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POLLEN SPECTRUM SEASONAL OVERVIEW IN RELATION TO HAY FEVER TYPE PREVALENCE IN VINNITSA, UKRAINE

Summary. *The article aimed the establishment of the main pollen spectrum of the ambient air of Vinnitsa city located in Central Ukraine in relation with patients' sensitivity. Study performed by volumetric sampling showed Urtica, Betula, Pinus, Alnus, Fraxinus, Ambrosia, Artemisia, Juglans, Carpinus, Populus, Quercus, Acer, Salix, Ulmus, Corylus; Poaceae, Amarathaceae, Polygonaceae, Asteraceae, Brassicaceae, Ranunculaceae, Cannabaceae pollens are the main airborne allergen types in the urban atmosphere. As it was shown children were sensitive to the weed pollens including ragweed, mugwort and grass while adults are more sensitive to the tree and grass pollens. The further studies of the pollen spectrum and its change in the ambient air of city mentioned are required in order to control the hay fever symptoms.*
Key words: *pollen spectrum, hay fever, pollen sensitivity types*

Introduction

Allergy is the most common chronic disease in Europe, with 20% or more than 150 million of the population afftected [The European Academy of Allergy and Clinical Immunology, Electronic resource, 2014]. The disease has been neglected to date because patients have been coping with their symptoms, even if severe, without much support. But the burden allergy is posing to our lives is getting worse [EFA Book on Respiratory Allergies, Electronic resource, 2011]. If no action is taken to stop the allergy epidemic, 1 in 2 Europeans will suffer from allergy by 2025 with no age, social or geographical distinction [Press Realise of European Academy of Allergy and Clinical Immunology, Electronic resource, 2015]. Furthermore, allergy imposes a significant social and economic burden on EU citizens and health systems. The avoidable indirect costs of failure to treat allergy properly in the EU is estimated to be between 55 and 151 billion Euro per annum.

One of the most common allergy reason is the *Plantago*

pollen. These harmless environmental molecules are mistaken for parasites and the immune system elicits a strong Th2 and IgE-driven response that fails to remove these "irrelevant threats" yet does induce the clinical symptoms of rhinorrhoea, nasal congestion, and itching [Cezmi et al., 2015]. There are a few other pollen types responsible for symptoms provocation. Tree, weed and grass pollen are among them including birch, alder, ash, oak, dandelion, mugwort and ragweed pollen grains.

As recent studies shows allergic symptoms are set to worsen due to climate change, as air pollution increases the aggressiveness of pollen particles and extends the reproductive season of Plantagots [Electronic resource European Academy of Allergy and Clinical Immunology, 2015]. Pollen of the invasive species which is not common for the pollen spectrum of certain area is another important reason of the pollen allergy number increase [Thibaudon, 2013]. While climate and flora change gradually for different regions it's important to know exact species provoking allergy symptoms in certain area for exact time period. In order to control pollen allergy symptoms it's necessary to study the pollen spectra peculiar for the given region through the pollen season.

Thus, the *aim* of our work was to establish the main pollen spectrum of ambient air of Vinnitsa, city located at the Central Ukraine in relation with patients' sensitivity in this city.

Materials and methods

Pollen collection was done by volumetric sampling in Vinnitsa employing a Burkard trap placed at a height of 25 meters above the ground on the roof of a Vinnitsa Medical University building for years 2009 - 2014. Samples were taken from the March 1 until October 31.

Pollen grains were identified by using the Pollen Identification Key Program [Sulmont, 2008] and Pollen Atlas issued under edition of American National Aerobiology Bureau [Kagen et al. 2005].

Symptoms of seasonal allergy were analyzed by reviewing the medical records from allergy specialty clinics at Vinnitsa Regional Clinical Children's Hospital and at Vinnitsa Municipal Hospital Number 1, Vinnitsa, Ukraine. 38 patients aged from 3 to 16 years were reviewed with 20 selected for further analysis among children admitted from 2004 to 2013. 38 patients aged from 18 to 45 were selected for analysis in Municipal Hospital as well. Prick tests for inhalant pollens using extracts made in Ukraine were done. The results of 50 separate clinical testing of children and 38 testing of adults of study group were analyzed.

Results and discussion

Study showed the annual prevalence of stinging nettle (*Urtica*) pollen and tree pollen in the ambient air of Vinnitsa city. Birch (*Betula*), pine tree (*Pinus*), alder (*Alnus*) and ash (*Fraxinus*) pollens were dominating among tree ones. The list of dominating pollen species included ragweed (Ambrosia), grass (*Poaceae*), mugwort (*Artemisia*), walnut (*Juglans*), hornbeam (*Carpinus*), poplar (*Populus*), oak (*Quercus*), maple (*Acer*), willow (*Salix*), elm (*Ulmus*), hazelnut (*Corylus*) pollens; amaranth (*Amarathaceae*), knotweed (*Polygonaceae*) including Rumex, aster (*Asteraceae*), cabbage (*Brassicaceae*), buttercup (*Ranunculaceae*) and hemp (*Cannabaceae*) Families' plant pollens as well (Table 1).

There were two main periods of pollen concentration increase in Vinnitsa. They were related to the trees pollination with intensive period of particles emission on April. The pollen peaks were the most common at the third ten-day period of April in this case and were related to the birch, hornbeam and ash pollination. Year 2014 was characterized by unusual earl birch pollination with a peak occurring at the first ten-day period of April.

The second pollen concentration increase was seen from the mid of June till the end of August. It was related to the *Urtica, Ambrosia, Artemisia* pollination. Peaks were associated to *Urtica* pollination at the first ten-day period of July. Nettle pollen concentrations were high till the end of August exceeding mugwort peak at the first ten-day period of August. Ragweed completed the pollen season peaking at the third ten-day period of August mostly. Grass pollen which is considered to be an important allergen was seen in the ambient air from the beginning of May till the mid of July. The most intensive Poaceae pollination was recorded at the last ten-day period of June and at the first ten-day period of July (Fig. 1).

While analyzing the medical records, it was established, 17 or 85% of children patients were males. The same number of them live in rural areas and just 3 represent Vinnitsa city. Two of three infants admitted to allergy-testing cabined being aged from 1 to 5 were tested repeatedly at the age of 6-10. Maximal numbers of hospital testing applied to one patient were 5. Children' age for 6-10 years old was noted as the time of symptoms appearance for most patients: 13 or 65% of children were tested at this age for the first time. Sensitization to pollen significantly prevalented over the susceptibility to other types of allergen in children aged from 6 to 16. Ragweed and sunflower allergens were leading causal agents for allergy symptoms for children aged from 3 to 5 years (patients showed the very high sensitivity). Reaction to *Poaceaeae* allergens showed mild sensitivity.

Versus clinical picture mentioned, children aged from 6 to 10 were sensitized to grasses mostly (*Festuca, Trigonella, Phl□um, Poa*). Sensitivity to ragweed and sunflower pollen varied from mild to very high (2 observations from 6). Sensitivity to tree pollen was at low level with some cases of moderate reaction to alder and hazelnut allergens from the side of Vinnitsa inhabitants. Recorded cases of birch and hornbeam allergy at one of this child were at a low level. However, reaction to grass or weed allergens (despite widespread of both of the plant categories in Vinnitsa as well) was absent or very low.

Table 1. Pollen spectra in Vinnitsa for Ukraine, years 2009-2014.

No	2009	%	2010	%	2011	%	2012	%	2013	%	2014	%
1	*Urtica*	42	*Urtica*	31	*Urtica*	29	*Urtica*	37	*Urtica*	49	*Betula*	49
2	*Pinus*	12	*Betula*	23	*Ambrosia*	11	*Betula*	21	*Betula*	10	*Urtica*	23
3	*Poacea*	9	*Alnus*	12	*Pinus*	9	*Alnus*	6	*Fraxinus*	6	*Alnus*	5
4	*Artemisia*	9	*Poacea*	4	*Fraxinus*	7	*Artemisia*	6	*Artemisia*	5	*Ambrosia*	3
5	*Amaranthaceae*	3	*Artemisia*	4	*Artemisia*	6	*Pinus*	6	*Alnus*	4	*Poacea*	3
6	*Betula*	3	*Populus*	3	*Alnus*	6	*Ambrosia*	5	*Carpinus*	4	*Juglans*	2
7	*Populus*	3	*Ambrosia*	3	*Poacea*	5	*Poacea*	4	*Poacea*	4	*Artemisia*	2
8	*Ambrosia*	3	*Fraxinus*	3	*Salix*	4	*Amaranthaceae*	3	*Juglans*	4	*Ostrya*	2
9	*Juglans*	2	*Carpinus*	2	*Juglans*	3	*Juglans*	2	*Ambrosia*	2	*Populus*	1
10	*Polygonaceae*	2	*Amaranthaceae*	2	*Quercus*	3	*Ranunculaceae*	2	*Populus*	2	*Acer*	1
11	*Rosaceae(herba)*	2	*Pinus*	2	*Amaranthaceae*	3	*Polygonaceae*	1	*Cannabaceae*	2	*Ulmus*	1
12	*Plantago*	2	*Juglans*	2	*Betula*	2	*Populus*	1	*Amaranthaceae*	1	*Salix*	1
13	*Asteraceae*	2	*Asteraceae*	2	*Ulmus*	2	*Fraxinus*	1	*Quercus*	1	*Pinus*	1
14	*Salix*	1	*Polygonaceae*	2	*Polygonaceae*	2	*Ostrya*	1	*Acer*	1	*Fraxinus*	1
15	*Carpinus*	1	*Cannabaceae*	1	*Carpinus*	2	*Quercus*	1	*Ranunculaceae*	1	*Amaranthaceae*	1
16	*Quercus*	1	*Acer*	1	*Asteraceae*	2	*Rumex*	1	*Rumex*	1	*Quercus*	1
17	*Rosaceae (arbo)*	1	*Corylus*	1	*Acer*	2	*Carpinus*	1	*Pinus*	1	*Brassicaceae*	1
18	*Acer*	1	*Ulmus*	1	*Ostrya*	1	*Corylus*	1	*Asteraceae*	1	*Carpinus*	1
19	*Ulmus*	1	*Quercus*	1	*Corylus*	1	*Plantago*	1	*Moraceaeceae*	1	*Cannabaceae*	<1
20	*Fraxinus*	1	*Ostrya*	1	*Plantago*	1	*Asteraceaeraceae*	1	*Salix*	1	*Rumex*	<1

The reaction to trees became prominent in patients from rural areas aged over 11. At this age such children became moderately and very sensitive to birch, alder and hazelnut pollen. However, the sensitivity to the grass and weed pollen prevalent over the severity of allergic reaction to tree pollen. Except very high sensitivity to grass allergens mentioned above, children showed moderate susceptibility to mugwort and sunflower and moderate to very high sensitivity to dandelion and ragweed allergens. Sensitivity to birch and alder pollen were dominating in the adult patients' group. Although *Alnus spp.* pollen held the second position after *Betula spp.* in total quantity of airborne pollen collected in Vinnitsa, *Alnus spp.* was determined as a main pollen type for patient's sensitivity. From 36 patients tested, 33 (80%) had acute reaction to *Alnus* pollen even for 1:1000 000 dilution of the allergen. *Betula* and *Carpinus* betulus pollen being significant for 1999 and 2000 year studies [Rodinkova, 2005] showed the second and third levels of sensitivity of the patients with 72% and 60% of patients sensitive to pollen types mentioned. The sensitivity to the hazelnut pollen recorded in top-20 in pollen spectra of years 2010 and 2011 was unexpectedly high. 40% of patients examined showed were sensitive for pollen mentioned. 10% of volunteers demonstrated the sensitivity to the oak pollen. Sensitivity to maple, poplar, ash, willow and walnut pollens was uncertain.

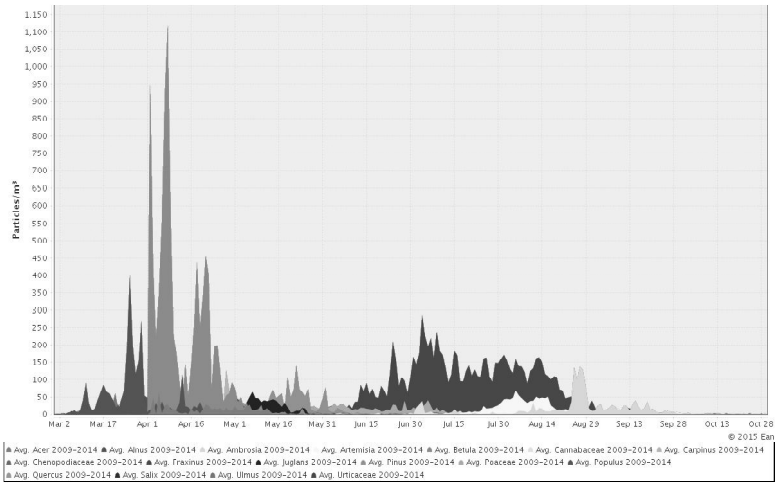

Fig. 1. The timing and intensity of pollen emission by main species in Vinnitsa, 2009-2014.

High reactivity to the hazelnut pollen which count was relatively low (Table 1.) might be explained by the cross-reactions of pollen within Betulaceae Family including birch, hornbeam and hazelnut plants [European Pollen Information, Electronic Resource].

Conclusions

1. Study shows *Urtica, Betula, Pinus, Alnus, Fraxinus, Ambrosia, Artemisia, Juglans, Carpinus, Populus, Quercus, Acer, Salix, Ulmus, Corylus*; *Poaceae, Amarathaceae, Polygonaceae,*

Asteraceae, Brassicaceae, Ranunculaceae, Cannabaceae are main airborne pollen types in the urban atmosphere of Vinnitsa city.

2. As it was shown *Urtica* pollen is prevalent in the ambient air of city mentioned. However, pollen of the nettle is not present in the list of the regional causal allergens due to its low allergenicity. *Ambrosia* and *Artemisia* pollens are more allergic being important for children while tree pollens like *Betula* and *Alder* ones are important for the adults of the Vinnitsa population.

3. There were noted children from rural territories of central region of Ukraine were much more susceptible to the grass and weeds allergens than to arboreal ones from the early childhood time. The severity of sensitization to tree pollen increases with age. However, reaction to grass and weed allergens stays at high and very high level in these patients as well.

Acute reaction of patients to *Alnus spp.* pollen might be explained by highest tree pollen peak was recorded in Vinnitsa for this category. Also increased abundance of this pollen type and peaks which are determined month early than 10 years ago might be important for patients' sensitivity. Thus, data of constant airborne pollen monitoring remains significant for pollinosis' control.

Citation

EFA Book on Respiratory Allergies : Raise Awareness, Relieve the Burden [Electronic resource] / ed.: E. Valovirta - Brussels (Belgium), 2011. - 59 p. : Retrieved from URL: http://www.efanet.org/images/documents/EFABookonRespiratoryAllergiesFINAL.pdf.

Global Atlas of Allergic Rhinitis and Chronic Rhinosinusitis / eds.: Cezmi A. Akdis, Peter W. Hellings, Ioana Agache. - Published by the European Academy of Allergy and Clinical Immunology. - Zurich, Switzerland, 2015. - 442 p.

Kagen S. The Classic Collection Transcribed / Steve Kagen, Walter H. Lewis, Estelle Levetin ; Aeroallergen PhotoLibrary of North America. - Appleton (Wisconsin) : DePass Media Productions, 2004-2005. - P. 35, 132.

More Europeans will be allergic to pollen if no measure is taken to reduce exposure [Electronic resource] : PRESS RELEASE of European Academy of Allergy and Clinical Immunology, European Aerobiology Sosiety, European Federation of Allergy and Airway Diseases Patients Associations and International Ragweed Society : 2015 : Retrieved from URL : http://eaaci.org/images/EAACI_-_EAS_-_EFA_-_IRS_Joint_PR_-_International_Ragweed_Day_2015.pdf.

Stronger together: Collaboration at policy level to tackle the allergy epidemic in Europe : Press Realise of European Academy of Allergy and Clinical Immunology [Electronic resource] : 2015, Barcelona, Spain : Retrieved from URL : http://www.eaaci2015.com/wp-content/uploads/2014/05/Press-Release_Stonger-Together-Collaboration-at-policy-level-to-tackle-the-allergy-epidemic_-EAACI-Congress2015_Final1.pdf.

Sulmont G. The pollen content of the air : identification key [Electronic Resource] / G. Sulmont ; translation: Beverly Adams-Groom ; production: Julie Collet ; Studio Bouquet. - Saint Etienne (France), 2008. - (Reseau National de Surveillance Aerobiologique). - 1 CD-ROM ; 12 sm. - System Requirements: 32, 64 Mb RAM ; Windows 2000, XP.

The European Academy of Allergy and Clinical Immunology (EAACI) Advocacy Manifesto Tackling the Allergy Crisis in Europe - Concerted Policy Action Needed [Electronic resource] : December 2014 version, - 6 pages : Retrieved from URL : http://www.eaaci.org/images/resources/fellowships/awardees/EAACI-Advocacy-manifesto-Nov2014.pdf.

Thibaudon M. Pollen: a biological pollutant? [Electronic resource] / M. Thibaudon // International Aerobiology Newsletter. - 2013. - July, issue 75. - P. 1. - Retrieved from URL : https://docs.google.com/viewer?a=v&pid= sites&srcid= ZGVmYXVsdGRvbWFpbn xhZXJvYmlvbG9neWludGVybmF0aW9uYWx 8Z3g6N2YyZThiZjE5MDVlNGQ5NQ

Rodinkova V. V. Povitryanii monitoring pilku allergennix roslin urbanizovanoii ekosistemi na prikladi m. Vinnici : avtoref. dis. na zdobuttia nauk. stup. kand. biol. nauk : spec. 03.00.16 "Ekologia" / V. V. Rodinkova. - Chernivci, 2005. - 20, [1] c.

European Pollen Information [Electronic Resource] : [European Aeroallergen Network / Medizinische Universit?t Wien]. - Retrieved from URL : https://ean.polleninfo.eu/Ean.

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ОГЛЯД СЕЗОННОГО ПИЛКОВОГО СПЕКТРУ ТА ТИПИ ЧУТЛИВОСТІ ПАЦІЄНТІВ ДО ПИЛКУ, ЩО ПЕРЕВАЖАЮТЬ У ВІННИЦІ, УКРАЇНА

Резюме. *Стаття присвячена питанню встановлення основного пилкового спектру у атмосферному повітрі міста Вінниця, яке знаходиться у Центральній Україні та порівняння його із чутливістю пацієнтів до пилку. Дослідження, що виконувались волюметричним методом, виявили, що основними пилкопродуцентами повітря Вінниці були рослини родів Кропива, Береза, Сосна, Вільха, Ясен, Амброзія, Полин, Горіх, Граб, Тополя, Дуб, Клен, Верба, В'яз, ліщина; родин Тонконогові, Амарантові, Гречкові, Айстрові, Хрестоцвіті, Жовтецеві, Конопляні. Було встановлено, що діти є чутливими до пилку бур'янів, зокрема, амброзії, полину і злаків, а дорослі сильніше реагували на пилкові зерна дерев та злаків. Для ефективного контролю симптомів полінозу необхідні подальші дослідження пилкового спектра та його змін у атмосферному повітрі згаданого міста.*

Ключові слова: *пилковий спектр, чутливість до пилку, поліноз.*

Мотрук И.И,, Кременская Л.В., Паламарчук Е.А, Родинкова В.В.

ОБЗОР СЕЗОННОГО СПЕКТРА ПЫЛЬЦЫ И ТИПЫ ЧУВСТВИТЕЛЬНОСТИ ПАЦИЕНТОВ К ПЫЛЬЦЕ, В ВИННИЦЕ, УКРАИНА

Резюме: *статья посвящена вопросу установления основного пыльцевого спектра в атмосферном воздухе города Винницы, который находится в Центральной Украине, и сравнению его с чувствительностью пациентов к пыльце. Исследования, которые выполнялись волюметрическим методом, обнаружили, что основными продуцентами пыльцы в воздухе Винницы были растения родов Крапива, Береза, Сосна, Ольха, Ясень, Амброзия, Полынь, Орех, Граб, Тополь, Дуб, Клен, Верба, Вяз, Орешник; семейств Тонконоговые, Амарантовые, Гречишные, Астровые, Крестоцветные, Лютиковые, Конопляные. Было установлено, что дети чувствительны к пыльце сорняков, в частности, амброзии, полыни и злаков, а взрослые сильнее*

реагировали на пыльцевые зерна деревьев и злаков. Для эффективного контроля симптомов поллиноза необходимы дальнейшие исследования пыльцевого спектра и его изменений в атмосферном воздухе упомянутого города.
Ключевые слова: *пыльцевой спектр, чувствительность к пыльце, поллиноз.*

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