Journal of Fundamental and Applied Sciences

ISSN 1112-9867

Available online at http://www.jfas.info

Research Article

PALYNOLOGICAL STUDY OF ANGIOSPERMS OF ROSTOMID PARK OF TIARET IN ALGERIA

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Received: 03 January 2019 / Accepted: 11 December 2019 / Published online: 01 January 2020

ABSTRACT

The present work consists of a palynological study carried out on 67 species of Rostomid park of Tiaret in Algeria. A classification of the orders according to the number of apertures of their pollens showed that, Monocots mainly present pollen with one aperture. While most of the Eudicots express Triaperturate pollen.

The classification of the studied species according to the form and the number of the apertures of their pollen revealed that the species having tricolpate pollen presented 21%, tricolporate 14%, stephanocolpate7%, Triporate 6%, monocolpate 5%, préporate5%, polyad 4%, while species with other pollen morphology (monad monoporate, dicolpate and inaperturate) represent only an insignificant number. The largest spherical pollen diameter is 122 µm and that of iso polar pollen diameters until111.8/116.6µm.

Keywords: Classification, Angiospermes , Pollen, Apertures, Pollenotheque , Algeria.

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doi: http://dx.doi.org/10.4314/jfas.v12i1.1

1. INTRODUCTION

Pollen is characteristic of the species that produced it [1,2], it is then one very resistant and fossilizable elements of the plant. It is also a kind of identity card, as many different flowers, as many different pollen [2]. A plant can be identified simply by observing its pollen (Roland, 1983). According to[2], palynology is based on the possibility of determining the plant that produced the pollen, according to the morphological characters (size, shape, position) of the observed grain[3,4]. Pollen databases have been set up to facilitate these reconstructions.

Concerning the production in quantity of pollen grains, plants with anemophilic pollination (by the wind) produce a large quantity of pollen grains of very small size (from 10 to 15 μm) and with reduced or no ornamentation Ex: Willows, Grasses [5]. To increase their chances of breeding, the anemophilous species will therefore produce a considerable number of pollen grains: it has been estimated that a rye spikelet could release in one day 50 000 grains of pollen and a kitten of hazel 4 million [6]. Anemophilous species will also produce smaller pollen grains [6].

Entomophilous pollinating plants (by insects) produce, less abundantly, larger grains (up to 200 to 250 mm) [5]. Hydrophilic pollinated plants (by water), pollen grains are often filamentous and large (up to 3 to 5 mm) without exine and sometimes coated with mucus.

Apertures played an important role in the survival of the pollen grain, as well as in pollen tube placement [7]. This character is therefore probably subject to selection. In addition, the apertural type has certain diversity in angiosperms.

The study of pollens has many applications: aeropalynology, treatment of allergies and respiratory diseases, plant biology and taxonomy, melissopalynology and archeology. These different applications of palynology can only be done by the presence of a pollen reference system, because pollen analysis is a comparative method. Our work consists of a classification of the plant species present at amusement park of Tiaret in Algeria amusement park according to the external appearance of their pollen (shape and number of apertures) and the measurement of diameters.

2. MATERIEL ANDMETHODES

2.1 Study area

The study was conducted at the amusement park and recreation, located north of the city of Tiaret. This park covers an area of 75 hectares. The terrain is characterized by acid soils of sandy

texture. The climate of the region of Tiaret is semi-arid inferior whose dry period extends from May to October. The work done during the four seasons of the year to study all the herbaceous, seasonal and annual plants.

2.2. Preparation of reference pollen collection

To make the reference pollen collection, the plants were collected just before the opening of their flower buds. The openings of these flower buds must be done in the laboratory to avoid contamination of the flower by anemophilic pollens present in the atmosphere or even pollen transported by insects. The ripe anthers are placed either directly on a slide or in a watch glass. Drops of chloroform are poured which has the effect of releasing the pollens of the anthers that contain them. After evaporation of the solvent and the removal of the remains of the anthers, the Canada balm fights the preparation. To keep the pollen in its natural color and its true appearance as can be observed in honey, this preparation was performed without staining. The prepared pollens are thus turgid as in honey.

The preparation is labeled. The label mentions, the botanical family, name of the species , the date and place of harvest and a number to list it. Taking pictures and measuring pollen grain diameters were done using a microscope with camera and measuring ruler.

3. RESULTATS AND DISCUSSION

3.1. Flowering periods

The determination of the flowering dates of the plants and the concentrations of each type of pollen is essential to know the periods of pollen emission and presents an aid to treat allergies and respiratory diseases. The richest period by the emission of the grains of pollen being from the beginning of March until the end of May without forgetting the autumnal herbaceous plants.

The trees flower in the spring and are designated as early to intermediate flowering plants. There are often cross allergies between these different trees, that is, a patient has allergy symptoms when exposed to pollen from various trees. Another important group of pollen production is herbaceous plants. Their allergic potential is, apart from a few exceptions, rather moderate [8].

In addition, pollen grains may be present in the air when flowering is complete. The period of the pollen season is then longer than the flowering period. Strongrain leaches the contents of the atmosphere, causing rapid sedimentation of pollens, thus reducing the amount of pollen in the air [9].

3.2. Identification of pollen aspects (Shapes and apertures)

Observation under optical microscopy of the pollen grains (figure 1), allowed us to distinguish several different aspects in shape and apertures. In fact, the forms encounters are spherical, rectangular, oval or hexagonal.

Apertures are therefore a key element of the pollen wall. The aperturate type is a character that takes into account the number, form, and disposition of apertures [10]. The number of apertures can vary from zero (for inaperturate pollen (figure.1.D)) to more than one hundred apertures, even though most species have apertures generally less than or equal to six. The three principals forms are ,the colpus(figure 1.I), which is called sulcus, the pore (figure 1.A), and the colpore (or colporus), is that is, an association between a colpus and a pore(figure 1.E),, which is common among Eudicots.

Depending on the number of apertures, the pollen is a monoporate (a pore), diporate (two pores), triporate (three pores), titraporate (four pores) or periporate (several pores).

The same designation is found for the apertures in furrows, one finds pollen monocolpate (a colpe), dicolpate (two colpes), tricolpate (three colpes), titracolpate (four colpa) or pericolpate (several colpes).

Pollens with colpes and pores are polluted pollens. Thus, monocolporate pollen carries a single colpe and a single pore, pollinated dicolporate (two colpes and two pores colpes), tricolporate (three colpes and three pores), titracolporate (four colpes and four pores) or pericolporate (several colpes and pores)).

These apertures present on the grains of pollen can condition the shape of the pollen grains and thus play a primordial role during the fertilization, because, through these openings will germinate the pollen tube.

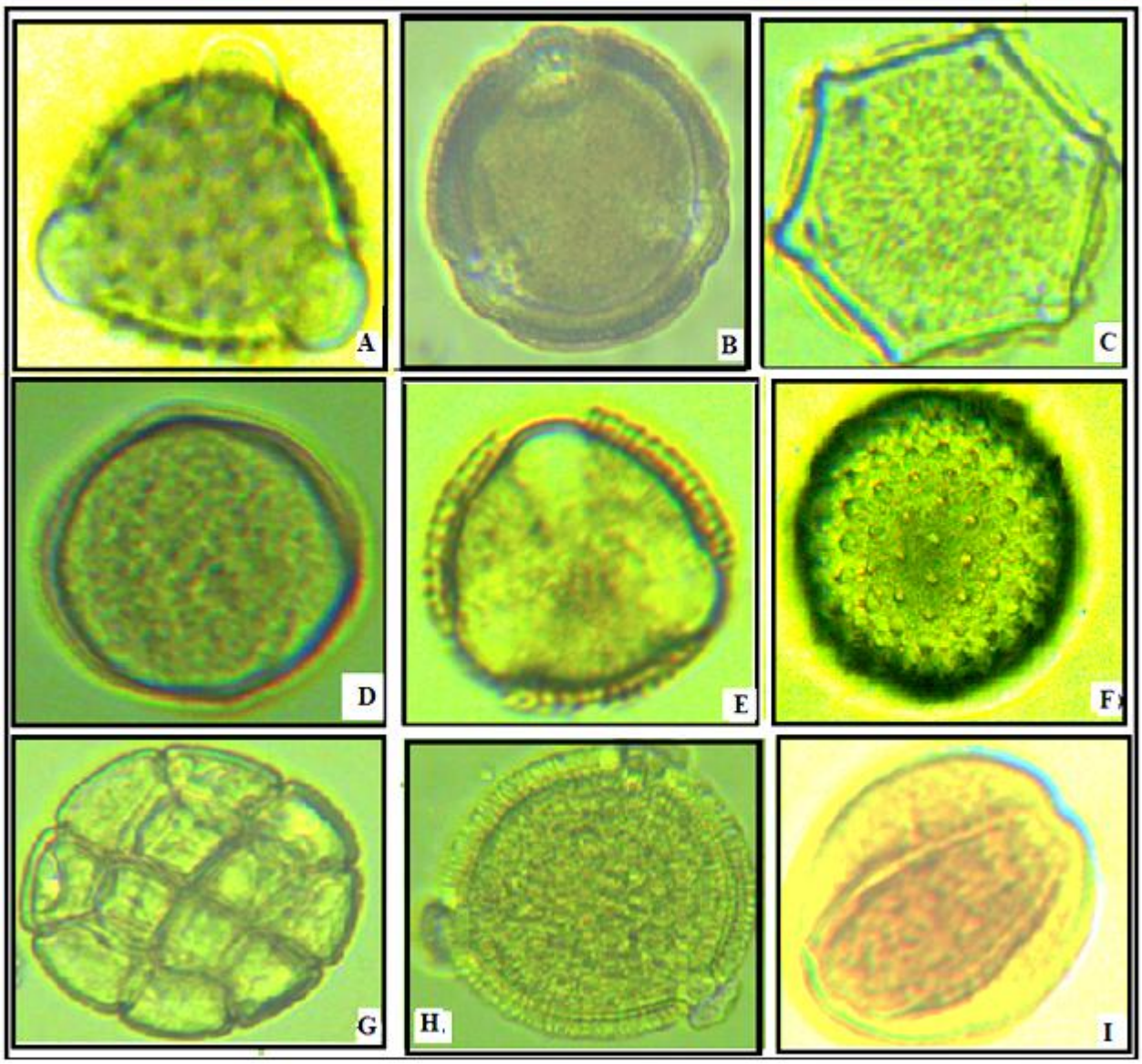

Fig.1. Some pollen species studied under optical microscopy (magnification × 40); **A:** Monad Triporate Pollen of *Calendula officinalis*, **B:** Monad Triporate Pollen of *Convolvolus arvensis*, **C:** Monad hexacolpate Pollen of *Lavandula pinnata*, **D:** Monad Inaperturate Pollen of *Raphanus raphanustrum*, **E:** Monad Tricolporate Pollen of *Sinapis arvencis*, **F:** Monad Périporate Pollen of *Malva sylvestris*, **G:** Polyade Inaperturate Pollen of *Acacia saligna* (ex *cyanophylla*), **H:** Monad Triporate Pollen of *Viola sylvestris*, **I:** Monad Dicolpate Pollen of *Phillyrea angustifolia*

3.3. Frequencies of appearance of various aspects of pollen at the studied species

The determination of the morphology of the pollen grain of each species studied showed the presence of a very important interspecific morphological polymorphism reflected by the

appearance of two forms of apertures (pore and colpe) and a very variable number of these apertures to different species (fig.2, tab1).

Through this study, we have found that the species having tricolpate pollen were in large numbers(21%), the tricolporate pollen (14%), then the species whose pollen appearance is stephanocolpate(7%), tricolporate pollen (6%), periporate pollen (5%), monocolpate(5%). . while the species polyad, pollen monoporate Monad, dicolpate Monad, and inaperturate Monad are represented by an insignificant number respectively(4%,2%, 2% and 1%).

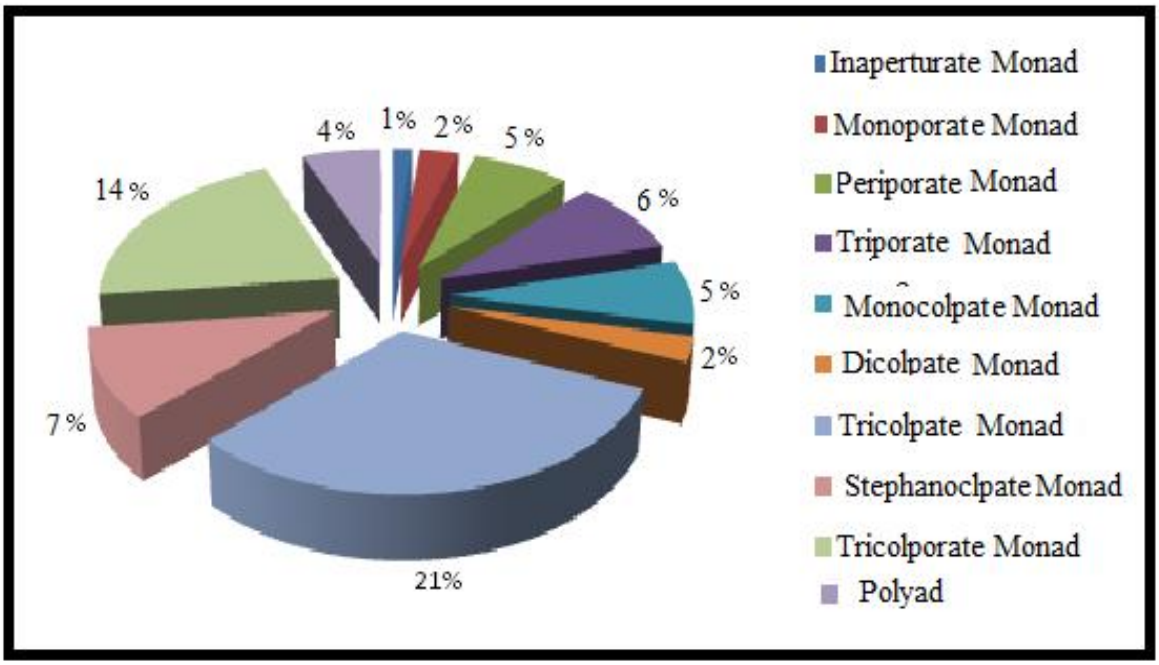

Fig.2. Frequencies of appearance of various aspects of pollen at the whole of the Angiosperms species of site

3.4. Classification of the Angiosperms of the study site according to the number of apertures of their pollen

The analysis of the results obtained shows that the Monocots studied are represented by three principal orders, Liliales, Asparagales and Arecales possessing a pollen of a single aperture (Mono-aperture) (fig.2). Inaperturate pollen appeared in some Liliales. Not only the number of apertures that vary but also the form of apertures. Indeed, the pored pollen is most manifested in Monocots than the colpate pollen (tab.1).

Concerningthe dicots, Triaperturate pollen is the morphology mainly expressed by the Rosidae and Asteridae, whose tripor pollen is much more common than the Tricolpate pollen.

The Ranunculales group and the Papaverales form the Proto-eudicots or pro-triporate group that has one, two or three apertures in their pollen. We found that the super clade is that of the Rosids with seven orders of the dicots Angiosperms produce pollen with three apertures in the form of pore or colpe.This clade arrangesthe central Eudicots(Fabales, Salicales, Malvales, Euphorbiales, Brassicales, Geraniales, Rosales and Myrtales.

Finally, the last clade gathers the evolved Eudicots, the Pre-Asteridae are the Cryophyllales, Asteridae I which contain the Boraginales, Lamiales, and the AsteridaeII (Campanulids) which gather the Apicales , Dipsacales and Asterales offering the pollen with three apertures. In the Lamiales acolpate pollen is the most dominant than that a pollen with pore .

Brassicales and Lamiales can produce pollen with more than three apertures. Indeed Brassicales carry a Stephocolpate pollen (more than three colpes) (example;,*Citrus limonum* risso).Than, order of Lamiales expose a peréporate pollen(*Ocimum basilicum, Salvia officinalis)* and Stephocolpate pollen (*Lavatera cretica).*

The two most representative types in Monocots and Eudicots in our study site are mono aperturate pollen and triaperturate pollen**,** and we found that monoapertured pollen is dominated in Monocts. However, Eudicots are characterized by the dominance of triapertured pollen. Accordingly, [11] showed that in spite of variations, two main pollen types dominate: a pollen with one aperture in Monocots and early diverging angiosperms, and a pollen with three apertures in Eudicots. Thus[11] showed that inspite of variations, two main pollen types dominate: a pollen with one aperture in Monocots and early diverging angiosperms, and a pollen with three apertures in Eudicots. Therefore our cladogram presenting the classifications of Angiosperms of our study site according to number of apertures of their pollen is much more in conformity with the new classification [12].

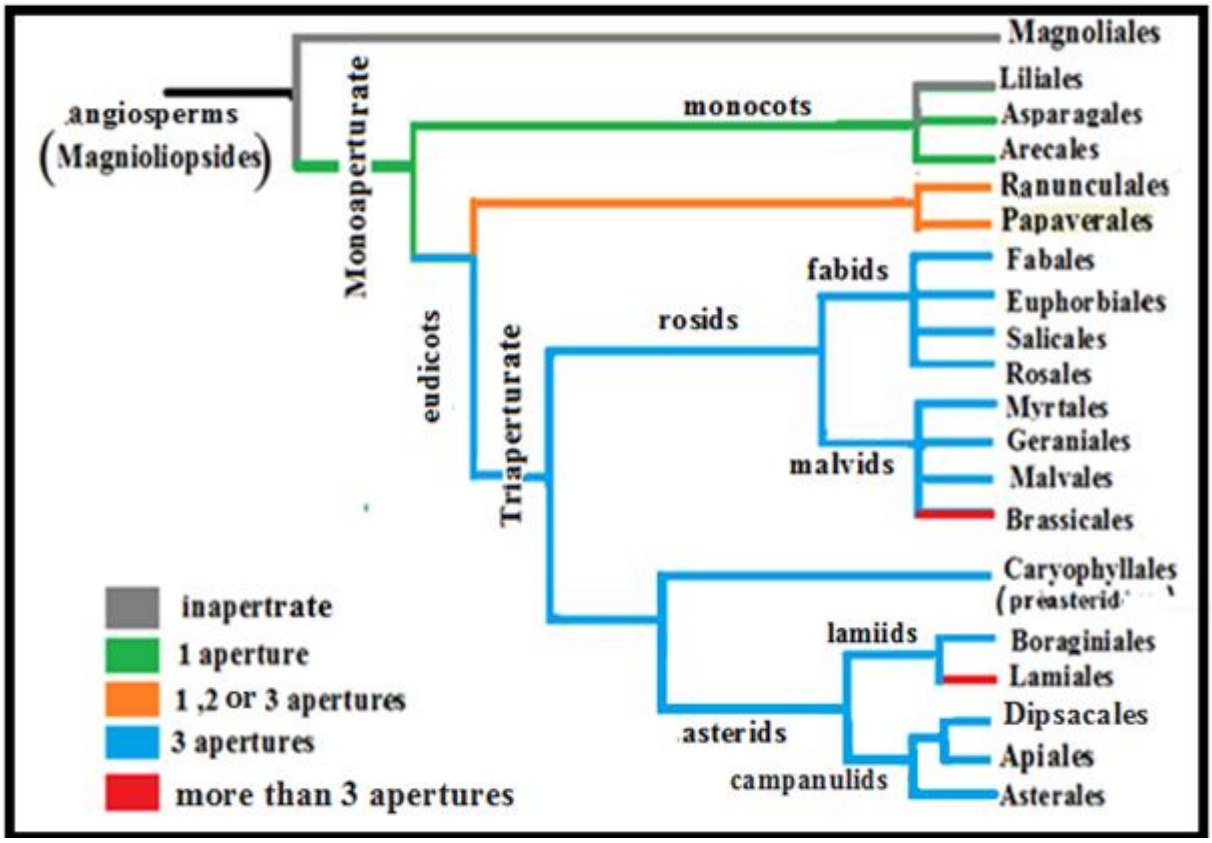

Fig.2. Classification of Angiosperms of Rostomid park of TIARET in ALGERIA according to the apertures number of their pollen

3.5. Diameter of pollens

In a pollen grain, the polar axis, designated by **P**, joins the two poles. The equatorial axis, denoted by **E**, is perpendicular to the polar axis, the equatorial plane divides the pollen into two hemispheres. These axes are identified on isolated grains by the arrangement of apertures (Openings in the membrane)[13].

The diameters of spherical pollen (tab.1) vary between 18.64 and 116.5 µm, the latter diameter is found in the species *Acacia floribonica*, the most frequent sizes vary between 18.64 and 58.25 µm. The iso polar pollens have diameters of 34.95 / 20.97 to 111.8/116.6µm (present by the species *Orchis papillon*.

Table 1: Classification of listed species according to aspects of their pollen (form and number of apertures) and diameter measurements

Aspect of pollen	**Species**	**Diamètre in (µm) P /E Or D**	**Aspect of pollen**	**Species**	**Diamètre in (µm) P /E Or D**
Inaperturate Monad	*Cupressus senpenverens*	96/4.66	**Dicolpate Monad**	*Dipcadi serotilom* *Ranonculus arvensis*	37.56/68.19 58.25
Monoporate Monad	*Orchis papillon* *Gladiolius seglium*	111.8/116.6 70/58.25	**Monocolpate Monad**	*Muscari comosum* *Alium nigrum* *Ornithogalum umbellatum* *Tulipa sylvestris* *Asphodelus microcarpus*	72.23/46.6 93.2/37.28 114.17/53.5 79.22/30.29 69.9/60.58
Triporate Monad	Scolymus grandiflorus *Euphorbia closcopia* *Convolvolus arvensis* *Viola sylvestris* *Jeneperus oxycedrus* *Fumaria capriolata*	46.6 39.61 122 115 41.94/25.63 58.25	**Stephanoco-lpate Monad**	*Lvandula stoechas* *Salvia sclarea* *Ocimum basilicum* *Salvia officinalis* *Rosmarinus officinalis* *Veronica cymbalaria* *Pulmonaria offecinalis*	51.26/46.6 65.24/55.92 62.92/58.25 95.53/81.55 58.25/46.6 55.92/51.26 55
Tricolpate Monad	*Trogopogon crocifolius* *Resida alba* *Malus pumila* *Eucalyptus globulus* *Fedia graciliflora* *Veronica persica* *Lonicera caprifolium* *Papaver roehas* *Tamarix Africana* *Adonis anua* *Raphanus raphanustrum* *Lamium amplexicaule* *Sanchus sp* *Jasminium fruticans* *Centaurea dealbata* *Centaurea pullata* *Centaurea vulgaris* *Centaurea sp* *Papver hybridum* *Coronella scorpioïda*	39.61 34.95 37.28 34.95 65.24 55.92 18.64 25.63 18.64/16.31 37.28 43.36 22.15 30.29 55.92/34.95 55.92/46.6 48.93/39.61 58.25 58.25 44.27/39.6 33.50 18.64	**Tricolporate Monad**	*Sinapis arvencis* *Anchuza azurea* *Cercis siliuastrum* *Cistus monospeleinsis* *Calendula officinalis* *Linaria vulgaris* *Vicia sativa* *Cistus incanus* *Cichorium intybus* *Erodium cicutarium* *Ranunculus sceleratus* *Chrysanthemum leuconthemum* *Anagalis arvensis* *Verbena officinalis*	53 58.25/45.6 30.29 51.26 61 23.3 46.6/27.95 41.94 37.28/34.9 65 69.9/62/91 25.63 23.3 46.6
Périporate Monad	*Cynglossom cheirifolium* *Thymelea hirusta* *Plantago officinalis* *Lavatera cretica* *Malva sylvestris*	18.64 96/27 34.95 25.63 104.85	**Polyad**	*Orcchis mascula* *Mimosa pseudo-acacia* *Acacia floribonica* *Acacia saligna* (ex *cyanophylla*),	37.28 34.95/30.29 116.5 135/105

4. CONCLUSION

The determination of the interspecific polymorphism of the pollen of the different species is a prerequisite for the definition of the strategies of their evolution over time. Thus, this study also classifies the Angiosperms of the study area in a cladogram more similar to that of APG III depending to the number of apertures.

It is very necessary to enrich the reference collection by the pollen of the different species of the region, to make the observation in 3D and to use the electron microscope in the palynological study and to enrich the pollen calendar by the dates of flowering of the most allergenic trees. It is also interesting to make a palynological study of different populations of the same species to see the inter-specific polymorphism. The knowledge of aspect and apertures of pollen as well as the determination of the periods of blooms allows us to know the sites and the allergising periods.

The presence of a pollen analysis laboratory in the region of Tiaret or in other regions is not only a necessity in beekeeping for the analysis of honeys ,but also a help archaeologists to know the past of Tiaret from the pollen analysis of archaeological sites which can give us information on vegetation and climate.

5. ACKNOWLEDGEMENTS

We thanks the director of Rostomid park of tiaret and all engineers of physiology vegetable laboratory of Ibn Khaldoun University of Algeria

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How to cite this article**:**
Maghni B**,** Ait Hammou M, Khedim R., Maatoug M, Hellal B. Palynological study of angiosperms of rostomid park of Tiaret in Algeria. J. Fundam. Appl. Sci., 2020, *12(1), 1-11.*