OCCURRENCE OF ALLERGENIC HAZEL POLLEN

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Abstract
Recreation is limited by the occurrence of allergenic pollen. The beginning of the growing season, and thus recreation, is determined by an increase in air temperature. However, the flowering of common hazel (*Corylus avellana*), whose pollen is allergenic, also begins. The average flowering time of the hazel in Lednice is 50 days and it blooms for about 26 days. In the last 10 years, there has been a later onset and a shorter flowering period. For the city of Ostrava, data from the two nearest phenological stations, Mladecko and Valašské Meziříčí, are processed for comparison. Both stations have more than twenty years of data. The average flowering time at the Mladecko station is 47 days and it blooms for an average of 45 days. In the last ten years, each year, a longer flowering period with an earlier onset has alternated with a shorter flowering period and a later onset of the beginning of flowering. The Valašské Meziříčí station shows a later onset and a shorter flowering period. The onset of the flowering period begins on average 66 days a year and lasts about 21 days. For people suffering from pollen allergy, the flowering period is less favorable for being in nature.

Key words: growing season, flowering phenophase, allergies, recreation

Introduction

For pleasant recreation, favorable conditions are necessary. The first sunny spring days may not be suitable due to the presence of allergenic pollen. Therefore, when choosing a location, it is essential to know the plants present, especially their flowering periods. The scientific discipline that studies the behavior and manifestations of organisms over a specific time period is called phenology. It primarily focuses on periodically recurring phenomena in plants and animals, depending on climatic conditions.
The word "phenology" originates from the Greek words "fainó" (to reveal) and "logos" (what appears). Among the earliest documented mentions are phenological observations of cherry blossoms by the Japanese imperial court. A thousand years later, Swedish naturalist and physician Carl von Linné, known as the father of modern taxonomy, established the first network of stations for regular and methodically unified observations. In the former Czechoslovakia, pioneers in this field included professors Václav Novák (1888–1967) and Bohuslav Polanský (1901–1983), who became prominent figures and organizers of phenology. Professors Alois Zlatník (1902–1979) and Jaromír Klika (1888–1957), who focused on biogeography, ecology, and phytosociology, also played a significant role in this discipline. In the Czech Republic, the Czech Hydrometeorological Institute can be considered an innovator in phenological observation. In 1983, changes were made to the methodology and observation practices, and sites were divided into stations monitoring field crops and fruit trees. Four years later, this group expanded to include other plants (Rožnovský et al., 2006; 2019; Hájková, 2012).
As mentioned earlier, phenological observations focus on the manifestations of plants and animals, but they also play an important role in human life. Recently, the term "climate change" has been increasingly encountered. According to studies, doctors worldwide agree that there has been a significant increase in patients suffering from allergic rhinitis or bronchial asthma. In the first half of the 20th century, the number of people suffering from pollinosis was estimated to be in the tens, but over the past decade, allergic symptoms have become one of the most common chronic diseases (Seberová, 2007; Bystroň, 2021).
An allergy is a type of disorder in which the immune system overreacts to substances commonly found in our environment. Aeroallergens are particles present in the air that can trigger an allergic reaction (Jae-Won Oh, 2003).
Kavková (2009) states in her work that allergic diseases are caused by the interaction between an individual's genetic predisposition and environmental influences. The speed and intensity of triggering an allergic reaction are significantly influenced by the availability of a sufficient source of pollen. For pollen to be released into the air in adequate amounts, suitable climatic conditions are required, including temperature, humidity, precipitation, sunlight, and the strength and direction of the wind.

Among the most significant allergens in the Czech Republic are birch and related species, grasses, and plants from the aster family. The periods during which these plants bloom and produce pollen can be divided into spring, summer, and autumn. In the spring, the dominant pollens are from the hazel subfamily and the birch family; in the summer, grass pollens are prominent; and in the autumn, pollens from tall herbaceous weeds are common (https://www.pylovasluzba.cz). This study focuses specifically on one of the largest spring allergens, the common hazel, and the data analysis pertains to the largest cities in the Czech Republic—Brno and Ostrava. The aim is to predict the onset of the pollen season, highlight more suitable tree species for urban areas, and thereby improve the quality of life for residents of these cities.
Finally, pollen allergies can have a significant impact on recreation, such as worsening health conditions, limiting outdoor activities, and affecting mental well-being.

Materials and methods

Due to the proven warming trend, the phenophases of the first herbs and shrubs are occurring earlier. Considering the presence of allergenic pollen in urban air, the phenological phase of flowering of the common hazel was selected for evaluation. The processed data originates from the database of the Czech Hydrometeorological Institute (ČHMÚ). These data were recorded based on observations conducted within the network of phenological stations, following the methodology outlined in the Manual for the Activities of Phenological Stations, Methodological Directive No. 1 - Forest Plants.
For this study, the phenological stations in Lednice, Mladecko, and Valašské Meziříčí were selected. The data were analyzed from 1991 (Lednice) and 1999 (Mladecko and Valašské Meziříčí) up to 2023 for all stations.
The data processing was carried out using standard statistical methods.

Results

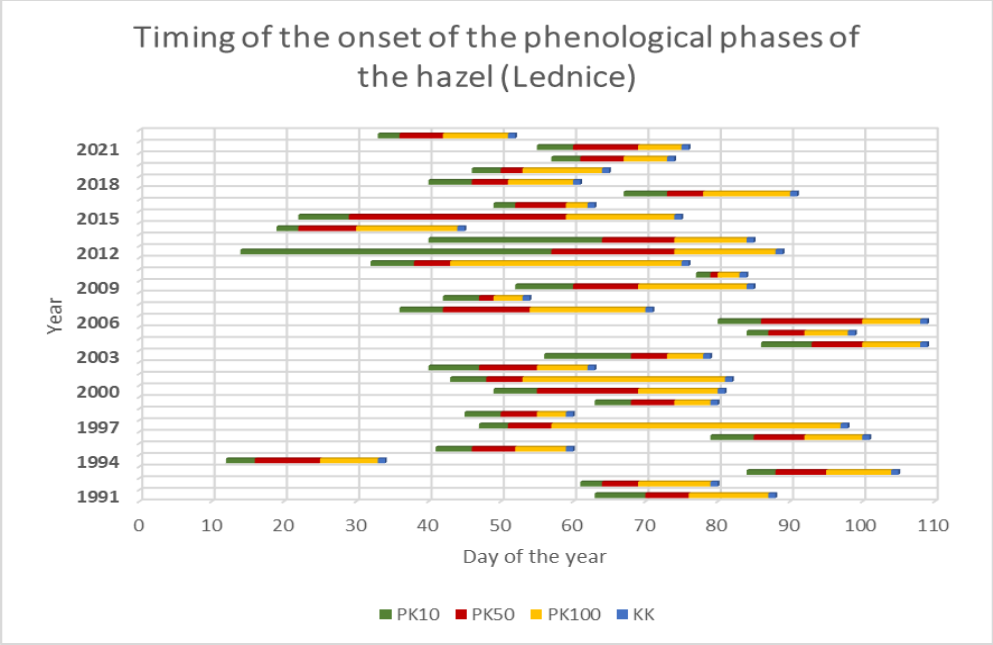
The results for the selected locations are presented in graphs No. 1, 2, and 3. These graphs show the onset of flowering of the common hazel up to the end of its flowering period. The individual phenophases are marked with abbreviations according to the aforementioned ČHMÚ methodology for forest plants: PK10: Onset of flowering (10 % of flowers in bloom), PK50: Onset of flowering (50% of flowers in bloom), PK100: Onset of flowering (100% of flowers in bloom), KK: End of flowering
These phases provide a detailed timeline of the flowering process for the common hazel in the studied locations. The phenological station in Lednice, Moravia (Graph 1), provides a data series spanning more than 30 years and is the closest station to the city of Brno. Between 2011 and 2015, an earlier onset of flowering was recorded, along with an increase in the duration of the flowering period. In the last five years, however, a later onset of flowering has been observed, with the pollen production period lasting approximately 18 days.
The average flowering duration over the entire observation period is 26 days, and on average, the common hazel begins to flower around the 50th day of the year.

The closest station to the third-largest city in the Czech Republic (Ostrava) is the phenological station in Mladecko (Graph 2). This station was established in 1999 and has been continuously monitored since then. The graph shows that since 2014, the onset of flowering has been occurring earlier, and the duration of the flowering period has been gradually increasing.
The average flowering duration over the entire observation period is 45 days, and on average, the common hazel begins to flower around the 47th day of the year. The difference between the longest and shortest flowering periods is 50 days.
The phenological station in Valašské Meziříčí (Graph 3) is located approximately 120 km from Brno and 70 km from Ostrava in a straight line. The first available data from this station also date back to 1999. This location is characterized by a later onset of flowering and a shorter flowering duration.
The average flowering duration over the entire observation period is 21 days, and on average, the common hazel begins to flower around the 66th day of the year.

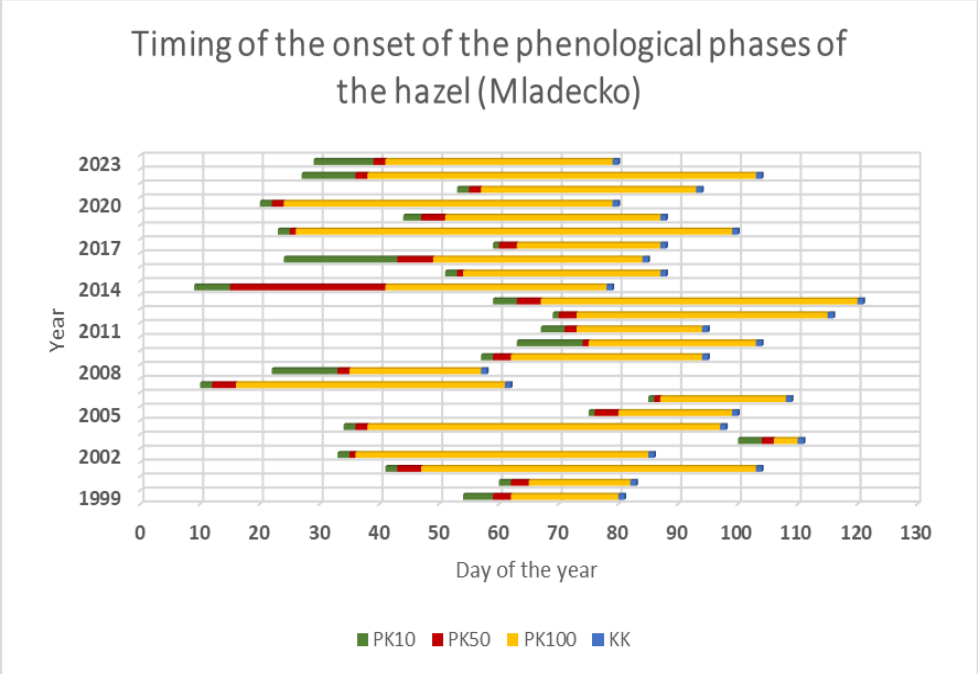
Discussion

In publications prior to 1990 (Böhm, 1976), allergenic trees and shrubs, such as the common hazel, were described as ideal, low-maintenance plants suitable primarily for gardens and residential areas. These plants were valued for their ability to thrive in any type of soil, under various light conditions, and in close proximity to other trees and shrubs. At that time, practicality outweighed concerns about potential impacts on the quality of life for residents. Since allergies were not as commonly reported,

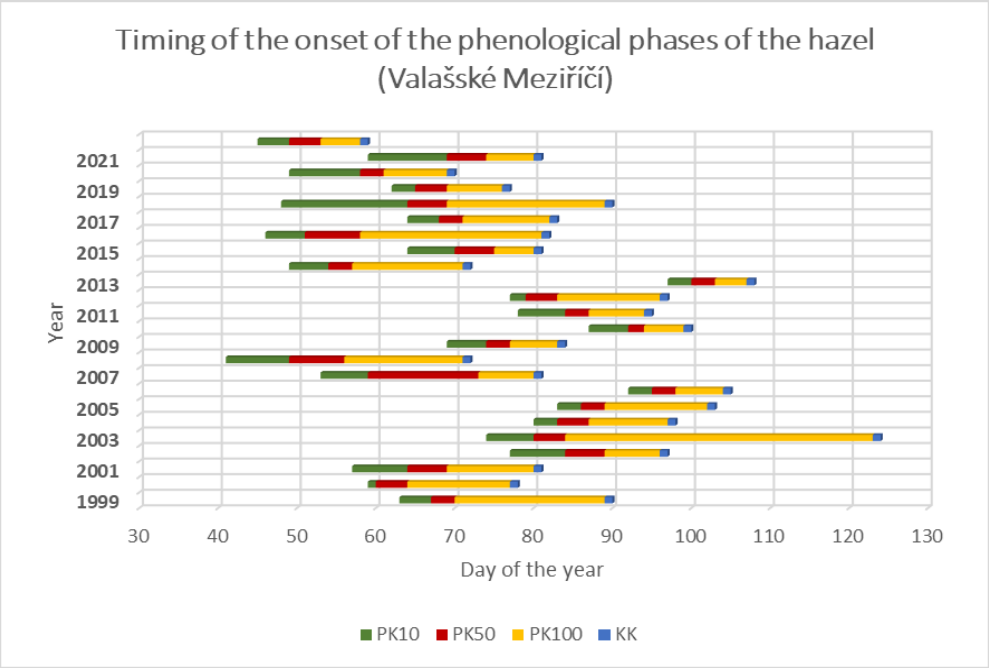
hazels, birches, lilacs, cypresses, and willows were often planted together, despite their potential to cause cross-reactivity in pollen allergies.
Given that cities are increasingly becoming popular destinations for recreation, they should provide suitable conditions not only for residents but also for visitors, including air free of allergenic pollen.
The question remains whether these allergenic plants should be gradually removed from urban areas to improve the quality of life for individuals. However, this would also result in the significant removal of a primary food source for various groups of insects. It is crucial to strike a balance between these considerations and, if necessary, replace allergenic plants with equally valuable non-allergenic species.



Graph 1: Timeline of the onset of phenological phases of hazel (Lednice)



Graph 2: Timeline of the onset of phenological phases of hazel (Mladecko)



Graph 3: Timeline of the onset of phenological phases of hazel (Valašské Meziříčí)

Conclusion

Based on the results, it cannot be conclusively stated that in recent years there has been an earlier onset of flowering and a longer flowering period across the entire Czech Republic. It is important to consider differences in climatic conditions, geographical factors, and other variables. More accurate conclusions can only be drawn by linking the relationships between individual phenophases and local or even global climate conditions.

One of the main benefits of this research could be its contribution to more effective planning of preventive measures for allergy sufferers, both in cities and in popular recreational areas. Healthcare organizations could better plan the availability of medications, while cities could use this information to adjust their approach to planting solitary trees and groups of public greenery. Lastly, this issue could also be valuable for education and public awareness efforts.

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Souhrn
Studie je zaměřena na vyhodnocení dat fenologických fází lísky obecné (Corylus avellana) z nejbližších fenologických stanic pro města Brno a Ostravu. V souvislosti s čím dál častěji se vyskytujícími pylovými alergiemi je zkoumána především doba nástupu a délka kvetení. V České republice líska patří mezi první významné, na jaře kvetoucí, alergenní dřeviny. Výsledky ukazují, že od počátku měření na stanicích Lednice na Moravě, Mladecko a Valašské Meziříčí dochází k dřívějšímu nástupu kvetení a v závislosti na meteorologických podmínkách v daném roce může docházet i prodlužování pylové sezóny. S těmito poznatky je třeba počítat při zajišťování rekreačních podmínek.

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