Analysis of Corylus pollen season in Poland in 2021

Krystyna Piotrowska-Weryszko[1], Elżbieta Weryszko-Chmielewska[1], Katarzyna Dąbrowska-Zapart[2], Monika Ziemianin[3], Małgorzata Puc[4], Grzegorz Siergiejko[5], Małgorzata Malkiewicz[6], Dariusz Jurkiewicz[7], Przemysław Bant[7], Piotr Rapiejko[8]

[1] Department of Botany and Plant Physiology, University of Life Sciences in Lublin, Poland
[2] Faculty of Natural Sciences, Institute of Earth Sciences, University of Silesia, Sosnowiec, Poland
[3] Department of Clinical and Environmental Allergology, Medical College, Jagiellonian University, Cracow, Poland
[4] Institute of Marine & Environmental Sciences, University of Szczecin, Poland
[5] Pediatrics, Gastroenterology and Allergology Department, University Children Hospital, Medical University of Bialystok, Poland
[6] Laboratory of Paleobotany, Department of Stratigraphical Geology, Institute of Geological Sciences, University of Wroclaw, Poland
[7] Department of Otolaryngology with Division of Cranio-Maxillo-Facial Surgery, Military Institute of Medicine, Warsaw, Poland
[8] Allergen Research Center, Warsaw, Poland

Abstract:

Corylus produces allergenic pollen grains that appear in the air in early spring and cause pollen allergy in sensitive people. The aim of this study was to compare the *Corylus* pollen seasons in 2021 in the following 11 cities in Poland: Bialystok, Bydgoszcz, Cracow, Sosnowiec, Lublin, Olsztyn, Piotrkow Trybunalski, Szczecin, Warsaw, Wroclaw, and Zielona Gora. This research was conducted using the volumetric method and Burkard or Lanzoni pollen samplers. Pollen season duration was determined by the 95% method. The hazel pollen season in 2021 began relatively late, between February 20th and March 1st. The season start was recorded earliest in Zielona Gora, while latest in Olsztyn. The highest values of maximum *Corylus* pollen concentration were recorded in Sosnowiec (230 grains/m^3) and Zielona Gora (213 grains/m^3), whereas the lowest ones in Bialystok (27 grains/m^3) and Bydgoszcz (54 grains/m^3). In most of these cities, the maximum daily concentration of *Corylus* pollen grains was recorded in the third 10 days of February or at the beginning of March and only in Lublin and Bialystok the peak value occurred later, on March 16th and March 26th, respectively. The highest risk of allergy in people sensitive to the pollen of this taxon was found in Lublin, Olsztyn, and Zielona Gora. The highest values of the annual pollen integral were determined in Lublin, similarly to the previous years.

Key words: aeroallergens, pollen concentration, risk of allergy, hazel, 2021

Introduction

The common hazel (*Corylus avellana* L.) is the most characteristic plant that begins the growing season in our country and its blooming is treated as the beginning of phenological early spring [1]. Hazel blooms before the leaves develop and it usually occurs at the turn of February and March. Male flowers are borne in inflorescences called catkins that grow at the end of shoots. Female flowers, clustered in twos, are concealed in the lateral buds and during flowering only the red stigmas can be seen.

Hazel is commonly found across Poland. The best conditions for the growth of this plant exist in the south-eastern part of our country where the largest number of hazel trees are found [2, 3]. The common hazel performs an important role for the forest environ-

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ment. Numerous species of mammals and birds feed on its fruits, the so-called hazelnuts, among others the jay and spotted nutcracker that owes its name to nuts. Despite that hazel belongs to anemophilous plants, it is valued by beekeepers due to the fact that this plant provides abundant pollen before other plant species blossom [4].

Hazelnuts are a valuable element of diet because they contain many valuable components necessary for the development of the human organism. They contribute to proper brain functioning, reduce the cholesterol and triglyceride level, and also help in treating many metabolic conditions [5]. But some people cannot eat hazelnuts due to allergy to them.

In spite of its many beneficial properties, hazel may have a negative effect on the health of sensitive people since its pollen contains allergens causing pollen allergy whose symptoms may occur in early spring.

Aim

The aim of the study was to analyse the hazel pollen seasons in selected cities of Poland in 2021.

Material and method

The investigations of the airborne hazel pollen concentration were conducted in Bialystok, Bydgoszcz, Cracow, Sosnowiec, Lublin, Olsztyn, Piotrkow Trybunalski, Szczecin, Warsaw, Wroclaw, and Zielona Gora. Volumetric Burkard or Lanzoni samplers were continuously used in all measurement stations in 2021. The daily pollen counts were determined. The results were expressed as the number of pollen grains in 1 m^3 of air per day (grains/m^3). 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 was trapped, respectively.

The number of days with a concentration equal to or greater than 35 grains/m^3 and 80 grains/m^3 was calculated for each city. The first allergy symptoms in subjects sensitized to hazel pollen and symptoms in all allergic patients occur at these threshold values [6].

Results

In 2021 the hazel pollen season in Poland began between February 20th and March 1st, earliest in Zielona Gora and latest in Olsztyn. The earliest and latest end of the season, respectively, were recorded in the same cities. The *Corylus* pollen season ended earliest in Zielona Gora (March 13th) and latest in Olsztyn (April 15th). In the other cities, the end of the season occurred between March 26th and April 2nd (tab. 1).

The maximum daily concentration values greatly varied in the individual cities and ranged between 27 grains/m^3 (Bialystok) and 230 grains/m^3 (Sosnowiec). Apart from Bialystok, relatively low seasonal peak values were also recorded in Bydgoszcz (54 grains/m^3), Piotrkow Trybunalski (68 grains/m^3),

Table 1. *Characteristics of Corylus pollen season in 2021.*

Site	Pollen season period by the 95% method	Peak value [grains/m^3]	Peak date	Days number with concentration above threshold		Annual pollen sum
				35 grains/m^3	80 grains/m^3	
Bialystok	24.02–2.04	27	26.03	0	0	119
Bydgoszcz	25.02–2.04	54	4.03 7.03	5	0	626
Cracow	24.02–26.03	144	26.02	4	2	593
Sosnowiec	24.02–30.03	230	26.02	6	2	888
Lublin	25.02–31.03	113	16.03	8	4	999
Olsztyn	1.03–15.04	97	7.03	9	1	702
Piotrkow Trybunalski	24.02–1.04	68	4.03	3	0	549
Szczecin	21.02–26.03	171	24.02	3	1	450
Warsaw	24.02–28.03	78	25.02	6	0	602
Wroclaw	21.02–26.03	129	26.02	6	3	663
Zielona Gora	20.02–13.03	213	24.02	6	4	958

Warsaw (78 grains/m^3), and Olsztyn (97 grains/m^3). In Cracow, Lublin, Szczecin, and Wroclaw, the peak value was in the range of 113–171 grains/m^3, whereas in Zielona Gora the maximum daily concentration was similar to that recorded in Sosnowiec, standing at 213 grains/m^3.

It was found that in many of these Polish cities the peak date was observed within a short time after the onset of the pollen season, even 1 day (Warsaw) or 2 days (Cracow and Sosnowiec). In six cities (Cracow, Sosnowiec, Szczecin, Warsaw, Wroclaw, and Zielona Gora), the peak date occurred between February 24th and February 26th, in Bydgoszcz, Olsztyn, and Piotrkow Trybunalski between March 4th and March 7th, in Lublin on March 16th, while this date was latest in Bialystok – March 26th (fig. 1–6).

One clear peak can be seen in the curve showing the dynamics of the pollen season in four Polish cities (Szczecin, Zielona Gora, Wroclaw, Cracow, and Sosnowiec) (fig. 3, 5, 6). On the other hand, the curves for Bialystok, Olsztyn, Warsaw, Lublin, Piotrkow Trybunalski, and Bydgoszcz are multimodal, with several peaks visible. The pollen season pattern in the cities located close to each other (Cracow and Sosnowiec as well as Zielona Gora and Wroclaw) was similar. The analysis of the airborne pollen concentration reveals that during the time of the daily peak in the above-mentioned six cities, which was the period of February 24th–26th, high pollen concentrations were also recorded in Lublin, Warsaw, and Piotrkow Trybunalski. Over this period, low pollen concentrations occurred only in Bialystok, Bydgoszcz, and Olsztyn.

The highest number of days with the pollen concentration exceeding the threshold value of 35 grains/m^3 was observed in Olsztyn (9 days) and Lublin (8 days), followed by Sosnowiec, Warsaw, Wroclaw, and Zielona Gora (6 days in each), Bydgoszcz (5 days), Cracow (4 days), Piotrkow Trybunalski and Szczecin (3 days in each), whereas in Bialystok no such days were recorded (tab. 1). The number of days with a pollen concentration of more than 80 grains/m^3 was highest in Lublin and Zielona Gora (4 days), whereas in Bialystok, Bydgoszcz, Piotrkow Trybunalski, and Warsaw no day was recorded on which this value was exceeded. In the other cities, 1 or 3 days were recorded on which the threshold value of 80 grains/m^3 was exceeded.

In 2021 the highest annual pollen sum was recorded in Lublin (999 grains) and little less in Zielona Gora (958 grains) and Sosnowiec (888 grains). The hazel pollen count was found to be lowest in Bialystok (119 grains). In the other cities, the annual pollen integral ranged between 450 and 702 pollen grains.

Discussion

In 2021 the hazel pollen season began at a similar time as in 2013, when the prolonged period of low temperatures had contributed to a delay in hazel flowering in different regions of Poland [7]. During the 2014–2020 period, in most of the cities the pollen season of this taxon was recorded much earlier: in January, in the first half of February, or even at the end of December (in 2016) [8–15]. The study conducted in 2020 had found that the hazel pollen season had started earliest in the western part of Poland and latest in eastern Poland [15], whereas in 2021 this relationship was observed only with respect to some of the cities.

In the previous years, the maximum daily concentrations of hazel pollen had usually been higher in Lublin than in the other cities, while in 2021 the peak value observed in Lublin was much lower than in five other cities. However, it is worth noting that high concentrations, reaching values of more than 100 grains/m^3, occurred in the above-mentioned city. The highest peak value was recorded in Sosnowiec and it was 230 grains/m^3. Nonetheless, in 2021 the annual pollen integral was highest in Lublin, similarly as in the previous years. The seasonal peaks were recorded latest in Bialystok and Olsztyn, while earliest in Szczecin, similarly as during the 2018–2020 period [13–15].

In 2021 the number of days exceeding the threshold value of 80 grains/m^3 was highest in Lublin and Zielona Gora (4 days), whereas in the previous years this number had been higher in Lublin than in the other cities.

In Poland the hazel pollen concentration reaches medium values compared to other European countries. The highest annual hazel pollen sums are recorded in the Alpine region of France, Switzerland, and Austria, where the total annual pollen counts are more than 3000 pollen grains per season. The lowest annual hazel pollen sums, on the other hand, are recorded in southern European countries and in Scandinavia (20–50 grains per season) [16].

Conclusions

In 2021 the hazel pollen season started in cities of Poland (except Olsztyn) in the third 10 days of February.

Figure 1. *Hazel pollen concentration in Bialystok and Olsztyn in 2021.*

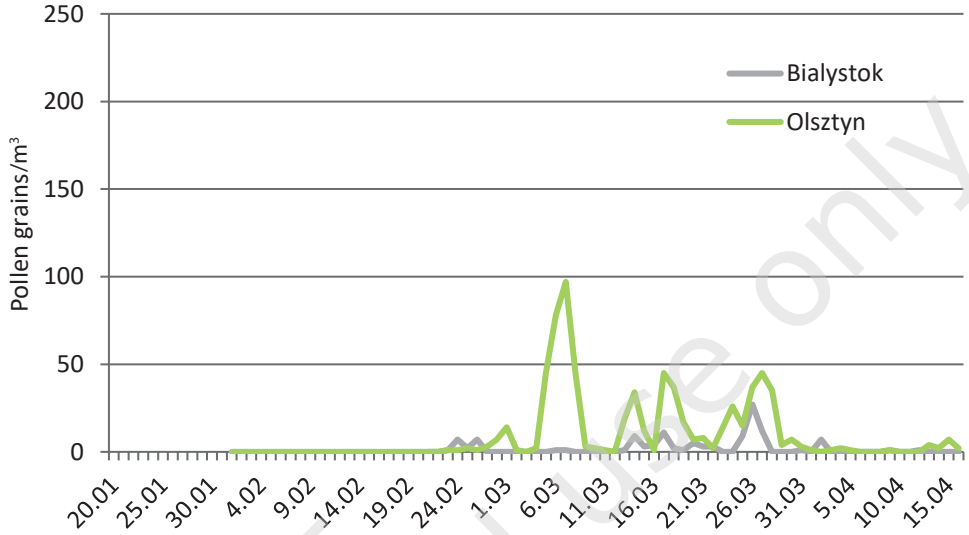


Figure 2. *Hazel pollen concentration in Warsaw and Lublin in 2021.*

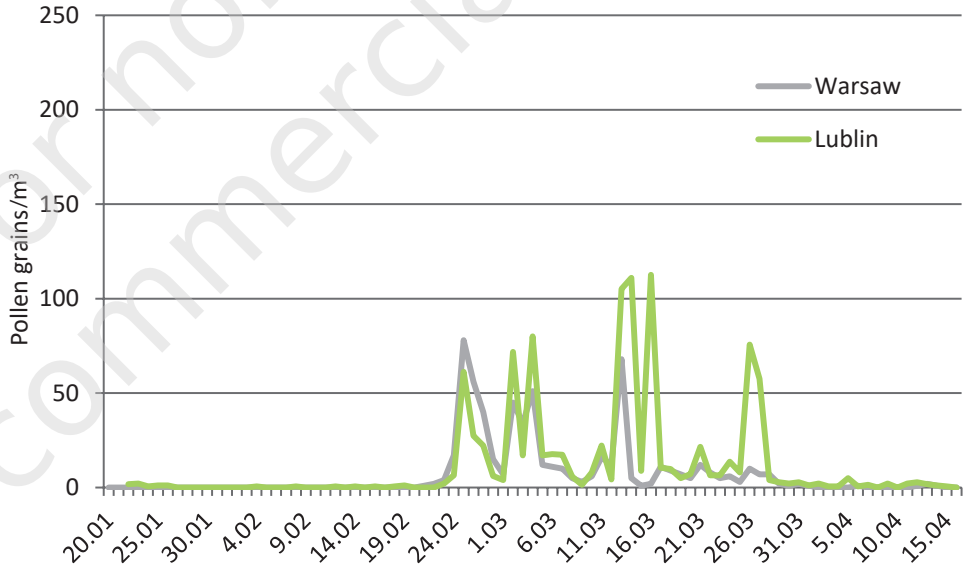


Figure 3. *Hazel pollen concentration in Cracow and Sosnowiec in 2021.*

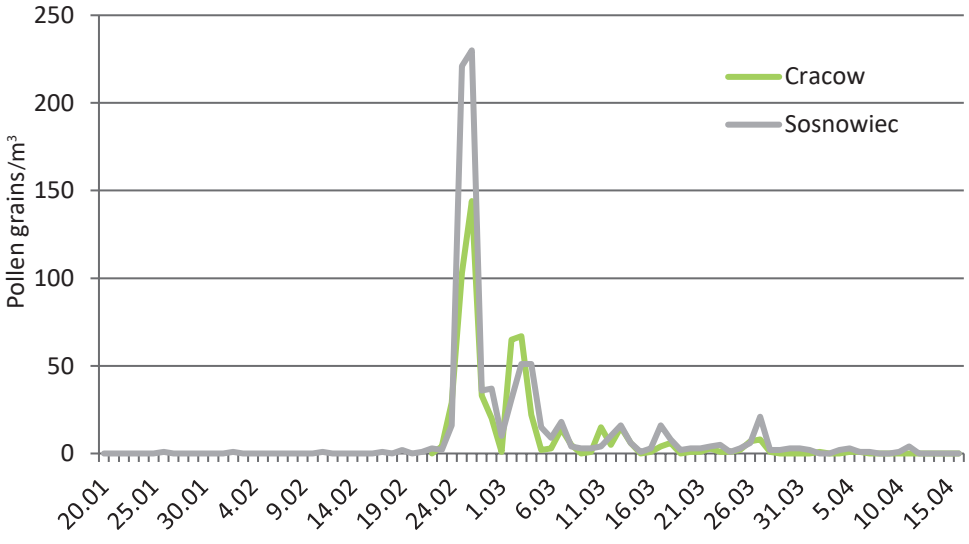


Figure 4. *Hazel pollen concentration in Piotrkow Trybunalski and Bydgoszcz in 2021.*

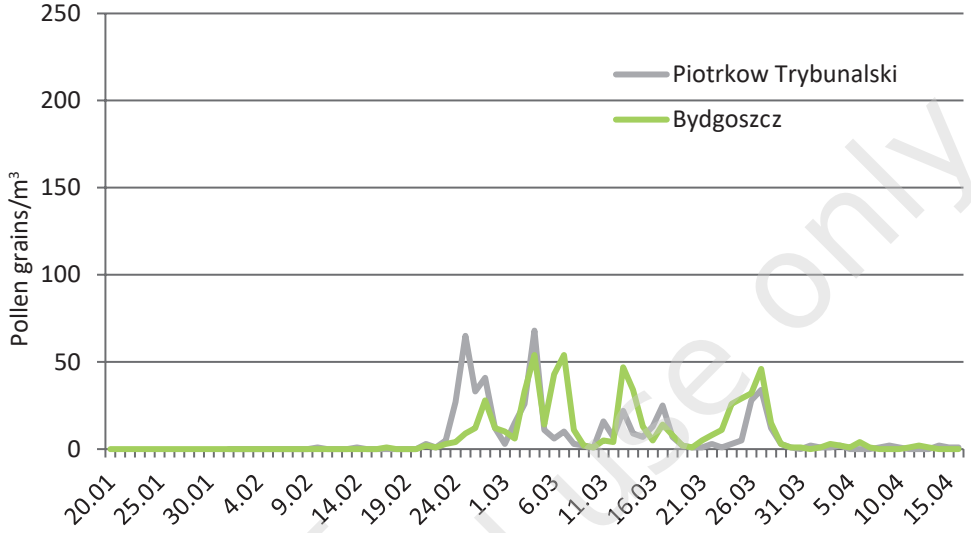


Figure 5. *Hazel pollen concentration in Zielona Gora and Wroclaw in 2021.*

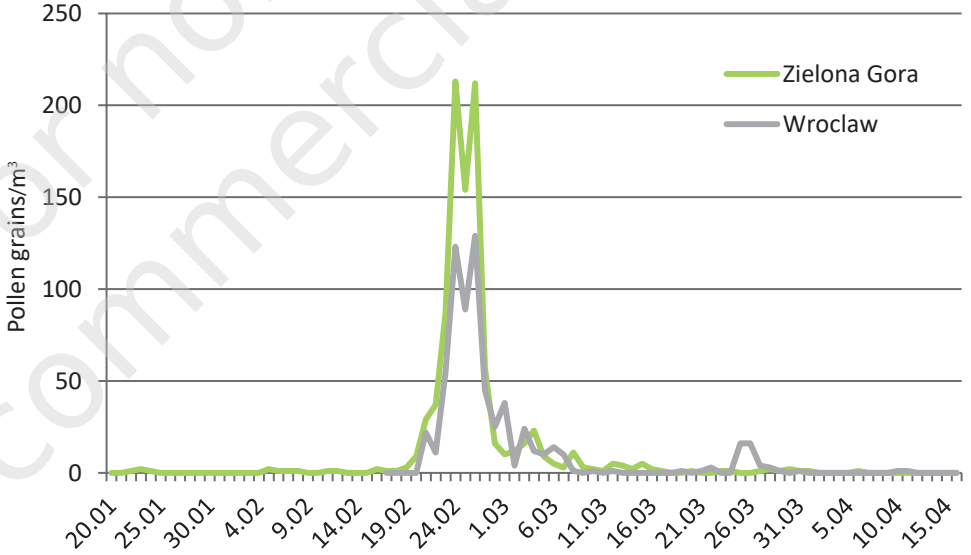
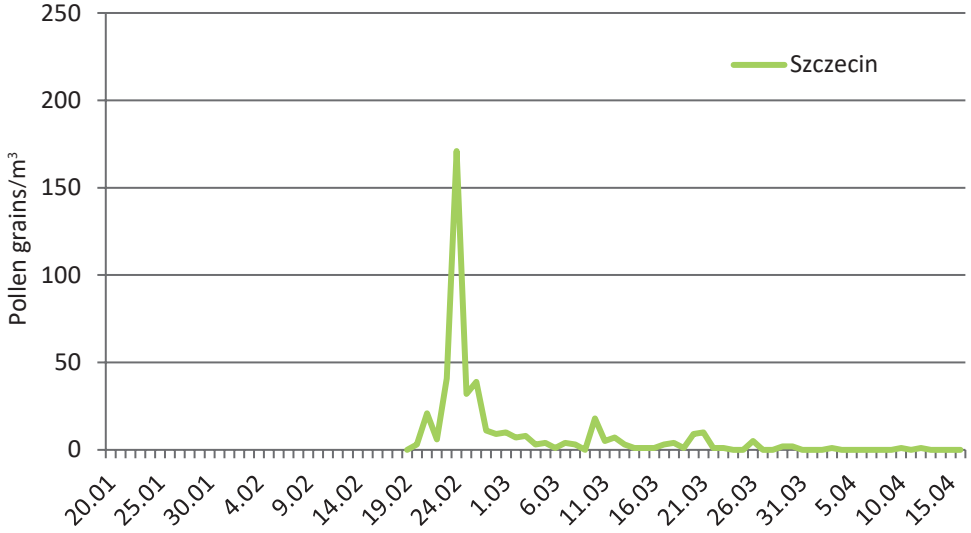


Figure 6. *Hazel pollen concentration in Szczecin in 2021.*



The seasonal maximum was recorded in most cities in the third 10 days of February or at the beginning of March.

The highest risk of allergy to *Corylus* pollen was found in Lublin, Olsztyn, and Zielona Gora.

The highest annual pollen sum and peak value were found in Lublin, similarly to the previous years.

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K. Piotrowska-Weryszko – ID – http://orcid.org/0000-0003-3827-3218
E. Weryszko-Chmielewska – ID – http://orcid.org/0000-0001-8410-2757
K. Dąbrowska-Zapart – ID – http://orcid.org/0000-0002-8976-7739
M. Ziemianin – ID – http://orcid.org/0000-0003-4568-8710
M. Puc – ID – http://orcid.org/0000-0001-6734-9352
G. Siergiejko – ID – http://orcid.org/0000-0003-4084-8332
M. Malkiewicz – ID – http://orcid.org/0000-0001-6768-7968
D. Jurkiewicz – ID – http://orcid.org/0000-0003-3729-2679
P. Bant – ID – http://orcid.org/0000-0002-1697-3152
P. Rapiejko – ID – http://orcid.org/0000-0003-3868-0294

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Correspondence:
Krystyna Piotrowska-Weryszko, Assoc. Prof.
Department of Botany and Plant Physiology,
University of Life Sciences in Lublin
20-950 Lublin, Akademicka 15
e-mail: krystyna.piotrowska@up.lublin.pl