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DATA ON THE PALYNOMORPHOLOGICAL FEATURES OF SOME PLANTS OF ALBANIA’S UMBELLIFERAE FAMILY

ABSTRACT

Palynomorphological features of the pollen grains of four honey plant: *Foeniculum vulgare*, *Eryngium maritimum*, *E. campestre* and *Crithmum maritimum* from 61 genera of Umbelliferae family present in Albania, were studied and examined by compound microscope. By the palynomorphological study of *Eryngium maritimum* plant compared with pollen grains of *E. campestre* resulted that there were similarities in the majority of their palynological features on one side, and there were differences in terms of the dimensions of pollen grains and furrows, the aperture and sporoderme features, on the other side. Based on the results obtained by this study, it was noted that the pollen grains of two plants: *Foeniculum vulgare* and *Eryngium campestre* were triaperturate, while at the pollen grains of *E. maritimum* and *Crithmum maritimum* showed three furrows and three pores. The exine sculpture of the four plants varied from granulate to rugulate at the pollen grains of *Foeniculum vulgare* and *Eryngium campestre*, reticulate to scabrate at *Crithmum maritimum*, and rugulate at *E. maritimum*.

The largest dimensions for the majority of the palynological indicators were identified for *Eryngium campestre* pollen grains and the smallest ones were found in *Crithmum maritimum* pollen grains.

Keywords: *Pollen grains, furrow, exine, intine, granulate.*

INTRODUCTION

Umbelliferae pollen grains belong to the Stenopalynous family ERDTMAN (1966). The features of the tectum were from uniformly granulate to rugulate PUNT *et al.* (2007). Referring to the data of the Albania’s Flora, Umbelliferae family is

represented by 61 genus QOSJA *et al.* (1992). *Eryngium campestre* is one out of four representative species of genus *Eryngium* in Albania, as well as *Eryngium maritimum*, according to the literature available by QOSJA *et al.* (1992), pollen grains of which were collected in fresh condition to its habitat of Vlora.

The genus *Foeniculum* was represented by one specie *vulgare* with two subspecies: *vulgare* and *piperitum*. The genus *Crithmum* was represented by a single specie *maritimum* QOSJA *et al.* (1992). The study of pollen biology has direct relevance in forestry, agriculture, biotechnology, plant and bee breeding AMJAD *et al.* (2012). The quality and the values of honey were determined by quantitative and qualitative reports of pollen grains in it LOUVEAUX *et al.* (1978).

The purpose of this study was:

- § To provide the palynomorphological features of four honey plant species of Umbelliferae Family, thus contributing to the enrichment of the palynological fund with representatives of Albania's plants unstated previously by local or foreign authors; and
- § To highlight the diversity in pollen grains features of the *Eryngium* species found in Albania, which may contribute in the future in taxonomic studies.

MATERIAL AND METHODS

Morphological characteristics of pollen grains of four honey plants of the Umbelliferae Family, collected in fresh condition, were studied by using three analytical methods as follows:

- Acetolysis of Erdtman method (ERDTMAN, 1960);
- Acetolysis of Avetisjan method (AVETISJAN, 1950);
- Basic fuchsin of Smoljaninova & Gollubkova method (SMOLJANINOVA and GOLLUBKOVA, 1953).

There were prepared 3 - 5 microscope slide by different methods and they were studied by the microscope "Biollamp". The microscopic photos of pollen grains of the plants studied with magnification X 1000 taken by Pupuleku B. and the photos of respective plants were presented as well.

STUDY AREA

The pollen grains were collected at Vlora and Elbasan habitats. Vlora region is situated in the wester lowland of Albania. It is a very mountainous area and its surface is 2,706 km². The highest natural point is Maja e Çikës, at 2,044 m. The region lies along the Adriatic Sea and Ionian one, forming Albanian Riviera. It has a typical Mediterranean climate, with an annual average temperature 16.5 °C. Annual average precipitation is 102.7 mm. Flora is characterized by Mediterranean

shrubs and halophilous plants. Elbasan region is situated in the boundary of the two physic-geographical zones of Albania. It has a surface of 1,481 km². Its average altitude is around 450 m. Climate of Elbasan region is typical Mediterranean with annual average temperature 15-16 °C. Annual average precipitation is some 1,100 mm (QIRJAZI, 1990).

RESULTS

Foeniculum vulgare Miller (*Foeniculum officinale* All.) - Fennel

Hemicryptophyte. Biennial or perennial plants, up to 250 cm high. Found in uncultivated land, edges of roads, streams etc. Flowering: June to August. Aromatic, medical and honey plant QOSJA *et al.* (1992).

Pollen grains were triaperturate with elliptic contours (resemble with silkworm). The pollen grains were strongly prolate (P/E = 1.98) and typically parallel-sided to constricted in the equatorial region. In polar view, the pollen grains had circular triangular shape, whereas in equatorial one they had compressed oval shape.

The furrows were smooth and did not go up to the pole. The width of furrows was 2.5 µm, while its length was 24.2 µm. Aperture had the shape of a lens, which exceeded the furrow and its limits. The length of the aperture went up to 6 µm. The exine thickens more in the area of the aperture.

The exine was doubled thin layers with the sculpture that varied from granulate to rugulate. The thickness of exine was about 3.4 µm in the equatorial zone, whereas in the polar zone it was around 1.7 µm. The ectexine was two times thicker than endexine in the middle, but in the ends they equalized. Intine was thin, and the cytoplasm was smooth.

The length of pollen grain varied from 28.2 to 30.6, while average value was (28.8) µm, while its width varied from 12.3 to 15.9 (14.5) µm (Figure 1: b, c, d).

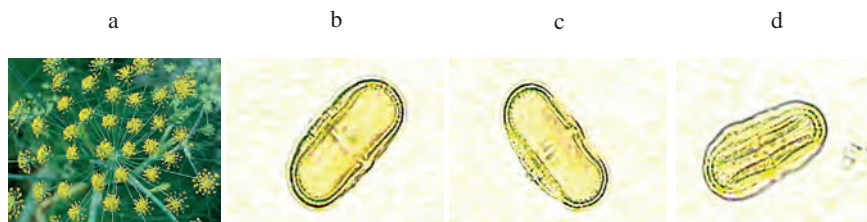


Figure 1. a: *Foeniculum vulgare* plant; Pollen grains b, c: In polar view; d: In equatorial view X 1000.

***Eryngium campestre* L.** - Field eryngo

Hemicryptophyte. Perennial plants, 15 - 70 cm high. Found in uncultivated land, dry grazing, hills and roadsides. Flowering: from July to September. Medical and honey plant QOSJA *et al.* (1992).

Pollen grains were triaperturate with elliptic contours (resemble with silk-worm). In polar view, the pollen grains had elliptical shape, whereas in equatorial one they had rectangular shape ($P/E = 2.06$).

The furrows were short, narrow, pointed end, and did not go up to the pole. The length of furrow varied from 10.2 to 10.8 (10.5) μm , while its width varied from 2.1 to 2.7 (2.5) μm . Aperture had the shape of a lens, which exceeded the furrow and its limits. The length of the aperture varied from 4.2 to 4.8 (4.5) μm . The exine thickens more in the area of the aperture.

The exine was doubled thin layers with the sculpture that varied from granulate to rugulate. The exine thickens in the equatorial zone and thins dramatically to the edges. The thickness of exine was about 3.5 μm in the equatorial zone, whereas in the polar zone it was around 2 μm . Intine was thin, and the cytoplasm was smooth.

The length of pollen grains varied from 42.8 to 47.9 (46) μm , while its width varied from 20.4 to 23.4 (22.3) μm (Figure 2: b, c).

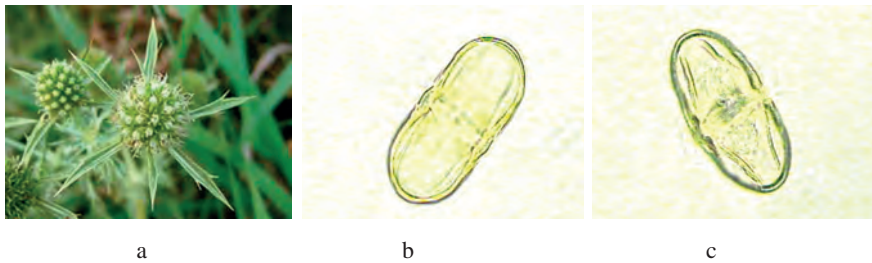


Figure 2. a: *Eryngium campestre* plant; Pollen grains b, c: In polar view X 1000.

***Eryngium maritimum* L.** - Sea holly

Geophyte. Perennial plants, sometimes monocarpique 12 - 60 cm high. In the sandy coastal dunes. Flowering: from June to September. Halophile plant QOSJA *et al.* (1992).

Pollen grains were three furrows three pores with elliptic contours. In polar view the pollen grains had elliptical shape, whereas in equatorial one they had rectangular shape ($P/E= 1.92$).

The large pores resulting from the fusion of the two pores at the other side of the short furrows that extend to the end of the pollen grains. The pores had oval contours. The length of pore varied from 7.7 to 10.6 (8.8) μm , while its width varied from 3.7 to 4.5 (4.1) μm . The furrows were short, narrow, pointed end, and did not go up to the pole. The length of furrow varied from 16.7 to 19.8 (18.1) μm , while its width varied from 7.5 to 9.2 (8.1) μm .

The exine was double thin layer with the rugulate sculpture. The exine thickens in the equatorial zone and thins to the edges. The thickness of exine was about 3.1 μm in the equatorial zone, whereas in the polar zone it was around 2.1 μm . Intine was thin, and the cytoplasm was smooth.

The length of pollen grains varied from 37.7 to 43.3 (41.7) μm , while its width varied from 20.8 to 23.9 (21.8) μm (Figure 3: b, c).

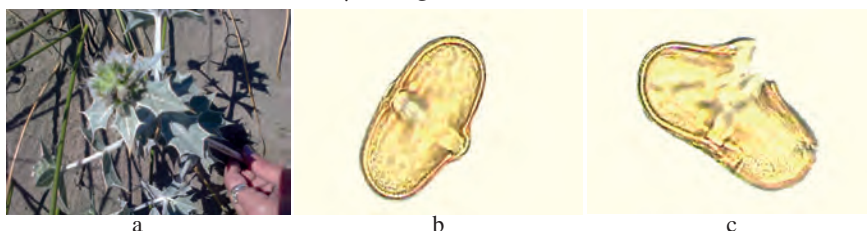


Figure 3. a: *Eryngium maritimum* plant; Pollen grains b: In polar view; c: In equatorial view x 1000.

***Crithmum maritimum* L. - Sea fennel**

Chamaephyte. Biennial or perennial plants, 15 - 50 cm high. Nearly shrubs plants. Found mainly in coastal rocks, rarely on sandy or gritty earth. Flowering: June to August Qosja al. (1992).

Pollen grains were three furrows three pores with elliptic contours. In polar view the pollen grains had prolate subcircular shape, whereas in equatorial one they had rectangular shape (P/E= 1.73).

The furrows were smooth with sharp edges and pointed end. The width of furrow varied from 2 to 2.85 (2.27) μm while its length varied from 14.55 to 21.15 (18.15) μm . The pores were alongate very drawn out and bilobed. The two lobes reunited by a thin bridge to long grooves extending to the edge of the pollen grains. The length of pore varied from 3 to 3.4 (3.2) μm , while its width varied from 3 to 3.2 (3.1) μm .

The exine was doubled thin layers with the sculpture that varied from reticulate to scabrate. The thickness of exine varied from 2.9 to 3.3 (3.2) μm in the equatorial zone, whereas in the polar zone it varied from 1.8 to 2.1 (2) μm .

The length of pollen grains varied from 19.2 to 24.2 (23.3) μm , while it width varied from 12.2 to 22.9 (13.5) μm (Figure 4: b, c, d).

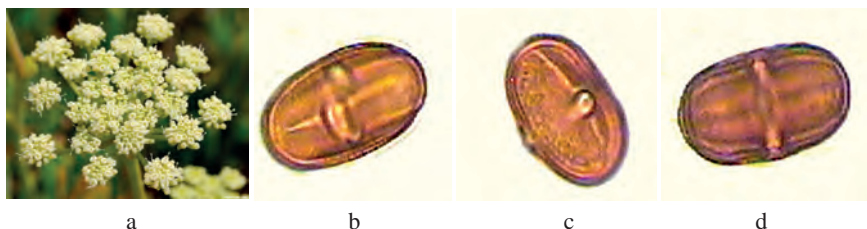


Figure 4. a: *Crithmum maritimum* plant; Pollen grains b, d: In polar view; c: In equatorial view x 1000.

DISCUSSION

By comparing the observed data of two species of *Eryngium* genus, with those of the literature (TING, 1961; SLADKOV, 1967; FAEGRI *et al.*, 1989; MOORE *et al.*, 1991; KAPIDANI, 1996; RICCIARDELLI D'ALBORE, 1998; PUPULEKU, 2002, PUNT *et al.*, 2007) we detected enough similarities but also differences between them, regarding the aperture and sporoderme features, the dimensions of pollen grains and the furrow, as well as the thickness of exine as follows:

1. The feature of the aperture appeared three furrows apertuide at the pollen grains of *Eryngium campestre*, while at the pollen grains of *E. maritimum* it was three furrows three pores;
2. The pores were in oval contours (longer than wider) at the pollen grains of *E. maritimum*, whereas the aperture at *E. campestre* had the shape of a lens overpassing significantly limits of the furrow;
3. Furrow wideness and length of *E. campestre* were smaller than those of *E. maritimum* as noted by the data of Figure 5, 6;
4. The exine structure of *E. campestre* varied from granulate to rugulate, whereas that of *E. maritimum* was almost rugulate;
5. The thickness of exine in equatorial zone was the biggest at *E. campestre* while a similar indicator in polar zone was greater at *E. maritimum*;
6. Referring to the data of Table 1, it was noticed that pollen grains of *E. campestre* were larger in dimensions in length of polar axis, whereas the equatorial axis length was the biggest to *Eryngium maritimum*.

Table 1. Dimensions of pollen grains of *Eryngium campestre* compared with *Eryngium maritimum*.

The palynological features	Minimum <i>Eryngium campestre</i>	Minimum <i>Eryngium maritimum</i>	Average <i>Eryngium campestre</i>	Average <i>Eryngium maritimum</i>	Maximum <i>Eryngium campestre</i>	Maximum <i>Eryngium maritimum</i>
The length of pollen grains	42.8	37.7	46	41.7	47.9	43.3
The width of pollen grains	20.4	20.8	22.3	21.8	23.4	23.9
The length of furrow	10.2	16.7	10.5	18.1	10.8	19.8
The width of furrow	2.1	7.5	2.5	8.1	2.7	9.2
The thickness of exine in equatorial zone	3.1	2.9	3.5	3.1	3.6	3.3
The thickness of exine in polar zone	1.9	2	2	2.1	2.2	2.3
The sculpture of exine	granulate to rugulate	rugulate	granulate to rugulate	rugulate	granulate to rugulate	rugulate

Palynomorphological features of *Eryngium campestre* were very similar with those of *E. maritimum*, with regard to:

- The shape of the pollen grain, which were elliptic in polar view and rectangular in equatorial one;
- Short furrows that did not go up to the pole, with pointed end;
- The exine structure were doubled thin layers almost equal.

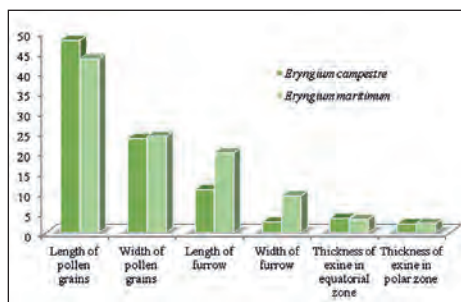
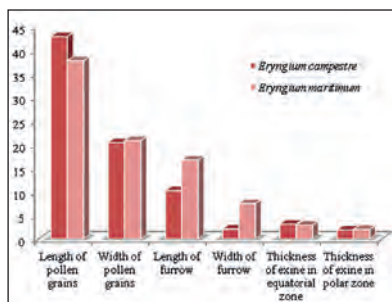


Figure 5. Minimum dimensions of pollen grains of *E. campestre* and *E. maritimum*. Figure 6. Maximum dimensions of pollen grains of *E. campestre* and *E. maritimum*.

CONCLUSIONS

According to the aperture feature, the pollen grains of four plants studied can be classified in two of the following groups:

- § Three furrows three pores: *Eryngium maritimum*, *Crithmum maritimum*;
- § Three furrows aperture: *Eryngium campestre*, *Foeniculum vulgare*.

Three ornamentation types have been determined in his studies, as follows:

1. Rugulate sculpture of exine at *Eryngium maritimum* pollen grains;
2. The exine sculpture varied from granulate to rugulate at *Foeniculum vulgare*, *Eryngium campestre*;
3. The exine sculpture varied from reticulate to scabrate at *Crithmum maritimum*.

The largest dimensions of the majority of the palynological studied indicators were identified to *Eryngium campestre* pollen grains (46 with 22.3 μm), while the smallest ones were found in *Crithmum maritimum* pollen grains (23.3 with 13.5 μm).

By the palynomorphological study of *Eryngium maritimum* plant compared with pollen grains of *Eryngium campestre*, we observed differences as related to the aperture and sporoderme features, as well as the dimensions of pollen grains, the furrow and the thickness of exine. This palynological diversity serves as an useful tool in taxonomic studies.

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