

Variability of allergic diseases from pollen grains in the Elbasan region, Albania

NIKOLETA KALLAJXHIU
SILVANA TURKU
ANXHELA DAUTI

Department of Biology, FNS,
University of Elbasan “Aleksandër Xhuvani”, Albania

GËZIM KAPIDANI

Department of Biology, FNS, University of Tirana, Albania

Abstract

*Allergic diseases caused by pollen grains of plants are very common in the Elbasan region, Albania. Presenting the plants according to the morphological description and the flowering period, allergologists are assisted in accurate diagnosis, patients receive information on the plants from which they should be aware of; by correctly determining the cause of the allergy, sensitize appropriate instances for taking measures to minimize allergic plants, but at the same time they serve as ornamental plants. To see how this disease varies in gender, place of residence and age group, there have been study cases of allergies from 374 patients 2018-2019 in three different laboratories. To determine the cause of the allergy, about 20 plant allergens (Graminaceae family, *Artemisia vulgaris*, *Ambrosia artemisiifolia*, *Chenopodium album*, *Ligustrum vulgare*, *Fraxinus ornus*, *Quercus ilex*, *Olea europea*, *Cupressus sempervirens*, *Plantago lanceolata*, *Platanus hybrida*, *Parietaria officinalis*, *Betulla pendula*, *Alnus glutinosa*, *Pinus sylvestris*) were used through Allergy Euroline Mediterranean Inhalation. Results of this study have demonstrated that the main cause of allergic diseases is the pollen of the Graminaceae family (146 cases); it is followed by the pollen grains of *Artemisia vulgaris* and *Chenopodium album*, respectively with 46 and 44 cases. At the end of the study, it turned out that for the period 2018-2019, allergic cases are most common in populated areas where about*

225 patients were affected while in the village only 149 patients. Furthermore, based on the statistics, the male gender and the age group 21-30 (101 cases) seemed to be more sensitive to this herbal allergen for non-fully explained reasons.

Keywords: allergic diseases, pollen grains, Elbasan, variability

1. INTRODUCTION

There are many national and international scientific studies who have presented the allergy problem caused by the pollen grains of plants all over the world and in particular in the Elbasan region, Albania (Newmark & Itkin, 1967; Bottelli *et al.*, 1982; Kapidani, G., 1996; Bauchau & Durham, 2004; Bachert *et al.*, 2006; Lekli *et al.*, 2008; Kallajxhiu, N., 2011; Kallajxhiu *et al.*, 2018; Kallajxhiu *et al.*, 2019; De Swert, L. F. (1999). Statistics around the world show how prevalent these diseases are. Based on them, it can be noticed that pollen grains of Graminaceae family are the major cause of allergy in many countries of the world. 40% of allergic patients in Brazil are very sensitive to pollen grains of this family. According to the American Academy of Allergy, Asthma and Immunology, about 8% of adults have been affected at least once by allergic diseases. In 2014, according to the US Department of Human Health, even the American children were diagnosed almost with the same percentage with these diseases (<https://www.healthline.com/health/allergies/pollen>).

On the other side, the Swiss Allergy Society reports that about 20% of the population suffers from allergies caused by pollen grains while in Italy the percentage seems to drop to a percentage of 10-19% (<http://www.epicentro.iss.it/problemi/allergie/epid.asp>).

Allergic diseases by pollen grains are also related to the gene. From a research made in Italy in 1978 to a population of patients, it was found that about 45% of cases were related to the genome (Bottelli *et al.* 1982).

Also, allergic diseases from pollen grains affect different age groups and gender. Thus, from the analysis of allergy cases at the Polyclinic of Elbasan for the years 2004-2008, the most affected age was 20-30 years with 79% of the cases. The most affected gender is the male, it is found in about 60% of the cases (Kallajxhiu, N., 2010).

Elbasan Region is one of the 12 regions in Albania, has a surface area of 3,278 km² and a population of 283,822 (2017) inhabitants. The Elbasan District Center is located in the city of Elbasan (https://sq.wikipedia.org/wiki/Qarku_i_Elbasanit).

This region is about 450 m above sea level. From the studies conducted about the climate of the Elbasan region, it turns out that it is typically Mediterranean, with an average annual temperature of 15-16°C.

The Elbasan region, including the valley of Shkumbini, the Krraba area, that of Shelcan and Bratila, is characterized by diversified vegetation. Specifically, it mainly consists of Mediterranean leaf shrubs such as: *Erica arborea* L., *Arbutus unedo* L., *Myrtus communis* L., *Juniperus oxycedrus* L., *Olea oleaster* Hoffm. et Link., *Olea europaea* L., *Rosa canina* L. In this region there are large plantations of olive trees, citrus groves associated with plants of Leguminosae, Graminaceae, Labiatae, etc., cultivated and many fruit trees as well. There are Mediterranean shrubs and associations *Carpinus orientalis-Quercus pubescens* and *Carpinus orientalis-Quercus cerris* (Naqellari, P., 1999).

The Elbasan is one of the most polluted regions in Albania because it has had a very developed industry and different gases are emitted in the atmosphere. Along with the gases released by the car, they negatively affect the health of the population and pollution is another factor that affects the increase in the number of allergic cases. To see this effect as well as the allergic plants factor, we undertook this study.

2. MATERIALS AND METHODS

To carry out the study, cases of allergic diseases have been taken for allergic patients in the Elbasan region in 3 different laboratories for the period 2018 - June 2019. In order to preserve anonymity, labs have been labeled with Lab 1, Lab 2, Lab 3. There were about 374 patients. With these patients it is done Allergy Euroline Mediterranean Inhalation test. Among allergens of different nature, there have been 20 plant allergens. They belong to 12 families. To complete the study, several field expeditions have been made in the Elbasan region to find allergy plants. At the habitat where the plants were found, have been taken photos and this helps the doctor and the patient know better the allergenic plants. Knowing the flowering

period of these plants, it is easier for the patients to protect them by taking preventive measures.

Table. 1 List of allergenic plants used for allergy tests

Nr.	The name of allergenes	Family	Botanical data for allergic plants
1.	<i>Alnus glutinosa</i>	Betulaceae	<i>Alder</i> ; Phanerophyta; the flowering period: February to March (Paparisto <i>et al.</i> , 1988).
2.	<i>Artemisia vulgaris</i>	Compositae	<i>Mugwort</i> ; Chamephyta; the flowering period: July to October (Vangjeli <i>et al.</i> , 2000).
3.	<i>Ambrosia artemisiifolia</i>	Compositae	<i>Ragweed</i> ; Terophyta; the flowering period: July to September (Vangjeli <i>et al.</i> , 2000).
4.	<i>Betula pendula</i>	Betulaceae	<i>Silver Birch</i> ; Phanerophyta; the flowering period: March to April (Paparisto <i>et al.</i> , 1988).
5.	<i>Corylus avellana</i>	Corylaceae	<i>Hazel, Cob-nut</i> ; Phanerophyta; the flowering period: March to May (Paparisto <i>et al.</i> 1988).
6.	<i>Parietaria officinalis</i>	Urticaceae	<i>Pellitory of the wall</i> ; Hemikriptophyta; the flowering period: May to October (Paparisto <i>et al.</i> , 1988).
7.	<i>Phleum pratense</i>	Graminaceae	<i>Timothy</i> ; Hemikriptophyta; the flowering period: May to August (Vangjeli <i>et al.</i> , 2000).
8.	<i>Platanus hybrida</i>	Platanaceae	<i>London Plane</i> ; Phanerophyta; the flowering period: April to May (Paparisto <i>et al.</i> , 1988).
9.	<i>Quercus ilex</i>	Fagaceae	<i>Holm Oak</i> ; Phanerophyta; the flowering period: April to May (Paparisto <i>et al.</i> , 1988).
10.	<i>Secale cereale</i>	Graminaceae	<i>Rye</i> ; Terophyta; the flowering period: May to July (Vangjeli <i>et al.</i> , 2000).
11.	<i>Avena fatua</i>	Graminaceae	<i>Wild Oat</i> ; Terophyta; the flowering period: May to July (Vangjeli <i>et al.</i> , 2000).
12.	<i>Poa pratensis</i>	Graminaceae	<i>Meadow-grass</i> ; Hemikriptophyta; the flowering period: April to July (Vangjeli <i>et al.</i> , 2000).
13.	<i>Cynodon dactylon</i>	Graminaceae	<i>Bermuda grass</i> ; Geophyta/Hemikriptophyta; the flowering period: May to October

			(Vangjeli <i>et al.</i> , 2000).
14.	<i>Dactylus glomerata</i>	Graminaceae	<i>Cock's-foot</i> ; Hemikriptophyta; the flowering period: april to july (Vangjeli <i>et al.</i> , 2000).
15.	<i>Plantago lanceolata</i>	Plantaginaceae	<i>Ribwort</i> ; Hemikriptophyta; the flowering period: april to november (Qosja <i>et al.</i> , 1966).
16.	<i>Cupressus sempervirens</i>	Cupressaceae	<i>Italian Cypres</i> ; Phanerophyta; the flowering period: march to april (Paparisto <i>et al.</i> , 1988).
17.	<i>Ligustrum vulgare</i>	Oleaceae	<i>Common Privet</i> ; Phanerophyta; the flowering period: april to june (Qosja <i>et al.</i> , 1996).
18.	<i>Olea europea</i>	Oleaceae	<i>Olive tree</i> ; Phanerophyta; the flowering period: may to june (Qosja <i>et al.</i> , 1996).
19.	<i>Chenopodium album</i>	Chenopodiaceae	<i>Fat Hen</i> ; Terophyta; the flowering period: july to october (Paparisto <i>et al.</i> , 1988).
20.	<i>Pinus sylvestris</i>	Pinaceae	<i>Scots pine</i> ; Phanerophyta; the flowering period: may to jun (Paparisto <i>et al.</i> , 1988).

2.1. Diagnostic mode

Before the allergy test was made, the patients had given their anamnesis. Thus, they were asked if it the first time they suffer from allergies was or whether there were any another member in their family who had suffered from this disease before and where did they live (village or city). Also, the patient has been asked whether he is a user of any medication recently. Immediately after this procedure was completed, the patient had to be tested for allergies. In order to correctly determine the cause of the allergy, measurement of the concentration of antibodies produced after the inhalation of the pollen grains of plan allergen has been made. According to the concentration (kU/l) of antibodies produced by the patient's body after the test was done, 6 classes (1, 2, 3, 4, 5, 6) have been assigned. Table 2 shows the detailed concentration of antibodies in the body for each class.

Table. 2 The table of concentration of antibodies in kU/l

Concentr. (kU/l)	Class	Explanation
< 0,35 kU/l	0	No specific antibody detection
0,35 kU/l - 0,7 kU/l	1	Very weak antibody, frequently no clinical evidence, in case of an existing sensibilisation
0,7 kU/l - 3,5 kU/l	2	Weak antibody detection, existing sensibilisation, frequently a clinical evidence in the upper range of this class
3,5 kU/l - 17,5 kU/l	3	Clear antibody detection, clinical evidence is mostly present
17,5 kU/l - 50 kU/l	4	Strong antibody detection, nearly always with existing evidence
50 kU/l - 100 kU/l	5	Very strong antibody detection
> 100 kU/l	6	Extreme high antibody titer

From the test, it has been shown that in some cases, the same patient is allergic to several plant allergens. The test data are presented in Table 3.

Table. 3 Number of allergic patients from pollen grains in 3 laboratories

Nr.	Allergens	Lab 1	Lab 2	Lab 3	Totally
1.	<i>Betulla pendula</i>	21	1	13	35
2.	<i>Graminaceae</i>	71	35	40	146
3.	<i>Coryllus avellana</i>	12	1	5	18
4.	<i>Artemisia vulgaris</i>	10	24	12	46
5.	<i>Ambrosia artemisiifolia</i>	4	1	6	11
6.	<i>Ligustrum vulgare</i>	10	4	7	21
7.	<i>Plantago lanceolatum</i>	10	16	3	29
8.	<i>Platanus hybrida</i>	6	-	7	13
9.	<i>Olea europea</i>	10	1	14	25
10.	<i>Parietaria officinalis</i>	8	8	12	28
11.	<i>Cupressus sempervirens</i>	6	2	7	15
12.	<i>Alnus glutinosa</i>	4	-	4	8
14.	<i>Quercus ilex</i>	5	-	15	20
15.	<i>Chenopodium album</i>	6	9	29	44
16.	<i>Pinus sylvestris</i>	4	-	2	6

3. RESULTS AND DISCUSSION

Knowing the main morphological characteristics of the plants, the pollen causing allergies and their association with the relevant photos taken at the habitat they are found, is considered by the experts as a great help for both the allergist doctor and the patients who suffers from allergies.

Knowing the plant, her flowering period, it is easier for the patient to defend himself and for the doctor to determine the diagnosis. During expeditions on the ground in the region of Elbasan, we found 20 plants, whose pollen allergens are used as for the patient. They belong to about 12 plant families. Determination of plants is done with the help of “Flora of Albania” (Vangjeli *et al.*, 2000; Qosja *et al.*, 1996; Paparisto *et al.*, 1988; Qosja *et al.* 1988). Accurately identifying the main causes of allergic diseases, the respective instances, in collaboration with the botanist, take measures to minimize the planting of these herbs as ornamental plants by replacing them with others. Below we present the original photos of allergic herbs.

Photos of allergic plants



Fig. 1 *Avena fatua*



Fig. 2 *Plantago lanceolata*



Fig. 3 *Olea europea*



Fig. 4 *Cynodon dactylon*



Fig. 5 *Parietaria officinalis*



Fig. 6 *Plantago hybrida*



Fig. 7 *Pinus sylvestris*



Fig. 8 *Artemisia vulgaris*



Fig. 9 *Phleum pratense*



Fig. 10 *Dactylis glomerata*



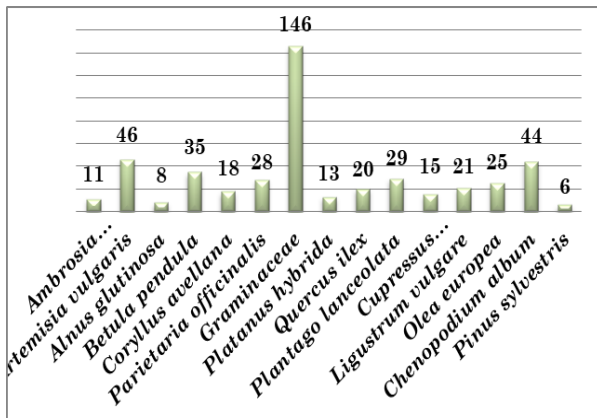
Fig. 11 *Ligustrum vulgare*



Fig. 12 *Chenopodium album*

3.1. Summary analysis of allergic cases of patients for the period 2017-2019

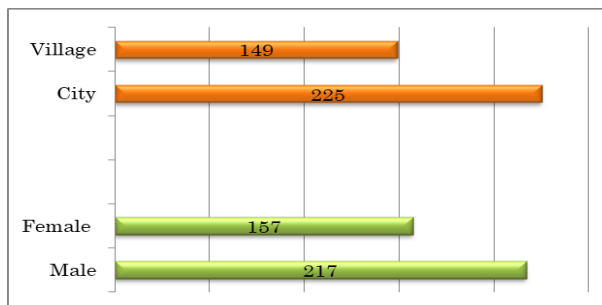
With the data of Table 3, we have seen the variability of allergic cases according to the pollen grains that caused it and we have built the corresponding graph. The following chart clearly shows that the allergen of the **Graminaceae** family is the main cause of allergy from pollen for patients who have undergone allergy tests during this period; namely 146 patients. Then it is followed by **Artemisia vulgaris** with 46 patients, **Chenopodium album** with 44 patients, **Betula pendula** with 35 patients and **Plantago lanceolata** with 29 patients. Other allergens have fewer positive cases. The results of the study are consistent with those of the literature (Bottelli *et al.*, 1982; Kallajxhiu N., 2011; Kallajxhiu, N., 2019).



Graf. 1 Graphical presentation of the cases of the disease according to the allergen

Within the Graminaceae family, *Phleum pratense* pollen has caused more allergic cases, with 50 cases. Then it can be spotted *Cynodon dactylon*, with 24 patients, *Dactylis glomerata* with 23 cases and so

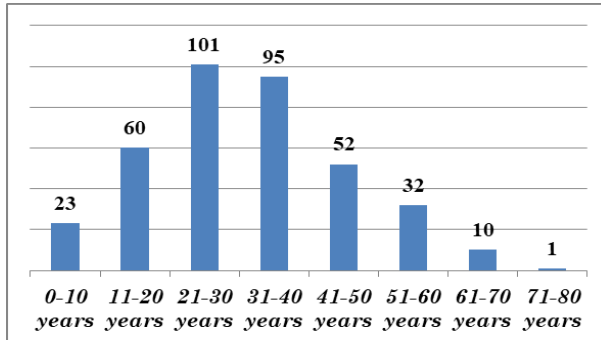
on. The graph below shows the allergy tests for 2018 - June 2019 in the three laboratories developed for 374 patients. Of these, 217 patients were males and 157 were females. The largest number of patients belongs to the population of the city, namely 225 allergic patients; in the countryside around 149. In my opinion, this is related to the pollution that is observed in the city. Moreover, the city of Elbasan where the study is done, is one of the most polluted cities in Albania. (Gega & Shehu, 2007; Hoxha & Avdolli, 2007). Starting from foreign and albanian literature, we have a record of the values recorded on this fact.



Graf. 2 Variability of disease by gender and place of residence

Studies have shown that allergic diseases from pollen grains are more numerous in the second and third decades of life. They begin to appear generally after the age of five (Lekli *et al.*, 2000). So, from the graph it is clear that for 2018-2019, the patients who suffered the most from allergy of pollen grains belonged to the age group 21-30 years with 101 cases. Further, age groups 31-40 years old with 95 cases and so on.

I think that this occurs because of the fact that these age groups are more active and the possibility of having a direct contact with the allergenic pollen is higher. Also, they seem to spend most of their time in closed environments where in many cases tobacco can be smoked. These factors greatly affect the appearance of allergic diseases.



Graf. 3 Variability of disease by age group

4. Conclusions

The study found that the main cause of allergic diseases from pollen grains is the Gramineae Family. Within this family, the pollen grains of *Phleum pretense* (Timoty) lies in the first place. The most affected gender is the male and the urban areas, namely 217 and 225 patients. The age group affected by allergies caused by pollen grains is 21 to 40, with 196 cases.

Acknowledgement

In particular, we would like to thanks the allergologists of the three laboratories that helped us with the allergic cases of our patients caused by the pollen grains of plants.

REFERENCES

1. Bachert, C., van Cauwenberge P., Olbrecht, J., van Schoor, J. (2006). Prevalence, classification and perception of allergic and nonallergic rhinitis in Belgium. *Allergy* 61: 693-698.
2. Bauchau, V., Durham, S. R. (2004). Prevalence and rate of diagnosis of allergic rhinitis in Europe. *Eur. Respir J.* 24: 758-764.
3. Bottelli, R., Falagiani, P., Galimberti, M., Lenzi, G., Pacini, E., Rolo, J. (1982). I pollini e la Pollinosi, Padova: 10-13, 15-20.
4. De Swert, L. F. (1999). Risk factors for allergy. *Eur. J. Pediatr.* 158 (2), 89-94.
5. Gega N., Shehu E. (2007). Ecuria e ndotjes mjedisore nga Kombinati Metalurgjik dhe Fabrika e Çimentos në rajonin e Elbasanit, *Buletini Shkencor i Universitetit të Elbasanit*, vol. 1, 21-32.

6. Hoxha B., Avdolini M. (2007). Pollution by heavy metals in Elbasan city. *Buletini Shkencor i Universitetit të Elbasanit*; vol. 2, 60-84.
7. Kallajxhiu, N. (2010). Studimi alergopalinologjik i bimëve alergjike të rrethit të Elbasanit dhe i alergjive të shkaktuara prej tyre. Ph.D. thesis, *University of Tirana*, 1-118.
8. Kallajxhiu N. (2011). Studimi alergopalinologjik i bimëve alergjike të rrethit të Elbasanit dhe i alergjive të shkaktuara prej tyre. (Monografi), *Rama Graf*, Elbasan, 1-106.
9. Kallajxhiu, N., Kapidani, G., Naqellari, P., Pupuleku, B., Turku, S., Dauti, A., Jançe, A. (2018). An allergopalinologic comparative study of the *HUMULUS LUPULUS*' pollen grains (Cannabaceae) in different habitats". *Alblakes3 2017. Salento University Publishing, Italy*. Volume 40, suppl. 2, 75-82, Proceedings, ISSN: 0563-3745; e-ISSN: 1591-0725.
10. Kallajxhiu, N., Kapidani, G., Turku, S., Dauti A. (2019). Influence of Pollen Grains in Allergic Diseases. *International Journal of Current Microbiology and Applied Sciences*, ISSN: 2319-7706, 8(03): 787-796. doi: <https://doi.org/10.20546/ijemas.2019.803.096>
11. Kapidani, G. (1996). Bazat e palinologjisë. Spore dhe polene të disa bimëve të sotme të Shqipërisë. Monografi: 55-178.
12. Lekli, L., Mersinllari, M., Qirko, E., Xhixha, F., Hoxha, M. (2008). Bimët alergjike në Shqipëri, *Presso Arti Grafiche Favia S. R. L. Modugno (BA)*, 1-297.
13. Naqellari, P. (1999). Studimi bioekologjik i bimëve mjeksore me alkaloide dhe rezervat e tyre në rrethin e Elbasanit. Disertacion, Elbasan. 19-20, 27-60.
14. Newmark, F. M., Itkin, I. H. (1967). Asthma due to pine pollen, *Ann. Alergy* 25. 251.
15. Paparisto K., Demiri M., Mitrushi J., Qosja Xh. (1988). Flore de L' Albanie. Vol. I, *Publ. "Mihal Duri"*, Tirana. Albania.
16. Qosja, Xh., Paparisto, K., Vangjeli, J., Ruçi, B., Marika, A. (1996). Flora e Shqipërisë, Volumi III, Tiranë.
17. Vangjeli J., Ruci B., Mullaj A. Flora e Shqipërisë (2000). Vëllimi IV, Akademia e Shkencave e Republikës së Shqipërisë, Tiranë. 2000.

<https://www.healthline.com/health/allergies/pollen>

<http://www.epicentro.iss.it/problemi/allergie/epid.asp>