Eco. Env. & Cons. 28 (3) : 2022; pp. (1301-1308)
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ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2022.v28i03.029

Effect of Biological Pollution on Human Health in North East Algeria "Case of Seraidi-Annaba Region"

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(Received 1 January, 2022; accepted 20 February, 2022)

ABSTRACT

The purpose of this study is twofold first, to identify the pollen that most likely can induce allergic symptoms second, a review of epidemiological records was undertaken from 2013 to 2017 with the aim of determining the prevalence of allergy in the Seraidi region "bouzizi-djnen el bey" in the Annaba Algeria region. The linking between the flowering schedule of the characteristic species of the region (Seraidi) and the results of the analysis has made it possible to identify the species likely to be at the origin of the recorded manifestations of allergy. These are the pollens of certain trees (the oak which occupies the first position, Erica, Pine, Olive tree), the pollens of certain spontaneous herbaceous plants (of the family Compositae, Urticaceae (Parietal)), and pollen from certain grasses (of the family Poaceae (Fecal)). The results of the epidemiological surveys carried out showed that the average allergy due to pollen was 198 in May for conjunctivitis and 100 in April for rhinitis and asthma. Overall, the maximum symptom frequency values recorded in March-April, May and August-November correspond to the maximum flowering of characteristic species. Seasonal variations in symptoms reveal the probable role of pollens in their induction.

***Key words**: Pollen, Allergy, Pollution, Seraidi, Algeria*

Introduction

Spring flowers mark the beginning of spring, but for millions of people, they also indicate the onset of intense respiratory problems and an increase in health problems among asthmatics. The sources often mentioned are many air pollutants, especially of plant origin, consisting of pollens and spores that could be responsible for respiratory genes called pollinosis. Allergies are the fourth disease in the world. (Crossject Newletter, 2017).

The counting and identification of pollen grains makes it possible to estimate and subsequently predict the dates of pollination of various plant families (in order to put in place a preventive action for the benefit of allergy sufferers), but also to decelerate possible changes in the flora and to prevent allergists from doing so. However, in a given place, the dates of pollination and the amounts of pollen present in the air vary greatly from one year to the next, depending on the time it takes at the time of flowering and the time it has taken in the weeks or months preceding it.The study of pollens and pollinosis cannot therefore be separated from that of the meteorological context (Halevy *et al.,* 2001; Vázquez *et al.,* 2003).

Because the concentration of these pollens in the air is influenced by weather conditions (Clot, 2003).

In this study, the aim is to establish a dose-response relationship between health impact and pollen exposure. Pollen exposure data will be provided by analyses on foam pads at the laboratory level,

health impact data will be obtained from a review of records at the polyclinic level. All this informations makes it possible to establish a dose-response relationship between pollen concentration and severity of symptoms and also to determine the sensitivity threshold of each patient taking into account urban parameters.

Materials and Method

Geographic location of the study area

The crystallographic massif of Edough, with an area of 47,350 hectares limited to the North- by the Mediterranean Sea, to the South by the plain of kherraza and the basin of Lake Fetzara, to the West by the commune of Chetaïbi and to the East by the commune of Annaba. (Toubal-Boumaza, 1986) (Fig. 1).

Vegetation

The vegetation cover of the Edough massif consists mainly of forest species, namely, (Oak-Cork, Oak Zeen, Pine Maritime) and other less answered secondary species (DGRF, 2006). On the Floristic plane, the presence of the Zeen oak series is marked by the abundance of aerohygrophiles (ferns, mosses and lichens) in connection with the condensations of orogenic mists

- The study of the vegetation series of the Edough massif has made it possible to individualize the series of the Zeen oak, thus three groups have been determined:
- The group has *Cytisus triflorus*, *Crataegus monogyna*, *Pteridium aquilinum* and *Rubus incanescens.*
- The *Castanea sativa* group.
- The *Alnus glutinosa*, *Laurus nobilis* and more rarely *Ilex aquifolium* group (Bonin *et al.*, 1986).

Types of plant formations

Following the North-South transect, with (Benderradji *et al.*, 1999) identifying the succession of the following plant formations:

- On the north side of the Edough massif, from 0m to 200 m above sea level. The *Quercus coccifera* occupies the dune formations (Cordon dunaire) juxta littoral.
- The space between 200 and 700 m. is dominated by a high scrub which is essentially the *Quercus suber*.
- From 700 m. up to the top, there is a forest of Zeen oak (*Quercus faginea*).
- On the southern slope, between 1000 and 900 m. a dense forest of Zeen oak (*Quercus faginea*) is concentrated mainly on the peaks.
- Between 900 and 500 m. there is a thicket of cork oak (*Quercus suber*).
- Being the two massifs (Djebel Edough and Djebel Rokba), going towards the numidic chain, we encounter low maquis of cork oak, oleo-lentisque and intensive cultures.
- Altitudes between 300 and 500 m. correspond to low *oleo-lentic* scrub.
- Altitudes between 500 and 700 m. show a low scrub of cork oak (*Quercus suber*).
- The altitudes between 700 and 900m are dominated by a high maquis of cork oak (*Quercus suber*).

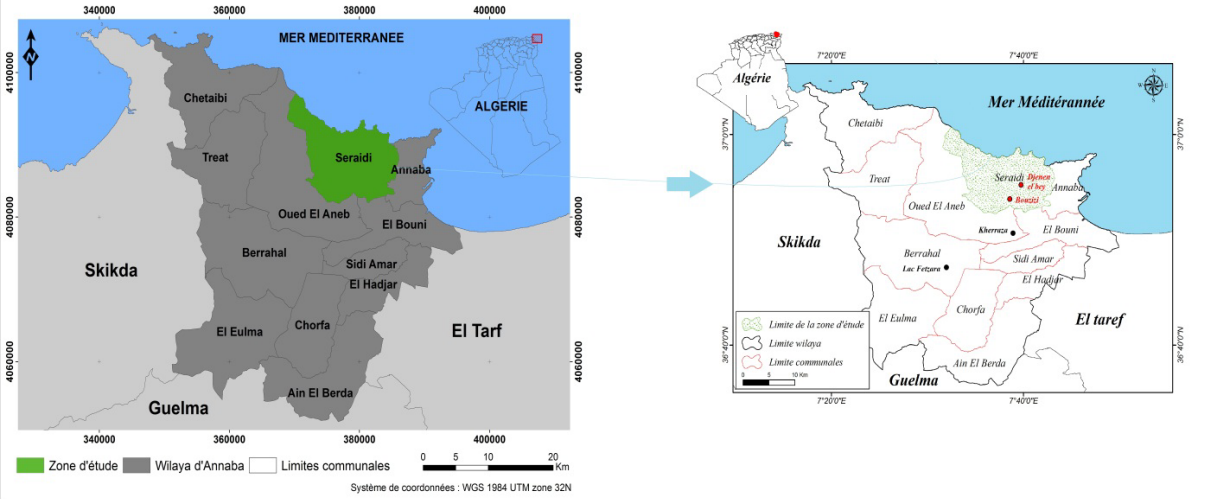

Fig. 1. Geographical location of the Edough massif.

- Altitudes above 900 m (up to the summit of Djebel Rokba) correspond to a dense forest of Zeen oak (*Quercus faginea*).

Climatological Overview

The region is characterized by a Mediterranean climate, an annual average of 15°C. Due to its altitude, the region receives abundant rainfall the annual total is 1043 mm at the Seraidi station during the period 1978-1995. Snowfalls are also frequent, accompanying rains and hail and cover the peaks whose altitude exceeds 700 m, the snow cover may reach 20 cm (Hani *et al.*, 1997).

During our outings, we took foam pads resting on the ground, Based on the following criteria:
- Station and region characteristics, especially humidity
- The longevity of the species that is related to the desiccation time.

Pollen extraction method: (Protocol)

The foam samples collected were stored in plastic bags for processing in the laboratory using the following protocol (Morteza, 2004).
- Put a few grams of undisturbed foams in a bag and then we pour 100 ml of KOH (10%) after a maceration step, we use Hcl a 50%.
- Elimination of all mineral by adding to the base of Zn Cl 2(1,9).
- Acetolysis
- Filtration with water, shake and use a 300 µm sieve
- A glycerine pellet
- Mounting between blade and slide.
- Samples are ready for observation and preservation.

Results

The pollen inventory of the sites studied was carried out after several stages of separation and purification of pollen retained in foam pads freshly harvested in the following sites:
- Bouzizi Station April 2016
- Station djnene el bey April 2017

Monthly pollen counts of atmospheric pollen show the presence of pollen in the region's atmosphere during most of the study period.

Tree and shrub inputs

We counted 25 species of pollen-producing trees and shrubs in the region, Figure 2.

The most common species

Species with high pollen counts are recorded in Table 2.

Table 2. Species with high pollen production

Species	Family	Bouzizi Station	Djnen El Bey Station
Quercus sp	*Fagaceae*	954	2254
Erica arborea	*Ericaceae*	482	1329
Erica multiflora	*Ericaceae*	-	*1178*
Olea europaea	*Oleaceae*	171	700
Pinus sp	*Pinaceae*	*126*	784

Table 1. The sites studied

Zone	Station	Sample	Type of vegetation	longitude E	latitude N	altitude
Bouzizi	**1**	1	Zeen oak forest	7° 38′ 48′′	36° 54′78′′	846 m
19/04/2016		2	Cork oak/zeenoak	7° 38′ 44′′	36°54′79′′	846 m
		3	Cork oak forest	7° 38′41′′	36° 54′ 79′′	839 m
		4	Cork oak forest	7° 38′ 38′′	36° 54′ 76′′	840 m
	2	1	Sample 1	7° 39′ 0.4′′	36° 54′0.4′′	864 m
	3	1	Cork oak forest	7° 39′ 0.1′′	36° 54′0.4′′	852 m
		2	The source	7° 39′ 0.1′′	36° 54′0.6′′	846 m
	4	1	Sample 1	7° 42′ 34′′	36 ° 55′ 43′′	694 m
Djnen el bey	1	1	Zeen oak forest	7° 40′ 498′′	36°54′ 645′′	
21/04/2017		2	Cork oak forest	7° 40′45′′	36°54′613′′	639m
		3	Selagenalafern	7°39′926′′	36°54′621′′	604 m
	2	1	Zeen oak forest	7° 39′ 97′′	36°54′736′′	627 m
	3	1	Zeen oak forest	.7° 39′ 57′′	36° 55′ 13′′	587m
		2		7°39′ 57′′	36° 55′ 16′′	598m
		3		7°39′ 56′′	36°55′ 14′′	580m
		4		7°39′764′′	36°55′ 49′′	552m

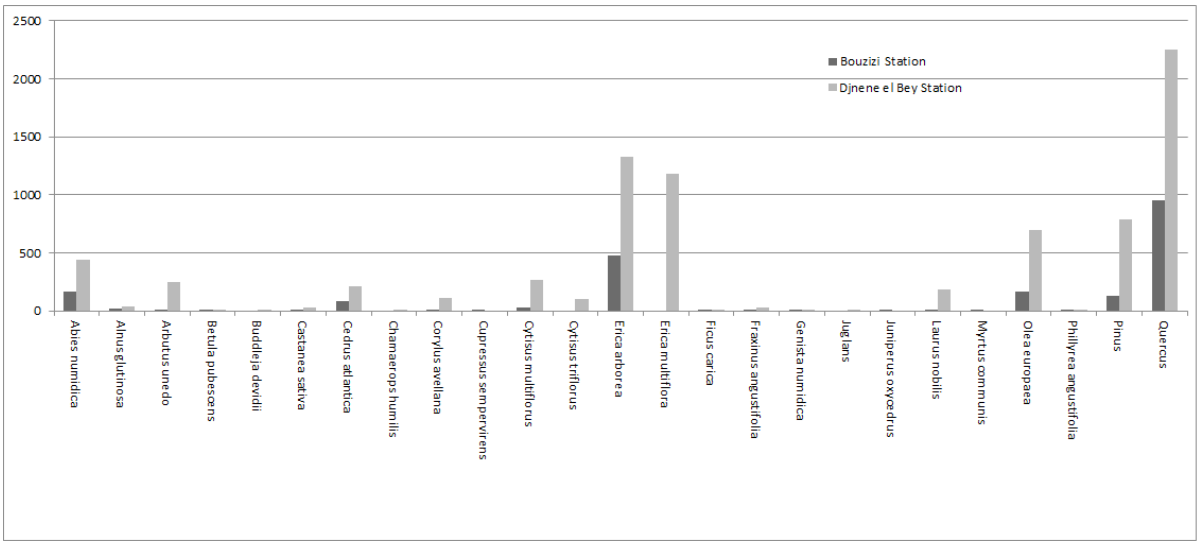

Fig. 2. Pollen supply from trees and shrubs

Pollen calendar of the most allergenic species

Figure 3 shows the flowering period of the species most represented by pollen.

Herbaceous Intake

All the pollen grains of the herbaceous plants recorded were used to draw up Figures 4a and b.

The most common species

Herbaceous species with a high pollen count are recorded in Table 3.

The reading of table N°3 shows a distinction between the species that frequent the low altitudes (Djnen El bey station) and the high altitude (Bouzizi station). The majority of these species are in bloom

Table 3. Herbaceous species with high pollen production

Species	Bouzizi Station	Djnen El bey Station
Polygonum		188
Euphrasia		109
Corrigiolalittoralis	92	
Primula		83
Samolus		62
Callitriche obtusangula		58
Bellis annua	58	
Althaea officinalis		57
Festucacoerulescens		52
Parietaria officinalis	50	
Asteraceae+Poaceae + Urticaceae	59	

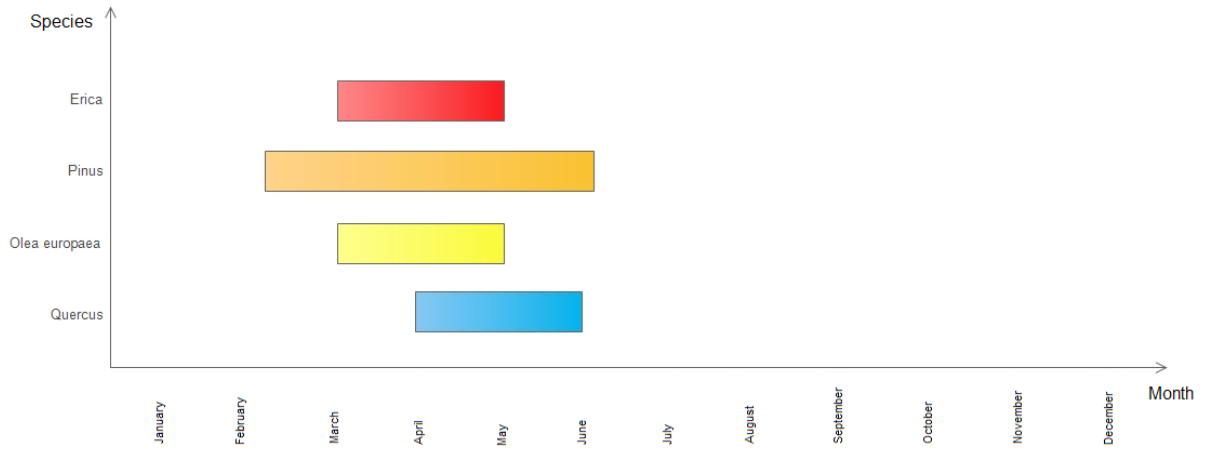

Fig. 3. Pollen calendar of the most allergenic species.

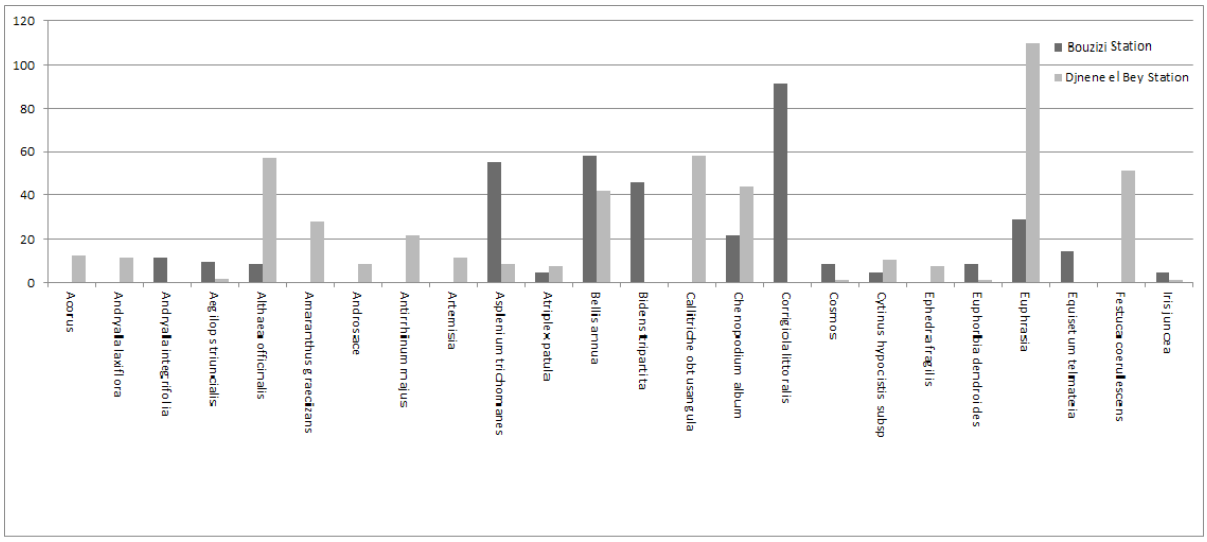

Fig. 4a. Herbaceous pollen supply to the region

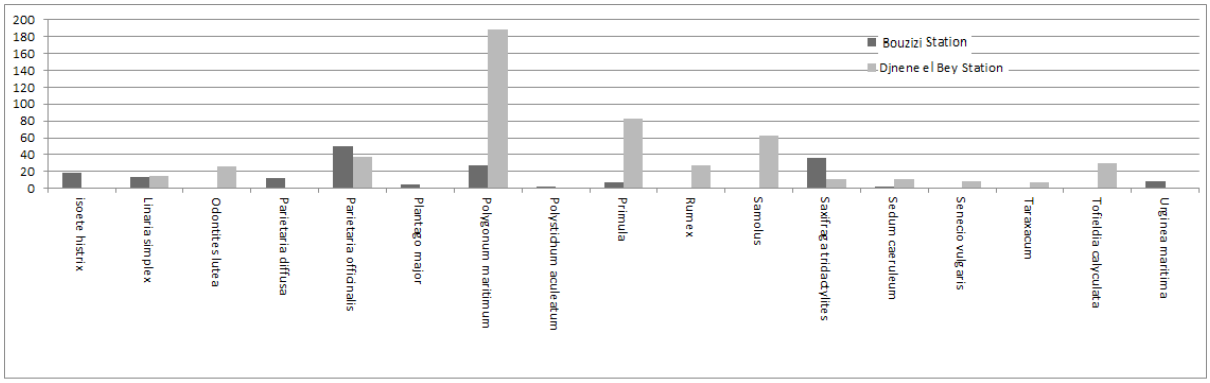

Fig. 4b. Herbaceous pollen supply to the region

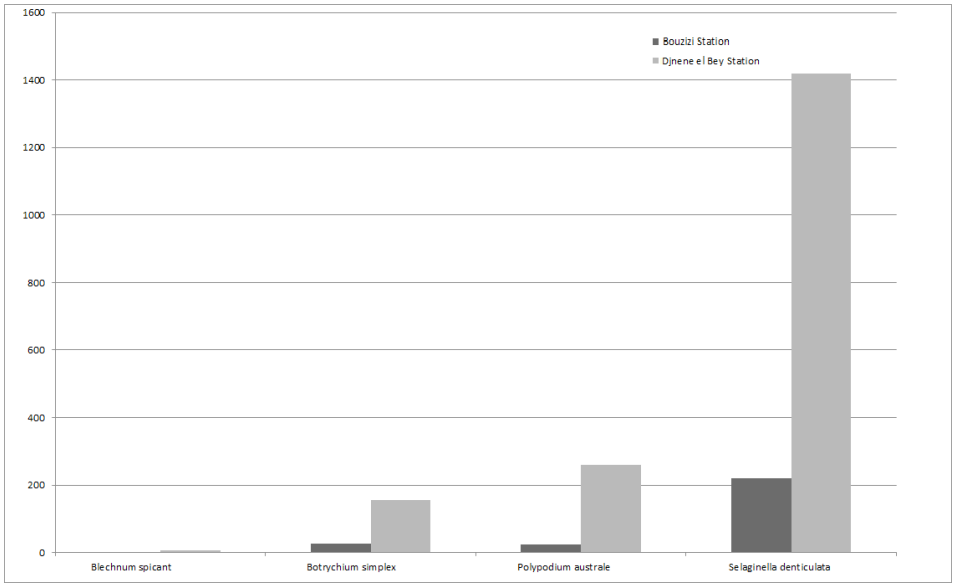

Fig. 5. Contribution of Ferns to Sport in the Study Area

during the spring period and their pollination period coincides with the period of low-speed winds.

Contribution of ferns to sport

The total number of fern sports recorded has made it possible to draw up Fig. 5.

Examination of Fig. 5 shows that *Selaginella denticulata* a Station Djnen El bey with 1420 sports dominates the 4 identified fern species.

Distribution of allergic patients by month of the year

The results of the examination of the records conducted with the health authorities of the region of Annaba (polyclinic safsaf) (Figure 6a and 6b) have shown that the highest number of allergic manifestations has been observed during the period from March to June and even until the month of August for the ophthalmic manifestations «conjunctivitis» while the pneumological manifestations «allergic rhinitis and asthma» are common during the winter period from November to April which reduces the effect of pollen as an allergenic factor.

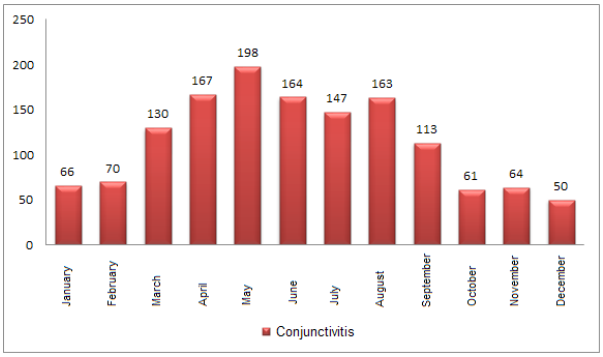

Fig. 6a. The average of allergic persons from 2013 to 2017

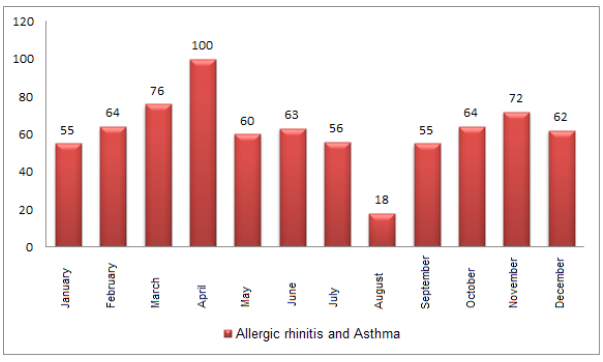

Fig. 6b. The average of allergic persons from 2013 to 2017

Discussion

The pollen inventory revealed the existence of three highly allergenic pollen-producing families in the region, namely the Fagaceae whose flowering period between April and May (Nikolaidis *et al.*, 2015), the Ericaceae between March and May (Mekious *et al.*, 2016) Oleaceae with a flowering period between March and May, (Negrini *et al.*, 1987; Rojo *et al.*, 2016) and Pinaceae which bloom from February to June (Gharnaout, 2015). While herbaceous plants represented by Urticaceae (*Prietaria*) often bloom from February to June. (Gharnaout, 2009).

The superposition of Figure 2 with 6-a and 6-b reveals a perfect correspondence between the flowering period of the main arboreal species and the peaks of allergic manifestations of the populations of the Annaba region, this coincidence is more visible especially when it comes to ophthalmic allergy.

The dominance of ophthalmic allergies is related to the nature of pollen and the manner in which it is dispersed and we find that the most representative family (Oleaceae) is characterized by high pollen production, an anemophilic mode of dispersion (Damialis *et al.*, 2011). This method of dispersal has negative consequences for public health. Olive pollen is one of the main causes of pollination in the region. Fagaceae are involved in triggering early allergic symptoms, such as seasonal rhinitis which is accompanied by conjunctivitis and bronchial asthma. According to (Gioulekas *et al.*, 2004), *Quercus* is considered one of the taxa that can cause respiratory allergies in the Mediterranean world (D'Amato *et al.*, 2007). Pinaceae are considered low allergenic, and this trend has been reported by several authors (Harris and German, 1985; Negrini *et al.*, 1987). Tree pollen is a major trigger for respiratory allergies such as allergic rhinoconjunctivitis (AR) and asthma (A). Sublingual immunotherapy (SLIT) is a treatment option for patients who suffer from it, but not all eligible patients are offered it by their doctor.

Conclusion

Our study area covers the forest of the Edough Forest Massif in the West of the Annaba region (North-East Algerian) with a very important plant diversity in forest species, fodder, honey and in particular allergenic species (Bennadja, 2005).

The flora of Edough is characterized by the preponderance of Fabaceae, Rosaceae, Ericaceae and Cistaceae as well as vegetal groupings consisting of series of Cork-oak, Zeen-oak, Maritime pine and Oleo-Lentisque (Toubal-Boumaza, 1986).

This richness can be linked to the diversity of the vegetation cover that characterizes the region, from which different types of pollen come.

The results obtained from the identification of the atmospheric pollen composition of this region, have provided an image on the specific diversity of the plant cover which is characterized by the presence of tree species including the *Quercus* sp, *Olea europaea*, *Pinus* , the shrubs are represented mainly by the Ericaceae and the Poaceae by Festuca, However the highest quantities are attributed to the trees

Our results are also consistent with those obtained by (Gharnaout, 2015) which concluded that the main allergenic pollens dominant in the atmosphere of the Algiers region and the pollination of trees is early, followed by grasses and then herbaceous.

Other studies carried out in other cities of Algeria (Chahat, 2018) in Guelma and lead to the same conclusions as ours with the highest amounts are attributed to trees (Cupressaceae, Pinaceae and Oleaceae notably *Olea europaea*) and a significant number have also been identified for herbaceous plants.

Indeed, olive pollen is considered a major source of pollen allergy in countries characterized by high olive production such as Italy, Spain and the Maghreb countries (Berghi**,** 2014; Liccardi *et al.,* 1996). The frequency of olive pollen sensitization in the Mediterranean basin is highly variable, with rates ranging from 15.4% to 80.3% (Yangui *et al.,* 2018; Gioulekas *et al.,* 2004; Souki *et al.,* 2015; Ariano *et al*., 1994; Sánchez-Mesa *et al.,* 2005).

On the other hand, the parietal is the main source of awareness of herbaceous pollen with a frequency ranging from 15.3% to 48%. (Yangui *et al.,* 2018; Souki *et al.,* 2015; Ariano *et al.,* 1994; Cosmes & Martín PM *et al.,* 2005; Scichilone *et al.,* 2013).

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