Original Paper

The Prevalence of Allergic Rhinitis to *Ambrosia Elatior* in Oltenia Area and the Association with Allergic Conjunctivitis or Asthma

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ABSTRACT: Introduction-Ambrosia elatior pollen sensitivity can lead to respiratory diseases such as rhinitis, asthma and allergic conjunctivitis. Ambrosia is quite an important source of pollen and it is thought to be an invasive plant. Sensitivity prevalence to Ambrosia pollen varies from one country to another. The aim of the present study was to assess the prevalence of pollen allergic rhinitis caused by Ambrosia elatior in the Oltenia area located in the south west part of Romania. Material and method-The study was carried on 1004 patients with allergic rhinitis. All the patients experienced symptoms of allergic rhinitis, associated with /without conjunctivitis or asthma, and positive skin tests to aeroallergens. Results-In the group under study, 48,80% of the cases are sensitized to Ambrosia elatior pollen. The number of patients with allergic rhinitis and pollen sensitivity to Ambrosia is higher in 2014-2015 compared to 2012, i.e. 282 cases and the symptoms are moderate-severe. Conclusions-Ambrosia elatior pollen has become a major source of aeroallergen in Oltenia area.

KEYWORDS: *Allergic rhinitis, Ambrosia, prevalence, conjunctivitis, asthma*

Introduction

Ambrosia allergy has become important health problem in recent years. *Ambrosia elatior* pollen is well-known for its high potential to cause type I hypersensitivity reactions in late summer and autumn. *Ambrosia* pollen sensitization can result into respiratory diseases such as rhinitis, asthma and allergic conjunctivitis and less skin symptoms [1]. The studies point out the fact that high exposure to pollen or increased pollen concentration over a certain period of time results into high sensitization rate and symptoms emergence [1].

Allergic rhinitis is the most common allergic disorder, a global health problem that affects 10 to 40% of the population [2] and 10-15% of the British children [3]. It is characterized by paroxysmal episodes of sneezing, rhinorrhea, nasal pruritus and nasal obstruction [4].

Ambrosia is an important source of pollen being considered an invasive plant by the Plant Protection Organization of Europe and the United Kingdom [5]. It is part of the *Asteraceae/Compositae* family. There are about 40 species of *Ambrosia* [1], but, from an allergological point of view, the following species are important: *Ambrosia artemisiifolia* var.*elatior* şi *Ambrosia trifida* (the latter less widespread) [6].

Identified for the first time as a major allergen in North America at the end of the nineteenth century, *Ambrosia* pollen is now an important source of allergen in many countries across Europe [7]. The prevalence to *Ambrosia* pollen sensitization depends on the country. There is an average prevalence of sensitization in Europe of 14%, ranging from the highest value reached in Hungary (54%) to 3.5% in Italy [8].

The high number of people who suffer from allergy to *Ambrosia* in Hungary, an estimate of 2.5 million, led to the elaboration in 2003 of a normative document which regulates the way in which citizens can fight against this plant and the obligations they have in order to eradicate the species of *Ambrosia*, but also to set up a National Defence Council in order to "rescue Hungary" in the fight against this species [6].

In Romania, in the Timis county (located in the western part of Romania, in the center of the historical province Banat, and close to Hungary), because of the increased incidence of allergic reactions, the Timis County Council in collaboration with the University of Agricultural Sciences and Veterinary Medicine of Banat, Timişoara and Timiş County Agricultural Chamber, issued in 2014 a Local Decision on the fight against *Ambrosia artemisiifolia* species [33].

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In 2017, the Romanian Society of Allergy and Clinical Immunology launched the campaign "Be careful to *Ambrosia*" which included a TV video informing public opinion, local and central authorities about the risk of *Ambrosia artemisiifolia* spread upon urban population's health [34].

In March 2018, the Romanian Parliament approved the Law No. 62/2018 on fighting against *Ambrosia* [35], but the methodological norms for law enforcement were approved on September 5th 2018 and published in the Official Journal of Romania on September 12th, 2018 [36].

International Ragweed Society [37] set the 23rd of June 2018 as the International *Ambrosia* Day aiming at intensifying the efforts to eradicate the plant.

In Southern Romania, ragweed was first identified in 1908 in Orsova, a Danube river port city with shipyard since 1890 [12,13]. Years later this invasive weed was also reported in other North-West, West, South and South-East areas of our country [6,11,13,27-31]. Nowadays, there is evidence that it grows in all the regions and it seems to have spread more extensively in the south and centre of our country [13].

Common ragweed (*Ambrosia artemisiifolia var. elatior*) has two common Romanian names: "floarea pustei" and "iarba parloagelor" and several Romanian studies mention it using these denominations [12,13]. Recent studies confirm the presence of this species in the Romanian Plain [11].

In Europe, at least 1 in 5 people suffers from respiratory allergy to *Ambrosia* [21]. This disease will probably become a major public health problem across Europe as according to the ATOPICA project (Atopic diseases in climate change and use and air quality) carried out by a team of European researchers who have discovered an average increase in *Ambrosia* pollen concentration 4 times higher by 2050 [32].

Ambrosia has a significant negative impact on the European economy because it affects health, it can affect agriculture and even tourism. *Ambrosia* epidemic can become a huge burden in terms of health care expenses across Europe [20].

Because of its highly allergenic effect, the spread of the species and the occurrence of allergic diseases should be studied by a team of agronomists, botanists and allergists [6]. Pollen grains can travel by air several hundred or even thousands of kilometres and can cause allergic symptoms even in the areas where the plant is less widespread [1].

The aim of the present study was to assess the prevalence of pollen allergic rhinitis caused by *Ambrosia elatior* and its association with allergic conjunctivitis or asthma in the Oltenia area. This region is located in South-West Romania, bounded to the north by the Meridional Carpathian Mountains and to the east by the Olt river and to the southwest by the Danube River.

Material and methods

The study was carried out on 1004 patients with allergic rhinitis. The patients had a consultation in the Allergology Ambulatory of "Filantropia" Central Hospital, Craiova from January 2011 to December 2012, July 2014-October 2015. All patients experienced rhinitis symptoms associated with conjunctivitis and/or asthma.

Skin testing was carried out using standardized allergen extracts in line with the European Allergies Panel agreed upon by the International guides and European Allergy Academy for 2012 [9] and revised in 2013 [10].

Aeroallergen positive skin tests patients were included in the study.

Patients' age ranged from 3 to 77 years old; i.e. 34.38±18.95 years average out of which 530 females and 474 male.

The patients come from Oltenia, an area whose counties are: Dolj, Olt, Mehedinti, Valcea, Gorj.

All the patients gave their written consent for the testing procedure and the study protocol was approved by the Ethics Committee of the University of Medicine and Pharmacy of Craiova.

For data processing Microsoft Excel (Microsoft Corp., Redmond, WA, USA) was used, together with XLSTAT for MS Excel (Addinsoft SARL, Paris, France), used in order to carry out Chi squared test.

Results

Out of 1004 patients under study most of them came from urban areas-over 90% of the subjects, 530 females and 474 male.

Patient distribution by age group largely follows general population distribution, except 10-19 years old age group, recording a higher percentage than the one expected for teenagers (Fig.1).

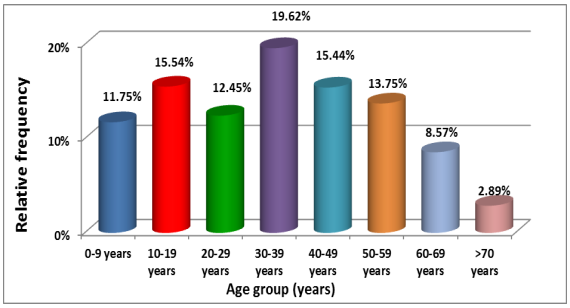

Fig.1. Allergic rhinitis age group distribution in the studied group

Out of 1004 patients, 77,09% cases were those of allergic rhinitis and sensitization to various pollens (Fig.2), followed by those with sensitization to mites 41,83%, mould 8,67% and a lower percentage to animal epithelium 7,87%.

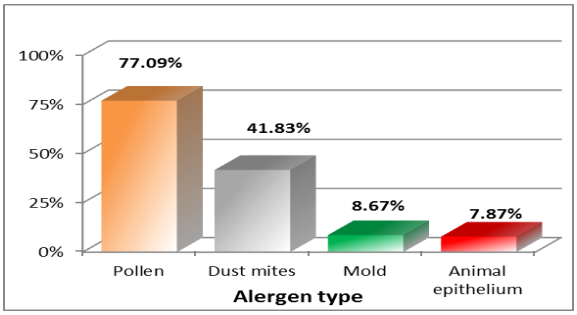

Fig.2. Allergic rhinitis and aeroallergen sensitization patient distribution

Out of the 774 patients, i.e. 77.09% of cases with allergic rhinitis and pollen sensitization, most patients, i.e. 48.80% (490 patients), are sensitized to *Ambrosia elatior* pollen followed by those sensitized to grass and to *Artemisia vulgaris*. As for the other types of pollen, sensitization is to be found in less than 5% of cases (Table 1).

Our results point out the fact that, pollen and mites are the most important aeroallergens [11]; grass and weed pollen are the most significant ones [10,11,13]; this only confirms the fact that, as it is the case of many areas in Europe, as well as in Western Romania, i.e. Oltenia area, *Ambrosia elatior* has become the major aeroallergen source as illustrated in Table 1.

Table 1. Allergic rhinitis and sensitization to various pollens patient percentage distribution

Pollen	Percentage
Ambrosia pollen	48.80%
Grass pollen	42.63%
Artemisia pollen	30.98%
Other pollens	<5%

Table 2. Socio-demographic distribution of the allergic rhinitis and Ambrosia elatior pollen sensitivity group

Factor	Category	No. of cases	Percentage
Sex	Male	227	46.33%
	Female	263	53.67%
Area	Urban	454	92.65%
	Rural	36	7.35%
Age	<18	64	13.06%
	18-65	401	81.84%
	>65	25	5.10%

Out of 490 patients sensitized to *Ambrosia* pollen 227 patients were males and 263 females, 92,65% of cases come from the urban environment and 7,35% from the rural environment, 64 patients were children and teenagers up to 18 years old, 401 patients from 18 to 65 years old and 25 over 65 years old (Table 2).

As it concerns the number of patients with allergic rhinitis and *Ambrosia elatior* pollen sensitivity, the research has showed that their number is higher between August 2014-September 2015 i.e. 60.65% compared to 38.59% between August 2011 and September 2012 as illustrated in Fig.3.

A higher increase of the number of cases with allergic rhinitis and sensitization to *Ambrosia elatior* pollen after a 2-year period meant also a higher increase of incidence of this type of allergy in Oltenia area (Fig.3). It is to be noted that the data were collected during the same period of the year after a two year period.

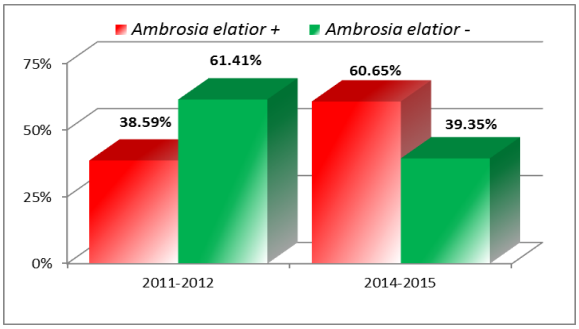

Fig.3. Allergic rhinitis incidence with sensitization to Ambrosia pollen depending on the time of the year

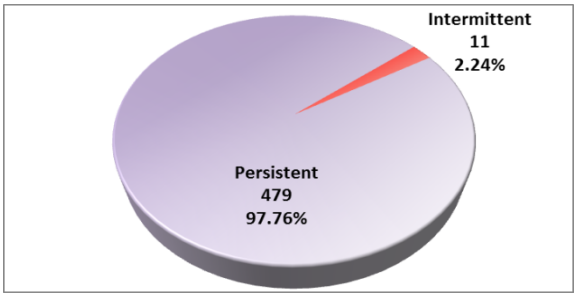

Fig.4. Allergic rhinitis and Ambrosia elatior sensitization patient distribution in terms of duration

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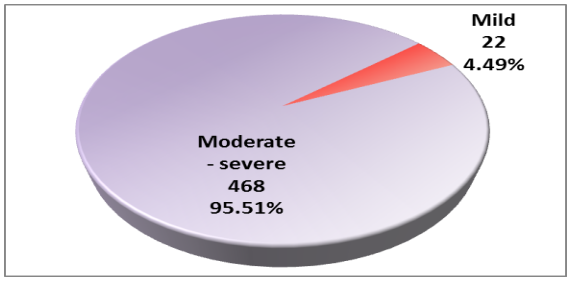

Fig.5. Allergic rhinitis and Ambrosia elatior sensitization patient distribution in terms of severity

Most patients with *Ambrosia elatior* sensitization were diagnosed with persistent rhinitis 97.76% (Fig.4) in moderate-severe form 95.51% compared to 4.49% in mild form (Fig.5).

Out of the 490 patients with allergic rhinitis caused by *Ambrosia elatior* pollen sensitization, nearly three quarters, i.e. 73.06% also associated symptoms of allergic conjunctivitis (Table 3).

Table 3. Allergic conjunctivitis associated with allergic rhinitis to Ambrosia elatior case distribution in Oltenia area during the study period

Conjunctivitis	Absence	Intermittent	Persistent	Conjunctivitis	Total
Cases	132	282	76	358	490
Percent	26.94%	57.55%	15.51%	73.06%	100.00%

As it concerns asthma association, only 22.65% out of the patients with allergic rhinitis and *Ambrosia* sensitization associated asthma, too (Fig.6).

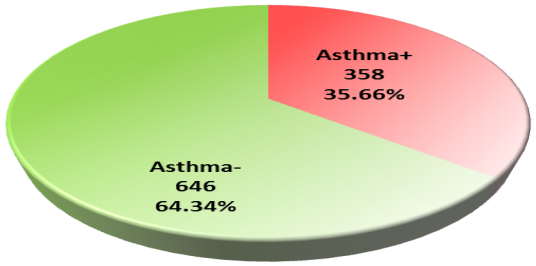

Fig.6. Allergic rhinitis sensitized to Ambrosia and associated asthma case distribution in Oltenia area during the study period

Discussion

Ambrosia pollen allergy is a global challenge for allergologists and it appears to be increasing in some geographical areas [8].

Oltenia area has a temperate continental climate, specific for Central Europe, but with submediterranean influences [12].

The results of our research are similar to those of other studies which confirm the fact that a great number of areas in Romania are greatly invaded by this weed [6,11-15], which is one of the most severe weeds sensitizing a significant number of patients. And yet, the way in which this weed spreads throughout the country is still little known [13,16].

Ambrosia is a weed which can cause severe allergic symptoms [8]. *Ambrosia artemisiifolia* is the most invasive plant of all species [11].

It grows along roads, uncultivated areas, grain crops, construction sites, pastures, railroad tracks. Its flowering period reaches the peak in August and September, when large quantities of pollen granules are released into the air, which are carried by the wind on great distances [6].

One gram of *Ambrosia elatior* pollen contains about 30-35 million pollen grains [11], and one single *Ambrosia* plant can release up to one billion pollen grains per season [1], but symptoms begin to appear at smaller concentrations, ranging from 5 to 20 grains/m³ [17].

Approximately 48 allergenic proteins are known for the genus *Ambrosia*, and 32 proteins, including multiple isoforms, are known for A. artemisiifolia [18].

Ambrosia first emerged in Europe in mid nineteenth century as a result of the contaminated grains cargos in the United States and Canada [19] and began to spread in Europe after 1940 [20].

It was first reported in Hungary, then, it spread to Eastern Europe countries, mainly in France, especially along the Rhône Valley [1] and northern Italy [20]. In Japan, South Korea and some Chinese areas, sensitization rate is lower, around 5% [1].

It is hypothesized that climate change and air pollution will affect the allergenic potential of pollen, either by a changed pollen season, by a changed pollen amount, by changes of the surface exine or by directly increasing the allergenic transcripts and proteins and interactions with biologically important ligands, e.g., flavonoids [18].

The increase in the number of uncultivated areas [19] as well as climate change [21] and urbanization [1] were some of the factors that

favoured the species to spread. High-prolonged autumn temperatures will have as consequences a prolonged *Ambrosia* season [21].

Vincenzo Patella et al. published in 2018 "The Decalogue: Allergy Safe Tree" for allergic and respiratory diseases care+on the influence of air pollution in the urban environment and climate change [22].

Vincenzo Patella et al.'s studies as well as other studies explain the presence of respiratory allergic manifestations for more than 90% of the group under study in the urban area.

The number of people suffering from *Ambrosia* allergy ranges from 2.5% in Finland to around 54% in Hungary [8]. Therefore, Hungary is one of the most affected countries in Europe [19].

The fact that Romania is one of Hungary's neighbours to the western border explains in fact the spread of the species on the Romanian territory, especially in the north-western area [6].

Time lag from *Ambrosia* sensitization to *Ambrosia* allergy was studied by Anna Tosi et al. over a period of 20 years (1989-2008) in northern Italy area [23].

The researchers noticed the fact that sensitization rates have steadily increased for more than 15 years and allergy incidence was delayed in the early years. Therefore, the effects of *Ambrosia* high pollen cannot be carried out on a short term. In 1989, almost 45% of *Ambrosia*-sensitized patients suffered from some respiratory disease symptoms (rhinitis and /or asthma) at the end of the summer [23].

After 5 years, this percentage increased to 70% and eventually reached 90%. Asthma prevalence was initially 30% [23] for *Ambrosia*-sensitized patients and it slightly increased to 40%.

In a study carried out in Croatia on a group of 4013 children aged 2 to 14 years old by diagnosing sensitization to *Ambrosia* pollen and other aeroallergens using the prick test, Maureen Agnew et al. have also tried to identify modifying risk factors for sensitization and *Ambrosia* allergic disease by statistical quantification and concluded that except ragweed pollen levels there were few other potentially significant modifying factors significantly associated [24].

The only exception was the protective effect of life in a rural area, but the reasons behind this association are unknown. According to Maureen Agnew et al., *Ambrosia* sensitization is a risk factor for rhino-conjunctivitis emergence, but without other allergic diseases in children. The results of the study point out the fact that the strategies to lower the risk of sensitization and ragweed-related diseases should focus on policies to limit the spread and eradication of ragweed plant [24].

Different countries experience has revealed the fact that *Ambrosia* infestation lasts for years before allergic sensitization begins to appear in an area and therefore it is misleading the fact that the presence of ragweed does not lead to allergic sensitization [38].

It is almost late to eradicate *Ambrosia* when allergic sensitization to this weed grows, because its seeds can survive up to 40 years in soil [38].

Still, perseverance in eradicating *Ambrosia* is the only way to reduce the large number of respiratory allergies. Unfortunately, time runs out fast [38].

Conclusions

Ambrosia pollen is a highly allergenic species, with increasing prevalence, with great potential to spread in many European countries as well as in Romania. Oltenia area has become one of Romania's regions highly affected by this weed.

Being a threat to the environmental health, the measures taken are meant to limit geographical expansion and inhibit the growth of plant population quantity in order to protect the people who are allergic to it.

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