

Analysis of Corylus pollen seasons in selected cities of Poland in 2018

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Abstract: The study compares the hazel pollen seasons in Szczecin, Drawsko Pomorskie, Bydgoszcz, Zielona Góra, Wrocław, Opole, Sosnowiec, Cracow, Piotrków Trybunalski, Warsaw, Lublin, Olsztyn and Białystok in 2018. The investigations were carried out using the volumetric method. The hazel pollen season began between 24th January and 7th March. Maximum daily pollen concentrations were noted earliest on 3rd March and latest on 4th April. The greatest risk of allergies caused by the presence of airborne hazel pollen was observed in Lublin. Based on phenological observations of hazel pollen emission, it was found that pollen release also occurred on frosty days with high sunshine hours.

Key words: aeroallergens, pollen concentration, hazel (*Corylus*), 2018

Hazel belongs to the earliest flowering allergenic plants and its pollen grains are the first ones to appear in the air. Due to year-to-year variations in weather conditions, the onset of pollen seasons of plants flowering in early spring is characterized by great variability. For example, over the period 2001–2009 the difference in start dates of the hazel pollen season in Lublin was more than 2 months (64 days) [1].

Despite that the hazel pollen concentration does not usually reach very high values, hazel allergens are of great importance in allergology due to frequently occurring cross reactions with birch and alder allergens

as well as with food allergens (hazelnuts, apples, pears, peaches) [2].

The first allergy symptoms in people sensitized to hazel pollen can occur at a concentration of 35 pollen grains per 1 m³ of air, whereas 80 grains/m³ cause symptoms in all allergic patients [3].

Aim

The aim of the study was to compare the hazel pollen concentrations in the air of 13 selected cities in Poland in 2018.

Material and method

Measurements of airborne pollen of *Corylus* were performed in Szczecin, Drawsko Pomorskie, Bydgoszcz, Zielona Gora, Wrocław, Opole, Sosnowiec, Cracow, Piotrków Trybunalski, Warsaw, Lublin, Olsztyn and Białystok. Aeroplankton samples were carried out with the volumetric method using Burkard or Lanzoni pollen samplers. Pollen concentrations were expressed as the number of pollen grains in 1 m³ of air per day (P/m³). The duration of the hazel pollen season was determined with the 95% method. The start and end of the season were defined as the date when 2.5% and 97.5% of the seasonal cumulative pollen count was trapped, respectively.

Results and discussion

In 2018 in most of the cities studied, the hazel pollen season started earlier and lasted longer than

in 2017 [4, 5]. At most of the study sites, in 2018 the start of the hazel pollen season occurred between 24th January and 31th January, whereas in Białystok and Cracow as late as the beginning of March (tab. 1). In all the cities, the end of the hazel pollen season was recorded in April, earliest on 4th April (Bydgoszcz, Zielona Gora, Wrocław, Piotrków Trybunalski, Warsaw) and latest on 12th April (Białystok).

The peak hazel pollen concentrations at the individual study sites were found at different dates, earliest on 3rd March and latest on 4th April (fig. 1–6). The values of peak hazel pollen concentrations clearly varied in the relevant cities. The highest concentrations were found in Lublin (136 P/m³), whereas the lowest ones in Drawsko Pomorskie (14 P/m³). In all the cities, the highest hazel pollen concentration recorded in 2018 was much lower than in the previous year. For example, in Szczecin the peak value was 13 times lower than in 2017, whereas in Białystok 8 times lower.

Table 1. Characteristics of *Corylus* pollen season in 2018.

Site	Duration of pollen season (number of days)	Peak value [P/m ³] and peak date	Number of days with concentration above threshold 35 P/m ³	Annual pollen sum
Szczecin	25.01–10.04 (76)	17 3.03 and 16.03	0	313
Drawsko Pomorskie	25.01–8.04 (74)	14 5.03	0	258
Bydgoszcz	25.01–5.04 (71)	28 13.03	0	476
Zielona Gora	24.01–5.04 (72)	32 5.03	0	516
Wrocław	30.01–5.04 (66)	73 12.03	4	675
Opole	25.01–8.04 (74)	42 14.03	2	551
Sosnowiec	25.01–9.04 (75)	36 4.04	1	552
Cracow	7.03–6.04 (31)	56 3.04	4	387
Piotrków Trybunalski	26.01–5.04 (70)	43 13.03 and 4.04	3	534
Warsaw	27.01–5.04 (69)	41 4.04	1	488
Lublin	31.01–5.04 (65)	136 13.03	6	1065
Olsztyn	30.01–7.04 (68)	32 26.03	0	534
Białystok	4.03–12.04 (40)	16 26.03	0	256

Figure 1. Hazel pollen concentration in Szczecin and Drawsko Pomorskie in 2018.

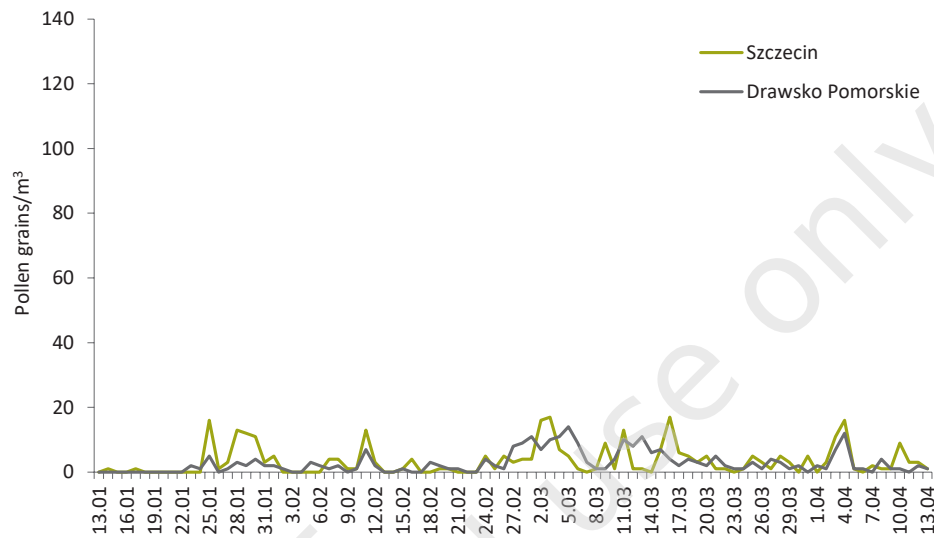


Figure 2. Hazel pollen concentration in Bydgoszcz and Zielona Gora in 2018.

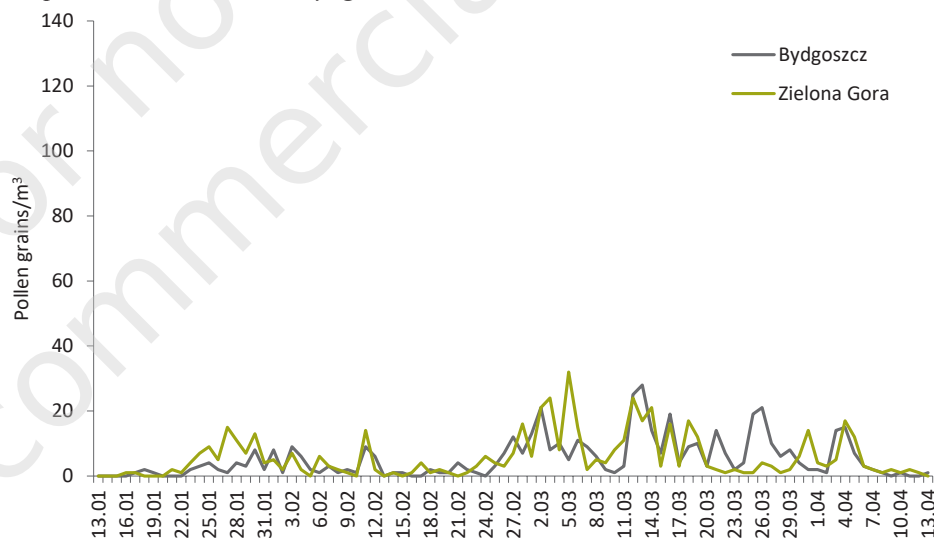


Figure 3. Hazel pollen concentration in Wrocław and Lublin in 2018.

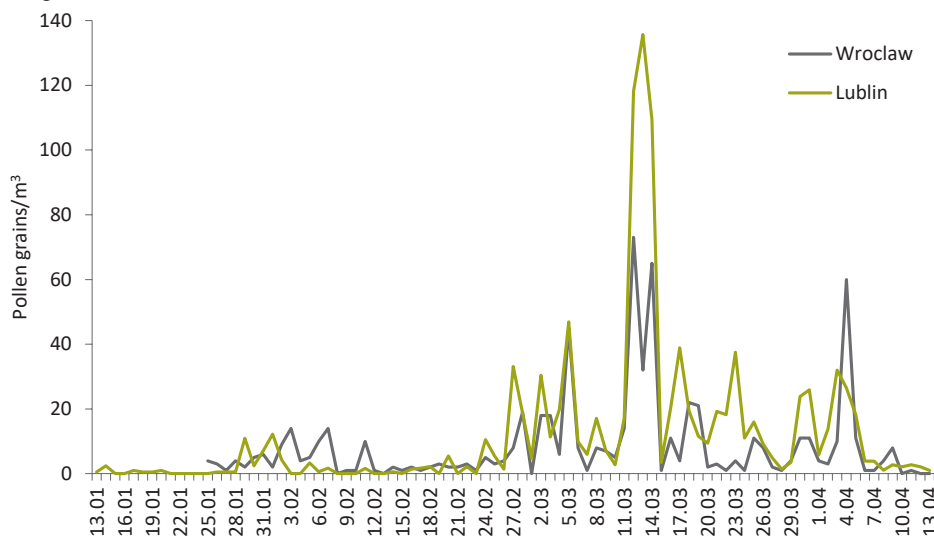


Figure 4. Hazel pollen concentration in Opole and Warsaw in 2018.

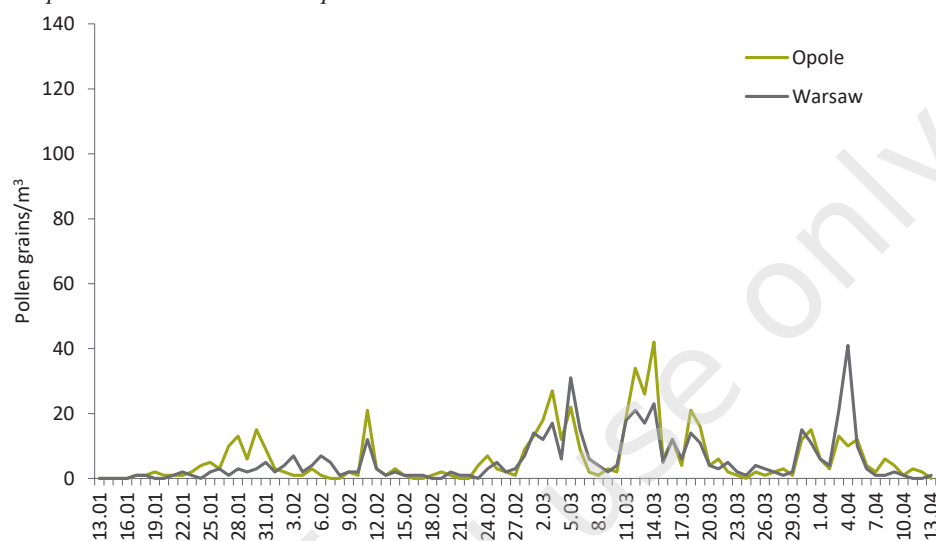


Figure 5. Hazel pollen concentration in Sosnowiec, Cracow and Piotrkow Trybunalski in 2018.

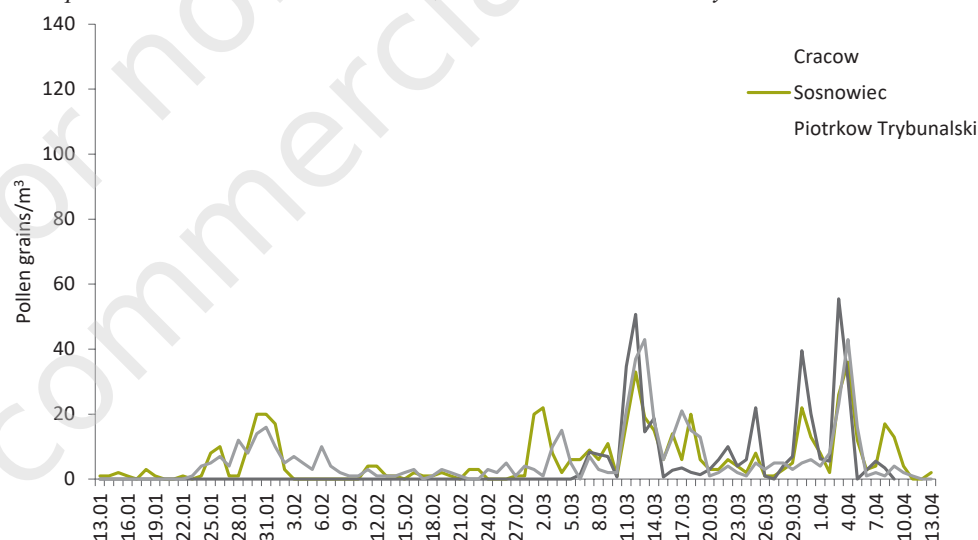
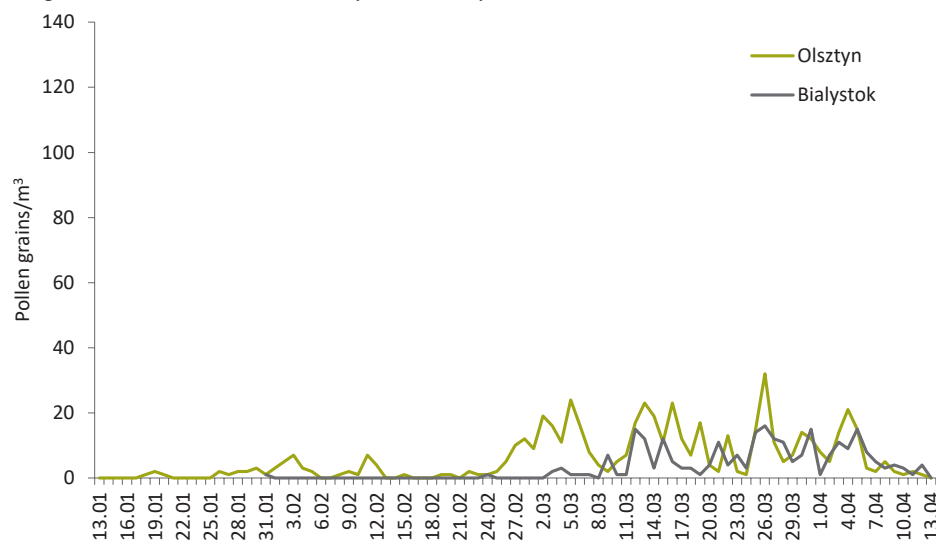


Figure 6. Hazel pollen concentration in Olsztyn and Bialystok in 2018.



In the other cities, the values of this parameter were 2–5 times lower [4, 5].

The highest number of days with the pollen concentration exceeding the threshold value of 35 P/m³ was observed in Lublin (6 days), while in 6 cities (Szczecin, Drawsko Pomorskie, Bydgoszcz, Zielona Gora, Olsztyn, Białystok) no concentrations exceeding this value were recorded in 2018 (tab. 1). The threshold value of more than 80 P/m³ was recorded only in Lublin (for 3 days). The annual pollen sum was also highest in Lublin, whereas it was lowest in Białystok. In Lublin much higher annual pollen counts were recorded than in the other cities, similarly to the years 2001–2005 [6]. This is due to the fact that large hazel plantations are located in Lubelskie Voivodeship. Almost half of hazelnut production comes from the Lublin region [7].

Based on phenological observations conducted in Lublin, it was found that in 2018 the emission of hazel pollen occurred on frosty days at an average daily temperature of -12°C and a maximum daily temperature of about -9°C (fig. 7). Before flowering, trees and shrubs require heat accumulation. Another opening occurs after the absorption of a specific dose

start to shed pollen still in a period of subzero temperatures [1].

Conclusions

Based on phenological observations of hazel pollen emission, it was found that pollen release also occurred on frosty days with high sunshine hours.

In 2018 the hazel pollen season started earlier and lasted longer than in the previous year as well as it was characterized by lower pollen concentrations. The annual pollen sum and the peak value in 2018 were much lower than in 2017.

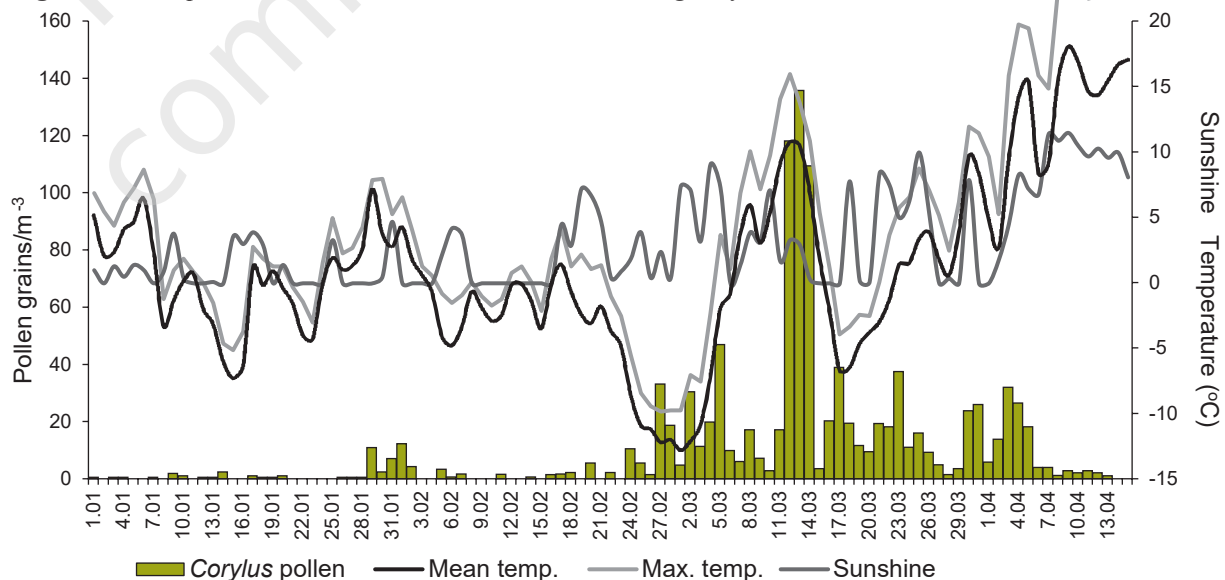
The highest pollen concentrations and the highest number of days with a concentration exceeding the threshold value were recorded in Lublin.

To provide more accurate forecasts, results of aerobiological studies should be enriched with phenological observations.

References:

1. Piotrowska K, Kaszewski BM. The influence of meteorological conditions on the start of the hazel (*Corylus L.*) pollen

Figure 7. Hazel pollen concentration in Lublin and meteorological factors.



of thermal energy (so-called cumulative temperature) [8]. In 2018 hazel pollen shed was preceded by relatively warm December and January; it was probably during this time that the relevant cumulative temperature was reached and on sunny days abundant pollen release was observed in spite of a very low air temperature. A previous study also showed that hazel can

season in Lublin, 2001–2009. *Acta Agrobotanica* 2009, 62(2): 59–66.

2. Rapiejko P, Lipiec A. Alergeny pyłku leszczyny. The hazel pollen allergens. *Alergoprofil* 2007, 3(2): 24–29.
3. Rapiejko P, Lipiec A, Wojdas A, Jurkiewicz D. Threshold pollen concentration necessary to evoke allergic symptoms. *Int Rev Allergol Clin* 2004, 10(3): 91–93.

4. Malkiewicz M, Piotrowska-Weryszko K, Chłopek K et al. The analysis of hazel pollen season in southern Poland in 2017. *Alergoprofil* 2017, 13(2): 72-76.
5. Puc M, Rapiejko P, Stacewicz A et al. Hazel pollen in the air of northern Poland in 2017. *Alergoprofil* 2017, 13(2): 68-71.
6. Weryszko-Chmielewska E (ed). *Pylek roślin w aeroplanktonie różnych regionów Polski*. Wyd Akademii Medycznej, Lublin 2006.
7. Kolesiewicz M. *Lubelszczyzna to orzechowe zagłębie*. *Dziennikwschodni.pl* 2011 [online: www.dziennikwschodni.pl/rolnictwo/lubelszczyzna-to-orzechowe-zaglebie,n,1000134168.html]. Dostęp: 15.03.2018.
8. Gonzalez-Parrado Z, Fuertes-Rodriguez CR, Vega-Murray AM et al. Chilling and heat requirements for the prediction of the beginning of the pollen season of *Alnus glutinosa* (L.) Gaertner in Ponferrada (León, Spain). *Aerobiologia* 2006, 22: 47-53.

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Piotrowska-Weryszko K: 40%; and other Authors: 4% each.

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Ethics: The contents presented in this paper are compatible with the rules the Declaration of Helsinki, EU directives and standardized requirements for medical journals.

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