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Prevention of allergy caused by pollen, domestic and fungal sensitization

Aeroallergens are particles in the air that may cause allergic reactions of respiratory organs, conjunctiva, and skin in sensitized people. Pollen, domestic and fungal allergens are the most widely spread among them.

Nowadays, there are about 100,000 **pollen allergens**, according to scientific literature data.

They include the following groups of allergens of this type:

1. **Grasses:** timothy, cocksfoot, foxtail, couch grass, fescue grass, etc.
2. **Grain crops:** oats, wheat, barley, rye, corn.
3. **Cultivated plants:** sugar beet, clover, dock, sunflower, etc.
4. **Trees:** oak, maple, alder, hazel, birch, poplar, aspen, pine, spruce, linden, etc.
5. **Weeds:** dandelion, ambrosia, plantain, nettle, wormwood, orach, etc.
6. **Fruit trees:** apple, cherry, pear, etc.
7. **Garden flowers:** daisy, rose, tulip, narcissus, lily, etc.

It has been proved in special researches that only those parts of plants containing their antigenic material may act as allergy etiologic factors (and not their aroma compound or oils which may cause non-immune reactions). This includes mostly plant pollen. Nevertheless, it has been established that factors containing allergens in smaller numbers are present also in other parts of plants.

However, according to Tomen's postulates, a plant may be considered as allergenic only if:

- pollen producing is very high (According to L. Yeager (1986), 1 ear of rye produces 4.2 mln pollen grains, and 1 ambrosia plant produces up to 1 mln pollen grains.) To develop a disease, a person has to inhale not less than 500 pollen grains, i.e. its density should be not less than 25 grains per one cubic meter of air. At the same time, entomophilous plants (flowers, fruit trees) produce less pollen, which is, in addition, sticky;
 - pollen is volatile enough. It may be found at the height of 2 kilometers and at far distances from the places where pollen-producing plants grow;
 - plants are commonly cultivated. Therefore, it is quite evident why allergy in Ukraine is caused mostly by grasses, weeds and meadow plants;
 - plant pollen is immunogenic enough. It has been proved that human immune system does not recognize particles with molecular weight less than 5,000 daltons, and the particles with weight more than 40,000 daltons are practically not absorbed on the Schneiderian membrane. As the result there are groups of plants whose pollen has the most pronounced sensitizing properties (e.g., pollen with molecular weight of 38,000 daltons). Allergic activity is connected with protein part of pollen cell. Pollen grains may penetrate into Schneiderian membrane 30 seconds after they get into the air.
- According to V. A. Fradkin, pollen with the most pronounced allergenic properties includes the pollen containing saponins, simple amines, and simple alkaloids: pigweeds (*Chenopodiaceae*), amaranths (*Amaranthaceae*), ether oils (rose (*Rosaceae*), aster (*Asteraceae*) as well as a great number of protein: beechen (*Fagaceae*), graminales (*Poales*).

European representatives of the International Association for Aerobiology (IAA) in their Recommendations for Methodology for Routinely Performed Monitoring Airborne Pollen recommend conducting obligatory verification of allergenic pollen of genera *Alnus* (alder), *Corylus* (hazel), *Betula* (birch), *Olea* (olive), species of families *Cupressaceae/Taxaceae* (cypress/yew), *Poaceae* (grasses) (including *Cerealia* (cereals), *Urticaceae* (nettle), *Artemisia* (artemisia), *Ambrosia* (ambrosia). In addition, they recommend registering the pollen of such genera as *Fraxinus* (ash), *Platanus* (plane), *Pinus* (pine), *Quercus* (oak), *Castanea* (chestnut), *Rutex* (dock), *Plantago* (plantain), *Chenopodiaceae/ Araranthaceae* (pig-weeds/amaranths).

Most of the above-mentioned plants are rather widely spread in Ukraine.

Currently, the issue of natural antigen modification affected by environmental factors has become important. According to B. T. Velychkovskyi, allergic diseases progress as the result of double effect of antigens and xenobiotics on human body.

A possibility has been established that pollen allergy may increase its effect under the influence of substances that are part of atmospheric air: ammonia, chlorine, fluorine, oxygenic residues, sulfates, nitrates, diesel fuel combustion products, etc. [4]. Moreover, environmental pollution extends the period of plant pollination changing the pollen antigenic structure [5].

H. Behrendt et al. have proven that air pollution not only affects morphological structure of cocksfoot (*Dactylis glomerata*) pollen grains but also increases content of allergenic protein in pollen. V. N. Kobzar et al. have observed similar morphological and biochemical changes of pollen from birch and cocksfoot exposed to UV rays, treated with cigarette smoke and benzpyrene, which would increase pollen allergenic properties. H. A. E. Schunko has found synergistic effect of all types of allergens.

Scientists have proven that contaminated pollen has an increased ability to induce sensibilization as well as increase sensitivity of mucous membrane of nose and bronchi. Phytotoxins also increase growing power of weed pollen which, combined with its increased density in the air, promotes increase in frequency of allergic diseases of respiratory organs for population living in industrial districts.

According to R. M. Alioshyna [5], development of new territories has led to disfigurement of landscapes, decline of range of species existing there, and significant expansion of weeds and ruderal (weed) grasses.

Ruderal plants include orach (*Atriplex*), barley (*Hordeum*), bluegrass (*Poa*), brome (*Bromus*), ryegrass (*Arrhenatherum*) known by their allergenic properties.

Domestic allergens include mostly allergens of house dust, pillow feathers, and library dust. House dust allergen is the major allergen among them.

Importance degree of onset of domestic sensitization caused by house dust has the following priority: house dust mites, animal epidermis, mold fungi, and insects.

According to Immunology Institute (Russia) data, 80 % of sick with bronchial asthma have house dust allergy, 11 % suffer from hives and 46 % are patients that have allergic rhinitis and conjunctivitis.

The main role in house dust allergenic activity belongs to micromites of genus *Dermatophagoides pteronyssinus* also called "bed" mites. The mites that are contained in house dust eat furfur, mold fungi, food particles and other organic products.

One gram of house dust can accommodate up to several thousand mite species. However, even 100-500 mites can cause people's sensibilization to them. Their life activity requires humidity of 70-80 % with temperature of 20°-25° C as well as oxygen. It is very important to remember that both alive and dead mites as well as their waste products are significant for allergy pathogenic mechanism. The mites get into human body by inhalation (during breathing).

It is also well known that house dust often contains hair and dandruff of domestic animals as well as rodents.

19% to 24% of sick with bronchial asthma living in bad indoor environment have specific IgE-antibodies for allergens of hair of mice and rats (Kang B., Kang J., 1989). Scientists have proved expressed sensitizing role of fowl feathers used for stuffing pillows and feather beds, geese feathers having the most antigenic activity. Frequency of sensitization to feather allergens in sick with bronchial asthma ranges from 5% to 60% (A. V. Bogova, 1984, A. A. Potiomkina, 1984). However, cross sensitivity between allergens of feathers and house dust is important in many cases.

According to many authors, domestic allergens include some species of fungi allergens (see below).

Recently, both native and foreign researchers have proved a negative role of cockroaches in development of allergic reactions because the particles of their bodies, eggs and waste products also make part of house dust. Thus, antibodies to American cockroach allergens are detected in 68-76 % of cases having domestic sensitization (Kang B. et al., 1989; Sperber K. et al., 1993). Sensitizing properties of cockroach *Blatella German*, which is widely spread in Europe, are much higher than those of the cockroaches dwelling in America and countries of the East (P. G. Rychman et al., 1984; M. D. Chapman et al., 1989).

Fungal allergens. According to A. D. Ado et al. (1966), it is fungal allergens that in 21.2 % of cases act as etiological factors for allergic diseases of respiratory organs. The mold fungi of genera *Mucor*, *Penicillium*, *Rhizopus*, *Aspergillus* have a leading role among them (M. K. Agarwal et al., 1982). The number of these species may rise up to 300. Most frequently people have sensibilization to fungi of such species as *Aspergillus*, *Penicillium*, *Alternaria*, *Cladosporium*, and *Candida*.

According to V. A. Fradkin (1990), 35.4 % of children examined by him who were sick with bronchial asthma were registered as having allergy to fungi. Fungi spores and hyphae may be found everywhere: on earth, in water, in air, and indoors. Humans confront about 100 species of microfungi.

The sources of mold fungi include mulch, musty rooms, cellars, earth from houseplants, etc. Density of fungi spores for genus *Cladosporium* makes up 3,000 per one cubic meter resulting in clinical implications for some allergy cases.

Treatment of allergic diseases includes four main directions:

1. Patient education.
2. Elimination therapy.
3. Allergenic vaccination.
4. Pharmacotherapy.

Elimination therapy (if we talk about short-term activity) can be conducted by patients on their own. Therefore, patient education, teamwork (compliance) are very good activities and in some way affect allergic disease forecast.

Many means have been proposed to solve the issue of eliminating allergens from indoor environment. The first means is to prevent their number from increasing. The second one is to reduce the number of allergens that are already in the room. In this case, thorough everyday cleaning of hard surfaces and air cleansing provide possibility to reach some positive results. However, technical difficulty is that conventional means are not capable of allergen "pulling out" as well as extracting it from the air. Practically, all dry filters, even those having fine-pored structure, cannot eliminate particles with the size of 5 microns and bigger making up 60% of all facultative allergens. Moreover, air conditioners and vacuum cleaners providing dry cleaning of air and using any filters, due to their contamination, become the sources of allergens themselves. These allergens spread around the room under pressure of ejected air.

The third way of eliminating allergens is to clear off constantly accumulating elements such as textile mites, insects, and epidermis particles. Similarly as for the abovementioned means, in this case a deep cleansing of surfaces is required combined with their dusting.

The most serious problem in implementing the abovementioned means is a deep cleansing of the air containing allergens. Full removal of skin flakes, dandruff and animal saliva is not possible using vacuum cleaners with dry cleaning and air conditioners. Air cleansing system using water has been proposed for this purpose.

HYLA system (Slovenia-Germany) was introduced in Ukraine about 10 years ago. This system stands out in comparison with other brands using water filters. The device is equipped with a separator which revolves with a superhigh speed of 25,000 revolutions per minute ensuring that all the dust getting inside is watered. This way of cleaning has no alternative. HYLA enables eliminating particles of allergens of mites, insects, mold fungi and epidermis as well as plant pollen. It ensures elimination of the smallest particles (less than 3 microns). This way the air coming out of the system is cleansed off all the elements of pollution. Besides, HYLA eliminates mites and their waste products from mattresses and pillows using a special nozzle. Thus, we can say that the air coming out of HYLA system has absolutely new quality.

So, what are the advantages of HYLA innovation? First, patients having cases of allergic rhinitis or bronchial asthma can clean their rooms themselves. Secondly, a sick person can now enjoy decorating his indoor environment with carpets, stuffed toys, and keep pets due to a deep cleaning effect. Thirdly, HYLA is a long-term prevention for the groups vulnerable to allergic pathology.

Using HYLA system is recommended for indoor environment, offices, libraries, storages where people spend much time.

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