

Analysis of mugwort (*Artemisia*) pollen seasons in selected cities in Poland in 2018

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Abstract:

The aim of the present study was to compare the mugwort pollen season in 2018 in Białystok, Bydgoszcz, Cracow, Drawsko-Pomorskie, Lublin, Olsztyn, Opole, Sosnowiec, Szczecin, Warsaw, Wrocław, and Zielona Góra. Pollen concentration measurements were made by the volumetric method using Burkard or Lanzoni pollen samplers. The pollen season was considered as the period during which 98% of the total annual pollen count occurred. The Seasonal Pollen Index (SPI) was calculated as the sum of the average daily pollen concentrations throughout the season determined for the individual cities. The mugwort pollen season started earliest in Białystok (June 21st) and Bydgoszcz (June 25th), while in the other cities its onset occurred in the first 10 days of July. Significant differences were found in season duration (68–110 days), SPI, and peak value. The longest season occurred in Zielona Góra and Bydgoszcz, while the shortest one in Wrocław. The highest SPI and maximum concentration values were observed in Lublin and Zielona Góra. In most of the cities, the peak value was recorded in the first 10 days of August. The highest risk of allergy in people sensitive to the pollen of this taxon was found in Zielona Góra, Lublin, and Warsaw.

Key words: aeroallergens, pollen count, mugwort (*Artemisia*), 2018

57 species of the genus *Artemisia* occur in Europe [1]. The area of their occurrence covers almost all Europe and spreads from the central part of Scandinavia to southern Italy and Spain [2].

14 species of the genus *Artemisia* are found in Poland and these species bloom from July to the end of September [3]. In 2013 the onset of mugwort pollen shed was recorded already in the middle of June [4]. Most frequently, these are weeds and ruderal plants. Some of them are used for seasoning or medicinal purposes [5]. All mugwort species grow in urban and sub-urban areas [6].

The common mugwort, *Artemisia vulgaris*, is most often found both in Poland and in other European countries [2, 5]. Among all European countries, the highest mugwort pollen concentrations are recorded in Poland, Lithuania, Latvia, and Ukraine [2]. Our study shows that in Lublin mugwort pollen accounts for 2.6% of all pollen grains contained in the aeroplankton [7].

In spite of a relatively low content of atmospheric mugwort pollen, in comparison to the content of pollen of other plant taxa, it ranks third among the most common causes of pollen allergy in Poland, after grass and birch with their pollen content of 9.3% and 23.6%, respectively [7, 8].

The major allergen of *Artemisia* pollen grains, Art v 1, is homologous to the *Ambrosia* pollen allergen Amb a 4. They may cause cross reactivity in sensitive patients [9].

Aim

The aim of this study was to compare airborne mugwort pollen concentrations in 2018 in Białystok, Bydgoszcz, Cracow, Drawsko Pomorskie, Lublin, Olsztyn, Opole, Sosnowiec, Szczecin, Warsaw, Wrocław, and Zielona Góra.

Material and method

Based on the study results obtained in 2018, an analysis was performed of atmospheric mugwort pollen seasons in 12 cities of Poland. Pollen concentration measurements were made by the volumetric method using Burkard or Lanzoni pollen samplers [10]. The start and end of the *Artemisia* pollen season were determined. Season duration was determined by the 98% method. The Seasonal Pollen Index (SPI) was calculated as the sum of the average daily pollen concentrations throughout the season in the individual

cities [11]. The peak values and peak dates were compared between all the pollen monitoring sites.

The risk of pollen allergy was determined as the number of days with a concentration exceeding the threshold values, which are 30 P/m³, 55 P/m³, and 70 P/m³ for mugwort. At a concentration of 30 P/m³, the first allergy symptoms occur, at 55 P/m³ pollen allergy occurs in all individuals sensitized to mugwort, while at 70 P/m³ allergic people may have severe symptoms [12].

Results and discussion

In 2018 the mugwort pollen season started in Poland between June 21st and July 13th, and in some cities it lasted until the middle of October. The first mugwort pollen grains were observed earliest in Białystok, while latest in Szczecin (tab. 1).

The pollen season duration was from 68 days (Wrocław) to 110 days (Bydgoszcz). The period of peak pollen concentrations was recorded in the cities in question between July 28th (Szczecin) and August 10th (Białystok). The peak value of mugwort pollen concentration ranged between 22 P/m³ (Bydgoszcz) and 88 P/m³ (Lublin) (figs 1–6).

The highest sum of mugwort pollen grains (SPI) in 2018 was recorded in Lublin (1085 grains) and Zielona Góra (1055 grains), whereas in Szczecin, Białystok, Bydgoszcz, and Cracow the total annual pollen counts were 2.5–3-fold lower (tab. 1).

A high risk of allergy related to a high mugwort pollen concentration (above 55 P/m³) occurred in Zielona Góra (4 days), Lublin (3 days), and Warsaw (3 days), while concentrations above 70 P/m³ throughout 1 day were recorded only in Lublin and Zielona Góra (tab. 1).

In most of the cities, the *Artemisia* pollen seasons were characterized by a condensed pattern, with the occurrence of the highest concentrations in the first half of the season (figs 2, 3, 5, 6), but in Białystok and Drawsko Pomorskie relatively high peaks occurred also in the second half of the season, which may be evidence of a significant proportion of pollen of several species of the genus *Artemisia* (figs 1, 4).

In Lublin the SPI value for *Artemisia* was much lower in 2018 than in previous years in this city, e.g. during the period 2001–2005 when it reached 1550–2533 [13], and this value was also lower than the average for 2001–2012 when it stood at 1741 [14]. In 2015, on the other hand, the value of the above-mentioned parameter was similar to that determined in 2018 [15].

Table 1. Characteristics of mugwort pollen season in 2018.

| Features of pollen season | Bialystok | Bydgoszcz | Cracow | Drawsko Pomorskie | Lublin | Olsztyn | Opole | Sosnowiec | Szczecin | Warsaw | Wroclaw | Zielona Gora |
|--|------------------|-------------------|-----------------|-------------------|-----------------|----------------|----------------|----------------|-----------------|-----------------|----------------|------------------|
| Duration of pollen season (number of days) | 21.06–10.09 (82) | 25.06–12.10 (110) | 5.07–15.09 (73) | 3.07–13.10 (103) | 8.07–23.09 (78) | 8.07–4.10 (89) | 5.07–4.10 (92) | 3.07–1.10 (91) | 13.07–1.10 (81) | 8.07–13.10 (98) | 3.07–8.09 (68) | 1.07–15.10 (107) |
| Seasonal Pollen Index 98% | 349 | 440 | 423 | 861 | 1085 | 692 | 615 | 397 | 296 | 957 | 733 | 1055 |
| Peak value and peak date | 30 (10.08) | 22 (3.08) | 41 (4.08) | 67 (1.08) | 88 (3.08) | 67 (5.08) | 53 (8.08) | 36 (3.08) | 32 (28.07) | 68 (7.08) | 65 (8.08) | 74 (4.08) |
| Days ≥ 30 P/ m^3 * [12] | 1 | 0 | 2 | 7 | 14 | 7 | 5 | 2 | 1 | 11 | 8 | 12 |
| Days ≥ 55 P/ m^3 ** [12] | 0 | 0 | 0 | 1 | 3 | 2 | 0 | 0 | 0 | 3 | 2 | 4 |
| Days ≥ 70 P/ m^3 *** [12] | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

* First allergy symptoms.

** Allergic reactions in most patients.

*** Trigger acute clinical symptoms.

Figure 1. Mugwort pollen count in Bialystok and Bydgoszcz in 2018.

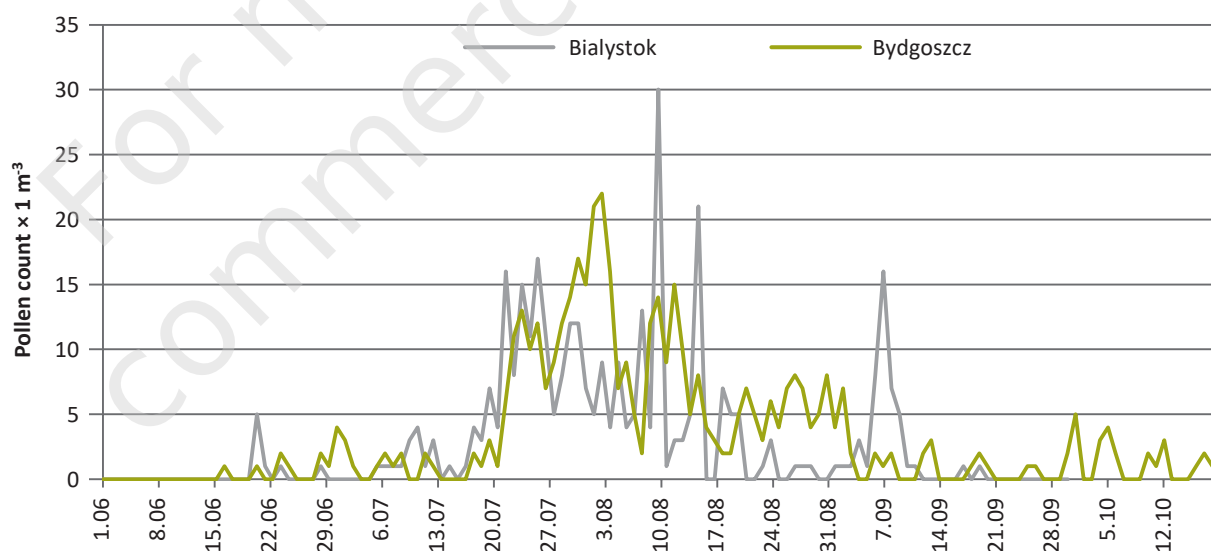


Figure 2. Mugwort pollen count in Sosnowiec and Wroclaw in 2018.

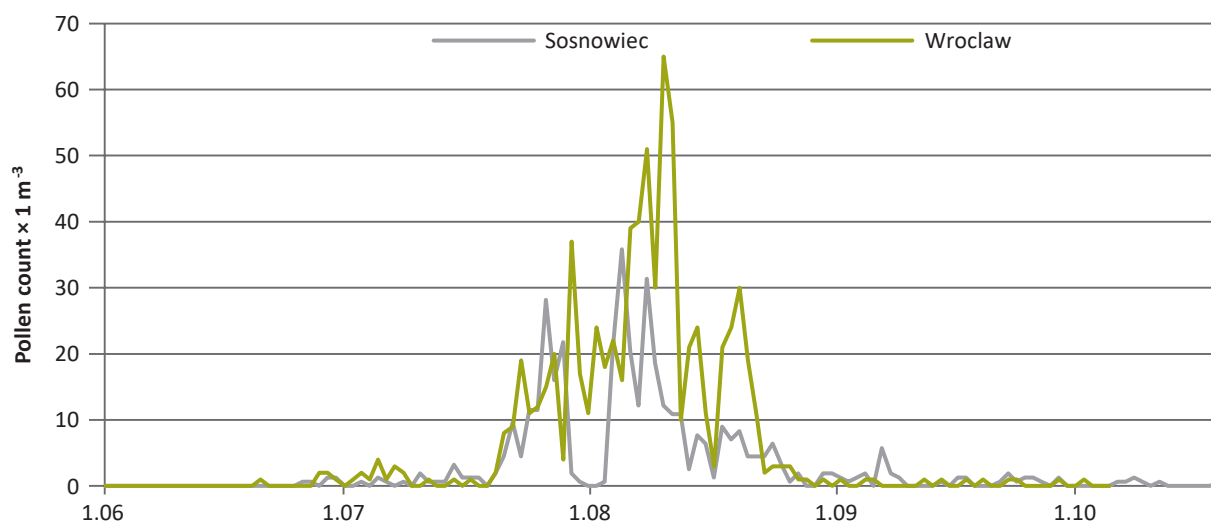


Figure 3. Mugwort pollen count in Cracow and Lublin in 2018.

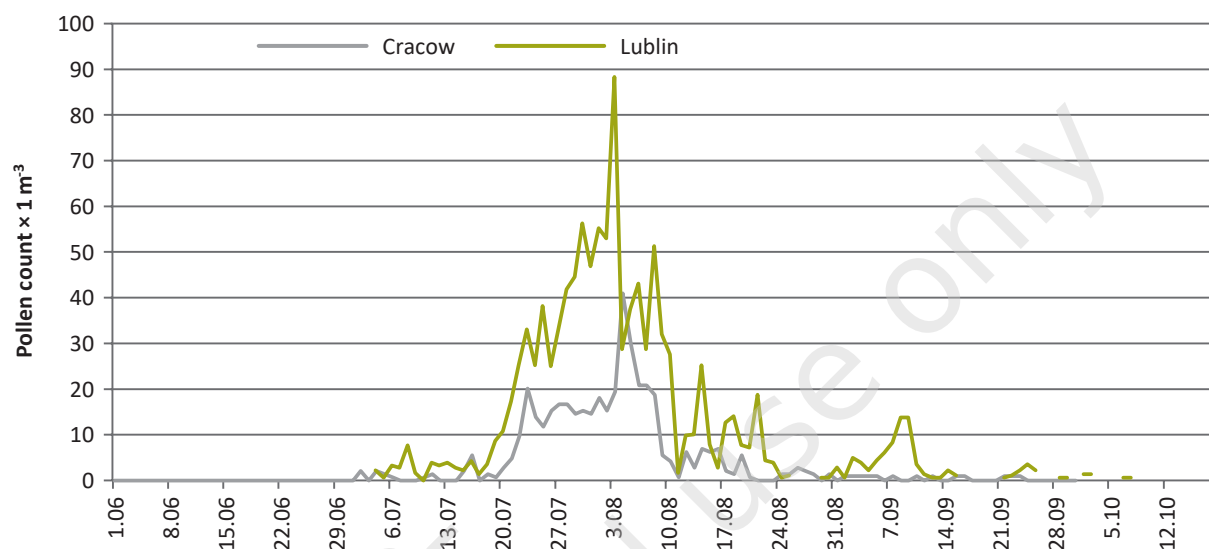


Figure 4. Mugwort pollen count in Drawsko Pomorskie and Szczecin in 2018.

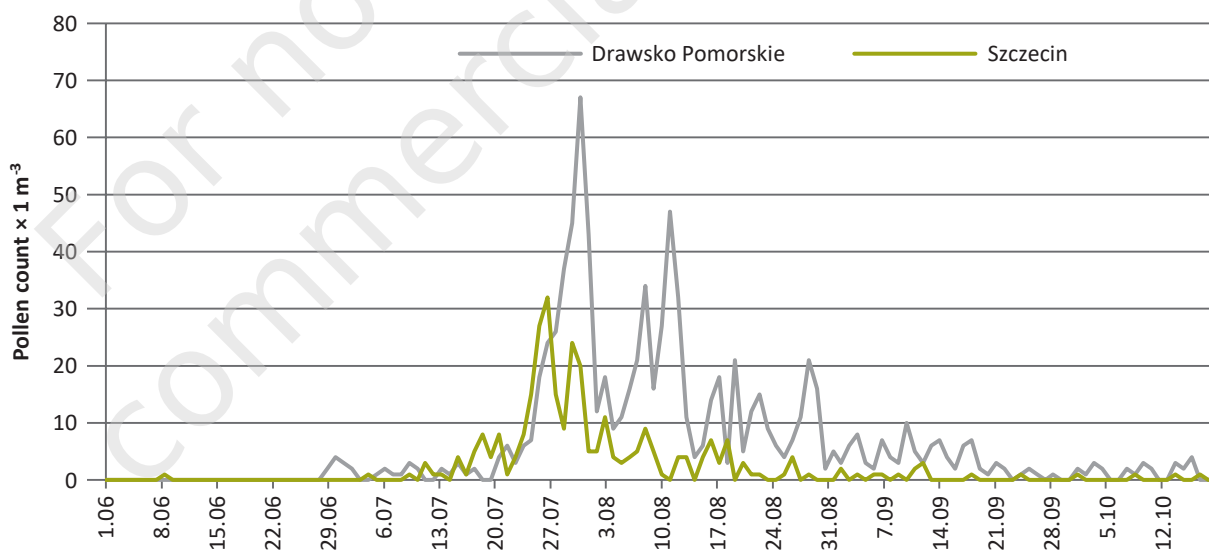


Figure 5. Mugwort pollen count in Zielona Gora and Warsaw in 2018.

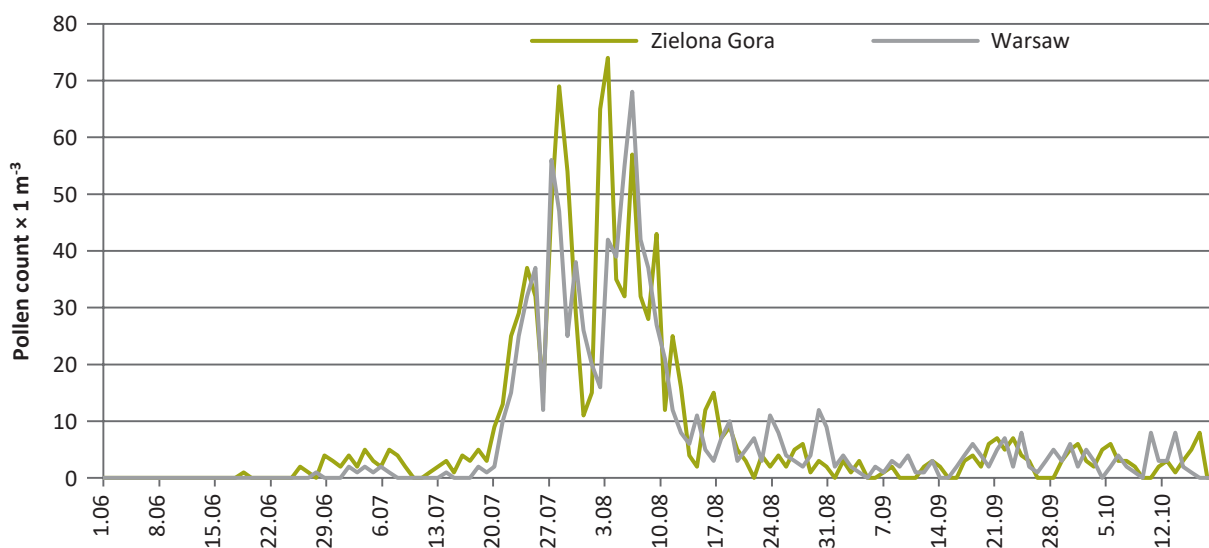
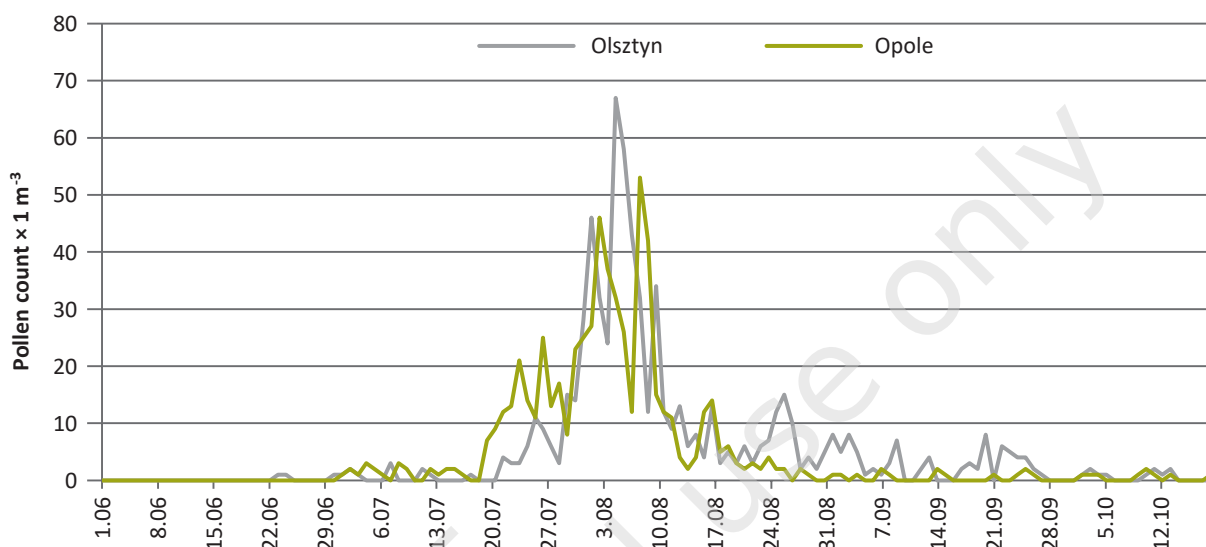


Figure 6. Mugwort pollen count in Olsztyn and Opole in 2018.



Conclusions

1. The mugwort pollen season in 2018 in the studied cities lasted from the third 10 days of June until the middle of October, and the longest season (Bydgoszcz) reached 110 days.
2. The highest daily mugwort pollen concentration was found in Lublin (88 P/m³). At most of the pollen monitoring sites, peak pollen shed occurred in the first 10 days of August.
3. The highest risk of pollen allergy during the mugwort pollen season was shown in Zielona Gora, Lublin, and Warsaw.

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