Parma than in Legnano. The most suitable criteria to describe the ragweed pollen season in Legnano was the ones by Galan (average start day concentration= 10 P m^{-3}; average last day concentration= 7 P m^{-3}). Indeed, a large number of days presenting high ragweed pollen concentrations was excluded from the season by applying the two other criteria (Jäger: average start day concentration= 72 P m^{-3}, average last day concentration= 41 P m^{-3}; Leuschner: average start day concentration= 74 P m^{-3}, average last day concentration= 73 P m^{-3}). On the contrary, Galan's criteria was not suitable to describe the ragweed pollen season in Parma, because too many days with zero or very low ragweed pollen concentrations were included and the season erroneously seemed longer. In this case, both Jäger's and Leuschner's criteria would be suitable (Jäger: average start day concentration= 4 P m^{-3}, average last day concentration= 4 P m^{-3}; Leuschner: average start day concentration= 6 P m^{-3}, average last day concentration= 6 P m^{-3}).

Conclusion

Our study confirms that it is not possible to use just one criterion to define the pollen season. The features of the sampling site involved are an important issue to take into consideration when deciding the criteria to be followed. This obviously needs to be linked to a preliminary observation of the data distribution. Therefore any aerobiological automatic software should allow the analysis of the data distribution and the assessment of different criteria to define the pollen season.

Grass pollen concentrations according to the urban-rural gradient in the Helsinki Metropolitan Area

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Introduction
Only few studies have assessed pollen concentrations according to the level of urbanization, but these studies were based on a small number of sampling points and regional pollen data. We studied the effect of urbanization on grass pollen concentrations in the breathing zone.

Methods
The study was conducted in the Helsinki Metropolitan Area Finland during the peak pollen season of grasses from 27 June to 21 July 2013. Two sampling lines of three kilometers were placed and four sampling site pairs were formed on the urban-rural gradient within sampling lines and within the City of Helsinki and Espoo. Altogether, pollen grains were monitored in 16 different points during morning (8:00–11:30) and afternoon (13:00–16:30) sessions. Rotorod-type samplers were attached on sampling poles to the heights of 1.5 meters and each sampling period was restricted to 30 minutes.

Results
Both in Helsinki and Espoo the smallest grass pollen concentrations were observed in the most urbanized sampling sites (mean 3.6 vs. 6.8 grains m^{-3} in Helsinki; $P < 0.0001$, and 5.2 vs. 87.5 grains m^{-3} in Espoo; $P < 0.0001$) and during the morning periods (mean 4.9 vs. 5.4 grains m^{-3} in Helsinki; $P = 0.0186$, and 21.8 vs. 67.1 grains m^{-3} in Espoo; $P = 0.0004$) and. On average the pollen concentration was lower in the more urbanized sampling site pair compared to the less urbanized pair (mean 2.2–7.1 grains m^{-3} vs. 3.6–9.7 grains m^{-3} in Helsinki, and 4.4–6.6 grains m^{-3} vs. 7.2–241.1 grains m^{-3} in Espoo) and the differences in pollen concentrations between morning and afternoon sessions were more pronounced in less urbanized Espoo compared to Helsinki (mean 2.2–10.5 grains m^{-3} vs. 1.7–10.9 grains m^{-3} in Helsinki, and 3.5–121.2 grains m^{-3} vs. 2.4–380.3 grains m^{-3} in Espoo). However, pollen concentrations fluctuated momentarily between moderate and abundant even in the most urbanized sampling sites (range in maximum values 11–86 grains m^{-3}).

Conclusions
Grass pollen concentrations were lowest in the most urbanized sampling sites and during the morning periods. Basically, pollen concentrations were less fluctuating in the more urbanized sampling sites compared to the less urbanized sampling sites both in Helsinki and Espoo. However, pollen concentrations in the most urbanized sampling sites can occasionally reach the level where individuals with asthma and allergies can react.

Distribution of pollen across Berlin – an introduction

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Pollen monitoring stations, which observe daily concentration of allergenic pollen in the air, are active in a large number of cities worldwide. In most cases, stations are equipped with a seven day volumetric spore trap of Hirst type. The traps are generally placed on rooftops, approx. 15 meters above ground level. Pollen forecast and pollen monitoring are typically based on only one trap for a whole town. There are also a few towns where two (or three) volumetric traps are continuously running, for example Berlin, Barcelona, Munich, Lyon, Nice and other towns in which some short-term studies with more than one trap were processed. Results of capturing pollen by multiple traps across towns show often almost the same seasonality but more or less different counts, which can be influenced by type of urban environment, local vegetation and meteorological conditions. These variations in the amount of pollen can cause different intensities of allergy symptoms from region to region also in on a smaller scale like those of urban districts. More detailed studies concerning the lack of knowledge about distribution of pollen in towns are necessary to provide pollen allergy sufferers with information they require. The necessity for a network of pollen monitoring stations in a town can be addressed by establishing further volumetric traps. But high costs for establishing and operating these kinds of traps, as well as time consuming analysis and the need of power supply lead to another variant of pollen trap. Different kinds of gravimetric traps, which are more cost effective and independent from any electrical power grid, also bring detailed information about current occurrence and amount of airborne pollen. Local differences of pollen distribution across town by using gravimetric traps were already shown in a small town in the Czech Republic (Humpolec) or in a part of bigger town in the United Kingdom (North London). To make a contribution to this topic, 14 gravimetric traps were placed across Berlin, representing a big town. These traps covered different urban environments from the city center through to industrial and residential areas up to the periphery. Traps were placed between 2 and 3 meters above ground level, i.e. near the level in which people breathe. Each of the traps contained a sticky slide which was placed between two horizontal plates. The slides were changed weekly from mid-March until the end of October 2014. As a comparison to the weekly total of volumetric counts, two additional gravimetric traps were placed near two Burkard traps. Early results already show differences in occurrence of pollen types and their amount from side to side.

POLLEN ALLERGY AND NEW TOOLS IN POLLEN INFORMATION

Risk of sensitization and allergy in Ragweed workers – a pilot study

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Background
Due to its high allergenic potential *Ambrosia artemisiifolia* has become a health threat in many European countries during the last few decades. Hence, several cities and communities initiated ragweed eradication campaigns. In Berlin, Germany, so-called Ambrosia scouts are being assigned the task of finding and eliminating this weed.
We sought to evaluate the potential risk of sensitization and allergy in these individuals.

Results
In order to assess the risk of sensitization and allergy, we followed-up 20 Ambrosia scouts by skin-prick test with inhalant allergens, immunoserological and pulmonary function tests. Additionally, medical conditions were evaluated by a questionnaire especially designed for this study.
Despite close contact to ragweed over a median duration of 13.8 months, none of the participants became sensitized or allergic to ragweed. One individual developed a clinical non-relevant sensitization towards the taxiconomically-related plant mugwort. A decline in relative FEV1 was most probably due to heavy smoking.

Conclusions
Our findings suggest that intensive contact and exposure to high ragweed pollen concentrations do not necessarily result in sensitization and/or allergy, meaning that the allergenic potential of this weed might be lower than hitherto expected. However, it is also conceivable that continuous exposure to high allergen levels induced tolerance in the ragweed workers.
Due to the relatively small number of subjects studied, our results might be biased and therefore investigations on larger study groups are needed.

Automated pollen monitoring, dream or reality?

Bernard Clot

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Background
Hirst-type samplers are used throughout the world as standard instruments for airborne pollen and spores monitoring. Manual microscope counting allows detailed identification of many taxa. However, this is a demanding and time-consuming activity; data are usually available once a week only. Thus, a major challenge in aerobiology is to produce real-time data for timely information and forecasting.

Method
Four different prototypes of automated pollen detection systems were tested in Payerne during the 2013 and/or 2014 pollen seasons and Hirst trap was used as reference. In one system, pollen identification is made by using image recognition (BAA500, Germany). In the three others, developed in Japan (KH-3000), England (WIBS-4) and Switzerland (PA-300), pollen grains are identified by optical systems based on lasers and fluorescence (air flow cytometry).

Results
The four tested systems present very different characteristics and capabilities. All showed good correlation with the Hirst data for total pollen count. In addition, the BAA500 allowed identification of a list of pollen types. The WIBS-4 allowed estimating the total number of fungal spores. The PA-300 is the most sophisticated system and demonstrated the capability of detecting and counting different types of particles, including different pollen types.

Conclusion
The tests run in Payerne, aimed at evaluating the state of development of automated systems for airborne pollen detection, showed that automated pollen monitoring could become a reality in a near future and helped identifying the necessary improvements in order to use such systems for operational monitoring.

Citizen science as a tool to monitor hay fever symptoms

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Presence of pollen in the air is a relevant trigger for symptoms in allergic rhinitis patients. The impact of the pollen can vary among patients and is dependent on the individual and the kind and the number of pollen, but it is also affected by several environmental factors. Citizen science can help to collect the symptom scores from large numbers of subjects that are needed to study these complex relations.

This study describes the relevance and the use of symptom scores collected by citizens.

In May 2009, a public website Allergieradar was launched on which participants registered by completing an extensive questionnaire. Subsequently they could register their daily symptom scores and their location on a map. In January 2013 an application for mobile phones (App) was introduced to facilitate the recording of symptom scores.

The registration questionnaire showed that the majority of the participants had a doctor diagnosed hay fever (77%) and had been tested for their allergy (65%), indicating that the large majority of the participants are hay fever patients. Interestingly, after the introduction of the Allergieradar App the number of participants tripled and the number of entries doubled. However, the compliance of the participants did not improve.

Symptom scores recorded in this way correlated with pollen concentrations in the air and with the sales of prescribed antihistamines. However, birch pollen concentrations often correlated poorly with the symptom scores, which most likely is due to the presence of other pollen during the flowering season e.g. ash pollen.

Conclusion: Allergic rhinitis symptom scores collected by citizen science are valuable in studies on the health impact of pollen.

The practical application of pollen monitoring in immunotherapy with pollen allergens

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Introduction

During the pollen season, especially when the symptoms of allergic rhinitis are manifested by patients, the dose of allergen should be reduced, or the scheduled visit should be postponed. In these cases the current and predicted pollen concentrations seem to be really useful for allergologists conducting SIT.
Aim of the study: The aim of the study was to check the effectiveness of the multinomial logistic regression models predicting the pollen concentration during the pollen season in the immunotherapy trial in patients treated with grass and birch allergens.

Methods

The pollen data were obtained in 1991-2013 in Krakow (Southeastern Poland), using the volumetric method. The multinomial logistic regression was used to find the relation between the probability of the pollen concentration occurrence in the selected threshold categories and meteorological elements. Predictive models were constructed using data in 1991-2011 and they were validated for 2012 and 2013. A group of patients treated with grass and birch allergens filled in the diary cards during the pollen season. After the 2011 season 14 diary cards were analysed, while 18 and 19, in 2012 and 2013, respectively.

Results

Because of manifested symptoms, the injection dose was reduced during the season in 12 patients in 2011, in 9 patients in 2012 and in 6 patients in 2013. No visits were delayed because of medical indications. In some cases patients got the injection in time of the high pollen occurrence (2 cases, in 2011 and 2012). In 2013 in 10/17 patients the high pollen exposure was avoided thanks the information from pollen monitoring, in opposite to 1 and 8 patients in 2011 and 2012, respectively. Patients used antihistaminic drugs on request.

Conclusions

The regional pollen monitoring data and satisfied co-operation with patients makes the possibility of closer control of the injection doses administration during immunotherapy in the pollen season.

Building a fully automated pollen monitoring network in Bavaria, Germany

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Pollen is monitored in Europe with a network of about 350 pollen traps, all operated manually. Automated pollen monitoring has not been feasible to date, except in areas with limit diversity in airborne pollen spectrum. There is a need for rapid reporting of pollen counts in addition to the alleviation of the workload of manual operation. BAA500 is an automated pollen monitor based on image recognition. The instrument consists of a 3-stage virtual impactor, the fraction of air containing pollen is deposited on a sticky surface that is moved towards a microscope equipped with a CCD camera. Images of the pollen are constructed and compared with a library of known samples. Results are reported online. Here we propose steps for building a pollen monitoring network in Bavaria, based on a network of several BAA500.

Main steps: 1. Testing the performance of the automatic monitor, by comparing its data with data from a Hirst spore trap at the same location; 2. Designing the monitoring network (number of traps and locations), by employing geostatistical methods and Analytic Hierarchy Process (AHP); 3. Training BAA500 in proposed monitoring places. 4. Automatic entering of data on forecasting system and diffusion.

To test the performance, we identified manually about 46,000 pollen grains from the BAA500. Most pollen particles were recognized correctly by the automated monitor. Excluding *Salix* sp., 77% of provided pollen were correct identified. The best recognition rates (>80%) were with urticaria and birch. Recognition rates for grasser were the lowest, still exceeding 60%. Of the reported number 93% were true positive and 7% were false positive. The correlation between daily concentrations reported by a Hirst-type pollen trap and the automated counter was 0.98, when available data. For step 2 we created a list of criteria that should be taken into account for designing trap locations including land uses, topography or demography, among others.

Performance test show satisfactory results for BAA500, which may mean a milestone in the method of pollen monitoring in Europe. We will test the usefulness of this monitor for future monitoring networks and expect lower maintenance costs and with higher quality data.

Climate Analysis Tools of MeteoSwiss used for pollen information

Regula Gehrig

MeteoSwiss, Zurich, Switzerland.

Climate Analysis Tools (CATs) are a framework of tools that facilitate climate analysis of MeteoSwiss. The tools are written in R, a free software environment for statistical computing and graphics. CATs provide daily updated data analysis as tables or graphs which serve as basis for data interpretation, media information or regularly published climatological bulletins. Secondly the automated produced graphs are published on the internet or in climate publications.

A new CAT for pollen information was developed recently. It consists of weekly updated graphs of the actual pollen season compared with the climatology of pollen concentrations: for internal use a comparison with different quantiles, maximum and minimum of the climatology and for the publication on the internet a comparison with the mean pollen season. A very helpful tool for writing pollen bulletins is a weekly updated table with a long list of pollen indicators for each station and 14 pollen types. Pollen indicators are different parameters which are derived of measured data for example several definitions of start dates, SPI, number of days above specific thresholds, different definitions of the length of the pollen season and maximum values. As an additional part of the pollen CAT, graphs with trends of the SPI are produced.

Relationship between climate variability indices and airborne pollination in Catalonia (NE Iberian Peninsula)

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Here we explore the effect of climatic variability on the airborne pollen series recorded in Catalonia (NE Iberian Peninsula) considered of high interest due to abundance, landscape importance and/or allergenic significance. In this sense, the relationship between the annual and winter (December to March) phases of the North Atlantic Oscillation (NAO), the Western Mediterranean Oscillation (WeMO) and the Arctic Oscillation (AO) and the Annual Pollen Index (API), the start, the end and the length of the pollination seasons of 22 taxa collected at 6 aerobiological stations in Catalonia during the 18 years-period 1994-2011 have been computed. In addition, daily back-trajectories cluster analysis has been carried out in order to determine the influence of climatic indices on the main atmospheric transport routes frequencies and the long range pollen transport. Our aim is to determine the respective vulnerability of taxa to climate variability, taking also into account the pollen provenance area.

Climatic indices showed significant negative correlations with the parameters API (except for *Corylus*) and pollination start (except for *Ambrosia*, *Castanea*, *Fagus* and *Betula*, the latter being Eurosiberian taxa often long range transported) of most taxa, while significant positive correlations with the end of the pollination period of most taxa. The most vulnerable taxa (more significant correlations) with regard to API were *Corylus*, *Olea*, *Platanus* and *Quercus* deciduous type.

Airborne allergens Bet v 1, Ole e 1 and Phl p 5 in different fractions of ambient air deviate from pollen counts in 10 countries across Europe

The HIALINE working group:

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Background
Allergies to grass pollen are the number one cause of outdoor hay fever. The human immune system reacts with symptoms to allergens from pollen. Biological material varies in component content and we investigated the variation in release of the major group 5 allergen from grass pollen across Europe.

Methods
Airborne pollen and allergens were simultaneously collected daily with a volumetric spore trap and a high-volume cascade impactor at 10 sites across Europe for 3 consecutive years. Bet v 1 for birch, Ole e 1 for olive and group 5 allergen for grass pollen was determined with specific ELISA´s in two fractions of ambient air: Particulate Matter (PM) >10µm and 10µm>PM>2.5µm. Mediator release by ambient air was determined in FcεR1-humanized basophils. Origin of pollen was modeled and condensed to pollen potency maps.

Results
Olive pollen in Portugal released on average 0.8 pg Ole e 1 per pollen whereas in Cordoba, Spain this was 3.9 pg/pollen. Birch pollen released 3.9 pg Bet v 1/pollen. On average grass pollen released 2.0 pg Phl p 5/pollen. However, pollen varied about 17-fold, p<0.001 in allergen release per pollen (potency). The main variation was locally day-to-day. Average potency maps across Europe varied between years. Mediator release from basophilic granulocytes

correlated better with allergen/m^3 (r^2=0.80, p<0.001) than with pollen/m^3 (r^2=0.61, p<0.001). Thus allergen monitoring to predict patient symptoms could have advantages. Indeed, pollen released different amounts of allergen in the non-pollen bearing fraction of ambient air depending on humidity.

Conclusions

Across Europe, the same amount of pollen may release 17-fold different amounts of the major group 5 grass pollen allergen, 10-fold different amounts of Bet v 1 and 12-fold different amounts of Ole e 1. This variation in allergen release is on top of variations in pollen counts. Molecular aerobiology, i.e. determining allergen in ambient air, may better represent allergen exposure.

POLLEN INFORMATION, FORECASTING MODELLING I

Copernicus Atmosphere Monitoring Service: taking the collaboration with EAN to the next step

Vincent-Henri Peuch

ECMWF, Copernicus Atmospheric Monitoring Service coordinator.

The talk presents the state-of-play of co-operation between EAN and MACC, which will be transformed into the operational Copernicus Atmospheric Monitoring Service (CAMS) in 2015.

Following the series of MACC-EAN leadership meetings, the following major lines of co-operation have been identified:
(1) To establish a long-term co-operation between MACC and its follow-up sustainable programme and the EAN.
(2) To work jointly to consolidate the case for sustainable pollen observations funding in Europe.
(3) To consolidate pollen deterministic forecasts as part of the portfolio of European-scale Copernicus services. This includes model forecasts, their evaluation against observations, definition of the scope of the (core) service and stimulation of its uptake by users/intermediate users (e.g. working on symptoms prognosis).

To-date, MACC includes a pollen forecasting work package within its European Regional air quality ensemble modelling. In co-operation with several EAN members, the ensemble performance was evaluated for the single year of 2013 (described in a separate presentation at this meeting).

Owing to MACC efforts, EAN is currently recognised at the EC level as a critical part of the European AQ monitoring infrastructure and mentioned in the Copernicus Delegation Agreement (in the final stage of negotiations between EC and ECMWF) along with main global and European observational networks on atmospheric composition. Together with the recent Written Declaration of European Parliament on the allergy burden, these specify a major step towards sustainable future of EAN and efficient pollen monitoring and forecasting in Europe.

Increasing the number of species in pollen forecasting

Marje Prank, Mikhail Sofiev, Pilvi Siljamo, Mari Kauhaniemi, EAN data providers

Finnish Meteorological Institute, Helsinki, Finland.

The talk considers the options of increasing the number of allergenic pollen species in SILAM pollen forecasts. Currently the forecasts are provided for birch, grass, olive and ragweed pollen. This list will be extended by alder and mugwort for the coming seasons. The experiences gathered developing the pollen emission algorithms for these species will be discussed, focusing on how they help us along with including new species. I will summarize the current knowledge, concentrating on similarities and differences between the taxa and the algorithms used for them.

A pollen emission model for a species requires two major components: a habitat map and a flowering model specifying the dependencies of the timing of flowering on external forcings.

Several data sources exist for obtaining plant habitat maps. Ecological databases of species observations have not proven very useful, as the observation frequency there is strongly differing between countries. Land cover and forest inventories can contain either the required land use type (e.g olive plantations or grasslands) or a surrogate type that still needs to be scaled for the specific species (e.g. broadleaf forest). For ragweed we needed to apply an ecological model to simulate the affected areas.

SILAM currently allows several parameters to influence the flowering – instant temperature and long term temperature accumulation, soil humidity and photoperiod. All trees are represented as temperature-sum-dependent species. The flowering of the annuals such as ragweed and mugwort is assumed to mainly depend on day length, while it can be delayed by cold growth season and frosts and dry soil can stop the flowering. For grasses currently a simplified model is used, where the flowering time is taken as the average observed season.

Pollen seasons in changing climate: a modeller's viewpoint

Mikhail Sofiev, Marje Prank, EAN data providers

Finnish Meteorological Institute, Helsinki, Finland.

The presentation considers the possible changes in atmospheric transport of aeroallergens that can be expected due to climate change. We focused on two types of analysis: (i) trends of meteorological parameters that are expected to affect the pollen transport, (ii) direct pollen dispersion modelling with fixed source term formulations and parameters. The overall effect of the meteorological trends, with all limitations of the current knowledge, should be a certain reduction of the pollen transport distance causing reduction of concentrations away from the sources. Changes in the near fields are more uncertain due to competition and partial mutual offsetting of these factors. This conclusion is in general agreement with studies published for "conventional" pollutants.

Pollen dispersion modelling over last 33 years generally confirmed the trends and suggested, in most cases, that the near-source concentrations grow by ~0.1% per year. A similar-magnitude reduction was suggested for the regions away from the main sources, with a chance to become even more pronounced when the effect of reducing relative humidity is included in the model.

Towards developing of short-term statistical model for birch pollen forecast

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A necessity of pollen short-term forecasting was recognized long ago but means of generation of such prognosis are still fall behind the demand. Several highly sophisticated deterministic models have been suggested to cover the regional- and European scales. However, their limited spatial resolution and complexity of such systems leave space for localized, easy-to-use statistical models with input data consisting of several parameters of meteorological forecast. Such approaches can provide vital complimentary information using in-situ pollen observations and regional/local meteorological forecasts. A combination of the information can be one of the best options for pollen forecasting services. It is well known, that birch, alder, hazel, grasses and mugwort are positioned as a main cause of pollen allergy in Northern Europe and Baltic States. Thus, birch was chosen for development of such model in Riga (Latvia). Model construction starts from the consecutive steps of meteorological and pollen data transformation before model identification. Main steps of data transformation include (i) normalization of pollen concentrations; (ii) switch from time –dependent axes to heat sum axes; (iii) expression of meteorological parameters in pollen concentration; (iv) non-linearity reduction of the normalized pollen concentrations. Model identification is based on result of (stepwise) multi-linear regression; data of 10-years pollen observations. Model validation was made by using observation data from the years withhold from the model identification. Already preliminary version of the model showed quite high scores for the control year: the season timing was captured with 3 days error, correlation coefficient during the season was 0.61. Both components are close or exceed the corresponding quality scores of regional-scale simulations of SILAM model. This confirms the feasibility of the localized statistical models as a complimentary source of information for the areas around the pollen observation sites.

POLLEN INFORMATION, FORECASTING MODELLING II

Forecast threshold for pollen allergy risk information in France

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RNSA (Réseau National de Surveillance Aérobiologique), Brussieu, France.

For 20 years the principal information provided by RNSA (French aerobiology network) about allergy due to pollen exposure was an index of allergy risk.

It exists, for some different areas of France, a theoretical correspondence between a quantity of each type of pollen and an allergy risk. These correspondences were made during 10 years with some information of health impact given by allergists regarding the pollen exposure. The theoretical allergy risk (RAth) depends of the allergy potency of the taxon, the number of grains and the location of the pollen trap. But this RAth does not take into account the real health impact, the duration of the specific pollen season, the phenological situation of the plants and the meteorological forecast.

For these reasons, RNSA produced an algorithm taking into account these parameters:

To do this, a grid mapping was developed between daily pollen concentrations and a theoretical risk of allergy (RAth) for each geographic area and for each taxon. This method can also be realized on other frequencies (weekly, etc ....). The values of this grid can be adjusted annually taking into account changes related to Climate Change. For each geographic area and for each taxon RNSA has developed the following algorithm: Rap = RA forecast

$$Rap = RAth + (C+P+M)/3$$

- C = clinical index ranges from -2 to +2, it takes into account the values obtained by:
  - The evolution of symptoms
  - The clinical index (type and severity)
- P = phenological index ranging from -1 to +1 depending on the evolution of pollination
- M = weather forecast index ranging from -2 to +2 depending on the averages of daily temperatures, duration of rain, and winds forecasts (direction and speed).

The total C + P + M is divided by 3 and the result is rounded to the closest integer value so (C + P + M)/ 3 can only takes the integer values from -2 to +2.

Rap and Rath are indexes which can only take values between 0 and 5.

For each forecast bulletin, RNSA send for each location and each taxa the pollen exposure in concentration of pollen grains by cubic meter and the allergy risk with an index between 0 (nul) to 5 (very high level). These information are given with a recommendation to limit the health impact from exposure to allergenic pollen.

Forecasting walnut crop yield based on aerobiological studies

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Crop yield influences prices on the trade market. Models have been developed for predicting the yield of agricultural crops that include the amount of airborne pollen as a predictor variable (i.e. for olives and grapes). It is therefore expected that airborne pollen data could contribute forecasts of seed and fruit yield in other crops.

In this study we have examined relationships between walnut (*Juglans*) yield and meteorological and airborne pollen data. We have then used this information as a foundation upon which simple regression models have been built.

Walnut yield is greatly dependent on weather conditions, particularly during fertilisation and seed growth, but the amount of airborne pollen also plays an important role. The introduction of the Seasonal Pollen Index (SPI) as a proxy for the amount of pollen available for fertilisation, improves the performance of models predicting walnut yield. This increases the possibilities for using aerobiological data in agriculture and shows the importance of recording airborne *Juglans* pollen during routine aerobiological monitoring.

Data EAN pollen database from 280 stations in 16 countries that routinely monitor airborne *Juglans* pollen were extracted from the EAN pollen database. Correlation analysis showed negative relationships between mean annual *Juglans* pollen concentrations and walnut yield in 9 countries. This suggests that there is a possibility for conducting detailed analysis in other European regions, and possibly expand the application of forecast models for walnut yield.

Smart Pollen - Effects of human-made correction to the SILAM grass pollen fields: preliminary verification results

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We will present very preliminary results how human-made corrections affect the quality of the numerical pollen forecasts.

The SILAM pollen forecasts left sometimes room for improvement. Pollen concentrations can be too low or high or the flowering area locates in a wrong place. In many cases aerobiologists know, where and how to fix it. Finnish Meteorological Institute (FMI) and Aerobiology Unit at Turku University are developing so called Smart Pollen –method for the correction of the numerical pollen forecasts. It bases on the SILAM modelling system, the Smart Met –editor (duty meteorologists tool in weather forecasting at FMI) and human work at Turku University, where the aerobiologists check and correct the SILAM pollen predictions in a daily basis. The corrected data will be sent back to FMI and from that data different type of pollen forecasts can be done.

Here we use the SILAM grass pollen forecasts, the corrected SILAM data by Turku University, and Finnish 2 hourly grass pollen observations in summer 2014. Forecasted, corrected and predicted 2h-pollen concentrations are compared and we will discus, how much human work can improve the quality of the SILAM grass pollen forecasts.

What would the ideal pollen information be like?

Annika Saarto

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Research brings about knowledge, technical development opens up new possibilities, and people ask or hope for even more advanced services. What does this all mean for pollen information service? What are the bricks of an ideal service solution? We analyzed the feedback that was sent to the Finnish Aerobiology Unit during the recent years concerning our pollen information. Discussions found at Internet forums around the same topic were included in the analysis. The feedback could be divided into three categories. Firstly, many people would appreciate general information on allergy plants, pollen and allergy symptoms. Secondly, many suggestions were given as to how to improve the technical and visual aspects of the pollen information. The major part of the feedback, however, concerned the content of the pollen forecasts. Shortly stated, the pollen allergists wish for more precise pollen forecasting and the exploitation of wider data. Insufficient and overdue information on the beginning of pollen season is one clear problem. University of Turku, Finland, and the Finnish Meteorological Institute are finishing a new method for pollen forecasting. The method makes it possible to produce much more precise forecasts than before, and the forecasts can easily be modified to different formats according to user needs even languagewise. The method combines aerobiological and meteorological expertise, SILAM modelling and modern information technology, and the piloting covers the pollen seasons of 2014 and 2015.

Pollen forecasts based on the numerical pollen dispersion model COSMO-ART

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Numerical pollen dispersion models such as COSMO-ART (COnsortium for Small-scale MOdeling - Aerosols and Reactive Trace gases) can provide spatially and temporally highly resolved pollen forecasts. COSMO is a non-hydrostatic mesoscale model that is used in operational weather forecasts in a number of European weather services.

The pollen module of ART calculates the pollen emission and dispersion processes. A phenological heat sum model is used to predict the start and the end of the pollen season whereas the plant distribution was derived from suitable sources such as land use datasets weighted with pollen data or inventories. The parameterization of the pollen emission is superposed on these factors and depends strongly on the meteorological conditions. Dry Sedimentation and washout of the pollen grains are modelled as well.

COSMO-ART is used operationally at MeteoSwiss to calculate birch, grass and ragweed pollen concentrations on a 7 km grid. The domain covers central and southern Europe. These forecasts are provided as concentration maps and are updated on a daily basis.

Verification results using a number of pollen stations are presented. The temporal resolution is up to 2 hours which allows detailed assessment of the diurnal cycle. Good agreement with observations was achieved at many observation sites. We discuss the potential and the limitations of this kind of pollen forecast. On the whole, COSMO-ART can provide very valuable pollen forecasts also due to the high spatial and temporal resolution. Future developments of COSMO-ART include the increase of the spatial resolution to 2 km. Additionally, further allergy-relevant species such as alder will be modelled on an operational basis.

Experience of birch pollen forecasting with multi-model MACC regional ensemble

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The presentation summarises the experience of the first-ever ensemble forecasting of birch pollen season in Europe. The seven-models strong European ensemble of MACC ENS teams, tested in the trial simulations through the season of 2010, has been run in operational forecasting mode over the season of 2013, compared with observations and then rerun in the analysis mode through the same season. The results were compared with observational data of 6 countries, members of European Aeroallergen Network EAN: Austria, Estonia, Germany, Finland, France, and Ukraine.

It is demonstrated that the simulations of ensemble members, all based on a synchronised pollen emission source of FMI, are both sufficiently close to each other and also span over a substantial range of predicted concentrations and patterns. This has confirmed the correctness of the source term implementation in all models, also highlighting the added value of the ensemble as a tool for studying the uncertainties of the pollen forecasts due to features of dispersion models. The solid performance of ensemble median, in agreement with the expectations, has confirmed the added value of the multi-model ensemble.

The successful experience of the ensemble pollen simulations and lessons learned from the data analysis clarified the shape of the future co-operation of EAN and MACC.

QUALITY CONTROL IN AEROBIOLOGY AND DR. SIEGFRIED JÄGER SYMPOSIUM

EAN – data base under construction: News and upcoming services

Maximilian Kmenta, Katharina Bastl, Uwe Berger

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The data base of the European Aeroallergen Network was established in 1988 on the initiative of Dr. Siegfried Jäger who takes care about the system up to now. Since the beginnings of EAN, pollen data was centralized in Vienna and even today, the data base is hosted by the Medical University Vienna, research group of Aerobiology and Pollen information. Up to now 40 European and non-European countries support the central data base voluntarily with pollen data for scientific and commercial reasons. Currently the system includes data from more than 420 active and about 300 historical pollen monitoring stations. EAN was and is a voluntary cooperation between analysts and aerobiologists of different backgrounds. Furthermore, the data base is a basic tool for pollen forecasts and essential for pollen information services in Europe. Service features of the last years such as European pollen load maps; the System for Integrated modelling of Atmospheric composition (SILAM); the Patient's Hayfever Diary and the personalized pollen information would not have been possible without the contribution of all EAN members. EAN is unique and the largest, non-commercial pollen data collection in the world. Hence the system is elementary for research projects and clinical studies on a European scale. To manage future challenges the data base is updated and improved periodically. These updates include improvements in IT and programming as well as in usability, input of data and quality control.

Pollen Quality Control in France

Charlotte Sindt, Michel Thibaudon

RNSA (Réseau National de Surveillance Aérobiologique), Brussieu, France.

About 70 analysts work in France for the pollen recognition. Each year, the RNSA organizes quality control. This quality control has existed for twenty years consisting in the recognition of 10 mono pollen blind slides and the re-reading of a wild slide. Indeed, each year, the scientific advisor of RNSA choose 10 slides for the blind test among the main allergenic taxa and some specificity of our country. On each selected slide, a sample of the pollen is dropped off and must be recognized by the analyst. Based on criteria established with the scientific advisor and the director of RNSA (a total concentration of pollen, a minimum number of taxa and a minimum concentration for the first taxa), a “wild” slide, resulting in impaction of the pollen trap, is selected for each analysis center and must be analyzed following the same method as for a normal one.

If a grading for the 10 blind slides has always existed (one point by recognized pollen for a total of 10 points), a scoring system was developed for the wild slide since 2010 to allow greater readability of results and not only an appreciation. This system includes four criteria: the total concentration, the number of different taxa, the recognition of the first five taxa and the undetermined pollens quantity. To these four criteria is added a penalty of 1 point for each serious error. An overall score on 30 is obtained for each analyst.

All analysts that have lower mark than the limit mark decided by the Scientific Council should return the following year for further training to identify the problems. Those who refused to participate to this training are no longer authorized to analyze pollen for RNSA association.

This grading allows RNSA to track the quality of analysts practicing in France and to monitor the results of each analyst over time.

Bio-monitoring Networks and Quality Control

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Training, Quality Assurance (QA) and Quality Control (QC) play an important role in building competence in monitoring and research in aerobiology. The *European Aeroallergen Network* (EAN) database was established in the late 1980s and provides a valuable service supplying pollen information to a variety of end users, including pollen allergy sufferers and health care professionals. All data suppliers follow a standardised methodology based on the Minimum Requirements described by Jäger et al. (1995). The ability to produce comparable data provides opportunities to construct models for predicting airborne pollen over large geographical areas. QC measures from valid samples are crucial for producing quality data and essential for comparative studies between different geographical regions. However, only a few studies have focused on proficiency testing to improve data quality in bio-monitoring networks. One of the main goals of the *European Aerobiology Society* (EAS), in the frame of the QC working group, has been to formulate an updated Minimum Requirements Report for all members involved in the EAN and ensure data quality. The latter was achieved by carrying out a pilot QC exercise of staff involved in pollen counting, in order to examine between analysts reproducibility (Galán et al. 2014).

A new step has been proposed by the EAS in association with COST Action SMARTER (http://ragweed.eu/). It has been focused to identify *Ambrosia* pollen grains, as well as other pollen grains that look similar and could be in the air at roughly the same time as *Ambrosia*. The collection of airborne *Ambrosia* pollen data is important for determining the current distribution, and potential future spread, of ragweed plants. This exercise is not just aimed for areas where ragweed is currently known to be a problem, but also for areas that could be infected by ragweed in the future. This excercise has both QC and educational aspect.

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Galán C, Smith M, Thibaudon M, Frenguelli G, Oteros J, Gehrig R, Berger U, Clot B, Brandao R, EAS QC Working Group (2014) Pollen monitoring: minimum requirements and reproducibility of analysis. *Aerobiologia*. DOI 10.1007/s10453-014-9335-5

New EAN software

Christoph Jäger

[1] www.polleninfo.org

PollRec is a new tool for recording pollen counts. It is a replacement for the currently used EANPoll software, which is increasingly difficult to run on current computer systems. PollRec is a webbrowser based application and runs on current versions of Firefox, Chrome and Safari. Based on demand, it could be enhanced to also support Internet Explorer in the future. It is an offline capable HTML5 / JavaScript application, which uses the built-in capabilities of modern webbrowsers. There is no need to install additional software or plugins. It is currently under development and will be available free of charge to all members of the European Allergen Network (EAN, https://ean.polleninfo.eu) with the start of the pollen season 2015. The main features and enhancements over the previous software are: secured, direct connection to the EAN database, the transfer of bi-hourly pollen counts as well as daily pollen counts, multi- lingual user interface (currently English and German, other translations can be added easily), audio feedback during pollen count entry to enable „blind" data entry (keep your eyes on the microscope), direct export of data to CSV and XLS formats, easy configuration and no software dependency on Java. The goal is to support EAN contributors with this new tool for recording pollen counts, to improve data quality and reduce the time it takes for new pollen data to be available in the EAN database.

Standardisation of Hirst method for airborne pollen and fungal spores measurements

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Pollen grains and fungal spores are considered in some Member States as an air pollutant as well as particles suspended in air (PM10, 2.5). In Europe, European Aerobiology Society (EAS) in coordination with International Association for Aerobiology (IAA) manage problems of sampling, analysis, quality control, development and information.

With the number of national networks of aerobiology which are growing it is necessary to standardize the techniques of sampling and analysis of biological particles in order to obtain the same methodology and the same operating procedures. This is why at the initiative of Michel Thibaudon; the French National Monitoring Network Aerobiological (RNSA) made a request to AFNOR in 2011-2012 and was accepted as part of a European approach CEN. The project was prepared by the RNSA January to October 2013 and subsequently validated by AFNOR.

In April 2013, the CEN 264 accepted the creation of a WG 39 (working group) which met in late October 2013 in Lyon to write a corrected version of the final document “Sampling and analysis of airborne pollen grains and fungal spores”. A final meeting of WG 39 was held in March 2014 in Berlin (VDI) and was followed by a proposal for signing the CEN during the second quarter 2014.

The aim of this standard is to improve the quality of analysis and standardize procedures. The document specifies the procedure to measure and analyse continuously the concentration of pollen grains suspended and fungal spores present in ambient air using the volumetric Hirst method. The paper describes both the sampling and analysis procedures.

The last version (technical sheet) was sent to the secretariat for TC consultation (vote by members) before the end of 2014 and its final acceptance.

Sharing fond memories of Siegi Jaeger

Carmi Geller-Bernstein

Zabludowicz Center for Autoimmune Diseases, Tel –Aviv, Israel.

In spring 1992 I invited Siegi to the "Symposium of Pollinosis in the Mediterranean Area" that I organized in Herzlya.

It was my late husband's idea to have the speaker's dinner at our house; we hired a pianist and asked him to play for every guest that enters the door a tune from his own country. It was a Wiener Walzer for Siegi, we danced and he said he never dreamed of dancing Walzer on the Mediterranean Sea Shore in an Israeli home….

I told him that this March the Negev desert is flowering after a rain rich winter and suggested him to take a car and drive some two hours Southward to see the blooming desert.

He went and he liked it.

I remember New York, many years ago, meeting of the AAAAI. Siegi showed his new and first ever presented pollen information system.

The Americans were impressed. One of them asked how much money was the grant that the Viena Uni paid for this project and Siegi said: "Nothing, we did it voluntarily" but the guy insisted:"You had a brilliant statistician though, how much did you pay him? And Siegi smiled: "It is my son he didn't take money either". So the American collapsed!

Last time I saw Siegi was in Krakow. He was very ill and very brave. We were seated next to one another at the speakers dinner and talked a long while about books that he liked.

It didn't occur to me then, that this was the last time, but sadly I know now, that it was….

May his memory be blessed.

The Siegfried Jäger scholarship committee

Uwe Berger
Karl-Christian Bergmann
Bernard Clot
Carmen Galán
Dorota Myszkowska
Ingrida Šaulienė
Michel Thibaudon

congratulates and awards Katharina Bastl with the honor of the Siegfried Jäger scholarship and acknowledges the talks of all candidates who participated with the contribution of their talks:

Katharina Bastl
Maximilian Kmenta
Barbora Obstová
José Oteros
Marija Prentovic
Anke Simoleit

The call for the next Siegfried Jäger scholarship is planned for the next possible occasion.

Recommended read of other symposia volumes

"Pollen, der Mensch und die Stadt. Aeroallergie & Aerobiologie"

interdisciplinary Symposium 2011
25th anniversary of the pollen information service Linz at the general hospital Linz
Herwig Schinko, Roland Schmidt, Bernd Lamprecht (editors): 82 pp.

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