

# *Alternaria* spores in the air of selected Polish cities in 2015

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**Abstract:** The aim of the study was to compare the concentration of *Alternaria* spores in the cities of Poznan, Bydgoszcz, Sosnowiec, Piotrkow Trybunalski, Olsztyn, Opole, Warsaw, Zielona Gora, Lublin and Szczecin in 2015. Measurements were performed by the volumetric method (Hirst). *Alternaria* season was defined as the period in which 90% of the annual total catch occurred. The *Alternaria* season started first in Bydgoszcz on the 27<sup>th</sup> May and in the other cities it started during the next four weeks. The highest airborne concentration of 900 *Alternaria* spores × m<sup>-3</sup> was noted in Lublin on the 4<sup>th</sup> July.

**Key words:** aeroallergens, spores, mould, *Alternaria*, 2015

## Introduction

*Alternaria* genus are known as plant pathogens and allergens in humans occurring in all climatic zones. About 300 species have been described and their taxonomic status is being the key to relevant changes based on nucleotide sequence data. Fungi of the genus *Alternaria* colonize the superficial layers of the soil and dying vegetation. Members of the genus tolerate a wide range of temperatures, but the most abundant spore production are observed at 22 to 28°C, while growth and development hardly occurs at sub 0°C temperatures [1].

*Alternaria* are commonly found in the atmosphere. *Alternaria* spores are classified as the so-called

dry spores, since they are released during warm and dry weather.

Spores of *Alternaria* characterized by strong allergenic features [2]. It has been estimated that 12 to 42% of atopic people are mould sensitive and about 70% of patients respond to the presence of *Alternaria* spores in air samples. Airborne fungal spores have been implicated as causative factors in respiratory allergy, particularly asthma and rhinoconjunctivitis mainly in pediatric population with a significantly high sensitization [3]. In addition to that, *Alternaria* can produce mycotoxins and around other 70 toxic secondary metabolites [4], some of them of a carcinogenic power. Therefore sensitivity to *Alternaria* has been

increasingly recognized as a risk factor for the development of asthma [5]. The frequency of positive skin prick tests varied from country to country. In US 12.9% positive skin prick tests were reported, approximately 3% of the Portuguese population suffered from allergy to *Alternaria* and *Cladosporium*, while in Spain 20%. The intensity of allergic reaction of patients to the presence of *Alternaria* spores in the air samples depends on the concentration of spores in the air. Subjects with hypersensitivity to *Alternaria* allergens experienced symptoms during exposure to the concentration of approximately 80 spores in 1 m<sup>3</sup> of air [6] whereas Gravesen [7] published a threshold value 20 spores higher. The dominant symptom occurring in sensitized to fungal allergens was loss of nasal patency. At higher concentrations repeated coughing.

The aim of the presented research was to compare the concentrations spores of *Alternaria* in 2015 in Poznan, Bydgoszcz, Sosnowiec, Piotrkow Trybunalski, Olsztyn, Opole, Warsaw, Zielona Gora, Lublin and Szczecin.

**Material and methods**

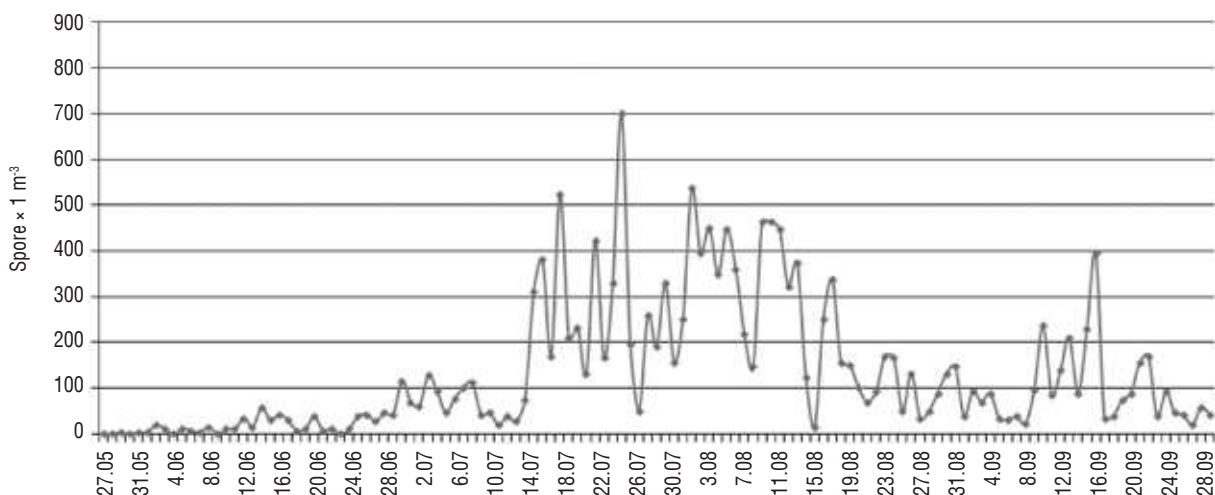
The analysis of the concentration spores of the genus *Alternaria* was performed on the basis of data collected of the selected cities in 2015. The study was carried out using a volumetric method (Hirst) and spores were counted under a light microscope (× 400).

The spores data were analysed to determine the start and duration of the season using the 90% method. The start of season was defined as the date when 5% of

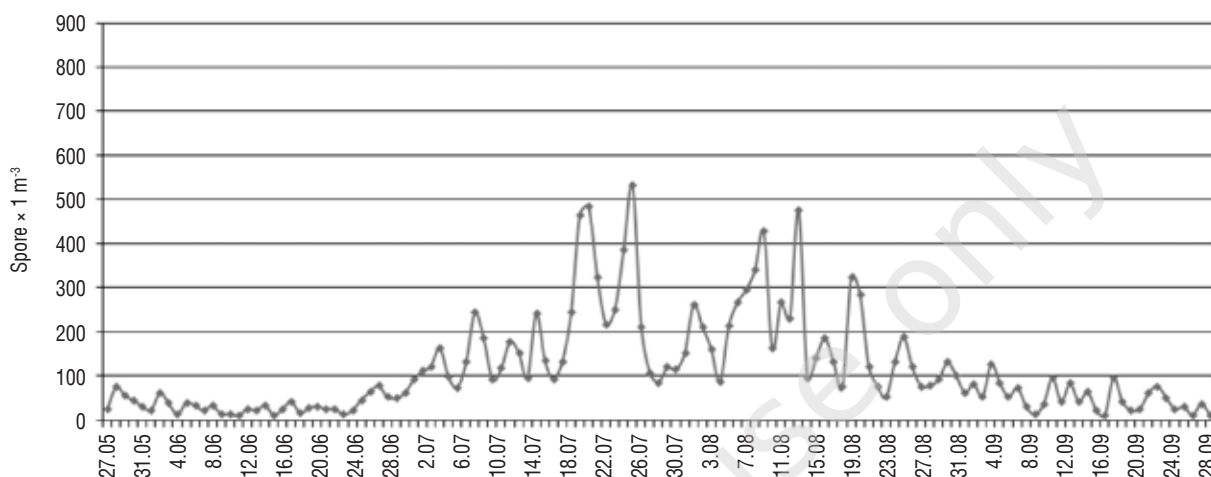
**Table 1.** Spore season for *Alternaria* in selected Polish cities.

City	Start of season	The day of maximum spores concentration	The number of days with spores count above 80 spores in 1 m <sup>3</sup> threshold of spores count at which allergy symptoms develop
Poznan	29.06	25.07	66
Bydgoszcz	27.05	26.07	62
Sosnowiec	1.07	23.07	28
Piotrkow Trybunalski	3.06	22.07	71
Olsztyn	2.07	24.07	33
Opole	31.05	30.07	66
Warsaw	4.06	1.07	78
Zielona Gora	3.06	30.07	76
Lublin	14.06	4.07	63
Szczecin	30.06	13.08	28

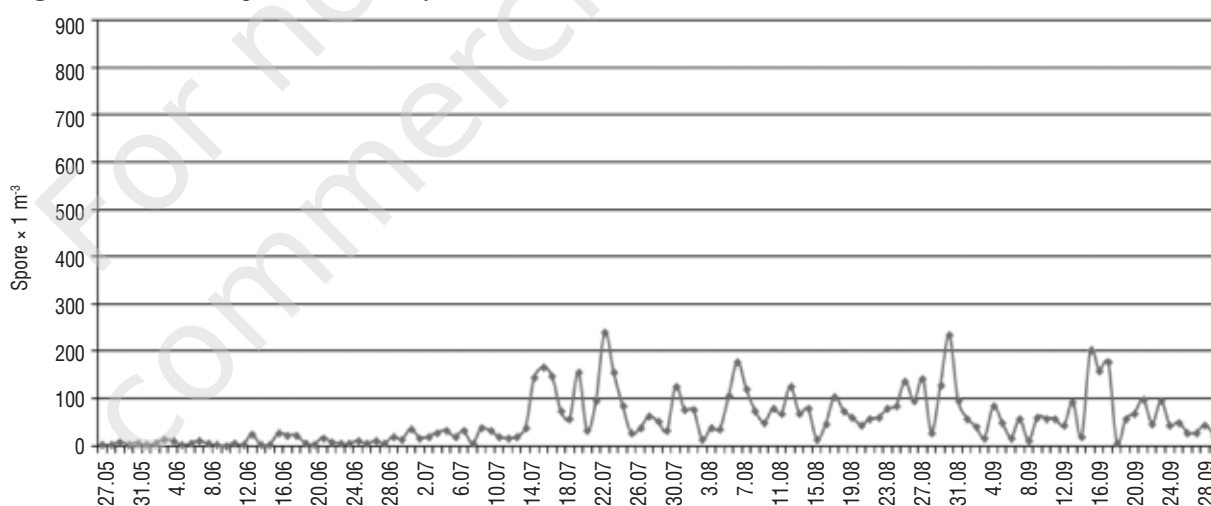
**Figure 1.** *Alternaria* spores in the air of Poznan in 2015.



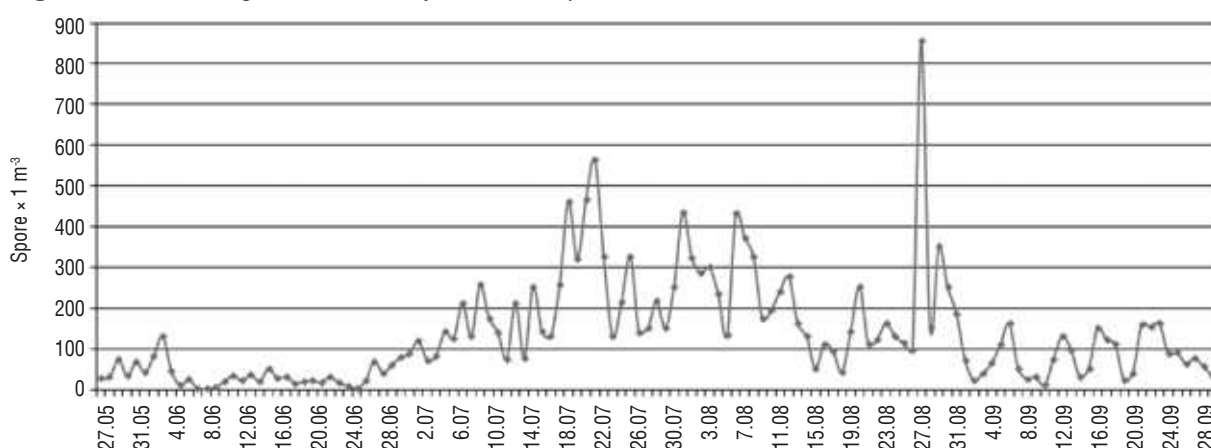
**Figure 2.** *Alternaria* spores in the air of Bydgoszcz in 2015.



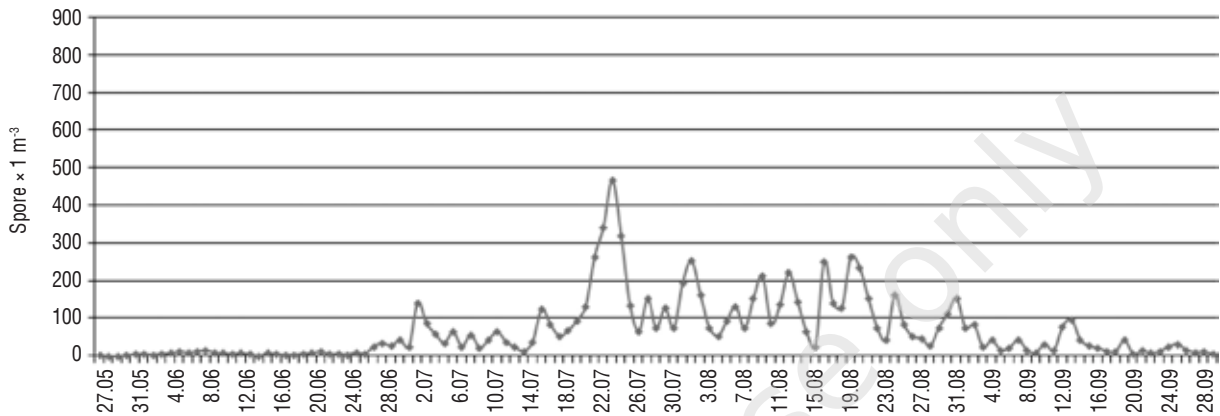
**Figure 3.** *Alternaria* spores in the air of Sosnowiec in 2015.



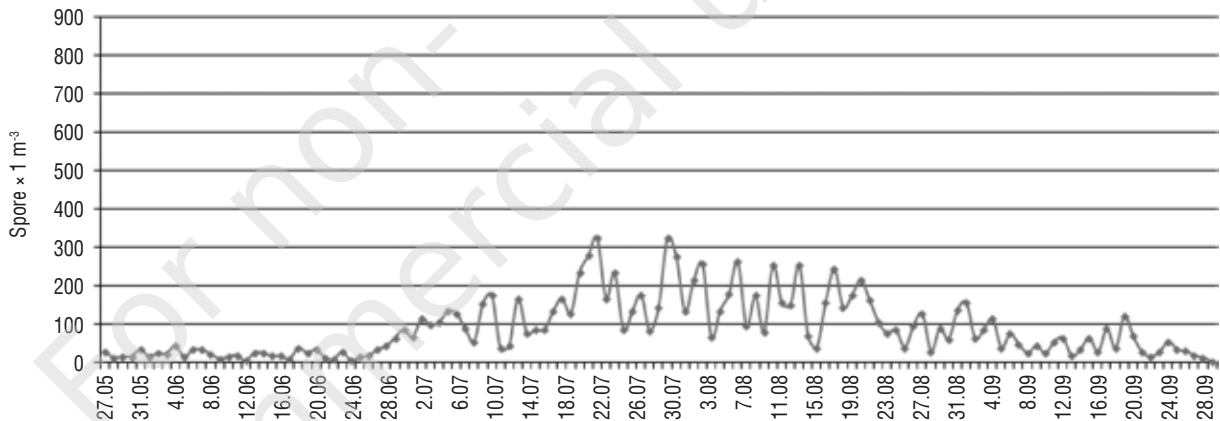
**Figure 4.** *Alternaria* spores in the air of Piotrkow Trybunalski in 2015.



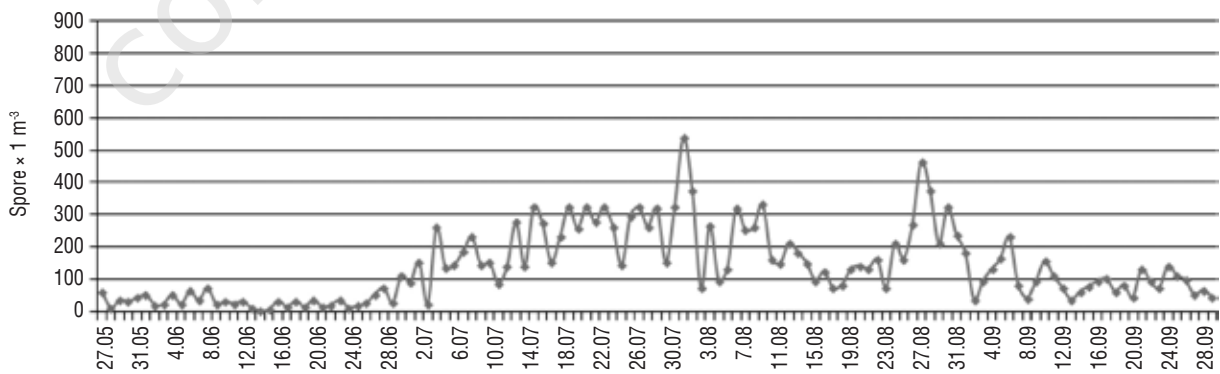
**Figure 5.** *Alternaria* spores in the air of Olsztyn in 2015.



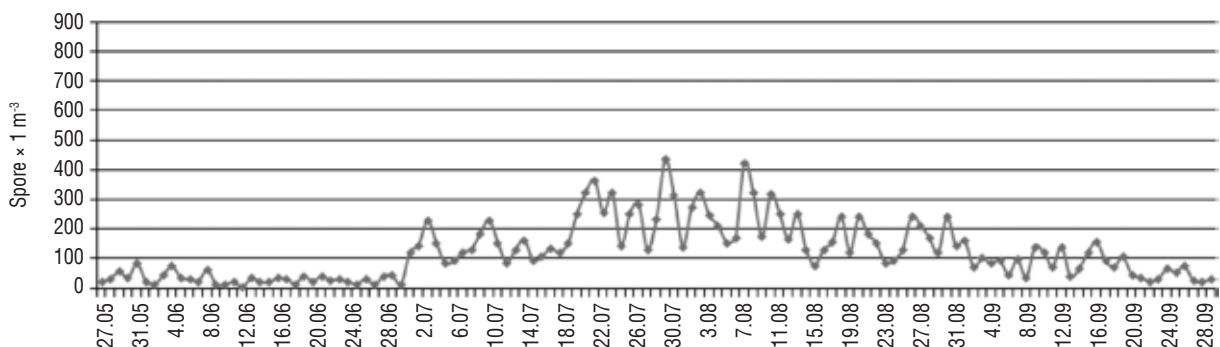
**Figure 6.** *Alternaria* spores in the air of Opole in 2015.



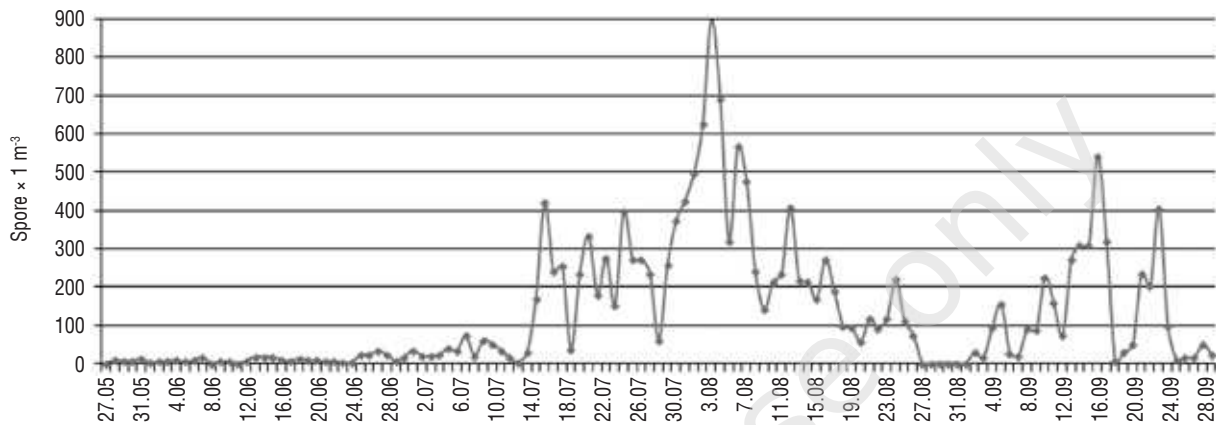
**Figure 7.** *Alternaria* spores in the air of Warsaw in 2015.



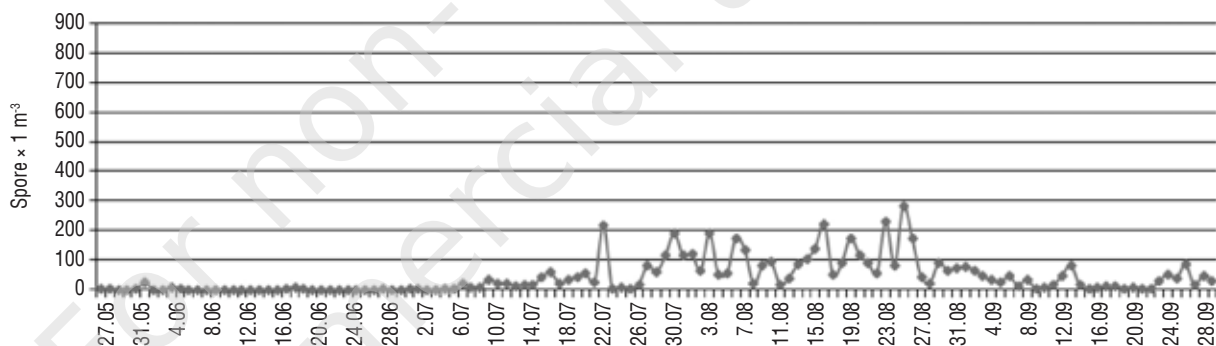
**Figure 8.** *Alternaria* spores in the air of Zielona Gora in 2015.



**Figure 9.** *Alternaria* spores in the air of Lublin in 2015.



**Figure 10.** *Alternaria* spores in the air of Szczecin in 2015.



the seasonal cumulative spore count was trapped. Moreover, in the analysis also determined the number of days with spores count above 80 spores in 1 m<sup>3</sup> threshold of spores count at which allergy symptoms develop.

### Results

Appointed by 90% sporulation season *Alternaria* in 2015 began at the earliest in Bydgoszcz (second half of May), and most measuring points between 3<sup>rd</sup> June (Zielona Gora) and 29<sup>th</sup> June (Poznan). Limit concentration of 80 spores per 1 m<sup>3</sup> air occurred early in Poznan and Warsaw (30<sup>th</sup> June) and in a few days intervals at the other measuring points (tab. 1).

### References

- Hjelmroos M. Relationship between airborne fungal spore presence and weather variables: *Cladosporium* and *Alternaria*. *Grana* 1993, 32: 40-47.
- Pringle A. Asthma and the Diversity of Fungal Spores in Air. *PLoS Pathog* 2013, 9(6): e1003371.
- Busch RK, Prochnau JJ. *Alternaria*-induced asthma. *J Allergy Clin Immunol* 2004, 113(2): 227-234.

- López P, Venema D, de Rijk T et al. Occurrence of *Alternaria* toxins in food products in The Netherlands. *Food Control* 2016, 60: 196-204.
- Cramer R, Weichel M, Flückiger S. et al. *Fungal Allergies: a yet unsolved problem* 2005, 12-13.
- Rapiejko P, Stankiewicz W, Szczygielski K, Jurkiewicz D. Progowe stężenie pyłku roślin niezbędne do wywołania objawów alergicznych. *Otolaryngol Pol* 2007, 61(4): 591-594.
- Gravesen S. *Fungi as a cause of allergic disease*. *Allergy* 1979, 34: 135-154.

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