

## Holocene Evolution of Rubiaceae Plants, Middle Albania.

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**Abstract**–For the realization of this scientific work, which is part of innovative studies, we have mainly focused on the presentation of data on fossil pollen, which belong to the New Holocene period. The study was carried out for the palynomorphs of the Rubiaceae family.

The results obtained on the fossil pollen of Rubiaceae plants were obtained by analyzing the soil deposits that after the time assignment belong to almost the last 20 centuries in the Elbasan area.

The analyzed soil championships are fixed with a weight of 2500 grams and belong to the depth from 4 meters to the surface. Soil samples were taken at five stations in the Elbasan area during the September-December 2022 period, by means of a dry rotary drilling probe with a diameter of 110 - 130 mm.

This study was carried out with the aim of presenting the evolutionary line that the Rubiaceae plants followed during the late Quaternary period (corresponding to the New Holocene). Data on the fossil pollen of Rubiaceae plants are provided for the first time and there are no studies on the Rubiaceae Family for the region by other researchers.

In conclusion, we found 555 palynomorphs of the Rubiaceae Family found in all soil samples analyzed from a depth of 4 meters towards the surface of the earth and we also find a consistent presence of these Palynomorphs. We are of the opinion that the vegetation change presented over the years is mainly related to the influence of the human hand on the cultivars, since there is no historical data on other factors that may have changed the vegetation.

*Keywords* – Fossil Pollen, Evolution, New Holocene, Rubiaceae Family, Elbasan Area.

### I. INTRODUCTION

This study presents paleopalynological record of New Holocene deposits in Elbasani town. Palynology is an Interdisciplinary Science, linked to geology and biological sciences, it is the science that studies the pollen during the organic sediments formation and includes the study of fossil and current palynoforms [1], [2]. The study of fossil pollen allows us to judge on the evolutionary path of the vegetation also by interpreting the quality of the outer wall of pollen grains [3], [4].

From the study of fossil pollen, we can discover historical traces in the use and cultivation of plants, the way of nutrition and the origin of agriculture [5].

The study we have presented provides palynological data for the Rubiaceae family belonging to the New Holocene deposits for the Elbasan area.

The microfossil plants evolution of the Rubiaceae have undergone over the years has not been studied before on Elbasan area and there is any study conducted by foreign and local scientists about the palynomorphs of this family plant in the Holocene sediments of Elbasan [4], [6], [7]. The deposits of the New Holocene studies provide us with important data about the influence of different factors on the vegetation diversity of a certain area [4]-[8].

This type of scientific study leads us to provide important data regarding the reconstruction of the

paleoclimate, paleoflora and stratigraphy of the Holocene [1], [2].

The paleopalynological data obtained provide a fundamental contribution on the evolution of the cultivation and use of different plants, as well as on the origin of vegetation [9].

Rubiaceae palynomorph counts were performed using light microscopes at 1500x magnification.

The data obtained on the fossil spore of the Rubiaceae family, deposited underground, show the evolution that this family plant has followed over the years.

## II. MATERIALS AND METHOD

Paleopalynological examination are used for paleoecologic studies of Quaternary period therefore and the Holocene period [10], [11]. Through these data we judge for the human impact on change of the natural environment [12], [13].

Physical-chemical composition of the fossil pollen allows saved and easily extracted from soil sediments.

Paleopalynological examination showed that all samples contained a large quantity of organic matter that it seemed appropriate for palynoforms analysis. Basically, for their extraction all the used methods join in the physical and chemical processing of 1 gram soil sediment [1], [4].

The samples are taken through September-December 2022 period in Elbasan and were collected in total 16 samples of soil, starting from 0.25 m to 4 m deepness with the distance between the sampling to 0.25 m.

### A. The Erdtman method of acetolysis

Processing of soil samples is carried out based on Erdtman method [14], [15]. So that to get better results first mix 1cm<sup>3</sup> soil with 10ml KOH (10%).

Erdtmanacetolyze method consists on processing the material with an acetolyze mixture, sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) and acetic anhydride (CH<sub>3</sub>COO)<sub>2</sub> in a 1:9 ratio.

We cleaned with distillated water and mixed it with acetolyze solution, until a neutral environment is taken. 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 [4], [6], [7], [14], [15], [16].

### 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 [17] by using 50 gram of gelatin, 175 ml of distillate water, 150 gram glycerin, 7 gram phenol (crystals).

## III. RESULTS

Table 1 provided the record about the palynomorphs number for Rubiaceae family by to the depth and the total pollen number.

The maximum palynoforms of Rubiaceae (42 spores per samples) is taken in 2.5 m of depth while the minimum number, 26 spores, is taken respectively in 3 m deepness.

Table 1. Number of palynoforms according to the depth

Sample	Depth (meters)	Spores' number (Rubiaceae)
1	4	33
2	3.75	31
3	3.5	30
4	3.25	28
5	3	26
6	2.75	36
7	2.5	42
8	2.25	40
9	2	38
10	1.75	36
11	1.5	36
12	1.25	35
13	1	36
14	0.75	37
15	0.5	36
16	0.25	35
Total number of spores		555

From the data analysis we mainly find that the permanent spores' number for Rubiaceae family from the bottom near to the surface, with the exception of the sample 7 where it is observed one increase tendency (exactly in 2.5 m of depth), also is clearly shown the stability trend for the palynoforms of this family.

The total palynoforms number of Rubiaceae family is 555 spores.

#### IV. DISCUSSION

From the results presented in Table 1 for all stations it is found that, all the Rubiaceae family palynomorphs are present at all depths, should be linked with human impact on the cultivation of the Rubiaceae plants.

The permanent number of spores of the Rubiaceae type in almost all samples, except 2.5 m deepness where it is observed one stabling palynomorphs number for this type, probably indicates that in this sustainability of the palynomorphs presence may have been influenced by both human and ecological factors.

Climate can cause land use changes or human societies to climate fluctuations cause complex impacts on the environment [4], [18].

Regarding the reason for the permanent presence of representatives of the Rubiaceae type over the years, we are mainly of the opinion as follows.

Rubiaceae with its many hybrids and cultivars, is usually presented in the literature as a garden flower and widely cultivated ornamental plant.

The Rubiaceae are known as a family of flowering plants, or otherwise known as the coffee, madder or bedstraw family. This family is represented by terrestrial trees, shrubs, lianas, or herbs. Rubiaceae occurs with a cosmopolitan distribution; however, the greatest diversity of species is concentrated in the tropics and subtropics [20],[21].

Among the most economically important genera we mention *Coffea*, the source of coffee, *Cinchona*, ornamental cultivars (eg *Gardenia*, *Ixora*, *Pentas*) and historically some dye plants (eg *Rubia*), the source of the antimalarial alkaloid quinine.

As for the fossil plants of the Rubiaceae family, we must go back to the Eocene. The geographical distribution of these fossils indicates an earlier origin of the family, probably in the Late Cretaceous or Paleocene.

In the Miocene, they are found for the first time in South America, but also in Europe [22].

In conclusion, we can confidently state that the impact of human activity over the years, mainly on planting useful plants, is the main cause of vegetation changes in the Elbasan.

The current vegetable crown of Elbasan area consists mainly of rich vegetation and fruit trees. The Rubiaceae palynomorphs shows its evolution line.

#### V. CONCLUSION

- Rubiaceae family palynomorphs are present in all samples belonging to different depths.
- Rubiaceae palynomorphs shows constancy from the bottom near to the surface.
- Based on the presence of Rubiaceae palynomorphs in all samples that correspond to the entire period of the New Holocene period, we think that this is mainly dedicated to the human influence in the cultivation of the vegetation necessary for him (nutritional-ornamental) over the years.

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