Interdisciplinarity of bioaerosol research/Bioaerosolu pētījumu starpdisciplinaritāte

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Book of Abstracts

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Long-Term Pollen Season Trends Of Fraxinus, Quercus And Ambrosia Artemisiifolia As Indicators Of Anthropogenic Climate Change Impact

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Background

Climate change significantly affects plant life cycles, including flowering, particularly in anemophilous species, which can release high concentrations of allergenic pollen into the air. Changes in meteorological variables and air pollution can lead to earlier onset, prolonged duration, and increased intensity of pollen seasons, with adverse effects on individuals suffering from allergic diseases such as hay fever, rhinitis, or asthma. This study aimed to investigate long-term trends in pollen season characteristics for woody genera *Fraxinus* and *Quercus*, and herbaceous species *Ambrosia artemisiifolia*, and to explore their correlations with climatic and air pollution variables.

Methods

The research was conducted at two urban sites in Slovakia, Bratislava and Banská Bystrica (hereafter B. Bystrica), over the past two decades. Pollen was captured using Hirst-type traps placed at rooftop levels, and samples were analysed following standard aerobiological methods [1]. Daily mean pollen concentrations (pollen grains/m³) were calculated, and the main pollen season (MPS) was defined as the period between the first and last day when daily pollen concentrations reached 10 pollen grains/m³. Characteristics of the MPS were calculated, including start date, end date, duration, peak value, seasonal pollen integral, number of high days (above symptom-causing thresholds: 50 pollen/m³ for *Fraxinus* and *Quercus*, 20 pollen/m³ for *Ambrosia*), and the date of the first high day. Meteorological variables (mean, minimum, and maximum daily temperatures, precipitation, and relative humidity) and air pollutants (PM10, SO2, NO2, O3, CO) were also analysed. To identify trends in these characteristics and variables, the Mann–Kendall trend test was employed. For variables with significant trends, the Theil-Sen estimator was applied to calculate the slope of the trend. Spearman´s correlation analysis was used to assess relationships between pollen season characteristics and significant trends in meteorological and air pollution variables.

Results

The study identified rising trends in temperature, precipitation, and air humidity, alongside mostly declining trends in air pollutants, except for increasing CO levels in B. Bystrica. For the woody taxa, pollen seasons demonstrated earlier onset, prolonged duration, and increased intensity, with *Quercus* showing more pronounced changes. For *Ambrosia*, trends included earlier start dates and extended durations at both locations and more high days and later end dates in B. Bystrica. Rising temperatures during the pre-season correlated with an earlier onset of the pollen season for trees, specifically significant for *Fraxinus* in Bratislava and *Quercus* in B. Bystrica. For *Ambrosia*, the significant delay in the end date of the pollen season correlated with increasing temperatures during its blooming period, particularly in B. Bystrica. Air pollutants, such as SO2 and NO2, negatively correlated with pollen intensity, while CO showed a positive correlation.

Conclusion

This study highlights the significant impact of climate change on the pollen seasons of allergenic plant taxa, emphasising the need for continued monitoring and prediction to mitigate health impacts on allergy sufferers. Understanding these trends contributes to a deeper comprehension of climate change effects on plant life cycles and aids in predicting future pollen seasons.

Acknowledgements

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Please, submit you abstract:

2

Scaling down birch and grass pollen emission sources for use in SILAM

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Mitigation measures can be taken for easing off allergy symptoms caused by allergenic airborne pollen by making available timely information on forthcoming pollen episodes. This calls for a forecasting system at the scale of the citizens. By providing modelled and forecasted airborne birch and grass pollen levels near the surface at the one by one kilometer scale we can achieve this in a better way. This requires the scaling down of birch and grass pollen emission sources.

SILAM is used as tool for modelling and forecasting airborne birch and grass pollen in Belgium. It is driven by ECMWF ERA5 meteorology in a bottom-up emission approach. Pollen emission source maps determine the spatial distribution and the potential amount of emitted pollen to the air. Currently, in Belgium, we apply maps with a spatial resolution of 0.10° x 0.10° and 0.05° x 0.05° for birch trees and grasses, respectively. Here, we combine monthly MODIS Land Surface Temperature (LST) data on a one by one kilometer grid with pollen emission source maps from earlier research on top of a pollen footprint analysis. We apply daily pollen footprints produced by SILAM running in a 3-day backward mode for five locations in Belgium, coupling the fraction of air to the pollen levels monitored by the devices of the aerobiological network. SILAM uses the down-scaled pollen emission source maps as input in the forward mode to obtain modelled birch and grass pollen concentrations more directly at the level of sensitive persons for pollen.

First results for the period 2013-2018 show that late winter/early spring MODIS LST might have some potential to assess the severity of the grass pollen season. For the birch pollen season, an accumulation of LST values from the period August-February (before the start of the birch pollen season in Belgium) might be a good proxy to estimate the seasonal pollen index. A substantial improvement between observed and modelled time series of airborne pollen levels (up to 210% increase in R^2 values for grass pollen) is found for some monitoring stations, especially at the site at the North Sea. This is probably due to the better separation between sea and land in the more detailed pollen emission source maps compared to the native coarser datasets.

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3

Evaluation and Comparison of Grass Pollen Measurement Accuracy in Iceland: Poleno Mars vs. Hirst in Akureyri (3 Years) and Reykjavik (1 Year)

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Background and Aim:
Iceland's unique bio-geographical position between Europe and North America, combined with its Arctic and Boreal climates, results in distinctive environmental conditions that affect airborne pollen concentrations. Grass (Poaceae) pollen, a major allergen in Iceland, is monitored in two primary locations: Reykjavik (SW Iceland) and Akureyri (N Iceland). Pollen seasons in Iceland are shorter and begin later compared to continental Europe. This study aims to compare the accuracy and reliability of grass pollen measurement devices in Iceland, focusing on the Swisens Poleno Mars (automatic) and Hirst (manual) devices over a three-year period (2022–2024) in Akureyri and one year (2024) in Reykjavik.

Methods:
Grass pollen measurements were conducted using the Poleno Mars device in Akureyri (2022–2024) and Reykjavik (2024), with the results compared to those obtained from the manual Hirst pollen trap during the same periods. The devices' performance was assessed using: correlation coefficient, R-squared, Mean Absolute Error (MAE), and Root Mean Square Error (RMSE). These metrics were used to evaluate the performance of the automatic trap in relation to the Hirst device across different years and locations.

Results:
In 2022, the correlation between the two devices was poor, but by 2024, the relationship improved significantly, with a solid correlation and modest error levels. The Poleno device, which underwent annual adjustments, performed best in 2023 but showed a slight decline in 2024, likely due to modifications made in tuning the device or the influence of specific environmental conditions, such as weather variations and changes in pollen levels. In Reykjavik, the second pair of devices showed better accuracy in 2024 compared to Akureyri, as evidenced by lower MAE and RMSE, although the correlation between the devices was weaker. Local environmental conditions, including regional weather patterns, plant species, and pollen density, significantly influenced device performance.

Conclusion:
This study highlights the impact of environmental factors on the accuracy of automatic grass pollen measurement devices. While the Poleno devices showed improved performance over time, the differences between locations suggest that local conditions, such as pollen species diversity and weather patterns, affect measurement reliability. The common classifier used across all devices may lead to slight variations in data quality, with the first year of measurements in Reykjavik showing better alignment than in Akureyri. Further adjustments and refinements to the devices are expected to improve their accuracy in future years, with anticipated improvements in 2025 based on the current findings.

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4

Urban vs. rural airborne fungal spore variability in Slovakia

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BACKGROUND
Fungal spores constitute a significant fraction of visible atmospheric bioaerosols. While they play

an essential role in decomposing organic matter within ecosystems, they can also negatively impact on agricultural crops and human health. Despite their immense diversity and abundance, fungal spores remain relatively understudied. Although some research has explored the full spectrum of airborne fungal spores, only a few studies have compared their concentrations in urban and rural environment. Up-to-date knowledge suggests that rural areas generally have higher fungal spore concentrations due to larger source areas and greater biomass, such as agricultural fields and organic waste [1, 2]. To address the limited research in this field, our study aimed to evaluate the diversity and abundance of fungal spores in two locations with varying levels of urbanisation.

METHODS

Airborne fungal spore samples were collected from February to November 2022 at two sites in Slovakia located 38 km apart: the rural village of Kaplna (KP) and the urban area of Bratislava (BA). The KP site is predominantly surrounded by farmland, while the BA site features diverse urban environment, including buildings and green spaces. Both locations share a temperate continental climate with warm summers and cold winters. Spore collection was conducted using two volumetric Hirst-type samplers, each operating at a suction rate of 10 L/min. Due to logistical constraints, the samplers were placed at different heights: 18 m above ground level in BA and 3 m in KP. Airborne particles were captured on adhesive tape, which was replaced weekly and divided into daily samples. These samples were analysed under a light microscope to identify fungal spore diversity and abundance. Each slide was examined along 12 vertical transects, and daily spore concentrations were expressed as spores per cubic meter of air (spores/m^3) [3]. The characteristics of the main spore season (MSS) were determined for taxa with an annual spore integral (ASIn) exceeding 2,000 spores*day/m^3 at both sites, covering 19 taxa. The MSS was defined using the 90% method. To investigate relationships between the 19 most abundant taxa and meteorological variables, a non-parametric Spearman's correlation analysis was performed. Statistical analyses were conducted using Statistica 12 and R software.

RESULTS

Microscopic analysis identified 67 fungal spore groups (FSG), with 64 detected in BA and 59 in KP. BA had eight unique groups, while KP had three, but these unique groups contributed less than 0,01% to total concentrations. The two sites shared 83.5% of the identified FSG.Most FSG belonged to the taxonomic groups of Ascomycota and Basidiomycota, except for Myxomycetes (Protozoa) and *Peronospora* (Chromista). The most frequently observed FSG, detected on more than 90% of sampling days at both sites, were *Alternaria*, *Arthrinium*, *Cladosporium*, *Coprinus* type, *Epicoccum*, and *Leptosphaeria* type.

Total spore abundance differed significantly, with ASIn of 2,368,367 spores*day/m^3 in BA and 1,113,864 spores*day/m^3 in KP. FSG concentrations were lowest in spring (March) and highest in summer, peaking in July in BA and June in KP. Summer months accounted for over 50% of the ASIn at both sites. The dominant FSGs contributing more than 90% of the ASIn included *Cladosporium*, *Coprinus* type, *Agaricus* type, *Leptosphaeria* type, *Oidium* type, *Alternaria*, Myxomycetes, and *Ganoderma*. *Cladosporium* was the most dominant, making up 69,6% of ASIn in BA and 65,2% in KP.

The MSS typically started earlier in KP but ended at the same time in mid-November for both sites. The MSS duration was generally longer in KP, with 11 FSGs showing an extended MSS of more than five days. The MSS duration across groups ranged from 46 to 236 days. Overal, spore concentrations were higher in BA, except for *Alternaria*, *Aspergillus/Penicillium*, *Arthrinium*, *Fusarium*, and *Torula*, which were more abundant in KP.

Spearman's correlation analysis identified relative humidity, temperature, and sunshine as key meteorological factors influencing spore concentrations. Relative humidity exhibited both positive and negative effects, with positive correlations being more common. Temperature and sunshine generally had a positive impact, although the effect of sunshine was weaker. Precipitation positively influenced four FSGs: *Leptosphaeria* type and *Pleospora* at both sites and *Ascochyta* and Diatrypaceae in BA. Wind speed, however, had minimal influence on spore concentrations.

CONCLUSION

Our findings showed significantly higher fungal spore concentrations in urban areas compared to rural ones, challenging the assumption that rural environments with more plant biomass naturally have higher spore levels. This may result from fungicide use in rural areas, while urban conditions may enhance spore aerosolization and dispersion. Despite concentration differences, fungal spore diversity was similar at both sites, including many economically and medically significant taxa. The MSS characteristics of these taxa offer valuable insights for allergology and agriculture. Our results also highlight significant spatial variations in fungal spore concentrations, even between geographically close areas. This underscores the need to expand monitoring networks and carefully select monitoring sites for more detailed data. Additionally, ongoing multi-year monitoring is essential to refine predictive models and enhance our understanding of fungal spore dynamics in various environments.

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5

Impact of Environmental Stressors on Birch Pollen Allergenicity and Fertility in Northern France

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Aim of the study:
Although its main purpose is to ensure sexual reproduction, birch pollen grain is also responsible for allergenic rhinitis and asthma, also known as pollinosis. In Northern Europe, Betula pendula is the birch species with the most allergenic pollen (P. Beck et al. 2016; G. D'Amato et al. 2007; Emberlin et al. 2002). Alteration of pollen fertility, changes of protein and lipid content, modifications of the chemical composition of the surface of birch pollen grains (I. Beck et al. 2013; Bychkova and Khlebova 2019; Cerceau-Larrival et al. 1990; Franze et al. 2005; Ramírez-Aliaga et al. 2022) : numerous studies highlight the interactions between atmospheric pollutants and pollen grains (Sénéchal et al. 2015). In addition, many studies have highlighted the exacerbation of pollen allergies symptoms by atmospheric pollution (Bowler and Crapo 2002; Burte et al. 2020; Gennaro D'Amato et al. 2016; Lubitz et al. 2010). Birch trees are widespread in Northern France, a densely populated, highly urbanised and industrialised region. For these reasons, the goal of my thesis is to assess the impact of specific environmental stressors in Northern France on the pollen grains allergenicity and fertility. To do so, we aim to characterize the pollution at the vicinity of the trees and to know the state of the pollen from the trees. The followed study shows preliminary results and the establishment of a germination protocol.
Material and method:
The first step was to identify contrasting sampling sites with issues specific to the region. Once the trees were selected, the soil was sampled at the foot of the tree and pollen was collected from the catkins. To characterise the environment at the vicinity of the trees, the heavy metal content in soil was quantify using Inductively Coupled Plasma Mass Spectrometry. To determine the state of the pollen, we measured its allergenicity pollination by quantifying the allergen bet v 1 in each sample. Also, the pollen fertility can be assessed by counting the germination rate of the pollen. As pollen grains need rehydration and nutrients, germination protocol has been set up to obtain the best results of germination rate so that all factors are controlled to compare pollen fertility of each tree.
Results:
A total of 97.28 g of pollen from 12 birch trees was harvested at 6 sites different sites in Northern France. Samples were taken at 2 urban sites (localised in a metropolitan area), 2 industrial sites (a brownfield and an active metallurgical industrial site) and 2 rural sites (one near a slag heap and one

in countryside).
As the pollen samples had been stored at -80°C, they had to be thawed before being rehydrated. The results show that the germination rate is the highest when thermal shocks are avoided, i.e. a gradual return to room temperature is recommended. Moreover, pollen germination kinetics experiments have also shown that the rate of germinated pollen stagnates after 4 hours. After this period, the pollen tubes continue to elongate and tangle, making image analysis unworkable.
The average Bet v1 concentration in the pollen samples are 91 091ng/10mg of pollen from rural sites, 66 942ng/10mg of pollen from urban sites and 77 811ng/10mg of pollen from industrial sites.
Means concentrations of heavy metals in soil show a very high levels of Cu, Zn, Pb, Cd, Se and As in industrial sites : Cu : 299 mg.kg-1, Zn : 8754 mg.kg-1, Pb : 859 mg.kg-1, Cd : 42 mg.kg-1, Se : 5.6 mg.kg-1, As : 141 mg.kg-1; followed by rural sites : Cu : 65 mg.kg-1, Zn : 235 mg.kg-1, Pb : 105 mg.kg-1, Cd : 0.46 mg.kg-1, Se : 1.3 mg.kg-1, As : 24 mg.kg-1; and then urban sites Cu : 33 mg.kg-1, Zn : 145 mg.kg-1, Pb : 101 mg.kg-1, Cd : 0,9 mg.kg-1, Se : 0.4 mg.kg-1, As : 11 mg.kg-1.

Conclusion:

In conclusion, preliminary results show that despite the high concentrations of heavy metals in the industrial soils, allergenicity of pollen from tree growing on this such sites doesn't show higher concentration of the allergen Bet v1. One of the reasons for these results may be the robustness of birch, which means it can grow in metal-rich soils without being impacted. Another next analysis will be to quantify heavy metal content in pollen samples to know if heavy metal in soil could influence heavy metal concentration in pollen grain in catkins. However, IgE reactivity of birch pollen-sensitized patients will be measured to assess allergenic risk for each pollen sample. The germination tests now allow us to assess the ability of pollen to germinate under optimum conditions and to observe differences in germination rate between the sampling sites.

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The Impact of Climate Change and Environmental Factors on the Pollination of Stinging Nettle (Urtica dioica) in Vinnytsia

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Pollen allergy is one of the most common allergic diseases globally, affecting the quality of life of a significant portion of the population [1]. In Ukraine, there are three main pollination waves: the

first, spring wave – pollination of woody plants (with Betula – birch having the most allergenic pollen), the second – summer wave caused by grass pollen, and the third, autumn wave – caused by weed pollen, among which Ambrosia artemisiifolia (ragweed) is the most potent allergen. The pollen of common nettle (Urtica dioica), which is a cosmopolitan plant with a long vegetation period, has lower allergenicity compared to other weeds such as Ambrosia artemisiifolia, but can also cause allergic reactions [2, 3], although it is considered low to moderately allergenic. At the same time, due to environmental pollution and climate change, pollen allergenicity may increase, and vegetation periods, along with flowering periods, may extend. Therefore, the aim of our work was to analyze the pollination patterns of stinging nettle (Urtica dioica) in Vinnytsia under climate change conditions, determine the impact of environmental factors on its flowering duration, and assess the potential risk for populations sensitive to its pollen.
The study of Urtica dioica pollination was conducted by the Educational-Scientific-Research Laboratory for the Study of Environmental Allergenic Factors at National Pirogov Memorail medical University during 2019-2023. Nettle has a long vegetation period in Ukraine, lasting from spring to mid autumn and produces the highest number of pollen grains in comparison with other species. The start of pollination is recorded in April-May, and the end in August-September. Due to global warming, plant flowering periods are extending. In 2024, common nettle in Vinnytsia flowered until the end of November, significantly exceeding usual timeframes. Peak pollen concentrations in different observation years occurred between July 16 and August 9, averaging 380 pollen grains/m^3.
Sensitivity to nettle pollen is evidenced by data obtained from Vinnytsia region residents using the ALEX test and consisted around 2,33 %.
Air pollution affects the increase in allergenicity of nettle pollen [4]. The presence of toxic substances in the environment contributes to changes in pollen protein structure, making them more aggressive for the immune system. Therefore, it is necessary to improve the pollen monitoring system and ensure access to medical care for patients with allergies.
Conclusions:
1. Urtica dioica remains an important component of Ukraine's phytoenvironment, particularly in the Vinnytsia region.
2. Climate change causes extension of vegetation and pollination periods, which increases the population's exposure time to allergens.
3. To assess the risks of nettle pollen allergy, continuous monitoring of pollen activity, climate impact, and environmental pollution is necessary, as well as implementation of patient sensitivity monitoring.
4. Implementation of measures to reduce air pollution, impact of climate change, and allergen exposure is necessary to minimize the risks of allergic diseases.

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Please, submit you abstract:

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Spore calendar for Vinnytsia, Ukraine

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Background: While pollen calendars are common, spore calendars are rare due to the limited number of aerobiological stations worldwide that monitor fungal spores. However, many fungi are known to cause allergic reactions and are important to consider when estimating seasonal allergy risk factors globally. The aim of our study was to identify the most numerous fungi and their sporulation patterns to create a spore calendar for Vinnytsia, Ukraine.

Method: Fungi were monitored using Hirst-type volumetric spore traps at the Laboratory of Environmental Factors Investigation of the National Pirogov Memorial Medical University, Vinnytsia, Ukraine during 2022-2023 years. Their number on the microscopic slides were calculated under X 400 magnification and then converted into the concentrations per cubic meter of air.

Results: Up to 30 fungal spore types were identified annually during each vegetation season from March to early November in 2022-2023. The most abundant types were consistently Cladosporium, Ascospores (with Leptosphaeria comprising a significant portion), Coprinus, and Alternaria. Ustilaginales and other unclassified Basidiospores were also numerous. Peak sporulation occurred from June to late August, with concentrations exceeding clinically significant thresholds for Cladosporium (2,500 spores/m³) and Alternaria (100 spores/m³) during this period and continuing until November. The annual Cladosporium peak in 2023 occurred more than one month earlier (July 5) compared to 2022 (August 8), while Alternaria peaked on August 18 in 2022 and August 5 in 2023. Basidiospores showed the latest peaks, varying among different members of this Order from July 25 (Ganoderma) to October 3 (Puccinia) in 2023 and from July 20 (Ganoderma) to November 8 (Epicoccum) in 2022.

Conclusions: A diverse range of airborne fungal spores maintains clinically significant concentrations throughout the vegetation season in Vinnytsia. Peak sporulation periods vary between fungal types and show year-to-year variations in timing. Cladosporium and Alternaria consistently exceed their clinical thresholds during summer months and in autumn. The extended period of high spore concentrations suggests a prolonged risk period for fungal allergy sufferers in the region.

Please, submit you abstract:

spore calendar, fungal allergy, molecular sensitization

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Patients' Sensitization to Environmental Allergens – New Combinations and Insights

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Background: Environmental allergens represent a large group of important triggers for seasonal and perennial allergies. Among these, outdoor allergens, comprising both plant pollen and fungal spores, form a distinct category of seasonal allergy triggers that are difficult to avoid during their pollination or sporulation periods. Consequently, patients may be exposed to these allergens for extended periods before symptoms manifest. Recent data suggests that sensitization to environmental allergens, particularly seasonal ones, develops sequentially, where a primary trigger may initiate a chain of sensitization events. Our study aimed to determine the patterns of sensitization development in individuals with tree pollen allergy.

Method: We analyzed data from 7,518 individuals (3,185 adults and 4,333 children under 18) sensitive to 26 molecular components from 19 tree species, tested using the ALEX method across 17 regions of Ukraine during 2020-2022. Agglomerative clustering, Bayesian modeling, and structural protein comparison were employed to identify predominant clusters and relationships between allergenic molecules.
Results: Patients most frequently reacted to established clusters of allergen molecules. PR-10 molecules clustered together, including aeroallergens (Bet v 1, Cor a 1.0103, Fag s 1, Aln g 1, * pollen extract) and related food allergens (Mal d 1, Fra a 1+3, Cor 1.04.01). Another group comprised pectate-lyases (Cry j 1 and Amb a 1). Walnut pollen grouped with profilins (Phl p 12, Cuc m 2, Pho d 2, Mer a 1, Bet v 2, Hev b 8). Act d 1 of green kiwi fruit (Cysteine protease) combined with birch phenylcoumaran benzylic ether reductase (Bet v 6). Additional clusters included Aspergillus fumigatus Asp f 1 (mitogillin family) with Olea europaea pollen Ole e 9 (1,3-beta glucanase), and shrimp allergens (Pen m 3, Cra c 6) combining with platanus pollen Pla a 1 and cockroach epidermis Bla g 1 plus latex Hev b 3.
Bayesian modeling identified Bet v 1 as the key trigger for sensitization to both PR-10 and other tree pollen allergen groups. Structural protein comparison generally confirmed biochemical groupings, with few instances of the unusual combinations seen in agglomerative clustering.
Conclusions:
Sensitization to environmental allergens follows distinct patterns with specific molecular clusters in accordance with their biochemical classes.
Bet v 1 appears to be a primary trigger initiating broader sensitization patterns.
Most allergen clustering follows established biochemical relationships, though some novel combinations were identified.
Cross-reactivity between food and airway allergens demonstrates complex sensitization patterns.
Understanding these patterns may improve diagnosis and treatment strategies for allergic patients.
The findings suggest the importance of early identification of primary sensitizing allergens for better patient management.

Please, submit you abstract:

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Pollen and fern spore seasons in Southeast Asia

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The spatiotemporal distribution of airborne pollen grains and fungal spores in Southeast Asia remains poorly understood. This study aims to address this gap by investigating potentially allergenic plants in the region, characterizing their pollen seasons, and assessing their clinical relevance. Through an extensive systematic literature review—conducted by screening the Scopus and PubMed databases—73 studies related to pollen allergies in Southeast Asia were identified and analyzed.
As a result, a list of ten potentially allergenic plants posing the highest risk in Southeast Asia, along with sensitization rates to their pollen allergens (based on 36 studies comprising over 150 extracted records), was compiled and summarized. Analysis of aerobiological monitoring practices in the region revealed that such studies have primarily been conducted in five countries: Thailand, the Philippines, Singapore, Indonesia, and Malaysia. Both gravimetric and volumetric methods have been used. The earliest documented pollen monitoring, carried out in the Philippines, began in the 1960s, while the longest pollen time series, conducted in Thailand, spans 15 years.
Prepared pollen calendars for six taxa across four countries revealed distinct spatiotemporal variability, closely associated with local bioclimatic characteristics. Based on the gathered data, several

recommendations have been proposed to enhance understanding of the aerobiological and allergological context in Southeast Asia. These include establishing local and regional aerobiological monitoring networks, creating pollen calendars for major tropical allergenic species, and developing clinical panel tests tailored to the region.

Please, submit you abstract:

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CAMS pollen forecasts in Europe: prediction quality for season 2022

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Modern technologies in representation of the future atmospheric conditions are relying on the use of three-dimensional numerical models. The advancements in the weather prediction and air quality models had provided a physically grounded prerequisites (served a solid basis) for the development of numerical pollen forecasts. In many numerical models, the pollen grains are considered as the passive tracers with fixed aerodynamical characteristics which are species dependent. The fundamental difference of pollen prediction models from others is the integration of phenological processes responsible for the pollen development, maturation and release. Not a single numerical model among the existent ones is capable of perfect reproduce the spatiotemporal evolution of the atmosphere. All of them do contain numerous uncertainties originated not only from their design but also from the imperfect knowledge of the state of the atmosphere at every moment of time. The numerical discretization in space and time of continuous atmospheric processes by model equations will inevitably generate some errors. One of the efficient ways to minimize the uncertainties of numerical models is to construct the ensemble out of their forecasts. This approach is applied in CAMS (Copernicus Atmosphere Monitoring Service, https://atmosphere.copernicus.eu/) to provide the optimal air quality prediction over the European domain. Together with other atmospheric pollutants the 4-days forecast for pollen is computed by 11 state-of-the-art chemical transport models and their ensemble. The surface concentrations fields are available on the regular grid with horizontal resolution of about 10 by 10 km. The aim of this work is to analyze the diversity of skill scores of the pollen predictions for different ensemble members for the pollen season 2022.

The quality of pollen forecast for every individual model is estimated with standard statistical characteristics: model mean bias, temporal correlation coefficient, root mean square error and also shift of the pollen season start/end for aerobiological and medical season. Hourly model timeseries were averaged and compared with corresponding daily observations from 100 European Aeroallergen Network (EAN) stations in Europe (provided within a contract agreement between CAMS and EAN). The model list consists of CHIMERE, DEHM, EMEP, EURAD, GEMAQ, LOTOS-EUROS, MATCH, MOCAGE, MINNI, MONARCH, SILAM, and ENSEMBLE.

The reliability of pollen predictions in 2022 varied depending on the model, statistical parameter and pollen taxon. The analysis had revealed the underestimation of the birch daily levels (less than 30% of mean concentrations 60 pollen/m3) for the majority of the models, while for ragweed the absolute bias was about 25% (of the mean 21 pollen/m3). The mean temporal correlation was about 0.5 - 0.6 for birch and above 0.6 for grass. The timing and duration of the birch season were predicted quite good by most of the models with errors in the season start/end about ± 2-3 days on average. The mean olive concentrations have negative bias (within about 50% of the mean value 20 pollen/m3) for most of the models while for the grass predictions only 6 models have lower than 50% (mean 21 pollen/m3). Olive season propagation was represented with lower accuracy than for birch that worsened the correlation scores.

In this study we analyzed the performance of the pollen forecasts by comparing them with the data from aerobiological observations. Results show that on average the ensemble of models routinely have better scores than any individual model.

Keywords
Pollen forecast, numerical model, CAMS ensemble, forecast evaluation

Please, submit you abstract:

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Towards automatic bioaerosol monitoring network in Europe: technology, organization, steps forwards.

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Introduction

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