

# Analysis of the grass pollen season in selected Polish cities in 2018

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## Abstract:

The paper presents the course of the grass (*Poaceae*) pollen season in Białystok, Bydgoszcz, Cracow, Sosnowiec, Lublin, Olsztyn, Szczecin, Drawsko Pomorskie, Warsaw, Piotrków Trybunalski, Opole, Wrocław and Zielona Góra in 2018. 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. Measurements were performed by the volumetric method (Burkard and Lanzoni pollen samplers). The pollen season of *Poaceae* started first in Sosnowiec, Lublin and Opole in the third decade of April. The highest, record airborne concentration of 243 pollen grains/m<sup>3</sup> was noted in Lublin on June 19<sup>th</sup>. The maximum values of seasonal pollen count occurred between of May 27<sup>th</sup> and June 4<sup>th</sup> in all cities. The highest grass pollen allergen hazard occurred in 2018 in Warsaw, Lublin and Zielona Góra.

**Key words:** pollen concentration, allergens, grass (*Poaceae*), 2018

In various climate zones grasses are a natural component of flora. In Poland, the grass family has about 300 species [1]. Species diversity causes that the flowering period of this population is long lasting [2]. The pollination season is also long, additionally the grass pollen grain in atmospheric air can maintain

for many months [3]. Grass pollen allergens are a frequent cause of periodic allergic rhinitis and conjunctivitis in many European countries [4, 5]. In Poland, they are also the main cause of pollen allergy [6]. Disease symptoms caused by grass pollen allergens appear in some patients after exceeding the concentration of

20 grains/m<sup>3</sup> of air, and in all sensitized patients with exposure to concentrations above 50 grains/m<sup>3</sup> [7].

**Aim**

The aim of the study was to compare the grass pollen concentrations in the air of Bialystok, Bydgoszcz, Drawsko Pomorskie, Cracow, Lublin, Olsztyn, Opole, Piotrkow Trybunalski, Sosnowiec, Szczecin, Warsaw, Wroclaw, Zielona Gora in 2018.

**Material and method**

The measurements of the pollen concentration in the study sites were performed with the volumetric method using Burkard and Lanzoni pollen samplers. Microscopic observations were performed on preparations obtained in a 7-day cycle with assessment of 24-hour periods. The results were expressed as the number of pollen grains in 1 m<sup>3</sup> of air per day (P/m<sup>3</sup>). 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 course of the pollen seasons in each city is shown in the graphs (figs 1–6).

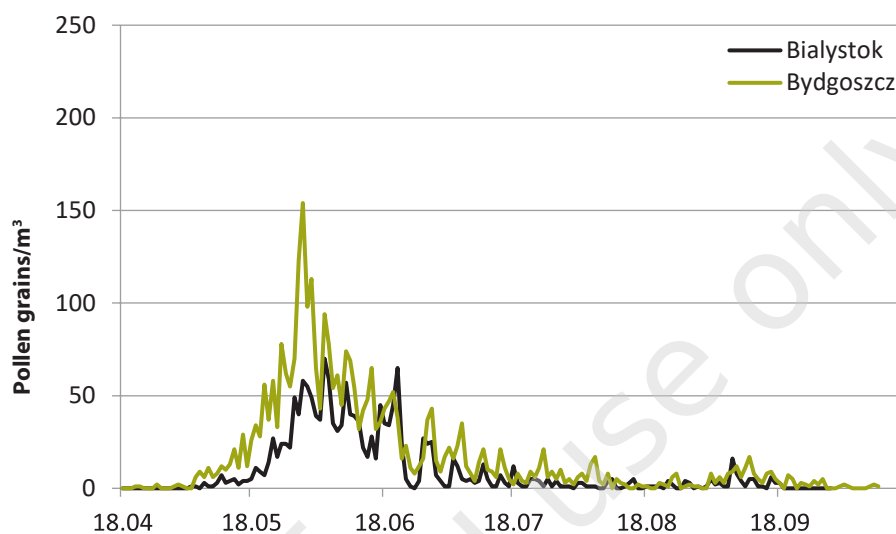
**Results and discussion**

The beginning of the pollination season in 2018 for grasses was registered in the third decade of April. The earliest in Wroclaw on April 25<sup>th</sup>, two days later in Zielona Gora, April 28<sup>th</sup> in Sosnowiec and Opole, and in Lublin on April 30<sup>th</sup> (figs 1–6). In the remaining measuring points, the beginning of the season was recorded in the first decade of May, and finally in Drawsko Pomorskie on May 23<sup>th</sup> (tab. 1). In 2018, the start of the pollen season was observed about two weeks earlier than in 2016–2017 [9, 10]. The end of the pollen season was registered in the second half of Sep-

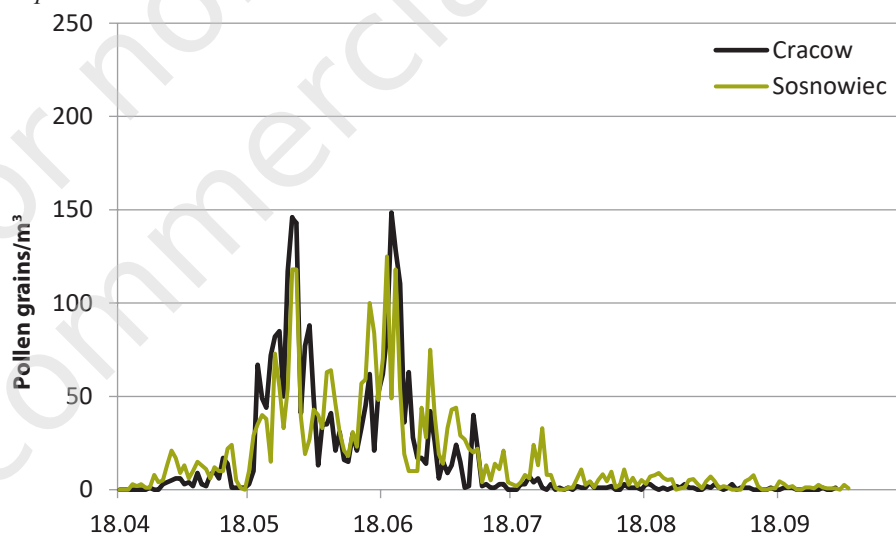
**Table 1.** Characteristics of grass (*Poaceae*) pollen season in 2018.

Site	Duration of pollen season (number and days)	Peak value [P/m <sup>3</sup> ] and peak date	Annual pollen sum	Number of days concentration above threshold 20 P/m <sup>3</sup>	Number of days concentration above threshold 50 P/m <sup>3</sup>	Number of days concentration above threshold 120 P/m <sup>3</sup>
Bialystok	11.05–12.09 125	70 4.06	1593	31	20	0
Bydgoszcz	7.05–20.09 137	154 30.05	3049	46	20	2
Cracow	3.05–25.08 115	149 20.06	2723	39	17	4
Drawsko Pomorskie	23.05–30.09 131	121 1.06	2745	46	19	1
Sosnowiec	28.04–12.09 138	125 19.06	2936	49	16	1
Lublin	29.04–24.09 118	243 19.06	4973	49	37	12
Olsztyn	2.05–16.09 138	125 1.06	3408	50	24	2
Opole	28.04–23.09 148	142 29.05	3549	53	25	2
Piotrkow Trybunalski	1.05–11.09 134	146 29.05	3807	50	27	3
Szczecin	13.05–17.09 128	177 29.05	2802	43	18	2
Warsaw	2.05–11.09 133	158 27.05	4025	54	34	5
Wroclaw	25.04–8.08 106	189 28.05	3392	52	23	3
Zielona Gora	27.04–19.09 146	147 28.05	4086	63	30	3

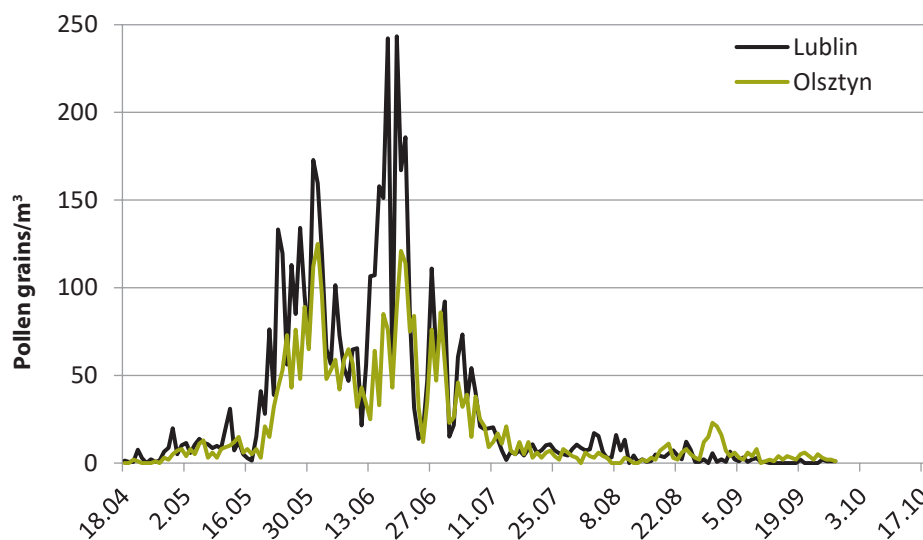
**Figure 1.** Grass pollen count in Białystok and Bydgoszcz in 2018.



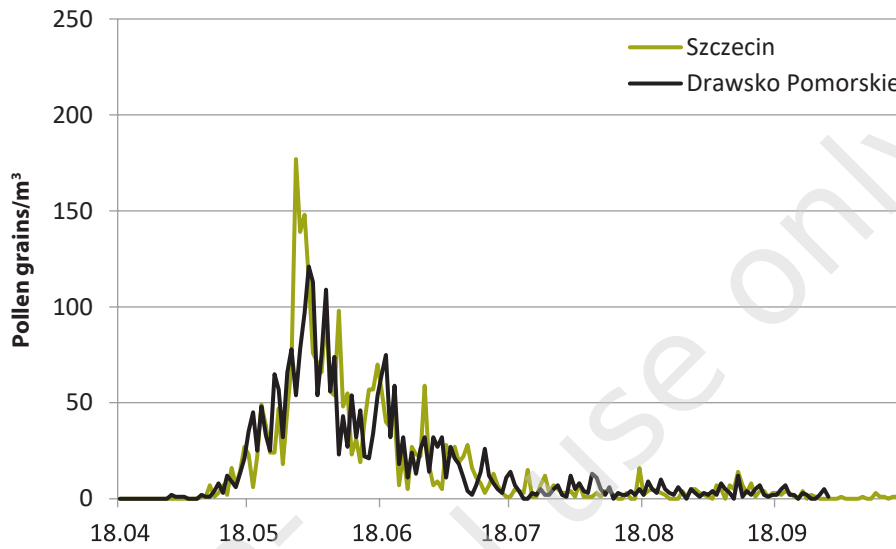
**Figure 2.** Grass pollen count in Cracow and Sosnowiec in 2018.



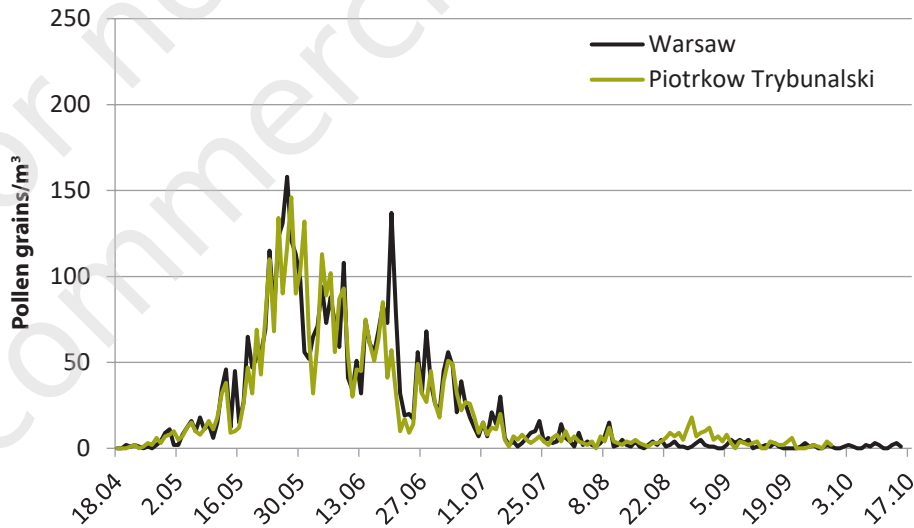
**Figure 3.** Grass pollen count in Lublin and Olsztyn in 2018.



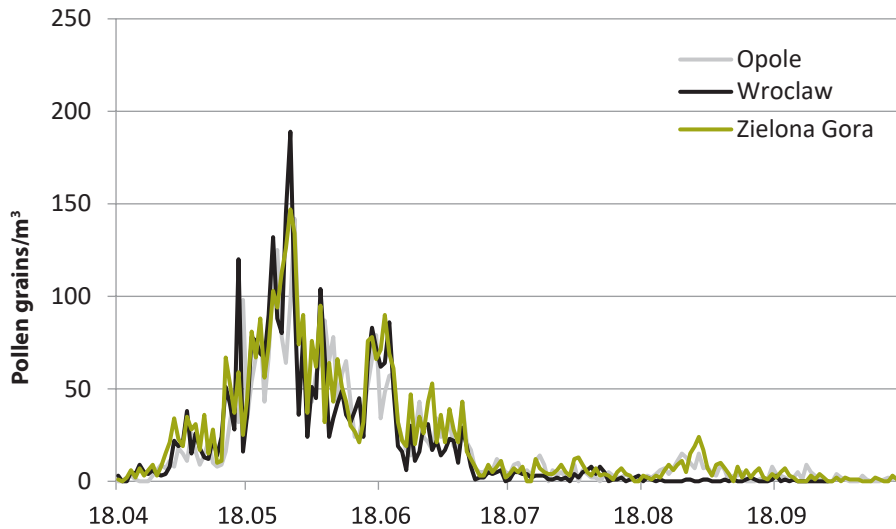
**Figure 4.** Grass pollen count in Szczecin and Drawsko Pomorskie in 2018.



**Figure 5.** Grass pollen count in Warsaw and Piotrkow Trybunalski in 2018.



**Figure 6.** Grass pollen count in Opole, Wroclaw and Zielona Gora in 2018.



tember. The grass pollination season ended in Wrocław exceptionally early – August 8<sup>th</sup> and Cracow – August 25<sup>th</sup>. The longest grass pollination season was recorded in Opole (148 days) and in Zielona Góra (146 days), and the shortest in Wrocław (106 days). In the remaining measuring points, grass pollen in the air maintained from 115 to 138 days. The pollen season of grasses in 2018 was long, but compared to the average of long-term research in the discussed cities, it did not show any significant differences [3, 8–10].

The highest values of maximum pollen grain concentration in 2018 were recorded in Lublin, amounting to 243 P/m<sup>3</sup>, and the lowest in Białystok – 70 P/m<sup>3</sup> (figs 1, 3). The pollen season of grasses in the following cities was dense. The period for the occurrence of maximum concentrations of grass pollen in most of the discussed cities were registered between May 27<sup>th</sup> and June 4<sup>th</sup>, only in Sosnowiec and Lublin the peak season occurred on June 19<sup>th</sup>, in Cracow the day after (tab. 1, figs 2, 3).

The daily concentrations of grass pollen varied between 1593 in Białystok and 4025 in Warsaw and 4973 in Lublin. The Polish average obtained from the results was 3321. The closest to the year's annual totals were recorded in Bydgoszcz, Olsztyn, Opole, Wrocław and Piotrków Trybunalski (tab. 1).

The worsening of clinical symptoms in people allergic to grass pollen usually occurs after reaching a concentration of 20 P/m<sup>3</sup>. The number of days with such concentration ranged from 31 in Białystok to 63 in Zielona Góra (tab. 1). Significant exposure to grass pollen allergens is demonstrated by the number of days with concentrations exceeding 50 P/m<sup>3</sup> [4]. Days with such concentration were found most in Lublin (36 days) and Warsaw (34 days). A very high concentration occurred in all measuring points (120 P/m<sup>3</sup>) except for Białystok (figs 1–6). The highest number of days was recorded in Lublin (12), in the remaining points the number of days with high concentrations ranged from 1 to 5 (tab. 1).

## Conclusions

The grass pollination season in 2018 in the discussed cities started in the third decade of April and lasted until the second decade of September.

The highest daily pollen grain concentration was recorded on June 19<sup>th</sup> in Lublin (243 P/m<sup>3</sup>).

The highest annual sum of daily concentrations of pollen grains was recorded in Lublin (4973), the lowest in Białystok (1593).

The greatest risk of grass pollen occurrence in 2018 was in Lublin, Warsaw and Zielona Góra.

## References

1. Frey L. *Taksonomia traw*. In: Frey L (ed). *Księga polskich traw*. Instytut Botaniki im. W. Szafera, Polska Akademia Nauk, Kraków 2007: 39-76.
2. Szafer W, Kulczyński S, Pawłowski B. *Rośliny polskie*. Wyd. IV. Państwowe Wydawnictwo Naukowe, Warszawa 1976.
3. Weryszko-Chmielewska E (ed). *Pylek roślin w aeroplanktonie różnych regionów Polski*. Copyright Katedra i Zakład Farmakognozji Wydziału Farmaceutycznego Akademii Medycznej, Lublin 2006.
4. Spięksma FThM. *Airborne pollen concentrations in the European Economic Community (EEC).VI. Poaceae (Grasses) 1982-1986*. *Aerobiologia* 1989, 5: 38-43.
5. Berger WE. *Overview of allergic rhinitis*. *Ann Allergy Asthma Immunol* 2003, 3: 7-12.
6. Ligęziński A, Rapijko P. *Koncentracja pyłku roślin w atmosferze Polski*. *Pneumonol Alergol Pol* 1994, 62: 347-351.
7. Rapijko P, Stankiewicz W, Szczygielski K et al. *Progowe stężenia pyłku roślin niezbędne do wywołania objawów alergicznych*. *Otolaryngologia Pol* 2007, 61(4): 591-594.
8. Weryszko-Chmielewska E, Piotrowska-Weryszko K, Rapijko P et al. *Analiza sezonu pyłkowego traw w 2013 roku w wybranych miastach Polski*. *Alergoprofil* 2013, 9(3): 18-23.
9. Puc M, Kotrych D, Rapijko P et al. *The analysis of grass pollen season in northern Poland in 2016*. *Alergoprofil* 2016, 12(4): 186-189.
10. Rapijko P, Lipiec A, Puc M et al. *The analysis of grass pollen season in northern Poland in 2017*. *Alergoprofil* 2017, 13(4): 154-156. DOI: 10.24292/01.AP.151217.

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### Author's contributions:

Dąbrowska-Zapart K: 15%; and other Authors: 4.47% each.

Conflict of interests: The authors declare that they have no competing interests.

Financial support: Does not occur.

Ethics: The contents presented in this paper are compatible with the rules the Declaration of Helsinki, EU directives and standardized requirements for medical journals.

Research in Białystok, Bydgoszcz, Drawsko Pomorskie, Olsztyn, Opole, Piotrków Trybunalski, Warsaw and Zielona Góra funded by Allergen Research Center Ltd.

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