

# Grass pollen season in selected cities of Poland in 2019

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## Abstract:

The pollen of grass is the primary trigger of pollen allergies during the summer months. It causes some of the most severe and difficult-to-treat symptoms. During the flowering of grass, over 90% of patients allergic to grass pollen suffer from allergic conditions. The symptoms caused by grass pollen allergens appear in some patients after exceeding the concentration of 20 grains in m<sup>3</sup> of air.

The aim of this study was to compare *Poaceae* pollen seasons in 2019 in 11 cities located in different regions of Poland. Pollen monitoring was conducted in Białystok, Bydgoszcz, Sosnowiec, Lublin, Olsztyn, Szczecin, Piotrków Trybunalski, Warsaw, Opole, Zielona Góra and Wrocław. Airborne pollen was monitored by the volumetric method using Burkard or Lanzoni pollen samplers. Pollen season length was determined by the 98% method, where the start of the season was defined as the date when 1% of the seasonal pollen total was trapped and the end of the season as the date, when 99% of the seasonal pollen total was reached.

The pollen season start date was recorded earliest in Zielona Góra (April 27<sup>th</sup>), latest in Szczecin (May 25<sup>th</sup>). The highest grass pollen concentration values were found in Lublin, Piotrków Trybunalski and Warsaw, whereas the lowest ones in Białystok. The annual grass pollen sum was highest in Lublin (4715 pollen grains), whereas it was lowest in Białystok (1256 pollen grains). A relatively high pollen count was also recorded in Warsaw (4106 pollen grains) and Zielona Góra (4077 pollen grains). The longest grass pollination season was recorded in Zielona Góra (139 days) and the shortest in Szczecin (110 days). In the remaining measuring points, grass pollen in the air maintained from 112 to 131 days. The highest grass pollen allergen risk occurred in Lublin, Olsztyn and Zielona Góra and the lowest in Białystok.

**Key words:** allergens, pollen count, grass (*Poaceae*), Poland, 2019

The grass family, belonging to the monocotyledon class, includes over 10 thousand species, with nearly 200 growing in Poland [1]. The following family contains the most valuable crop species

for humans, which are the basic source of food. The taxonomic diversity of grasses causes that their flowering period is long and it lasts from April to October [2], making pollination season also long. Grass pollen in

the atmospheric air are present for many months [3]. The first grains of grass pollen appear in the atmosphere in the last decade of April, but due to very low concentration (single grains) they do not pose a clinical threat. During the flowering of grass, over 90% of patients allergic to grass pollen suffer from allergic conditions [4]. The symptoms caused by grass pollen allergens appear in some patients after exceeding the concentration of 20 grains in  $\text{m}^3$  of air, and in all patients allergic to grass pollen at a concentration exceeding 50 grains in  $\text{m}^3$  of air. Exposure to a concentration of 120 grains in  $\text{m}^3$  of air causes severe allergic symptoms from the lower respiratory tract and dysfunction of other organs [5]. Grass pollen allergens are the most common cause of allergic diseases in our climate. Cross reactions are noted between pollen allergens of all species within the family, as well as after consumption of beans, soybeans and peanuts [6, 7].

## Aim

The aim of this study was to compare grass pollen seasons in 2019 in selected cities of Poland.

## Material and method

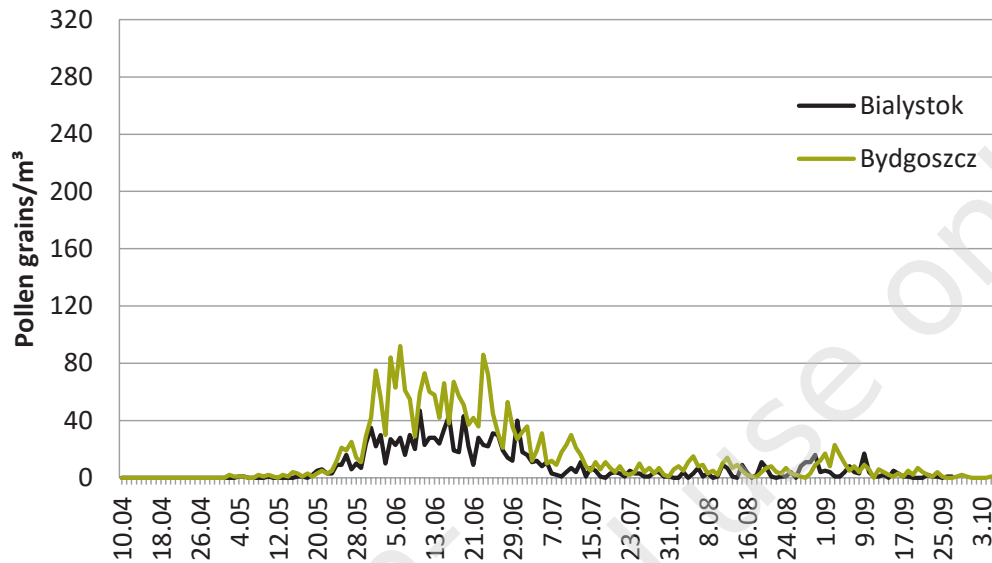
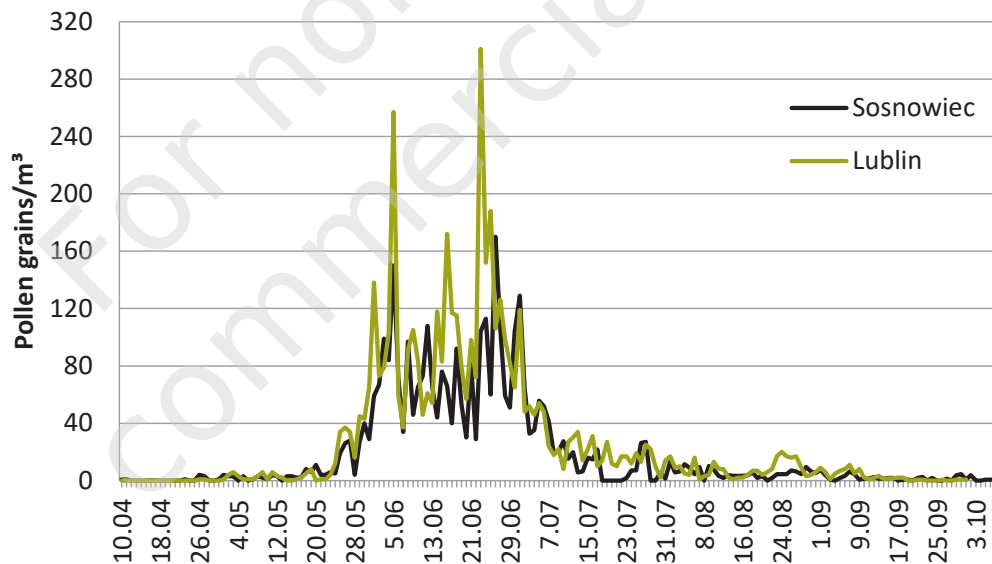
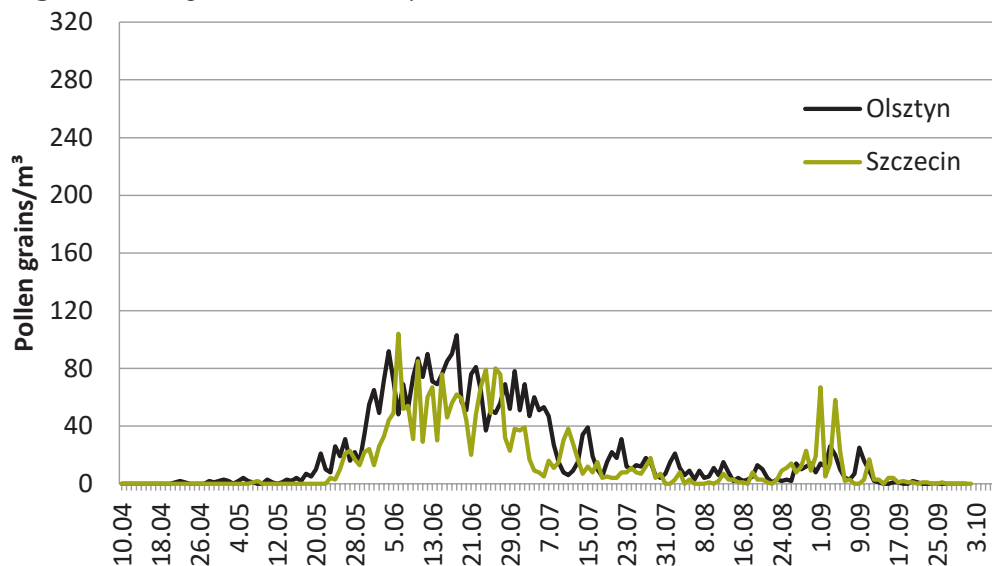
In 2019 monitoring of airborne grass pollen was carried out in Białystok, Bydgoszcz, Sosnowiec, Lublin, Olsztyn, Szczecin, Warsaw, Piotrków Trybunalski, Opole, Wrocław and Zielona Góra. Airborne pollen concentrations were investigated by the volumetric method using Burkard or Lanzoni pollen samplers. Microscopic observations were performed on slides obtained in a 7-day cycle with assessment of 24-hour periods. Pollen concentrations were expressed as the number of pollen grains in 1  $\text{m}^3$  of air per day ( $\text{P}/\text{m}^3$ ). The start of the season was defined as a date when 1% of the seasonal cumulative pollen count was trapped and the end of the season when cumulative pollen count reached 99%. The total pollen count over this period was expressed by the symbol SPI (Seasonal Pollen Index). The study results are presented in graphs and shown in a table (figs 1–6, tab. 1).

## Results and discussion

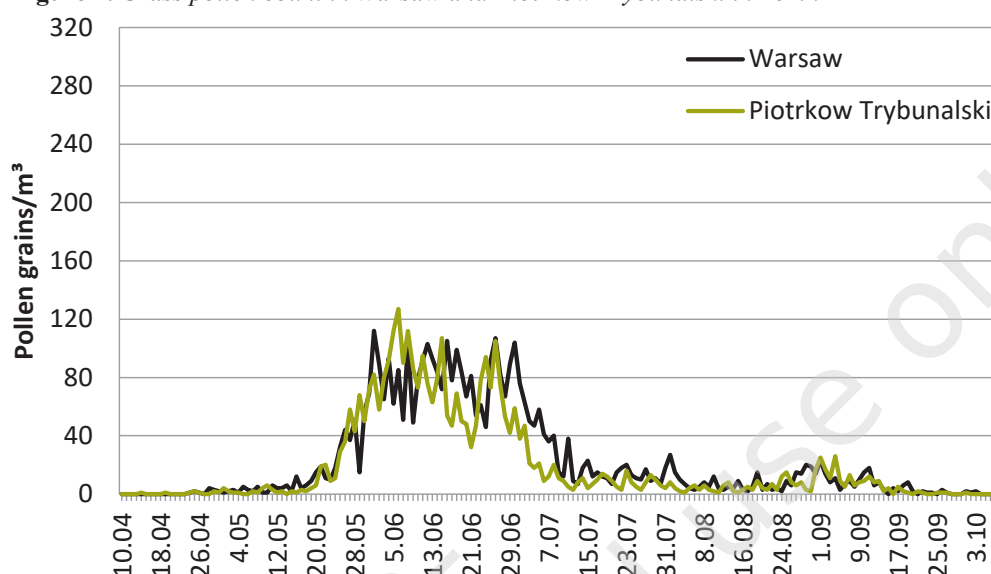
In most of the cities, the grass pollen season in 2019 started in the first or second decade of

**Table 1.** Characteristics of grass (*Poaceae*) pollen season in 2019.

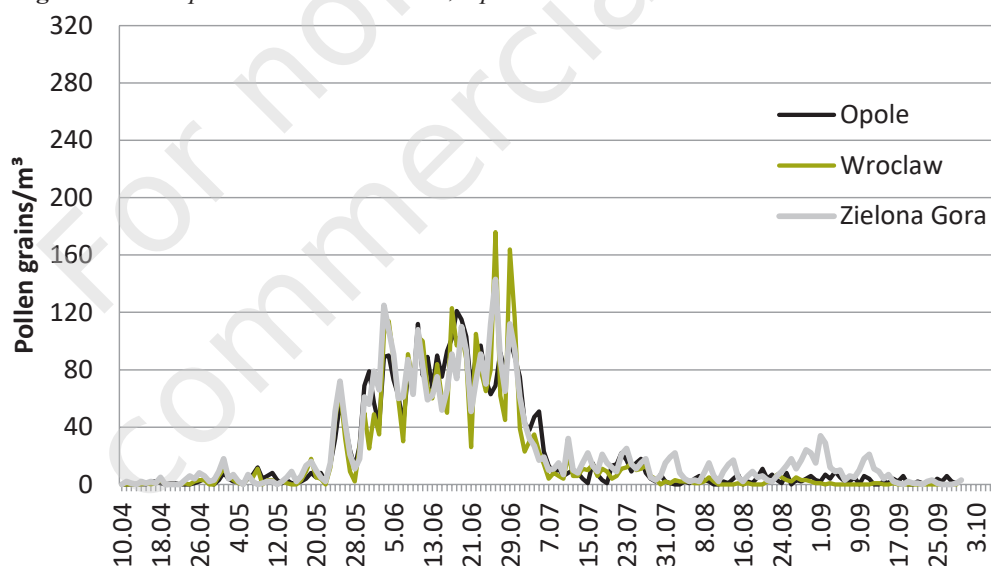
Site	Duration of pollen season (number and days)	Peak value [ $\text{P}/\text{m}^3$ ] and peak date	Annual pollen sum (SPI)	Number of days concentration above threshold 20 $\text{P}/\text{m}^3$	Number of days concentration above threshold 50 $\text{P}/\text{m}^3$	Number of days concentration above threshold 120 $\text{P}/\text{m}^3$
Białystok	20.05–13.09 117	47 10.06	1256	23	0	0
Bydgoszcz	17.05–19.09 126	92 6.06	2528	41	18	0
Sosnowiec	9.05–10.09 125	170 26.06	3444	46	28	3
Lublin	18.05–6.09 112	301 23.06	4715	52	32	7
Olsztyn	15.05–9.09 118	103 18.06	3514	52	32	0
Szczecin	25.05–11.09 110	104 6.06	2453	41	16	0
Piotrków Trybunalski	10.05–11.09 125	127 6.06	3441	43	27	1
Warsaw	5.05–12.09 131	112 1.06	4106	48	34	0
Opole	4.05–11.09 131	121 18.06	3607	44	33	1
Zielona Góra	27.04–12.09 139	143 26.06	4077	51	35	2
Wrocław	1.05–23.08 115	176 26.06	3314	42	25	3

**Figure 1.** Grass pollen count in Białystok and Bydgoszcz in 2019.**Figure 2.** Grass pollen count in Sosnowiec and Lublin in 2019.**Figure 3.** Grass pollen count in Olsztyn and Szczecin in 2019.

**Figure 4.** Grass pollen count in Warsaw and Piotrkow Trybunalski in 2019.



**Figure 5.** Grass pollen count in Wrocław, Opole and Zielona Góra in 2019.



May (tab. 1). The earliest pollen season start was recorded in Zielona Góra (April 27<sup>th</sup>), whereas the latest one in Szczecin (May 25<sup>th</sup>). The grass pollen season in 2019 started in all cities later than in 2018, with the exception of Zielona Góra, where the pollen season started on the same day as the year before (April 27<sup>th</sup>) [8]. The end of the grass pollen season was observed between August 23<sup>rd</sup> (in Wrocław) and September 19<sup>th</sup> (in Bydgoszcz) (tab. 1).

The longest grass pollination season was recorded in Zielona Góra (139 days) and the shortest in Szczecin (110 days). In the remaining measuring points, grass pollen in the air maintained from 112 to 131 days. The pollen season of grasses in 2019 was long, but compared to the average of long-term re-

arch in the discussed cities, it did not show any significant differences [8–12].

Maximum daily pollen concentrations ranged between 301 P/m<sup>3</sup> and only 47 P/m<sup>3</sup>, with the highest ones recorded in Lublin and the lowest ones in Białystok (figs 1, 2), as in 2018 [8]. Our study reveals that in Bydgoszcz, Szczecin and Piotrkow Trybunalski the dates of maximum pollen concentration occurred on June 6<sup>th</sup> (tab. 1, figs 1, 3, 4) and in Sosnowiec, Zielona Góra and Wrocław also on the same date June 26<sup>th</sup> (tab. 1, figs 2, 5). The risk of pollen allergy due to the persistence of pollen concentrations above 20 P/m<sup>3</sup> was highest in Lublin and Olsztyn (52 days) and the lowest in Białystok (23 days) (tab. 1). Significant exposure to grass pollen allergens is demonstrated by the number of

days with concentrations exceeding 50 P/m<sup>3</sup> [5]. Days with such concentration were found most in Zielona Gora, Warsaw, Opole, Lublin and Olsztyn (more than 30 days). In Białystok, however, no such day was registered (tab. 1). A very high concentration (120 P/m<sup>3</sup>) have only appeared in some cities (tab. 1, figs 1–6) The highest number of days was recorded in Lublin (7 days) as in 2018 [8].

The annual grass pollen sum was highest in Lublin (4715 pollen grains), whereas it was lowest in Białystok (1256 pollen grains). A relatively high pollen count was also recorded in Warsaw (4106 pollen grains) and Zielona Gora (4077 pollen grains).

## Conclusions

1. In 2019, the grass pollen season in all the analysed cities started between April 27<sup>th</sup> (Zielona Gora) and May 25<sup>th</sup> (Szczecin). The pollen season duration at the investigated monitoring sites was 110–139 days (on average 123 days).
2. The maximum daily concentrations of pollen grains were recorded in Lublin, Piotrków Trybunalski and Warsaw, whereas the lowest concentrations were noted for Białystok.
3. In Lublin, the highest annual sum was also found and proportionally to the daily maximum, the lowest annual sum of pollen grains was recorded in Białystok.
4. The highest grass pollen allergen risk occurred in Lublin, Olsztyn and Zielona Gora and the lowest in Białystok.

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## Author's contributions:

Dąbrowska-Zapart K.: Sosnowiec aerobiological data, work concept, writing the manuscript, literature review, proofreading;

Chłopek K.: Sosnowiec aerobiological data, preparation of figures and table;

Lipiec A.: Warszawa, Opole aerobiological data;

Puc P.: Szczecin, Białystok aerobiological data;

Malkiewicz M.: Wrocław aerobiological data;

Piotrowska K.: Lublin aerobiological data;

Jurkiewicz D.: Piotrków Trybunalski aerobiological data;

Siergiejko G.: Białystok aerobiological data;

Kalinowska E.: Olsztyn aerobiological data;

Rapiejko P.: Bydgoszcz, Opole aerobiological data, work concept;

Rapiejko A.: Zielona Gora aerobiological data.

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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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