

The analysis of alder pollen season in northern Poland in 2016

Małgorzata Puc^{1,2}, Agnieszka Lipiec^{3,4}, Alina Stacewicz¹, Piotr Rapiejko^{5,3}, Tomasz Wolski⁶, Grzegorz Siergiejko⁷, Ewa M. Świebocka⁷, Jarosław Kosek³, Dariusz Jurkiewicz³, Agata Szymańska⁸

¹ Department of Botany and Nature Conservation, Faculty of Biology, University of Szczecin, Poland

² Molecular Biology and Biotechnology Centre, Faculty of Biology, University of Szczecin, Poland

³ Allergen Research Center Ltd., Warsaw, Poland

⁴ Department of Prevention of Environmental Hazards and Allergology, Medical University of Warsaw, Poland

⁵ Department of Otolaryngology with Division of Cranio-Maxillo-Facial Surgery in Military Institute of Medicine, Warsaw, Poland

⁶ Coastal Marine Hydrography Unit, Department of Geosciences, Institute of Marine and Coastal Sciences, University of Szczecin, Poland

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

⁸ Laboratory of Aeropalynology, Faculty of Biology, Adam Mickiewicz University, Poznan, Poland

Abstract: This paper presents the course of the pollen season of alder (*Alnus* spp.) in Szczecin, Poznan, Drawsko Pomorskie, Bydgoszcz, Olsztyn, Piotrków Trybunalski, Warsaw and Białystok in 2016. In northern Poland, the genus *Alnus* Mill is represented by only the two species, *A. glutinosa* (L.) Gaertner and *A. incana* (L.) Moench. 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 alder started first in Szczecin, on the 3rd February, and lasted till the 29th March in Bydgoszcz and Piotrków Trybunalski. The differences of pollen seasons duration were considerable. The highest, record airborne concentration of 1324 pollen grains/m³ was noted in Piotrków Trybunalski on the 11th and 13th March. The maximum values of seasonal pollen count occurred between of 7th February and 22nd March in all cities.

Key words: allergens, pollen count, alder (*Alnus*), 2016

Clinical symptoms of allergic disease are connected with the concentration of aeroallergen, e.g. alder pollen allergen the subjects are exposed to [1].

The genera *Alnus* belongs to the Fagales Engl. order and the Betulaceae S.F. Gray family, which also includes *Betula* and *Carpinus* (APG II 2003) [2]. The northern ranges of the two species of alder growing in Poland are different. *A. glutinosa* is common throughout the country. However, it avoids higher altitudes in the mountains. *A. incana* is not so common; its sites are situated along the whole course of the Vistula river.

Additionally, this species also has a northern centre extending from the Suwalki Lake District to the Tuchola Forest [3].

In Poland the threshold value for first clinical symptoms for *Alnus* pollen grains for the majority of sensitised patients is visible during exposure to the concentration of 35 pollen grains in 1 m³ of air. Symptoms were noted in all the subjects sensitized to alder pollen at the concentration of approximately 85 grains/m³ of air. During exposure to the concentration of 95 pollen grains per m³ the symptoms were acute symptoms [1].

Aim

The aim of the study was to compare the alder pollen concentrations in the air of in Szczecin, Poznan, Drawsko Pomorskie, Bydgoszcz, Olsztyn, Piotrkow Trybunalski, Warsaw and Bialystok in 2016.

Material and method

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

The pollen season was defined using the 98% method; the day on which the cumulative pollen count during the period 1st January–30th June reached the value of $\geq 1\%$ 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 $\geq 99\%$ [4]. 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 alder genus exceeding the threshold values at which the consecutive allergy symptoms develop were determined (tab. 1) [1].

Results and discussion

A. glutinosa and *A. incana* can be regarded as pioneer plants easily occupying new or previously disturb habitats. If grown in the same habitat, *A. incana* flowers several days to three weeks prior to *A. glutinosa* [3]. In 2016, the alder pollen season started between 3rd and 17th February and lasted until the beginning of April. However in 2015 the alder pollen season in most of Poland’s area started 9–10th March and lasted 9 days in Sosnowiec to 19 days in Szczecin.

In 2015 the maximum daily concentration was observed between 8th a 13th March [5]. Similarly in 2016 in most cities of central and northern Poland the dates of maximum concentrations were noted on 13th March; however in Szczecin and Drawsko Pomorskie the peak dates were recorded much earlier than in 2015, between 7th and 8th February (tab. 1, fig. 1–4).

The highest daily pollen count was noted in 2016 in Piotrkow Trybunalski (1324 g/m³) (tab. 1) and the highest annual sum of alder pollen grains (SPI) was observed also in Piotrkow Trybunalski (14806) and it was about two times higher than in Drawsko Pomorskie (7735).

The highest alder pollen allergen hazard occurred (above 45 g/m³) in Poznan and Piotrkow Try-

Table 1. Characteristics of alder pollen season in 2016.

Features of pollen season	Szczecin	Poznan	Drawsko Pom.	Bydgoszcz	Olsztyn	Piotrkow Tryb.	Warsaw	Bialystok
Duration of pollen season (number of days)	3.02–27.03 (54)	7.02–29.03 (52)	7.02–23.03 (46)	6.02–29.03 (53)	8.02–28.03 (50)	7.02–29.03 (52)	5.02–23.03 (48)	17.02–1.04 (45)
Seasonal Pollen Index SPI (total)	10371	12259	7735	10710	12544	14806	9660	3072
Peak value and peak date	1276 (7.02)	1040 (23.02)	964 (8.02)	890 (13.02)	1205 (22.02)	1324 (11.03, 13.03)	1232 (13.03)	821 (13.03)
Days ≥ 45 g/m ³ [1]*	34	41	34	37	39	43	33	15***
Days ≥ 85 g/m ³ [1]**	30	34	24	29	33	34	27	9***

* First symptoms of allergy; ** symptoms present in all examined patients; *** from 17th to 29th March there are no pollen data in Bialystok.

Figure 1. Alder pollen count in Szczecin and Poznan in 2016.

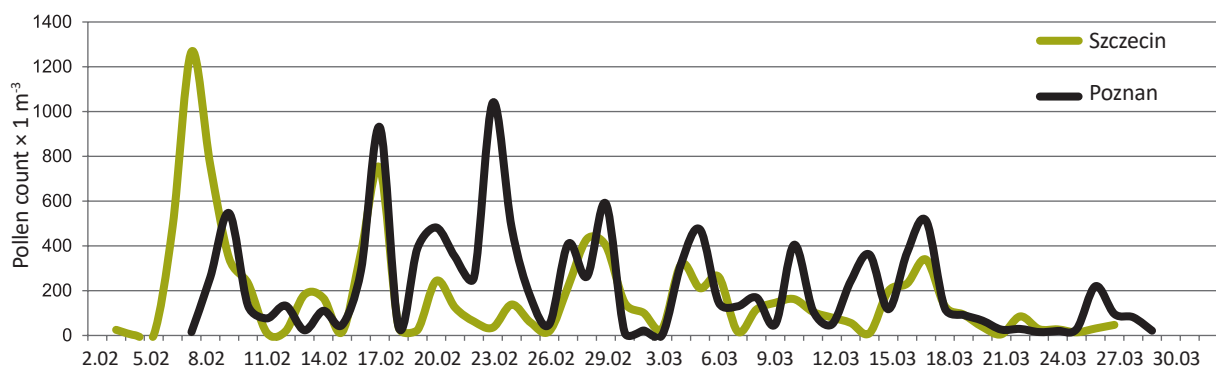


Figure 2. Alder pollen count in Drawsko Pomorskie and Bydgoszcz in 2016.

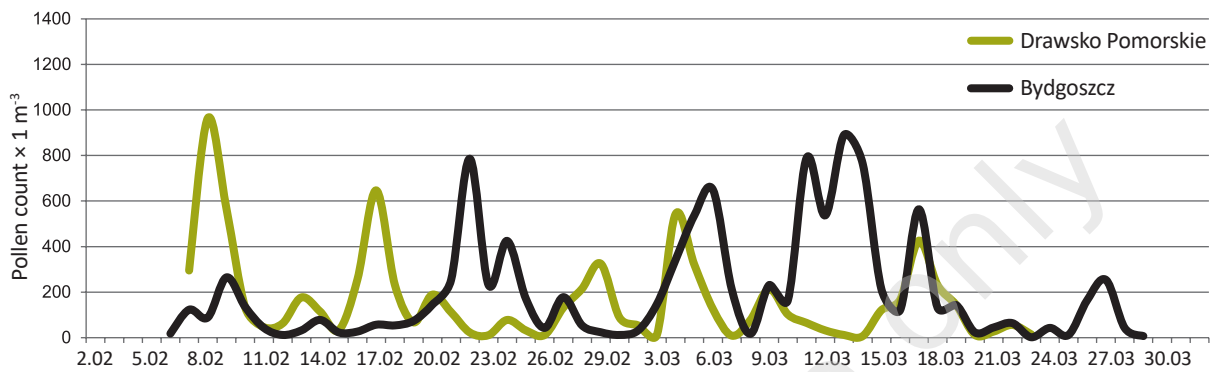


Figure 3. Alder pollen count in Olsztyn and Piotrkow Trybunalski in 2016.

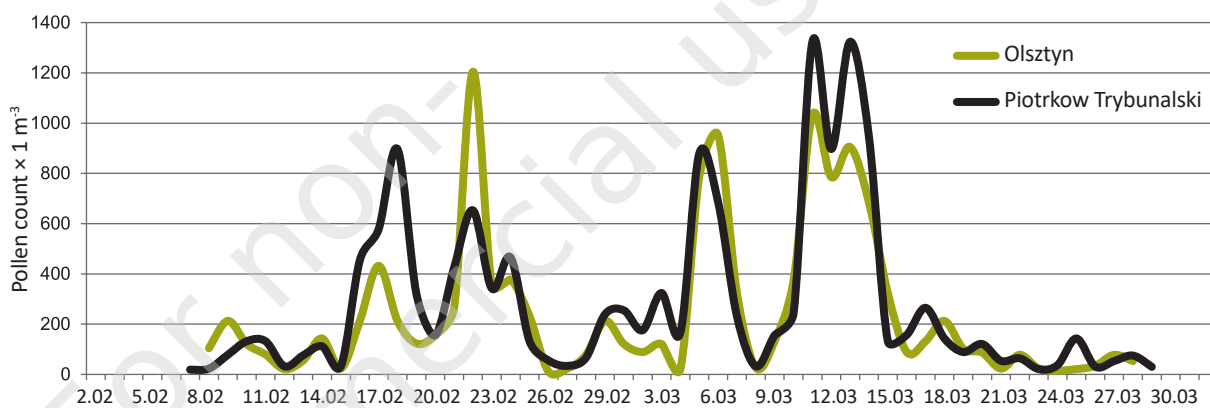
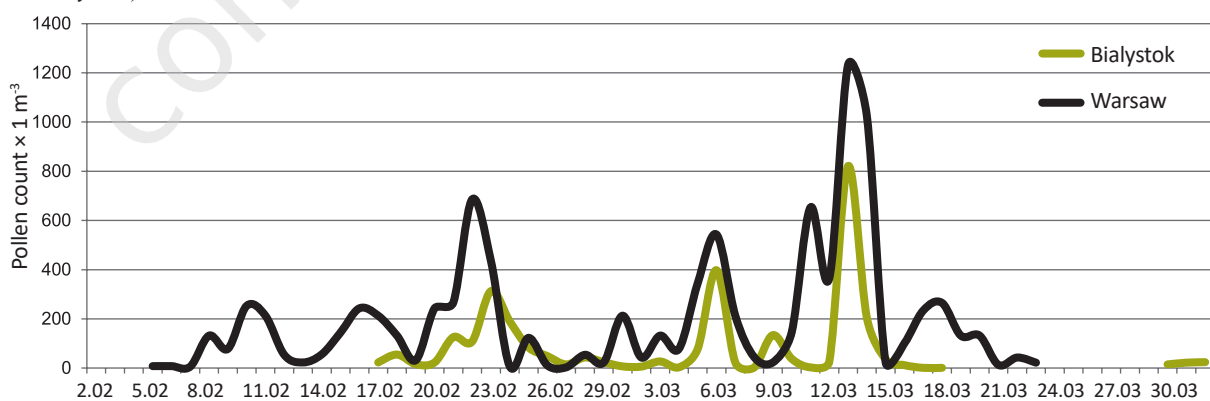


Figure 4. Alder pollen count in Warsaw and Bialystok* in 2016 (*from 17th to 29th March there are no pollen data in Bialystok).



bunalski (41–43 days). Pollen concentration causing severe clinical symptoms (above 85 g/m³) was noted also in Piotrkow Trybunalski and Poznan (34 days). The comparison of alder pollen seasons in previous years revealed that in 2015 alder pollen concentrations in Szczecin were much lower than in 2016 [5]. In comparison to data from 2001–2005 [6] in northern Poland, in 2016 pollen concentration of alder was one of the highest in all analysed cities.

Conclusions

Alder pollen season in most cities was more than 50 days long and was characterized by very high total annual pollen (even to 14806 g/m³).

The start of alder pollen season in 2016 occurred in the beginning of February; in Szczecin as early as 3rd February and lasted to the end of March.

The highest alder pollen allergen hazard occurred in 2016 in Poznan and Piotrkow Trybunalski. The period with pollen counts exceeding the threshold

value ($\geq 45 \text{ g/m}^3$) lasted as long as 41 and 43 days. The lowest risk of allergy symptoms to alder pollen was observed in Warsaw and Szczecin: 33 and 34 days of exceeded threshold count.

The updating of pollen calendars and accurate pollen announcements are important for efficient prophylaxis and treatment of pollen allergies.

References:

1. Rapiejko P, Lipiec A, Wojdas A et al. Threshold pollen concentration necessary to evoke allergic symptoms. *Int Rev Allergol Clin* 2004, 10 (3): 91-93.
2. APG II system. An update of the Angiosperm Phylogeny Group Classification for the Orders and Families of Flowering Plants: APG II. *Bot J Linn Soc* 2003, 141(4): 135-149.
3. Zajac A, Zajac M. (ed). *Distribution Atlas of Vascular Plant of Poland. Pracownia Chorologii Komputerowej, Instytut Botaniki UJ, Cracow* 2001.
4. Nilsson S, Persson S. Tree pollen spectra in the Stockholm region (Sweden) 1973-1980. *Grana* 1991, 20: 179-182.

5. Lipiec A, Puc M, Rapiejko P et al. Alder pollen in the air of selected Polish cities in 2015. *Alergoprofil* 2015, 11(2): 45-52.

6. Weryszko-Chmielewska E (ed). *Pylek roślin w aeroplanktonie różnych regionów Polski. Katedra i Zakład Farmakognozji, Wydział Farmaceutyczny Akademii Medycznej, Lublin* 2006.

Authors' contributions: Puc M: 50%; Lipiec A: 10%; Stacewicz A: 10%; Rapiejko P: 6%; and other Authors: 4% each.

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

Financial support: Research in Białystok, Bydgoszcz, Drawsko Pomorskie, Olsztyn, Piotrków Trybunalski and Warsaw funded by Allergen Research Center Ltd. (Ośrodek Badania Alergenów Środowiskowych Sp. z o.o.).

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

Corresponding author:

Małgorzata Puc, MD, PhD, Ass. Prof.

Department of Botany and Nature Conservation,
Faculty of Biology, University of Szczecin
71-412 Szczecin, ul. Zygmunta Felczaka 3c
e-mail: mapuc@univ.szczecin.pl