

## First allergenic pollen monitoring in Bucharest and results of three years collaboration with European aerobiology specialists

POLLIANA MIHAELA LERU<sup>1,2</sup>, ANA-MARIA EFTIMIE<sup>1</sup>, MICHEL THIBAUDON<sup>3</sup>

<sup>1</sup>“Colentina” Clinical Hospital, Șos. Ștefan cel Mare No. 19-21, District 2, 020125 Bucharest, Romania

<sup>2</sup>“Carol Davila” University of Medicine and Pharmacy, Dionisie Lupu Street, no. 37, 030167 Bucharest, Romania

<sup>3</sup>Reseau National de Surveillance Aerobiologique (RNSA), Le Plat du Pin, 69690 Brussieu, France

**Introduction.** Respiratory allergies induced by allergenic plants pollen represent an important public health problem with increasing prevalence and severity. Aerobiologic study of allergenic pollens is performed in many countries on regular basis and correlated with health data from allergists in the frame of national aerobiology networks. Romania has no aerobiology network and pollen measurements have been done between 1999-2012 in West region only. In the frame of COST Action called Sustainable management of *Ambrosia artemisiifolia* in Europe (SMARTER FA 1203), three years collaboration with Reseau National de Surveillance Aerobiologique (RNSA) from France and the first pollen monitoring center in Bucharest were established. The aim of this paper is to present results of first pollen monitoring in Bucharest, activities of Romanian SMARTER group and collaboration with European aerobiology specialists.

**Material and method.** We used a Hirst-type pollen trap placed on the roof of the Research Center from “Colentina” Clinical Hospital and the pollen monitoring method based on European Aeroallergen Network (EAN) standardized requirements. Monthly results during the pollen seasons 2014-2016 were sent to RNSA and EAN and posted on the European pollen information site.

**Results.** We found high amounts of allergenic pollen, mainly grasses from May to September and *Ambrosia artemisiifolia* during September.

**Conclusions.** We concluded that SMARTER offered access to aerobiology training, improved multidisciplinary collaboration and perspectives to further develop national and international projects. More coordinated efforts to develop national aerobiology network and to recuperate the gap comparing to other European countries in the field of aerobiology and respiratory allergology are needed.

**Key words:** allergies, Ambrosia, pollen monitoring, public health.

### INTRODUCTION

Allergenic plants pollen of the atmosphere have important consequences on the health and environment in European countries, with significant individual and socio-economic impact, mainly due to increasing prevalence of respiratory allergies [1]. Reports of the World Health Organization (WHO) and World Allergy Organization (WAO) show increasing trend of both prevalence and severity of pollen-induced allergy symptoms [2]. Recent aerobiology and allergology studies revealed regional differences between countries and some changes of the pollen map in Europe, pointing out the need for a better integration of data from each country and for a global evaluation of the problem [3]. Aerobiologic study of allergenic pollens is performed in many countries on regular basis and correlated with health data from allergists in the frame of national aerobiology networks. Many Western European countries have a long term experience over 35 years of pollen

monitoring, which has become progressively more active in Europe since 1990s. Most pollen monitoring stations in Europe take part in the European Aeroallergen Network (EAN), which pools pollen data from pollen traps adhering to the standard requirements. There are more than 420 pollen monitoring stations in Europe contributing to EAN, France has about 80 stations, Hungary and Poland have about 20 stations each [4]. It is important to know the presence, distribution and flowering time of allergenic wild and cultivated plants, compared with monitoring the concentration of atmospheric pollen in a particular area, in order to make a clear etiologic diagnosis of respiratory allergies [5]. Another important aspect for aerobiologists and allergists is the continuous spread of the danger represented by the invasive weed *Ambrosia artemisiifolia* in many European countries [6]. The recent European Commission Cooperation in Science and Technology (COST) Action FA-1203, called Sustainable management of *Ambrosia artemisiifolia* in Europe –

SMARTER, offered the opportunity and tools for complex evaluation of the impact and recommendations for efficient management and future eradication of Ambrosia in all European countries [7].

Romania has no aerobiology network and pollen measurements have been done between 1999-2012 in the West region only, around the city of Timișoara [8, 9]. No pollen measurement data are available for other regions, including the capital Bucharest. Despite this gap, a significant amount of scientific literature has been published by many plant specialists based on field studies and observations of invasive weeds in some regions of the country [10]. Romanian specialists have been involved in some regional projects dedicated to allergenic pollens, mainly Ambrosia [11, 12]. Romania was invited for the first time to take part in a global project dedicated to ragweed, due to clear expansion of this invasive weed to Eastern European countries and the need for global evaluation of the danger [7]. The interest to develop an aerobiology laboratory in Bucharest came back in 2009 from local allergists, due to an increasing number of patients with respiratory allergic diseases and the need to investigate the allergenic pollens from urban environment. Recognized specialists from European countries with advanced experience in aerobiology have been invited to attend Aerobiology symposia during the annual Allergology conferences.

The aim of this paper is to present results of the first pollen monitoring in Bucharest, during three seasons between 2013-2016, the main activities of Romanian specialists in the frame of SMARTER FA-1203, benefits and perspectives of the scientific collaboration with top European specialists in the field of aerobiology and respiratory allergology. We took into consideration both participation of SMARTER group members to international meetings, conferences and workshops and the main local activities based on extended scientific collaborations.

## MATERIALS AND METHOD

### INITIATION OF THE FIRST AEROBIOLOGY LABORATORY IN BUCHAREST

We established a three years collaboration between “Colentina” Clinical Hospital from Bucharest and Reseau National de Surveillance Aerobiologique (RNSA) from France immediately after beginning of COST project SMARTER, end of 2012 and we started to perform pollen monitoring on regular basis for the first time in Bucharest. We

used a Hirst type volumetric pollen trap placed on the roof of the four levels building of the Research – Development Pavilion (CDPC) from “Colentina” Clinical Hospital, at 19 m height. We applied the standardized pollen monitoring method according to European Aerobiology Society (EAS) recommendations [13]. The analysis was done weekly and results expressed in pollen grains per cubic meter of air (pollen grains/m<sup>3</sup>). Since one of our main difficulties is missing specialized staff, RNSA has offered two training courses in aerobiology: one Basic Course in Lyon, January 2013 and the second Advanced Course organized in cooperation with International Aerobiology Association (IAA) and EAS in Lithuania, in August 2015. The activity of the first aerobiology center in Bucharest started with the pollen season 2014, from March to October. Monthly results of the pollen season during three years between 2013-2016, have been sent for validation to laboratory of RNSA and then to European Aeroallergen Network (EAN). We consider 2014 the year of reference for the study period. Our attention was focused on grasses and *Ambrosia artemisiifolia* pollen, which are considered the major allergenic plants in our geographical area and were measured for the first time in the South-East part of the country. The pollen data from our center in Bucharest, which are actually the only data from Romania, have been posted on the site polleninfo.org, starting with 2016.

### RECORDED ACTIVITIES OF ROMANIAN SMARTER GROUP

Romanian SMARTER group consisted in nine specialists from six university centers, representing four different geographical regions – West, North, East and South, including the capital Bucharest. The specialists involved are four biologists, two agricultural specialists and three medical doctors, already interested in the field of invasive weeds, environment and health impact of allergenic pollens. Two of the members are directors of Botanical Gardens from Bucharest and Iași. The national coordinators of SMARTER were an allergist from Bucharest (first author of this paper) and a plant specialist from Timișoara, both involved in university teaching and research.

Romania has an area of 238.391 km<sup>2</sup>, with three big regions: Moldavia at East, Muntenia at South and Transilvania at North-West. The climate is temperate-continental, with four seasons, but climate changes occurred during last decade, with longer hot Summer and shortened Spring and Winter. Previous national studies showed that the

main relevant pollens responsible for inducing seasonal respiratory allergies are grass pollen in Spring, followed by *Ambrosia artemisiifolia* in Summer-Autumn. Increased spread of *Ambrosia artemisiifolia* is sustained by many field observational studies performed by plant specialists in many regions of the country. *Ambrosia* was previously considered to be more prevalent in the West regions and rural areas.

## RESULTS

Results of the first pollen monitoring on regular basis in Bucharest during the seasons 2014-2016 showed a significant amount of allergenic pollen, mainly grasses and weeds, the last being represented by *Ambrosia artemisiifolia* (*Amb*) and *Artemisia vulgaris* (*Art*) (Table 1).

We found a high amount of grasses pollen during May-June and surprisingly also in September,

with values ranging from 25 to 89 total monthly pollen grains/m<sup>3</sup> air (Figure 1). Previous data from the literature mention that atmospheric concentration of grass pollen able to induce hay-fever symptoms is between 10-50 grains/m<sup>3</sup> air [14]. Regarding weeds pollen, *Ambrosia* had high levels starting with August and increased significantly during September 2014, to a total monthly amount of 754 grains/m<sup>3</sup> air (Figure 2). We recorded high values of *Ambrosia* pollen during five consecutive days between 3<sup>rd</sup> – 9<sup>th</sup> September 2014, ranging from 64 to 231 grains/m<sup>3</sup> air (Figure 3). The measurements of *Ambrosia* during August and September 2015 were unfortunately compromised due to technical problems of the pollen trap, therefore we have no reliable data from the summer 2015. Regarding trees pollen, the most abundant were silver poplar (*populus*) in March and mulberry (*Moraceae*) in April, both being not highly allergenic trees (Table 2). We found slightly increased values of Birch pollen, which is a highly allergenic pollen mainly in Central and Northern Europe, only during March 2014 (Figure 4).

Table 1  
Monthly concentration of *Ambrosia*, *Artemisia* and Grasses pollen (pollen grains/m<sup>3</sup> air)

	2014			2015			2016		
	Amb	Art	Grass	Amb	Art	Grass	Amb	Art	Grass
<b>May</b>			72	1		59	2	1	29
<b>June</b>			80	1		58	3		73
<b>July</b>	10	24	49	10	1	47	12	14	84
<b>August</b>	84	44	25	3	2	11	101	41	71
<b>September</b>	754	53	89	6	2	2	450	14	12
<b>October</b>	4		1						

Table 2  
Monthly concentration of trees pollen (Spring-Summer, 2014-2016) (pollen grains/m<sup>3</sup> air)

		March	April	May	June	July
<b>2014</b>	<b>Moraceae (mulberry)</b>		1247	51	5	
<b>2015</b>			456	18		
<b>2016</b>			41	1	12	21
<b>2014</b>	<b>Populus (Poplar)</b>	401		2		1
<b>2015</b>		198	49			
<b>2016</b>			19	28	1	
<b>2014</b>	<b>Cupres (Cypres)</b>	115	7	2	2	1
<b>2015</b>		272	10	10		1
<b>2016</b>		35	29	40	7	11
<b>2014</b>	<b>Ulmus (elm)</b>	120	7			
<b>2015</b>		104	17			
<b>2016</b>			30	10		
<b>2014</b>	<b>Acer (adler)</b>	143	26			
<b>2015</b>		15	4			4
<b>2016</b>			31	1	3	2
<b>2014</b>	<b>Betulaceae (Birch)</b>	86	12	2		
<b>2015</b>		8	15	3		
<b>2016</b>		47	14	4	3	

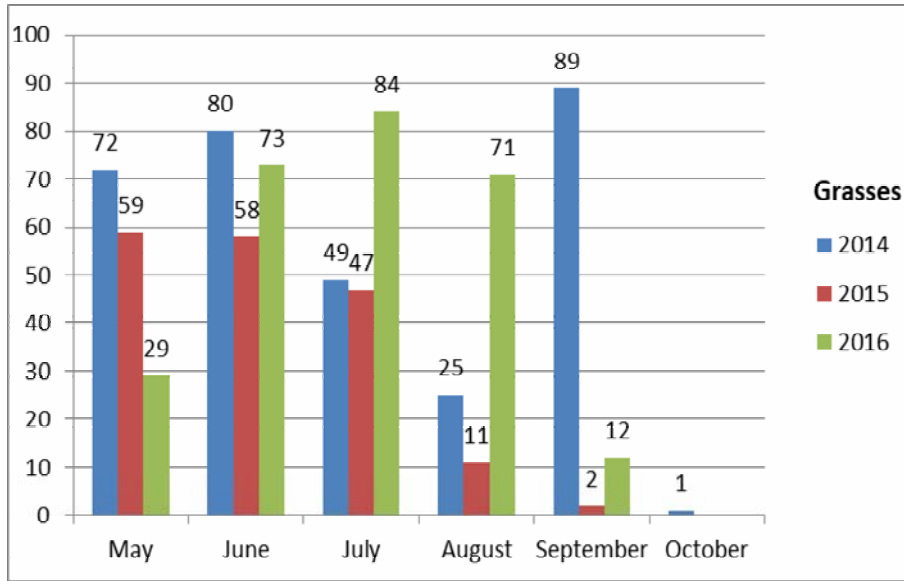


Figure 1. Monthly concentration of grasses pollen during May-September 2014–2016 (pollen grains/m<sup>3</sup> air).

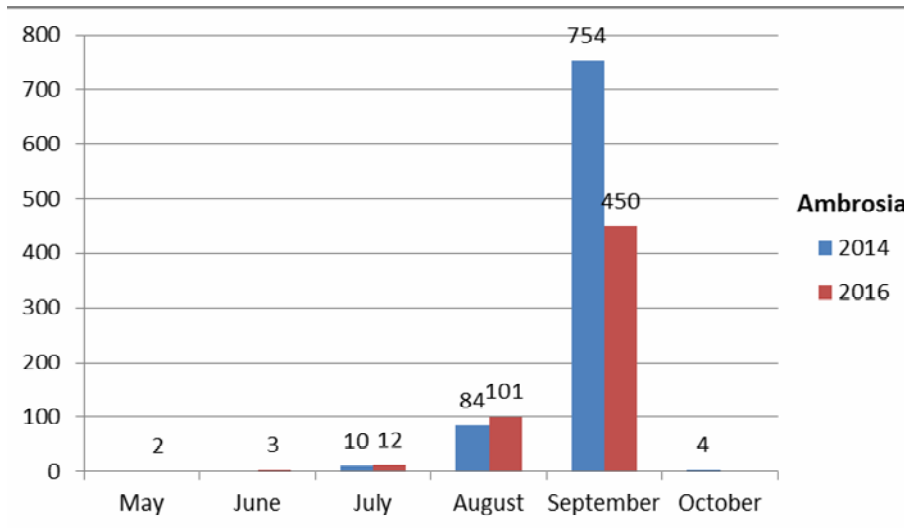


Figure 2. Monthly concentration of Ambrosia pollen during 2014 and 2016 (pollen grains/m<sup>3</sup>).

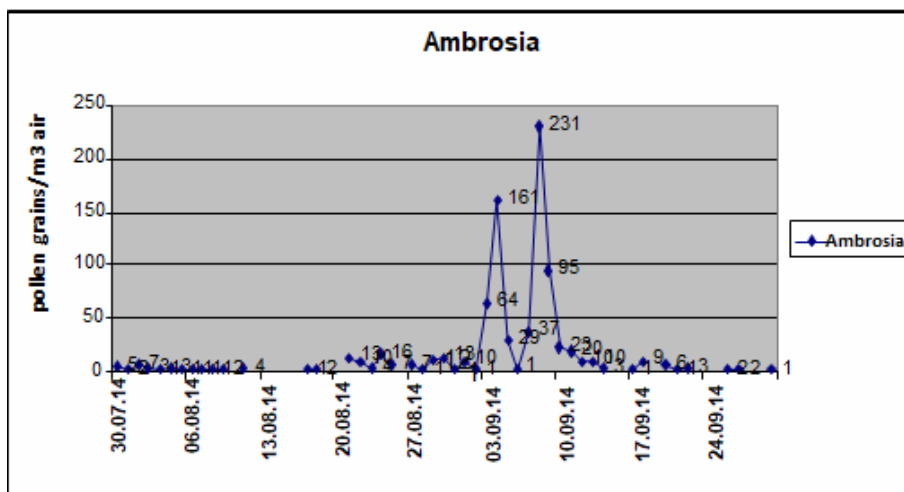


Figure 3. Daily concentration of Ambrosia during September 2014 (pollen grains/m<sup>3</sup> air).

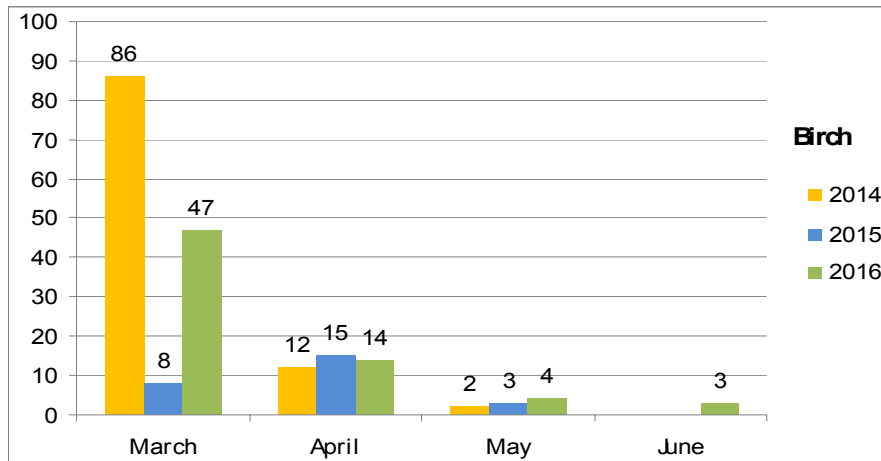


Figure 4. Monthly concentration of Birch pollen (pollen grains/m<sup>3</sup> air).

The main activities of Romanian SMARTER group were focused on initiation of national aerobiology network, establishment of a center with continuous aerobiology activity in Bucharest and publication of our data on the EAN site. We looked for improved collaboration between specialists from different national centers and for opportunities to participate to national and international projects. The activity of SMARTER members consisted in publication of papers on ragweed, including evaluation of allergists opinion and medical activity [15], participation to annual SMARTER meetings, to many national and international aerobiology and allergology conferences and symposia, media information campaigns about Ambrosia. One biologist from our SMARTER group attended the two workshops on Ambrosia population dynamics survey held in Montpellier in 2014 and Vienna in 2015.

## DISCUSSION

Results of the first pollen monitoring center in Bucharest showed a high amount of allergenic pollen belonging to grass and weed plants families. Grass pollen in the atmosphere was increased from May to September, with peak values in June, July and September, showing a longer period than considered before. No data for comparison with other regions of Romania and other years could be found. Ambrosia pollen was increased from August to September, with five days having very high levels beginning with September 2014. We found a peak value of 231 pollen particles/m<sup>3</sup> air in early September, comparing with 292 particles/m<sup>3</sup> in August 2009, which was mentioned in the literature for Timișoara region from Romania [16]. These

data confirm that Ambrosia is a relevant allergenic pollen for the South region of Romania also and have to be followed for a longer period and correlated with symptoms of induced seasonal respiratory allergies.

The main achievements and benefits of SMARTER for Romania are: establishment of national collaboration between different specialists based on first Ambrosia group involving many centers and regions of the country, evaluation of the national situation regarding pollen monitoring, increasing the public interest for Ambrosia and media campaigns about this danger for public health. Other benefits are: dissemination of the main European objectives in the field of aerobiology and the fight against Ambrosia, establishment of the first pollen monitoring center in Bucharest, publication of pollen data from Bucharest on the polleninfo.org website [17]. We had preliminary discussions to establish a collaboration with national institutions for vegetation and environment, such as Research-Development Institute for Plant Protection and National Agency for Environment. Our recent participation in the Workshop on Ragweed Pollen Alarm System in Budapest in September 2016 has reinforced the need for a better regional collaboration in this field. A law stating the obligation of land owners to eradicate Ambrosia was proposed by a Deputy of the Romanian Parliament in September 2016, still pending [18]. Our data have to be correlated with field observations from different plant specialists and health information from allergists. It is important that local authorities take into consideration allergenic potential of different plant species in urban planning of green zones, since avoiding allergenic species could provide a more healthy environment.

The main perspectives of our activity are: translation and implementation of the patient hay-fever diary in Romania according to EAS requirements and development of collaboration with allergists, in order to better correlate aerobiology data with patients symptoms [19, 20]. Another priority is to inform and convince local authorities and decision-makers about the risk of allergenic plants for public health and to influence implementation of non-allergenic plants in the urban areas, following models from occidental countries [21].

## CONCLUSIONS

We concluded that our participation to European projects in the field of aerobiology and collaboration of Romanian specialists with other European specialist and institutions can bring a very fruitful

experience and enthusiasm and accelerate the local activities and development. More coordinated and increased efforts to recuperate the gap comparing to other European countries in the field of aerobiology and respiratory allergology are required. We have to increase awareness of population and authorities about health impact of Ambrosia and other allergenic pollen and to decrease the risk of allergenic plants for environment and public health. There is an urgent need to continue research and to participate to national and international projects involving health and environment authorities.

**Authors' contribution.** PML is the allergist who coordinated the Romanian SMARTER group and the aerobiology center from Bucharest, collected the data, designed the study and drafted the manuscript. AME is the chemist who attended the aerobiology training, performed the pollen count and communicated the results to EAN. MT is the RNSA coordinator who performed the training of the Romanian staff, supervised the activity of our center and contributed to drafting the manuscript.

---

**Introducere.** Alergiile respiratorii produse de polenul plantelor alergizante reprezintă o problemă importantă de sănătate publică, cu prevalență și severitate în creștere. Măsurarea polenurilor alergice din atmosferă se face constant în majoritatea țărilor europene, în cadrul rețelelor naționale de aerobiologie, integrate în Rețeaua Europeană a Aeroalergenelor (EAN). România nu are o rețea națională de aerobiologie, iar măsurarea polenurilor alergice s-a făcut doar în zona de Vest, în perioada 1999-2012. În cadrul proiectului COST intitulat „Managementul susținut al Ambrosia artemisiifolia în Europa” (SMARTER FA-1203), am inițiat un protocol de colaborare între Spitalul Clinic Colentina și Rețeaua Națională de Supraveghere Aerobiologică (RNSA) din Franța și am început măsurarea polenurilor atmosferice în București. Scopul acestei lucrări este prezentarea rezultatelor primului centru de monitorizare a polenurilor alergizante din București în perioada 2013-2016, activitatea grupului român în cadrul proiectului SMARTER și colaborarea cu specialiști europeni în domeniul aerobiologiei.

**Materiale și metodă.** Am utilizat un colector de polen tip Hirst amplasat pe acoperișul Centrului de Cercetare-Dezvoltare Colentina și metoda de colectare standardizată recomandată de EAN.

**Rezultate.** Măsurătorile noastre au arătat cantități mari de polenuri alergizante în atmosferă, în special din speciile de graminee, în perioada mai-septembrie și de Ambrosia artemisiifolia în septembrie.

**Concluzii.** Participarea noastră în SMARTER ne-a oferit acces la cursuri de pregătire în aerobiologie, colaborarea multidisciplinară și perspectiva implicării în proiecte de cercetare naționale și internaționale în acest domeniu. Sunt necesare eforturi instituționale pentru dezvoltarea rețelei naționale de aerobiologie în România și pentru recuperarea decalajului față de celelalte țări europene în domeniul aerobiologiei și alergologiei respiratorii.

---

## REFERENCES

1. D'AMATO G, CECCHI L, BONINI S, NUNES C, ANNESI-MAESANO I, BEHRENDT H, van CAUWENBERGE P. *Allergenic pollen and pollen allergy in Europe. Review article.* Allergy. 2007; doi:10.1111/j.1398-9995.
2. www.worldallergy.org
3. SIKOPARIJA B, SKOJTH CA, CELENK S, TESTONI C, ABRAMIDZE T, ALMKUBLER K, et al. *Spatial and temporal variations in airborne Ambrosia pollen in Europe.* Aerobiologia. 2016;doi:10.1007/s 10453-016-9463-1.
4. THIBAUDON M. *Aerobiology in Europe : from pollen exposure to health impact.* Presentation at Annual Conference of Romanian Society of Allergology and Clinical Immunology, 2013.
5. BURBACH GJ, HEINZERLING LM, EDENHARTER G, BACHERT C, BINDSLEV-JENSEN C, BONINI S et al. *GA2LEN skin test study II: Clinical relevance of inhalant allergen sensitizations in Europe.* Allergy 2009, 64(10), 1507-1515.
6. SMITH M, CECCHI L, SKJOTH CA, KARRER G, SIKOPARIJA B. *Common ragweed: A threat to environmental health in Europe.* Environment International. 2013; 61:115-126.
7. www.ragweed.eu, www.cost.eu
8. IANOVICI N. Research Report "Aerobiological analysis of air quality through volumetric monitorization of aeroplankton and aspects concerning the impact of invasive and allergenic plants on the biodiversity of urban environments" contracted with the Municipality of Timișoara, SC 2008-7021.
9. IANOVICI N, PANAITESCU BUNU C, BRUDIU I. *Analysis of airborne allergenic pollen spectrum for 2009 in Timișoara, Romania.* Aerobiologia. 2012; doi:10.1007/s 10453-012-9266-y.
10. SIRBU C. Research report "Alien plants: population, dynamics and risk of new species introduction", funded by ANCS-UEFISCDI, PN II Capacitati, 2011-2012. SK-RO 0013-10.
11. ANASTASIU P, NEGREAN G. *Invasive and potential invasive alien plants in Romania (Black list).* In Bioplatform – Romanian National Platform for Biodiversity. Inter-Institutional Protocol for Biodiversity Research Development (ed. Mihailescu Simona), Bucharest. Edit. Academiei Române. 2005; ISBN 973- 27-1211-2.
12. ANASTASIU P, NEGREAN G, BASNOU C, SIRBU C, OPREA A. *A preliminary study on the neophytes of wetlands in Romania, Neobiota.* 2007;7:181-192.
13. GALAN C, SMITH M, THIBAUDON M, FRENGUELLI G, OTEROS J, GEHRING R. et al. *Pollen monitoring: Minimum requirements and reproducibility of analysis.* Aerobiologia. 2014; 30(4):385-395.
14. DAVIES RR, SMITH LP. *Forecasting the start and severity of the hay-fever season.* Clin Allergy 1973; 3: 263-267.
15. LERU PM, MATEI D, IANOVICI N. *Health impact of Ambrosia Artemisiifolia reflected by Allergists practice in Romania. A questionnaire-based survey.* Annals of West University of Timișoara, ser Biology. 2015; 18(1), pp. 43-54.
16. PANAITESCU C, IANOVICI N, MARUSIAC L, CERNESCU L, MATIS B, MURESAN R, BALACEANU A. *Impact of sensitization to Ambrosia pollen and to other inhaled allergens in the population of the Timișoara area. Oral presentation. Annual Conference of Romanian Society of Allergology and Clinical Immunology, 2012.*
17. LERU PM, EFTIMIE AM, THIBAUDON M. *Aerobiologic study of allergenic pollens during the first monitoring season in Bucharest.* Poster presented at the Annual Congress of European Academy of Allergology and Clinical Immunology (EAACI), Barcelona, 2015.
18. CAMERA DEPUTAȚILOR, Propunere legislativă privind combaterea răspândirii plantei puternic alergenă, pericol pentru sănătatea publică, *Ambrosia artemisiifolia.* BP 493/06.09.2016.
19. VOUKANTSIS D, KARATZAS K, JAEGER S, BERGER U, SMITH M. *Analysis and forecasting of airborne pollen-induced symptoms with the aid of computational intelligence methods.* Aerobiologia. 2012; doi:10.1007/s 10453-012-9271-1.
20. KARATZAS K, VOUKANTSIS D, JAEGER S, BERGER U, SMITH M, BRANDT O. et al. *The patient's hay-fever diary: three years of results from Germany.* Aerobiologia. 2013;doi: 10.1007/s 10453-013-9303-5.
21. THIBAUDON M, FAUCHERAND L, OLIVER G. *Urban vegetation and allergy risk.* Poster presented at Annual Congress of European Academy of Allergology and Clinical Immunology (EAACI), Milan. 2013.

Received July 11, 2017