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A MODERN VIEW ON POLLINOSIS IN THE REPUBLIC OF BELARUS

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Abstract. *The article presents data on aeropallinological monitoring and the dust calendar in the Republic of Belarus, on the most common and new allergenic plant species growing in Belarus, and also provides an analysis of referrals with hay fever to the allergist of the 6th city hospital in Minsk.*

Keywords. *Pollinosis, hay fever, the dusting calendar, new plant species, pollen modification, allergy, aeropallinological monitoring.*

Introduction. Pollinosis or hay fever or allergic rhinoconjunctivitis is a chronic disease based on an inflammatory IgE-mediated allergic reaction caused by the entry of causally significant allergens into the nasal mucosa and conjunctiva. The disease is characterized by rhinorrhea, nasal congestion, sneezing attacks, itching in the nasal cavity and eyes, redness of the conjunctiva, decreased sense of smell [1]. The hay fever clinic is characterized by recurring seasonality, coinciding with the flowering period of certain plants. Out-of-season manifestations of pollinosis are also known when using cosmetics with allergenic plant components, herbal remedies, and when consuming honey, nuts, fruits, and vegetables.

In recent years, there has been a significant increase in allergic diseases around the world. Thus, pollinosis affects 23–30% of the population of Western Europe and 12–30% of the population USA [1]. According to the results of the phase III ISAAC study (International Study of Asthma and Allergy in Childhood, 2009), which included more than 1 million children aged 6–14 years from all regions of the globe, the average incidence of symptoms of allergic rhinoconjunctivitis in children is 13–14 years was 31,7% [1].

Risk factors contributing to the development of hay fever include a hereditary predisposition to atopy, the presence of occupational hazards, smoking, prolonged exposure to an unfavorable environmental environment, and frequent respiratory viral diseases. Thus, when assessing risk factors in adolescents of conscription age in Belarus suffering from pollinosis, hereditary predisposition was identified in 41.3%, the presence of occupational hazards in 19.2%, smoking in 13.2% [2].

Immunogenic mechanisms have a key role in the development of pollinosis [3, 4]. Along with this, it is important to modify and increase the allergenic properties of pollen under the influence of industrial pollutants.

Research results. In Belarus, monitoring of pollen and spores in aerosols for allergological purposes has been carried out since 1985. To date, there is a list of regional pollen allergens, a calendar of their presence in the air, an atlas of allergenic pollen, the dominant pollen allergens and their chemical composition have been established [5]. In practical terms, it should be noted that there are significant interannual differences in the pollen content in the air, which depend on the composition of the vegetation cover, the timing of pollination, plant productivity, quantitative dynamics and systematic diversity of the aeropalinospectrum. These circumstances determine the necessity of constant aerobiological monitoring.

The dusting calendar in the Republic of Belarus in 2023 is presented in figure 1. The first period of exacerbation of pollinosis is spring (April - May). During this period, woody plants release pollen. The most allergenic trees growing in the Republic of Belarus are alder (Alnus), hazel (Corylus), birch (Betula), hornbeam (Carpinus), oak (Quercus), willow (Salix), poplar (Populus), elm (Ulmus), ash (Fraxinus), maple (Acer). Linden (Tilia) dusts later than all other trees (in June).

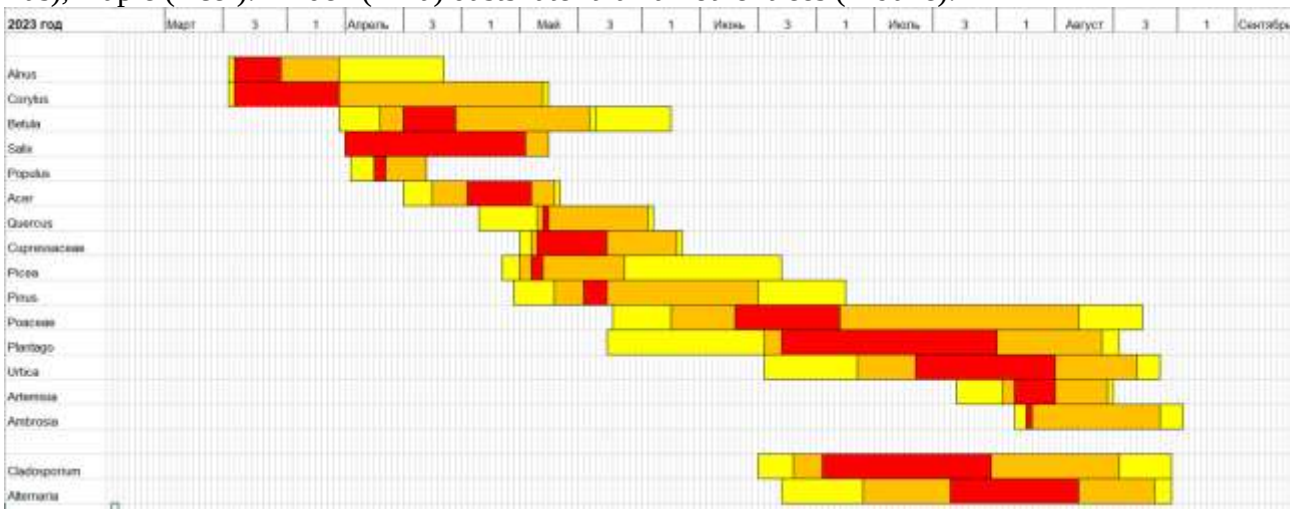

Figure 1 — Dust calendar in the Republic of Belarus in 2023

- the beginning of dusting;
- increase in dustiness;
- maximum dusting;
- dust fading;
- end of dusting.

During the **spring wave**, it is worth noting the species Ash-Leaf Maple (Acer negundo L.). The plant was first recorded on the territory of Belarus in the 1830s. In the second half of the 20th century, the species quickly became wild and is now very common throughout the country, with the maximum number recorded in the Minsk region. Ash-leaved maple is one of the most aggressive invasive plants in the flora of Belarus. Since 2011, it has been included in the list of species that pose a threat to biological diversity, as well as to the health of citizens, and its cultivation is prohibited. Ash-leaved maple pollen is a fairly strong allergen. During the spring flowering period, the wind carries pollen over long distances, and its presence in the air can cause hay fever in people.

Speaking about **the spring-summer pollen wave**, you need to pay special attention to pine pollen, which make up more than half of the spectrum and are in the air for quite a long time. Pollen does not have the same risk of developing hay fever, but has begun to attract the attention of allergists,

as are the types and varieties of pine that are widely used in green urban construction. They produce a large amount of large volatile pollen, which becomes allergotoxic due to the absorption of various pollutants on its surface (Figure 2). In addition, mountain pine (Pinus mugo), which is native to the Balkans and the Eastern Alps, is increasingly preferred in landscape design. Such introduced species are characterized by frequent deformation of pollen during its formation as a natural protective reaction of the plant to new environmental conditions, which certainly increases the degree of its allergenicity. This allergen is not included in the standard screening panel for determining allergen-specific IgE to respiratory allergens; however, according to some data [6], specific IgE to the allergens P. radiata or P. strobus was positive in 77% of patients; in addition, a high degree of cross-reactivity was observed between different types of pine pollen.

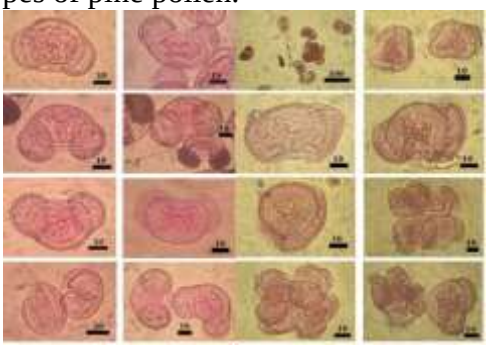

Figure 2 - Deformed pollen of *Pinus sylvestris* and *Pinus mugo*

Evergreen cypress (Cupressus sempervirens L.) is a member of the cypress family that can live 500-600 years, and begins to release pollen in winter, in January. Cypress pollen is a strong allergen that affects residents of the Mediterranean, where this plant comes from, and pallination of cypress and its relatives - juniper and thuja, with which cypress pollen shares the same allergens, can last for several months. Among 6,185 patients who had any allergy over a 36-month period, 20.7% of patients were sensitized to cypress pollen, and 46.4% had symptoms during the pollen season. Interestingly, allergen immunotherapy was effective in 57.9% of cases [7]. The prevalence of cypress allergy in the general European population ranges from 0.6 to 3% depending on the degree of pollen exposure. Depending on the geographic area and population studied, between 9 and 65% of Mediterranean outpatients consulted an allergist may have sensitization to cypress pollen. Repeated studies of patients in this geographic area have demonstrated a threefold increase in the percentage of cypress allergy in the Mediterranean region. In addition, due to global warming, cypress trees are taking root further north every year [8].

According to a study in southern Tuscany (Italy), sensitization to Cypress evergreen (*Cupressus sempervirens*) and Common juniper (*Juniperus communis*) was found in 294 (36.25%) patients: 289 (98.3%) were sensitized to Cypress evergreen, and 198 (67.34%) to Common juniper. Cosensitization between the above two types was observed in 193 (65.6%) patients. The predominant symptom is rhinitis; asthma is less common [9].

The summer pollen wave is characterized by an abundance of **cereal pollen**. Not all grass pollens are considered allergenic, but those that are dangerous bloom one after another. Therefore, a level of allergens in the atmosphere sufficient to cause symptoms is maintained for several months. Meadow grass (Poa pratensis L.), as well as timothy (Phleum) and fescue (Festuca), are among the most allergenic grains. Timothy grass is used as a lawn grass, and if lawns are mowed late, when the grass is already in flower, allergenic pollen grains become even more scattered into the air, worsening symptoms. Poplar powder puffs also ripen at this time. These puffballs collect remaining pollen from trees and grass pollen, carrying out their mechanical transfer. More often, this pollen is the true cause of allergies, which manifest themselves when there is an abundance of puffballs.

Allergy symptoms in late summer and early autumn are often associated with the bloom of weeds such as wormwood (Artemísia), ragweed (Ambrosia), nettle (Urtica), quinoa (Atriplex). Ambrosia wormwood (Ambrosia artemisiifolia L is an annual herbaceous plant of the Aster family Ambrosia, a very prolific plant, individual specimens produce up to 80–150 thousand seeds. The

homeland of the plant is North America. Ambrosia came to the territory of Belarus from the more southern regions of Europe, where it is considered an extremely dangerous and widespread species in its habitats, and in the second half of the 20th century it began to intensively expand its area. Its pollen is a strong allergen and, even in very low concentrations, can cause a reaction in sensitized people. Ambrosia contains about 22 allergens. Its pollen is the number two seasonal allergen in our country after cereal pollen. The flowering periods of ragweed and wormwood practically coincide and the plants are cross-reactive.

Goldenrod (Solidago canadensis L.), another alien plant of the Asteraceae family, is often mistaken for ragweed. Like Ash Maple, it is included in the list of especially dangerous invasive plant species for the Republic of Belarus. The uncontrolled spread of this species leads to oppression and even complete displacement of native plants from natural ecosystems. Goldenrod's natural distribution area is the eastern half of North America; as a wild species, this species is found throughout most of North America and Europe. Canadian goldenrod is an allergenic aggressive plant; each individual produces more than 20,000 seeds, which pose a threat to human health, increasing the incidence rate. Thus, scientists found that in one of the regions of Russia, IgE antibodies to the allergen from Goldenrod pollen were detected in 35% of those studied [10]. It is interesting to note that H. brasiliensis latex and goldenrod contain cross-reactive and unique allergenic proteins. Exposure to goldenrod may sensitize patients to latex and vice versa [11]. In a study of occupational allergies caused by flowers (among flower growers), positive skin prick tests to goldenrod were detected in 12 of 14 patients studied [12].

Pellitory (Paritaria officinalis L.) is an herbaceous plant from the Nettle family, but much more allergenic than nettle. It is native to Europe and the Mediterranean and is found throughout the US. In Belarus it grows mainly in the south of the territory. The pellitory has a long period of dusting. The flowering season of the plant begins in May and can last until October. Because it releases large amounts of allergenic pollen into the wind, it is known to cause severe hay fever. It is believed that allergy to pellitory pollen is one of the leading ones in Southern European countries (Spain, France, Italy) [13]. In 1988, it was reported that 13% of patients with respiratory allergy in the Southampton (UK) area had positive mural skin prick tests. [14]. Bronchial asthma, almost always associated with rhinoconjunctivitis, is present in 52% of monosensitized to pellitory patients in central and southern Italy, reaching a peak of 60% in Naples and Rome, while in patients suffering from hay fever caused by cereals, the figure is 40% [15-19].

Thus, 4 dusting seasons can be identified in the Republic of Belarus (Figure 3):

1. spring (woody plants)
2. spring-summer (pine, juniper, thuja, cypress)
3. summer (cereals)
4.late summer (weeds)

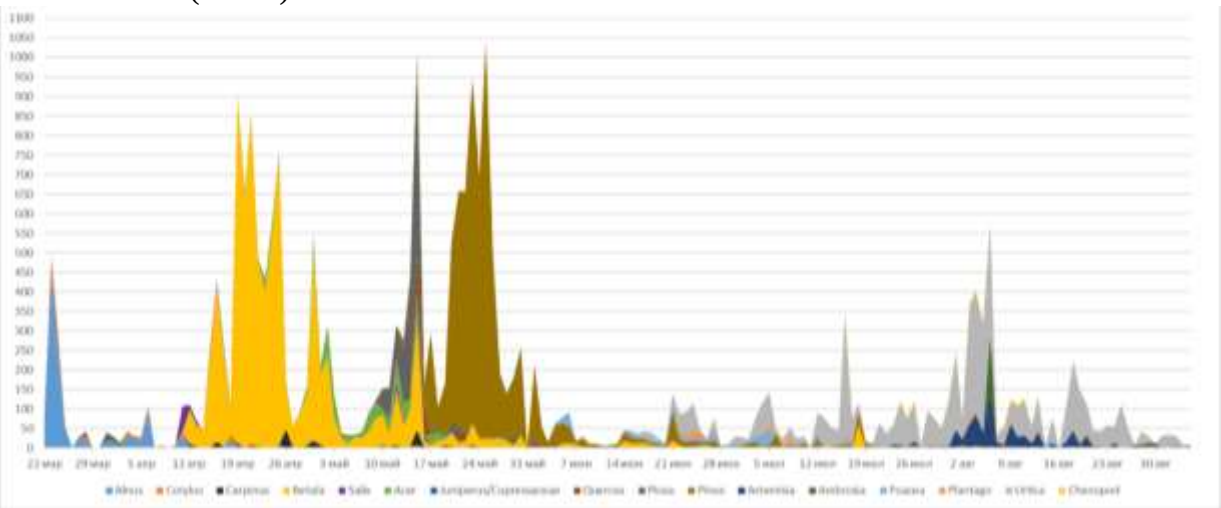

Figure 3 – Pollen spectrum by season in 2023

Obviously, pollination waves largely determine the clinical picture and the nature of sensitization of patients. When analyzing the appeal of patients with pollinosis to the allergist of the 6th City Clinical Hospital in Minsk in the period from 2020-2023, out of 108 patients, 53 (49%) had sensitization to tree pollen, and the most common allergy to birch pollen (in 47 patients, 43%), alder (33 patients, 30%), hazel (20 patients, 19%). Most of these patients were allergic to pollen from several trees; only 12 people were characterized by monosensitization to birch pollen.

The largest number of patients were allergic to cereal grasses (rye, timothy grass, orchard grass) - 71 patients (66%). The most common allergy was to rye (in 49 patients, 45% among all patients and 70% among patients with allergies to cereal herbs). 21 patients (19%) were allergic to both tree pollen and grass pollen.

11 patients (10%) were allergic to pollen of asteraceae (wormwood), of which 8 patients were also allergic to pollen of trees or cereal grasses. Thus, a total of 29% of patients were polysensitized to several groups of pollen allergens.

Conclusions. Taking into account the above several key conclusions can be drawn:

firstly, aeropallinological monitoring is an urgent task, the solution of which can improve the quality of medical care for patients with hay fever;

secondly, the allergenicity of pollen in the Republic of Belarus is changing upward, which is associated both with the penetration of new plants into the country and with the modification of existing pollen under environmental conditions;

and, finally, an urgent task is to assess the allergenicity of new plant species that are rapidly spreading in the Republic of Belarus.

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