Ragweed pollen season in the cities of northern Poland in 2016

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Abstract: This paper presents the course of the pollen season of ragweed (*Ambrosia*) in Szczecin, Drawsko Pomorskie, Bydgoszcz, Olsztyn, Piotrkow Trybunalski, Warsaw and Bialystok in 2016. The ragweed pollen grains are known as very potent aeroallergens, often noted to enter into cross reactions. This pollen is a common cause of pollinosis in North America, but in Europe the occurrence of ragweed pollen is not uniform. 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. Seasonal Pollen Index (SPI) was estimated as the annual sum of daily average pollen concentrations. The pollen season of *Ambrosia* started first in Olsztyn, on the 7th of August and in Szczecin, on 10th of August (about two weeks earlier than the other cities) and lasted between the 14th of September and 14th of October. The differences of pollen seasons duration ware slight. The highest airborne concentration of 47 pollen grains/m^3 was noted in Bialystok on the 29th of August. The maximum values of seasonal pollen count occurred between of 20–30th of August, only in Szczecin 9th of September. The highest grass pollen allergen hazard occurred in 2016 in Warsaw (5 days) and Piotrkow Trybunalski (4 days) and was very low.

Key words: allergens, pollen count, risk of allergy, ragweed (*Ambrosia*), 2016

Till the end of the 60s in the last century, ragweed had been believed to occur sparsely in Europe, and so it had not been considered as a source of serious allergenic threat. For many years ragweed appeared in Europe in the hitherto unknown localities, and the number of people allergic to the allergens of this plant has been gradually increasing [1, 2]. In Europe the occurrence of ragweed pollen is not uniform, it has been abundantly noted in Hungary, Ukraine and in Northern Italy, less frequent in France, in the Balkan Peninsula, in Switzerland, Austria, Slovakia and Czech Republic [2–5] and the weed has become a spreading neophyte in Europe.

The genus *Ambrosia* contains about 42 species of which only 5 have been noted in Europe [6].

Ambrosia pollen cross react with almost all other composites, especially with *Artemisia* pollen (mugwort). The majority of patients allergic to ragweed are also allergic to the pollen of mugwort, grass and the allergens of apple and celery [7]. The threat related to

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the allergens of *Ambrosia* pollen is enhanced by the fact that the concentration of these taxa pollen (as well as the pollen of other herbs) just above the ground level is a few times higher than at a height of 15–25 m [8].

Aim

The aim of this work was to analyse the ragweed pollen concentrations in the air of Olsztyn, Warsaw, Drawsko Pomorskie, Bydgoszcz, Szczecin, Piotrkow Trybunalski and Bialystok in 2016 and assess the level of exposure of cities inhabitants to the allergenic ragweed pollen grains.

Material and method

Measurements of airborne *Ambrosia* pollen were carried out in Olsztyn, Warsaw, Drawsko Pomorskie, Bydgoszcz, Piotrkow Trybunalski, Bialystok and Szczecin in the year 2016.

The pollen season was defined using the 98% method; the day on which the cumulative pollen count during the period 1 January–30 June reached the value of ≥ 1% was determined to be the start date of the pollen season, and the end of the season was the day when the cumulative pollen count was ≥ 99% [9]. The total pollen count over this period was expressed by the symbol SPI (Seasonal Pollen Index).

On the basis of literature data, the number of days with concentrations of the pollen of the ragweed exceeding the threshold values at which the consecutive allergy symptoms develop were determined (tab. 1).

On the basis of literature data the number of days at which the pollen concentrations of the taxa studied exceeded the threshold values at which allergy symptoms develop, was determined. Laaidi and Laaidi [10] reported a threshold value for *Ambrosia* pollen of 13 g/m^3 in Burgundy, France.

Results and discussion

Belmonte et al. [11] have shown that the high *Ambrosia* pollen count in Catalan is a result of long distance transport. Similar phenomena have been noted in many European cities [3, 4, 10]. In Szczecin, in three seasons analysed [12] a positive statistically significant correlation was noted between the ragweed pollen count and the maximum wind speed. This fact suggests that the pollen observed comes also from long distance transport. The phenomenon of transportation of ragweed pollen grains and other taxa over very long distances has been described by e.g. Yankowa et al. [3], Laaidi and Laaidi [10] and confirmed in this paper.

In 2016, in all the measurement points studied, the ragweed pollen season started between 7th and 23st of August and lasted 28–69 days, to the second decade of August (fig. 1–4, tab. 1). In comparison to data from 2001–2005 [13], in northern Poland, in 2016 pollen concentration of *Ambrosia* pollen was one of the lowest in all analysed cities, especially in Szczecin and Drawsko Pomorskie.

Also in studies conducted in the years 2001–2005, in Poland the maximum daily concentration was observed within 3 weeks: between the end of August and mid-September [13]. In 2016 in most cities of central and northern Poland the dates of maximum concentrations were noted within 12 days: between 29th of August and 9th of September and the highest annual sum of *Ambrosia* pollen grains (SPI) was observed in Warsaw (174) and in Bydgoszcz and Piotrkow Trybunalski (140) (tab. 1, fig. 1–4).

Owing to the huge production of the *Ambrosia* pollen (one specimen produces 0.5 mln grains in a pollen season), it can be present in concentrations much higher than the threshold value (≥ 13 g/m^3) for 25–30 days in the critical period in Burgundy (France) [10]. According to some authors the threshold value is the pollen count at which 60–80% of people allergic to *Ambrosia* pollen reveal acute symptoms of pollinosis

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

Features of pollen season	Olsztyn	Warsaw	Drawsko Pomorskie	Bydgoszcz	Szczecin	Piotrkow Trybunalski	Bialystok
Duration of pollen season (number of days)	7.08–14.10 (69)	20.08–12.10 (54)	23.08–11.10 (50)	20.08–8.10 (50)	10.08–14.09 (35)	18.08–5.10 (49)	20.08–16.09 (28)
Seasonal Pollen Index SPI (total)	105	174	83	140	36	140	86
Peak value and peak date	32 (29.08)	38 (29.08)	11 (29.08)	26 (29.08)	7 (9.09)	22 (30.08)	**47** (29.08)
Days ≥ 13 g/m^3 [10]*	2	5	0	2	0	4	1

** first symptoms of allergy.*

Figure 1. *Ragweed pollen count in Olsztyn and Warsaw in 2016.*

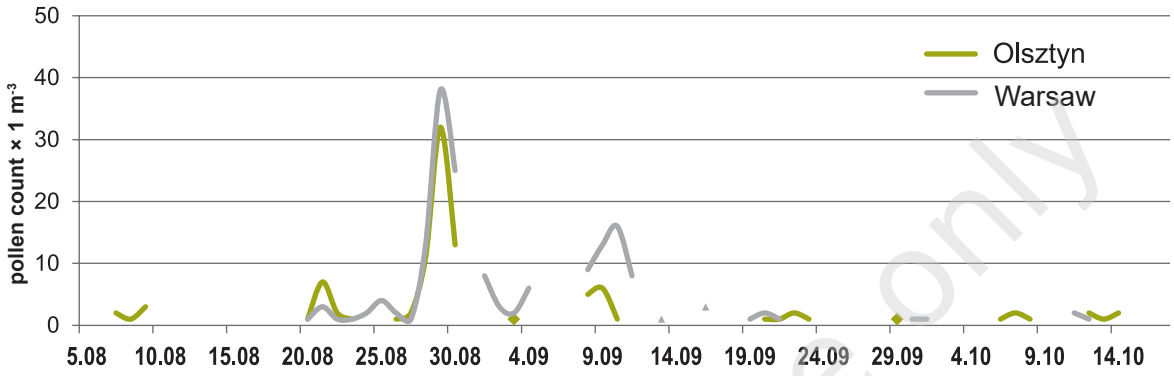


Figure 2. *Ragweed pollen count in Drawsko Pomorskie and Bydgoszcz in 2016.*

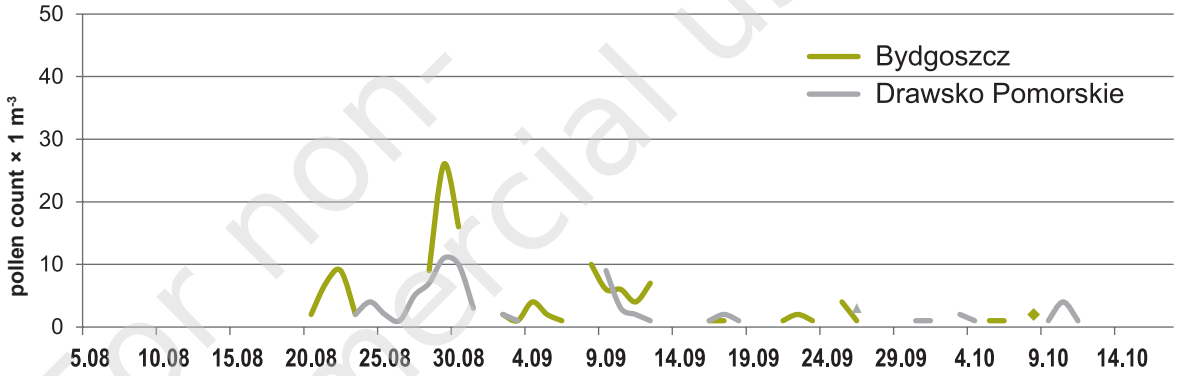


Figure 3. *Ragweed pollen count in Bialystok and Piotrkow Trybunalski in 2016.*

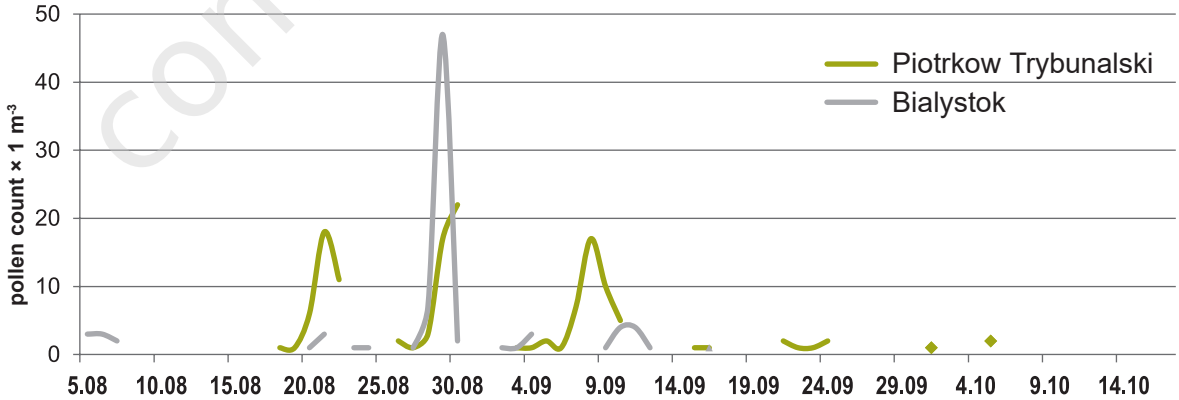
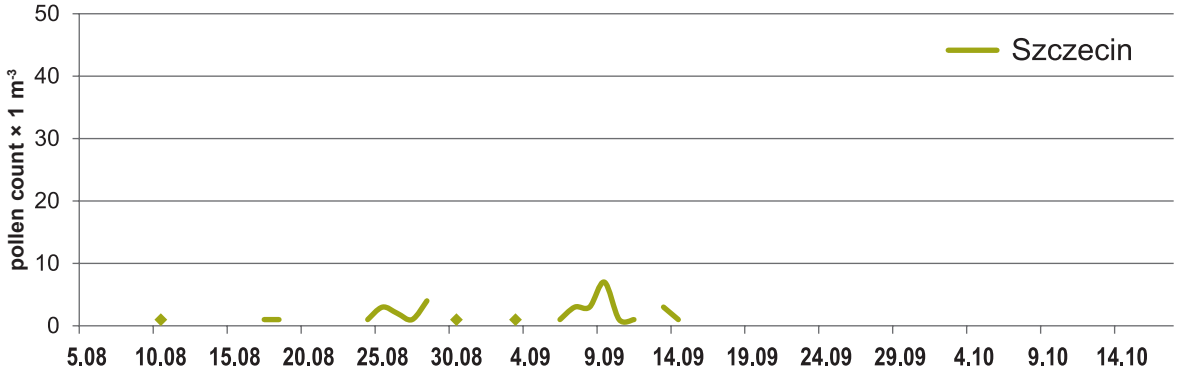


Figure 4. *Ragweed pollen count in Szczecin in 2016.*



[5, 10]. In Szczecin in the years 2000–2003 only very short periods (0–7 days) were noted with the concentration of pollen grains higher than the threshold value [12]. In 2014 in Lublin period with pollen counts exceeding the value ≥ 20 g/m^3 lasted 9 days [14].

Additionally, the allergens of ragweed pollen exhibit increased allergenicity after exposure to NO_2, especially in highly urbanized areas [15]. In sensitive persons the symptoms of pollinosis occur when the counts are above a threshold value (≥ 13 g/m^3), therefore, the greatest threat from *Ambrosia* pollen allergens in this study was noted on 30th of August and 9th of September, however in 2016 the period did not exceed 5 days (in Warsaw) (tab. 1).

Conclusions

The start of ragweed pollen season in 2016 occurred mostly in the second half of August; however in Olsztyn as early as 7th of August. The end of ragweed pollen season lasted to the half of October.

Ambrosia pollen season in most cities was between 28 and 69 days long and was characterized by very low total annual pollen (maximum to 174 g/m^3 in Warsaw).

The highest ragweed pollen allergen hazard occurred in 2016 in Warsaw and Piotrkow Trybunalski. The period with pollen counts exceeding the threshold value (≥ 13 g/m^3) lasted as long as 0 and 5 days. Nevertheless in 2016 the lowest risk of allergy symptoms to *Ambrosia* pollen was observed in all the cities of northern Poland.

The differences between pollen concentration of ragweed in the cities of northern Poland are mainly caused by the long-distance transport and probably that differences are also a result of the expansiveness of the taxon, populating new areas.

The knowledge of the potentially allergenic pollen count and the updating of pollen calendars are important for efficient prophylaxis of inhalant allergies.

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

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