Ash pollen season in selected Polish cities in 2023

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Abstract:

According to some authors, ash pollen has strong allergenic properties. In Europe the allergenic significance of this pollen has been poorly studied as the amounts of ash pollen in the air are low. However, in Poland we are more and more often observing ash pollen seasons with the total annual pollen sum exceeding 1000 grains. In 2023, it was found in Cracow and Łódź. This study compares the ash pollen seasons in Bialystok, Bydgoszcz, Cracow, Kielce, Piotrkow Trybunalski, Opole, Olsztyn, Szczecin, Lodz, Wroclaw, Zielona Gora, Warsaw and Lublin in 2023. The investigations were carried out using the volumetric method (Hirst type pollen sampler). Seasonal pollen index (SPI) was estimated as the sum of daily average pollen concentrations in the given season. The ash pollination is mainly observed in April. Diagnosis of ash pollen allergy is made difficult due to an overlapping pollination period with *Betulaceae* and some cross-reactivity with allergens from birch, and even privet and olive. It is not clear whether ash pollen is a primary cause of sensitization or whether it is implicated through cross-sensitization to other pollens. In 2023 the pollen season of ash started first in Kielce and Opole, on the March 11th and 13th. At the latest, a pollen season ended in Bialystok, on the May 12th. The differences of pollen seasons duration were very considerable, from 23 to 57 days. The highest airborne concentration of 530 (!) pollen grains/m^3 was noted in Cracow on the April 3rd. The peak values of seasonal pollen count in Polish cities occurred between April 3rd and 24th, most often between April 17th and 24th. The highest ash pollen allergen hazard occurred in 2023 in Cracow and Lodz, and was at least 2–3 times higher than in other cities. The highest variability in the analysed seasons was found in the peak value and annual total.

Key words: pollen count, aeroallergens, ash (*Fraxinus excelsior*), 2023, pollen season

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Introduction

Ash (*Fraxinus spp.*) pollen may provoke symptoms of inhalant allergy due to cross-reaction with olive and even privet (*Ligustrum*) proteins [1]. Privet hedges are a semi-evergreen, fast growing deciduous shrub featuring delicate white flowers that make a great addition to any garden. Not only do they provide privacy and security but are also ideal for urban areas, which is why they are eagerly planted there. In temperate zones of North-Central Europe the sensitization to ash pollen is a recognized problem, also extended to the Northern areas of the Mediterranean basin. Some observations in Poland suggest that ash pollen season could be as important as birch pollen period due to cross-reactions. The allergenic significance of this pollen has been poorly studied in Europe as the amounts of ash pollen are low [2].

In Poland, pollen allergens of the pollen of *Fraxinus* and *Betula* show cross-reactivity, which can enhance the allergy symptoms in persons allergic to the pollen of one of these taxa. Ash pollen allergens are also cross-reactive with Timothy grass and olive pollen. Pollinosis and allergic respiratory disorders of a population in a given geographical region are mainly determined by the presence and quantity of native plants causing allergy. Weather parameters are known to affect the dispersion dynamics of particles of biological origin. The release and dispersal of pollen also depend on the microclimate, which explains the differences in the timing of flowering and occurrence of pollen in the air for the same species [3].

Fraxinus genus belongs to the *Oleales* Lindl. order and the *Oleaceae* Hoffmanns and Link family, which also includes *Forsythia*, *Ligustrum*, *Jasminum* and *Syringa*. Although there are no foods specific to ash tree pollen, the ash tree, like the olive tree, may cause OAS (oral allergy syndrome) from olive-related foods due to the similarities between the pollen allergens. Cross-reactivity applies to fruits such as peaches, pears, melons, kiwis, bananas and pineapples [4].

Ash is a species occurring in Europe and also in Asia Minor. In the north it reaches central Sweden and northern Finland, and in the south it reaches just the northern edge of the Iberian Peninsula, but occurs over much of the Apennine Peninsula and the Balkans. In the European sub-Mediterranean regions ash is found only in the cool and moist montane zones [5].

Within the present-day borders of Poland, only *Fraxinus excelsior* is found; this genus is quite evenly distributed throughout the country. In the mountains, it rarely occurs at altitudes over 800 m. It prefers the warm temperature climate of the European sub-oceanic area and it has a varied and quite wide tolerance to hydrological conditions, soil type and light conditions. Ash is wind-pollinated and begins to flower in April and continues to flower almost until the end of May. *Fraxinus excelsior* can develop male, female and hermaphrodite flowers. Its pollen production is rather low, up to 160,000 pollen grains in an inflorescence [5].

Knowledge of intradiurnal variation patterns of ash and birch pollen and meteorological influence is important for allergy patients and permits avoiding overexposure to allergens, therefore this should be taken into account when planning outdoor activities. Subjects living in urban areas tend to be more affected by plant-derived respiratory disorders than those who live in rural areas [6].

Interestingly, in the work of Szmidt and Gondorowicz (1994) [7] it was reported that inhalation of ash wood dust (challenge test) can induce a very strong, immediate bronchospastic reaction, associated with profuse watery rhinorrhea, conjunctival congestion and lacrimation.

Aim

The aim of the study was to compare the ash pollen concentrations in the air of Bialystok, Bydgoszcz, Cracow, Kielce, Piotrkow Trybunalski, Opole, Olsztyn, Szczecin, Lodz, Wroclaw, Zielona Gora, Warsaw and Lublin in 2023 as well as to indicate the highest risk of pollen allergens in individual cities.

Material and method

Measurements of aeroplankton were carried out in the selected cities of Poland, in Bialystok, Bydgoszcz, Cracow, Kielce, Piotrkow Trybunalski, Opole, Olsztyn, Szczecin, Lodz, Wroclaw, Zielona Gora, Warsaw and Lublin in 2023. Measurements were performed by the volumetric method. The used devices, which are recommended by the IAA (International Association for Aerobiology), take air samples (Burkard and Lanzoni as the Hirst type pollen sampler) in volumes corresponding to average human respiratory parameters [8].

The duration of the pollen season was determined by the 98% method [9], assuming that the onset and end of the season were days with recorded 1% and 99% of the annual total of pollen grains, respectively. The total pollen count over this period was expressed by the SPI (seasonal pollen index).

On the basis of literature data, the number of days was determined in which concentrations of pollen

of the *Fraxinus* genus exceed the threshold values of consecutive allergy symptoms' development (tab. 1) [10, 11].

pollination periods usually coincide with each other in April and pollen allergen exposure during this period is the highest.

Table 1. *Characteristics of ash pollen season in 2023.*

Features of pollen season/ city	Bialystok	Bydgoszcz	Kielce	Lublin	Olsztyn	Opole	Szczecin	Piotrkow Tryb.	Warsaw	Lodz	Zielona Gora	Wroclaw	Cracow
Duration of pollen season (number of days)	31 IV–12 V (35)	7 IV–3 V (27)	11 III–6 V (57)	7 IV–10 V (34)	6 IV–11 V (36)	13 III–4 V (53)	29 III–9 V (42)	31 III–6 IV (37)	24 III–7 V (45)	8 IV–6 V (29)	23 III–7 V (46)	17 IV–9 V (23)	24 III–6 V (44)
Seasonal pollen index (SPI) – total	191	870	508	242	800	895	764	688	672	1161	662	235	2305
Peak value and peak date	27 (17 IV)	123 (23 IV)	49 (24 IV)	34 (21 IV)	75 (23 IV)	165 (3 IV)	78 (18 IV)	65 (21 IV)	79 (24 IV)	135 (18 IV)	116 (3 IV)	43 (20 IV)	530 (3 IV)
Days ≥ 45 g/m^3 [11]	0	7	2	0	7	4	5	5	5	12	3	0	12
Days ≥ 85 g/m^3 [11]	0	3	0	0	0	2	0	0	0	6	2	0	3
Days ≥ 150 g/ m^3 [10]	0	0	0	0	0	1	0	0	0	0	0	0	2

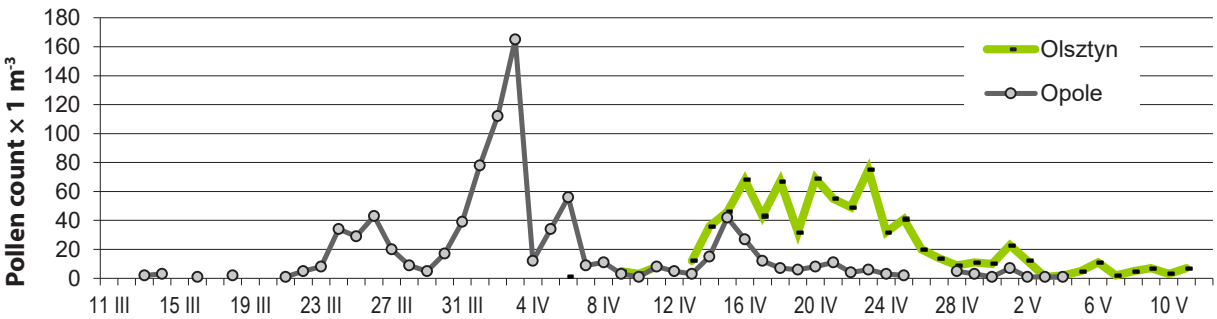
Results and discussion

Fraxinus excelsior is a common cause of allergic rhinitis, asthma and allergic conjunctivitis [12]. Individuals with ash pollen allergy are often symptom-free in years with low levels. A comparison of their symptoms between years with a low ash pollen count and last years makes it possible to assess the relevance of ash sensitization. It is very difficult to judge in polysensitized individuals which pollen levels cause which symptoms, since the most important trees in terms of allergy – birch and ash – bloom almost simultaneously in Switzerland: the ashes usually only for a few days, but sometimes up to 2 weeks before or after birch trees [13]. Therefore, it is virtually impossible to determine pollen thresholds responsible for symptoms in polysensitized individuals (two concomitant allergies) [14]. Allergy to ash pollen, for example, is well known in Switzerland [1]. In Poland, ash and birch

In 2023, two types of pollen seasons were observed in Poland. The first type is characteristic of most cities, with many peaks and the beginning of the season at the end of March. The second type of season, single-peak, with the beginning of the season between March 13th and 24th, i.e. 2 weeks earlier than in the first type (tab. 1, fig. 1–3). These two season types were not observed in studies from 2017 and earlier [15].

In 2023 ash pollen season started between March 11th in Kielce and March 13th in Opole and lasted until on the May 12th in Bialystok (tab. 1, fig. 4). Similarly in 2017 the *Fraxinus* pollen season in most Polish cities started the earliest at the beginning of March [12, 15], whereas one week earlier than in 2019 [16]. Comparison of the onset of pollen season in Polish cities in 2008 [17], 2019 [16] and 2023 showed almost identical dates for the beginning of the pollen season in 2017 and 2023.

Figure 1. *Ash pollen count in Olsztyn and Opole in 2023.*



The highest, record value for many years of daily pollen count of ash was noted in 2023 in Cracow on April 3rd (530 g/m^3) (tab. 1, fig. 3) and the highest annual sum of *Fraxinus* pollen grains (SPI) was observed also in Cracow and Lodz (2305 and 1161); in other cities in 2023 SPI value was much lower (the lowest value in Bialystok). The lowest SPI was most often observed in Bialystok, in 2008 was 980, in 2019 – 285, and in 2023 only 191.

Figure 2. *Ash pollen count in Szczecin and Piotrkow Trybunalski in 2023.*

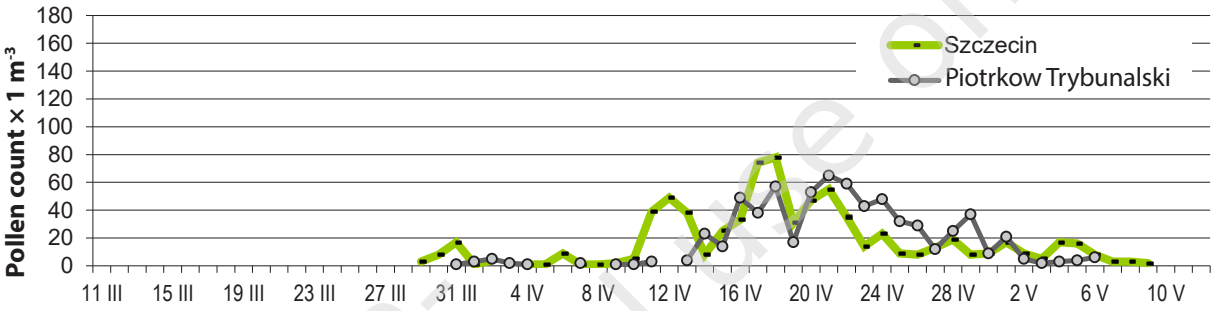


Figure 3. *Ash pollen count in Cracow in 2023.*

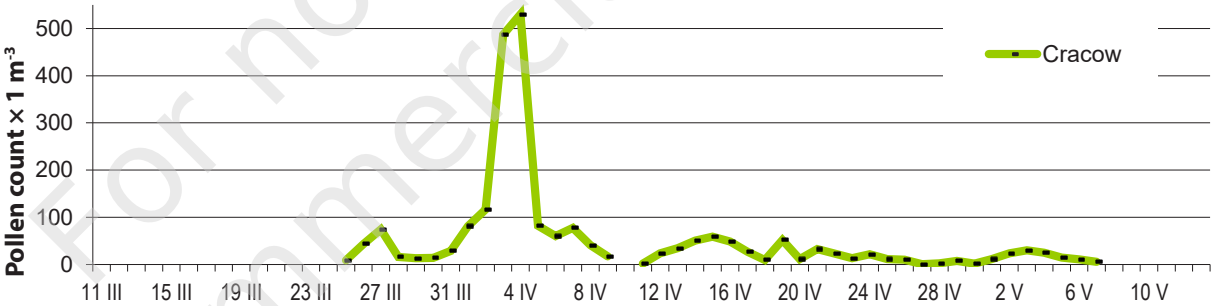


Figure 4. *Ash pollen count in Bialystok and Bydgoszcz in 2023.*

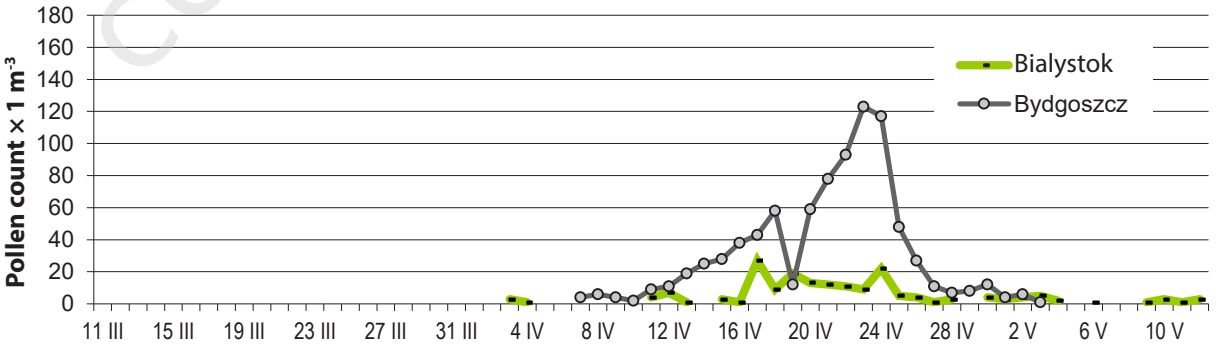


Figure 5. *Ash pollen count in Kielce and Lublin in 2023.*

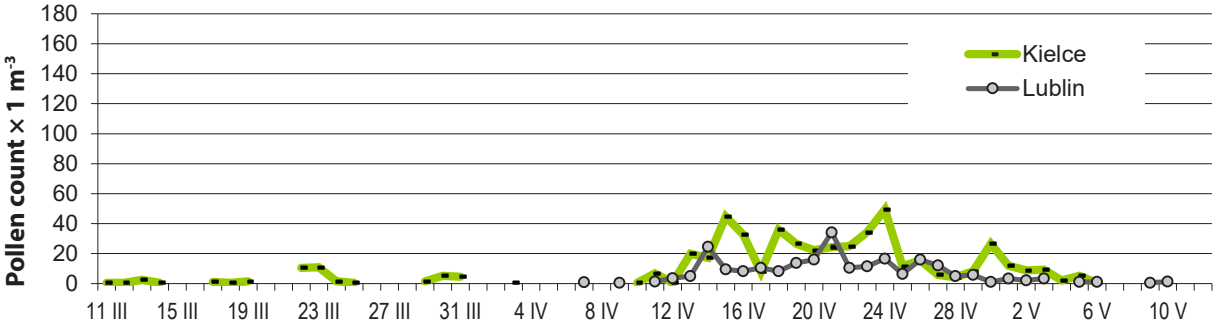


Figure 6. *Ash pollen count in Warsaw and Lodz in 2023.*

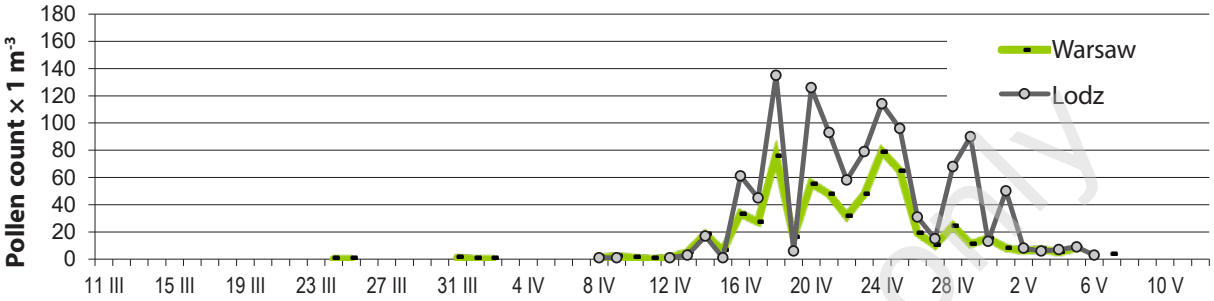
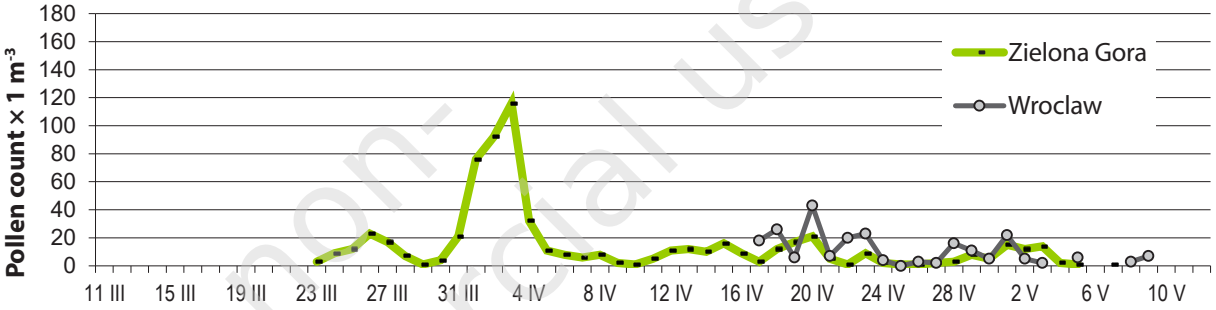


Figure 7. *Ash pollen count in Zielona Gora and Wroclaw in 2023.*



The peak values of seasonal pollen count in 2023 occurred between April 3rd and 24th, most often between April 17th and 24th (tab. 1, fig. 1–7). In 2008 [17] the maximum daily concentration was observed April 15th in Lublin and in 2017 [12] – April 2nd in Cracow (like in 2023).

The highest *ash* pollen allergen hazard in 2023 occurred (above 150 g/m^3) in Cracow – 2 days and in Opole – one day. In other cities the value above 85 g/m^3 ranged between 0 to 3 days. The comparison of these taxa's pollen seasons in previous years revealed that in 2008 [15] and 2019 [16] pollen concentrations were similar to 2023 while in 2017 [15] pollen allergen hazard was much lower than in 2023 (tab. 1, fig. 1–7).

European ash (*Fraxinus excelsior*) is often utilised as a landscape tree and is commonly found in gardens and parks (high concentrations of *Fraxinus* pollen are also recorded in Polish cities, which is confirmed by this work) [18].

Conclusions

In 2023 *Fraxinus* pollen grains are present in the air of Polish cities from mid-March to early May; in previous years the season was starting usually in April and lasted to the beginning of May.

Ash pollen season in most cities was above 30–40 days long (only in Kielce and Opole – over 50 days) and was characterized by extremely different total annual pollen SPI (from 191 in Bialystok to 2305 in Cracow).

In Opole, Zielona Gora and Cracow on the April 3rd the highest seasonal maximums were recorded.

The highest ash pollen allergen hazard occurred in 2023 in Cracow and Lodz, and was at least 2–3 times higher than in other cities.

The highest variability in the analysed seasons was found in the peak value and annual total, while the lowest in the end of the season.

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