The oak pollen concentration in the air of selected cities in Poland in 2018

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Abstract: This paper contains an analysis of oak pollen seasons in selected cities of Poland in 2018. Sampling sites were located in the following cities: Białystok, Bydgoszcz, Cracow, Drawsko Pomorskie, Lublin, Olsztyn, Opole, Piotrkow Trybunalski, Sosnowiec, Szczecin, Warsaw, Wroclaw and Zielona Gora.

The volumetric method was applied using the Burkard or Lanzoni trap. The pollen season was determined by the 98% method. The season started earliest in Sosnowiec (April 14th). The mean duration of the pollen season was 33 days. The highest pollen concentration (713 P/m³) was observed in Wroclaw (April 19th). The peak values were recorded between April 19th and May 1st in the different cities.

Key words: aeroallergens, pollen concentration, oak (Quercus), 2018

The oak (Quercus) genus belongs to the family Fagaceae and it comprises about 600 species that are found almost exclusively in the Northern Hemisphere [1]. In Poland only 3 species grow in the wild: pedunculate oak (Quercus robur L.), sessile oak (Quercus petraea [Matt.] Liebl.), and pubescent oak (Quercus pubescens Willd.), as well as a hybrid of the former two species (Quercus × roseaæ Bechst.) [1, 2]. Due to their longevity, up to 1000 years and more, Q. robur and Q. petrea often constitute the core of forest stands. Ornamental varieties of the above mentioned species, with various leaf forms and colors, are also used in park planting. The northern red oak (Q. rubra L.) is the most frequently planted species of foreign origin (from Northern America); it grows faster than other oaks and is very resistant to frost...
and air pollution [1]. In total, about 40 oak species are
grown in Poland, among which the most important
ones are mentioned above [2, 3].

Oak pollen grains are among 12 most allergenic
pollen types [4]. Rapiejko [5] reports that for most sensi-
titized patients, clinical symptoms are visible during
exposure to a concentration of ca. 80 oak pollen grains
in 1 m³ of air.

According to Burge [6], in the case of Quercus
pollen grains the threshold value is a concentration of
16 pollen grains in 1 m³ of air, at which clinical symp-
toms occur in many sensitized patients exposed to this
concentration, while for most sensitized patients clinical
symptoms are visible during exposure to a concentra-
tion of 91 pollen grains in 1 m³ of air.

Aim

The aim of the study was to compare the oak
pollen season in 13 monitoring sites in Poland: Białystok, Bydgoszcz, Cracow, Dzawski Pomorskie, Lublin,
Olsztyn, Opole, Piotrkow Trybunalski, Sosnowiec,
Szczecin, Warsaw, Wroclaw and Zielona Gora.

Material and method

Measurement of the concentration of oak pollen
grains in atmospheric air was performed by the volumet-
ric method using Burkard or Lanzoni pollen sam-
plers. 24-hour periods were analyzed in microscopic
slides. The pollen season duration was determined by
the 98% method. Pollen season start and end dates,
pollen grains sum during the season expressed by the
SPI (Seasonal Pollen Index), maximum pollen con-
centration, peak date and number of days with the oak
pollen concentration exceeding the threshold value at
which the consecutive allergy symptoms develop (ac-
cording to Burge) [6] were determined.

Results and discussion

In 2018 the oak pollen season started in the
studied cities between April 12th and April 21st,
earliest in Sosnowiec (tab. 1). In 6 cities, the onset of the season
occurred 6–16 days later than in 2017, while in 5 cities at
dates similar to those in the previous year [7]. The
average duration of the oak pollen season at the inves-
tigated monitoring sites was 33 days in 2018 (tab. 1),
while in 2017 it was 44 days [7]. In 2018 the end of the
oak pollen season occurred between May 13th
and May 26th. The highest seasonal pollen count (SPI) for
oak was recorded in Lublin, followed by Wroclaw
(tab. 1). The next values of this parameter, very similar,
were observed in Warsaw and Piotrkow Trybunalski,
followed by Opole, Zielona Gora and Olsztyn. The
least oak pollen was observed in Białystok (tab. 1). The
average SPI in 2018 was 1816 pollen grains, whereas
in 2017 it was 1363 [7].

The pattern of oak pollen seasons in the individ-
ual cities is illustrated by curves characterized by the
presence of several peaks, which indicates that flow-
ering and pollen shed of different oak taxa occurred
at different times (figs 1–6). Because flowering of the
most frequently found oak species in Poland, the pe-
dunculate oak, occurs about 2 weeks earlier than that
of the sessile oak [3, 8], in the graphs this corresponds
to the first peak, which is most often higher than the
next peaks (figs 2, 3, 5, 6). The multiple peak curves

Table 1. Characteristics of oak pollen season in 2018.

<table>
<thead>
<tr>
<th>Features of pollen season</th>
<th>Białystok</th>
<th>Bydgoszcz</th>
<th>Cracow</th>
<th>Drawsko Pomorskie</th>
<th>Lublin</th>
<th>Olsztyn</th>
<th>Opole</th>
<th>Piotrkow Trybunalski</th>
<th>Sosnowiec</th>
<th>Szczecin</th>
<th>Warsaw</th>
<th>Wroclaw</th>
<th>Zielona Gora</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of pollen season (number of days)</td>
<td>14.04–22.05</td>
<td>16.04–16.05</td>
<td>18.04–14.05</td>
<td>19.04–22.05</td>
<td>20.04–17.05</td>
<td>17.04–18.05</td>
<td>16.04–26.05</td>
<td>19.04–19.05</td>
<td>12.04–20.05</td>
<td>17.04–18.05</td>
<td>21.04–19.05</td>
<td>15.04–13.05</td>
<td>15.04–19.05</td>
</tr>
<tr>
<td>Seasonal Pollen Index</td>
<td>285</td>
<td>1674</td>
<td>1794</td>
<td>1673</td>
<td>4488</td>
<td>2137</td>
<td>2181</td>
<td>2865</td>
<td>930</td>
<td>1359</td>
<td>2728</td>
<td>3808</td>
<td>2120</td>
</tr>
<tr>
<td>Peak pollen concentration and peak date</td>
<td>44</td>
<td>275</td>
<td>396</td>
<td>243</td>
<td>581</td>
<td>275</td>
<td>354</td>
<td>287</td>
<td>207</td>
<td>197</td>
<td>378</td>
<td>713</td>
<td>342</td>
</tr>
<tr>
<td>Days ≥ 16 Pm*** [4]</td>
<td>4</td>
<td>7</td>
<td>10</td>
<td>13</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>6</td>
<td>12</td>
<td>14</td>
<td>8</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>Days ≥ 91 Pm*** [4]</td>
<td>0</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>14</td>
<td>9</td>
<td>8</td>
<td>14</td>
<td>3</td>
<td>5</td>
<td>12</td>
<td>9</td>
<td>8</td>
</tr>
</tbody>
</table>

* Symptoms present in many patients.
** Symptoms present in most patients.
Figure 1. Oak pollen count in Białystok and Szczecin in 2018.

Figure 2. Oak pollen count in Bydgoszcz and Drawsko Pomorskie in 2018.

Figure 3. Oak pollen count in Cracow and Lublin in 2018.
Figure 4. Oak pollen count in Olsztyn and Piotrkow Trybunalski in 2018.

Figure 5. Oak pollen count in Sosnowiec, Opole and Wroclaw in 2018.

Figure 6. Oak pollen count in Warsaw and Zielona Gora in 2018.
illustrating the pattern of oak pollen seasons in some cities (Lublin, Szczecin, Warsaw) confirm the occurrence of several oak species in urban green spaces and at the outskirts of the cities, as reported by Puc et al. [7] for Szczecin, as well as by Adamiec and Trzaskowska [9] for Lublin.

The highest daily pollen count of Quercus was recorded in 2018 on April 19th in Wroclaw, followed by Lublin on April 22nd, while the lowest value of this trait was found in Bialystok on May 1st (tab. 1).

The highest Quercus pollen risk (above 91 P/m³/24 h) occurred in Lublin and Piotrkow Trybunalski (14 days) as well as in Warsaw (12 days). In the other cities this value was 0–9 days (tab. 1). For most of the cities these are higher values than those recorded in 2017 [7].

Conclusions
1. In 2018 the oak pollen season started in the second 10 days of April in most of the cities. The pollen season duration at the investigated monitoring sites was 27–41 days (on average 33 days).
2. In 2018 the average seasonal oak pollen count (SPI) for the investigated monitoring sites was 1816 pollen grains and was higher than the average in 2017. The highest SPI and peak value were found in Lublin and Wroclaw.
3. The highest oak pollen allergen risk occurred in Lublin, Piotrkow Trybunalski and Warsaw.

References

Authors’ contributions:
Sulborska A: 30%; Weryszko-Chmielewska E: 5%; Piotrowska-Weryszko K: 5%; and other Authors: 3.1% each.

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

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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