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COMPARATIVE DATA ON THE PALYNOMORPHOLOGICAL CHARACTERISTICS OF POLLEN GRAINS STUDY OF FOUR *SEDUM* SPECIES IN ALBANIA

SUMMARY

Four species of *Sedum* genus from twentyone species of this genus present in the flora of Albania such as: *litoreum, sexangulare*, *cepaea* and *rubens* were analyzed comparatively for their palynomorphological characteristics versus the *hispanicum* specie of Albanian palynological literature sources. By the comparative study of palynomorphological features of pollen grains of analyzed species, it was noted that the pollen grains of four plants: *litoreum, sexangulare*, *cepaea* and *hispanicum* were three furrows and three pores, while at the pollen grains of *Sedum rubens* were presented as variable from three furrows and three pores to four furrows and four pores. Based on P/E ratio, the shapes of pollen grains of four species studied were varied from prolate spheroidal to oblate spheroidal, triangular or tetrangular in polar view and oblique in equatorial one. The furrows were with sharp edges and rounded end and the pores were elliptical, located within the contour of the furrow with exine remnant. The exine sculpture varied from rugulate at the pollen grains of three species: *litoreum*, *sexangulare* and *hispanicum*, to reticulate with uniform reticle at *cepaea* specie and varied from reticulate to rugulate at *Sedum rubens*. The biggest polar and equatorial axis dimensions were identified at *Sedum rubens* plant, while in terms of thickness of exine, length of furrow and mesocolpium the biggest size of pollen grains was found at *hispanicum* specie. While in terms of pore length appeared to be the largest at *cepaea* specie and for the width of furrow at *Sedum litoreum* plant. Regarding to the palynological indicator of pore width, it was seen that the pollen grains of three species: *cepaea*, *rubens* and *litoreum* had the largest dimensions simultaneously.

INTRODUCTION

Referring to the sources of Albania's First Flora (Paparisto *et al.*, 1988) the Crassulaceae family is represented by four genus, while the Sedum genus is represented by 21 species, of which four species*: litoreum*, *sexangulare*, *cepaea* and *rubens* were studied for their palynomorphological features.

Referring to Romanian literature sources, (Radulescu, 1963), pollen grains in some species of the Sedum genus were found to have variable apertures from 3-colporate, 3-symcolporate to 4-colporate (Kim, 1994).

While Hart (1974) in his study showed that the pollen of 24 European species of the *Sedum* genus, were mainly 3-colporate with occasional, although rare, 2- or 4-colporate, thus indicating variations in the number and volume of water regulation to the pollen grains, or number of apertures of these one.

This study aims to provide:

- The palynomorphological description and highlight the diversity in pollen grains features of four *Sedum* species found in Albania;
- Evidence of similarities and differences based on the palynomorphological features of the pollen grains of four species of the *Sedum* genus: *litoreum*, *sexangulare*, *cepaea* and *rubens*, with the *hispanicum* specie by Albanian palynological literature sources.

MATERIAL AND METHODS

Pollen grains of four plants of *Sedum* genus were collected in fresh condition in different locations such as: Himara, Korab, Shebenik.

Morphological characteristics of pollen grains were studied by using three analytical methods as follows:

- Acetolysis of Erdtman method (Erdtman, 1960);
- Acetolysis of Avetisjan method (Avetisjan, 1950);
- Basic fuchsine of Smoljaninova and Gollubkova method (Smoljaninova and Gollubkova, 1953).

There were prepared from 3 to 6 microscope slide by different methods and they were studied by the light microscope "Motic". The microscopic photos of pollen grains of the plants studied with magnification X1000 taken by Pupuleku Blerina and Qahja Anjeza the photos of respective plants were presented as well.

For the description of the morpholopalynogical characteristics of the pollen grains was used the terminology proposed by Erdtman (1986) and Ricciardelli D'albore (1998).

RESULTS AND DISCUSSION

Morphological description of four pollen grains of *Sedum* genus

1- ***Sedum litoreum*** Guss. - Coastal Stonecrop, Shore Stonecrop.

Annual succulent plant with erect steam. Geographical spread: On coastal rocks and stony places. Flowering: April - May (Paparisto *et al.*, 1988). The material was collected in fresh conditions in Himara-Vlorë.

The pollen grains were isopolar monad and had a radial symmetry. In polar view they had triangular frame, while in equatorial view had oblique frame. The shape of pollen grains according to the contours was prolate spheroidal [P/E = 0.9-1.07 (0.97)]. According to the aperture type, pollen grains were tricolporate. The furrows were smooth membrane, narrows with pointed end and went up to the center of pollen grains referred to Fig. 1.

Furrows length varied from 4.5 to 10.5 (7.3) µm. Furrows width varied from 3 to 7.5 (5.4) µm. The length of mesocolpium varies from 9 to 10.5 (10.1) µm.

Pores in the center of the furrows were elliptical, wider than long. They not passed visibly the borders of furrows. In the area of the pore, the exine was detached forming exine remnant. The width of pores varied from 4.5 to 9 (6.7) µm, whereas its lengths varied from 4.5 to 7.5 (6.4) µm.

The exine was rugulate, similar to the sporoderm features of *Sedum senxagulare* and *Sedum hispanicum*. The exine was doubled thin equal layers. Cytoplasm was smooth. Exine thickness varied from 1.35 to 1.5 (1.5) µm. The length of polar axis varied from 13.5 to 21 (17.5) µm, while the length of equatorial axis varied from 15 to 19.5 (17.9) µm.

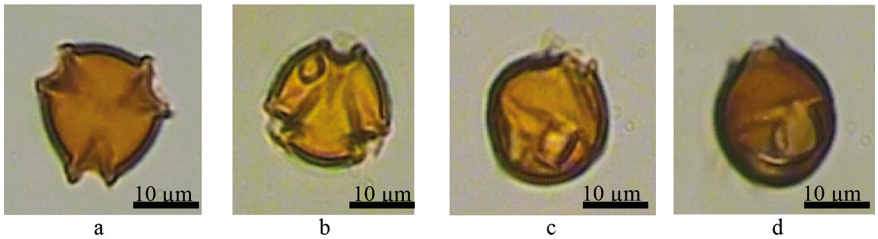


Fig. 1- Pollen grains of *Sedum litoreum*.**a, b**. Polar view X1000; **c, d**. Equatorial view X1000.

2- ***Sedum sexangulare*** L. - Tasteless stonecrop

Perennial succulent and evergreen plant. Geographical spread: In dry places with stones and grass, on rocks and walls of mountainous areas. Flowering: May-August (Paparisto *et al*., 1988). The material was collected in fresh conditions in Korab.

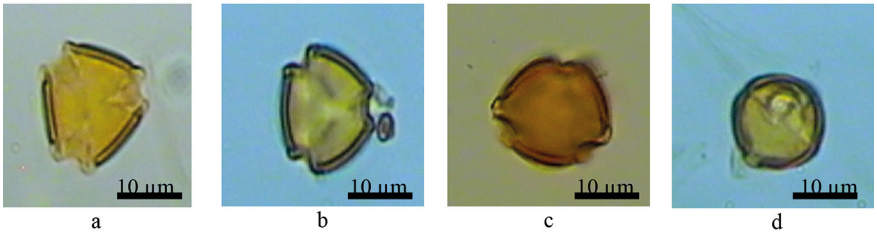
The pollen grains were isopolar monad and had a radial symmetry. In polar

view they had triangular frame, while in equatorial view had oblique frame. The shape of pollen grains according to the contours was oblate spheroidal [P/E = 0.9-1 (0.98)]. According to the aperture type, pollen grains were tricolporate. The furrows were smooth membrane, with pointed end and went up to the center of pollen grains referred to Fig. 2.

Furrows length varied from 3.15 to 7.5 (5.56) µm. Furrows width varied from 3 to 6 (4.41) µm. The length of mesocolpium varies from 6 to 10.5 (8.8) µm.

Pores in the center of the furrows were elliptical, wider than long. They not passed visibly the borders of furrows. In the area of the pore, the exine was detached forming exine remnant. The width of pores varied from 4.5 to 7.5 (6.17) µm, whereas its lengths varied from 2.25 to 9 (5.23) µm.

The exine was regulate. The exine layers were not equal. Cytoplasm was granular. Exine thickness varied from 0.75 to 1.2 (0.79) µm. The length of polar axis varied from 15 to 18.45 (16.52) µm, while the length of equatorial axis varied from 15 to 20.25 (16.94) µm.



a b c d

Fig. 2- Pollen grains of *Sedum sexangulare*.**a, b, c**. Polar view X1000; **d**. Equatorial view X1000.

3- ***Sedum cepaea*** L. **-** Stonecrop as an onion

It is an annual or, rarely, biennial or perennial plant, partly glandular, greenish. Geographical spread: In stony places, on wet rocks, shady places up to mountainous areas. Flowering: May-August (Paparisto *et al*., 1988). The material was collected in fresh conditions in Shebenik.

The pollen grains were isopolar monad and had a radial symmetry. In polar view they had triangular frame, while in equatorial view had oblique frame. The shape of pollen grains according to the contours was prolate spheroidal [P/E = 1-1.04 (0.99)]. According to the aperture type, pollen grains were tricolporate referred to Fig. 3.

The furrows were smooth membrane, with pointed end and went up to the centre of pollen grains. Furrows length varied from 3 to 7.5 (5.53) µm. Furrows width varied from 2.25 to 4.5 (3.84) µm. The length of mesocolpium varies from 7.05 to 12 (9.15)µm. Pores in the center of the furrows were elliptical. They not passed visibly the borders of furrows. In the area of the pore, the exine was detached forming exine remnant. The width of pores varied from 4.5 to 9 (6.21) µm, whereas its lengths varied from 4.5 to 11.25 (6.21) µm. The exine was reticulate, with

uniform reticle. The exine was doubled thin equal layers. Exine thickness varied from 0.6 to 1.05 (0.75) μm. The length of polar axis varied from 15 to 19.5 (16.98) μm, while the length of equatorial axis varied from 15 to 18.75 (17.04) μm.

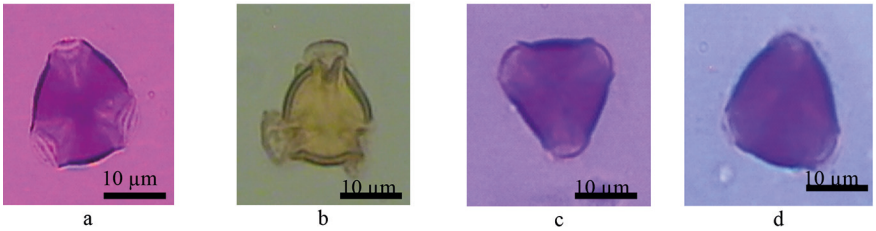


Fig. 3- Pollen grains of *Sedum cepaea*.**a, b, c, d**. Polar view X1000.

4- ***Sedum rubens*** L. (*Crassula rubens* L.) - Red Stonecrop

Annual plant, with glandular hairs, usually reddish, with thin roots. Geographical spread: In wastelands, dry and grassy places, mainly in mountainous areas. Flowering: May-July (Paparisto *et al*., 1988). The material was collected in fresh conditions in Shebenik.

The pollen grains were isopolar monad and had a radial symmetry. In polar view they varied from triangular to tetrangular frame, while in equatorial view had oblique frame. The shape of pollen grains according to the contours was oblate spheroidal [P/E = 0.9-0.94 (1.26)]. According to the aperture type, pollen grains were tricolporate and rarely tetracolporate referred to Fig. 4.

The furrows were with pointed end and went up to the center of pollen grains. Furrows length varied from 4.5 to 7.5 (6) µm, whereas its widths varied from 3 to 6 (4.13) µm. The length of mesocolpium varies from 7.5 to 10.5 (6.96) µm. Pores in the center of the furrows were elliptical.

In the area of the pore, the exine was detached forming exine remnant. The width of pores varied from 4.5 to 9 (6.75) µm, whereas its lengths varied from 3.75 to 7.5 (5.25) µm. The exine sculpture varied from reticulate to rugulate. Exine thickness varied from 0.6 to 0.9 (0.75) µm. The length of polar axis varied from 15 to 24 (23.56) µm, while the length of equatorial axis varied from 16.5 to 25.5 (18.67) µm.

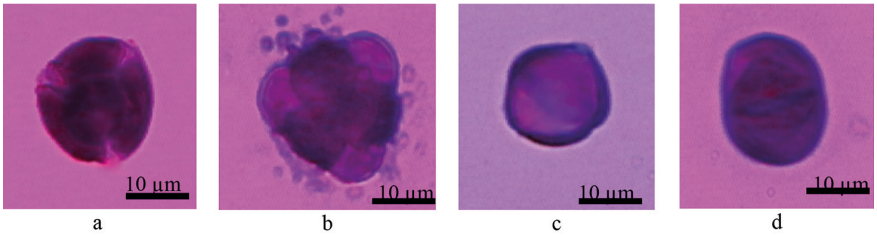


Fig. 4- Pollen grains of *Sedum rubens*. **a, b**. Polar view X1000; **c, d**. Equatorial view X1000.

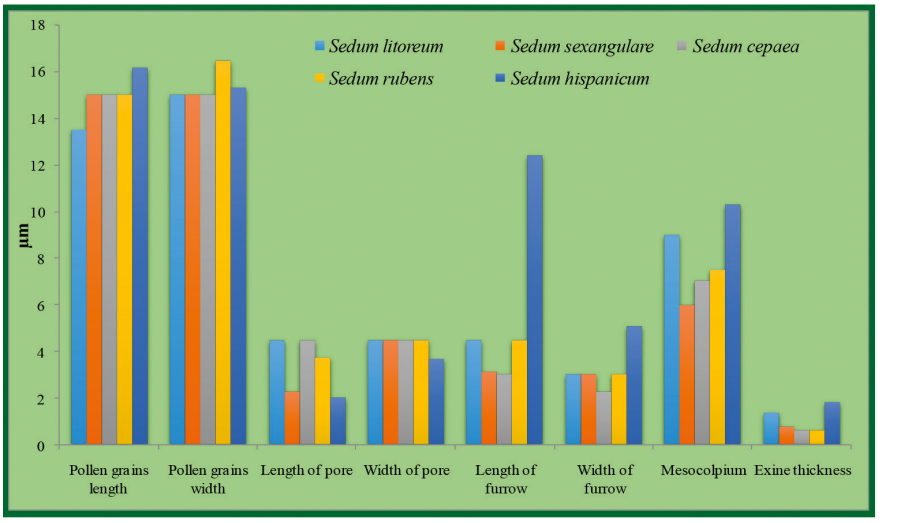


Fig. 5- Minimum pollen grains dimensions of four species of *Sedum* genus compared with *Sedum hispanicum* from the literature.

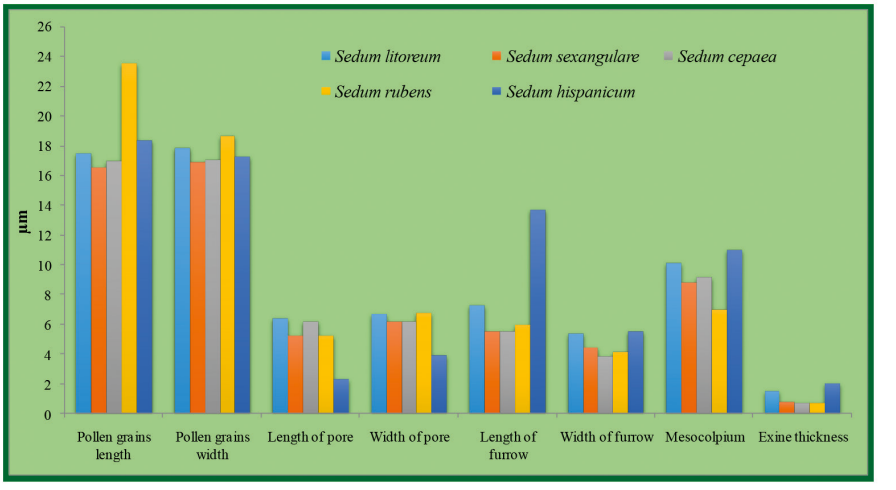


Fig. 6- Average pollen grains dimensions of four species of *Sedum* genus compared with *Sedum hispanicum* from the literature.

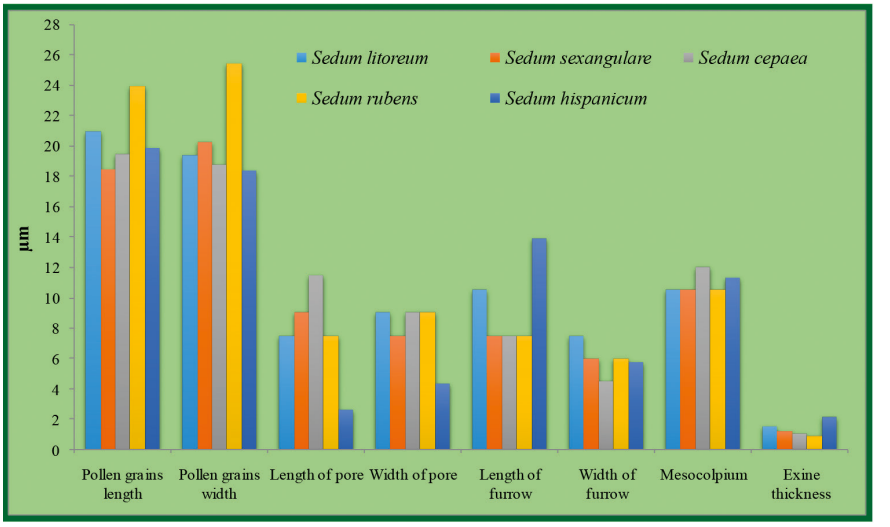


Fig. 7- Maximum pollen grains dimensions of four species of *Sedum* genus compared with *Sedum hispanicum* from the literature.

By comparing the observed palynological data of four different species of *Sedum* genus with the *Sedum hispanicum* previously studied from (Pupuleku, 2002), we detected enough similarities and differences referred to the literature (Radulescu, 1963;(Sladkov, 1967; Hart, 1974; Moore *et al*., 1978; Erdtman, 1986; Faegri *et al*., 1989; Kim, 1994; Kapidani, 1996; Ricciardelli D'albore, 1998; Pupuleku, 2002; Kapidani, 2005).

Referring to the data in Fig. 5, it was observed that the pollen grains of *Sedum cepaea* were smaller in terms of dimensions in length and width of furrows and the exine thickness, whereas for the length and width of the pores and pollen grains were smaller at *hispanicum* specie. Also it was noted that pollen grains of *Sedum litoreum* plant were smaller than those of *Sedum* species for the length of pollen grains and at *Sedum sexangulare* for the length of mesocolpium.

Referring to the data in Fig. 6, it was observed that the largest average sizes were identified in *Sedum rubens* pollen grains in terms of length and width of pollen grain and pore width. The largest average dimensions in terms of length of mesocolpium and furrow, exine thickness and furrow width were identified in the *Sedum hispanicum* plant. The largest average dimensions in terms of pore length appeared at *Sedum litoreum* pollen grains.

With regards to the width and length of pollen grains, the largest dimensions were identified to *Sedum rubens*. The same result was found at *Sedum litoreum* plant for the palynological indicator such as furrow width and at *Sedum cepaea* for the length of pore. As indicated by the data of Fig. 7, the maximum dimensions for the length of furrow and mesocolpium and the thickness of the exine, were identified at *Sedum hispanicum* plant.

The same situation was found in the maximum values the width of pore in the pollen grains of *Sedum cepaea*, *Sedum rubens* and *Sedum litoreum* plants.

CONCLUSIONS

According to the light microscopy investigations, the four pollen grains of *Sedum* genus studied, it was observed that there were many similarities and differences between them in palynological characteristics.

Palynomorphological features of four *Sedum* genus compared with *hispanicum* specie of Albanian palynological literature were very similar, in terms of:

- The aperture that were three furrows and three pores at four species: *litoreum*, *sexangulare*, *cepaea* and *hispanicum* and variable from tricolporate to tetracolporate at *Sedum rubens* plant;
- Pores with the eliptical contours without exceeding the borders of furrow and in the area of the pore, the exine was detached forming exine remnant;
- The furrows had pointed ends and went to the center of pollen grains;
- The shape of pollen grains which were triangular in polar view except of *Sedum rubens* whose pollen grains varied from triangular to tetrangular frame and oblique in equatorial one.

There were some differences between them, in terms of:

- The exine sculpture varied from rugulate at the pollen grains of three species: *litoreum*, *sexangulare* and *hispanicum*, to reticulate with uniform reticle at *cepaea* specie and varied from reticulate to rugulate at *Sedum rubens*;
- The shapes of four pollen grains studied varied from prolate spheroidal to oblate spheroidal, based on P/E ratio;
- The biggest length and width dimensions of pollen grains were identified at *Sedum rubens* plant, while in terms of thickness of exine, length of furrow and mesocolpium the biggest size was found at *hispanicum* specie. While with regards to the wideness of furrow the largest dimensions were identified to *Sedum litoreum* plant and in terms of pore length appeared to be the largest at *cepaea* specie. Referring to the palynological indicator pore width, the maximum dimensions were identified to be the same simultaneously in the species: *cepaea*, *rubens* and *litoreum*.

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