

# *Betula pollen season in southern Poland in 2016*

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**Abstract:** The paper presents a comparison of birch pollen seasons in 2016 in study sites located in the southern part of Poland: Zielona Góra, Opole, Wrocław, Sosnowiec, Cracow, Lublin, and Guciów in the Roztocze National Park. The pollen concentrations were measured with the volumetric method using Burkard or Lanzoni pollen samplers. The annual pollen sum was calculated for each measurement site. In 2016, the birch pollen season started at a similar time, i.e. between 4<sup>th</sup> and 6<sup>th</sup> April in all the localities. The highest annual sums and maximum pollen concentrations were recorded in Lublin and Guciów. The maximum concentrations of birch pollen were noted from 5<sup>th</sup> and 15<sup>th</sup> April, with the highest value in Lublin, i.e. 8573 P/m<sup>3</sup> (14.04).

**Key words:** aeroallergens, pollen concentration, birch (*Betula*), 2016

**B**irch pollen contains strong allergens, which often cause allergic rhinitis atopic pollen asthma in inhabitants of northern and central Europe. The birch pollen season in Poland starts in April and persists until May [1, 2]. The air-borne concentrations of the birch pollen may exhibit high values, although their large variation has been observed in the recent years. Some authors have reported a 2-year cycle of abundant birch pollen production [3, 4]. Based on multiyear investigations, a trend towards increasing quantities of birch pollen grains has been noted in many European countries [5, 6]. Cross-reactivity between birch pollen

and carrot, celery and soy as well as various fruits (apples, pears, peaches, cherries, hazelnuts) has been well described [1, 7]. Cross-reactions of birch pollen allergens with alder, hazel, hornbeam, oak, beech, and walnut pollen allergens have been reported [8].

The threshold concentration of birch pollen causing the first allergy symptoms has been established for Poland at 20 P/m<sup>3</sup>. At a concentration of 75 P/m<sup>3</sup>, allergy develops in all individuals that are allergic to birch pollen, and at a concentration exceeding 155 P/m<sup>3</sup>, symptoms of dyspnoea can be observed in allergic patients [9, 10].

**Aim**

The aim of the study was to compare the concentration of birch pollen in 2016 in the air of southern Polish cities: Zielona Gora, Opole, Wrocław, Sosnowiec, Cracow, Lublin, and in Guciw in the Roztocze National Park.

**Material and method**

In 2016, the measurements of the pollen concentration in the study sites were performed with the volumetric method using Burkard or Lanzoni pollen samplers. The length of the hazel pollen seasons was determined with the 98% method. 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 values and dates of occurrence of the respective concentrations as well as the daily pollen concentrations during the season were presented. The number of days with concentrations exceeding the threshold values for birch pollen (20, 75, 90, 155 P/m<sup>3</sup>), at which allergy symptoms are manifested with varying severity [9], was specified. The course of the pollen seasons in each city is shown in the graphs (fig. 1–7).

**Results and discussion**

**Onset of the birch pollen season**

In 2016, the birch pollen season determined with the 98% method began on similar dates in each of the locations (4–6.04).

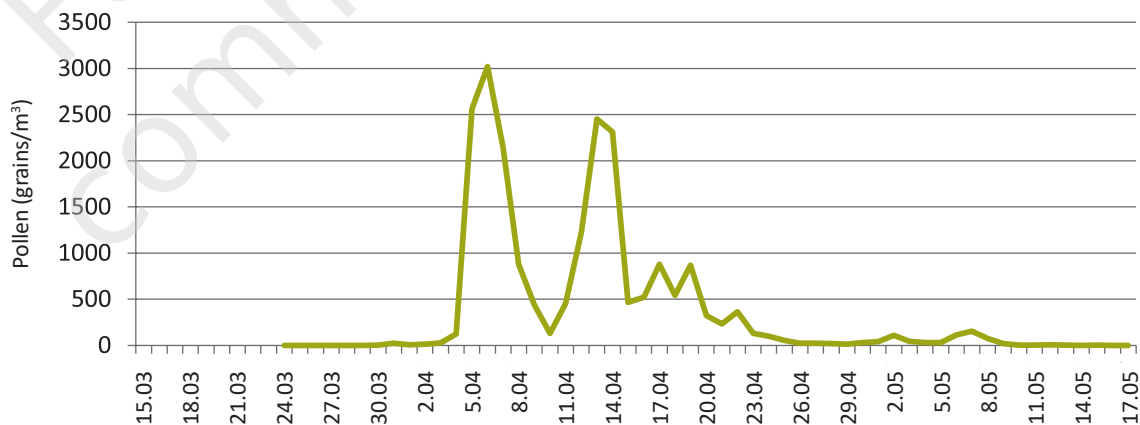
In the western part of the country, i.e. in Zielona Gora, Opole, Wrocław, and Cracow, the beginning of the pollen season was recorded on 4<sup>th</sup> April. In eastern Poland, i.e. in Lublin and Guciw, the season began on 6<sup>th</sup> April.

The comparison of the dates the onset of the birch pollen season in 2013, 2015, and 2016 indicates that the season began 10–14 days earlier in the latter year analysed [11, 12]. However, an even earlier onset of the birch pollen season was noted in 2014, e.g. in Wrocław on 29<sup>th</sup> March and Zielona Gora on 30<sup>th</sup> March [13, 14].

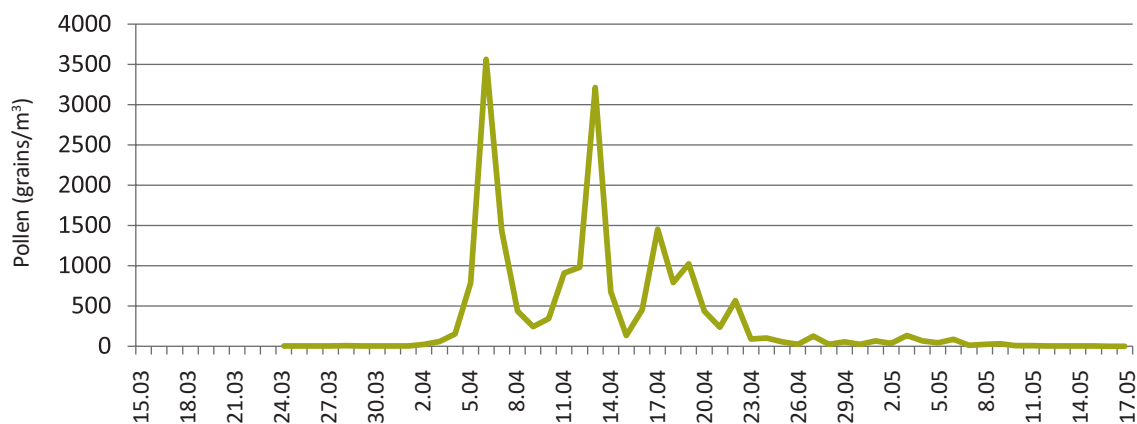
**Number of days with the threshold concentration**

The length of the pollen season in the measurement sites was similar. In turn, the number of days with the pollen concentration exceeding the thresholds

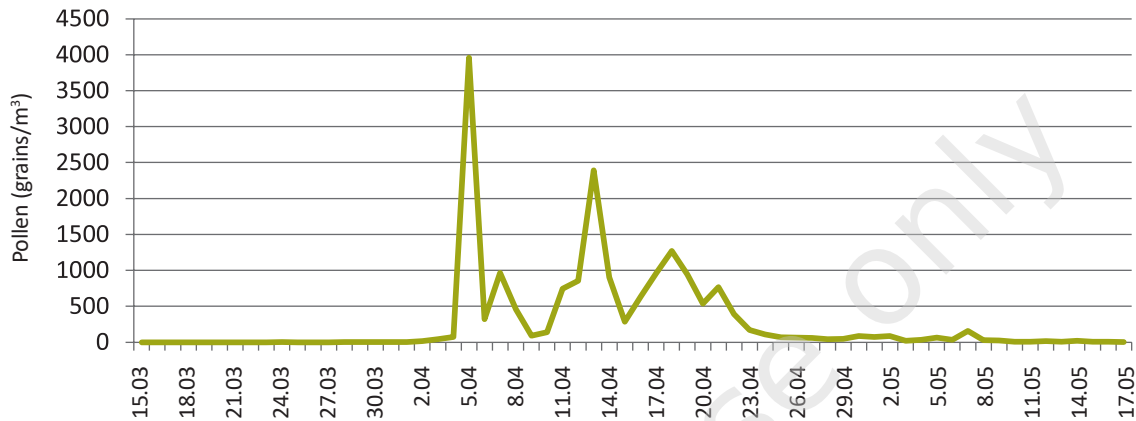
**Figure 1.** Birch pollen count in Zielona Gora in 2016.



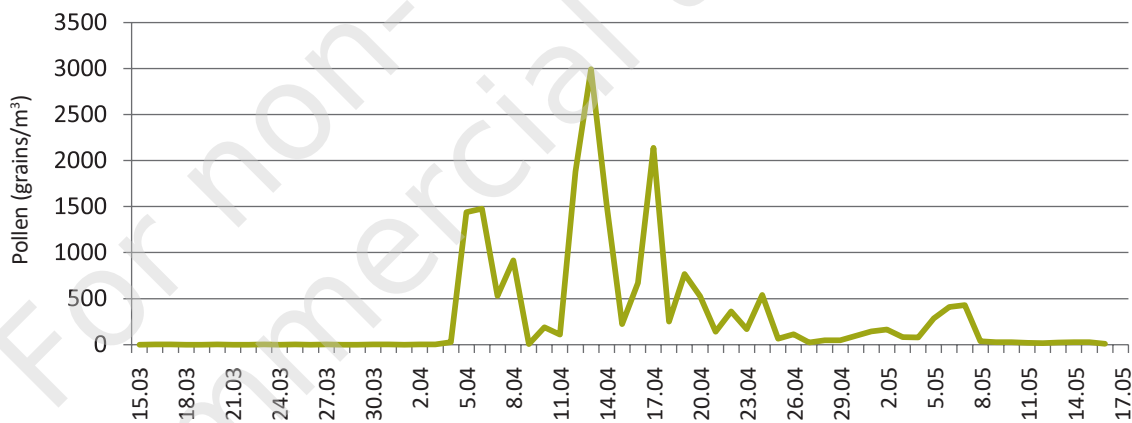
**Figure 2.** Birch pollen count in Opole in 2016.



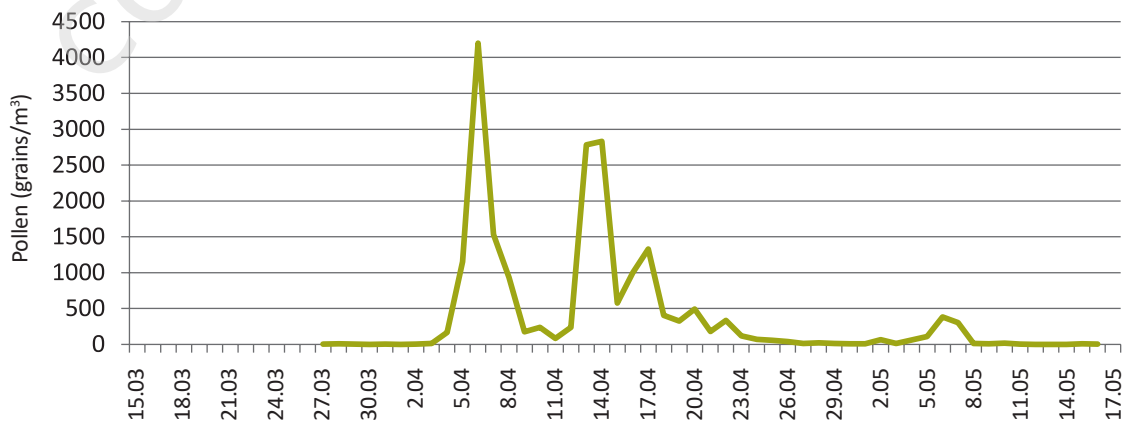
**Figure 3.** Birch pollen count in Wrocław in 2016.



**Figure 4.** Birch pollen count in Sosnowiec in 2016.



**Figure 5.** Birch pollen count in Cracow in 2016.



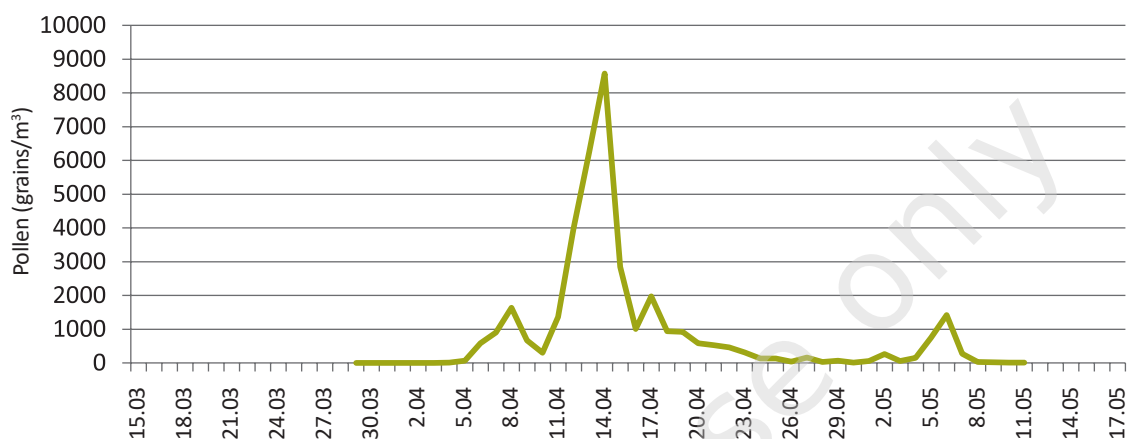
varied. The number of days with a concentration equal to or higher than 20 P/m<sup>3</sup> was 39 in Sosnowiec, 37 in Zielona Gora, Opole, and Wrocław, 33 in Lublin, 32 in Guciw, and 29 in Cracow. The threshold value of 75 P/m<sup>3</sup> was exceeded in the cities for 23–28 days, a value over 90 P/m<sup>3</sup> was noted for 21–26 days, and a value over 155 P/m<sup>3</sup> was recorded during 17–21 days. The greatest risk of severe allergy symptoms due to the

great number of days with pollen concentrations exceeding the threshold value was noted in Sosnowiec.

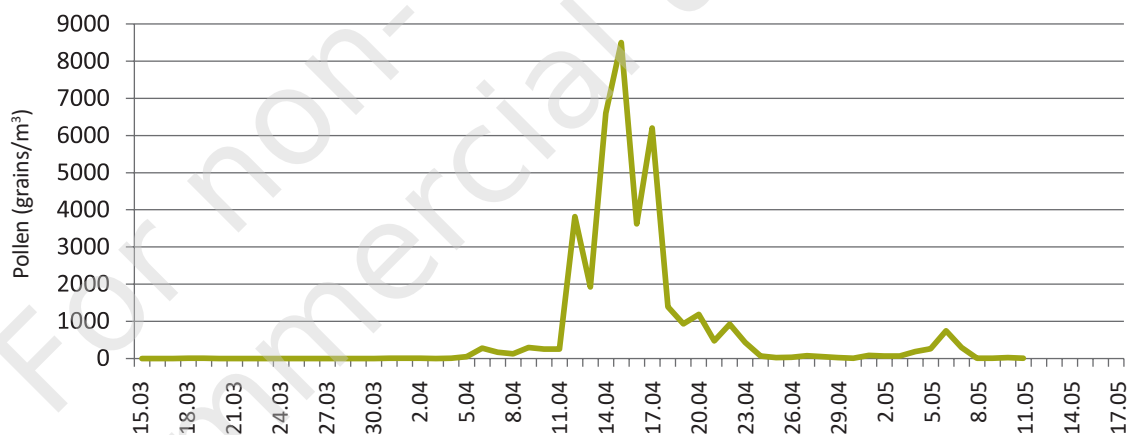
**Annual sums of birch pollen**

In 2016, exceptionally high annual totals of birch pollen were noted in all the measurement sites. They ranged from 18041 to 21068 P/m<sup>3</sup> in Zielona Gora, Opole, Wrocław, and Cracow. Substantially

**Figure 6.** Birch pollen count in Lublin in 2016.



**Figure 7.** Birch pollen count in Guciw (Roztocze) in 2016.



higher annual sums, i.e. 37532 and 39381 P/m<sup>3</sup>, were recorded in Lublin and Guciw, respectively (tab. 1).

In 2016, the total annual sum of pollen grains in Lublin was nearly 10-fold higher than in 2013, whereas

**Table 1.** Characteristics of *Betula* pollen season in 2016.

Site	Pollen season period by the 98% method	Maximum pollen count (P/m <sup>3</sup> ) date	Annual pollen sum	Days number above threshold			
				20 P/m <sup>3</sup>	75 P/m <sup>3</sup>	90 P/m <sup>3</sup>	155 P/m <sup>3</sup>
Zielona Gora	4.04–7.05	3021 6.04	21068	37	25	24	18
Opole	4.04–5.05	3564 6.04	18923	37	24	22	17
Wroclaw	4.04–7.05	3960 5.04	18041	37	23	21	18
Sosnowiec	5.04–8.05	2993 13.04	19081	39	28	26	21
Cracow	4.04–7.05	4199 6.04	20369	29	23	22	20
Lublin	6.04–7.05	8573 14.04	37532	33	26	26	23
Guciw	6.04–7.05	8502 15.04	39384	32	23	22	21

in Wrocław in 2016 the sum was 3-fold higher than in 2013 and 4-fold higher than in 2015 [11, 12]. The abundance of birch pollen in 2016 was comparable in some cities with the amount of pollen noted in 2014 (Zielona Góra). In many other cities, 2016 was a record year in terms of the number of birch pollen grains, e.g. in Wrocław, 18041 P/m<sup>3</sup> were recorded in 2016 and 13481 P/m<sup>3</sup> were noted in 2014, which was characterised by equally abundant pollen production [13].

### Maximum daily concentrations of birch pollen

The maximum concentrations of birch pollen in 2016 were very high and exceeded the maximum concentrations reported in 2013–2015 [11–13]. The highest values of this parameter were noted in Lublin and Guciów (8573 P/m<sup>3</sup>, 8502 P/m<sup>3</sup>). The other high values of these concentrations were reported from Cracow (4199 P/m<sup>3</sup>) and Wrocław (3960 P/m<sup>3</sup>). In Zielona Góra, Opole, and Sosnowiec, these values were in the range of 2993–3564 P/m<sup>3</sup> (tab. 1).

The maximum concentrations were noted on the following dates: 5<sup>th</sup> April in Wrocław, 6<sup>th</sup> April in Zielona Góra, Opole, and Cracow, 13<sup>th</sup> April in Sosnowiec, 14<sup>th</sup> April in Lublin, and 15<sup>th</sup> April in Guciów. It is worth noting that the maximum birch pollen concentration was recorded on days 1–2 after the beginning of the season (fig. 1–3) in 4 cities and on days 8–9 of the pollen season in the other 3 localities (tab. 1, fig. 4–7).

### Conclusions

In 2016, the birch pollen season started in the first decade of April (4–6.04) in the southern part of Poland.

The end of the birch pollen season was noted in the first decade of May (5–8.05).

The maximum concentrations of birch pollen were very high; they were noted in 5<sup>th</sup>–15<sup>th</sup> April. The highest daily concentration was recorded in Lublin (8573 P/m<sup>3</sup>).

### References:

- Rapiejko P. *Alergeny pyłku roślin*. Medical Education, Warszawa 2012.
- Puc M, Wolski T, Cámara Camacho I et al. *Fluctuation of birch (Betula L.) pollen seasons in Poland*. Acta Agrobot 2015, 68(4): 303-313.
- Latalowa M, Miętus M, Uruska A. *Seasonal variations in atmospheric Betula pollen count in Gdańsk (southern Baltic coast) in relation to meteorological parameters*. Aerobiologia 2002, 18: 33-43.

- Spieksma FThM, Corden JM, Detandt M et al. *Quantitative trends in annual totals of five common airborne pollen types (Betula, Quercus, Poaceae, Urtica and Artemisia), at five pollen – monitoring stations in western Europe*. Aerobiologia 2003, 19(3): 171-184.
- Spieksma FThM, Emberlin JC, Hjelmroos M. *Atmospheric birch (Betula) pollen in Europe: Trends and fluctuations in annual quantities and starting dates of the seasons*. Grana 1995, 34: 51-57.
- Clot B. *Trends in airborne pollen: An overview of 21 years of data in Neuchatel (Switzerland)*. Aerobiologia 2003, 19: 227-234.
- Jahn-Schmid B, Radakovics A, Lüttkopf D et al. *Bet v 1142-156 is the dominant T-cell epitope of major birch pollen allergen and important for cross-reactivity with Bet v 1-related food allergens*. J Allergy Clin Immunol 2005, 116(1): 213-219.
- Weryszko-Chmielewska E (ed). *Aerobiologia*. Wydawnictwo Akademii Rolniczej w Lublinie 2007.
- Rapiejko P, Stankiewicz W, Szczygielski K et al. *Progowe stężenie pyłku roślin niezbędne do wywołania objawów alergicznych*. Otolaryngol Pol 2007, LXI(4): 591-594.
- Rapiejko P, Malkiewicz M, Lipiec A. *Analiza stężenia pyłku brzozy w 2012 roku w wybranych miastach Polski*. Alergoprofil 2012, 8 (2): 33-37.
- Puc M, Kruczek A, Lipiec A et al. *Pylek brzozy w powietrzu wybranych miast Polski w 2013 r.* Alergoprofil 2013, 9(2): 44-48.
- Rapiejko P, Puc M, Woźniak-Kosek A. *Pylek brzozy w powietrzu wybranych miast Polski w 2015 r.* Alergoprofil 2015, 11(2): 53-61.
- Malkiewicz M. *Dynamika sezonów pyłkowych drzew (Alnus, Corylus, Betula) i roślin zielnych (Ambrosia, Artemisia, Poaceae) w powietrzu Wrocławia w latach 2003–2013*. In: Weryszko-Chmielewska E (ed). *Ziarna pyłku i zarodniki grzybów w powietrzu różnych regionów Polski*. Wyd Norbertinum, Lublin 2014: 63-80.
- Rapiejko A, Lipiec A, Kalinowska E. *Charakterystyka sezonów pylenia leszczyny, olszy i brzozy w Zielonej Górze w 2014 r.* Alergoprofil 2014, 10(2): 49-52.

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