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METEOROLOGICAL INFLUENCE ON THE VARIABILITY OF THE AIR BORN POLLEN

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Abstract

In the City of Annaba, respiratory diseases are important causes of consultation and hospitalization. To contribute to the development of the research as for the biological and environmental pollution, it seemed to us essential to establish a pollen calendar of the city of Annaba. The objective of this study is to know the variability of its allergenic pollen component. The pollen calendar offers a preventive therapeutic utility because it supplies the critical dates of the pollination so allowing knowing the periods about high allergenic risks. For this study, we chose a gravimetric method, using the pollen sensor of Durham. The results we obtained have revealed the existence of pollen from trees or grasses, their monthly average as well as various pollen peaks where these are plentiful in the air of Annaba. The elaboration of the average pollen calendar allowed us to distinguish the seasons in the course of which the allergenic pollen component is plentiful in the air as well as its duration of appearance, periods in the course of which the allergenic symptoms are the most important. The knowledge of the pollen seasons is necessary. It allows us to prevent the appearance of the likely allergic symptoms when the pollen concentration of the air is intense. It is necessary to act as first aids to the public. Thanks to this knowledge the more precise planning of the rhythm of the desensitization of the allergic individuals is possible and easier. We determined the monthly behavior of main allergenic pollens, which we confronted with the weather conditions (pluviometry, temperature and humidity averages). The objective is to manage with this work to make forecasts of the appearance of the pollen rains when the weather conditions are similar. This revealed us that the weather conditions act on the presence of the pollen and its abundance in the air.

Introduction

Among the atmospheric allergens, pollens occupy a dominating place[1]. They are produced in considerable quantities in the water, the air and the ground. They can be transported on long distances[2]. They are involved in the induction and the release of the diseases of allergic causes is essentially anemophilous pollens but they can result from plants with mixed pollination[2]. Allergenicity of pollen grain depends on many factors[3]: Their number and their sizes which can intervene in the genesis of the pathological demonstrations, their smooth or sticky surfaces and the variable rate of the protein fractions which they contain. The allergy is an abnormal immunological reaction of the body face to face of a foreign substance. The set of these clinical demonstrations led by the hay fever is called pollinize[4]. Establishing a pollen calendar allows preventing allergies and offers a preventive utility because it supplies the critical dates of the pollination of the various let us tax[5]. During four years, we collected pollens. The results which we obtained revealed us the dates of the pollen peaks, where the allergenic symptoms are the most important. The knowledge of the pollen seasons is necessary. It allows us to prevent the appearance of the likely allergic symptoms when the pollen concentration of the air is intense; it is necessary to act as first aids to the public. The allergy to the pollen is a real problem of public health; it represents an economic cost mattering for the society in terms of medicinal consumption, medical consultations, hospitalizations and school or professional absenteeism. The knowledge of pollens responsible for allergic appearances allows undoubtedly targeting the treatment of the allergic

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appearances of pollen origin by making cutaneous tests more adequate thus more effective by the elaboration of drum kits containing of pollen allergens specific to the region. The pollinic calendar would allow determining better the threshold of risks for the raising sensitization and the allergic appearances[6]. We determined the monthly behavior of main allergenic pollens, which we confronted with the weather conditions (pluviometry, temperature and humidity averages. The objective is to manage with this work to make forecasts of the appearance of the pollen rains when the weather conditions are similar. This revealed us that the weather conditions act on the presence of the pollen and its abundance in the air. The presence of pollen in the air is conditioned by a set of factors among which three main things are plants susceptible to release them. Count of grains released by every plant and the weather conditions, which act in the various stages of the process[7]: The climate is the synthesis of the daily variations observed in a precise place; It includes generally the following meteorological elements: the temperature, the pluviometry, the humidity, the period of sunshine and the speed of winds[8]. The temperature establishes an important parameter of the climatic environment. Plants undergo the variations according to a seasonal or daily period, which is necessary for their growth and for their development. It intervenes in the levying of dormancy, which is essential to the floral expression[9]. The blooming of flowers takes place only in the favorable conditions of the spring and the summer[10]. The temperature is probably the critical factor, which determines the rate of maturation and the explosion of the floral buds. The early flowering species, prosper when the temperature is still low. It is higher for the species with later blooming. The process of growth also depends on the temperature, but the required minimal temperature is higher[11].

Material and methods

Situation of Annaba city

Annaba opened on the Mediterranean Sea and situated in extreme East of Algeria. The city is characterized by a climate Mediterranean and established by mountains, by forests and by hills. It is very rich by its floral holdings. Many botanical families grow to the spontaneous state; certain plants are used in medicinal purposes for their therapeutic properties recognized by the Pharmacopoeia either by the tradition.

The pollen sensor

We used the sensor of Durham, a gravimetric device, crafted according to the specific standards of size, removable foot and diameter disc. It was placed on one of the terraces of a hospital situated in the urban area of the city of Annaba. This method is descriptive; it concerns a sanitary supervision of the atmosphere. The criteria of evaluation are the presence and the identification of the airborne pollen in the city of Annaba

Harvesting pollen

Pollens are collected on microscope slides. The slides are coated in part with a thin layer of glycerinated gelatin colored with the basic fucsin, the role of which is the support of the pollen on the slide and the facilitation of its microscopic observation. A label is attached to the end of each slide indicating the day, the month and the year. The location of these slides on the sensor is fixed daily and hour. After 24 hours of exposure, they are sent to the laboratory for microscopic observation.

Reading of slides

The reading of the slides is made by using an optical microscope used in magnifications (X10, X40 and X100).
The reading is made on 2 cm^2 of the gelatinized slide by sweeping in slots (from top to bottom and from left to right).

Identification of pollens

It is made by the determination of their morphological characteristics (the size, the ornamentation of the exine, the presence or the absence of apertures).
We use different Atlas that determines both the morphological characteristics of pollen as their identification[4]. The identification is also done with the help of “Palynothèques” (a reference slide collection containing pollen previously collected and identified). These slides are an indispensable tool. They allow us to identify the pollens whose determination may seem doubtful. It is provided by several laboratories:
- Medical material Laboratory of Pharmacognosy, Faculty of Medicine of Algiers,
- Mediterranean Institute of Ecology and paleoecology of the Faculty of St. Jerome of Science and Technology of the University of Aix-Marseille.
- Climate and Health Laboratory of the Faculty of Medicine, University of Bourgogne.

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Results and discussion

Effects of the meteorological parameters on the monthly pollen evolution

To explain the interannual variations of the pollination, we confronted our pollen data with the meteorological parameters of the city of Annaba: The pluviometry (calculated in millimeters (mm). The temperature averages (calculated in degree Celsius (°C) with which the exact appreciation is supplied by the observation of thermometer, represents all the variable weather situation translated subjectively into relative sensations of warmth and cold. The humidity averages (calculated in percentage (%). The wind is an inescapable meteorological factor by its main characteristics: The direction and the strength. Prevailing wind the city of Annaba are winds of the North, the West and to a lesser degree the northwest. The North winds blow on the plain of in the middle of April in October. The winds of the northwest blow of November until in the middle of April. During February, we obtained an average number of grains pollens rather high (757,75) (Fig. 1). The temperature averages being low (11,175°C) (Fig. 3). The high average humidity (77 %) (Fig. 4) and the pluviometry is important (48,875 mm) (Fig. 2). A rise of the pollen quantity and pollen peak is observed in March, with an average number of grains pollens of 8681 (Fig. 1). The humidity is higher than that noticed during February (73 %) (Fig. 4). As well as the temperature (14,325°C) (Fig. 3). On the other hand, the pluviometry are lower (30,425 mm) (Fig. 2). A pollen peak is observed in April (8225,75) (Fig. 1). Weather conditions during this period are favorable. Indeed, the humidity stabilizes around 79,75 % (Fig. 4). The pluviometry is decreased (35,15 mm) (Fig. 2) and a rise temperature is observed (15,325°C) (Fig. 3). It is full the blooming where factories plants release maximum of pollen. One leave of may, common sense observed a pollen decrease. It is fin the period of it of blooming and liberation of the pollens arrived later. The autumnal including season September, in October and november shows of an average of Number of grains less important that the spring season, actually the average number of grains of pollens is respectively 293,75, 307 and 335,75 (Fig. 1). The temperature during this period is finally lower (23,4°C, 20,675 °C, 15,65 °C) (Fig. 3). The pluviometry arrives at a maximum in November with 88,1 mm (Fig. 2) and an average humidity higher is 74,75 % (Fig. 4). This period corresponds to the blooming of some let us tax of arboréen type. For July, in particular of August, pollens reach only average number of 5,75 (Fig. 1). During this month, the pluviometry and the average humidity are decreased (12,85 mm, 71,5 %) (Fig. 2, 4), the temperature during this month, is raised (26,275°C (Fig. 3). It is the period when the majority of the botanical families are at the end of blooming.

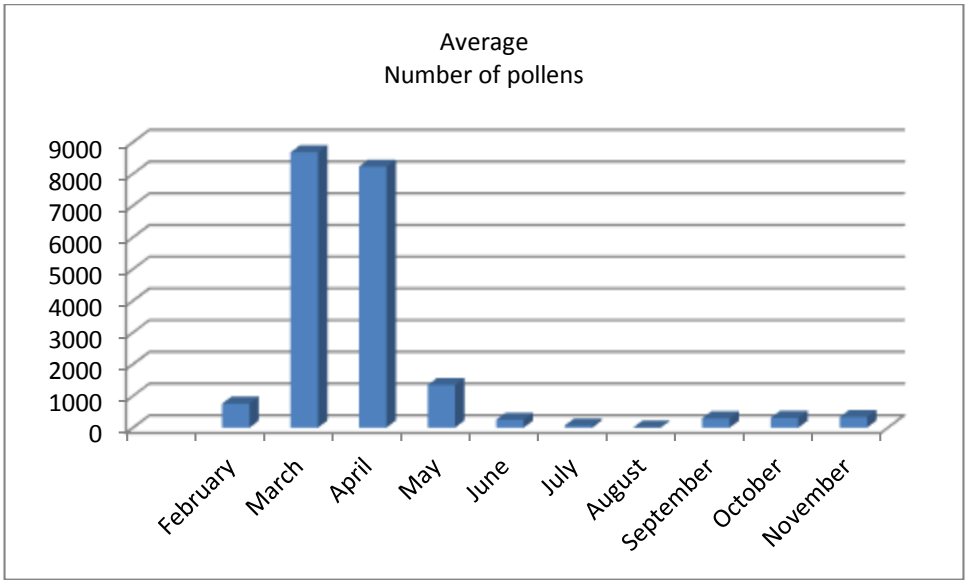

Fig. 1: Average Number of pollens

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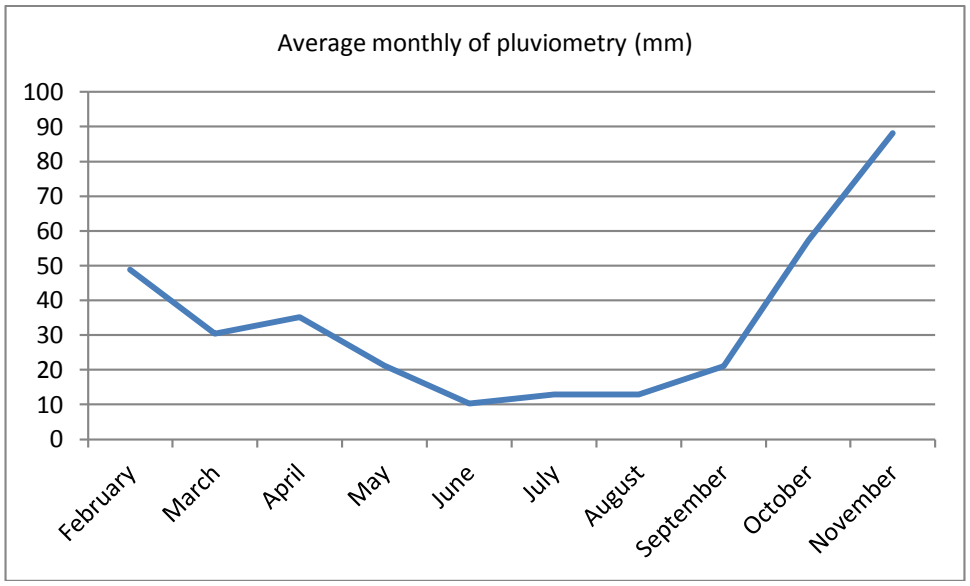

Fig. 2: Average monthly of pluviometry

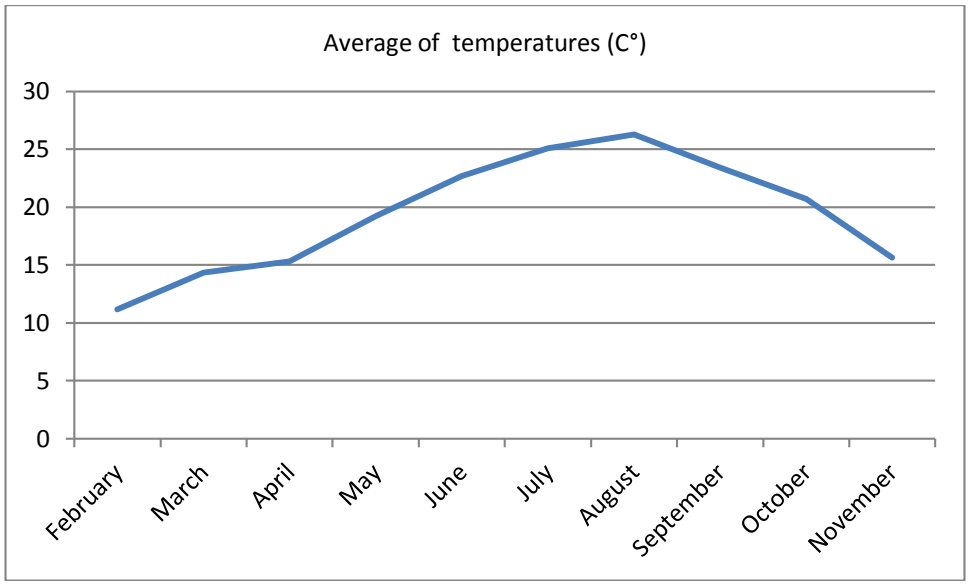

Fig. 3 : Average of temperatures

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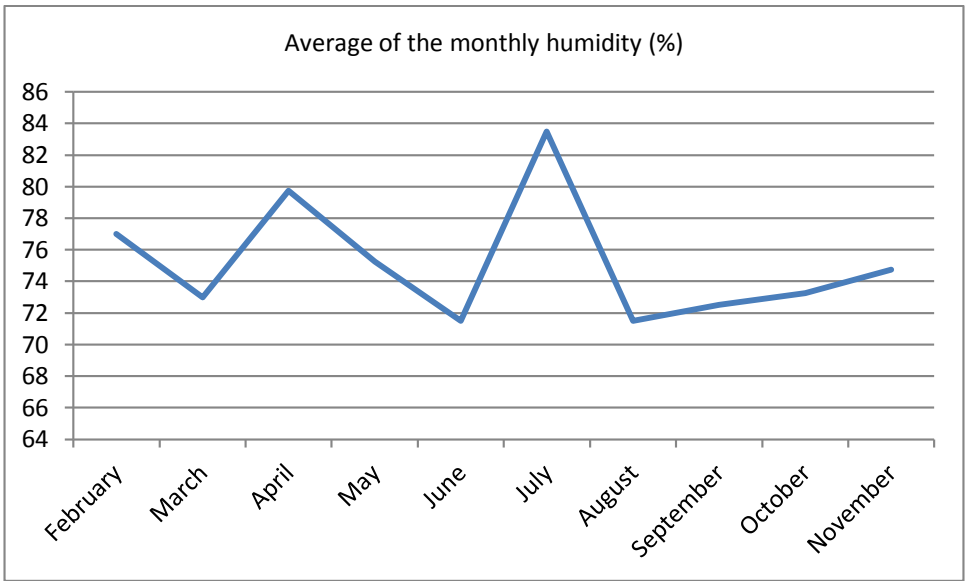

Fig. 4 : Average of the monthly humidity

Allergenic pollen, frequency and dependence in the meteorological variations

The confrontation of the pollen evolution of *Cupressaceæ*, *Fagaceæ*, *Myrtaceæ* and *Rosaceæ* in meteorological conditions allowed us to demonstrate the degrees of influence of these meteorological conditions on the pollen evolution. So, pollen of *Cupressaceæ* abound in the air in March, to reach their maximum by the appearance of a pollen peak of the value of 4900 grains/m ². This increase coincides with a low average temperature as well as pluviometry (14,1°C, 49,5 mm). The average humidity is on the contrary, raised (79 %). The pollen density begins to decrease from April, period in the course of which we let us notice on one hand, a decrease of the pluviometry and the average humidity (44,8 mm, 73 %); on the other hand, a rise of the temperature (15.5°C. It is the end of the period of blooming (table I, fig.5). As for pollens of *Fagaceæ*, they show them selves by the appearance of a pollen peak at the beginning of April, with a value of 2000 grains/m ². Weather conditions during this period show themselves differently. The temperature, the pluviometry and the average humidity are low (16°C, 17,5 mm, 71 %) in March. A lower content in pollens is observed in May with low pluviometry but average humidity and a temperature averages raised (75 %, 20,4°C). It is the end of the process of the blooming of this taxon (table I, fig.5). *Myrtaceæ* is pollens the pollen peak of which appears at the beginning of March with a rate of pollen upper to 840 grains/m ². The average temperature and the pluviometry are little raised during this period (14,1°C, 49,5 mm) and the average humidity is superior to 71 %. A decrease in pollen of the air shows it self from April with an average temperature and a humidity raised achieving respectively 25,2°C and 96 %. The pluviometry is low (13,4 mm) (table I, fig.5). The pollen peak of *Rosaceæ* appears at the beginning of April with a rate of pollens upper to 900 grains / m ². It coincides with a temperature and low pluviometry (18,1°C, and 28,5 mm) but an important average humidity (96 %). A pollens fall begins from May indicating the end of the blooming of this taxon. The pluviometry is decreased (37,6 mm) but the temperature and the average humidity increase to achieve respectively towards the 20,4°C and 80 % (table I, fig. 5).

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Table I : Confrontation of the meteorological conditions with the monthly evolution of allergenic pollen

Pollens	Average humidity (%)	Average Temperature (°C)	Pluviometry (mm)	Pollens value (grains/m²)	Periods of the pollens peaks	Periods of the pollens decrease
Cupressaceæ	79 73	14,1 15.5	49, 44, 8	4900 3200	Mars	Avril
Fagaceæ	71 75	16 25,2	17,5 20,4	2000 500	Avril	Mai
Myrtaceæ	71 96	14,1 25,2	49,5 13,4	840 630	Mars	Avril
Rosaceæ	96 80	18,1 20,4	28,5 37,6	900 20	Avril	Mai

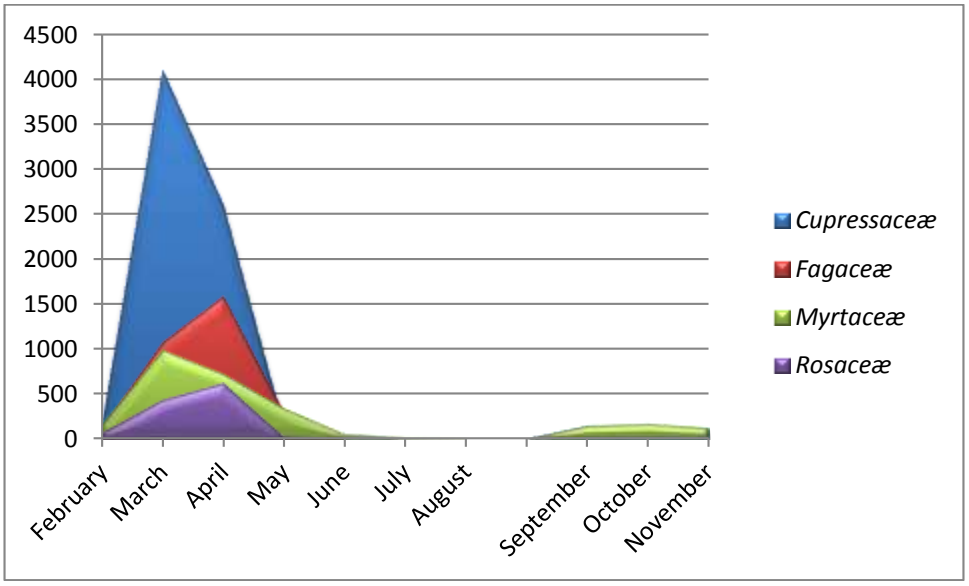

Fig. 5: Monthly periods of the pollen emissions

Conclusion

We attempted to make a pollen inventory in the air of Annaba, wanting by this study, highlight the interest which presents pollen in the atmosphere. For this study, we chose a gravimetric method, using the pollen sensor of Durham. The results we obtained have revealed an important lot of pollen in the air of Annaba. We determined the monthly behavior of main allergenic pollens, which we confronted with the weather conditions (pluviometry , temperature and humidity averages. The weather conditions can have an impact as well over the beginning of the pollen season as on the quantity of present pollen in the air, the temperature acting on the speed of growth of the vegetation in first part of season and determines the moment of the blooming. Numerous methods which are based on the weather conditions are finalized to try to plan the date of the beginning of the pollination of a pollen defined well[16]. What allows the allergic subjects to begin an effective processing before the appearance of the first allergenic

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pollens. Other studies show that the date of appearance of pollens is more and more premature. So in Brussels, the beginning of the pollination of Betula the appearance of which in the atmosphere is situated in March instead of April, is an advance of month within forty years[9]. A little later in the season, the phenomenon finds itself for japonica Cryptomeria. This very allergenic tree saw its pollination moving forward from more than a month to twenty one years [17]. An evolution of the same nature, but less systematic and the lesser scale, is attested for the herbaceous, than it is about Poaceæ between in the middle of May and in the middle of July, than of Plantago, Parietaria judaica or in second summer half, of Artemisia and Ambrosia [18]. This phenomenon is doubtless due to the increase of the wintry temperatures, which would have the effect of extending the wintry dormancy and afterward the blooming. The end of the period of pollination is often delayed on average five days for the set of the species[19]. Even if we find exceptions for certain plants and localities. This already pulls an extension of the period of exposurein allergenic pollens which could increase in the coming years. Certain observations indicate that the increase of the produced quantities of pollens is correlated to the temperatures[20]. The rise of the temperatures would return the more allergenic pollen. This is shown for the birch, the pollen of which contains all the more allergens as the temperature is raised. The same phenomenon is observed for the ragweed the increase of which from 30 to 50 % in allergen in the grains of pollen is pulled by a reheating of 3,5°C[20]. Finally, the global warming could modify the geographical distribution of the allergenic plants and as a consequence, reveal new allergies in regions where they were unknown until now. The models connecting the increase of the temperatures and the cards of vegetation in 50 or 100 years predict a translation generalized of the species northward[19]. However, the projections are difficult to make as far as it is also necessary to count with the capacity of acclimatization of plants, the temporal variability and the frequency of the extreme events as well as the evolution of the human plantations of ornament or agricultural[19].

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