

Holocene Evolutionary Line for Liliaceae Plants in Central Albania

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Abstract – The paleopalynological data presented in this scientific work were carried out in the soil deposits of Elbasan city, an ancient city located in Central Albania. For this scientific paper, data on the evolutionary line that the representatives of the Liliaceae family have followed for centuries have been presented. The time that is determined based on archaeological studies for the underground of Elbasan, corresponds to the period of the New Holocene. The main goal of this scientific work is to present the relationship between the presence of Liliaceae fossil pollen found in different depths of the earth, with its distribution in different time phases. Paleopalynological data for Liliaceae plants, during the analyzed period October-November 2022, are provided for the first time.

Starting from the data obtained after the chemical and statistical analysis of the fossil pollen of Liliaceae plants, we have reached very interesting results, where we mention the fact of finding Liliaceae family palynomorphs at all soil depths, which corresponds to the entire New Holocene period to the present day. There is also a total of 828 fossil pollens that present an increasing trend from depth to the surface.

Based on the results achieved, we are mainly of the opinion that: the change in vegetation presented over the years is related to the human influence in the cultivation of important and necessary plants for it, since the review of the literature does not reveal other factors that may have had a flora impact.

Keywords – Paleopalynological, New Holocene, Liliaceae Family, Palynomorphs, Elbasan.

I. INTRODUCTION

The scientific work that we have carried out and presented below presents the palynological features of the New Holocene deposits for Central Albania, and specifically for the Elbasan City.

Paleopalynology represents a branch of Palynology and is an interdisciplinary science, which is closely related to the biological sciences (mainly botany), but also geology.

This discipline deals with the study of pollen and spores deposited in organic sediment, and above all this science includes the study of current and fossil palynoforms [1], [2].

Pollen has been proven to be stored for years in underground layers, since the outer wall or exine of pollen grains is extremely resistant [3], [4].

Based on the study that can be done on fossil pollen, it is possible to make an important contribution on the use and cultivation of plants over the years, the way of feeding our ancestors as well as the origin of agriculture [5].

This paper provides important data that contribute to the reconstruction of paleoflora, paleoclimate, stratigraphy of the Holocene, etc. [4], [6], [7].

In this scientific work that we have undertaken, we have conducted the study of the distribution of vegetation during the new Holocene period, presenting the factors that have had their influence on the transformation of the flora for, always focused on the evolution of the Liliaceae family [1]-[2], [6]-[8].

We emphasize that there are no similar studies carried out by local or foreign researchers on the data on the content of fossil spores and pollen for Liliaceae plants in the Holocene deposits in the area where the study was carried out, so in this way the microfossils of this family plants are not previously studied in the Elbasani town [6], [7].

The obtained paleopalynological data manages to make a fundamental contribution to the evolution of the cultivation and use of Liliaceae plants, as well as to the origin of the vegetation [6], [8], [9].

Counting of Liliaceae palynomorphs was performed using light microscopy at 1000x magnification.

The essence of undertaking this evolutionary scientific study was to provide the correlation between the quantitative data of spores and fossil pollen and the evolution over the years that the representatives of the Liliaceae family have undergone.

II. MATERIALS AND METHOD

Through the study and analysis of fossil pollen, we can judge the transformation of the natural environment and the human influence on this transformation [10], [11].

Paleopalynological tests are mainly used, offering a considerable accuracy, for the paleoclimate and palaeoecological studies of the Quaternary period, and therefore the Holocene period [12], [13].

The physics-chemical composition of the pollen enables it to be successfully stored and extracted from the soil sediments where it is deposited.

Mainly for fossil pollen processing, almost all methods used consist of physical and chemical processing of 1 gram of soil sediment [1], [4], [6].

Afterwards, the fossil pollen extracted from the soil sediments is analysed qualitatively and quantitatively.

During this study, we took 16 soil samples in the field, during the October-November 2022 period, starting from 0.25 m to 4 meters deep, where the distance between sampling was 0.25 m.

From the paleopalynological test that was performed on all the samples, it was found that all the soil samples contained a significant amount of organic matter that appears suitable to continue with the fossil pollen analysis.

A. *The Erdtman method of acetolysis*

The soil sampling is based on Erdtman method [14], [15]. To get better results first mix 1cm³ soil with 10ml KOH (10 %).

Erdtman acetolyze method consists of processing the material with an acetolyze mixture, acetic anhydride (CH₃COO)₂ and sulfuric acid (H₂SO₄) in a 9:1 ratio.

We cleaned with distillate water and mixed it with acetolyze solution, until a neutral environment is obtained.

The emasculation process is followed by a centrifugal process for three minutes (3000 rotation/minute).

The acetolyze method is widely used in paleopalynology; because it gives better visibility over the spores and pollen compared with the other methods used during the microscopic observation process [6], [7], [14], [15].

B. *Fixing the prepared compounds*

The fixture of prepared composites was realized by using the method of glue-preparations through gel-glycerin, which was prepared based on the Kisser method [16] by using 50 gram of gelatin, 175 ml of distillate water, 150-gram glycerin, 7-gram phenol (crystals).

The composite was isolated to the edges of microscope slide with spray or paraffin and after 3 days it was ready to be used and stored.

III. RESULTS

On table 1 are given the data about the spores' number for Liliaceae family conform to the depth and is presented also the total number of palynoforms for this family.

The maximum spores' number of Liliaceae family (78 spores per sample) is taken in 0.25 m of depth while the minimum number, 28 spores, is taken in the bottom respectively 4 m of deepness.

On figure 1 is clearly shown the increasing trend of the total number of representatives of the Liliaceae Family from the bottom near to the surface, with the exception of the samples 8 and 15 where it is observed one slight decrease in number (exactly in 2.25 and 0.5 m of depth), also is clearly shown the increasing number of spores for this family almost throughout the depths in a constant manner. In samples 3, 9, 10, the Liliaceae spores' number undergoing an immediate increase.

Table 1. Liliaceae palynofoms according to the deepness.

Sample	Years after AD	Depth (meters)	Liliaceae Palynofoms
1	0	4	28
2	100	3.75	31
3	200	3.5	38
4	300	3.25	36
5	400	3	42
6	500	2.75	45
7	650	2.5	50
8	800	2.25	46
9	950	2	52
10	1100	1.75	58
11	1250	1.5	63
12	1400	1.25	61
13	1550	1	65
14	1700	0.75	69
15	2850	0.5	66
16	2000	0.25	78
Total number of spores			828

Based on the data presented in table 1 the spore's total number of Liliaceae family is 828 spores.

IV. DISCUSSION

Climate can be a factor that can cause changes in the way land is used, also human societies can cause complex impacts on the environment [17].

Based on the obtained data, the growing trend of Liliaceae plants from the depth of the soil towards the surface is clearly expressed, this phenomenon shows that the increase in the presence of representatives of the Liliaceae family should be dedicated to the human influence in the cultivation of this family plant.

Also, the surface samples show a greater number of fossil pollen obtained, a phenomenon that can be explained by the newest forms of pollen can be preserved better than the older ones, which belong to the deep samples. Interesting is the fact found in samples 8, which corresponds to the depth of 2.25 m, where an immediate increase in the fossil pollen of the Liliaceae family is observed.

Since after reviewing the literature, no data on important climate factors were found in this period, the year 800 AD, which may have influenced the change of the vegetation, we have relied on the medieval history of Albania [18], in which it is claimed that this period is related to the brutal exterminating wars of the Bulgarian and Serbian occupation, which led to a great decrease in the

population and the city lost the economic importance it had until then.

Liliaceae plants fossils have been dated for the first time to the Paleogene and Cretaceous eras in the Antarctic [19].

The family Liliaceae or as it is mainly known the lily family, is represented by 15 genera and 610 species of flowering plants of the Liliales [20].

Liliaceae plants are important decorative plants, widely cultivated for their very beautiful flowers, they are also cultivated as floriculture of cut flowers and dry bulbs.

A considerable number of Liliaceae genera are widely cultivated plants in private and public spaces, even more so in the Elbasan city, which is otherwise known in Albania as the City of Flowers.

Mainly lilies and tulips have always had significant symbolic and decorative value and are often encountered in frescoes, paintings, and decorative arts.

These plants are also presented as a product with important economic values.

The presence in all the samples and the growing tendency of the Liliaceae palynofoms, with the transition from the samples of the depths to the surface, may indicate that the human factor has had an important impact on these plants, mainly related to the cultivation of plants of this family over the years in Elbasan city.

This is reinforced by the fact that during all these years these plants are always present.

Many species are widely cultivated for their ornamental leaves, flowers, and fruits. Ornamental varieties of Liliaceae are grown in gardens for their showy flowers, fruits, and leaves.

Liliaceae plants are very diverse ecologically [21]. The different representatives of the Liliaceae family bloom at different times of the year, mainly from spring to the end of summer.

The colourful flowers of these plants produce large amounts of nectar and pollen that attract the insects that pollinate them (entomophilous) [22].

Germination of Liliaceae plants is generally not affected by soil type or pH level and can be grown virtually anywhere with sufficient sunlight.

Nowadays, Elbasan city is presented with different plants, mainly filled with olive plantations, generally cultivated fruit trees, and a very rich flora with vegetation.

A special and indisputable importance is the influence of ecological and human factors on the spread of pollen grains.

The quantitative data presented on the fossil pollen of the Liliaceae family show the evolutionary direction of its plants over the years.

V. CONCLUSION

- Liliaceae family Palynofoms show an increasing tendency of their presence from depth to surface direction.

- Representatives of the Liliaceae family are present in all analyzed samples.

- Since Elbasan has not had strong climatic factors that could have influenced the change in vegetation, it is thought that the change in vegetation that has occurred over the years is due to human influence.

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