Alnus pollen grains in the atmospheric air in Poland in 2022

Krystyna Piotrowska-Weryszko[1], Elżbieta Weryszko-Chmielewska[1], Małgorzata Puc[2], Monika Ziemianin[3], Anna Kopacz-Bednarska[4], Joanna Rapiejko[5], Kazimiera Chłopek[6], Małgorzata Malkiewicz[7], Grzegorz Siergiejko[8], Dariusz Jurkiewicz[9], Agnieszka Lipiec[10]

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

Abstract:
In addition to hazel pollen, alder pollen causes allergy symptoms in subjects suffering from early spring allergies. The study consisted in the analysis of the concentration of *Alnus* pollen in the air of 12 Polish cities: Bialystok, Bydgoszcz, Cracow, Kielce, Lublin, Olsztyn, Piotrkow Trybunalski, Sosnowiec, Szczecin, Warsaw, Wroclaw, and Zielona Gora. The research was carried out in 2022. The volumetric method and Burkard or Lanzoni samplers were used. The pollen season was determined with the 95% method. The onset of the season was recorded earlier in the west of Poland than in the east of the country, i.e. between January 30th and February 18th. The season ended between March 23rd and April 3rd. The maximum alder pollen concentrations were determined in between February 14th and March 16th. The highest concentrations of alder pollen were detected in Kielce and Piotrkow Trybunalski, while the lowest values were recorded in Bialystok and Szczecin.

Key words: aeroallergens, pollen concentration, risk of allergy, alder, 2022

Introduction

The genus *Alnus* Mill. from the *Betulaceae* family comprises trees and shrubs growing in the northern hemisphere. Five species of this genus occur in Europe [1]. Black alder (*Alnus glutinosa* L.) and gray alder (*A. incana* L.) grow in wet habitats along the banks of rivers and lakes [2].

In Poland, alders are one of the first trees to begin flowering, most often in February or March [3]. The onset of the pollen season largely depends on the thermal conditions prevailing at the beginning of the year [4]. Alder pollen often causes allergic rhinoconjunctivitis and bronchial asthma in early spring. The threshold value for *Alnus* pollen is 45 pollen grains in 1 m^3 [5].

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Since the middle of the last century, the incidence of allergic rhinitis and asthma has been increasing. This results not only from air pollution but also from the increase in the amount of allergenic pollen produced mainly by trees, including *Alnus* pollen [6]. Based on the results of analyses carried out at 97 research stations in many European countries, it has been suggested that not only climate change but also anthropogenically induced increase in the atmospheric CO_2 level are the causes of this phenomenon [6].

Alder is used for reclamation of devastated land. It is sometimes planted as an ornamental tree and used as a medicinal plant [2]. Alder wood is used in sculpture, the manufacture of string instruments, boats, and yachts, and the construction of underwater structures (Venice, Amsterdam). It is characterized by high resistance to decay. It is also used for the production of charcoal and gunpowder [7].

Aim

The aim of the study was to analyse the alder pollen seasons in selected cities of Poland in 2022.

Material and method

The investigations of the airborne *Alnus* pollen concentration were carried out in Bialystok, Bydgoszcz, Cracow, Kielce, Lublin, Olsztyn, Piotrkow Trybunalski, Sosnowiec, Szczecin, Warsaw, Wroclaw, and Zielona Gora. Volumetric Burkard or Lanzoni samplers were continuously used in all measurement stations in 2022. The daily pollen concentrations were determined. The results were expressed as the number of pollen grains in 1 m^3 of air per day (P/m^3). The length of the alder 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 45 P/m^3 and 85 P/m^3 was determined. The first allergy symptoms in subjects sensitized to alder pollen and symptoms in all allergic patients occur at these threshold values [5].

Results

In 2022, the earliest onset of the alder pollen season was recorded in Szczecin (January 30th) and Zielona Gora (February 9th) as well as Sosnowiec and Wroclaw (February 10th). The latest beginning of the season was noted in Lublin (February 18th) as well as Bialystok and Kielce (February 17th). The multimodal curves of the course of the alder pollen season were characterized by several peaks (fig. 1–6). In all cities, a significant decrease in the concentration of airborne pollen was recorded at the end of the first 10 days of March; this was followed by an increase in the concentration of alder pollen in mid-March. The alder pollen season ended on the last ten days of March, with the exception of Bialystok and Lublin, where the end was recorded at the beginning of April. The pollen seasons lasted 37–55 days; the shortest season was reported in Cracow, and the longest season was recorded in Szczecin (tab. 1).

Table 1. *Characteristics of Alnus pollen season in 2022.*

Site	Pollen season period by the 95% method (number of days)	Peak value [P/m^3]	Peak date	Days number with concentration above threshold		Annual pollen sum
				45 P/m^3	85 P/m^3	
Bialystok	17.02–3.04 (46)	108	16.03	5	1	968
Bydgoszcz	15.02–26.03 (40)	687	21.02	38	32	9248
Cracow	16.02–24.03 (37)	740	24.02	33	26	6947
Kielce	17.02–26.03 (38)	1048	15.03	37	29	9632
Lublin	18.02–2.04 (44)	459	15.03	34	27	5363
Olsztyn	16.02–27.03 (40)	464	16.03	34	23	6689
Piotrkow Trybunalski	15.02–26.03 (40)	879	25.02	40	35	10 076
Sosnowiec	10.02–24.03 (43)	621	26.02	38	26	7142
Szczecin	30.01–25.03 (55)	256	14.02	14	9	2144
Warsaw	14.02–25.03 (40)	689	25.02	39	31	9022
Wroclaw	10.02–3.03 (42)	683	18.02	38	30	7732
Zielona Gora	9.02–23.03 (43)	642	24.02	40	32	8522

The maximum concentrations of alder pollen in Bialystok, Olsztyn, Lublin, and Kielce were noted on a similar date, i.e. on March 15th–16th. The season maximum in the other cities was recorded between February 14th and February 26th. An exceptionally high daily concentration of alder pollen was reported from Kielce (1048 P/m^3). It was almost 10-fold higher than that in Bialystok, where the lowest maximum value was recorded (tab. 1). The highest annual pollen sums in the range of 9022–10 076 grains were noted in Piotrkow Trybunalski, Kielce, Bydgoszcz, and Warsaw. The lowest values of 968 and 2144 were recorded in Bialystok and Szczecin, respectively.

The lowest risk of allergy related to the presence of high concentrations of alder pollen (above 45 P/m^3) was noted in Bialystok (5 days) and Szczecin (14 days); this period in the other cities lasted 33–40 days. The shortest period with a very high concentration of pollen of this taxon (above 85 P/m^3) was reported in Bialystok (1 day) and Szczecin (9 days), while the very high concentrations of alder pollen in the other cities persisted for 23 (Olsztyn) to 35 days (Piotrkow Trybunalski) (tab. 1).

Figure 1. *Alnus pollen concentration in Bialystok and Szczecin in 2022.*

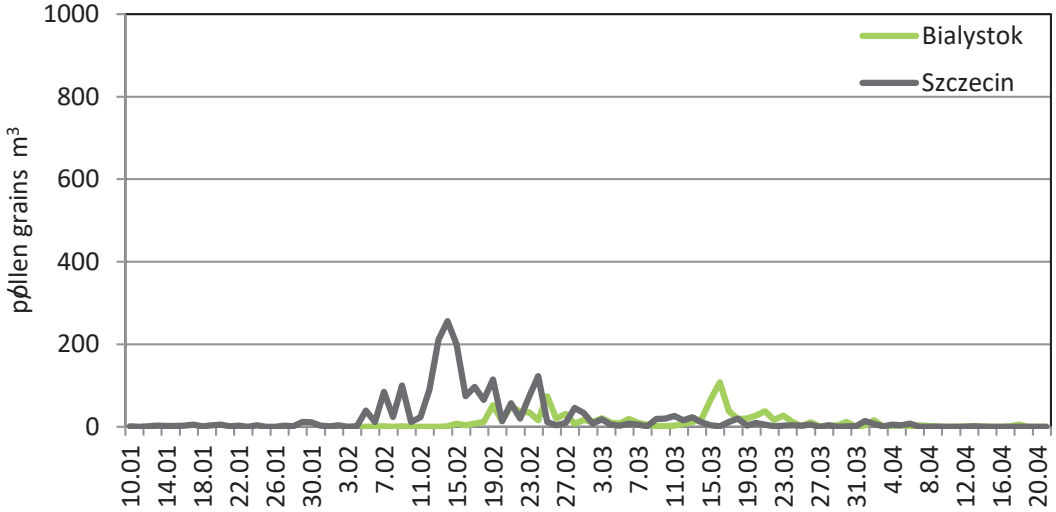


Figure 2. *Alnus pollen concentration in Bydgoszcz and Wroclaw in 2022.*

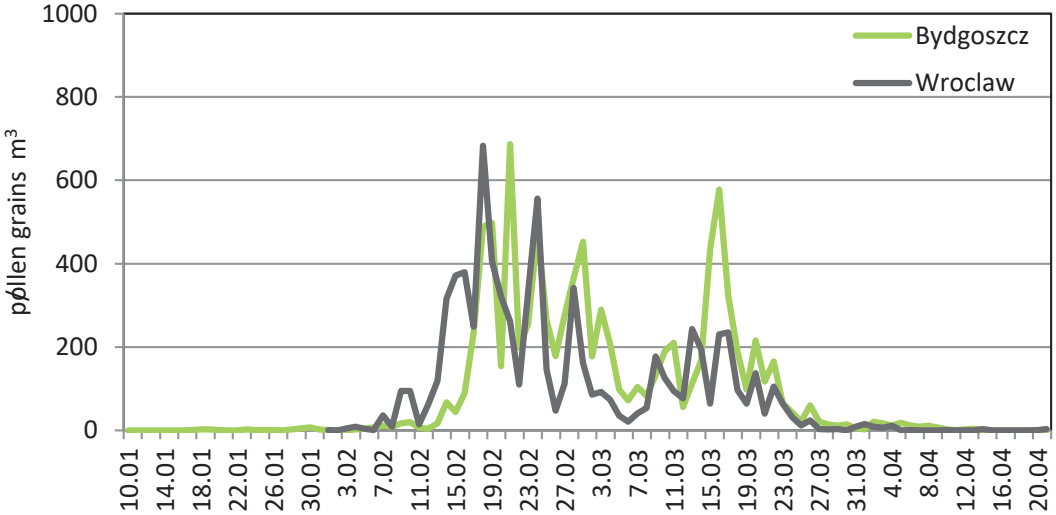


Figure 3. *Alnus pollen concentration in Cracow and Sosnowiec in 2022.*

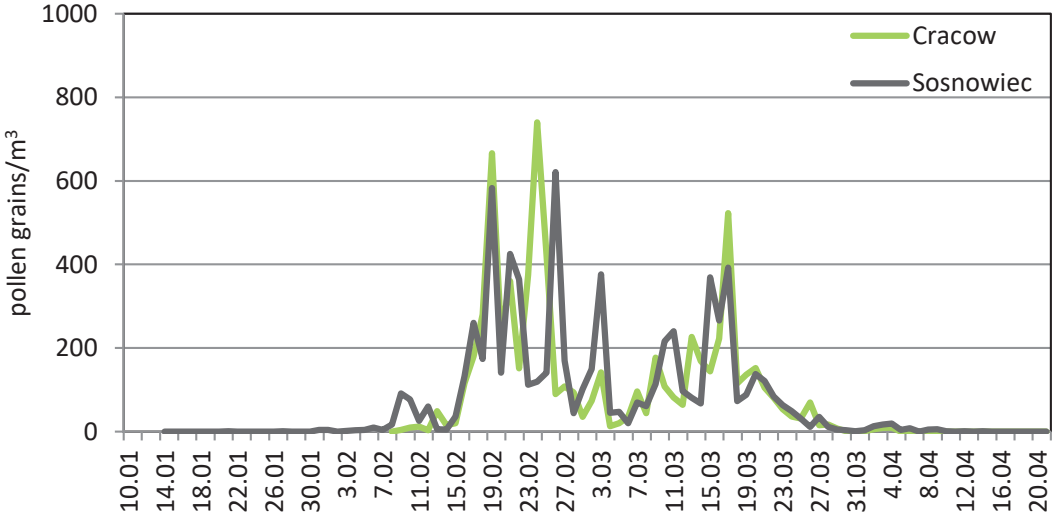


Figure 4. *Alnus pollen concentration in Kielce and Piotrkow Trybunalski in 2022.*

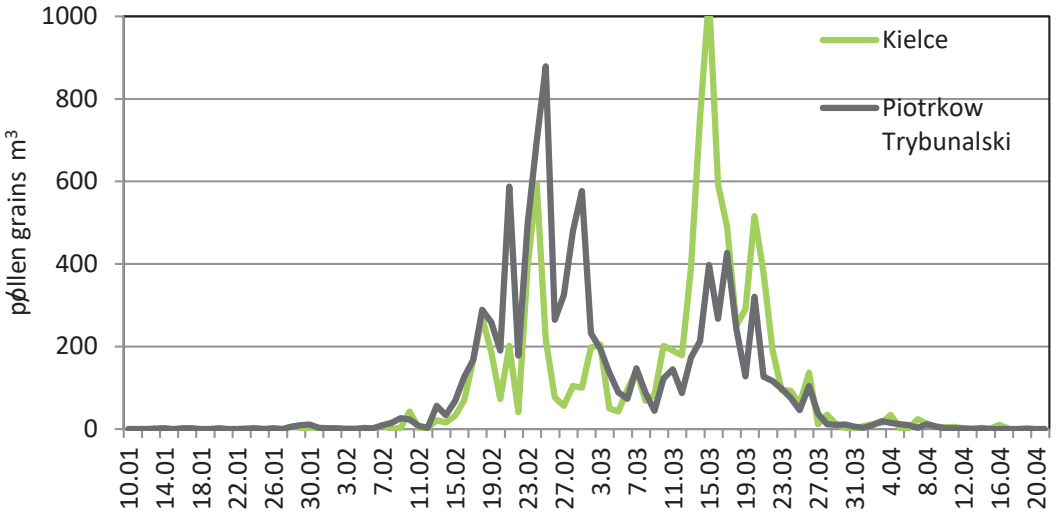


Figure 5. *Alnus pollen concentration in Lublin and Olsztyn in 2022.*

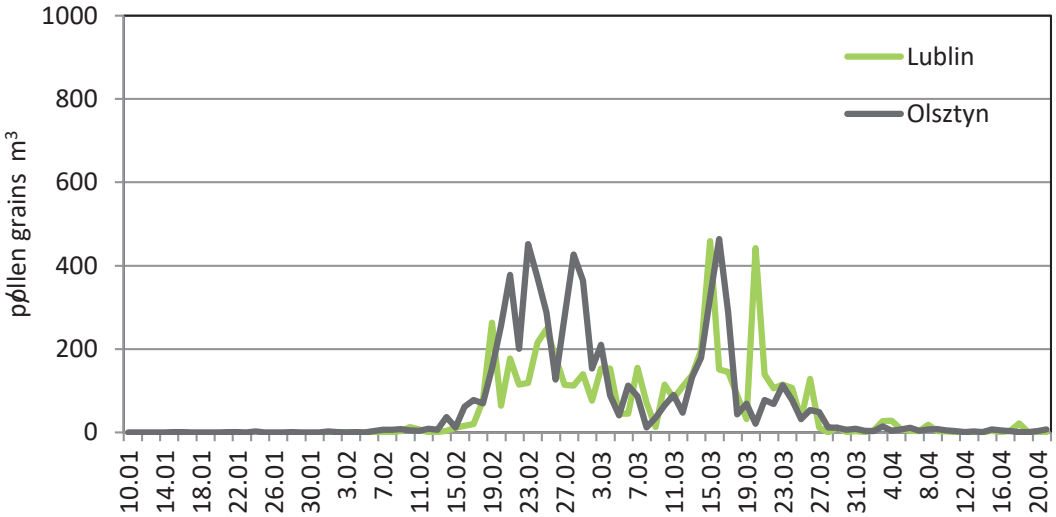
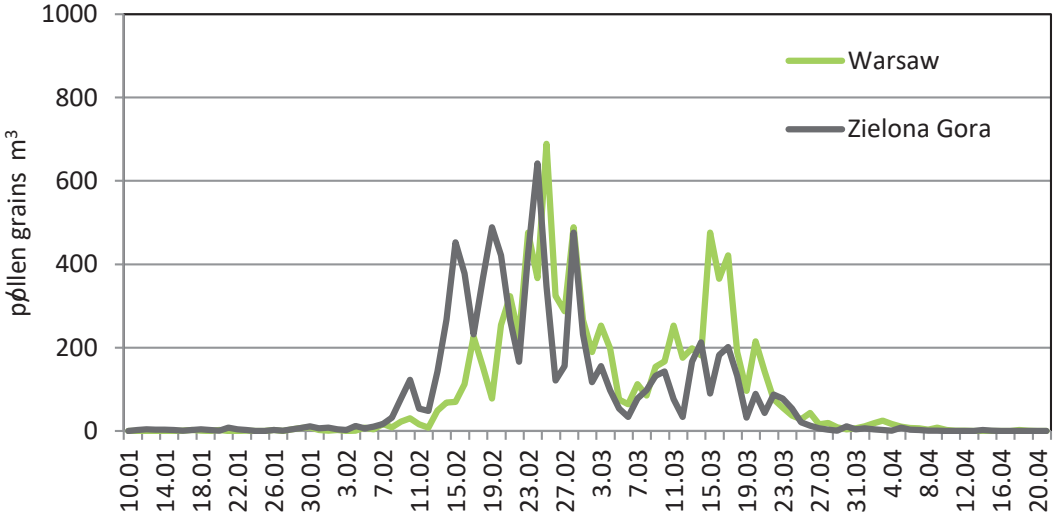


Figure 6. *Alnus pollen concentration in Warsaw and Zielona Gora in 2022.*



Discussion

In 2022, the alder pollen season in most Polish cities (except Szczecin) began between February 9th and February 18th, i.e. approximately 10 days earlier than in the previous year. The comparison of data from 2019–2022 showed that the alder pollen season typically began on different days of February. The season started at the end of January in 2020 and 2022 only in Szczecin [8–10]. In all the study years, the alder pollen season began earlier in the west of the country than in the eastern part.

In 2022, the end of the pollen season was recorded in the third ten days of March or in early April. The season usually ended in the first or second days of March in 2019 and 2020 and between March 26th and April 19th in 2021.

During these four years, the maximum daily concentrations of alder pollen were recorded on different days of February or March, usually between mid-February and the beginning or mid-March. The maximum values were recorded at the end of March (March 26th) only in Bialystok.

The alder pollen season in 2022 was characterized by substantially lower pollen concentrations than in 2021. As shown by the comparison of the results from 2019–2022, the lowest concentrations of alder pollen were usually recorded in Cracow and Sosnowiec, but not in 2022 [8–10]. In 2022, high and very high concentrations of alder pollen persisted over a greater number of days than in 2019–2021 in most cities.

Conclusions

1. In 2022, the earliest onset of the alder pollen season was recorded in Szczecin (at the end of January), while the season in the other cities started in the first or second 10 days of February.
2. The highest risk of pollen allergy caused by the presence of airborne alder pollen was noted in Kielce and Piotrkow Trybunalski.
3. The annual alder pollen sums were lower in 2022 than in 2019–2021.

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ORCID
K. Piotrowska-Weryszko – ID – http://orcid.org/0000-0003-3827-3218
E. Weryszko-Chmielewska – ID – http://orcid.org/0000-0001-8410-2757
M. Puc – ID – http://orcid.org/0000-0001-6734-9352
M. Ziemianin – ID – http://orcid.org/0000-0003-4568-8710
A. Kopacz-Bednarska – ID – http://orcid.org/0000-0003-0664-1450
J. Rapiejko – ID – http://orcid.org/0000-0001-9832-0413
M. Malkiewicz – ID – http://orcid.org/0000-0001-6768-7968
G. Siergiejko – ID – http://orcid.org/0000-0003-4084-8332
D. Jurkiewicz – ID – http://orcid.org/0000-0003-3729-2679
A. Lipiec – ID – http://orcid.org/0000-0003-3037-2326

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