

Analysis of the plantain pollen season in selected Polish cities in 2018

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Abstract:

The paper presents the course of pollen season of plantain in Białystok, Bydgoszcz, Drawsko Pomorskie, Cracow, Lublin, Olsztyn, Opole, Piotrków Trybunalski, Sosnowiec, Szczecin, Warsaw, Wrocław and Zielona Góra in 2018. Measurements were performed by the volumetric method (Burkard and Lanzoni pollen samplers). Pollen season was defined as the period in which 98% of the annual total catch occurred. The plantain pollen season started in the first decade of May and lasted until the end of September. Despite such a long pollen season in Poland, only in some cities there are days with an average concentration exceeding 10 P/m³. Significant differences were observed in annual sum values. The highest values were recorded in Lublin (400 grains) and Zielona Góra (308 grains), and the lowest in Drawsko Pomorskie (160 grains) and Olsztyn (184 grains). The value of annual average in 2018 was usually lower than in the previous years.

Key words: allergens, pollen concentration, plantain (*Plantago*), Poland, 2018

The *Plantago* variety (*Plantago* L.) has about 300 species, which is a common weed in our climate. There are 9 species in Poland, the most numerous of which are *Plantago lanceolata*, *Plantago major*, *Plantago media* [1]. The pollen season lasts from May to September [2, 3]. *Plantago* is known primarily as medical plant, but also have allergenic properties. The concentration of its pollen is usually low. Symptoms

coming from this allergen may increase during weed and plant pollination. *Plantago* allergens in a small percentage can cause disease symptoms and exacerbate asthma attacks [4]. Many publications contain contradictory information on the significance of plantain allergens, and the threshold levels that can cause disease symptoms are also unknown [5, 6].

Aim

The aim of the study was to compare the plantain (*Plantago*) pollen concentrations in the air of Białystok, Bydgoszcz, Drawsko Pomorskie, Cracow, Lublin, Olsztyn, Opole, Piotrków Trybunalski, Sosnowiec, Szczecin, Warsaw, Wrocław and Zielona Góra 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 m³ of air per day (P/m³). The duration of the pollen season was determined by the 98% method, assuming that the onset and end of the season were days with recorded 1% and 99% of the annual total pollen grains, respectively. 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

In 2018, the start of *Plantago* pollen season was recorded from April 30th till May 29th (tab. 1). The earliest pollen season began in Opole and the latest in Wrocław (May 21st) and Szczecin (May 29th). The pollen season was long and exceeded 100 days at all measuring points (tab. 1). The longest season was observed in Opole (151 days), and the shortest in Warsaw, Szczecin (105 days) and Wrocław (108 days).

Despite warm summer and long warm autumn, the exposition to *Plantago* pollen grains in Poland was relatively low. The values of maximum concentrations of pollen ranged from 7 P/m³ to 17 P/m³. In Zielona Góra there was the highest daily concentration of 21 P/m³ – June 23rd. The period of occurrence of higher concentrations of *Plantago* pollen was varied. In most cities it was in the second half of June (Drawsko Po-

Table 1. Characteristics of *Plantago* pollen season in 2018.

Site	Duration of pollen season (number and days)	Peak value [P/m ³] and peak date	Annual pollen sum	Number of days concentration above threshold 10 P/m ³
Białystok	1.05–20.08 112	13 15.08	285	3
Bydgoszcz	9.05–10.09 125	16 24.06	287	2
Cracow	11.05–9.09 122	12 19.06, 24.06	199	4
Drawsko Pomorskie	9.05–1.09 116	7 25.06	160	0
Sosnowiec	3.05–19.09 140	8 21.06, 3.08, 6.08, 19.08	292	0
Lublin	10.05–8.09 122	13 9.07	400	1
Olsztyn	19.05–5.09 110	9 10.07, 25.07	184	0
Opole	30.04–27.09 151	9 5.07	226	0
Piotrków Trybunalski	6.05–10.09 128	14 23.06	315	2
Szczecin	29.05–10.09 105	11 10.06	227	1
Warsaw	9.05–24.09 105	17 25.06	303	3
Wrocław	21.05–5.09 108	10 4.07	195	0
Zielona Góra	2.05–1.09 123	21 23.06	308	2

Figure 1. Plantain pollen count in Białystok and Bydgoszcz in 2018.

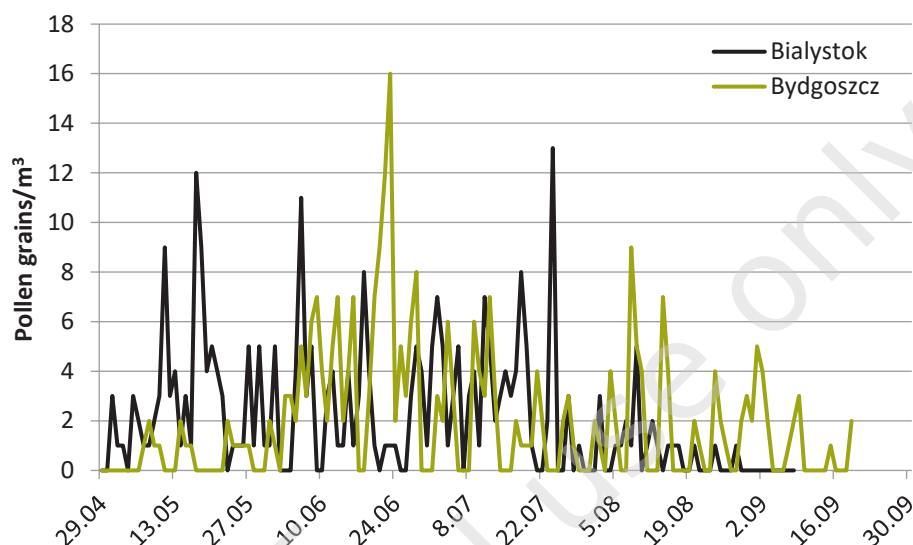


Figure 2. Plantain pollen count in Cracow and Sosnowiec in 2018.

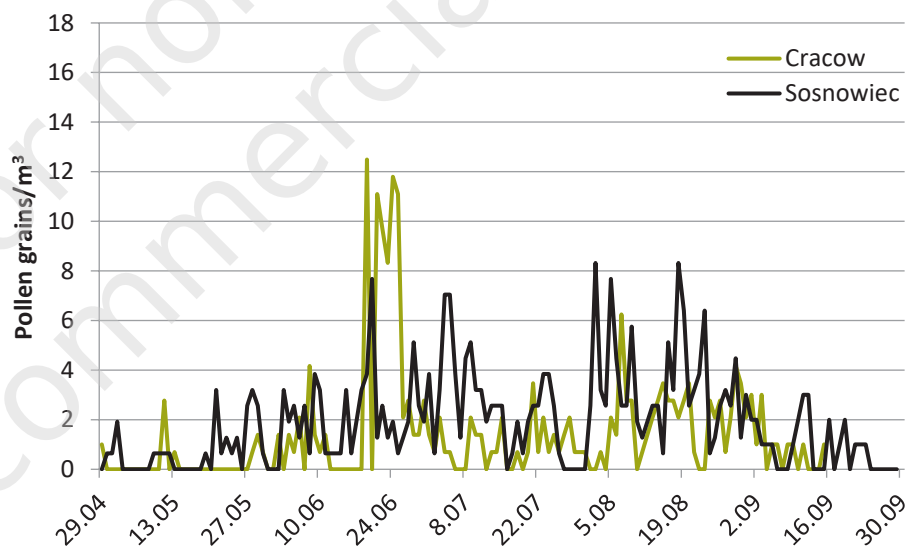


Figure 3. Plantain pollen count in Lublin and Olsztyn in 2018.

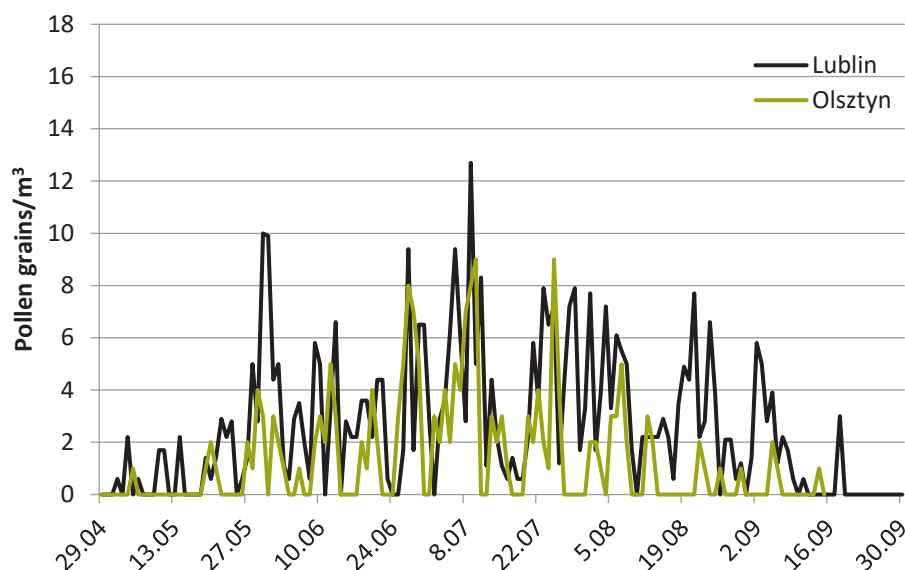


Figure 4. Plantain pollen count in Warsaw and Piotrkow Trybunalski in 2018.

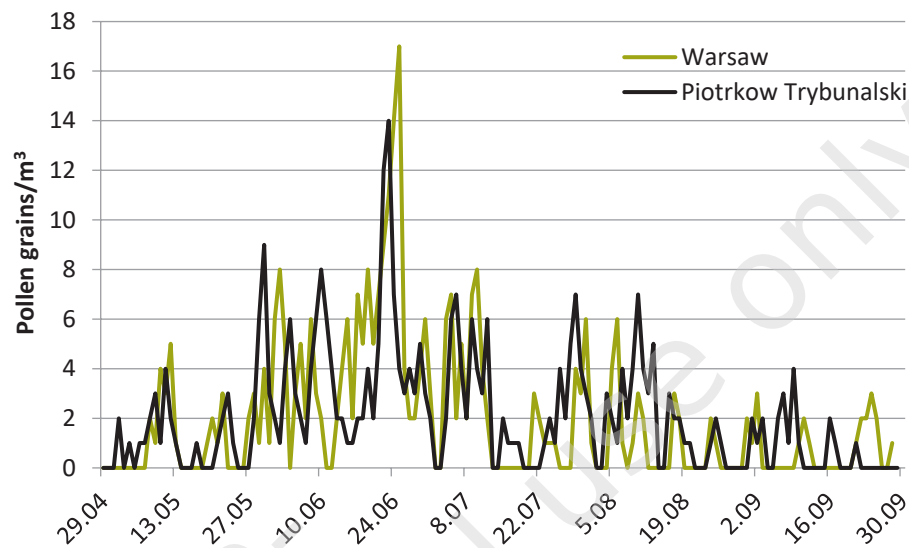


Figure 5. Plantain pollen count in Szczecin and Drawsko Pomorskie in 2018.

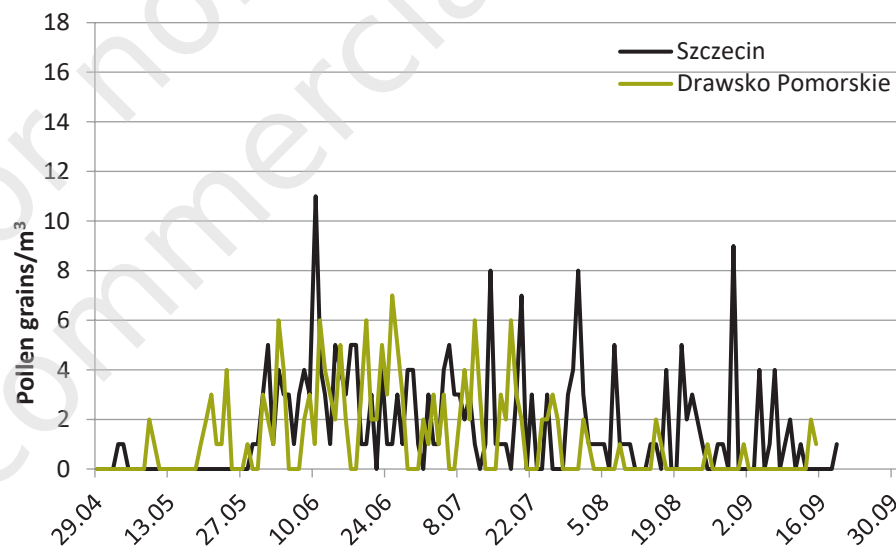
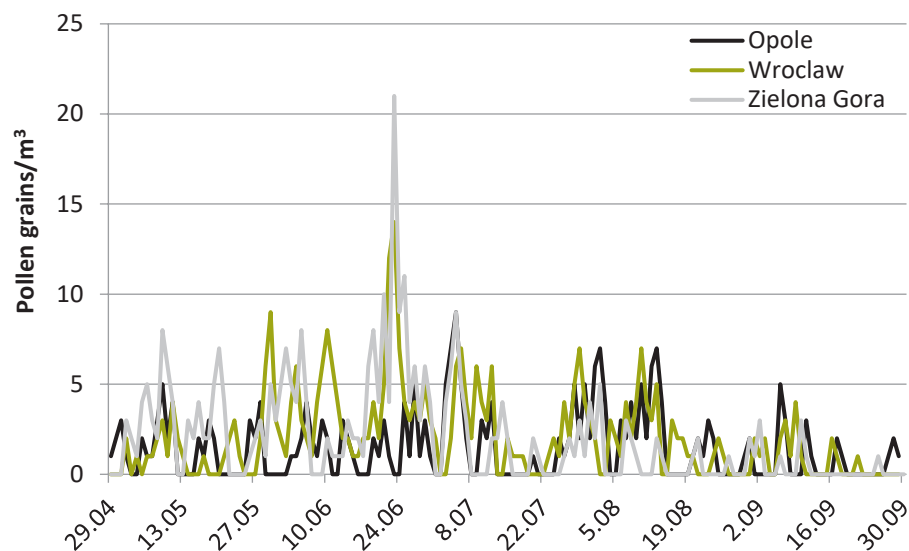


Figure 6. Plantain pollen count in Opole, Wroclaw and Zielona Gora in 2018.



morskie, Cracow, Piotrkow Trybunalski, Sosnowiec, Warsaw, Zielona Gora). In Lublin, Olsztyn, Opole and Wrocław, the maximum concentration period was later – in the first decade of July, and in Białystok and Sosnowiec in the second decade of August (tab. 1). The pollen season of plantain is characterized by a large extent over time and shows several periods of higher concentration (Cracow, Olsztyn and Sosnowiec) (tab. 1, figs 2, 3).

Significant differences were observed in annual sum values. The highest values were recorded in Lublin (400 grains) and Zielona Gora (308 grains), and the lowest in Drawsko Pomorskie (160 grains) and Olsztyn (184 grains). The value of annual average in 2018 was usually lower than in the years 2001–2005 [7] and 2006–2007 [8, 9]. Higher values were registered only in Białystok, Bydgoszcz and Szczecin. In Warsaw and Wrocław, the value of annual sums in the above-mentioned years was similar.

In 2018, the *Plantago* pollen season was long, but days with a concentration above 10 P/m³ were observed in all cities in very little amount or none. In Cracow there were 4 such days, in Białystok and Warsaw – 3, in Bydgoszcz, Piotrkow Trybunalski and Zielona Gora – 2, and in Lublin and Szczecin – 1 day (tab. 1). Exposure to pollen grains was low, only in Zielona Gora, the concentration of pollen exceeded 20 P/m³.

Despite such a long pollen season in Poland, only in rare cases and not in all cities there are days with an average concentration exceeding 10 P/m³ [7–9]. In other European countries, pollen grains also occur in small amounts [10]. The *Plantago* pollen measurements in Warsaw at different altitudes in 2006 showed significant differences in pollen concentration [8]. The results obtained at a height of 5 m above the ground were several times higher than the results obtained at a height of 23 m. The result is probably due to the fact that the plant belongs to low plants whose pollen achieves the highest concentrations near the ground, where the flowering of plants occur.

Conclusions

1. The highest daily concentration of *Plantago* pollen was observed in Zielona Gora (June 23rd).
2. The highest annual sum was recorded in Lublin (400 grains), the lowest in Drawsko Pomorskie (160 grains).
3. The pollen season was long and lasted 105–151 days.

References

1. Kiljańska I, Mojewska H. *Zielnik polski*. Interpress, Warszawa 1988.
2. Rutkowski L. *Klucz do oznaczania roślin naczyniowych*. Wydawnictwo Naukowe PWN, Warszawa 2004.
3. Szczepanek K. Pollen calendar for Cracow (southern Poland), 1982–1992. *Aerobiologia* 1994, 10(1): 65–69.
4. Tobias A, Galan I, Banegas JR, Aranguez E. Short term effects of airborne pollen concentrations on asthma epidemic. *Thorax* 2003, 58(8): 650–651.
5. Helbling A, Leuschner RM, Wuthrich B. Pollinosis. IV. Which pollens should be tested in allergology practices? Results of determinations of allergy-causing pollens in the Zurich air 1981–1984, with reference to threshold concentrations. *Schweiz Med Wochenschr* 1985, 115(34): 1150–1159.
6. Rapijko P. Alergeny pyłku babki. *Alergoprofil* 2008, 4(3): 61–64.
7. Weryszko-Chmielewska E (ed). *Pylek roślin w aeroplanktonie różnych regionów Polski*. Copyright Kat i Zakład Farmakognozji Wydz Farmaceutycznego Akademii Medycznej, Lublin 2006.
8. Lipiec A, Chłopek K, Siergiejko Z et al. Analiza stężenia pyłku babki w wybranych miastach Polski w 2006 r. *Alergoprofil* 2007, 3(1): 44–50.
9. Myszkowska D, Puc M, Nowak M et al. Analiza sezonów pyłkowych babki w wybranych miastach Polski w 2007 r. *Alergoprofil* 2007, 3(4): 50–56.
10. Peternel R, Cullig J, Mitic B et al. Analysis of airborne pollen concentration in Zagreb, Caroti, 2002. *Ann Agric Environ Med* 2003, 10(1): 107–112.

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Author's contributions:

Dąbrowska-Zapart K: 15%; and other Authors: 4.72% 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, Piotrkow Trybunalski, Warsaw and Zielona Gora funded by Allergen Research Center Ltd.

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