Oak pollen season in selected cities in Poland in 2022

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Abstract:

Oak (Quercus sp.) is a common species in Poland. Que a 1, which triggers allergic reactions in spring, is the main oak allergen. The aim of the study was to compare the oak pollen season in 13 Polish cities in 2022. Pollen was monitored with the volumetric method. The analyses determined the annual sum of pollen grains, the length of the pollen season (using the 98% method), the highest peak pollen concentrations, the dates of maximum pollen concentrations, and the number of days with pollen concentrations above threshold values causing clinical allergy symptoms. The earliest onset of the oak pollen season was noted in Szczecin (April 11th), and the latest beginning was recorded in Lublin and Kielce (May 5th). The shortest and the longest pollen seasons were recorded in Cracow (22 days) and in Szczecin (48 days), respectively. The highest total daily concentration of pollen grains was recorded in Opole (5083) and the lowest value was noted in Bialystok (112) and Szczecin (328). The highest maximum concentration of oak pollen was recorded in Sosnowiec and Kielce (625 and 543 grains/m³, respectively), whereas the lowest values were noted in Bialystok and Szczecin (27 and 47 grains/m³, respectively). In most of the analyzed cities in Poland, the peak oak pollen release was recorded between May 7th and 12th. The highest risk of allergic reactions caused by oak pollen allergens was reported from Opole, Piotrkow Trybunalski, and Zielona Gora.

Key words: oak (Quercus), allergens, pollen season, 2022

Introduction

The oak (Quercus sp.) represents the family Fagaceae and the order Fagales [1]. In addition to birch, alder, and hazel, it is a common source of environmental allergens triggering allergic reactions.

The genus Quercus is the largest genus in the family Fagaceae comprising up to 600 species. Due to the large number of species and morphological diversity, the taxonomy of Quercus is extremely complex [2]. The genus Quercus is characterized by a wide ge-
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Material and method

The concentration of pollen grains in the selected Polish cities was determined with the volumetric method using Lanzoni and Burkard devices. The amount of pollen grains in the air was monitored on a weekly basis and analyzed for 24-h periods. The concentration of pollen grains was expressed in 1 m³ of air. The following parameters were determined and analyzed in the study:
1. the annual sum of pollen grains
2. the length of the pollen season determined with the 98% method, which assumes that days with 1% and 99% of the annual sum of pollen grains indicated the beginning and end of the pollen season, respectively [13]
3. the highest peak pollen concentrations and the dates of maximum pollen concentrations
4. the number of days with threshold values triggering clinical allergy symptoms.

As shown by literature data, the first symptoms of allergy in subjects sensitive to oak pollen allergens may appear when the pollen concentration in 1 m³ of air is ≥ 16. In turn, the concentration of ≥ 91 oak pollen grains/m³ of air causes allergy symptoms in a majority of sensitive subjects [14].

Results

The oak pollen season in 2022 in most of the analyzed Polish cities began between April 11th and 30th and lasted until the third decade of May. The earliest onset of the pollen season was noted in Szczecin (April 11th) and Sosnowiec (April 13th). In turn, the latest beginning of the pollen season was recorded in Warsaw (May 3rd) and in Lublin and Kielce (May 5th). The earliest end of the pollen season was recorded on May 20th in Cracow and Zielona Gora, whereas the latest end was noted in Olsztyn (June 1st). The shortest period of oak pollen release was found in Cracow (22 days), Kielce (23 days), and Lublin (24 days), while Szczecin (48 days) and Sosnowiec (44 days) were characterized by the longest pollen release period. Since no data on pollen were available from two days in Wroclaw, the exact date of the pollen season end was not determined. The great similarity in the course of the pollen season between Wroclaw and Zielona Gora may suggest that the pollen season in Wroclaw ended around May 20th as well (tab. 1; fig. 1–7).

The lowest annual pollen grains sum was recorded in Białystok (112) and Szczecin (328). In turn, the highest number of pollen grains was recorded in the atmospheric air of Opole and Zielona Gora, respectively 5083 and 3240. The annual sum of pollen grains in the other Polish cities, i.e. in Olsztyn, Lublin, Cracow, Bydgoszcz, Sosnowiec, Warsaw, Kielce, Piotrkow Trybunalski, and Wroclaw, ranged from 1222 to 2944 (tab. 1; fig. 1–7).

The highest maximum concentration of pollen grains was recorded in Sosnowiec (625 grains/m³), Kielce (543 grains/m³), and Opole (453 grains/m³). The lowest peak values were recorded in Białystok (27 grains/m³) and Szczecin (47 grains/m³). The maximum pollen concentration values recorded in the other measurement stations ranged from 156 grains/m³ in Olsztyn to 418 grains/m³ in Wroclaw. The earliest
and latest pollen release peaks were observed on April 27th in Opole and on May 15th in Olsztyn, respectively. The maximum concentration of pollen grains in the other Polish cities was recorded between May 7th and 12th (tab. 1; fig. 1–7).

In most of the analyzed measurement stations, the number of days with threshold values ≥ 16 grains/m³ was within the range of 16–25. Only in Białystok and Szczecin, there were 1 and 5 days, respectively, on which the first symptoms of allergy may have appeared in allergic subjects. Additionally, there were no days with a pollen concentration ≥ 91 grains/m³ in Szczecin and Białystok. Olsztyn, Lublin, Sosnowiec, and Bydgoszcz were characterized by 3, 5, 6, and 7 such days, respectively. The highest number of days (19) with pollen grain concentrations above the latter threshold value was recorded in Opole. In turn, from 9 to 12 days with the concentration triggering symptoms in the majority of allergic subjects were recorded in the other 6 cities (tab. 1).

Discussion

In the cities of Poland analyzed in 2022, oaks released pollen with varying intensity. With the exception of Lublin, Kielce, and Warsaw, the onset of the pollen season was recorded in the second and third decade of April, likewise in previous years [4, 15].

In comparison with 2020, the oak pollen season in 2022 began 3 and 8 days earlier in Piotrków Trybunalski, Sosnowiec, and Białystok, respectively, and 7–10 days later in Wrocław, Olsztyn, Opole, Cracow, Lublin, and Warsaw. The shortest (only 1-day) and the longest (13-day) shifts in the onset of the oak pollen season were noted in Bydgoszcz and Szczecin, respectively [4]. In Kielce, the onset of the oak pollen season in 2022 was comparable to that in 2021 [9].

In 2022, the average length of the oak pollen season in the analyzed Polish cities was 32 days, as in 2018–2019 [7, 15]. The longest oak pollen season was recorded in Szczecin (48 days) and Sosnowiec (44 days), similar to 2019 (46 and 41 days, respectively) [7]. In 2022, the shortest oak pollen season was noted in Cracow, Kielce, and Lublin (22–24 days), and it was the shortest pollen period compared to 2018–2020 [4, 7, 15]. In most of the analyzed cities, the oak pollen season in 2022 ended in the third decade of May, i.e. later than in 2018–2019 [7, 15]. In 2022, the latest end of the pollen season was recorded in Olsztyn, similar to that in 2020 [4].

In 2022, the average annual sum of oak pollen grains in the 13 Polish cities was 2145. It was the

<table>
<thead>
<tr>
<th>Site</th>
<th>Duration of pollen season (number of days)</th>
<th>Peak value (pollen/m³)</th>
<th>Peak date</th>
<th>Number of days with concentration above threshold</th>
<th>Annual pollen sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Białystok</td>
<td>15.04–26.05 (42)</td>
<td>27</td>
<td>12.05</td>
<td>Days ≥ 16 (pollen/m³) 1 Days ≥ 91 (pollen/m³) 0</td>
<td>112</td>
</tr>
<tr>
<td>Bydgoszcz</td>
<td>25.04–28.05 (34)</td>
<td>269</td>
<td>11.05</td>
<td>24 Days ≥ 16 (pollen/m³) 7 Days ≥ 91 (pollen/m³)</td>
<td>2098</td>
</tr>
<tr>
<td>Cracow</td>
<td>29.04–20.05 (22)</td>
<td>276</td>
<td>11.05</td>
<td>16 Days ≥ 16 (pollen/m³) 9 Days ≥ 91 (pollen/m³)</td>
<td>1971</td>
</tr>
<tr>
<td>Kielce</td>
<td>5.05–27.05 (23)</td>
<td>543</td>
<td>11.05</td>
<td>18 Days ≥ 16 (pollen/m³) 9 Days ≥ 91 (pollen/m³)</td>
<td>2426</td>
</tr>
<tr>
<td>Lublin</td>
<td>5.05–28.05 (24)</td>
<td>262</td>
<td>12.05</td>
<td>17 Days ≥ 16 (pollen/m³) 5 Days ≥ 91 (pollen/m³)</td>
<td>1376</td>
</tr>
<tr>
<td>Sosnowiec</td>
<td>30.04–1.06 (33)</td>
<td>156</td>
<td>15.05</td>
<td>18 Days ≥ 16 (pollen/m³) 3 Days ≥ 91 (pollen/m³)</td>
<td>1222</td>
</tr>
<tr>
<td>Opolo</td>
<td>23.04–23.05 (31)</td>
<td>453</td>
<td>27.04</td>
<td>25 Days ≥ 16 (pollen/m³) 19 Days ≥ 91 (pollen/m³)</td>
<td>5083</td>
</tr>
<tr>
<td>Piotrków Trybunalski</td>
<td>21.04–24.05 (34)</td>
<td>276</td>
<td>12.05</td>
<td>23 Days ≥ 16 (pollen/m³) 10 Days ≥ 91 (pollen/m³)</td>
<td>2436</td>
</tr>
<tr>
<td>Warsaw</td>
<td>13.04–26.05 (44)</td>
<td>625</td>
<td>12.05</td>
<td>23 Days ≥ 16 (pollen/m³) 6 Days ≥ 91 (pollen/m³)</td>
<td>2256</td>
</tr>
<tr>
<td>Zielona Gora</td>
<td>11.04–28.05 (48)</td>
<td>48</td>
<td>12.05</td>
<td>5 Days ≥ 16 (pollen/m³) 0 Days ≥ 91 (pollen/m³)</td>
<td>328</td>
</tr>
<tr>
<td>Warsaw</td>
<td>3.05–29.05 (27)</td>
<td>399</td>
<td>11.05</td>
<td>17 Days ≥ 16 (pollen/m³) 9 Days ≥ 91 (pollen/m³)</td>
<td>2393</td>
</tr>
<tr>
<td>Zielona Gora</td>
<td>23.04–20.05 (28)</td>
<td>368</td>
<td>7.05</td>
<td>21 Days ≥ 16 (pollen/m³) 10 Days ≥ 91 (pollen/m³)</td>
<td>2944</td>
</tr>
</tbody>
</table>

* No data from May 14th and 15th (no electricity).
Figure 1. Oak pollen concentration in Lublin and Piotrkow Trybunalski in 2022.

Figure 2. Oak pollen concentration in Bialystok and Szczecin in 2022.

Figure 3. Oak pollen concentration in Wroclaw and Zielona Gora in 2022.
Figure 4. Oak pollen concentration in Bydgoszcz and Cracow in 2022.

Figure 5. Oak pollen concentration in Warsaw and Kielce in 2022.

Figure 6. Oak pollen concentration in Sosnowiec and Olsztyn in 2022.
The course of the oak pollen season presented in the graphs indicates a large variability of pollen release recorded in the analyzed measurement stations. The curves reveal the presence of several pollen peaks, which was possibly related to the different terms of different oak species flowering. The greatest similarity in the course of the oak pollen season was observed between Cracow and Bydgoszcz and between Wroclaw and Zielona Gora.

In 2022, the highest concentration of oak pollen grains was recorded in Sosnowiec, characterized by a relatively long pollen season of the plant. This concentration was almost twice as high as the average value calculated for the 13 measurement stations. The lowest peak concentration of oak pollen grains was recorded in Bialystok, similar to that shown in previous years [4, 7, 15]. In 2022, the highest oak pollen concentration was recorded on May 11th and 12th in 9 of the analyzed Polish cities. The dates of the maximum pollen concentrations in 2022 and 2020 coincided in Bydgoszcz and Warsaw, and only a one-day shift was observed in Piotrkow Trybunalski and Sosnowiec [4].

In 2022, the oak pollen season began at the earliest in Szczecin, and at the latest in Lublin and Kielce. The shortest oak pollen season was recorded in Cracow, and the longest in Szczecin.

The highest annual sum of daily concentrations of oak pollen grains was recorded in Opole, and the lowest values of the parameter were noted in Bialystok and Szczecin.

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In most of the analyzed cities in Poland, the maximum oak pollen concentration was recorded between May 7th and 12th. The highest peak concentration was almost 3-fold higher in Cracow, over 4-fold higher in Sosnowiec, and over 2-fold lower in Lublin [4]. In Kielce, the maximum concentration of pollen grains in 2022 was over 2-fold higher than in 2021 [9]. In 2022, the maximum concentration of pollen grains in Kielce and Lublin was observed already on days 6 and 7 days after the onset of the oak pollen season.

In the 2022 pollen season, the highest risk of symptoms of allergic reactions induced by oak allergens was determined in Opole, Piotrkow Trybunalski, Zielona Gora, Wroclaw, and Bydgoszcz. In most of the analyzed cities, the number of days with an exceeded threshold value of 91 grains/m³ generating allergy symptoms in the majority of allergic subjects was higher than in 2020. The highest number of days with a pollen concentration above the threshold values was observed in Opole, as in 2020. In turn, the risk of oak pollen-induced allergy in Lublin was lower than in 2020 [4].

Conclusion

In 2022, the oak pollen season began at the earliest in Szczecin, and at the latest in Lublin and Kielce. The shortest oak pollen season was recorded in Cracow, and the longest in Szczecin.

The highest annual sum of daily concentrations of oak pollen grains was recorded in Opole, and the lowest values of the parameter were noted in Bialystok and Szczecin.

In most of the analyzed cities in Poland, the maximum oak pollen concentration was recorded between May 7th and 12th. The highest peak concentra-
tions were recorded in Sosnowiec and Kielce, and the lowest values were noted in Białystok and Szczecin.

The highest risk of allergy symptoms triggered by oak pollen allergens was observed in Opole, Piotrkow Trybunalski, and Zielona Gora.

References


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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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