Pollen dynamics of hazel (*Corylus* spp.) in the air of Banská Bystrica and its dependence on meteorological factors

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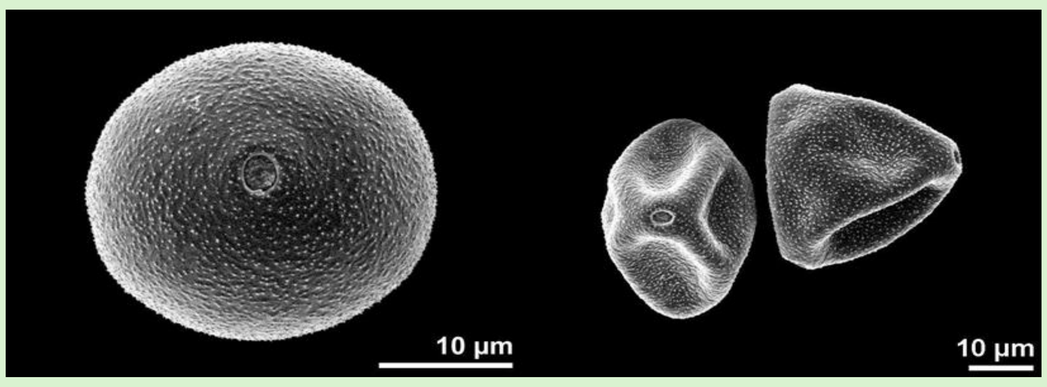
INTRODUCTION

The occurrence of pollen grains and maternal pollen cells in the air is a frequently discussed topic in the professional community. Pollen grains are carriers that provide information about genetics, past climatic conditions, and the current state of the climate. Due to their high sensitivity and the direct occurrence of pollen grains in the environment, they are also excellent bioindicators, which are practically useful in biomonitoring, especially in assessing the threat to specific environments in various locations. Their study is also necessary from a medical perspective. Aerological diseases are becoming increasingly common today, especially among the pediatric population. Climate changes are leading to an extension of the pollen season by several days, which significantly worsens the condition for pollen allergy sufferers. Based on research, monitoring, and studying pollen grains and their occurrence in individual years, in relation to changes in meteorological parameters, we can assist in creating pollen calendars aimed at improving the treatment of allergy sufferers and also alerting to the increased presence of a specific allergen in the air during certain times of the year. For allergists, this information is essential for diagnosis, helping pollen allergy sufferers better manage the pollen allergy season. Last but not least, the analysis of pollen grains is part of forensic sciences. The analysis of pollen grains in criminalistics is gaining prominence, as pollen grains are an excellent forensic tool for several reasons. Their advantages include resistance to chemical, biological, and mechanical damage.

RESEARCH OBJECTIVES

The aim of this work was to evaluate the pollen seasons in terms of the quantity of pollen grains in the air for the allergen of the genus Corylus in the area of Banská Bystrica from 2017 to 2021, as well as to assess the impact of meteorological factors on the quantity of pollen grains of the allergen Corylus during the aforementioned years. The main goal was to examine the influence of selected meteorological elements (sunshine duration, air temperature and relative humidity, precipitation, wind speed, sum of active temperatures, etc.) on the concentration of hazel pollen grains during the period of their culmination. We chose this period because the culmination period represents the period of the highest physiological burden for allergy sufferers.



Hydrated and dry pollen grains of the species Corylus avellana (PalDat)

METHODS

Pollen service data for the genus hazel - Corylus, were obtained from the station of the Regional Public Health Authority based in Banská Bystrica, where aeropalynological monitoring is carried out using a Burkard volumetric rotary pollen trap. This is located on the roof of the infectology pavilion, at the Old Faculty Hospital with Policlinic in Banská Bystrica. Meteorological data were obtained from the Slovak Hydrometeorological Institute, Banská Bystrica station, Zelená 5. From the values of the average daily air temperature, we calculated the sums of active temperatures above 0 °C (SAT 0) and above 5 °C (SAT 5) for a precisely defined period. From the values of the average daily air temperature, we calculated the sums of active temperatures above 0 °C (SAT 0) and above 5 °C (SAT 5) for a precisely defined period. Basic aerobiological characteristics were determined, such as the annual pollen index (API), the seasonal pollen index (SPI) using the 95% method, as well as the start and end and duration of individual pollen seasons. We statistically assessed the significance of the relationships between the concentration of pollen grains of Corylus and selected meteorological elements during the peak period using Student's test for the significance of correlation coefficients and graphically illustrated and evaluated the impact of meteorological elements and the concentration of allergenic pollen grains of the genus Corylus in the air of Banská Bystrica from 2017 to 2021.

	2017	2018	2019	2020	2021
maximum air temperature	***	***	**	*	**
minimum air temperature	n.s.	**	n.s.	n.s.	n.s.
sum of active temperature above 0 °C	***	****	***	*	****
sum of active temperature above 5 °C	****	****	**	n.s.	****
wind speed	n.s.	n.s.	n.s.	n.s.	n.s.
relative air humidity	n.s.	n.s.	n.s.	n.s.	**
total precipitation	n.s.	n.s.	**	n.s.	n.s.
duration of precipitation	n.s.	n.s.	n.s.	*	n.s.
sunshine duration	n.s.	n.s.	n.s.	n.s.	**

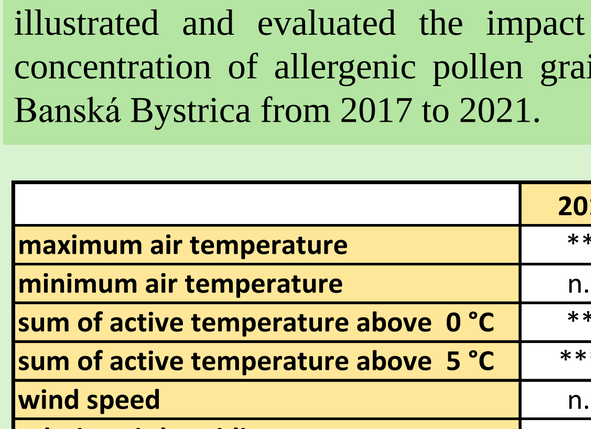
Statistical significance of correlation coefficients between meteorological factors and concentrations of hazel pollen grains in individual years from 2017 to 2021 (according to Šmelka (1987)). $\alpha > 0.1$ n.s – not significant, $0.1 < \alpha < 0.05$ * – marginally significant, $0.05 < \alpha < 0.01$ ** – significant, $0.01 < \alpha < 0.001$ *** – highly significant, $\alpha < 0.001$ **** – very highly significant.

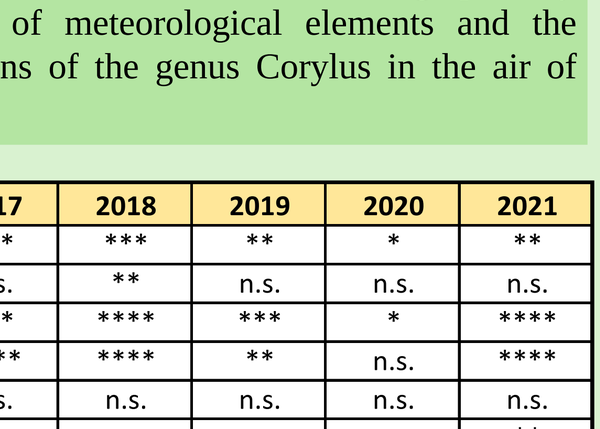
RESULTS

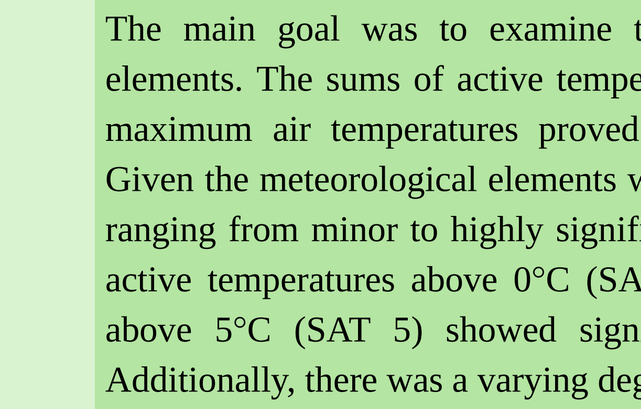
The given results show the differences between the values of API and SPI. The largest difference in the amount of pollen grains can be observed in 2019, when the difference between the amount of pollen grains in API and SPI is 637 grains per cubic meter. Such differences are a good example that illustrates the importance of calculating the seasonal pollen index, as it is during the main pollen season that the burden on allergy sufferers is the greatest. The SPI reached its maximum value in 2018 (3725 Grains.m -3), the longest duration of the main pollen season was in 2020 (44 days) and the maximum pollen concentration was 1170 Grains.m -3 and was found on March 4, 2019.

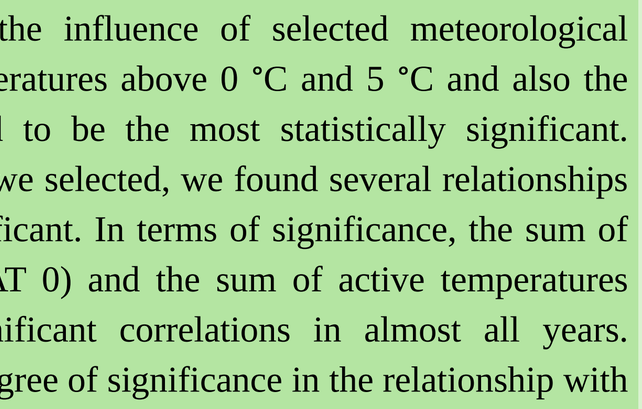
		2017	2018	2019	2020	2021
Annual pollen index (API)	PZ-m^{-3}	3479	3856	3815	3187	3435
start	date	17.02.	16.02.	16.02.	31.01.	19.02.
end	date	01.04.	20.04.	09.04.	13.04.	14.04.
duration	days	44	64	53	74	55
Seasonal pollen index (SPI)	G .m-3	3346	3725	3188	3018	3300
start	date	26.02.	02.03.	25.02.	04.02.	25.02.
end	date	24.03.	07.04.	25.03.	23.03.	01.04.
duration	days	27	37	29	44	36
Date max. concentration/ value	date / G .m^{-3}	04.03./1004	13.03./334	04.03./1170	05.03./682	03.03./610

The main goal was to examine the influence of selected meteorological elements. The sums of active temperatures above 0 °C and 5 °C and also the maximum air temperatures proved to be the most statistically significant. Given the meteorological elements we selected, we found several relationships ranging from minor to highly significant. In terms of significance, the sum of active temperatures above 0°C (SAT 0) and the sum of active temperatures above 5°C (SAT 5) showed significant correlations in almost all years. Additionally, there was a varying degree of significance in the relationship with maximum air temperature across all years. Conversely, based on our findings, we could anticipate the significance of the meteorological elements of humidity and wind speed, which, for the genus Corylus in the years we selected, were statistically insignificant, except for the year 2021, when the relationship with relative humidity emerged as significant. As an example, we will use the year 2021, which was statistically the most significant in terms of correlation.









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