

Oak pollen season in selected cities of Poland in 2019

Katarzyna Dąbrowska-Zapart¹, Kazimiera Chłopek¹, Małgorzata Malkiewicz², Krystyna Piotrowska-Weryszko³, Daniel Kotrych⁴, Ewa Kalinowska⁵, Anna Rapiejko^{5, 6}, Grzegorz Siergiejo⁷, Dariusz Jurkiewicz⁸, Kornel Szczygielski⁸, Agnieszka Lipiec⁹

¹ Faculty of Natural Sciences, Institute of Earth Sciences, University of Silesia, Poland

² Department of Palaeobotany, Institute of Geological Sciences, University of Wrocław, Poland

³ Subdepartment of Aerobiology, Department of Botany and Plant Physiology, University of Life Sciences in Lublin, Poland

⁴ Department of Orthopedics and Traumatology, Pomeranian Medical University of Szczecin, Poland

⁵ Allergen Research Center, Warsaw, Poland

⁶ Medical University of Warsaw, Poland

⁷ Pediatrics, Gastroenterology and Allergology Department, University Children Hospital, Medical University of Białystok, Poland

⁸ Department of Otolaryngology with Division of Cranio-Maxillo-Facial Surgery in Military Institute of Medicine, Warsaw, Poland

⁹ Department of Prevention of Environmental Hazards and Allergology, Medical University of Warsaw, Poland

Abstract:

The study compares the oak pollen seasons in Białystok, Bydgoszcz, Sosnowiec, Lublin, Olsztyn, Opole, Piotrków Trybunalski, Szczecin, Warsaw, Wrocław and Zielona Góra in 2019. The investigations were conducted using the volumetric method. The oak season started in all measurement sites between April 6th (Szczecin) and April 24th (Lublin and Piotrków Trybunalski). The peak values of seasonal pollen count occurred between April 25th and May 2nd. The highest daily pollen count was recorded in Lublin (273 P/m³) and the lowest pollen count in Białystok (23 P/m³). The highest annual totals were recorded in Lublin, Piotrków Trybunalski and Warsaw. The most days with concentration equal to or above 16 P/m³, causing symptoms in many allergic patients, were recorded in Lublin and Warsaw. Days with concentration equal to or above 91 P/m³, which causes allergy of all sensitized patients, were the most frequent in Lublin, Piotrków Trybunalski and Warsaw.

Key words: allergens, pollen count, oak (*Quercus*), Poland, 2019

Oaks belong to the beech family (*Fagaceae*), two species of which grow wild in Poland, with pollen period varying by about 2 weeks: pedunculate oak (*Quercus robur* L.) and sessile oak (*Q. petraea* Liebl.). Due to different pollination terms of pedunculate and sessile oak, exposure to oak pollen allergens may be long (up to 4 weeks), but usually one species dominates in a given area.

Pedunculate oak is common across the country, often growing in mixed forests and in clean oak forests, parks, along roads and in the mountains up to 600–700 m a.s.l. It usually blooms at the turn of

April and May and throughout May. Pedunculate oak blooms about 2 weeks before sessile [1, 2]. Sessile occurs in forests, except for mountainous areas and the north-eastern part of the country, it is also popular in parks [3]. An alien species, often found in forests and parks throughout Poland is red oak (*Q. rubra* L.), which grows faster than other oak species [4].

Oak pollen next to birch pollen, alder, ash and hazel is considered as one of the most crucial tree pollen allergens [5, 6]. The threshold value for clinical symptoms for *Quercus* pollen grains for the many of sensitised patients is visible during exposure to the

concentration of 16 pollen grains in 1 m³ of air, while the clinical symptoms for the most of sensitised patients is visible during exposure to the concentration of 91 pollen grains in 1 m³ of air [7]. The cross-reactions of oak pollen allergens with pollen from other *Fagaceae* species and with pollen from *Corylaceae* and *Betulaceae* species also are known [8].

Aim

The aim of the study was to compare the oak pollen season in Białystok, Bydgoszcz, Sosnowiec, Lublin, Olsztyn, Opole, Piotrków Trybunalski, Szczecin, Warsaw, Wrocław and Zielona Góra in 2019.

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 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 1–5).

Results and discussion

In 2019, the oak pollen season started between April 6th (Szczecin) and April 24th (Lublin and Piotrków Trybunalski) and ended up in the second or third decade of May (tab. 1, figs 1–5). The earliest pollen season of oak began in Szczecin, already in April, much earlier than in 2018 (April 17th) [9]. The latest pollen season of oak began in Lublin and Piotrków Trybunalski, as it was not until April 24th (tab. 1, fig. 3), a few days later than in the previous season [9]. In Szczecin a very long pollen season was found, which was 46 days (tab. 1). The highest oak pollen concentrations were detected in the third decade of

Table 1. Characteristics of *Quercus* pollen season in 2019.

Site	Duration of pollen season (number and days)	Peak value [P/m ³] and peak date	Seasonal Pollen Index (SPI)	Days ≥ 16 g/m ³ *	Days ≥ 91 g/m ³ **
Białystok	17.04–20.05 34	23 29.04	172	0	0
Bydgoszcz	17.04–25.05 39	56 4.05	474	8	0
Sosnowiec	9.04–19.05 41	68 27.04	371	5	0
Lublin	24.04–20.05 27	273 2.05	1928	22	7
Olsztyn	23.04–21.05 29	45 2.05	444	10	0
Opole	14.04–14.05 31	142 25.04	711	10	2
Piotrków Trybunalski	24.04–18.05 25	143 2.05	1342	11	4
Szczecin	6.04–21.05 46	33 25.04	295	5	0
Warsaw	23.04–19.05 27	112 2.05	1123	19	2
Wrocław	15.04–14.05 29	118 25.04	690	15	1
Zielona Góra	8.04–11.05 34	97 25.04	770	17	1

* symptoms present in many patients, ** symptoms present in most patients.

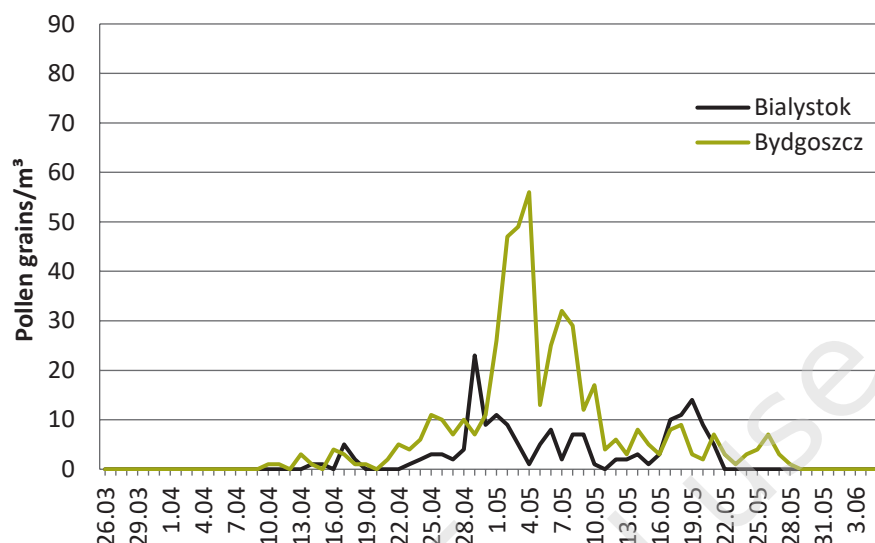
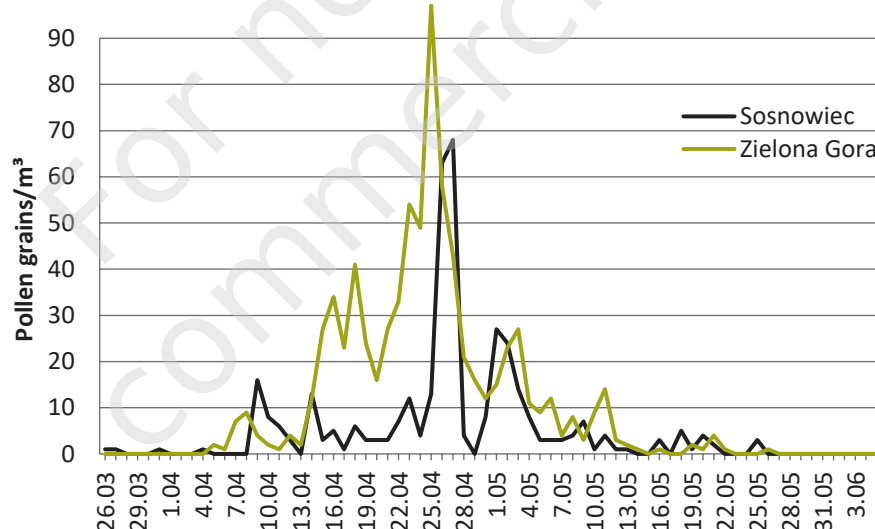
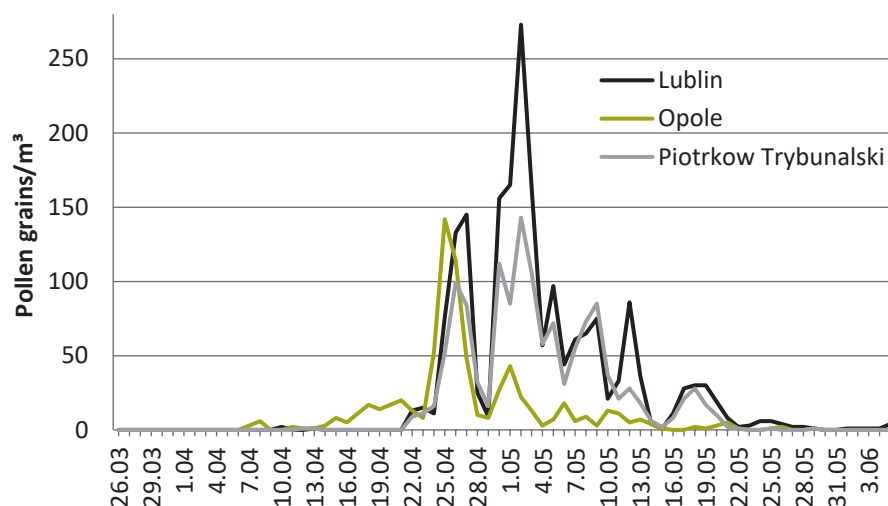
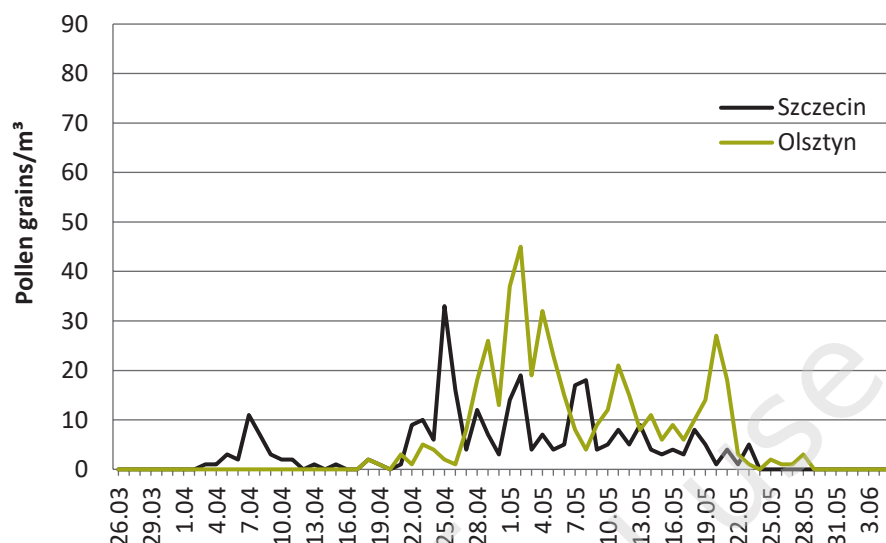
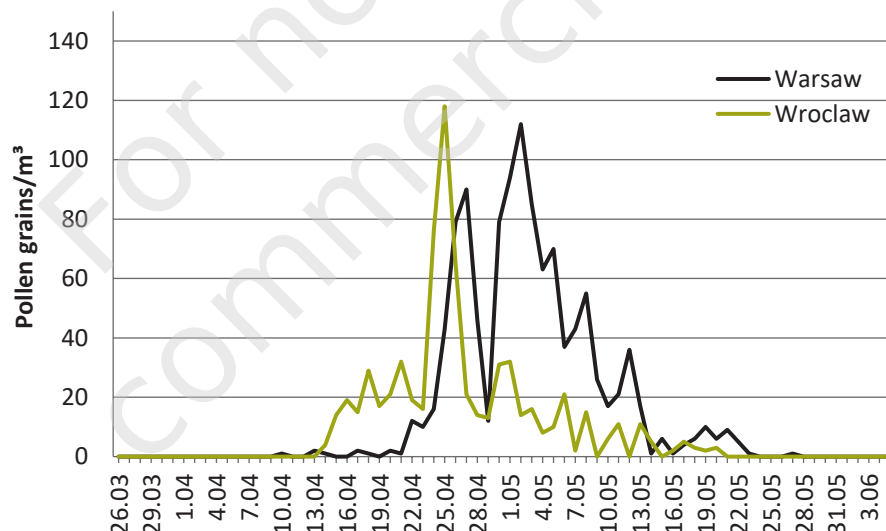
Figure 1. Oak pollen count in Białystok and Bydgoszcz in 2019.**Figure 2.** Oak pollen count in Sosnowiec and Zielona Góra in 2019.**Figure 3.** Oak pollen count in Lublin, Opole and Piotrków Trybunalski in 2019.

Figure 4. Oak pollen count in Szczecin and Olsztyn in 2019.**Figure 5.** Oak pollen count in Warsaw and Wrocław in 2019.

April and in the first days of May in all analyzed cities (tab. 1). The highest daily pollen count was recorded in Lublin – 273 P/m³, Piotrkow Trybunalski – 143 P/m³ and in Warsaw – 112 P/m³ on the same day in all three cities (May 2nd) (fig. 3, 5). While the lowest concentration of pollen was found in Białystok – it was only 23 P/m³ (fig. 1).

In 2019, the sums of oak pollen grains were in the range of 172–1928; the highest sum of grains was noted in Lublin (1928), Piotrkow Trybunalski (1342) and Warsaw (1123) and the lowest totals were recorded in Białystok (172) and Szczecin (295) (tab. 1).

The highest oak pollen risk (above 91 P/m³) occurred in Lublin (7 days) and Piotrkow Trybunalski (4 days) (tab. 1). In the other cities this value was

0–2 days (tab. 1). For most of the cities these are lower values than those recorded in 2018 [9] and 2017 [10].

Conclusions

1. In 2019, the oak pollen season in all the analysed cities started between April 6th and April 24th. The pollen season duration at the investigated monitoring sites was 25–46 days (on average 33 days).
2. The highest concentrations of oak pollen were recorded in Lublin, Piotrkow Trybunalski and Warsaw, whereas the lowest concentrations were noted for Białystok.
3. The peak values of seasonal pollen count occurred between April 25th–May 2nd in all cities.

4. The highest oak pollen allergen risk occurred in Lublin and Piotrkow Trybunalski.

10. Puc M, Myszkowska D, Chłopek K et al. Oak pollen in the air of Poland in 2017. *Alergoprofil* 2017, 13(3): 124-128.

References

1. Rutkowski L. *Klucz do oznaczania roślin naczyniowych Polski niżowej*. PWN, Warszawa 2004.
2. Rapiejko P. *Alergeny pyłku roślin*. Medical Education, Warszawa 2012.
3. Bugala W. *Drzewa i krzewy*. Państwowe Wyd. Rolnicze i Leśne, Warszawa 2000.
4. Seneta W, Dolatowski J. *Dendrologia*. PWN, Warszawa 2008.
5. Bohadana AB, Massin N, Wild P et al. Symptoms, airway responsiveness, and exposure to dust in beech and oak wood workers. *Occup Environ Med* 2000, 57(4): 268-273.
6. Rapiejko P. Sezon pylenia leszczyny i olszy w Warszawie w 2008 roku (doniesienie wstępne). *Alergia* 2008, 1: 49-50.
7. Burge HA. Monitoring for airborne allergens. *Ann Allergy* 1992, 69: 9-21.
8. Spiessma FThM, Frenguelli G. Allergenic significance of *Alnus* (alder) pollen. In: *Allergenic pollen and pollinosis in Europe*. Blackwell Sci Pub 1991: 85-87.
9. Sulborska A, Weryszko-Chmielewska EK, Piotrowska-Weryszko A et al. The oak pollen concentration in the air of selected cities in Poland in 2018. *Alergoprofil* 2018, 14(3): 67-71.

ORCID

K. Dąbrowska-Zapart – ID – orcid.org/0000-0002-8976-7739
 M. Malkiewicz – ID – orcid.org/0000-0001-6768-7968
 K. Piotrowska-Weryszko – ID – orcid.org/0000-0003-3827-3218
 D. Kotrych – ID – orcid.org/0000-0003-4221-2944
 E. Kalinowska – ID – orcid.org/0000-0003-4821-6882
 A. Lipiec – ID – orcid.org/0000-0003-3037-2326

Author's contributions:

Dąbrowska-Zapart K: 40%; Chłopek K: 10,5%; other authors: 5,5% each.

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

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, Piotrkow Trybunalski, Opole, Zielona Gora, Warsaw funded by Allergen Research Center Ltd. (Ośrodek Badania Alergenów Środowiskowych Sp. z o.o.).

Corresponding author:

Katarzyna Dąbrowska-Zapart, MD, PhD

Faculty of Natural Sciences, Institute of Earth Sciences,
University of Silesia

41-200 Sosnowiec, Będzińska 60

phone: (32) 368-94-77

e-mail: katarzyna.dabrowska-zapart@us.edu.pl