Analele Universităţii din Oradea, Fascicula: Ecotoxicologie, Zootehnie şi Tehnologii de Industrie Alimntară, Vol. XIV B, 2015

CLIMATE CHANGE INFLUENCE ON ENVRONMENTAL ALLERGENS AND THEIR IMPACT ON POPULATION HEALTH

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Abstract

There is currently a widespread opinion related to climate change effects upon main allergens development trend, which are responsible for respiratory diseases such as rhinitis and asthma, opinion that there is a direct link between this climat evolution and change in the health of the population.

We will try, through data analysis of 69 patients who accused respiratory problems during 2012-2015 period, to verify the aforementioned climate change impact hypothesis by using two allergens, ragweed and dust mites, factors with high impact on this type of diseases. This option take into account the fact that this allergens are specific to the two different development environments, ragweel in external one and dust mites specific housing conditions to each family.

Key words: ragweed, dust mites, rhinitis, urban, rural

INTRODUCTION

The prevalence of respiratory allergic diseases like asthma and rhinitis has increased to epidemic proportions worlwide.

Climate change effects on respiratory allergies are well defined and therefore still need more studies on this topic (D'Amato at al.,2015).

Global warming is expected to be one of the main factor that influences beginning stage, duration and intensity of pollen seasons and on the other hand air pollution could be a strong reason for exacerbations of asthma togheter with respiratory infections and/or cold air inhalation as well (D'Amato at al.,2015).

It was noted that climate changes at regional level such as increased temperature, already affect various physical and biological systems in many world geographic areas and also respiratory allergic diseases which are strongly influenced by pollen and molds production as well known induction factors for allergic symptoms. Also there is a link between climate changes and air pollution. Some pollutants associated to rhinits and asthma exacerbations episodes are produced by climate factors that favoring pollutants accumulation such as ground-level ozone.

Enviromental factors are often directly influenced by those who are called and ranked as external. Because of this relationship the effect of indor humidity and dampness are taken into account. Sources of fungi are difficult to be identified , especially since some species are found bouth indoors and outdoors as well. Furthermore, inside mold spores may come from external sources (D'Amato at al.,2015).

Respiratory allergic diseases are result of the environmental and immunological factors interaction. Weather influences the human environmental and allergens outcome.

The main outdoor pollutants remain important vehicles for industrialized cities, while industrial pollutants are still a source of air living environment for industrializing cities.

Internal environmental factors are a mixture of chemical pollutants and allergens as: paints, adhesives, chemicals floors, cleaning and combustions products from heating and cooking, asbestos, animal allergens, mycotoxins and fungal allergens, smoke as well.

Ozone is a very active oxidation and can cause inflammation mediators release such as hyaluronate (Mayer D, Branscheid D, 1992), PAF, (Samet JM at al., 1992) IL 1ß, 6, 8 and TNFα from lung cells (Arsalane K at al., 1995), granulocyte macrophage factor, ICAM-1 on bronchial epithelial cells which suppressed the glutathione, an antioxidant that occurs naturally in cells . Moreover, NO2 stimulates the release of leukotrienes, granulocyte stimulating factor, TNF, IL-8, which are controlled by the activation of normal T cells and ICAM-1 (Devalia JL, at al. 1997; Bayram H at al., 1999).

Seasonal pollens are reponsable for exacerbations of allergic rhinitis and asthma and they depend on the period of flowering plants and their origin. Therefore a great importance is to knowledge of the geographical plants distribution and their flowering period and possible inference based on climate change (D'Amato G at al., 2005).

For a complete development, plants require a constant amount of heat. The air temperature plays a key rol in conjunction with other factor such as lenght, water, availability of nutrients and soil type. International garden phenological observations network over 30 years have been showing that spring starts to be installed 6 days early especially in western Europe and Baltic region (Cecchi L at al., 2010). On the other hand, the trend is different phenological Eastern Europe where there is a delay of 1-2 weeks. An early start was confirmed by the study of allergic plants such as birch, weeds (urticaceae), herb and japanese cedar. Pollination period is also extended, especially in summer for late flowering species. Furthermore, thare are evidences for stronger allergenicity in case of pollen of trees that grow at higher temperatures (D'Amato at al.,2015).

Increasing of CO_2 and temperature level have a major impact for higher pollen production of ragweed in experimental conditions and natural as well, for both urban and rural areas (Ziska LH at al., 2003).

Grass pollen is responsable for high percentage of pollinosis globe. Since the last decade of the nineteenth century, ragweed has risen in importance in terms of allergy, covering large areas of central and eastern Europe. In the eastern countries, ragweed seeds expansion is associated more with major social-economic transition than climate change (Emberlin J at al., 2002).

MATERIAL AND METHOD

The objective was to assess the impact of climate changes on Bihor county patients, based on 2012-2015 evolution period for those persons who experiencing sensitivity to the most important environmental allergens.

The study was included 69 patients, of which 46(67%) were from urban area and 23 (33%) persons from rural vilages. Investigated patiens had mild or moderate-severe rhinitis in 58 (84%) cases, respectively manifestations of asthma related to 20 patients (29%). Regarding gender distribution, were investigated 38 male patients and 31 female, which indicates a relatively balanced proportion (55% / 45%) in respect to abovementioned acute manifestations. Patients were between the ages of 2 and 53 years. All patients were evaluated using prick tests for most common environmental allergens, namely: ragweed, dust mites, trees, turf grasses, artemisia, grasses and mold. As shown in the table, the highest number of patients (46%) is the one whose sensitivity is linked to ragweed, allergen whose presence is **significantly influenced by climate changes** and dust mites, allergen whose presence is **significantly influenced by inside home living conditions**.

Table 1

Distribution of positive tested patients between urban and rural area

2012-2015	**Number of patients***	**Urban area**	**Rural area**	**%**
Ragweed	32	21	11	46
Dust mites	30	18	12	43
Trees	18	10	8	26
Turf grasses	12	8	4	17
Artemisia	14	12	2	20
Grasses	17	9	8	25
Mold	8	4	4	12

We focus on the analysis of possible differences between the percentage of patients with sensitivity to ragweed according to urban and rural area versus the same indicator related to dust mites sensitivity and patients distribution throughout each month of the year.

RESULTS AND DISCUSSION

The results from the analysis of number of patients with sensitivity to ragweed and those with sensitivity to dust mites indicate no differences in structure between urban and rural during the period of 2012-2015.

Table 2

Distribution of positive tests to ragweed and dust mites between urban and rural area

Anul	Ragweed urban	Ragweed rural	*Total ragweed**	Dust mites rural	Dust mites urban	Total dust mites*
2012	8	3	*24*	6	5	11
2013	5	1	*14*	1	2	3
2014	3	5	*14*	3	6	9
2015	5	3	*17*	1	5	6

* It is the sum of each years number of patients from urban and rural areas, related to each allergen

ANOVA analysis confirms this conclusion by showing the following statistics:

Table 3

ANOVA analysis

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Period 2012-2015	22,25	3	7,4167	2,7526	**0,1044**	3,8625
Ragweed/Dust/Urban/Rural	17,25	3	5,7500	2,1340	**0,1660**	3,8625
Error	24,25	9	2,6944			
Total	63,75	15				

One possible conclusion is that climate change, both in terms of changes of temperature but also related to intensification of air circulation (extrem meteo events can be such indicator), equally affect the concentration of specific ragweed allergens in urban and rural areas, even assuming the presence of this plant is higher in rural areas. If we take a close look to P value we can notice that the yearly factor come close to 0,05 level, that indicates potential differences with statistical significance. Even taking only ragweed as independent factor, ANOVA analysis will provide a P-value at 0,24 level, which is much far away than 0,05 limit. Further analysis should be performed by using other yearly climate indicators such as local moisture level in the soil, local air temperature and so on. Only in this case, we can draw better statistical conclusions releted to climate change impact upon ragweed allergens action.

Montly analysis of the number of patients tested and found positive for ragweed, highlight in Fig.1 the same result, namely that there is no statistically significant difference between the montly averages of patients detected with sensitivity to ragweed from urban area and those from rural area.

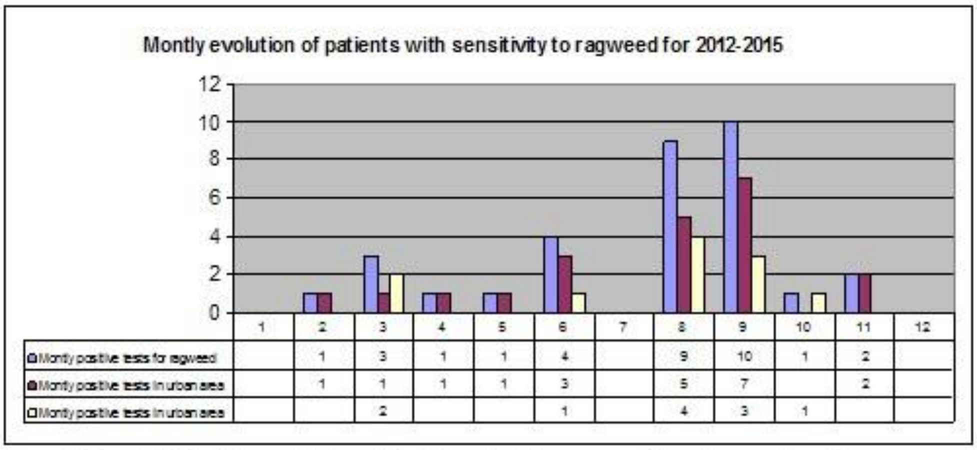

Figure 1. Montly evolution of positive tests to ragweed in urban and rural area.

This result is confirmed by ANOVA-single factor analysis Table 5, in which case P-value is 0,712, much higher than the minimum threshold of significance 0,05.

Table 5

ANOVA analysis

SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Montly positive tests in urban area	8	21	2,625	5,125		
Montly positive tests in rural area	5	11	2,2	1,7		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0,556	1,000	0,556	0,143	**0,712**	4,844
Within Groups	42,675	11,000	3,880			
Total	43,231	12,000				

CONCLUSIONS

1. Statistical analysis of patients number with sensitivity to ragweed per each year leads to the conclusion that there are not strong significant differences from year to year, thus action of climat change on this type of allergen being over long period of time.
2. The relative correlation between the number of cases of sensitivity to ragweed and the house dust mites indicates that an additional factor has to be taken into consideration: the local communities actions through planning lots of land and access roads, and indoor habits for dust mites level .
3. Ragweed as one of the main outdoor allergen in recent years, responsable for rhinitis and asthma, acts in the same extent in urban and rural locations, even if its development hasn't got a uniform territorial dispersion.

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