

Corylus pollen season in Poland in 2019

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Abstract:

The aim of the study was to compare the course of *Corylus* pollen season in 2019 in 12 cities located in different regions of Poland: Szczecin, Bydgoszcz, Zielona Góra, Wrocław, Opole, Sosnowiec, Cracow, Piotrków Trybunalski, Warsaw, Lublin, Olsztyn, and Białystok. The analyses were carried out with the volumetric method using Burkard or Lanzoni pollen samplers. The length of the pollen season was determined with the 95% method. The earliest onset of the season was recorded in Warsaw and Szczecin, and at the latest beginning was noted in Lublin. The highest maximum concentrations of *Corylus* pollen were recorded in Lublin (244 P/m³), while Olsztyn (65 P/m³) as well as Białystok and Bydgoszcz (66 P/m³ in each) were characterized by the lowest values. The maximum daily concentration of *Corylus* pollen grains was recorded in 3 cities in the second decade of February (16–19.02) and in the other eight cities in the third decade of February (24–28.02). The exception was Białystok, where the peak value was only noted on 5.03. The annual pollen sum reached the highest values in Lublin (1301 grains) and Wrocław (1031 grains). The highest risk of allergy in individuals sensitive to the pollen of this taxon was found in Lublin, Wrocław, and Piotrków Trybunalski. In Lublin, the highest hazel pollen concentrations were recorded in the earlier years of the investigations as well.

Key words: aeroallergens, pollen concentration, risk of allergy, hazel, 2019

As a rule, the allergenic hazel pollen appears in the air in February; however, pollen release may take place even in January during sunny although sometimes relatively cold days. Hazel male flowers are resistant to temperatures below 0°C and can release pollen even at -12°C [1, 2]. Since the main

hazel allergen (*Cor a 1*) represents the strongest pollen allergens and often shows cross reactions with allergens of birch and alder pollen as well as food allergens, i.e. those contained in hazelnuts, apples, pears, or peaches, monitoring this taxon is extremely important for both allergy sufferers and allergists [3, 4].

Not only the commonly growing wild *Corylus avellana* L. plants, but also the ornamental and horticultural cultivars originating from *C. avellana* var. *pontica* Winkl., *C. maxima* Mill., and *C. colurna* L. abundantly cultivated in Europe and in Poland are a source of hazel pollen [5, 6]. The area of hazelnut plantations has increased in recent years. The highest concentration of hazel crops is noted in Lublin Province (42.4% of the entire area of hazel plantations). Large areas of hazel orchards are located in Mazowieckie, Łódzkie, Świętokrzyskie, Małopolskie, and Podkarpackie Provinces as well [7]. The concentration of hazel pollen in urban agglomerations does not usually reach high values; however, the concentration of the pollen of this taxon can be high in suburban areas as well as near hazel orchards and allotment gardens [4].

Aim

The aim of the study was to compare the hazel pollen concentration in the air of selected cities in Poland in 2019.

Material and method

Airborne hazel pollen was monitored in Szczecin, Bydgoszcz, Zielona Góra, Wrocław, Opole, Sosnowiec, Cracow, Piotrków Trybunalski, Warsaw, Lublin, Olsztyn and Białystok in 2019. Aeroplankton samples were collected with the volumetric method using Burkard or Lanzoni pollen samplers. Microscopic observations were performed on preparations obtained in a 7-day cycle with assessment of 24-hour periods. Pollen concentrations were expressed as the number of pollen grains in 1 m³ of air per day (P/m³). The length of the hazel pollen seasons 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 were trapped, respectively. The number of days with values of 35 P/m³ and 80 P/m³ was calculated for each city. The first allergy symptoms in subjects sensitized to hazel pollen and symptoms in all allergic patients appear at these threshold values [8].

Results

In Poland, in 2019, the hazel pollen season began on different days of February. The earliest onset of the season was recorded in Warsaw (5.02) and the latest start was noted in Lublin (18.02). The difference between the dates of the beginning of the hazel

pollen season in these cities was almost two weeks. The pollen season in all cities ended in March (tab. 1). The earliest date of the end of the pollen season was 6.03 in Szczecin, while at the latest dates, i.e. 22.03 and 23.03, were recorded in eastern Poland (Lublin, Olsztyn, Białystok). The highest pollen concentrations were recorded in Lublin. The maximum daily concentration of hazel pollen was estimated at 244 P/m³ in this city. A much lower seasonal maximum was found in Olsztyn, Białystok, Bydgoszcz, and Warsaw, where it reached a similar range of 65–68 P/m³. The peak value was recorded between 16.02 (Szczecin) and 5.03 (Białystok) (figs. 1–6). The seasonal maximum was noted on 19.02 in Cracow and Wrocław and in the third decade of February in other cities (24–28.02). The greatest number of days with a pollen concentration exceeding the threshold value of 35 P/m³ was observed in Lublin and Wrocław (10 days), Piotrków Trybunalski (9 days), and Zielona Góra (8 days). In turn, only one day when this value was exceeded was recorded in Białystok (tab. 1). The highest number of days with a threshold value exceeding 80 P/m³ was recorded in Lublin (4 days), followed by Wrocław and Piotrków Trybunalski (3 days), Zielona Góra and Cracow (2 days), Szczecin, Opole, and Sosnowiec (1 day). In the other cities, the pollen concentration did not exceed the threshold value of 80 P/m³. The annual sum of pollen grains was the highest in Lublin (1301 grains) and the lowest in Białystok (317 grains). A relatively high sum of pollen grains was also recorded in Wrocław (1031 grains) and Piotrków Trybunalski (933 grains).

Discussion

The annual pollen grains sum calculated based on the results from 12 cities in Poland was an average 729 in 2019. This value is similar to the average (714 grains) for 13 measurement stations in 2017 [9, 10]. In turn, in 2018, the annual total count of pollen registered in 13 measurement stations was lower, i.e. on average 508 grains [2]. In 2019, the annual sum of pollen hazel was the highest in Lublin, compared with the data from the other 12 investigated cities, likewise in the previous years, e.g. 2017 [9] and 2018 [2]. The high concentrations of hazel pollen in Lublin Province are associated with the high number of plantations of these shrubs in this area [7]. As demonstrated by the comparison of the annual sum of hazel pollen grains in Lublin in 2016–2019, i.e. on average 1246 grains [2, 9, 11], and the annual pollen sum from 2001–2005 for the same city, i.e. on average 959 grains [12], the number of pollen grains increased by 30% of the pre-

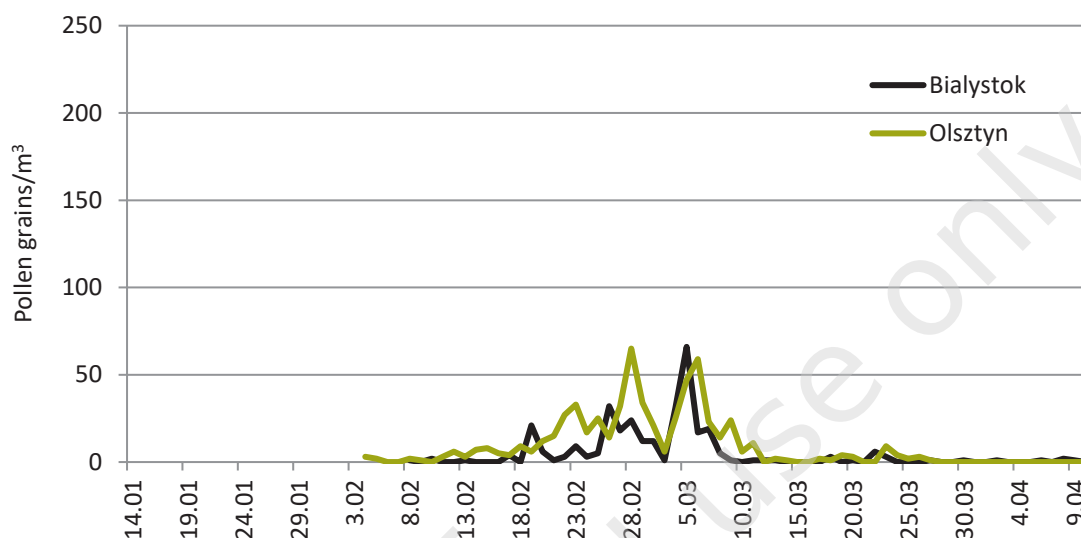
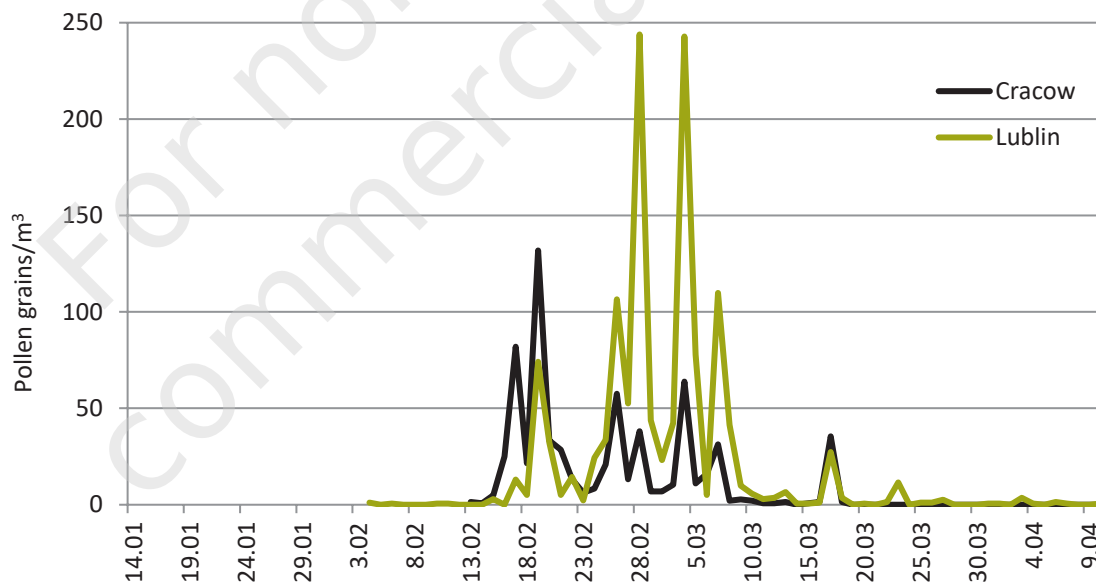
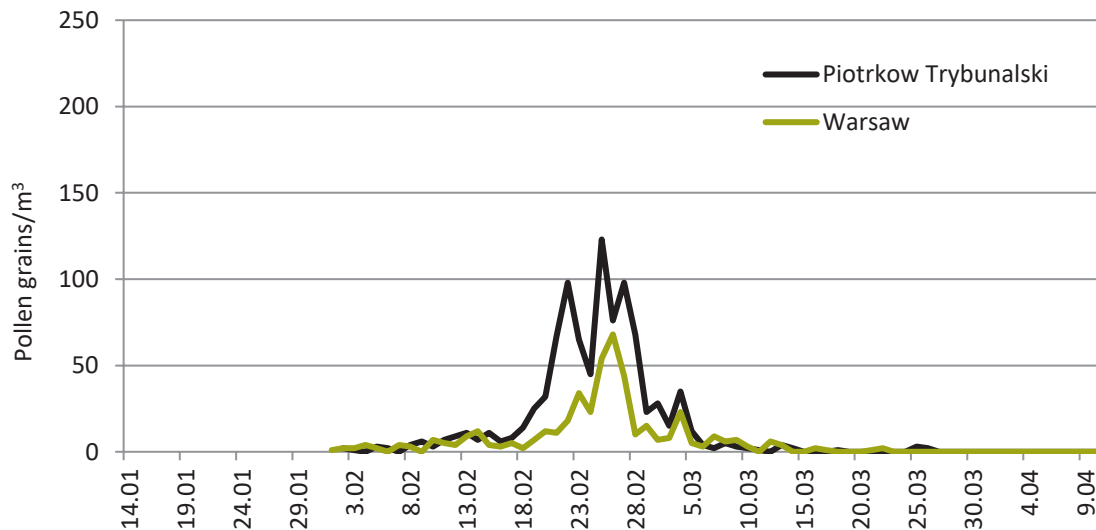
Figure 1. Hazel pollen concentration in Białystok and Olsztyn in 2019.**Figure 2.** Hazel pollen concentration in Cracow and Lublin in 2019.**Figure 3.** Hazel pollen concentration in Piotrkow Trybunalski and Warsaw in 2019.

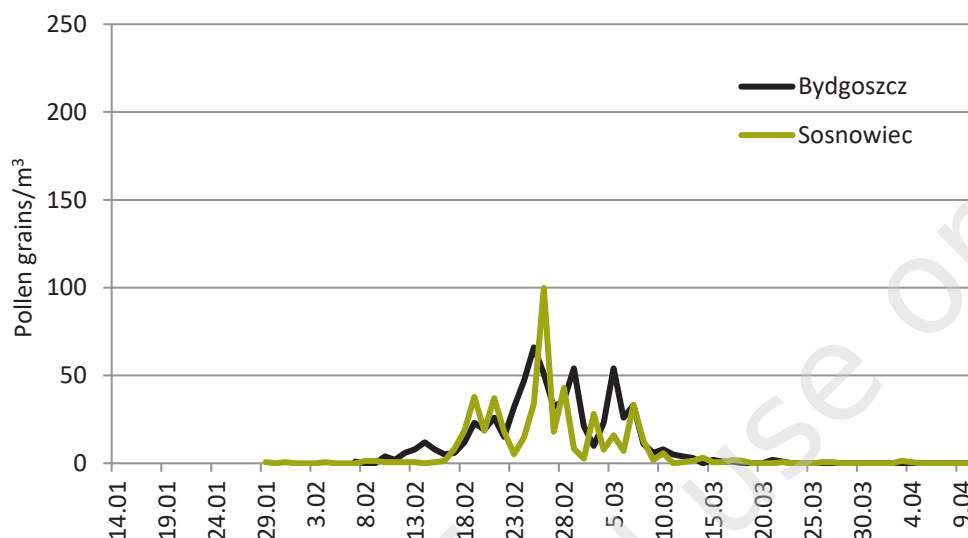
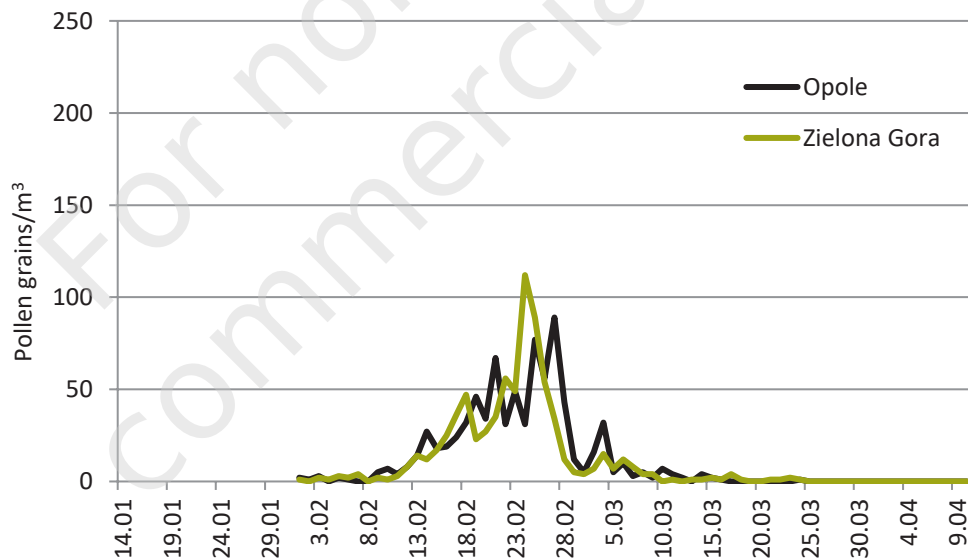
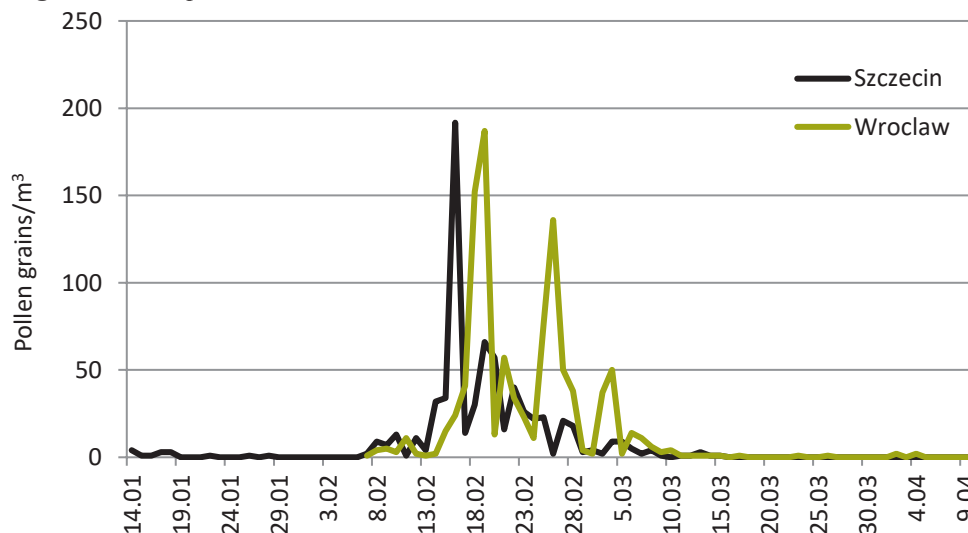
Figure 4. Hazel pollen concentration in Bydgoszcz and Sosnowiec in 2019.**Figure 5.** Hazel pollen concentration in Opole and Zielona Gora in 2019.**Figure 6.** Hazel pollen concentration in Szczecin and Wrocław in 2019.

Table 1. Characteristics of *Corylus* pollen season in 2019.

Site	Pollen season period by the 95% method	Peak value [P/m ³]	Peak date	Days number with concentration above threshold		Annual pollen grains sum
				35 P/m ³	80 P/m ³	
Szczecin	7.02–6.03	192	16.02	4	1	701
Bydgoszcz	13.02–11.03	66	25.02	6	0	676
Zielona Gora	11.02–9.03	112	24.02	8	2	751
Wroclaw	12.02–7.03	187	19.02	10	3	1031
Opole	10.02–10.03	89	27.02	7	1	801
Sosnowiec	17.02–13.03	100	26.02	4	1	499
Cracow	16.02–17.03	132	19.02	6	2	682
Piotrkow Trybunalski	10.02–7.03	123	25.02	9	3	933
Warsaw	5.02–12.03	68	26.02	3	0	452
Lublin	18.02–22.03	244	28.02	10	4	1301
Olsztyn	12.02–23.03	65	28.02	3	0	601
Bialystok	17.02–23.03	66	5.03	1	0	317

vious value. An upward trend in the annual pollen sum and peak value of hazel was recorded in Cracow in 2001–2013 [13].

Substantially higher values of the annual hazel pollen sum have been recorded in other European countries. Skjøth et al. [14] have reported that the average value of this parameter from 457 research stations from EAN is 3239 grains. *Corylus* grows almost across entire Europe: from Scandinavia to central Spain and Italy. The highest concentrations of hazel pollen are noted in the Alpine region in France, Switzerland, and Austria [14]. This information may be important for travelers around Europe or tourists spending winter holidays in the Alps.

In 2019, the highest risk of allergy to hazel pollen was noted in Lublin, Wroclaw, and Piotrkow Trybunalski. A similar risk was reported for Lublin, Wroclaw, and Cracow in 2018 [2] and for Lublin and Opole in 2017 [9].

Substantially lower threshold values than those used in this study to calculate the allergy risk (35 P/m³ and 80 P/m³) were reported by Thibaudon [15] from France. As suggested by this author, allergy symptoms can develop already at a hazel pollen concentration from 6 to 13 grains/m³/24 h, which he describes as “low”.

Conclusions

In 2019, the earliest onset of the hazel pollen season was recorded in Warsaw and Szczecin.

The highest values of the annual pollen sum and peak value were noted in Lublin, likewise in the previous years.

The highest risk of allergy to *Corylus* pollen was reported for Lublin, Wroclaw, and Piotrkow Trybunalski.

References

1. Piotrowska K, Kaszewski BM. The influence of meteorological conditions on the start of the hazel (*Corylus* L.) pollen season in Lublin, 2001–2009. *Acta Agrobotanica* 2009, 62(2): 59–66.
2. Piotrowska-Weryszko K, Konarska A, Kaszewski BM et al. Analysis of *Corylus* pollen seasons in selected cities of Poland in 2018. *Alergoprofil* 2018, 14(1): 21–26.
3. Mattiesen F, Ipsen H, Lowenstein H. Pollen allergens. In: *Allergenic pollen and pollinosis in Europe*. Blackwell Sci Publ 1991: 36–44.
4. Rapiejko P, Lipiec A. Alergeny pyłku leszczyny. The hazel pollen allergens. *Alergoprofil* 2007, 3(2): 24–29.
5. Rutkowski L. Klucz do oznaczania roślin naczyniowych Polski niżowej. PWN, Warszawa 1998.
6. Dolatowski J, Seneta W. *Dendrologia*. PWN, Warszawa 2000.
7. Wojciechowska M. Uprawa leszczyny [online: <http://www.leszczyna.org.pl/uprawa-leszczyny.html>]. Dostęp 26.04.2019.
8. Rapiejko P, Lipiec A, Wojdas A et al. Threshold pollen concentration necessary to evoke allergic symptoms. *Int Rev Allergol Clin* 2004, 10(3): 91–93.

9. Malkiewicz M, Piotrowska-Weryszko K, Chlopek K et al. The analysis of hazel pollen season in southern Poland in 2017. *Alergoprofil* 2017, 13(2): 72-76.
10. Puc M, Rapiejko P, Stacewicz A et al. Hazel pollen in the air of northern Poland in 2017. *Alergoprofil* 2017, 2(13): 68-71.
11. Piotrowska-Weryszko K, Weryszko-Chmielewska E, Sulborska A et al. *Corylus* pollen season in southern Poland in 2016. *Alergoprofil* 2016, 12(2): 87-91.
12. Weryszko-Chmielewska E (ed). *Pollen of plants in the aeroplankton of various regions of Poland*. Wydawnictwo Akademii Medycznej w Lublinie, Lublin 2006.
13. Myszkowska D, Ziemianin M, Piotrowicz K et al. Analiza sezonów pyłkowych wybranych taksonów roślin w Krakowie w latach 2001-2013. In: Weryszko-Chmielewska E (ed). *Ziarna pyłku i zarodniki grzybów w powietrzu różnych regionów Polski*. Wydawnictwo Norbertinum, Lublin 2014: 27-46.
14. Skjøth CA, Šikoparija B, Jäger S; EAN-Network. Pollen Sources. In: Sofiev M, Bergmann KC (ed). *Allergenic Pollen: A Review of the Production, Release, Distribution and Health Impacts*. Springer Dordrecht, Heidelberg, New York, London 2013: 9-27.
15. Thibaudon M. Allergy risk associated with pollen in France. *European Annals of Allergy and Clinical Immunology* 2003, 35: 170-172.

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