Acta Scientific MICROBIOLOGY (ISSN: 2581-3226)

Volume 5 Issue 6 June 2022

Research Article

Road Tree Pollen Grains Sensation to Allergy and their Effects on the Immune System

Wafaa Kamal Taia[1]*, Ahmed A Zayed[2], Abdelbasit M Asker[3] and Salem AH Mohamed[4]

[1]Alexandria University, Faculty of Science, Botany and Microbiology Department, Alexandria, Egypt

[2]Alexandria University, Faculty of Medicine, Alexandria, Egypt

[3]Botany Department, Faculty of Science, Benghazi University, Libya

[4]Microbiology Department, Faculty of Science Al-Khoms, El-Mergib University, Libya

***Corresponding Author:** Wafaa Kamal Taia, Alexandria University, Faculty of Science, Botany and Microbiology Department, Alexandria, Egypt.

DOI: 10.31080/ASMI.2022.05.1084

Received: April 19, 2022

Published: May 25, 2022

Abstract

Air pollution beside climatic conditions has severe effect on pollen grains collected from different plant species. Outdoor allergens are an important cause of allergic rhinitis, conjunctivitis and asthma, especially pollen grains and fungal spores being the major outdoor allergens that induce symptoms in atopic patients. Specific airborne pollen grain types, especially those collected from anemophillous plants, trigger respiratory allergy symptoms in sensitive individuals and cause immunity disorders. This work aims to investigate the effect of eight road trees commonly planted in Alexandria city streets by analyzing the protein contents and some element contents as an allergy inducing particles. The pollen grains collected from the flowers of *Bauhinia galpinii, B. variegata, Casia javanica*, *Parkinsonia aculeate, Peltophorum roxburghii*, *Delonix regii, Croton cotinifolia*, and *Jacaranda mimosifolia*. The pollen grains have been obtained during the summer period of July till November 2019, acetolyzed and examined. Non-acetolyzed pollen grains have been prepared for SEM examination. Pollen grains have been smeared onto glass slides, stained and photographed for protein contents evaluations. X-ray analyses has been used in measuring the mineral contents. The results obtained revealed that allergic symptoms appeared in response to the density, dispersion, and protrusions. Our data indicated that many factors inducing allergic diseases can trigger the immune system as several environmental conditions and loss of biodiversity. This stimulant beside the exposure to submicronic particles may be causes the stimulation of the immune system and result in breath difficulty and asthmatic symptoms. Meanwhile, the high protein contents, C, S and K can induce breath disorders. These results discussed according to their effect on the immune system. From the present study *Delonix regia* and *Parkinsonia aculeata* are the most responsible road trees which stimulate the human immune system, as they have small size pollen grain and high contents of C, S and K.

Keywords: Allergy; Immunology; Pollen Grains; Road Trees

Introduction

Allergy became from the most globally important issues in this time, especially after the increase in air pollution and viral infections. Symptoms of allergy are due to the interaction between the body and any foreign substances. These interactions stimulate the immune system to a harmless materials carried in the air to produce IgE by the mast cells and basophils bacteria. The degree of sensitivity to the inhaled substances depends on the people history, age, sex, as well as the type and quantity of these substances. Smaller particles can penetrate the bronchi very easily and cause allergenic effects and in severe cases cancer or even mortality. Meanwhile [1-4] linked between air pollution and the increased number of Covid-19 death risk. Air pollution may be due to the increase and unbalance in any air contents, biotic or a biotic. From the dominant biotic factors are bird feathers, pollen grains and the fungal spores. The pollen grains can be seen as the yellow or orange dusts found on the petals of opened flowers. They are the male gametes in both Gymnosperms and Angiosperms, and considered from the most important outdoor sources of allergens especially those released from anemophilous plants, trees, grasses and weeds. In Mediterranean and hot countries, the governments planted many road trees for decreasing the hot feelings in summer and ornamentation. Pollen grains released by some species of these trees constitute one of the most important causes of pollinosis [5]. Continuous inhaling to these pollen grains led to a variety of allergic symptoms and severe asthma in susceptible individuals [6]. [7] mentioned that many types of pollen grains stimulate the production of IgE which is the allergens indicator. [8] noted to the annual periodicity of pollinosis in humid countries, usually occurring at the time of pollination of the common road trees.

Pollen allergens are usually water-soluble proteins, or glycol-proteins, sometimes starch and fats, which stimulate evoking an IgE antibody-mediated allergic reaction in seconds to those peoples with allergic history. [9] isolated fifteen distinct groups of proteins with diverse biochemical properties as allergens in species belonging to subfamily Pooideae, family Poaceae (Graminae). [10] clarified the allergens as proteins capable of citing powerful T helper lymphocyte type 2 (Th2) responses, resulting in the production of immunoglobulin (Ig)E antibody. Unfortunately, specific selection of aeroallergens for the skin prick test by allergists is not always evidence-based. [6,7] recognized that trees of the Fabales, Fagales, Lamiales, Proteales, and Pinales are recognized as the most allergen sources. In the same time, they specified both *Prosopsis juliflora* and *Peltophorum pterocarpum* trees as source of the important allergen. Also [11] found that date palms polen grains produce clinically relevant allergens. [12] found that allergy is not due to certain types of trees, shrubs, or herbs, but it depends mainly on the quantity of pollen grains released in the air beside several environmental and climatic factors.

This work provides description of the pollen grains of some widely cultivated in Alexandria road trees and estimating their protein and mineral contents. Alexandria city has its own climatic factors which can aid in the release of the pollen chemical constituents causing allergy. It lies in the Mediterranean coastal region of Egypt, has specific weather with high humidity in summer and rainfall in winter. The chosen trees are widely cultivated in the streets of Alexandria city and their flowers are flourished in the summer from July to November. This hot summer hydrates the pollen grain to excrete their allergens substances affecting the human immune system causing severe symptoms to allergic people. This work can aid those working in aeropalynological, immunological, and horticultural studies and governments planning strategies in planting road trees. The present research has been done to investigate whether the protein and element contents of the cultivated road trees stimulate the human allergic response and the immune system.

Mechanisms underlying allergy response

Allergy is defined as an extraordinary immune system response against normal environmental compounds, i.e., allergens. Symptoms of allergy start when allergens crosslink the performed immunoglobulin E (IgE) bound to the high-affinity receptor FcεRI on mast cells. [13] announced that mast cells are crucial for the progression of allergic reactions, and function as sensors of psychological and environmental stress. The main role of IgE, lies in its ability to activate the release of biologically active mediators in an antigen-specific manner by sensitizing mast cells. More accurate upon activation, mast cells release chemokines, lipid mediators, beside cytokines to perpetuate the TH2 response. The differentiation of naïve allergen-specific T cells into TH2 cells is stimulated by an early burst of IL-4 presence. IL-4 seems to be obtained from a specialized subset of T cells. The IgE, produced as a defense strategy to specific allergen, stacked to the high-affinity receptor for IgE on the above mentioned mast cells.

In the case of pollen allergy, the TH2-biased immune system begins to react against pollen-derived allergens. The allergic reaction against the pollen grains progress in the same way as other known allergic responses, and composes two phases. The first phase, the begining, depends on IgE receptors binding, which resulted in the activation of mast cells and basophils. The second phase, comes later, in which the adhesive molecules, eosinophils, lymphocytes and their products, and neuropeptides engagemed [14]. [15] unveiled the basic mechanism for the quick developing of an allergy to pollen grain causing allergic asthma or even seasonal nasal allergies. Inhaling the pollen grains rapidly induces recruitment of neutrophils, white blood cells that run to an affected site and induce inflammation. The mechanism of action through which this reaction happens is an induction a state of sustained oxidative stress in the airways. Chronic oxidative stress can alter the function of dendritic cells, worsen allergic asthma, and modify the balance of TH1 and TH2. [16] correlated the role of oxidative stress and susceptibility to pollen allergy. The impact of oxidative stress happened by pollen grains on dendritic cells has a dual-action, besides activating the production of pro-inflammatory cytokine from dendritic cells linked to local innate immunity, it also an adjuvant factor in the adaptive immunity initiation against pollen allergens.

Materials and Methods

Flowers buds collected from eight road trees; four deciduous, and four evergreens; during the summer period of July till November 2019 subjected in this study. These flower buds from perennial trees, widely planted in Alexandria streets namely; *Bauhinia galpinii, B. variegata, Casia javanica, Parkinsonia aculeate, Peltophorum roxburghii, Delonix regii, Croton cotinifolia,* and *Jacaranda mimosifolia*. The confirmation of the identifications and data of collections are listed in table 1. The plants are identified with the aid of [17,18]. The anthers are carefully removed by using forceps immediately after gathering under stereomicroscope and the pollen grains have been smeared onto glass slides with a thin film of egg albumin. Then the slides stained with bromophenol blue for 2 min., washed with tap water, cleared in xylol, mounted in Canada balsam, then covered for examination by Olympus light microscope and photographed [19]. Acetolyzed pollen grains according to [20] have been measured and described carefully using Olympus light microscope. At least 30 pollen grains/each species were measured and described. Non-acetolyzed pollens were sputtered onto Aluminum stubs, coated with 30 nm gold, and examined and photographed using JEOL JSL IT 200 SEM allocated at Faculty of Science, Alexandria University at 15 Kev. For mineral contents, pollen grain pellets have been prepared to the studied species and subjected to X-ray analysis under 20 kv, using JEOL JSL IT 200 SEM. The terminology used is that of [20].

Species	Date of collection	Source of name confirmation	Synonyms
Bauhinia galpinii N.E. Br. (Photos 1 and 2)	5/7/2019	"ILDIS Legume Web entry for Bauhinia"	*B. galpinii var. galpinii* *Perlebia galpinii* (N.E.Br.) A. Schmitz
B. variegate (L.) Benth. (Photos 3 and 4)	12/7/2019	. "ILDIS LegumeWeb entry for Bauhinia"	*Phanera varigata* (L.) Bent
Cassia javanica L. (Photos 5 and 6)	10/8/2019	IPNI (2022)	*Bactyrilobium javanica* (L.) Hornem.,
Parkinsonia aculeate L. (Photos 7 and 8)	8/9/2019	IPNI (2022)	-
Peltophorum. Roxburghii (G. Don) Degener (Photos 9 and 10)	7/7/2019	IPNI (2022)	-
Delonix regia (Bojer ex Hook.) Raf. (Photos 11 and 12)	19/9/2019	IPNI (2022)	*Aprevalia* Baill.
Croton cotinifolia L. (Photos13 and 14)	8/8/2019	IPNI (2022)	*Codiaeum variegatum*
J. mimosifolia D. Don (Photos 15 and 16)	12/9/2019	IPNI (2022)	-

Table 1: Studied species, date of collection, confirmation of nomenclature and synonyms.

Results

Table 2 and figure 1 give complete description of the studied pollen grains and their protein contents are photographed, while table 3 summarized the mineral contents within the studied taxa. Meanwhile, detailed pollen grain morphology is given below. The estimated protein contents are qualitatively noticed by the degree of staining.

Taxa	Family	Status	Pollen characters					
			Polarity	Size	P/E	Shape	Exine Ornamentation	Protein
B. galpinii	Caesalpinaceae	Eg.	Isopolar	M.	1.5	Prolate	Foveolate rugate	Medium
B. variegata		Eg.	Isopolar	L.	0.9	Ob-Sp	Striate	Medium
C. javanica		D.	Isopolar	M.	1.2	SubProlate	Reticulate	High
P. aculeata		Eg.	Isopolar	S.	1.3	Prolate	Reticulate	High
P. roxburghii		D.	Isopolar	L.	1.3	Prolate	Reticulate	High
D. regia		Eg	Isopolar	S.	1.25	SubProlate	Reticulate Rugulate	Low
C. cotinifolia	Euphorbiaceae	D.	Isopolar	M.	1.3	Prolate	Reticulate	High
J. mimosifolia	Bignoniaceae	D.	Heteropolar	M.	1.3	Prolate	Psilate, Faintly Punctate	Medium

Table 2: Summary of the different features within the studied taxa.
Abbreviations: Eg.= Ever green, D.= Deciduous; L.= Large ≥ 50 μm, M.= Moderate from 25-48 μm, S.= Small ≤25 μm; Ob-Sp= Oblate Spheroidal.

Taxa	%of the Mass of Investigated Elements														
	C	N	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Fe	Cu	Zn
B. galpinii	59.24 ± 0.19	2.12 ± 0.21	33.52 ± 0.39	0.07 ± 0.02	0.05 ± 0.02	0.20 ± 0.02	00	0.03 ± 0.02	0.22 ± 0.02	0.0	0.65 ± 0.04	0.22 ± 0.03	0.06 ± 0.02	0.48 ± 0.07	0.24 ± 0.07
B. variegata	58.84 ± 0.19	2.22 ± 0.21	36.62 ± 0.39	0.06 ± 0.02	0.14 ± 0.02	0.05 ± 0.01	0.05 ± 0.0	0.28 **± 0.02**	0.17 ± 0.01	0.0	0.80 ± 0.03	0.33 ± 0.02	0.04 ± 0.02	0.28 ± 0.04	0.13 ± 0.04
C. javanica	62.85 ± 0.23	0.0	34.24 ± 0.45	0.11 ± 0.03	0.0	0.08 ± 0.02	00	0.48 ± 0.03	0.22 ± 0.02	0.05 ± 0.01	0.70 ± 0.0	0.38 ± 0.03	0.12 ± 0.03	0.39 ± 0.06	0.39 ± 0.06
P. aculeata	60.16 ± 0.20	2.11 ± 0.22	35.26 ± 0.39	0.08 ± 0.02	0.05 ± 0.02	0.20 ± 0.02	0.19 ± 0.02	0.22 ± 0.02	14 ± 0.01	0.13 ± 0.01	65 ± 0.03	0.28 ± 0.02	0.04 ± 0.02	0.26 ± 0.05	0.25 ± 0.05
P. roxburghii	59.59 ± 0.28	11.97 ± 0.51	24.77 ± 0.49	0.07 ± 0.03	0.03 ± 0.02	0.11 ± 0.02	0.42 ± 0.03	0.03 ± 0.02	0.0	1.99 ± 0.06	0.02 ± 0.02	0.22 ± 0.03	0.06 ± 0.02	0.48 ± 0.07	0.24 ± 0.07
D. regia	60.16 ± 0.20	2.11 ± 0.22	35.26 ± 0.39	0.08 ± 0.02	0.05 ± 0.02	0.20 ± 0.02	0.19 ± 0.02	0.22 ± 0.02	14 ± 0.01	0.13 ± 0.01	65 ± 0.03	0.28 ± 0.02	0.04 ± 0.02	0.26 ± 0.05	0.25 ± 0.05
C. cotinifolia	60.86 ± 0.24	2.75 ± 0.28	33.03 ± 0.46	0.03 ± 0.03	0.37 ± 0.03	0.02 ± 0.02	0.06 ± 0.02	0.66 ± 0.03	0.25 ± 0.02	0.36 ± 0.03	0.65 ± 0.04	0.41 ± 0.03	0.03 ± 0.02	0.27 ± 0.05	26 ± 0.06
J. mimosifolia	57.86 ± 0.30	2.28 ± 0.33	35.97 ± 0.60	35.97 ± 0.60	0.20 ± 0.03	0.06 ± 0.03	0.11 ± 0.03	0.61 ± 0.04	0.38 ± 0.03	0.02 ± 0.02	1.29 ± 0.07	0.45 ± 0.05	0.0	0.49 ± 0.09	0.06 ± 0.07

Table 3: Summary of the investigated minerals within the studied taxa as shown by X-ray analyses.

Figure 1: Series 1 = State of the tree, Series 2 = Pollen size, Series 3 = Protein contents, Series 4 = different taxa.

Pollen morphology

The studied taxa have been grouped according to the pollen size into three categories; taxa have small pollen grains, others with moderate size pollen grains and the third with large size pollen grains. The taxa with small pollen grains are *P. aculeata* and *D. regia,* the second group has four taxa; *B. galpinii, C. javanica, Cr. cotinifolia* and *J. mimosifolia*; while the third group with large pollen grains has two species; *B. variegata* and *P. roxburghiana.* The size of the pollen grains has no relation with the state of the tree; evergreen or deciduous; or the protein contents (Figure 1).

Bauhinia galpinii N.E.Br Family Caesalpinioideae, evergreen tree (Photos 1-2)

Symmetric, isopolar P/E ratio:1.5, polar axis P 37.2 (43.15) 48.5 µm and equatorial diameter 25.3 (29.12) 35.2 µm. Prolate, sometimes subprolate, tricolporate, colpi, length 27.2 (29.4) 31.54 µm and width 2.9 (3.4) 4.5 µm, colpus membrane granulate. Ora lalongate. Mesocolpium 12.0 (13.34) 14.7 µm. Apocolpium 7.0 (9.23) 11.5 µm. Exine 1.00 (1.9) 2.5 µm thick. Sexine and nexine are of the same thickness (Photo 1). Tectum ornamentation is foveolate rugate. The protein contents are moderate (Photo 2).

Bauhinia variegata L. Family Caesalpinioideae, evergreen tree (Photos 3-4)

Symmetric, isopolar P/E ratio:0.9**,** polar axis P 54.2 (56.15) 62.5 µm and equatorial diameter 55.3 (59.12) 64.2 µm. Oblate spheroidal, sometimes subprolate, tricolporate, colpi, length 38.2 (39.4) 41.54 µm and width 3.9 (5.4) 6.45 µm, colpus membrane granulate. Ora lalongate. Mesocolpium 12.6 (13.44) 17.7 µm. Apocolpium 10.0 (12..47) 14.5 µm. Exine 1.00 (1.9) 2.5 µm thick. Sexine and nexine are of the same thickness. Tectum ornamentation is striate (Photo 3). The protein contents are moderate (Photo 4).

Cassia javanica L. Family Caesalpinioideae, deciduous tree (Photo 5-6)

Symmetric, isopolar P/E ratio 1.2, polar axis P 27.8 (32.15) 37.2 µm and equatorial diameter E 21.7 (24.9) 28.2 µm. Subprolate to prolate, tricolporate. Colpi length 16.2 (15.2) 18.3 µm with lolongateora. Mesocolpium9.8 (10.44) 14.7 µm. Apocolpium10.19 (11.75) 14.8 µm. Exine 1.0 (1.8) 2.0 µm thick. Sexine and nexine are of the same thickness. Exine ornamentation is widely reticulate with granulate endexine (Photo 5). The protein contents are very high (Photo 6).

Parkinsonia aculeate L. Family Caesalpinioideae, evergreen tree (Photos 7-8)

Symmetric, isopolar P/E ratio:1.3**,**polar axis P 19.2 (20.15) 22.5 µm and equatorial diameter E 14.05 (15.9) 18.2 µm. Prolate, tricolporate, colpi, length 15.9 (19.2) 20.54 µmand breadth 6.4 (7.45) 9.25 µm,ora lalongate. Mesocolpium 12.6 (13.44) 14.7 µm. Apocolpium 14.59 (16.47) 19.5 µm. Exine 1.00 (1.9) 2.5 µm thick. Sexine thicker than nexine. Tectum ornamentation is reticulate (Photo 7). The protein contents are very high (Photo 8).

Peltophorum roxburghii (G. Don) Degener. Family Caesalpinioideae, deciduous tree (Photos 9-10)

Symmetric, isopolar P/E ratio1.3,polar axis P 48.8 (57.79) 65.2 µm and equatorial diameter E. 39.5 (47.2) 59.7 µm. Prolate to prolate, tricolporate, colpi length 7.6 (12.85) 15.8 µm and breadth 5.8 (7.65) 11.75 µm. Mesocolpium 24.2 (33.36) 44.2 µm. Apocolpium37.9 (52.9) 56.2 µm. Exine 2.0 (2.5) 3.0 µm thick. Sexine thicker than nexine. Tectum ornamentation is coarsely reticulate (Photo 9). The protein contents are very high (Photo 10).

Delonix regia (Bojer) Rafin. Family Caesalpinioideae, evergreen tree (Photos 11-12)

Symmetric, isopolar P/E ratio1.25, Polar axis P 16.8(19.95) 21 µm and equatorial diameter 12.6(15.75) 16.8 µm. Sub-prolate, tricolporate, triangular, colpi length 6.3(9.45) 10.5 µm and breadth 2.1(4.935) 6.3 µm, ora lalongate. Mesocolpium 12.6 (16.38) 18.9 µm. Apocolpium 14.7(17.85) 18.9 µm. Exine 1.8 (2.0) 2.3 µm, sexine thicker than nexine. Tectum ornamentation is reticulate-rugulate (Photo 11). The protein contents are low (Photo 12).

Croton cotinifolia L. Family Euphorbiaceae, deciduous tree (Photos 13-14)

Symmetric, isopolar P/E ratio 1.3, Polar axis P 38.4 (41.95) 46.8 µm and equatorial diameter 22.6(27.75) 31.8 µm. Prolate, tricolporate, colpi length 19.3(27.45) 31.5 µm and breadth 1.8(2.9) 3.3 µm, ora very small, lalongate. Mesocolpium14.3 (16.38) 18.5 µm. Apocolpium 15.7(17.85) 19.2 µm. Exine 1.8 (2.0) 2.3 µm, sexine and nexine of the same thickness.. Tectum ornamentation is reticulate (Photo 13). The protein contents are very high (Photo 14).

Jaccaranda mimosifolia D. Don Family Bignoniaceae deciduous tree (Photos 15-16)

Symmetric, heteropolar P/E ratio 1.3, polar axis P 38.2 (41.8) 46.7µm and equatorial diameter 25.8 (32.3) 39.75 µm. Prolate, tricolporate, the colpi syncolpate at one pole, colpi length 25.8 (28.3) 32.5 µm and breadth 3.2 (4.5) 6.7 µm, ora small and plugged lolongate. Exine 2,0 (3.5) 3.8 µm, sexine thicker than nexine, tectatum has no ornamentation i.e. psilate, or faintly punctuate (Photo 15). The protein contents are moderate (Photo 16).

Element contents

Mineral contents are listed in table 3. The data obtained revealed that all the mineral contents in the investigated pollen grains are considerably low, except the C and O which are in moderate quantities in all the taxa. The N content is slightly fair in *P. roxburghii* and Na content is very low in all the pollen taxa, except *J. mimosifolia* and reach 35.97%. The rest of the investigated elements; P, Mg, Al, Si, Cl, Ca, Fe, Cu and Zn; are considerably low in all the pollen grains under study, except the Zn is higher in *C. cotinifolia*, reach 26%. The two investigated elements; S and K; are very low in all the pollen taxa, except in both *D. regia* and *P. aculeata*, where it was 14% (S) and 65% (K) in both taxa.

Photo

External shape: 1-2 *Bauhinia galpinii*, 3-4 *B. variegata*, *5-6 Casia javanica, 7-8 Parkinsonia aculeate*, 9-10 *Peltophorumroxburghii*, 11-12 *Delonix regii*, 13-14 *Croton cotinifolia*, 15-16 *Jacaranda mimosifolia.*

Pollen SEM photographs: 1,3,5,7,9,11,13 and 15, X = 5000.

Protein intensity 2,4,6,8,10,12,14 and 16 (X = 40).

Discussion

The study of Pollen allergens becomes one of the recent and more interesting topics of research in these days. These type of allergy arises from the inhaling the pollen graind dispersed through plant pollination happened in wind pollinated trees, shrubs and herbs. The data obtained indicated that many factors can induce allergy and stimulate the immune system, such as environmental conditions include climate change, temperature, humidity, air pollution and loss of biodiversity. The amount of these allergens depends on specific characters of the inhaled pollen such as their quantity, dispersion, and profusion. [2] mentioned that the exposure to both pollen grains and fungal spores; especially in the period of spring and early morning; induce severe allergic symptoms and cause respiratory and eye disorders. [6] gave specific analyses to the pollen grains of *Prosopis juliflora* trees and found that certain types of proteins and polysaccharides allocated on the surface of the pollen grains induce asthma to those peoples with allergic history. On the other side, [7] found that the use of *Peltophorum pterocarpum* pollen grains can be of Clinical and immune-biochemical characterization. Accordingly, the street trees can be bi-sided, the first is being reasons for pollinosis known as seasonal allergy and other side can be used in immunotherapy. [21] indicated that there are many other factors all together inducing allergic diseases and this which we obtained from this study. These stimulants, besides the excess of air pollution and exposure to sub-micronic particles, may be stimulating allergy. Many studies indicated to the highly significant impact of climate fluctuation on the status of both plants; flowering time and stage in each area; and people public health. This fact urges the need for an up-to-date, frequency, and distribution of allergenic tree pollens in each country. Now a day [4,5] beside others found that air pollution can be cause in the increased number of Covid-19 death risk. This isn't just bad news for those with hay fever history, it indicated that even those people who don't have allergic history, pollen can suppress the way the body responds to viruses by reducing their immune response in the airways. The problem that the pollen season in these days is lengthening; with great change in temperature and humidity; resulting to the increase in patients. In the same time most people are allergens to some pollen trees, grasses or even herbs. [12] conclude that not only the type of road trees causing pollinosis, but also many other factors combine with the dispersed pollens that are all together causing allergy. In this work, we studied the pollen grains of eight widely planted road trees in Alexandria city, Mediterranean region, as allergic stimulants. Pollen external morphology, their protein and mineral contents have been estimated.

The results showed that both *Parkinsonia aculeata* and *Delonix regia* have small pollen grains with high contents in both S. and K than the other studied trees. The size of the pollen grains is considered one of the important characters in inducing allergy. [22] pointed to the effect of small pollen grains on the sensitive peoples. Small pollen grains are easily carried by air and easily inhaled passes through the bronchitis. The effective reasons for pollinosis are the exposure to both sub-micronic particles and pollen organic compositions which stimulate the allergens present in the pollen cytoplasm causing severe symptoms. In fact, the pollen organic substances are specific to each plant species in order to facilitate the recognition the way to its specific stigma. The mineral contents showed that all the studied trees have high Carbon and Oxygen contents, which indicate high contents of Carbohydrates. In the same time the Nitrogen content is low due to the decrease in Proteins. The rest of the investigated elements are considerably low, and this can be attributed to the difference in their physiological activity. In fact, the mineral contents of the pollen grains varied greatly during their developmental stages and we cannot consider them as constant contents. Worth mentioning is the fact that pollens contain aqueous pollen extract proteins, proteases, NADPH oxidases, and lipids that stimulate the immune responses. These responses not only stimulate the above mentioned neutrophils and modulate functions of the dendritic cells, but also induce TH2 polarization, and promote allergic inflammation [24]. [23] found pollen allergens do not act alone on the immune system it must combine with other factors.

Conclusion

From this study, we found that the most stimulating pollen grain trees to allergy are those possessing small pollen grains with high contents of starch, polysaccharides and release more proteins on their surfaces. In the same time they must release their pollens in huge quantity From the studied trees, *Delonix regia* and *Parkinsonia aculeata* are the most responsible road trees which can stimulate the human immune system in this study, as they have small size pollen grain and high contents of C, S and K.

Bibliography

1. Seedat RY. "Environmental Control of Outdoor Allergens". *Current Allergy and Clinical Immunology* 32.1 (2019): 12-14.

2. Dušička J., *et al*. "Aeropalynological aspects in the detection of the quality of air in Bratislava". *Ekológia (Bratislava)* 32.1 (2013): 39-53.

3. Bowler H. "New Evidence Shows How COVID-19 Has Affected Global Air pollution". Science Alert 17th. March (2020).

4. Khahka NS. "Air pollution linked to raised Covid-19 death risk". Environment correspondent, BBC World Service 20th. April (2020).

5. Liccardi G., *et al*. "Oleaceae pollinosis. a review". *International Archives of Allergy and Immunology*, 111 (1996): 210-217.

6. Florido JF., *et al*. "High levels of Olea europaea pollen and relation with clinical findings". *International Archives of Allergy and Immunology* 119 (1999): 133-137.

7. Bousquet J., *et al*. "Allergic Rhinitis and its Impact on Asthma (ARIA) 2008 update (in collaboration with the World Health Organization, GA2LEN, and AllerGen)". *Allergy* 63 (2008): 8-160.

8. Vieira FAM. “Novas práticas agropastoris estão influenciando a relação meio ambiente/polinose no sul do Brasil?”. *Revista Brasileira De Alergia E Imunopatologia* 26.1 (2003): 37-38.

9. Stewart GA and Robertson C. “The structure and function of allergens”. *Middleton`s Allergy*, 8th. Edition (2014).

10. Roschmann KIL., *et al*. “Purified Timothy grass pollen major allergen Phl p 1 may contribute to the modulation of allergic responses through a pleiotropic induction of cytokines and chemokines from airway epithelial cells”. *Clinical and Experimental Immunology*167.3 (2012): 413-421.

11. Asturias JA., *et al*. “Pho d 2, a major allergen from date palm pollen, is profilin: cloning, sequencing, and immunoglobulin E cross-reactivity with other profilins”. *Clinical and Experimental Allergy* 35 (2005): 374-381.

12. Taia WK. “Pollen Allergens of some Road Trees, Shrubs and Herbs in Alexandria, Egypt”. *Biomedical Science* 1.5 (2020): 187-194.

13. Theoharides TC., *et al*. “Recent advances in our understanding of mast cell activation - or should it be mast cell mediator disorders?”. *Expert Review of Clinical Immunology* 15.6 (2019): 639-656.

14. Cichocka-Jarosz E., *et al*. “Alergia pyłkowa. Cześć I: Patofizjologia i klinika Pollen allergy. I. Pathophysiology and clinic”. *Przeglad lekarski* 54.9 (1997): 614-619.

15. Hosoki K., *et al*. “Innate responses to pollen allergens”. *Current Opinion in Allergy and Clinical Immunology* 15.1 (2015): 79-88.

16. Csillag A., *et al*. “Pollen-induced oxidative stress influences both innate and adaptive immune responses via altering dendritic cell functions. *Journal of immunology (Baltimore, Md. : 1950)* 184.5 (2010): 2377-2385.

17. Heinedy SZ. “Plant Atlas, The Botanic Garden (Alex)”. Manshaet El Maaref, GalalHezy et al., Alexandria, Egypt. 1st. ed. (2011).

18. IPNI. The International Plant Names Index and World Checklist of Selected Plant Families (2022) Published on the Internet at http://www.ipni.org and http://apps.kew.org/wcsp/ © Copyright 2017 International Plant Names Index and World Checklist of Selected Plant Families (2022).

19. Mazia D., *et al*. “The cytochemical staining and measurement of proteins with mercuric bromophenol blue”. *Biology Bulletin* 104.1 (1953): 57-67.

20. Erdtman G. “Pollen Morphology and Plant Taxonomy: Angiosperms”. (An introduction topalynology. I) Hafner Publishing Company, New York (USA) (1966): 456-458.

21. Gilles S., *et al*. “Pollen allergens do not come alone: pollen associated lipid mediators (PALMs) shift the human immune system towards a TH2-dominated response”. *Allergy, Asthma, and Clinical Immunology* 5 (2009): 3.

22. Spieksma FTM. “Regional European pollen calendars”. In: D’Amato G, Spieksma FTM, Bonini S (eds.). Allergenic pollen and pollinosis in Europe. Oxford: Blackwell Sci Publishing, USA (1991): 49-65.

23. Terada T., *et al*. “Sustained effects of intralymphatic pollen-specific immunotherapy on Japanese cedar pollinosis”. *Rhinology* 58.3 (2020): 241-247.

24. Hosoki K., *et al*. “Facilitation of allergic sensitization and allergic airway inflammation by pollen-induced innate neutrophil recruitment”. *American Journal of Respiratory Cell and Molecular Biology* 54.1 (2015).